Federal
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Projects

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FERC/FEIS – 0190F

Final Environmental Impact Statement
Priest Rapids Hydroelectric Project
Washington

(FERC Project No. 2114)

Wanapum Dam

Priest Rapids Dam

888 First Street, Washington, DC 20426

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 Priest Rapids Hydroelectric Project No. 2114-116, located on the Columbia River in Grant, Yakima, Kittitas, Douglas, Benton, and Chelan Counties, Washington.

This final EIS documents the views of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and Commission staff. It contains staff evaluations on the applicant's proposal and the alternatives for relicensing the Priest Rapids Hydroelectric Project.

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 final EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about.

Copies of the final EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street NE, Washington, D.C. 20426. An electronic copy of the final EIS may be viewed on FERC's website at http://www.ferc.gov using the "eLibrary" link. Please call 866-208-3676 or TTY (202) 208-1659 for assistance.

Attachment: Final Environmental Impact Statement

COVER SHEET

a. Title: Relicensing the Priest Rapids Hydroelectric Project in Washington, Federal Energy Regulatory Commission (FERC or Commission) Project No. 2114-116

b. Subject: Final Environmental Impact Statement

c. Lead Agency: Federal Energy Regulatory Commission

d. Abstract: Public Utility District No. 2 of Grant County Washington (Grant PUD) filed an application for a new license for the existing 1,768.8-megawatt (MW) Priest Rapids Hydroelectric Project (project) located on the Columbia River in Grant, Yakima, Kittitas, Douglas, Benton, and Chelan Counties, Washington. The nearest city is Ellensburg, located approximately 30 miles east. The project occupies about 3,104 acres of federal lands managed by the Bureau of Land Management, Bureau of Reclamation, Department of Energy, Department of the Army, and U.S. Fish and Wildlife Service.

The project is operated under the terms of the 1997 Mid-Columbia Hourly Coordination Agreement (Hourly Coordination Agreement), to which Grant 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. Grant PUD and the agencies proposed to implement a variety of measures with the goal of achieving no net impact on the salmon and steelhead species through a combination of fish passage improvements, hatchery supplementation, and habitat enhancements.

Key issues associated with relicensing this project are: addressing total dissolved gas concentrations; implementing the proposed measures for salmon and steelhead; improving conditions for other fish species, including bull trout, white sturgeon, Pacific lamprey, and resident fish; protecting and enhancing wildlife habitat; enhancing local recreational opportunities; and protecting cultural resources.

The staff's recommendation is to relicense the project as proposed, with additional measures recommended by agencies and the staff to protect and enhance environmental resources.

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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. 2 of Grant County Washington for the existing Priest Rapids Hydroelectric Project (No. 2114-116) is being made available to the public on or about November 24, 2006, as required by the National Environmental Policy Act of 1969[1]

[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 Act[3] 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]

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[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).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AF	acre-feet
aquatic invasive species	AIS
Alaska DFG	Alaska Department of Fish and Game
APE	Area of Potential Effects
BLM	U.S. Bureau of Land Management
BO	biological opinion
BOR	U.S. Bureau of Reclamation
BPA	Bonneville Power Administration
Colville	Confederated Tribes of the Colville Reservation
°C	degree Celsius
cfs	cubic feet per second
cfu	coliform forming unit
COE	U.S. Army Corps of Engineers
Commission	Federal Energy Regulatory Commission
Council	Advisory Council on Historic Preservation
CRITFC	Columbia River Inter-Tribal Fish Commission
CRWG	Cultural Resources Working Group
CWA	Clean Water Act
DAHP (Washington SHPO)	Department of Archaeology and Historic Preservation
DO	dissolved oxygen
DOE	U.S. Department of Energy
dps	distinct population segment
EIS	environmental impact statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
ft	feet
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act

FWS	U.S. Fish and Wildlife Service
GBD	gas bubble disease
GBT	gas bubble trauma
Grant PUD	Public Utility District No. 2 of Grant County, Washington
Hanford Reach Agreement	Hanford Reach Fall Chinook Protection Program Agreement
HCA	Mid-Columbia Hourly Coordination Agreement
HGMP	Hatchery and Genetic Management Plan
HPMP	Historic Properties Management Plan
IAC	Washington State Office of Interagency Committee
Interior	U.S. Department of the Interior
JFP	Joint Fisheries Parties
kcfs	thousand cubic feet per second
kV	kilovolt
kWh	kilowatt-hour
MCCC	Mid-Columbia Coordinating Committee
MOA	Memorandum of Agreement
mg/L	milligrams per liter
ml	milliliter
mm	millimeter
MW	megawatts
MWh	megawatt-hour
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act of 1969
NERC	North American Electric Reliability Council
NMFS	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NNI	no net impact
NPS	U.S. National Park Service
NTU	nephelometric turbidity units
NWPP	Northwest Power Pool

OAHP	Washington State Office of Archaeology and Historic Preservation
O&M	operation and maintenance
ORV	off-road vehicle
PA	Programmatic Agreement
Pacific Lamprey Plan	Pacific Lamprey Management Plan
PMF	Probable Maximum Flood
PNCA	Pacific Northwest Coordination Agreement
PRCC	Priest Rapids Coordinating Committee
Project	Priest Rapids Hydroelectric Project
QAPP	Quality Assurance Project Plan
Recreation Plan	Recreation Resource Management Plan
Resident Fish Plan	Resident Fish Mitigation and Enhancement Plan
RM	river mile
RPA	Reasonable and Prudent Alternative
RLF	Reverse Load Factoring
ROR	run-of-river
7Q10	7-day 10-year frequency flood
SSA	Salmon Settlement Agreement
SHPO	State Historic Preservation Officer
SPCC	Spill Prevention, Containment and Countermeasure Plan
TCP	Traditional Cultural Property
TDG	total dissolved gas
TDS	total dissolved solids
TMDL	total maximum daily load
TNC	The Nature Conservancy
TSS	total suspended solid
UCR	Upper Columbia River
Umatilla	Confederated Tribes of the Umatilla Reservation
USGS	U.S. Geological Survey

VBA	Vernita Bar Settlement Agreement
WAC	Washington Administrative Code
Wanapum	Wanapum Indians
Warm Springs	Confederated Tribes of the Warm Springs Reservation
Washington DFW	Washington Department of Fish and Wildlife
Washington DNR	Washington Department of Natural Resources
Washington DOE	Washington Department of Ecology
Washington DOT	Washington Department of Transportation
Washington SPRC	Washington State Parks and Recreation Commission
Water Quality Plan	Water Quality Management Plan
WECC	Western Electric Coordinating Council
White Sturgeon Plan	White Sturgeon Management Plan
Wildlife Plan	Wildlife Habitat Management Plan
WSCAP	White Sturgeon Conservation Aquaculture Plan
Yakama	Confederated Tribes and Bands of the Yakama Nation

EXECUTIVE SUMMARY

On October 29, 2003, Public Utility District No. 2 of Grant County, Washington (Grant PUD) filed with the Federal Energy Regulatory Commission (Commission) an application for a new license for the 1,768.8-megawatt (MW) Priest Rapids Hydroelectric Project No. 2114-116 (Project), located in portions of Grant, Yakima, Kittitas, Douglas, Benton, and Chelan Counties, Washington. This final environmental impact statement (final EIS) evaluates the potential effects on the environment associated with relicensing the Project. The project is an integral part of the seven-dam mid-Columbia River Hydroelectric System, which is the single largest coordinated hydroelectric system in the country. The area referred to as the mid-Columbia River extends from Grand Coulee dam, which at 6,809 MW is the largest hydro generating facility in the United States, to the Hanford Reach, nearly 210 miles downstream. The Project is operated in coordination with other mid-Columbia hydroelectric projects that utilize project storage to reshape the inflow hydrograph to help meet hourly changes in electricity demands. The current project license expired on October 31, 2005 and the Project is currently operating on an annual license per a Notice of Authorization issued on November 2, 2005.

The project occupies an estimated total 3,103.6 acres of federal land managed by the Bureau of Reclamation, Bureau of Land Management, U.S. Department of the Army, U.S. Fish and Wildlife Service, U.S. Department of Energy, and Bonneville Power Administration. The project also occupies an estimated total 2,804 acres of Washington State land.

In this final EIS we, the Commission staff, assess the effects of operating the project: (1) with no changes or enhancements to the current facilities or operations (No-action Alternative); (2) as proposed by Grant PUD (Proposed Action); and (3) as proposed by Grant PUD with additional or modified environmental measures to further protect and enhance environmental resources (Staff Alternative). Specifically, this final EIS evaluates the potential environmental effects and developmental costs associated with relicensing the Project.

No-action Alternative

On July 23, 2004, the Commission issued an order, 108 FERC ¶ 62,075 (2004), amending Grant PUD's license and authorizing the replacement of the 10 turbines at the Wanapum development with 10 new, upgraded turbines over a period of about 8 years. The order authorized the replacement of one turbine, followed by a study to test the effect of the advanced turbine design on fish passage survival. On October 11, 2005, Grant PUD filed a report on fish survival through the first installed turbine and, subsequently, on December 14, 2005, the Commission issued an order, 113 FERC ¶ 62,205 (2005), authorizing the installation of the remaining nine turbines. Upon completion of the replacement of all 10 turbines, the total capacity at the Wanapum development would increase from 900 MW to 1,038 MW.

Under the No-action Alternative, the project would continue to operate under the terms and conditions of the existing license, including the installation of all 10 turbines at the Wanapum dam, and no new environmental measures would be implemented. We use this alternative as the baseline against which we evaluate other alternatives. Under the No-action Alternative, the project (Priest Rapids and Wanapum developments) has a total authorized capacity of 1,893 MW, a dependable capacity of 1,647 MW and would annually generate an average of 9,039,634 megawatt-hours (MWh) of electricity. 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 Project has an average annual power value of $346,876,000 ($38.4/MWh). The average annual cost of producing this power is $78,380,000 ($8.7/MWh), resulting in an annual net benefit of $268,495,000 ($29.7/MWh).

Proposed Action

Under the Proposed Action, Grant PUD would implement the environmental measures detailed in its final license application and in subsequent filings. Measures proposed by Grant PUD include the following:

Geology and Soils Resources

- Continue to monitor the project impoundment rims for instability and erosion.
- Develop and implement erosion and sediment control measures related to project land-disturbing activities.

Water Quantity and Quality

- Implement a Water Quality Monitoring Plan (401 Application) that includes: continued reservoir management, maintenance, and monitoring of spill patterns to minimize ambient total dissolved gas levels; a water temperature monitoring plan; a dissolved oxygen, turbidity, and pH monitoring plan; operating according to the Hanford Reach Agreement; a plan for managing nuisance aquatic macrophyte and zebra mussels (see also Terrestrial Resources section); addressing potential short-term water quality impacts; and developing details for calibrating water quality monitoring sites.
- Coordinate the spill program for the project with the spill activities of other projects through the Priest Rapids Coordinating Committee (see also Aquatic Resources section).
- Continue to operate each taintor gate at Wanapum dam (see also Aquatic Resources

section).

- Continue to identify and implement experimental spill regimes as may be warranted to test opportunities for improving fish survivals with less spill flow and/or reducing TDG levels at either Priest Rapids or Wanapum Dams (see also Aquatic Resources section).
- Provide biological monitoring to determine the incidence of gas bubble disease symptoms in downstream migrating juvenile salmonids.
- Provide tailrace pumping to replace gravity fishway attraction water supply.

Aquatic Resources

- Implement and assess anadromous fish measures using an adaptive management process, various technical committees, and a dispute resolution process.
- Make steady progress towards achieving a minimum 91 percent combined adult and juvenile salmonid survival performance standard.
- Develop and annually revise a downstream passage alternatives action plan to contribute to achievement of the applicable performance standards at Wanapum and Priest Rapids dams.
- Develop and implement a performance evaluation program to assess the hatchery program, habitat program, and improvements to juvenile and adult passage survival.
- Produce annual progress and implementation plans to describe the implementation activities for spring-run Chinook salmon and steelhead.
- Contribute to a No Net Impact fund for annual juvenile salmonid survival.
- Evaluate modifications to the spill regime and spill pattern at each dam to improve juvenile salmonid survival.
- Continue to operate and maintain two adult fishways at each dam and investigate methods for improving hydraulic conditions in the fishway collection channels, junction pools, and entrance pools.
- Use the spill and bypass programs for juvenile downstream passage to provide fallback passage routes for adult spring and summer Chinook salmon. Operate the sluiceways at both Priest Rapids and Wanapum dams to provide fallback routes for steelhead and fall Chinook salmon.
- Construct, operate, and maintain an off-ladder adult trapping facility in the left-bank fishway at Priest Rapids dam.
- Operate and maintain PIT-tag detection equipment at the Priest Rapids fishways.
- Fund fish counting at Priest Rapids and Wanapum dams and provide daily fish counts for both facilities. Develop video monitoring capability for counting adults in fishways at both dams.

- Modify diffusion chambers on both fishways at Priest Rapids to improve adult lamprey passage. Modify the design of the fish count stations at Priest Rapids and Wanapum dams to improve adult lamprey passage and enumeration. If appropriate, reduce fishway flows at night to improve adult lamprey passage.
- Continue to study possible ways to improve downstream juvenile salmonid survival at Priest Rapids dam.
- Continue to provide spill (61 percent of river flow in spring and 39 percent in summer) for downstream passage at Priest Rapids dam until a better downstream passage alternative is designed, tested, and implemented.
- Continue to provide spill (43 percent river of flow in spring and up to total dissolved gas limits in summer) for downstream passage at Wanapum dam until a better downstream passage alternative is designed, tested, and implemented.
- Develop and implement operating criteria to improve turbine passage survival at Priest Rapids dam and, in the future, install new Advanced Design Turbines.
- Install gatewell exclusion screens to prevent smolts from entering the emergency wheelgate or bulkhead slots at the Priest Rapids and Wanapum dams.
- Construct a downstream fish bypass at Wanapum dam consisting of an ogee-crested weir through the center of Unit 11 and a submerged tailrace chute.
- If the proposed downstream bypass for Wanapum dam fails to achieve 95 percent dam passage survival, consult with the joint fisheries parties to improve survival through additional operational or structural modifications.
- Fund a northern pikeminnow removal program to improve smolt passage survival through the reservoirs and tailraces of Priest Rapids and Wanapum dams.
- Fund and implement an avian hazing and control program to improve smolt passage survival through the tailraces of Priest Rapids and Wanapum dams.
- Use radiotelemetry or other techniques to evaluate upstream and downstream route-specific survival at Priest Rapids and Wanapum dams.
- Conduct survival studies using PIT-tag technology or other suitable study methods to obtain dam and project passage survival estimates.
- Develop and implement a Hatchery and Genetic Management Plan for spring, summer, and fall Chinook salmon, steelhead, and sockeye salmon.
- Fund and develop the hatchery facilities necessary to annually produce 600,000 yearling spring Chinook salmon, 833,000 yearling summer Chinook salmon, 1,143,000 sockeye salmon smolts, and 100,000 steelhead smolts. Upgrade and renovate the Priest Rapids Hatchery and continue to annually produce 6,000,000 fall Chinook salmon smolts and 1,000,000 fall Chinook salmon fry. Consult on options to develop equivalent alternative mitigation programs if annual production of 1,143,000 sockeye salmon smolts is unattainable.

- Annually provide $1,096,552 to the Priest Rapids Project Habitat Fund. Develop a habitat plan to identify goals, objectives, a process for coordination, and a process by which habitat projects would be identified and implemented.
- Investigate the feasibility of habitat modifications in the Wanapum dam tailrace.
- Implement operating agreements with the Bonneville Power Administration, Douglas County PUD, and Chelan County PUD to address the cumulative effects of operations at the seven main stem dams (Priest Rapids to Grand Coulee) that control flows and result in flow fluctuations in the Hanford Reach.
- Provide a minimum flow of 55 to 70 thousand cubic feet per second in the Hanford Reach during the fall Chinook salmon spawning period.
- Establish a Critical Flow for protection of fall Chinook salmon during the pre-hatch, post-hatch, and emergence periods.
- Limit fluctuations in outflow from Priest Rapids dam during the fall Chinook rearing period within the Hanford Reach.
- Maintain a minimum flow of 36 kcfs in the Hanford Reach during all times outside the fall Chinook salmon spawning, pre-hatch, post-hatch, and emergence periods.
- Continue to use Standard Operating Procedures at both dams.
- Construct a white sturgeon conservation facility at the Priest Rapids Hatchery.
- Provide funding for upgrades, improvements, and operating costs at the Columbia Basin Hatchery.
- Enhance and improve fish habitat in the lower five miles of Crab Creek.

Terrestrial Resources

- Develop and implement a Wildlife Habitat Management Plan that would enhance riparian/wetland habitat within the lower five miles of Crab Creek and the Priest Rapids Wildlife Area and enhance wildlife habitats at the Colockum, Whiskey Dick, and Quilomine wildlife areas.
- Develop a transmission line avian collision protection plan.
- Continue current programs of installation and maintenance of: 48 wood duck nest boxes around the project shoreline, 12 raptor nesting, roosting, and perching structures, and 50 waterfowl nesting platforms.
- Support a fire suppression program in the Colockum, Quilomene, Whiskey Dick, Priest Rapids, Crab Creek, and Buckshot Wildlife Management Areas.

Rare, Threatened and Endangered Species

- Fund a rare, threatened and endangered botanical species protection plan that includes: operations and maintenance expenses, a construction schedule of any future projects to avoid disturbance of rare species, conducting pre-construction surveys, identifying measures to protect any species found during the surveys, developing an implementation schedule for protective measures, and developing a monitoring plan to evaluate the effects on rare species and habitat.

- Develop a long-term plan to monitor rare, threatened and endangered plants within the project area that includes: a description of the methods to be employed, mapping and quantifying population trends, an implementation schedule, schedule for reporting and consulting with appropriate agencies regarding the monitoring results, and funding and managing of research information.
- Develop a bald eagle perching and roosting tree enhancement and protection program.
- Develop a northern wormwood conservation plan that would include: continuing annual demographic monitoring for 10 years, working with Bureau of Reclamation to maintain 5,000 feet of fencing to eliminate vehicular access, and funding of ongoing noxious weed control, access control, data management, taxonomic investigations, and research.

Cultural Resources

- Continue its commitments to the Wanapum reflected in the agreement entered on January 8, 1957, and subsequently modified, and through any future modifications agreed to by the parties.
- Develop a multiple property documentation format for National Register of Historic Places evaluation.
- Implement a proposed schedule for determining National Register eligibility and assess/address adverse effects on remaining cultural resource properties so far inventoried.
- Within one year of license issuance and in consultation with the established the Cultural Resource Working Group, finalize and implement a Historic Properties Management Plan.

Recreation and Land Use

- Finalize the draft Recreation Resource Management Plan that defines the management of existing and future recreation resources associated with the project, including operation and maintenance costs; recreation monitoring; interpretation and education (includes interpretive displays/kiosk); integration of recreation resources with other resource management plans; and review.
- Provide funding for one full-time law enforcement (FTE) officer to Washington Department of Fish and Wildlife and one FTE to be equally divided between Grant County and Kittitas County Sheriff’s Offices; continue to provide a boat at Wanapum

dam for use by local law enforcement officers.

- Concentrate new recreation development in suitable areas that is compatible with the draft Shoreline Management Plan.
- Develop and implement a final Shoreline Management Plan and manage lands accordingly; protect the scenic quality of the mid-Columbia River and its surrounding.

Grant PUD proposes to replace the 10 existing turbines at the Priest Rapids development with advanced design turbines beginning in 2017 and extending through 2023, assuming the existing turbines have reached the end of their useful life. Upon completion of the replacement of all 10 turbines, the total capacity at the Priest Rapids development would increase from 855 MW to 955.6 MW, the rated capacity of the existing generators. Upon completion of the proposed turbine replacement upgrades at both developments, the total Project capacity would increase from 1,768.8 MW to 1,994 MW, an increase of 225 MW over the current installed capacity. With a total capacity of 1,994 MW, a dependable capacity of 1,742 MW and an average annual generation of 9,753,677 MWh, the Project, with all of Grant PUD's proposed measures, would have an average annual power value of $377,346,000 ($38.69/MWh), an annual production cost (levelized over the 30-year period of our analysis) of $146,722,690 ($15.04MWh), and an annual net benefit of $230,623,310 ($23.75/MWh).

Staff Alternative

After evaluating Grant PUD's proposed action, and the recommendations from the resource agencies and other interested parties, we considered what, if any, additional measures would be necessary or appropriate with continued operation of the project. The Staff Alternative generally consists of the Proposed Action with additional or modified environmental measures, which include some of the agency recommendations made pursuant to sections 18, 10(a), and 10(j) of the Federal Power Act, or modifications thereof, as noted.

The Staff Alternative for the Project includes most of the environmental measures proposed by Grant PUD above, except for five measures that Staff is *not* recommending:

- Contribute to a No Net Impact fund for annual juvenile salmonid survival.
- Installation of gatewell exclusion screens to prevent smolts from entering the emergency wheelgate or bulkhead slots in Priest Rapids and Wanapum dams.
- Provide funding for upgrades, improvements, and operating costs at the Columbia Basin Hatchery.
- Enhance and improve fish habitat in the lower five miles of Crab Creek.
- Provide funding for law enforcement officers.

Staff also recommends the following additional and/or modifications to environmental measures:

Aquatic Resources

- Develop a detailed fishery operations plan.
- Investigate the gate seals at Wanapum dam as a source of juvenile salmonid mortality.
- Study the effects of gatewell exclusion screens on juvenile salmonid and lamprey passage.
- Develop and implement a bull trout monitoring plan to document occurrences of bull trout in the project area.
- Add components to the Pacific Lamprey Management Plan.
- Develop and implement a White Sturgeon Management Plan.
- Prepare a final White Sturgeon Conservation Aquaculture Plan.
- Establish a Priest Rapids Fishery Forum
- Develop a Crab Creek/Burkett Lake Enhancement Plan

Terrestrial Resources

- Develop a Wildlife Habitat Management Plan (Wildlife Plan) that fully describes the actions that would be implemented in the first five years of any license and includes provisions for updating the plan every five years thereafter. The plan should identify the projects that would be implemented, where they would be implemented, how they would be implemented, how they would be maintained and monitored to ensure their continued success, and a schedule for their implementation--habitat improvement projects should identify and give priority to projects that address shrub steppe, riparian, and wetland habitats within and immediately adjacent to the project and should consider access controls.
- Develop and implement a Wildlife Habitat Monitoring and Information & Education Program to monitor the indirect effects of project-related recreation on wildlife and sensitive wildlife habitats. The wildlife monitoring and information and education program, coordinated with the Shoreline Management Plan and the Recreation Plan, should describe the methods that would be employed to educate the recreating public about the potential adverse effects of dispersed recreation on sensitive habitats and a detailed methodology for assessing recreation impacts on wildlife habitats and identifies potential corrective actions.
- Implement an Aquatic Invasive Species (AIS) Plan (same as nuisance aquatic plan proposed by Grant PUD) with three additional components: provisions for identifying and recommending any additional measures for detecting future AIS infestations; a detailed information and education program that includes: identifying

boat access points and distributing education material during peak boating season (May 1-October 30 each year), conducting voluntary boat inspection demonstrations to explain the AIS program and proper methods of cleaning boats, and distributing voluntary boater surveys prepared by Washington Department of Fish and Wildlife; and an implementation schedule.

Cultural Resources

- File with the Commission a Memorandum of Agreement between Grant PUD and the Wanapum, which may include any relevant portions of past agreements, to protect cultural resources of significance to the Wanapum.
- Provide the Department of Archaeology and Historic Preservation with the missing and incomplete information associated with the submitted site record and determination of eligibility forms.
- Develop and implement protection/mitigation measures for 20 archeological sites.
- Determine National Register eligibility for all remaining inventoried archeological sites and other cultural resources located within the Project's area of potential effect.
- Identify site-specific project-related effects on all National Register-eligible cultural resources and implement measures to protect such sites.
- Reconvene a committee similar to the Hanford Reach National Monument Federal Planning Advisory Committee to address shoreline-related effects on archeological sites in the Hanford Reach.

Recreation and Land Use

- Conduct recreational use monitoring on project lands every 6 years rather than every 12 years as proposed by Grant PUD.
- Provide additional signage at identified recreation sites.
- In a final Recreation Plan, include a provision (*e.g.*, signs) at Quilomene Dune and Bay to address wake size by boaters.
- Dredge and lengthen the Kittitas County boat launch at Vantage.
- In a final Shoreline Management Plan, manage Crescent Bar Island under the land classifications proposed as planned development and conservation, but no further development should occur beyond the existing disturbed footprint; delineate a shoreline buffer zone on the island.

The staff alternative includes the same developmental upgrades as Grant PUD's proposal and, therefore, would have the same capacity and energy attributes. Based on a total capacity of 1,994 MW, a dependable capacity of 1,742 MW and an average annual generation of 9,753,677 MWh, the Project would have an annual power value of

$377,346,000 ($38.69/MWh). Since the staff alternative includes costs of additional measures, the annual production cost (levelized over the 30-year period of our analysis) is about $145,669,980 ($14.93/MWh), yielding an annual net benefit of about $231,676,020 ($23.75/MWh).

Section 4(e) of the Federal Power Act gives the Secretaries of the Interior and Agriculture authority to impose conditions on a license 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 May 26, 2005, Interior on behalf of Bureau of Reclamation submitted the preliminary terms and conditions pursuant to section 4(e). For a summary of these preliminary conditions, see section 2.3.1. By letter dated March 24, 2006, Interior withdrew the preliminary section 4(e) terms and conditions and instead, submitted them pursuant to section 10(a).

Section 18 of the Federal Power Act, 16 USC § 811, states that the Commission shall require a licensee to construct, maintain, and operate fishways such as the ones the Secretaries of the U.S. Department of Commerce and Interior may prescribe. In a letter filed on May 27, 2005, National Marine Fisheries Service provided preliminary fishway prescriptions for salmon and steelhead at the Project. In a letter filed on May 26, 2005, Interior filed preliminary fishway prescriptions for salmon, steelhead, bull trout, and Pacific lamprey at the Project. For a summary of these prescriptions, see section 2.3.1.

The Staff Alternative does not include several of the section 10(a) conditions, section 18 prescriptions[6], as well as some recommendations filed by Interior, National Marine Fisheries Service, and Washington Department of Fish and Wildlife, pursuant to section 10(j) of the Federal Power Act. We did not recommend measures that we find are not justified or would not provide benefits over the staff-recommended measures. We address all recommendations throughout this final EIS and specifically in section 5.0, *Staff’s Conclusions.*

Conclusion

We chose the Staff Alternative as the preferred alternative because: (1) the Project would provide a significant (1,994 MW) and dependable source of electrical energy for the region; (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,

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[6] Section 18 subjects licensed projects to mandatory prescriptions for fishways imposed by the Secretary of the Interior (via Fish and Wildlife Service) and/or of Commerce (via National Marine Fisheries Service).

mitigation, and enhancement measures proposed by Grant PUD, combined with the 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 the other alternatives or license denial.

1.0 PURPOSE OF ACTION AND NEED FOR POWER

On October 29, 2003, Public Utility District No. 2 of Grant County, Washington (Grant PUD), a consumer-owned electric utility operating as a municipal corporation of the State of Washington, applied to the Commission for a new license for the Priest Rapids Hydroelectric Project No. 2110-116 (Project). With a total generating capacity of 1,768.8 megawatts (MW), the Project includes two separate dams and powerhouses located on the Columbia River in Grant, Yakima, Kittitas, Douglas, Benton, and Chelan Counties, Washington (Figure 1). The Project boundary encompasses approximately 34,380 acres, of which approximately 3,104 acres, including inundated lands, are Federal lands managed by the U.S. Bureau of Land Management, BLM, (748.85 acres), U.S. Bureau of Reclamation, BOR, (1,874.79 acres), U.S. Department of Energy, DOE, (51.24), U.S. Department of the Army (378.98 acres), and U.S. Fish and Wildlife Service, FWS, (49.83 acres).

1.1 PURPOSE OF ACTION

The Federal Power Act (FPA) provides the Commission with the exclusive authority to license non-federal water power projects on navigable waterways and federal lands. The Commission must decide whether to issue Grant PUD a new license for the Project and what conditions to place on any license it issues. The FPA requires the Commission to adopt conditions that will be best adapted to a comprehensive plan for improving or developing the waterway on which the project is located. In addition to the power and other developmental purposes, the Commission must give equal consideration to the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife (included related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

To ensure that the Commission makes an informed decision and to comply with the National Environmental Policy Act (NEPA) 42 U.S.C. 4321-4347, Commission staff prepared this final environmental impact statement (final EIS). In the final EIS, we assess the environmental and economic effects of the following alternatives: (1) continuing to operate the Project as it is currently being operated (No-action); (2) operating the Project consistent with the measures proposed by Grant PUD; and (3) operating the Project as proposed by Grant PUD with modifications recommended by staff.

Figure 1. Location of the Priest Rapids Project within the Columbia River Basin (Source: U.S. Army Corps of Engineers website; Priest Rapids labeling added by FERC Staff).

1.2 NEED FOR POWER

The 1,768.8-MW Project produces an average of approximately 8,609,000 megawatt hours (MWh) of energy annually for use by Grant PUD and the region. The energy produced by the project is roughly equivalent to the energy consumed in a year by a city the size of Seattle, Washington.

The federal law (Public Law 83-544) that authorized the non-federal development of the Project requires Grant PUD to offer a "reasonable portion" of the output of the Project for sale in neighboring states. During the initial license period Grant PUD sold 63.5 percent of the Project output under separate but uniform long-term power sales contracts and retained 36.5 percent for its own use. Grant PUD sells its share of Project power on a non-profit basis to its own retail customers and sells wholesale power to bulk power purchasers that serve customers in Washington, Oregon, Idaho, Montana, Wyoming, California and Utah.[7] Each power purchaser receives its percentage share of the Project power and pays its corresponding share of Grant PUD's total annual costs for operation, maintenance and debt service.

Commission orders of February 11, 1998 and June 12, 1998 (Kootenai Electric Cooperative, et al),[8] allow Grant PUD to keep up to 70 percent of the Project power for its own use in the next license period, and require it to market 30 percent to the utility participants in the Commission's Kootenai proceeding pursuant to a Marketing Plan to be developed by Grant PUD and filed with its application for a new license. A Marketing Plan was filed by Grant PUD with its license application.

In December 2001 Grant PUD signed new power sales contracts with the twelve original purchasers and expanded the group to include ten utilities serving customers in Idaho. The power to be sold under those contracts will consist of that portion of the 70% of the Project output which Grant PUD does not expect to need in the early years of the new license period to meet its anticipated loads. The future power purchasers are investor-owned and consumer-owned utilities headquartered in Oregon, Washington and Idaho, namely: PacifiCorp, Portland General Electric, Puget Sound Energy, Tacoma

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[7] Twelve Northwest utilities hold contracts that expire on October 31, 2005, for portions of the output from the 855-MW, Priest Rapids development. Nine Northwest utilities hold contracts that expire on October 31, 2009, for portions of the output from the 900-MW, Wanapum development.

[8] *Kootenai Electric Cooperative, et al. v. P.U.D. No. 2 of Grant County, WA*, 82 FERC ¶ 61,222 (1995), *reh'g denied*, 83 FERC ¶ 61,307 (1995), *aff'd*, 192 F.3d 144 (D.C. Cir. 1999) (*Kootenai* orders).

Power, Avista, Seattle City Light, Cowlitz PUD, Eugene Water & Electric Board, McMinnville Water and Light, City of Milton-Freewater, City of Forest Grove, Kittitas County PUD, Kootenai Electric Cooperative, Idaho County Light and Power, Northern Lights, Clearwater, and the Snake River Power Association. In total, they serve millions of customers in seven Western states.

The regional need for power is reported by the Western Electric Coordinating Council (WECC) Region of the North American Electric Reliability Council (NERC). The project is located in the Northwest Power Pool (NWPP) area of the WECC region. The NWPP area includes all or major portions of the states of Washington, Oregon, Idaho, Wyoming, Montana, Nevada and Utah, as well as a small portion of northern California and the Canadian provinces of British Columbia and Alberta. The NWPP area has a significant winter peak demand and depends heavily on hydroelectric generation (62 percent of installed capacity). For the period from 2003 through 2012, WECC expects winter peak demand and annual energy requirements in the NWPP area to grow at annual compound rates of 1.6 and 1.7 percent, respectively. With a significant percentage of hydroelectric generation in the region, it is expected that the ability to meet winter peak demand is adequate for the next ten years.

The ability to meet sustained seasonal requirements over the 10-year period depends on planned new generation additions (NERC, 2003). NERC's estimate of planned additions over the next ten years is significantly lower than estimated in 2002, down from an estimate of 81,055 MW to 32,323 MW, although approximately 8,000 MW of the 81,055 MW planned went into operation in 2002. The reduction in planned additions was primarily due to the deteriorated financial condition of several major merchant plant developers, and that more capacity was planned than was needed. Assuming the new capacity is constructed as planned, resource capacity margins for the winter-peaking area range between 23.4 and 29.6 percent of firm peak demand for the next ten years. We conclude that the region has a need for power over the near term and that the Project, which supplies a part of the current regional electricity demand, could continue to help meet part of the regional need for power.

The power from the proposed increase in turbine capacity at the Project would help to meet Grant's needs, as well as meeting part of the local and regional need for power. The project provides low-cost energy that displaces non-renewable, fossil-fired generation and contributes to a diversified generation mix. Displacing the operation of fossil-fueled facilities avoids some power plant emissions and creates an environmental benefit. The additional output resulting from the upgraded Wanapum turbines, if produced by fossil-fueled generation, would result in an increase in greenhouse gases of about 66,780 metric tons of carbon per year.

1.3 INTERVENTIONS AND PROTESTS

On November 7, 2003, the Commission issued a notice accepting Grant PUD's application for a new license for the Project. This notice set January 4, 2004, as the deadline for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene. All late interventions listed below are allowed. One intervenor, the Confederated Tribes and Bands of the Yakama Nation (Yakama), opposes the issuance of a new license to Grant PUD, alleging illegal conduct by Grant PUD regarding a competing license application pursued by the Yakama and Grant PUD's contracting practices.

Intervenor	**Date of Filing**
Washington Department of Fish and Wildlife (Washington DFW)	December 4, 2003
American Rivers	December 18, 2003
Kootenai Electric Cooperative, Inc.; Clearwater Power Company; Idaho County Light and Power Cooperative Association, Inc.; and Northern Lights, Inc.	December 31, 2003
U.S. Department of Interior (Interior)	January 6, 2004
Columbia River Inter-Tribal Fish Commission (CRITFC)	January 6, 2004
Yakama	January 6, 2004
Alaska Department of Fish and Game (Alaska DFG)	January 6, 2004
National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS)	January 6, 2004
Benton Rural Electric Association	January 6, 2004
Avista Corporation	February 23, 2004
Kittitas County Public Utility District	November 2, 2004
Yakima County	May 27, 2005
Wanapum Indians/Tribe/Band (Wanapum)	May 27, 2005

1.4 SCOPING PROCESS

Before preparing this EIS, we conducted public scoping to determine the environmental issues associated with the licensing decision and to identify the alternatives for detailed analysis. An initial scoping document was prepared by Commission staff and made available to interested parties on March 9, 2004. Public scoping meetings and a site visit were held in Moses Lake, Washington on April 6 and

April 7, 2004. Notice of the meetings and availability of the scoping document was published in the Federal Register and local newspapers. Transcripts of the meetings are part of the public record for the project. In addition to the comments received at the meetings, the following entities provided written comments:

Commenting Entity	**Document Date**
Clifford J. Appel	April 7, 2004
Bill Crawford	April 9, 2004
Juanita Hackler	March 27, 2004
Pat Kelleher	April 29, 2004
AgFARMation	April 14, 2004
Basic American Foods	May 3, 2004
Chem-Con Materials Corporation	April 20, 2004
Columbia Basin Development League	May 3, 2004 (filed)
Columbia Basin Vegetable Seed Association	May 7, 2004
Grant County Black Sands Irrigation District	April 7, 2004
Industrial Customers of Northwest Utilities	May 6, 2004
McMinnville Water and Light	April 16, 2004
National Frozen Foods Corporation	April 5, 2004
Pacific Northwest Vegetable Association	May 17, 2004
Quincy-Columbia Basin Irrigation District	April 19, 2004
Samaritan Healthcare	April 6, 2004
Solar Grade Silicon LLC	May 3, 2004 (filed)
Washington State Potato Commission	May 3, 2004
Back Country Horsemen of Washington	April 22, 2004 (filed)
CRITFC	May 7, 2004
Grant County Economic Development Council	April 20, 2004
John Wayne Trail Wagons and Riders Association	May 1, 2004
Alaska DFG	May 7, 2004
Association of Grant County Cities and Towns	May 6, 2004
Grant County Board of County Commissioners	May 6, 2004

Commenting Entity	Document Date
Grant County Tourism	May 4, 2004
NMFS	May 3, 2004
Port of Matawa	April 6, 2004
Port of Warden	April 6, 2004
Port of Moses Lake, Grant County International Airport	April 26, 2004
U.S. Bureau of Indian Affairs	April 27, 2004
BOR	April 30, 2004
FWS	May 4, 2004
Washington Department of Natural Resources (Washington DNR), Recreation Dept.	April 29, 2004
Washington DFW	April 27, 2004
Washington Department of Ecology (Washington DOE)	April 30, 2004
Washington DNR, Natural Heritage	April 16, 2004
Yakama	May 7, 2004

1.5 AGENCY CONSULTATION

On March 25, 2005, the Commission issued a notice that the application was ready for environmental analysis and solicited comments, recommendations, terms and conditions, and prescriptions to be filed by May 24, 2005. The following entities responded:

Entity	Date Filed
CRITFC, jointly with the Yakama and the Confederated Tribes of the Umatilla Indian Reservation (Umatilla)	May 27, 2005
NMFS	May 27, 2005
Washington DFW	May 27, 2005
Interior	May 26, 2005
Alaska DFG	May 26, 2005
Washington DNR	May 31, 2005
Kittitas County Department of Public Works	May 26, 2005

Entity	Date Filed
Pat Kelleher (individual)	May 17 & 31, 2005
Terry W. Garrick (individual)	May 31, 2005

On July 8, 2005, Grant PUD filed comments in reply to the comments, terms and conditions recommended by the above listed entities.

1.6 COMMENTS ON THE DRAFT EIS

On February 24, 2006, we issued the draft EIS for relicensing the Project. A February 28, 2006, notice inviting comments on the draft EIS was published in the *Federal Register* on March 8, 2006. The notice specified that all comments be filed with the Secretary of the Commission by May 2, 2006. In addition, Commission staff held two public meetings on April 19, 2006, in Grant County, Washington to provide interested parties the opportunity to comment on the draft EIS. The comments given at these meetings were recorded and a transcription of the meeting placed in the Commission's record for this proceeding.

We have modified the text of the final EIS as appropriate in response to comments on the draft EIS. Appendix A lists the commenters, summarizes the comments, and presents our responses to those comments.

2.0 PROPOSED ACTION AND ALTERNATIVES

In this section, we describe the proposed action and alternatives considered. Section 2.1 describes the no-action alternative under which the Project would continue to be operated in accordance with the current license conditions. This alternative represents the existing conditions and is the baseline to which we compare the other action alternatives. Section 2.2 describes Grant PUD's proposed project as described in its license application filed with the Commission on October 29, 2003. Section 2.3 describes a staff alternative consisting of the proposed project, with modifications based on the resource management agencies' required environmental protection measures together with additional measures recommended by Commission staff and interested parties. Section 2.4 discusses other alternatives that have been considered but eliminated from detailed evaluation in this EIS.

2.1 NO ACTION

Under the no-action alternative the project would continue to operate under the terms and conditions of the existing license and no new environmental measures would be implemented. Any ongoing effects of the project would continue. The no-action alternative represents the baseline environmental conditions for comparison with other alternatives.

2.1.1 General Description of Existing Project

The Project includes two hydroelectric developments, Wanapum and Priest Rapids, located on the Columbia River in central Washington. Since the developments went into commercial service in 1964 and 1961, respectively, they have provided over 300 billion kilowatt-hours (kWh) of low cost, renewable energy to the people and industries of the Northwest. The current authorized installed capacity of the Project is 1,768.8 MW.

Each development includes a dam, powerhouse, fishway, spillway, reservoir, 230-kilovolt (kV) transmission lines, water rights, rights-of-way, and structures and lands associated with the operation of the Project. The Project also includes associated switchyards, transmission facilities, a control system, maintenance and safety equipment and other structures, and the Priest Rapids Hatchery.

Both dams have embankment sections extending from the left and right abutments to center concrete sections. The primary purpose of the spillways is to safely release river flows that exceed the turbine capacity. These spillway gates have also been used more recently to spill water for the purpose of aiding downstream fish migration. Both dams are equipped with fish ladders on the east and west banks of the river to provide upstream passage for salmon, steelhead and other anadromous fish.

Wanapum and Priest Rapids powerhouses each have ten turbines with FERC authorized installed capacities of 913.8 MW and 855 MW respectively, for a present installed capacity of 1,768.8 MW. The current maximum hydraulic capacity of each powerhouse is approximately 175,000 cubic feet per second (cfs), assuming all ten units are operating at full capacity.

The total area within the Project Boundary is 34,380 acres, consisting of the lands necessary for the safe operation and maintenance (O&M) of the Project and other purposes, such as recreation, shoreline control and protection of environmental resources. Several small streams and creeks flow into the Columbia River within the Project boundaries. The Wanapum Indian Village is on the west bank of the Columbia River at Priest Rapids dam.

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 Wanapum Development

The Wanapum development, located at river mile (RM) 415 near the I-90 Bridge at Vantage, Washington, has a powerhouse containing the original nine, vertical shaft, Kaplan turbine generator sets with a total authorized generating capacity of 810 MW and one, new advanced design turbine connected to the original generator with a total authorized capacity of 103.8 MW for a total authorized installed capacity of 913.8 MW. The total authorized capacity of the Wanapum development is 1,038 MW based on the Commission's December 14, 2005 license amendment[9], which authorized the replacement of the remaining nine turbines at Wanapum with advanced design turbines.

The total length of Wanapum dam is 8,637 feet, with the axis of the powerhouse being almost parallel with the general direction of river flow. The development has two 'elbows' in its layout and this geometry of the structure is unique on the Columbia River.

[9] 113 FERC ¶ 62,205 (2005)

A Future Units section designed for six additional generating units extends from the powerhouse to the spillway. Wanapum reservoir extends 38 miles upstream to the tailwater of Chelan County PUD's Rock Island dam, and has a surface area of approximately 14,680 acres.

2.1.3 Priest Rapids Development

The Priest Rapids development, located at RM 397, just upstream of the Hanford Reach section of the Columbia River, has a powerhouse containing 10, vertical shaft, Kaplan turbine generator sets with a total generating capacity of 855 MW. The Priest Rapids dam is 10,103 feet long, and is sited essentially perpendicular to the river flow. The Priest Rapids reservoir extends for 18 miles upstream to the tailwater of Wanapum dam, and has a surface area of approximately 7,725 acres.

2.1.4 Project Transmission Lines

The output from the Wanapum Development is connected to the main transmission grid by three 1.5-mile long, 230-kV overhead transmission lines at two switchyards: Grant PUD's Wanapum switchyard and the adjacent Bonneville Power Administration (BPA) Vantage switchyard. From there, one 230-kV transmission line runs north for 31 miles, connecting to BPA's Columbia substation located about 4 miles south of Rock Island dam. Another 230-kV line (the Wanapum-Priest Rapids tie line) runs about 17 miles south from the Wanapum substation to the Priest Rapids substation. The third 230-kV line terminates at the BPA Vantage switchyard. All three transmission lines are primary to the Wanapum Development and are part of the Project.

Power generated from the Priest Rapids Development is stepped up from 13.2 kV to 230 kV by transformers located at the powerhouse. The transformers feed into a common 230 kV bus from which three 230-kV transmission lines extend about 1 mile to the Priest Rapids switchyard and then for about 6 miles to BPA's Midway Substation, which is part of the integrated regional transmission grid.

2.1.5 Project Hatcheries

The Priest Rapids Hatchery was originally a spawning channel developed under a 1963 agreement between Washington DFW and Grant PUD. The Umatilla indicated that the spawning channel was unsuccessful because adult salmon failed to migrate the length of the channel. Beginning in 1972, Washington DFW experimented with raceway culture techniques for fall Chinook at the Priest Rapids Hatchery by modifying sections of the spawning channel and removing the spawning gravels. This test program continued from 1972 through 1978 and produced positive results suggesting that the facility could be converted from a spawning channel to a rearing pond facility. In 1978, Grant PUD funded a study, which determined that the Priest Rapids spawning channel showed potential for conversion to a conventional pond-rearing hatchery. By agreement between Grant PUD and Washington DFW dated March 4, 1980, a production target of 100,000 pounds of fall Chinook was established for the Priest Rapids Hatchery. Since that time, the hatchery has continued to produce approximately 7 million fall Chinook smolts annually which contribute to the upriver bright run of fall Chinook returning to the Hanford Reach.

2.1.6 Project Recreation Facilities

The Project includes the following 11 recreation facilities, owner in parentheses, associated with the Wanapum development:

- Wanapum dam Picnic Area (Grant PUD)
- Wanapum dam Heritage Center (Grant PUD)
- Wanapum dam Upper Boat Launch (Grant PUD)
- Wanapum dam Overlook (Grant PUD)
- Getty's Cove Campground and Boat Launch (privately owned and operated)
- Ginkgo/Wanapum State Park (Washington SPRC operated/Grant PUD owned)
- Kittitas County Boat Launch (Kittitas County operated/Grant PUD owned)
- Riverstone Resort Campground and Marina (privately operated/Grant PUD owned)
- Frenchman Coulee (Washington DFW; Grant PUD)
- Sunland Estates Boat Launch (Washington DFW operated/BLM owned)
- Crescent Bar Resort (privately operated/Grant PUD owned)

The following three facilities associated with the Priest Rapids development:

- Desert Aire (privately operated/Grant PUD owned)
- Buckshot Ranch (Washington DFW operated/Grant PUD owned)
- Wanapum dam Lower Boat Launch (Grant PUD)

The Priest Rapids and Wanapum reservoir areas and project lands are open for use by the public for recreational purposes subject to the provisions of Grant PUD's draft Shoreline Management Plan, dated August 2003.

2.1.7 Project Cultural Resource Facilities

The Project includes the Wanapum dam Heritage Center that consists of a public museum and repository for information regarding cultural, historical, and archaeological resources of the Wanapum. The Heritage Center consists of three areas: a museum with historical information with an observation deck, a hydroelectric Project interpretive and viewing area, and a fish ladder viewing site and interpretive facility. All three sites are located at the Wanapum Development, and are accessed via a paved road from Highway 243.

2.1.8 Existing Project Operation

The 1,768.8-MW Project is an integral part of the seven-dam mid-Columbia River Hydroelectric System, which is the single largest coordinated hydroelectric system in the country with a total combined capacity of just under 13,600 MW. The area referred to as the mid-Columbia River extends from Grand Coulee dam, which at 6,809 MW is the largest hydro generating facility in the United States, to the Hanford Reach, nearly 210 miles downstream (see Figure 2).

Each of the seven mid-Columbia dams is operated in accordance with the terms of the Mid-Columbia Hourly Coordination Agreement (HCA)[10] which seeks to maximize electricity generation to satisfy regional customer needs within the constraints of operating criteria designed for non-power, environmental protection purposes.

Exhibit B of the license application contains a detailed description of the complex and interrelated set of laws, treaties and operating agreements that govern the operation of 29 major federal water resource projects and dozens of large non-federal projects, including the Project, that have been developed in the Columbia River Basin since the early 1900s. Table 1 summarizes the major non-power operating agreements that currently govern the operation of the Project, as well as other mid-Columbia Projects.

Grant PUD says the benefit of coordinated operation is better management of the water resources and hydroelectric facilities of the mid-Columbia River to achieve a diverse set of goals for the region, including flood control, protection and enhancement of fishery resources, power generation at the time of highest electricity demand, load-following, and assuring reliability of the transmission system. To better understand the importance of coordinated operation in achieving these goals, it is important to consider the physical attributes of the mid-Columbia dams, their relationship to each other and their unique position in the Columbia River.

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[10] In 1966, Congress authorized the expansion of power generation facilities at the federally-owned, Grand Coulee and Chief Joseph dams. Because of concerns about the potential effects of having a much greater turbine discharge capacity at Grand Coulee than at the 5 non-federal, mid-Columbia PUD projects on the river just downstream, the parties agreed to jointly develop a method for coordinating the operation of all 7 of the mid-Columbia River projects. This eventually led to the signing in 1972 of the HCA, which has recently been extended through November 1, 2017. (Grant PUD, final license application, Exhibit B, p. B-5, 2003)

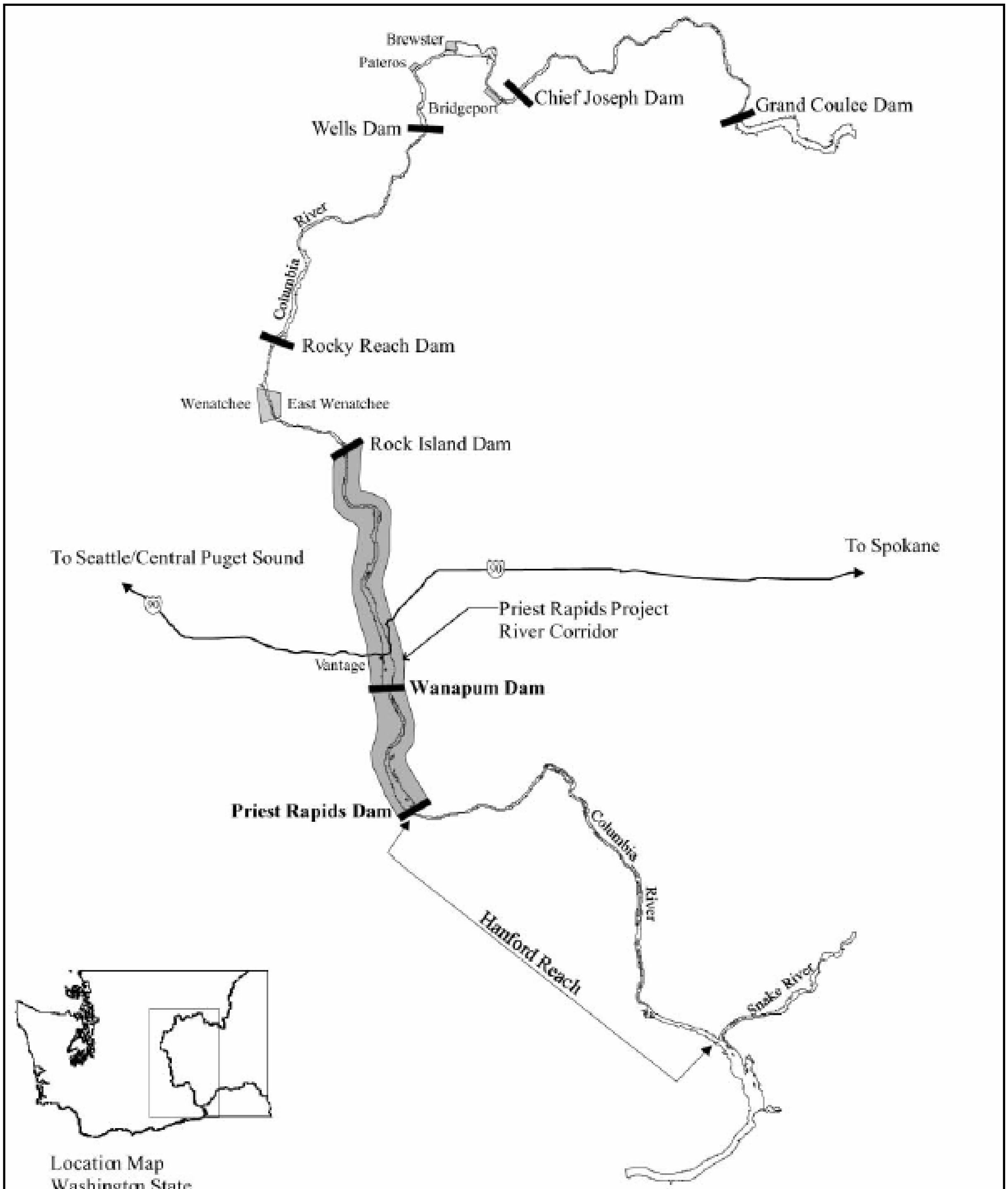

Figure 2. Map showing Mid-Columbia Projects and the Hanford Reach (Source: Grant PUD, 2003).

Table 1. Non-power programs related to Priest Rapids Project and mid-Columbia River operations (Source: Exhibit B, License Application, October 2003).

Development Affected	Non-Power Requirement	Constraint	Approximate Period	Comments[1]
Priest Rapids	License Order	36 kcfs minimum flow	Continuous	Based on downstream nuclear plant cooling water requirements.
Priest Rapids Wanapum	1988 Vernita Bar Settlement Agreement (VBA)	50-70 kcfs daytime maximum flow	Spawning Period, from mid-October to the Sunday prior to Thanksgiving	Reverse load factoring (RLF)
Priest Rapids Wanapum Rocky Reach Wells Chief Joseph Grand Coulee	1988 VBA	50-70 kcfs Protection Level Flow from end of spawning to end of emergence.	From late November to May	Protection level flows are met from GCL, CHJ, and tributary flows. If this is not sufficient, PRD drafts 3 feet (ft), then WAN drafts 2 ft, then RRH drafts 1 foot, and WEL drafts 1 foot, then PRD drafts an additional 0.7 ft. If flows are still not sufficient, operators meet protection level flow through Hourly Coordination.
Priest Rapids Wanapum	1994 FERC Interim Order	Spill to ensure downstream passage of 70% of spring migrants and 50% of summer migrants over 80% of the runs.	Spring; start mid-April, end mid-June. Summer; start mid-June to mid-July, end mid/end of August.	Superseded by 2000 Memorandum of Agreement (MOA), except for 2001.
Wanapum	2000 MOA	Spill to increase downstream passage of spring and summer migrants via non-turbine routes.	Mid-April to mid-June for spring spill; mid-June to mid-August for summer spill.	Spill during both periods is typically limited by Total Dissolved Gas (TDG) levels.
Priest Rapids	2000 MOA	Spill to increase downstream passage of spring and summer migrants via non-turbine routes.	Mid-April to mid-June for spring spill; mid-June to mid-August for summer spill.	Spill during either period may be increased to make up for WAN shortfall.

Priest Rapids	2004 NMFS's Biological Opinion (BO)	Combination of fish passage measures, hatchery programs, and fish habitat enhancements along tributary rivers and streams.		
14 Developments on the Columbia River	2004 Federal Columbia River Power System BO	Modified spill and transportation schedules based on new research for Endangered Species Act-listed salmon and steelhead	Through 2014	
Priest Rapids	2004 Hanford Reach Agreement	Part of Grant PUD's proposal (see section 2.2.3)	See section 2.2.3	
Rock Island Rocky Reach Wells	2004 Anadromous Fish Agreement and Habitat Conservation Plans (HCP)	Combination of fish passage measures, hatchery programs, and funds for habitat improvement of salmon and steelhead	50 years	
Priest Rapids	2006 Salmon Settlement Agreement (SSA)			
Priest Rapids Wanapum Rock Island Rocky Reach Wells Chief Joseph Grand Coulee	Hanford Reach Juvenile Fall Chinook Protection Program	1. When PRD outflow is between 36 and 80 kcfs limit PRD daily delta to no more than 20 kcfs. 2. When PRD outflow is between 80 and 110 kcfs limit PRD delta to no more than 30 kcfs. 3. When PRD outflow is between 110 and 140 kcfs limit PRD flow delta to no more than 40 kcfs. 4. When PRD outflow is between 140 and 170 kcfs limit PRD delta to no more	From late March (start of emergence) to early June (400 TUs after end of emergence).	Implemented by using PRD and WAN to re-shape incoming flow fluctuations according to fluctuation limits. On-peak generation shortfall is made up by upstream Projects using Hourly Coordination.

		than 60 kcfs. 5. When PRD outflow is greater than 170 kcfs, maintain PRD minimum outflow of 150 kcfs.		

[1] Abbreviations used in this table are: GCL-Grand Coulee; CHF-Chief Joseph; PRD-Priest Rapids; WAN-Wanapum; RRH-Rocky Reach; WEL-Wells

Figure 3 is a profile of the mid-Columbia River showing the relationship of the seven dams and the reservoirs created by each. At normal operating water surface elevations, backwater conditions extend from each dam to the tailwaters of the next upstream dam. Because of this, a change of flow at one dam very quickly produces a change of water surface elevation in the forebay of the next downstream dam unless a corresponding (coordinated) change is made in the flow at the downstream dam. By coordinating the operations, the relatively small amount of storage available at each of the PUD projects can be used to make minor (hourly) changes to the shape of the outflows.

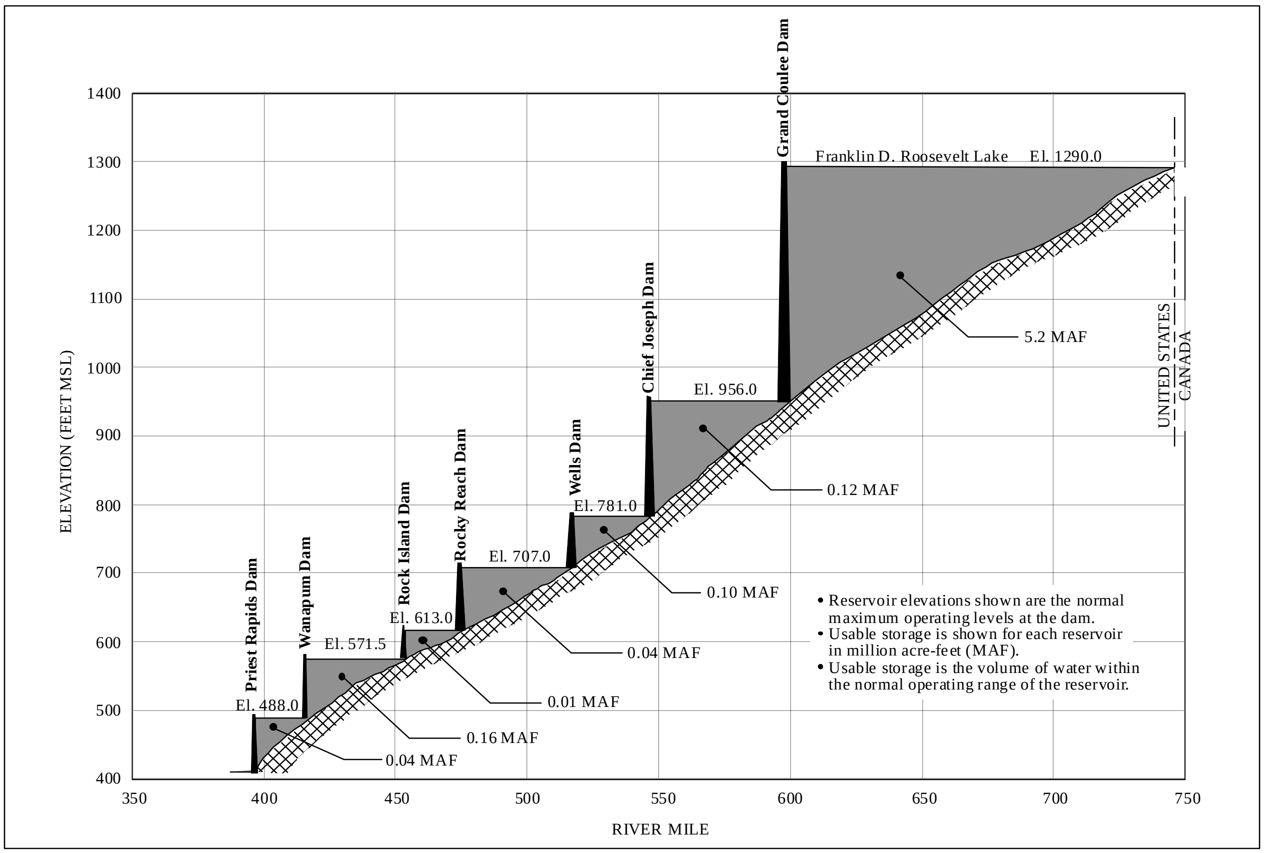

Figure 3. Mid-Columbia River profile and useable storage volumes (Source: Grant PUD, Exhibit B, License Application, October, 2003).

Table 2 shows the travel time (defined as the time required for changes in the water surface elevation at the forebay of a downstream dam in response to a flow change at the next upstream dam) through each of the reservoirs downstream from Grand Coulee. The travel times range from 45 minutes for the smaller reservoirs to 2 hours and 45 minutes for the larger ones. The travel time is 1 hour and 30 minutes for Wanapum and

45 minutes for Priest Rapids. The total time required for a flow change at Grand Coulee to begin to affect reservoir elevation at Wanapum dam would be about 9 hours with no flow shaping by the intervening projects. Normal operating practice, however, includes some re-shaping at each of the reservoirs in accordance with the requirements of their respective power demands and non-power operating requirements.

Table 2. Reservoir length and travel time for mid-Columbia Projects below Grand Coulee (Source: Exhibit B, License Application, October 2003).

Project	**Reservoir Length**	**Travel Time**
Chief Joseph	52 miles	2 hr 45 min
Wells	29 miles	1 hr 15 min
Rocky Reach	38 miles	2 hr 45 min
Rock Island	21 miles	45 min
Wanapum	38 miles	1 hr 30 min
Priest Rapids	18 miles	45 min

Another physical attribute of the mid-Columbia projects that necessitates a coordinated approach to their operation is the hydraulic capacity of the respective project turbines to handle the maximum generating output capability of Grand Coulee. Grand Coulee and Chief Joseph are primarily used to satisfy on-peak demand. With the addition in 1975 of a third powerhouse at Grand Coulee dam, the turbine hydraulic capacity at Grand Coulee exceeds that of the downstream PUD projects (Table 3). Without a coordinated approach to operation, this imbalance, together with the short response (travel) times, would result in a significant amount of unplanned spill (wasted energy) at the downstream projects.

Table 3. Maximum turbine hydraulic capacity of mid-Columbia Projects (Source: Exhibit B, License Application, October 2003).

Project/Development	**Maximum Hydraulic Capacity (cfs)**
Grand Coulee	280,000
Chief Joseph	213,000
Wells	220,000
Rocky Reach	220,000
Rock Island	220,000
Wanapum	180,000 (188,000[1])
Priest Rapids	175,000 (185,000[1])

[1] Estimated station hydraulic capacity after replacement with advanced design turbines.

The HCA provides a framework for coordinating the operation of the mid-Columbia projects to make efficient use of the water resource for power, while protecting non-power resource benefits by incorporating project specific environmental operating constraints. This EIS considers recommendations by agencies, tribes and other parties to the licensing proceeding for changes to the current non-power operating requirements at the Project. Because implemented through the HCA, the following section describes the HCA in greater detail and the current non-power operating requirements and agreements.

Mid-Columbia Hourly Coordination Agreement (HCA)

The HCA was originally signed for a one-year experimental period from July 1, 1972 to June 30, 1973. Twelve parties representing the federal government, the three mid-Columbia PUDs, and all of the power purchasers at that time signed the original agreement. Several one-year agreements were signed covering subsequent periods until a ten-year contract was signed on July 1, 1977. At the end of that term, another 10-year contract was signed, extending the arrangement through June 30, 1997. A new 20-year renewal agreement has been signed extending the term to November 1, 2017.

In general, the parties to the HCA have agreed to coordinate the operation of the projects to achieve the following objectives:

1. Coordinate the hydraulic operation of the projects for the purpose of optimizing the amount of energy from the available water consistent with the need (1) to adjust the total actual generation to match the total requested generation, and (2) to operate within all power and non-power requirements.
2. Provide flexibility and ease of scheduling project generation through centralized, coordinated scheduling and the use of composite scheduling and accounting procedures.
3. Minimize unnecessary changes in project generation to avoid frequent unit starts and stops.
4. Reduce the amount of fluctuation in river flow that could otherwise occur without such coordination.

Grant PUD has been designated to coordinate the scheduling activities and dispatching at its headquarters (Central) in Ephrata. Communications were established between Central and the dispatching centers controlling the seven dams.

Each day the non-federal Hourly Coordination participants provide an estimated schedule of desired generation from the lower five projects. The federal project operators provide an estimate of water expected to be discharged from Grand Coulee and Chief Joseph. Central then determines an estimated operation schedule for the following day based on anticipated flows from the federal projects, reservoir levels and load. Central sends the schedule to each of the five lower projects. Each project then pre-schedules its operation, including hourly generation, for the following day based on Central's estimated operation schedule.

During real-time operation each non-federal project sends Central an uncoordinated load request signal every four seconds. Based on the sum of these load requests, Central's computer system determines the actual allocation of generation required to meet load demand and non-power constraints for the system. Central operators use power generation characteristics and reservoir target elevations to set desired generation and discharges at each of the developments.

After Central establishes the coordinated generation by sending a coordinated request signal back to each of the non-federal projects, the coordinated generation signal is also sent to the federal projects in the form of a "bias," defined as the difference between coordinated and uncoordinated generation. A significant change in load requests, which might, for example, be driven by power market prices, can result in significant bias. Therefore, the federal projects have established limits on the amount of bias they would accept. Under certain conditions, the federal projects can elect to have zero bias, during which Central has no ability to control generation at the federal projects. During these periods the federal projects are considered to be "off" coordinated operation and they operate for maximum power which typically results in larger flow fluctuations. This occurs about 10% of the time and can also result in spill at the lower five projects.

Power operations at the Priest Rapids and Wanapum Developments are designed primarily to meet daily load requirements through the assignment of "allocated generation" by Central Control at Grant PUD. Automatic control logic is used to maintain preset reservoir levels in order to meet load requirements and prevent inadvertent spill due to unscheduled changes in flows from upstream projects. The typical daily power operations of both Wanapum and Priest Rapids include a drawdown of approximately 1 to 3 ft below the normal maximum pool elevation. Depending on river flow conditions and load requirements, drafting of the reservoirs may begin at the start of each daily cycle to sustain generation during peak demand until releases from Chief Joseph reach Priest Rapids. The reservoirs are typically restored to maximum reservoir elevation overnight and may be drafted again the following morning.

During periods when one or more turbines are out of service for maintenance, the reservoir levels at Wanapum or Priest Rapids may be lowered by approximately 2 to 3 ft to capture daily generation flows released from Chief Joseph without spilling. The reservoirs are typically refilled overnight and drafted the next morning until the outage is over.

Daily drafts of the reservoir averaging about 2 to 3 ft at the Priest Rapids Development also occur when flows below the dam must be adjusted to accommodate downstream barging activity or to permit groundwater testing in the Hanford Reach. These activities typically occur in the spring or fall when load demand is relatively low. Impoundment levels are lowered so that daily generation flows received by the Project from upstream can be stored and re-regulated. Barging requires flows between 40,000 and 140,000 cfs, and the Hanford Reach groundwater testing requires 60,000 cfs or less discharge from the Priest Rapids Development. Similar to reservoir drawdowns to accommodate turbine outages, the reservoirs are typically refilled each night and redrafted the next day until the associated activity is completed.

Fluctuations of the Wanapum and Priest Rapids reservoirs typically occur during fall implementation of the VBA. During a 40-day period beginning in mid-October until the last Sunday prior to Thanksgiving, the Project is used to re-shape flows to the Hanford Reach. This is termed Reverse Load Factoring (RLF) and may result in daily reservoir fluctuations of several feet. To sufficiently control flows, the Wanapum reservoir may be drafted overnight to regulate next day inflows from upstream storage released for daytime generation. During this operation, both the Wanapum and Priest Rapids reservoirs are used to re-regulate generation flows to maintain lower daytime flows below the Project.

Vernita Bar Settlement Agreement (VBA)

The VBA was filed with FERC on July 16, 1988, and approved on December 9, 1988 (45 FERC 61,401; Grant PUD et al. 1988). The agreement ensures that the operation of the mid-Columbia River system provides adequate flow for salmon eggs and fry in the Vernita Bar area located approximately four miles below the Priest Rapids Development. Parties to the agreement include three mid-Columbia PUDs (Grant, Chelan, and Douglas), the BPA, NMFS, the Washington Department of Fisheries (now known as the Washington DFW), the Oregon Department of Fish and Wildlife, and the Umatilla, the Confederated Tribes of the Colville Indian Reservation (Colville), and the Yakama. The current VBA is set to expire concurrently with the term of the existing Project license although the signatories agreed that it is to continue for the term of any annual licenses.

The VBA stipulates that operations under the Agreement provide acceptable protection for fall Chinook salmon at Vernita Bar, and that all requirements are satisfied with respect to existing laws and regulations, including the FPA. The agreement also satisfied the Vernita Bar Phase of the mid-Columbia Proceeding. The agreement describes the manner in which Grant, Chelan, and Douglas PUDs and the BPA will cooperate to provide the required flow regimes. The VBA also defines special conditions that apply in cases of impossibility of performance and adverse water conditions.

In order to minimize the formation of redds above water levels corresponding to a flow of 70 kcfs, flows are managed in a unique manner. The agreement provides that Grant PUD will operate the Project to the extent feasible to produce Priest Rapids outflows during daylight hours that equal 68% of the daily average Wanapum inflow. This obligation is in effect during the spawning period (defined as initiation of spawning typically in late October through the last Sunday prior to Thanksgiving) for inflows between 80 and 125 kcfs and is termed RLF. However, in practice, Grant PUD makes every effort to maintain daytime flows below 70 kcfs, regardless of the inflow in order to accomplish the goal of limiting spawning to areas below 70 kcfs. Under the VBA, BPA has no obligation to limit fall flows; however the VBA contemplates BPA cooperation in managing fall flows.

Following the spawning period, a monitoring team determines a protection level flow (minimum flow) by counting redds in the Vernita Bar index area. The protection level flow is set using the following criteria:

- If 31 or more redds are located above the 65 kcfs elevation, the Critical Elevation will be the 70 kcfs elevation
- If there are 15 to 30 redds above the 65 kcfs elevation, the Critical Elevation will be the 65 kcfs elevation
- If there are fewer than 15 redds above the 65 kcfs elevation, then the Critical Elevation will be the first 5 kcfs elevation above the elevation containing the 16th highest redd within the survey area on Vernita Bar (Table B-8 for examples of the application of these counts)

To maintain the protection level flow below Priest Rapids dam, the VBA describes operating obligations for Grant PUD, Chelan PUD, Douglas PUD and BPA. During non-holiday weekdays, BPA is required to provide flow from Chief Joseph dam (less side inflow) that is not less than the protection level flow. On Saturdays, BPA can reduce Chief Joseph flows so that the difference of Chief Joseph flow and side inflows compared to the protection level flow does not exceed 38.5 kcfs for that day. On Sundays, BPA can reduce Chief Joseph flows so that the difference of Chief Joseph flow and side inflows compared to the protection level flow does not exceed 35.6 kcfs for that day.

When necessary to make up for the difference between Chief Joseph outflow, side inflows and protection level flows, Grant, Chelan and Douglas PUDs are obligated to make up the deficiency by drafting according to the following schedule as necessary, to maintain the protection level flow:

1. Grant PUD drafts up to 3 ft from Priest Rapids reservoir
2. Grant PUD drafts up to 2 ft from Wanapum reservoir
3. Chelan PUD drafts up to 1 ft from Rocky Reach reservoir
4. Douglas PUD drafts up to 1 ft from Wells reservoir

5. Grant PUD will draft up to 0.7 ft from Priest Rapids

The VBA allows Grant, Chelan and Douglas PUDs to draft their reservoirs in an alternative manner as long as the alternative provides an equivalent volume and also provides a mechanism to provide additional water through use of the HCA. Drafts are limited to levels within the applicable reservoir operating elevations. Whenever a reservoir is within 1 ft of minimum elevation, reservoir refill is to be accomplished in reverse order of draft or alternative manner by agreement of Grant, Chelan and Douglas PUDs.

Under the VBA, a team of biologists monitors salmon spawning activities and establishes the protection level flow, which is the minimum flow required to keep redds fully watered through the incubation and emergence period. The VBA establishes a cap of 70 kcfs on the protection level flow. The monitoring team also tracks temperature data, and uses this information and the redd counts to determine dates of spawning, hatching, emergence and end of emergence. The protection level minimum flow ceases following completion of emergence. This typically occurs in mid-May, although under the VBA it has been as early as April 21 (in 1992) and as late as June 22 (in 1996).

Fish Spill Operations

In May 1994, FERC issued an Interim Order (58 FERC 63,022) requiring Grant PUD to spill water at both Wanapum dam and Priest Rapids dam to achieve non-turbine downstream passage of 70% of the spring migrants over 80% of the run, and 50% of summer migrants over 80% of the run. This order was based on an initial ruling under the Mid-Columbia Proceeding. Grant PUD has operated under this Interim Order since 1994, although the level of spill has been increased as a result of informal consultation under the Endangered Species Act (ESA). With the listing of Upper Columbia steelhead as an endangered species in 1997 (62 FR 43,937) and Upper Columbia spring Chinook in 1999 (64 FR 14,308), Grant PUD filed an Interim Protection Plan with FERC that called for spring spill of 43% of river flow at Wanapum dam and 61% at Priest Rapids dam to cover 95% of the spring out-migration of juvenile steelhead and spring Chinook. During most years, total dissolved gas (TDG) limits prevented spill up to target levels at Wanapum dam. Beginning in 1999, Grant PUD agreed to a corresponding increase in spill at the Priest Rapids Development to make up for this shortfall at Wanapum. From 1998 to 2001, Grant PUD operated under these Interim Protection Plan spill levels.

Grant PUD provided summer spill operations under the Interim FERC Order from 1994 to 1999. In the summer of 2000, a Memorandum of Agreement (MOA) between Grant PUD and the Joint Fisheries Parties (JFP) that set a summer spill at 49% for Wanapum and 39% for Priest Rapids was filed with FERC. Again, in the event that TDG limited Wanapum spill, Grant PUD agreed to make a corresponding increase in Priest

Rapids spill. This MOA governed summer spill operations in 2000 and 2002. During the 2001 energy emergency and drought, Grant PUD reduced summer spill to Interim Order levels.

Under these operating orders and agreements, fish spills have increased steadily from 1995 to 2002. However, variable hydraulic conditions and authorized experiments to test the effectiveness of various fish passage alternatives have led to variability in year to year spill rates. At Priest Rapids dam, spring spill has ranged from a low of 22% in 1995 to a high of 68% in 1999, with summer spill ranging from a low of 18% in 1995 to a high of nearly 55% in 2002.

Hanford Reach Juvenile Fall Chinook Protection

In 1997, concerns were raised about the effects of flow fluctuations from the mid-Columbia River system on fall Chinook fry rearing in the Hanford Reach of the Columbia River. Grant PUD and BPA jointly funded a multi-year study undertaken by the Washington DFW to evaluate the impacts of flow fluctuations on fall Chinook fry. During high flows in 1997, very little fry impact was observed. During the average flow year of 1998, Washington DFW researchers sampled over 30,000 newly emerged fry from isolated pools along the river margin. In the fall of 1998, the Washington DFW approached BPA and Grant, Chelan and Douglas PUDs about potential operational modifications to address the issue. Starting in 1999, the mid-Columbia operators provided an experimental re-shaping program to limit flow fluctuations in the Hanford Reach which has continued to evolve. The basic approach of the program is to develop an allowable flow fluctuation band that varies according to defined criteria. The period of time affected is generally mid-March through June.

In 1999, the program allowed for 40 kcfs fluctuations below Priest Rapids dam when no fish spill was occurring and 60 kcfs fluctuations below Priest Rapids dam during fish spill when weekly average flows were below 170 kcfs. When flows were greater than 170 kcfs, a 150 kcfs minimum flow was applied. In addition, a re-wetting program was attempted in 1999; however this was abandoned after two weekends when sampling revealed higher numbers of stranded or entrapped fish. In 2000, the program was continued without the re-wetting operation. During 2001, the program was further modified with 40, 60, and 80 kcfs fluctuation limits when weekly flows were less than 170 kcfs (flows never exceeded 170 kcfs in 2001 so the 150 kcfs minimum operation was not used). Modifications in 2002 provided smaller fluctuation limits of 20 kcfs when flows at Priest Rapids dam were less than 80 kcfs, 30 kcfs when Priest Rapids flows were from 80 to 110 kcfs, 40 kcfs fluctuations when Priest Rapids flows were 110 to 140 kcfs and 60 kcfs fluctuation limits when Priest Rapids flows were from 140 to 170 kcfs. When weekly flows were greater than 170 kcfs, the 150 kcfs minimum flow constraint was in effect.

This operation to minimize stranding has been accomplished through use of the HCA and available active storage in Priest Rapids and Wanapum reservoirs. This results in a reduction of peak generating capacity at the Priest Rapids Development and Wanapum Development. Peak generation requirements are then shifted to upstream projects under Hourly Coordination operations. The primary difficulty in implementing this operation results from excessive upstream flow fluctuations that occur in the spring at Grand Coulee and Chief Joseph dams. Grant PUD says the limited storage available at the Project often results in the inability to stay within program fluctuation limits. Coordinated operations involving upstream projects and operators under the HCA allows the reduced on-peak generation and increased off-peak generation at the Project to be balanced by generation from upstream projects.

2.2 GRANT PUD'S PROPOSAL

Grant PUD proposes to continue to operate and maintain the Project, including existing environmental protection facilities and programs; to replace existing generation equipment with more efficient and, potentially, environmentally improved (fish friendly) equipment; and to implement a number of new environmental protection, mitigation, and enhancement measures.

2.2.1 Proposed Turbine Replacement

On July 23, 2004, the Commission issued an order[11] amending Grant PUD's license and authorizing the replacement of the 10 turbines at the Wanapum development with ten new, upgraded turbines over a period of about 8 years. The order authorized the replacement of one turbine, followed by a study to test the effect of the advanced turbine design on fish passage survival. Replacement of the remaining 9 turbines would be allowed to proceed only after the Commission informed the licensee that test results were satisfactory.

On October 11, 2005, Grant PUD filed a report[12] on fish survival through the first installed turbine and, subsequently, on December 14, 2005, the Commission issued an order[13] authorizing the installation of the remaining nine advanced design hydro turbines. Upon completion of the replacement of all 10 turbines, the total capacity at the Wanapum

[11] 108 FERC ¶ 62,075 (2004).
[12] Quantitative Evaluation of the Performance of the New Advanced Hydro Turbine System (AHTS) at Wanapum dam, Columbia River, Washington, prepared for Public Utility District No. 2 of Grant County, by John R Skalski, et al, August 16, 2005.
[13] 113 FERC ¶ 62,205 (2005)

development would increase from 900 MW to 1,038 MW, and the total hydraulic capacity would increase from 178,000 cfs to 188,000 cfs.

In its license application, Grant PUD proposes to replace the 10 existing turbines at the Priest Rapids development with the same advanced design turbines beginning in 2017 and extending through 2023, assuming the existing turbines have reached the end of their useful life. Upon completion of the replacement of all 10 turbines, the total capacity at the Priest Rapids development would increase from 855 MW to 955.6 MW, the rated capacity of the existing generators. Upon completion of the proposed turbine replacement upgrades at both developments, the total Project capacity would increase from the existing authorized installed capacity of 1,768.8 MW to 1,993.6 MW, an increase of 224.8 MW.

2.2.2 Proposed Project Operations

Grant PUD proposes to continue to operate the Project in coordination with the other mid-Columbia hydroelectric projects to meet its own and its utility customers' needs for electric power and ancillary services within the constraints of non-power requirements and agreements for the protection and enhancement of water quality, fish, and flood control (see section 2.1.8). The resulting operation would continue the use of project storage to reshape the inflow hydrograph to help meet hourly changes in electricity demands. Because of Grant PUD's proposed improvements in the efficiency of generation equipment and proposed methods for meeting downstream fish passage goals with reduced spill flow, project generation would increase under the proposed operation. In a mean water year, Grant PUD estimates the project would generate 9,754,000 MWh compared to 8,609,000 MWh under current conditions. Power losses associated with non-power water releases for fish would be reduced under the proposed operation from 1,366,000 MWh under the current operation to 527,000 MWh under the proposed operation after completion of proposed project modifications.[14]

2.2.3 Proposed Environmental Measures

Grant PUD proposes to develop and implement a Resource Integration and Coordination Program, whereby management of the environmental, recreation, and cultural resource protection, enhancement and mitigation measures will be coordinated to achieve a balanced integration of sometimes competing and complementary resource goals for Project lands and waters.

Subsequent to filing the license application for the Project, Grant PUD filed two

[14] Energy estimates by Grant PUD based on mean water year as represented by 1998 hydrology. (Exhibit B, Final License Application, Grant PUD, 2003)

settlement agreements that modified the proposed environmental measures for relicensing the project. On April 19, 2004, Grant PUD filed an offer of settlement that included the Hanford Reach Fall Chinook Protection Program Agreement (Hanford Reach Agreement).[15] Signatories to the Hanford Reach Agreement include Grant PUD, Chelan PUD, Douglas PUD, BPA, NMFS, Interior[16], Washington DFW, and the Colville. The measures included in the Hanford Reach Agreement are described below in the Aquatic Resources section and evaluated in section 3.5.2.

On February 10, 2006, Grant PUD filed a second offer of settlement that included the Priest Rapids Salmon and Steelhead Settlement Agreement (SSA).[17] This agreement encompasses the Hanford Reach Agreement as well as new measures to address project effects on salmon and steelhead. Signatories to the SSA include Grant PUD, NMFS, Interior, Washington DFW, Yakama[18], and the Colville. The measures included in the SSA are described below in the Aquatic Resources section and evaluated in section 3.5.2.

Grant PUD proposes to implement the following environmental resource protection and enhancement measures.

Geology and Soils Resources

- Continue to monitor the project impoundment rims for indications of instability and erosion.
- Develop and implement erosion and sediment control measures related to project land-disturbing activities.

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[15] The Hanford Reach Agreement is intended by the parties to replace the 1988 VBA effective with the issuance of a new license to Grant PUD for the Priest Rapids Project.
[16] Interior did not initially sign the Hanford Reach Agreement; however, their signature was added to the agreement on December 16, 2005.
[17] In filing their SSA on February 10, 2006, Grant PUD effectively modified their licensing proposal. However, Grant PUD did not specify which measures from the original license application proposal should be removed, modified, or replaced by measures included in the settlement. Therefore, in describing Grant PUD’s proposal for aquatic resources, we have: 1) added any new measures; 2) retained all aspects of the original proposal that we concluded were not in conflict with the measures included in the SSA; and, 3) deleted or modified measures from the original proposal that we concluded were inconsistent with measures from the SSA.
[18] The Yakama did not initially sign the SSA; however, their signature was added to the agreement on August 10, 2006.

Water Quantity and Quality

- Implement a Water Quality Monitoring Plan (401 Application) that includes:
  - Continued reservoir management and maintenance operations, and monitoring of spill patterns to minimize ambient total dissolved gas levels.
  - A water temperature monitoring plan at four fixed sites.
  - Monitor dissolved oxygen (DO), turbidity, and pH at the four fixed monitoring sites during the non fish-spill season (September 15 through April 1).
  - Operating according to the terms of the Hanford Reach Agreement.
  - A plan for managing nuisance aquatic plant species at key recreation sites within the Project area, including information and signage and assessing aquatic macrophyte density at eight transects within the Project every four years, and incorporating aerial photos into GIS maps of macrophyte coverage through the reservoirs; as well as continuing to monitor for zebra mussels cooperatively with Washington DFW (see also Terrestrial Resources section).
  - Addressing potential short-term water quality impacts associated with construction activities at the Project, emergency situations, and routine maintenance activities.
  - Developing additional details for calibrating its four water quality monitoring sites following issuance of the 401 certificate.
- Coordinate the spill program for the project with the spill activities of other projects through the Priest Rapids Coordinating Committee (see also Aquatic Resources section).
- Continue to operate each Taintor gate at Wanapum dam (see also Aquatic Resources section).
- Continue to identify and implement experimental spill regimes as may be warranted to test opportunities for improving fish survival with less spill flow and/or reducing TDG levels at either Priest Rapids or Wanapum Dams (see also Aquatic Resources section).
- Provide biological monitoring to determine the incidence of gas bubble disease (GBD) symptoms in downstream migrating juvenile salmonids and continue development of its “real-time” TDG monitoring system at the fixed monitoring sites.
- Provide tailrace pumping to replace gravity fishway attraction water supply.

Aquatic Resources

- Implement and assess anadromous fish measures using an adaptive management process that would include establishment of a Priest Rapids Coordinating Committee (PRCC), various technical committees (includes hatchery and habitat subcommittees), and a dispute resolution process. This measure is part of the SSA.

- Make steady progress towards achieving a minimum 91 percent combined adult and juvenile salmonid survival performance standard at the project. This measure is part of the SSA.
- Develop and annually revise a downstream passage alternatives action plan (DPAAP) to contribute to achievement of the applicable performance standards at Wanapum and Priest Rapids dams. This measure is part of the SSA.
- Develop and implement a performance evaluation program to assess the hatchery program, habitat program, and improvements to juvenile and adult passage survival. This measure is part of the SSA.
- Produce annual progress and implementation plans to describe the implementation activities for spring-run Chinook salmon and steelhead. Prepare a performance evaluation report that assesses the ability of each program to meet program objectives and contribute to achievement of performance standards. This measure is part of the SSA.
- To provide near-term compensation for annual juvenile salmonid survival that is less than the performance standard, Grant PUD would contribute to a No Net Impact (NNI) Fund. The NNI Fund would be used to undertake measures to improve juvenile salmonid survival. This measure is part of the SSA.
- Evaluate modifications to the spill regime and spill pattern at each dam to improve juvenile salmonid survival while remaining within applicable TDG limits. This measure is part of the SSA.
- Continue to operate and maintain two adult fishways at each dam according to Fishway Operating Plans and investigate methods for improving hydraulic conditions in the fishway collection channels, junction pools, and entrance pools. This measure is part of the SSA.
- Use the spill and bypass programs for juvenile downstream passage to provide fallback passage routes for adult spring and summer Chinook salmon. Operate the sluiceways at both Priest Rapids and Wanapum dams to provide fallback routes for steelhead and fall Chinook salmon. This measure is part of the SSA.
- Construct, operate, and maintain an off-ladder adult trapping facility in the left-bank fishway at Priest Rapids dam. This measure is part of the SSA.
- Operate and maintain PIT-tag detection equipment at the Priest Rapids fishways. This measure is part of the SSA.
- Fund fish counting at Priest Rapids and Wanapum dams and provide daily fish counts for both facilities. Develop video monitoring capability for counting adults in fishways at both dams. This measure is part of the SSA.

- Modify diffusion chambers on both fishways at Priest Rapids to improve adult lamprey passage. Modify the design of the fish count stations at Priest Rapids and Wanapum dams to improve adult lamprey passage and enumeration. If appropriate, reduce fishway flows at night to improve adult lamprey passage.
- Continue to study possible ways to improve downstream juvenile salmonid survival at Priest Rapids dam, including alternative application of top-spill concepts. This measure is part of the SSA.
- Continue to provide spill (61 percent of river flow in spring and 39 percent in summer) for downstream passage at Priest Rapids dam until a better downstream passage alternative is designed, tested, and implemented. This measure is part of the SSA.
- Continue to provide spill (43 percent river of flow in spring and up to TDG limits in summer) for downstream passage at Wanapum dam until a better downstream passage alternative is designed, tested, and implemented. This measure is part of the SSA.
- To improve turbine passage survival at Priest Rapids and Wanapum dams, develop and implement operating criteria to avoid settings that have been shown to result in poor survival and, in the future, install new Advanced Design Turbines. This measure is part of the SSA.
- To prevent smolts from entering the emergency wheelgate or bulkhead slots in Priest Rapids and Wanapum dams, install gatewell exclusion screens.
- Construct a downstream fish bypass at Wanapum dam consisting of an ogee-crested weir through the center of Unit 11 and a submerged tailrace chute. This measure is part of the SSA.
- If the proposed downstream bypass for Wanapum dam fails to achieve 95 percent dam passage survival, consult with the joint fisheries parties to improve survival through additional operational or structural modifications.
- Fund a northern pikeminnow removal program to improve smolt passage survival through the reservoirs and tailraces of Priest Rapids and Wanapum dams. This measure is part of the SSA.
- Fund and implement an avian hazing and control program to improve smolt passage survival through the tailraces of Priest Rapids and Wanapum dams. This measure is part of the SSA.
- As part of anadromous fish monitoring and evaluation studies, use radiotelemetry or other techniques to evaluate upstream and downstream route-specific survival at Priest Rapids and Wanapum dams.

- As part of anadromous fish monitoring and evaluation studies, conduct survival studies using PIT-tag technology or other suitable study methods to obtain dam and project passage survival estimates.
- Develop and implement a Hatchery and Genetic Management Plan (HGMP) for spring, summer, and fall Chinook salmon, steelhead, and sockeye salmon. This measure is part of the SSA.
- To help recover natural populations to self-sustaining and harvestable levels and to mitigate for 7 percent unavoidable losses for each development, fund and develop the hatchery facilities necessary to annually produce 600,000 yearling spring Chinook salmon, 833,000 yearling summer Chinook salmon, 1,143,000 sockeye salmon smolts, and 100,000 steelhead smolts. Upgrade and renovate the Priest Rapids Hatchery and continue to annually produce 6,000,000 fall Chinook salmon smolts and 1,000,000 fall Chinook salmon fry. Consult on options to develop equivalent alternative mitigation programs if annual production of 1,143,000 sockeye salmon smolts is unattainable. This measure is part of the SSA.
- Annually provide $1,096,552 to the Priest Rapids Project Habitat Fund to mitigate for a 2 percent per development unavoidable loss of upriver stocks. Develop a habitat plan to identify goals, objectives, a process for coordination, and a process by which habitat projects would be identified and implemented. This measure is part of the SSA.
- Investigate the feasibility of habitat modifications in the Wanapum dam tailrace to increase the amount of high quality fall Chinook salmon habitat.
- Implement operating agreements with the BPA, Douglas County PUD, and Chelan County PUD to address the cumulative effects of operations at the seven main stem dams (Priest Rapids to Grand Coulee) that control flows and result in flow fluctuations in the Hanford Reach. This measure is part of the Hanford Reach Agreement.
- Provide a minimum flow of 55 to 70 thousand cubic feet per second (kcfs) in the Hanford Reach during the fall Chinook salmon spawning period. This measure is part of the Hanford Reach Agreement.
- Through monitoring of redd locations on Vernita Bar within the Hanford Reach, annually establish a Critical Flow for protection of fall Chinook salmon during the pre-hatch, post-hatch, and emergence periods. Flows within the Hanford Reach would be maintained at or above the Critical Flow subject to the constraints of the 3.7 foot draft limit for the Priest Rapids reservoir and the 2 foot draft limit for the Wanapum reservoir. Additional water beyond Grant PUD's ability to maintain the Critical Flow would need to be obtained from upstream operators, which could be

coordinated as part of the operating agreements described above. This measure is part of the Hanford Reach Agreement.

- Within the constraints of the HCA, limit fluctuations in outflow from Priest Rapids dam during the fall Chinook rearing period within the Hanford Reach. This measure is part of the Hanford Reach Agreement.
- Maintain a minimum flow of 36 kcfs in the Hanford Reach during all times outside the fall Chinook salmon spawning, pre-hatch, post-hatch, and emergence periods. This measure is part of the Hanford Reach Agreement.
- Continue to use Standard Operating Procedures at both dams to provide operators with turbine operating criteria, spill patterns for use during downstream passage operations, fishway operation criteria, and other criteria pertaining to upstream and downstream passage of salmon and steelhead.
- To address the effect of the Project on white sturgeon, construct a white sturgeon conservation facility at the Priest Rapids Hatchery. Broodstock would be obtained from the Hanford Reach or Wanapum reservoir and the conservation facility would be designed to produce yearling white sturgeon for stocking into the Project reservoirs. This effort would include experimentation with hatchery supplementation to develop optimal rearing and release strategies and to monitor and evaluate the effectiveness of hatchery releases.
- To address continuing project effects on recreational fisheries, provide funding for upgrades, improvements, and operating costs at the Columbia Basin Hatchery which currently raises 1.4 million fish for stocking in roughly 140 lakes throughout the region (the majority of the lakes are within Grant County, Washington).
- Enhance and improve fish habitat in the lower five miles of Crab Creek (a tributary that enters the Columbia River in the project area).

Terrestrial Resources

- Enhance riparian/wetland habitat within the lower five miles of Crab Creek and the Priest Rapids Wildlife Area; provide funding in the amount of $30,000 per year to support operations and maintenance related to the enhancement measures and capital funding in the amount of $7.2 million over the course of the license term.
- Develop a transmission line avian collision protection plan; provide capital funding in the amount of $500,000 over the course of the license to support the measures including marking transmission lines, over-head ground wires at specific crossings.
- Enhance wildlife habitat in the Colockum, Whiskey Dick, and Quilomine Wildlife Areas;[19] provide annual O&M funding of $70,000, $1 million for land acquisitions,

[19] In a letter filed January 14, 2005, from Laurel Heacock, Manager, Licensing and

and capital funding over the term of the license of $2 million to support:

- Development of the plan.
- Noxious weed control on big-game winter range.
- Re-activation of agriculture program in the Colockum area and/or rehabilitation of agricultural lands to native bunch grasses.
- Improvements to riparian/wetland areas at West Bar Slough.
- Development of mountain meadows and maintenance of existing meadows.
- Fertilization of summer and winter ranges.
- Development of water sources.
- Land acquisitions to consolidate land holdings.

• Continue current programs of installation and maintenance of: 48 wood duck nest boxes around the project shoreline; maintenance of 12 raptor nesting, roosting, and perching structures; and installation of 50 waterfowl nesting platforms (mallard nest baskets and goose nesting tubs).

• Provide $60,000 per year to Washington DFW to support a fire suppression program in the Colockum, Quilomene, Whiskey Dick, Priest Rapids, Crab Creek, and Buckshot Wildlife Management Areas. Any unused funds at the end of the year would be allocated for habitat rehabilitation.

Rare, Threatened and Endangered Species

• Fund a rare, threatened and endangered botanical species protection plan that includes:
  - Budgeting $7,000 per year to defray operations and maintenance expenses to address potential habitat disturbances resulting from maintenance activities within the project transmission line corridor and any future modifications or additions in the number and/or configuration of transmission lines and structures.
  - A provision for developing a construction schedule of any future projects to avoid disturbance of rare species.
  - A provision for conducting pre-construction surveys.
  - A provision for identifying measures to protect any species found during the surveys.
  - A provision for developing an implementation schedule for protective measures.
  - A provision for developing a monitoring plan to evaluate the effects on rare species and habitat.

Regulatory Compliance, Grant PUD revised its proposal for development and implementation of a single habitat management plan instead of two separate plans for the Upper Wanapum and Lower Crab Creek areas.

- Develop a long-term plan to monitor rare, threatened and endangered plants within the project area that includes:
  - A description of the methods to be employed.
  - A provision to map and quantify population trends.
  - An implementation schedule.
  - A provision and schedule for reporting and consulting with appropriate agencies regarding the monitoring results.
  - Providing $13,500 per year to the Washington DNR’s Natural Heritage Program for funding and management of research information to further the knowledge of the ecology of rare plants in the project area.
- Develop a bald eagle perching and roosting tree enhancement and protection program.
- Develop a northern wormwood conservation plan to protect and monitor populations within the Project area that would include: continuing annual demographic monitoring for 10 years; working with BOR to maintain 5,000 feet of fencing to eliminate vehicular access; and funding of ongoing noxious weed control, access control, data management, taxonomic investigations, and research to support long-term conservation of the species in the amount of $40,000 per year.

Cultural Resources

- Continue its commitments to the Wanapum reflected in the agreement entered on January 8, 1957, and subsequently modified, and through any future modifications agreed to by the parties.
- Develop a multiple property documentation format for National Register of Historic Places evaluation.
- Implement a proposed schedule for determining National Register eligibility and assess/address adverse effects on remaining cultural resource properties so far inventoried.
- Within one year of license issuance and in consultation with the established Cultural Resource Working Group (CRWG), finalize and implement a Historic Properties Management Plan (HPMP).

Recreation and Land Use

- Finalize its draft Recreation Resource Management Plan (Recreation Plan) that defines the management of existing and future recreation resources associated with the project, including O&M costs; recreation monitoring; interpretation and education (includes interpretive displays/kiosks); integration of recreation resources with other resource management plans; and review. The plan would be guided by an adaptive management strategy.

- Provide funding for one full-time law enforcement (FTE) officer to Washington DFW and one FTE to be divided equally between Grant County and Kittitas County Sheriff's Offices; continue to provide a boat at Wanapum dam for use by local law enforcement officers.
- Concentrate new recreation development in suitable areas that is compatible with the draft Shoreline Management Plan.
- Finalize its draft Shoreline Management Plan and manage lands accordingly; protect the scenic quality of the mid-Columbia River and its surrounding landscape.

2.3 STAFF ALTERNATIVE

Pursuant to the REA notice issued March 28, 2005, various resource agencies and other interested parties provided comments and formal recommendations (see section 1.3). Grant PUD responded with reply comments in letters dated July 8, 2005. Based on our analysis of the project proposed by Grant PUD and the recommendations made by resource agencies and others, Commission staff recommends the alternative of issuing a new license to Grant PUD as proposed by Grant PUD in its license application, with some modifications and additions. We refer to this alternative as the staff alternative. The staff alternative adopts some, but not all, of the recommendations and preliminary mandatory conditions made by parties to this proceeding. The following sections summarize the agencies' mandatory license conditions and the license conditions staff recommends in the staff alternative.

2.3.1 Mandatory Conditions

Any license issued for the Project may be subject to the mandatory conditioning authority of state and federal agencies. The following describes the source of such authority and the status of conditions filed or to be filed for the Project. Agencies with mandatory conditioning authority may modify their conditions after the draft EIS is issued. In the final EIS the staff analyzes any "preliminary" mandatory conditions filed and in the comprehensive development section summarizes its reasons for not including some of the mandatory conditions in the staff alternative.

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 September 17, 2003, prior to the October 30, 2003, filing of its license application with the Commission, Grant PUD requested a section 401 water quality certificate from the Washington DOE. At the request of Washington DOE, Grant PUD withdrew and refiled its request on October 8, 2004, October 4, 2005, and again on October 3, 2006. A decision by Washington DOE on the certification request is pending.

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 Interior may prescribe. In a letter filed on May 27, 2005, NMFS provided preliminary fishway prescriptions for salmon and steelhead at the Project. On June 22, 2006, NMFS provided modified fishway prescriptions for salmon and steelhead at the Project. These modified prescriptions specify that Grant PUD shall:

- Develop and implement a comprehensive Fall Chinook Protection Program that includes an adaptive management based passage program, the Hanford Reach Agreement, 2 percent compensation through the habitat program, and a Fall Chinook Artificial Propagation Program.
- Develop and implement a comprehensive Summer Chinook Protection Program that includes making steady progress towards achieving Passage Survival Performance Standards, an adaptive management based passage program, 2 percent compensation through the habitat program, a Summer Chinook Artificial Propagation Program, and a variable NNI Fund.
- Develop and implement a comprehensive Spring Chinook Protection Program that includes making steady progress towards achieving Passage Survival Performance Standards, an adaptive management based passage program, 2 percent compensation through the habitat program, a Spring Chinook Artificial Propagation Program, and a variable NNI Fund.
- Develop and implement a comprehensive Steelhead Protection Program that includes making steady progress towards achieving Passage Survival Performance Standards, an adaptive management based passage program, 2 percent compensation through the habitat program, a Steelhead Artificial Propagation Program, and a variable NNI Fund.
- Develop and implement a comprehensive Sockeye Salmon Protection Program that includes making steady progress towards achieving Passage Survival Performance Standards, an adaptive management based passage program, 2 percent compensation through the habitat program, a Sockeye Salmon Artificial Propagation Program, and a variable NNI Fund.
- Review the performance of the Fall, Summer, Spring Chinook, and Steelhead and Sockeye Salmon Protection Programs from time-to-time and determine the ability to achieve each program's performance standards.

- Make steady progress towards achieving a minimum 91 percent combined adult and juvenile salmonid survival performance standard.
- Develop fish passage programs and operational measures to achieve the passage survival standards for spring, summer, and fall Chinook salmon, sockeye salmon, and steelhead.
- Annually revise a DPAAP for Wanapum dam designed to test, evaluate, and implement capital and operational measures implemented to improve juvenile passage survival while remaining within applicable TDG limits.
- Complete the construction of the Wanapum dam future unit top spill facility for operations starting with the 2007 juvenile downstream migration season.
- Conduct biological testing of the Wanapum powerhouse to determine if the new turbines are performing as expected with respect to juvenile survival.
- Continue to implement an interim spill program at Wanapum dam that includes a spring spill level of 43 percent of average daily total river flow and summer spill up to the TDG limits. Subject to approval by NMFS, the licensee may replace the interim spill program at Wanapum dam if more biologically efficient and effective measures are designed, tested, and implemented.
- Attempt to identify and eliminate sources of potential fish injury at the Wanapum spillway.
- Implement the 2000 TDG Abatement Plan for Wanapum dam.
- Optimize juvenile survival through the Wanapum dam turbines.
- Annually revise a DPAAP for Priest Rapids dam designed to test, evaluate, and implement capital and operational measures implemented to improve juvenile passage survival while remaining within applicable TDG limits.
- Explore downstream passage designs at Priest Rapids dam focusing on alternative application of top spill concepts.
- Continue to implement a spill program at Priest Rapids dam that includes a spring spill level of 61 percent of average daily total river flow and summer spill up to 39 percent. Subject to approval by NMFS, the licensee may replace the interim spill program at Priest Rapids dam if more biologically efficient and effective measures are designed, tested, and implemented.
- Evaluate further modifications the spill regime and spill pattern at Priest Rapids dam to improve juvenile passage survival.
- Investigate alternatives for reducing TDG production in the Priest Rapids spillway.
- Optimize juvenile survival through the Priest Rapids dam turbines.
- Maintain PIT tag detection capability in the right and left bank fishways at Priest Rapids dam.

- Complete construction of the off-ladder adult trap in the left-bank fishway at Priest Rapids dam.
- Continue to investigate methods implemented for improving hydraulic conditions in the Project fishway collection channels, junction pools, and entrance pools.
- Maintain video monitoring equipment for counting adults migrating through the right and left bank fishways at Priest Rapids and Wanapum dams.
- Operate the sluiceways at both dams continually from the end of summer spill until November 15 to provide a safer passage route for adult fallbacks.
- Produce annual Progress and Implementation Plans that describe implementation activities required by the SSA. These plans will report the status of actions performed during each calendar year, the schedule for future actions and studies, and the results of monitoring, modeling, or other analyses.
- Prepare a Performance Evaluation Report that assesses the ability of each program element to meet its program objectives.
- Coordinate the design of the Performance Evaluation Program with development of relevant parallel monitoring or evaluation systems by other hydropower operators.
- Implement the protection, mitigation, and enhancement measures contained in the SSA according to the principals of adaptive management.
- Develop and implement monitoring and evaluation programs designed to evaluate the success of measures in the SSA.

In a letter filed on May 26, 2005, Interior provided preliminary fishway prescriptions for salmon, steelhead, bull trout, and Pacific lamprey at the Project. These preliminary prescriptions specify that Grant PUD shall:

- Operate the Project to provide effective upstream and downstream fish passage over the full range of river flows.
- Develop a fishway O&M plan.
- Develop plans for and conduct periodic evaluations of fishway effectiveness.
- Continue to construct, operate, maintain, and monitor all project structures, facilities, and devices contained in the existing license for upstream and downstream passage of salmon.
- Construct, operate, and maintain the future unit 11 downstream bypass at Wanapum dam.
- Construct, operate, and maintain the proposed spillbay 22 bypass at Priest Rapids dam, subject to Interior and NMFS approval.
- Construct, operate, and maintain the unit 8 fish-friendly turbines at Wanapum dam and the potential 9 additional fish-friendly turbine units.

- Conduct improvements to the Wanapum and Priest Rapids fish ladders to improve fish passage efficiency for adult salmon and steelhead.
- Make steady progress towards achieving the 91 percent combined adult and juvenile salmonid standard.
- Operate the project's upstream and downstream fish passage facilities as prescribed for salmon and steelhead to provide safe, timely, and effective upstream and downstream passage for bull trout.
- Complete the formulation of the upstream passage elements of the Pacific Lamprey Management Plan (Pacific Lamprey Plan).
    - Complete modeling and conceptual design work to determine the most appropriate designs for improving upstream adult lamprey passage.
    - Examine and incorporate successful techniques for improving adult lamprey passage in the existing fishways.
    - Conduct more detailed adult radio-telemetry studies of adult lamprey upstream passage.
    - Conduct a hydraulic study of the fish ladders.
    - Develop and implement specific procedures for salvaging lamprey from fishways during dewatering and maintenance.
    - Evaluate the feasibility of a capture-and-haul program for adult lamprey.
    - Conduct post-improvement radio-telemetry studies to determine the effects of structural and operational improvements on adult lamprey passage.
    - Continue enumerating adult lamprey upstream passage.
    - Assess the effectiveness of modifications made to improve adult lamprey upstream passage.
    - Implement an interim capture-and-haul program for adult lamprey if adult lamprey passage improvements do not achieve passage similar to the best passage rates found at other Columbia River projects.
    - Implement and annual adult lamprey salvage program.
    - Complete preliminary design work and develop a plan to install additional or new adult lamprey volitional passage facilities.
    - Continue to monitor and evaluate the effectiveness of all adult lamprey passage improvements.
    - Install additional or new adult lamprey volitional passage facilities if passage improvements and the interim capture-and-haul program do not achieve passage similar to the best passage rates found at other Columbia River projects.
    - Continue to monitor and evaluate the effectiveness of all adult lamprey passage improvements.

Energy Policy Act of 2005

In accordance with the Energy Policy Act of 2005, Grant PUD filed a request for trial-type hearing with Interior on December 19, 2005. Grant PUD also provided alternative conditions and prescriptions in response to section 18 fishway prescriptions filed by FWS.[20]

In its filing, Grant PUD disputes three issues of material fact, including: 1) whether bull trout passage at the Project is an impediment to healthy bull trout populations, 2) whether the survival performance standards for listed salmon and steelhead are factually or rationally relevant to bull trout at the project, and 3) whether there is a need to conduct additional modeling and design work, environmental measures, and intensive monitoring and evaluation for adult lamprey passage at the Project. In addition, Grant PUD proposed alternatives to six measures prescribed by Interior under section 18 of the FPA. Alternatives prescriptions proposed by Grant PUD include reservations of authority and the measures included in the license application that would benefit Pacific lamprey.

In a letter filed on March 17, 2006, Interior indicated that it would file its answer to Grant PUD's request for hearing on January 5, 2007.

2.3.2 Staff Recommended Operation and Environmental Measures

The Commission staff recommends including most of the operation and environmental measures proposed by Grant PUD in section 2.2.3 above in any license issued for this project. The following environmental measures, proposed by Grant PUD, are *not* recommended by the Commission staff:

- Contribution to the NNI Fund for annual juvenile salmonid survival.
- Installation of gatewell exclusion screens to prevent smolts from entering the emergency wheelgate or bulkhead slots in Priest Rapids and Wanapum dams.
- Provide funding for upgrades, improvements, and operating costs at the Columbia Basin Hatchery to address continuing project effects on recreational fisheries.
- Enhance and improve fish habitat in the lower five miles of Crab Creek.
- Provide funding for law enforcement officers.

Staff also recommends the following additions and/or modifications to

[20] On January 12, 2006 and March 30, 2006, Grant PUD filed two amendments to its original filing. Grant PUD deleted two disputed issues of material fact and deleted alternatives to Interior's 4(e) conditions, which had been withdrawn on March 24, 2006.

Grant PUD’s proposed environmental, protection, mitigation and enhancement measures:

Aquatic Resources

- Develop a detailed fishery operations plan.
- Investigate the gate seals at Wanapum dam as a source of juvenile salmonid mortality.
- Study the effects of gatewell exclusion screens on juvenile salmonid and lamprey passage.
- Develop and implement a bull trout monitoring plan to document occurrences of bull trout in the project area.
- Add components to the Pacific Lamprey Management Plan.
- Develop and implement a White Sturgeon Management Plan.
- Prepare a final White Sturgeon Conservation Aquaculture Plan.
- Establish a Priest Rapids Fishery Forum.
- Develop a Crab Creek/Burkett Lake Enhancement Plan.

Terrestrial Resources

- Develop a Wildlife Habitat Management Plan (Wildlife Plan) that fully describes the actions that would be implemented in the first five years of any license and includes provisions for updating the plan every five years thereafter. The plan should identify the projects that would be implemented, where they would be implemented, how they would be implemented, how they will be maintained and monitored to ensure their continued success, and a schedule for their implementation—habitat improvement projects should identify and give priority to projects that address shrub steppe, riparian, and wetland habitats within and immediately adjacent to the project and should consider access controls.
- Develop and implement a Wildlife Habitat Monitoring and Information & Education Program to monitor the indirect effects of project-related recreation on wildlife and sensitive wildlife habitats. The wildlife monitoring and information and education program, coordinated with the Shoreline Management Plan and the Recreation Plan, should describe the methods that would be employed to educate the recreating public about the potential adverse affects of dispersed recreation on sensitive habitats and a detailed methodology for assessing recreation impacts on wildlife habitats and identifies potential corrective actions.
- Implement an aquatic invasive species (AIS) plan (same as nuisance aquatic plan proposed by Grant PUD) with three additional components:
  - Provisions for identifying and recommending any additional measures for detecting future AIS infestations;

- A detailed information and education program that includes identifying boat access points and distributing education material during peak boating season (May 1 – October 30 each year), conducting voluntary boat inspection demonstrations to explain the AIS program and proper methods of cleaning boats, and distributing voluntary boater surveys prepared by Washington DFW; and
- An implementation schedule.

Cultural Resources

- File with the Commission a Memorandum of Agreement between Grant PUD and the Wanapum, which may include any relevant portions of past agreements, to protect cultural resources of significance to the Wanapum.
- Provide DAHP with the missing and incomplete information associated with the submitted site record and determination of eligibility forms.
- Develop and implement protection/mitigation measures for 20 archeological sites (listed in Table 27, section 3.8) and all other archeological sites within the Project APE known to contain human remains.
- Determine National Register eligibility for all remaining inventoried archeological sites and other cultural resources located within the Project APE.
- Identify site-specific project-related effects on all National Register-eligible cultural resources and implement measures to protect such sites within the Project APE.
- Reconvene a committee similar to the Hanford Reach National Monument Federal Planning Advisory Committee to address shoreline-related effects on archeological sites in the Hanford Reach.

Recreation and Land Use

- Conduct recreational use monitoring on project lands, including BLM lands, every 6 years rather than every 12 years as proposed by Grant PUD.
- Provide additional signage at identified recreation sites.
- In a final Recreation Plan, include a provision (*e.g.*, signs) at Quilomene Dune and Bay to address wake size by boaters.
- Dredge and lengthen the Kittitas County boat launch at Vantage.
- In a final Shoreline Management Plan, manage Crescent Bar Island under the land classifications proposed as planned development and conservation, but no further development should occur beyond the existing disturbed footprint; delineate a shoreline buffer zone on the island.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Other alternatives to the relicensing proposal were considered and eliminated from detailed study because they are not reasonable in this case. They are: (1) federal takeover; (2) issuance of a non-power license; and (3) project retirement. The following sections give our reasons for not undertaking a detailed analysis of these alternatives.

2.4.1 Federal Government Takeover of the Project

Federal takeover and operation of the project is not considered to be a reasonable alternative. Grant 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 Federal takeover would be appropriate, and no Federal agency has expressed an interest in operating the Project.

2.4.2 Issue Non-Power License

A nonpower license is a temporary license the Commission would terminate whenever it determines that another governmental agency is authorized and willing to assume regulatory authority and supervision over the lands and facilities covered by the nonpower license. At this time, no government agency has suggested a willingness or ability to take over the project. No party has sought a nonpower license, and we have no basis for concluding that the Project should no longer be used to produce power. Thus, we do not consider a nonpower license a reasonable alternative.

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 the 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. Because the power supplied by the project is needed in the region, a source of replacement power would have to be identified. The 1,768.8-MW Project serves an important role in meeting both daily and seasonal peaks in power demand in the region and contributes to the reliability and stability of the regional electric system. These benefits would be lost if the project were retired.

3.0 ENVIRONMENTAL ANALYSIS

3.1 GENERAL DESCRIPTION OF THE PROJECT AREA

The two-development Project is located on the Columbia River in central Washington (Figure 1). The Columbia River is one of the largest rivers in North America. It is approximately 1,214 miles long, with 460 miles of the river in Canada and 754 miles in the United States. Originating in British Columbia, the river enters the United States in the northeastern corner of the State of Washington. From there it flows south, then east, then south again to its confluence with the Snake River near Richland, Washington. The Columbia River then turns westward, forming the Washington-Oregon border for 320 miles and eventually entering the Pacific Ocean near Astoria, Oregon. The Columbia River drains an area of approximately 260,000 square miles in the Pacific Northwest. Most of the states of Washington, Oregon, and Idaho, the northwestern portion of Montana, the southeastern portion of British Columbia, and small areas of Wyoming, Nevada and Utah lie in the Columbia River Basin.

Much of the Columbia River Basin is located east of the Cascade Mountain Range, in a generally semi-arid region lying between the Cascades and the mountain ranges to the east. The average annual rainfall in the region varies from a high of about 150 inches on the western slopes of the Cascades to less than 8 inches at the Ephrata Airport, located approximately 30 miles east of the Project.

In Grant County, the heaviest precipitation usually falls between November and March, whereas July through September is the driest season (average of less than ½-inch of precipitation per month). Accordingly, vegetation is sparse and restricted to low-lying shrubs and native grasses. Air temperatures are warmest between June and September, with an average maximum temperature of 87 degrees Fahrenheit (°F) occurring in July. The area is moderately cold in winter; the coldest temperatures occur in December and January with an average maximum of 33° to 35°F.

Wind data collected by Grant PUD at the east end of the Priest Rapids dam between 1977 and 1982 shows that winds are predominantly from 240° to 310° azimuth (southwest to northwest) for wind speeds of 20 miles per hour (mph) or less. Wind speeds exceeding 20 mph were on average oriented from the west (270° azimuths).

The Project is situated along the western edge of a vast basalt plateau that dominates the landscape of central Washington. The geology of the region is volcanic and prevailing geologic theory indicates that during glaciation, spectacular catastrophic floods raged through this area, carving canyons known as coulees. Many of these coulees are dry, evidence of where waters flowed in the distant past. The result of this climate and geology is a dramatic and stunning open setting.

Several streams flow into the Columbia River within the Project Boundary. Colockum (RM 450), Douglas (RM 448), Tarpiscan (RM 445), Johnson (RM 416), Skookumchuck (RM 428), Tekison (RM 438), Whiskey Dick (RM 426), Sand Hollow (RM 419), Quilomene (RM 433 right bank), and Trinidad (RM 441), Casey (RM 433 left bank) creeks enter the Columbia River upstream of Wanapum dam. These are relatively small creeks, some of which are dry part of the year. Below Wanapum, Crab Creek (RM 411) is a meandering waterway with its headwaters west of Spokane, Washington, that enters the Columbia River between Wanapum dam and Priest Rapids dam. Hanson Creek (RM 406), which drains a large part of the Department of the Army, Yakima Training Center west of the Project, is the only other natural perennial stream along the Columbia River between Wanapum and Priest Rapids Dams.

Each of the two project reservoirs can be considered to have a riverine section and a lacustrine section. The component of the reservoir that is lacustrine exhibits lake-like properties; that is, the slope of the water surface remains relatively flat over most flow conditions. Conversely, the water levels in the riverine sections are more dependent on flow, and the reservoir levels will vary from one location to another. A more prominent current exists in the riverine environment, and a surface water gradient from upstream to downstream can be readily measured. On the Wanapum reservoir, the riverine section extends from about RM 434 to Rock Island dam at RM 453; the lacustrine section extends downstream of the riverine section to Wanapum dam. On the Priest Rapids reservoir, the riverine section extends from about RM 404 to Wanapum dam at RM 415; the lacustrine section exists between the Priest Rapids dam and RM 404. In each reservoir, water surface gradients of 10 to 15 ft may occur between the upper and lower reaches of the riverine section at high river flows (greater than 500,000 cfs).

The Project area is largely undeveloped except for a few irrigated orchards and some small residential communities. Developments at Crescent Bar, Sunland Estates, Desert Aire and the towns of Vantage and Beverly are exceptions to the predominantly undeveloped character of the 58-miles of Project reservoirs. The Project area retains a natural character with substantial undeveloped areas provided by the Colockum, Quilomene, and Quincy Wildlife Areas and the Ginkgo/Wanapum State Park.

Grant County is in the center of the State of Washington. The Columbia River forms part of the county's western and southwestern boundary between the White Bluffs area in the Hanford Reach and Crescent Bar, and touches again at the county's most northern corner at Grand Coulee dam. The Project is located on the portion of the Columbia River that makes up the western boundary of Grant County and also forms partial boundaries of Benton, Yakima, Kittitas, Douglas, and Chelan counties.

3.2 CUMULATIVELY AFFECTED RESOURCES

Cumulative effects are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR § 1508.7). 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.

Based on information in the license application, agency comments, other filings related to the project, and preliminary staff analysis, we have identified the following resources that have the potential to be cumulatively affected by the continued operation of the Project in combination with other activities in the Columbia River Basin: (1) water quality; (2) fisheries; (3) terrestrial; (4) recreation; and (5) cultural resources.

3.2.1 Geographic Scope

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the proposed action would affect the resources differently, the geographic scope for each resource may vary.

In this case, the geographic scope for water quality, fisheries, and terrestrial resources encompasses the Columbia River from the tailrace of Rock Island dam to the lower end of the Hanford reach, a distance of about 107 miles. We chose this geographic scope because of the influence of the Federal projects and upstream projects on hydrologic conditions in the project area, heavy recreational pressures from adjoining land uses, mitigation measures associated with the Columbia River Basin Project, and adjoining land uses practices. Figure 2 shows the location of the Project in relation to the seven upstream dams (including the 2 project dams) that constitute the mid-Columbia projects and the Hanford Reach.

This final EIS evaluates recreation resources on the Columbia River from the tailrace of Rock Island dam to the lower end of the Hanford Reach, a distance of approximately 107 RM. This important mid-Columbia geographic area supports anadromous fish spawning, rearing and migration which contribute to a popular recreation fishery. The project area receives an estimated quarter million visits annually (Grant County Public Utility District, 2003, ES-23), and the Interagency Committee for Outdoor Recreation (2002) finds that Washington State's population has increased about 20 percent since the last statewide recreation survey, which was conducted in 1990.

The geographic scope for cultural resources is proposed to include the same geographic area as for fisheries and terrestrial resources. We chose this geographic scope because the potential effects of flow augmentations by the coordinated operation at the dams located upstream from the Hanford Reach, the proposed mitigation measures associated with the Project, and adjoining land use practices.

3.2.2 Temporal Scope

The temporal scope of our cumulative analysis in the EIS will include past, present, and future actions and their possible cumulative effects on each resource. Based on the license term, the temporal scope will look 30 to 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions. The historical discussion will, by necessity, be limited to the amount of available information for each resource.

3.3 GEOLOGY AND SOILS

In this section we address geologic and soils resources within the context of the following issues identified during the scoping process that relate to project effects on geology and soils resources: (1) effects of project operation, recreation, land use and other events (such as, wind-induced waves, high flow events) on the geological and soil resources; (2) cumulative effects of the Project and upstream dam operations on bank erosion in the Hanford Reach; and (3) cumulative effects of the Project and other river damming and development on the decline of sand dunes and the unique terrestrial habitat they provide in the Columbia River Basin. A comprehensive overview of geology and soils including detailed descriptions of the geologic history, bedrock geology, faults and seismic activity can be found in Exhibit E9 of the license application (Grant PUD, 2003).

3.3.1 Affected Environment

The Project is located in a largely undisturbed setting, flanked on both shorelines by near vertical basalt cliffs extending north of the Interstate-90 (I-90) freeway crossing. There is very limited residential and commercial development along the shoreline, and the distinct geologic features in the area are a significant part of the Project’s appeal and aesthetic character.

The project reservoirs are carved through a thick succession of basalt lava flows known as the Yakima Basalt Formation. Approximately 27 miles of the Wanapum development shoreline (about 34 percent) is composed of this exposed basalt, and the majority of this basalt shoreline is evident in steep cliffs rising 700 feet above the reservoir level. Minor spalling of the basalt cliffs that rim much of the Columbia River floodplain and the project reservoirs has produced talus slopes at the base of the bedrock cliffs that extend to the waters edge along much of the shoreline. The talus consists predominantly of sand, gravel, cobble and boulder-sized particles of basalt and is the result of freeze-thaw spalling of basalt from cliff faces. Basalt talus slopes make up about 25 percent of the reservoir shoreline.

The basalt formation is less prevalent along the immediate Priest Rapids reservoir shoreline where the basalt is overlain by surface deposits of glaciofluvial and fluvial origin. Many of these deposits were the result of catastrophic Pleistocene flooding caused by glacial meltwater released by the bursting of glacial lakes impounded by ice in valleys of the Rocky Mountains. The resulting deposit forms a large part of the shoreline of the reservoirs, and exhibits a high resistance to erosion in part due to its granular composition. Subsequent to this catastrophic flooding, the Project area was subject to more recent Holocene fluvial deposition (Holocene terrace deposits). This landform is exposed above reservoir level most typically in the riverine sections of each reservoir and presumably is inundated in the lacustrine section of each reservoir. The Holocene terrace deposits are generally fine-grained and more susceptible to erosion than the Pleistocene catastrophic flood deposits. The Holocene terrace deposits make up about 28% of the Project shorelines. A detailed description of bedrock and surface geology at the Project is included in the license application (Grant PUD 2003, Technical Appendix E-9.A).

Other surface deposits along project shorelines consist of alluvium, alluvial fans, talus, dune sand, loess, riprap and fill. Alluvium consists of clay, silt, sand, and gravel deposited by the Columbia River and the streams emptying into it. The alluvium is variable in thickness and gradation, and includes reworked loess, outburst flood deposits, Mazama tephra, and other sediment formations. It is typically found at tributary mouths, and is found between elevation 450 ft and 600 ft along the Project reservoirs. Alluvium makes up 8% of the shoreline. Alluvial fans consist of very deep, well-drained soils consisting of clay, silt, sand, and gravel material that have been deposited by running water, usually at the mouths of tributaries or gullies. These soils were formed in colluvium derived from loess and basalt on slopes of 25 to 65% at elevations ranging between 450 ft to 1,500 ft. Alluvial fans make up about 5% of the reservoir banks.

Talus is predominately sand, gravel, cobble and boulder-sized particles of basalt that form a steep slope at the base of basalt cliffs. The talus material is the result of freeze-thaw spalling of basalt from cliff faces, and includes colluvium in places. It consists of a very deep, well-drained soil/aggregate on hillsides and steep slopes at the base of basalt cliff faces, and is typically encountered at elevations ranging between 450 ft to 1,500 ft. Basalt talus makes up approximately 25% of both reservoir shorelines and is more typically found along the Wanapum reservoir shoreline.

Dune sands consists of eolian (wind deposited) medium to fine sand and silt composed of quartz, basalt, and/or feldspar grains, and volcanic ash. Dune sand generally consists of deep, well-drained soils along the margins of the alluvial floodplain, on terraces and high bars, and is found to cap many other soil types. These soils formed from sand derived from mixed sources. They comprise approximately less than 2% of the shoreline and form shoreline slopes from 5 degrees up to 35 degrees where they overlay the basalt talus. In the project area, dune sand has been mapped on the right bank near Crescent Bar (on West Bar at RM 441), along the left bank east of the YTC at RM 404, along the left bank near Sand Hollow Creek (RM 419), and along Crab Creek.

Loess is homogeneous, nonstratified, unconsolidated silt with lesser amounts of sand and clay. The silt has been winnowed from alluvium and glaciofluvial material along the Columbia River by the prevailing westerly winds and deposited as a veneer over the basalt and gravel east of the river. It consists of variable depth, well-drained soils on hills and areas of topographic relief and elevation. It is found at elevations between 600 ft and 1,300 ft (above the elevation of the shoreline in the project area). Although there are no loess exposures along the shoreline, this material is found at several locations along the Project transmission corridors.

Riprap ranging in size from gravel to boulders 4-ft in diameter, is composed of basalt or broken concrete that has been placed by man, generally as a veneer, along the shoreline for bank protection. Riprap armored slopes range between 30 and 40 degrees in the Project area. Riprap is found at Wanapum dam (RM 416), Priest Rapids dam (RM 397), at the base of the railroad embankment across from West Bar (RM 443), along the left bank adjacent to the railroad downstream of Rock Island dam (RM 451 to RM 453) around the Vantage Bridge (RM 420), and occasionally along the abandoned railroad on the right bank of Priest Rapids reservoir between Hanson Creek and the Priest Rapids dam (RM 398 to RM 406).

Fill ranges in size from silt, sand, and gravel to cobbles and boulders, and is composed of excavated deposits of alluvium and/or Pleistocene catastrophic flood deposits. Fill is a result of deliberate human activity typically relating to construction of the dams and adjacent transportation systems (roads and railroads). It is generally found adjacent to both Wanapum and Priest Rapids Dams and along roadways that approach the reservoirs, and can often cover relatively large areas and be significantly thick.

Hanford Reach

The U.S. Department of Energy (DOE) Hanford Site (Hanford Site) and the Hanford Reach National Monument contain all the main geologic characteristics of the Columbia Basin as described above for the lands occupied by the Project. In addition, the Hanford Site lies within a topographic depression referred to as the Pasco Basin. The Pasco Basin is bounded by the Saddle Mountains to the north, Naneum ridge to the west, Rattlesnake Hills to the south, and the Palouse Slope to the east (Figure 4).

Sediments overlying the basalt in the Pasco Basin include the Ringold Formation, Cold creek unit, and the Hanford formation from oldest to youngest. The Hanford Reach of the Columbia River is carved into these sediments, the oldest of which (the Ringold Formation) were laid down by the ancestral Columbia River between 8.5 and 3.0 million years ago and the youngest of which (the Hanford formation) were deposited by ice-age floods as recent as 12,000 years ago (Neitzel, D.A., ed. 2004).

Regional uplift associated with the Cascade Mountains caused the Columbia River to cut through the Pasco Basin sediments, which consist of gravel, sand, silt and clay deposits, exposing up to 900 feet of the Ringold Formation at White Bluffs in the Hanford Reach National Monument. The White Bluffs extend for about 30 miles along the east side of the Columbia River and vary in height from 150 to 500 feet above the river. Since the late 1960s, landslide activity along the White Bluffs has noticeably increased and has become a subject of considerable interest and scientific investigation because of its potential effects on fish habitat and Indian cultural resource materials in the Hanford Reach.

Sand Dunes

Since the end of the ice age, winds in the semi-arid climate of the Columbia River Basin have reworked the deposits of sand and silt, creating sand dunes in the lower elevations. An area known as the Moses Lake dune field, located in the Quincy Basin to the south and west of Moses Lake, Washington, and 20 kilometers east of the Wanapum reservoir on the Columbia River, appears to be the nearest dune field to the Project. Prevailing winds at the end of the glacial period drove the Moses Lake sands in an east-northeast direction, and eventually dammed a portion of Rocky Ford Creek creating Moses Lake. The dunes rate of advance is thought to have been significantly slowed during the past century. Among the reasons cited are the extensive amount of irrigated land brought about by the Columbia Basin Project and the inundation of a large fraction of the dune field by Potholes reservoir, which was built in 1952 to catch irrigation runoff.

Dunes west of the Potholes reservoir became much more wet and vegetated while dunes to east of the reservoir, although located at a higher elevation above the water table, receive a reduced supply of sand from the east. These influences together with local farmers attempts to stabilize the dunes with bales of hay and planted grasses, have contributed to a reduction in active dunes. However, a small portion of the Moses Lake dune field between northeastern Potholes reservoir and southern Moses Lake remains active and is reserved for off road vehicle recreational use. (Banfield, J. A., et. al., 2002).

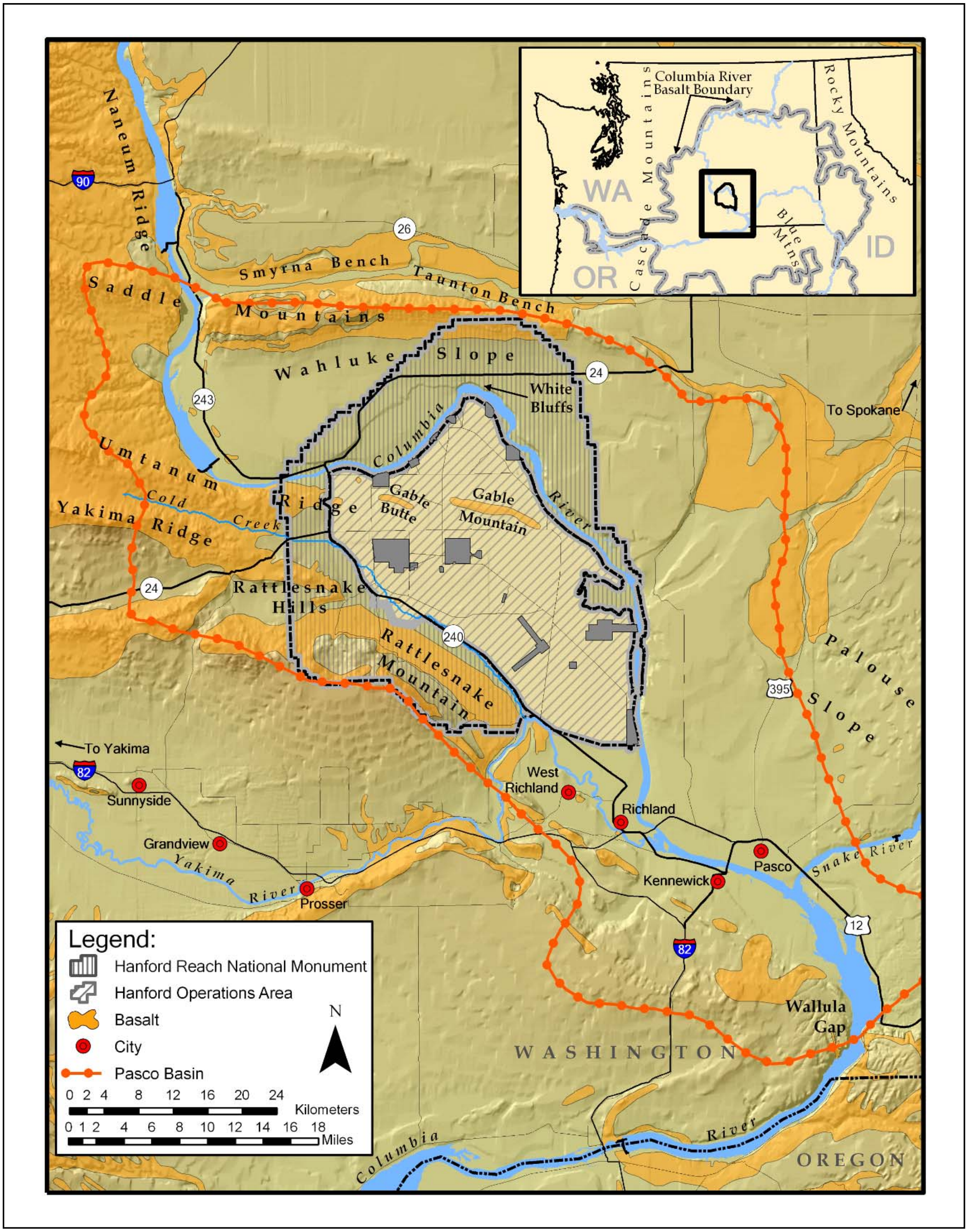

Figure 4. Geologic Elements of the Pasco Basin Portion of the Columbia Basin, Washington (Source: Neitzel, D.A., ed. 2004).

The Pasco Basin, which lies to the south of the Quincy Basin and in which the

Hanford Site is located, contains dune sands at the lower elevations around its margins. Although anchoring vegetation has stabilized many of the dunes in this area, some of them were reactivated by the removal of vegetation caused by fire in June and July, 2000. (Neitzel, D.A., ed. 2004)

3.3.2 Environmental Effects and Recommendations

Project operations and facilities, together with the presence and operation of upstream hydropower dams, have altered the natural stream channel and flow regime of the Mid-Columbia River. These altered stream flow conditions affect the interaction of the river with the geologic formations and soils of the river bed, the adjoining floodplain and, to a much lesser extent, the surrounding valley walls. Reservoir operations designed to capture and store high flow events for power and irrigation purposes have reduced the magnitude of seasonal high river flows and floods. Because major changes to river bed and floodplain geology and soils are caused by high flow and flood flow conditions, the project and upstream reservoirs have tended to reduce the force of the river to change its course by lateral cutting (meander) or deepen its valley by bottom scour. The reservoirs trap coarse sediments, changing the channel substrate composition in the reservoirs and the downstream river reaches. This section discusses the effects of the proposed project and alternatives on this altered geologic environment with particular attention to the geologic and soils issues identified during NEPA scoping.

Effects of Project Operation, Recreation, and Land Use

Project operations that result in frequent fluctuation of flows and reservoir water surface elevation to help meet the daily peak energy needs of power customers contribute to erosion and sloughing of soils within the zone of fluctuation where the shoreline consists of unconsolidated soil materials. With prevailing wind direction from the west, wave action from wind contributes to erosion along exposed sections of unconsolidated deposits on the left (westward facing) shoreline. Wave action from recreational boating also contributes to erosion of susceptible shoreline soils.

Any new construction on project lands or public use of existing lands can result in soil disturbance, loss of protective vegetation and soil erosion caused by wind or surface water runoff. Because of the semi-arid climate in which the project is located (total annual rainfall is about 7 inches per year), rainfall events of sufficient magnitude to cause erosion from surface water runoff would be rare, their occurrence is a natural condition that contributes to river bank erosion.

Field studies of reservoir shoreline erosion conducted for Grant PUD in 2002 provide a detailed documentation of erosion sites along the project shoreline (Grant PUD 2003, Technical Appendix E-9.A). Sites that exhibited historic erosion characteristics were recorded as erosion sites, even where there was no evidence of recent or active erosion activity. A total of 131 erosion sites representing approximately 11% of the shoreline were documented by the study. The sites were mapped and the type of erosion, soil type, scarp dimensions, beach characteristics, vegetation details, land use details, and level of erosion activity (active, moderately active, or in-active) documented. The erosion sites are shown on Figures E9-15 through E9-27 in Exhibit E9 of Grant PUD's final license application. The following paragraphs summarize the major results and conclusions of this study.

A total of 106 erosion sites along the Wanapum reservoir represent approximately 11% of the total reservoir shoreline. Approximately 5% of the total length was considered active. A total of 66 sites were recorded on the left (west) bank (61% of the eroded length), and 40 sites were recorded on the right (east) bank (39% of the eroded length). The majority of the erosion was observed in the Pleistocene catastrophic flood and Holocene terrace deposits, with a significantly lower number of sites observed in alluvium and alluvial fan deposits.

A total of 25 erosion sites on the Priest Rapids reservoir represent approximately 12% of the total reservoir shoreline. Approximately 28% of the eroded length, or 3% of the total length, is considered active. One additional site has been recorded by Grant PUD downstream of Priest Rapids dam on the right bank (Grant PUD 2002b). In general, a relatively low amount of erosion was observed on the impoundment shoreline. The most significant erosion on the left bank was observed near Desert Aire (RM 398 to RM 400), with virtually no erosion on this bank above RM 400. The most significant erosion on the right bank was observed south of Sentinel Gap (RM 410) adjacent to existing orchards and at the mouth of Hanson Creek. Erosion was nearly equally divided between Pleistocene catastrophic flood and Holocene terrace deposits. Virtually no erosion was observed in alluvium, which is considered significant, given its extent along the shorelines of both reservoirs.

The greatest amount of overall erosion along the Project shoreline occurs in Pleistocene catastrophic flood deposits, which contributes over twice the length of shoreline erosion as the Holocene terrace deposits. Pleistocene catastrophic flood deposits make up 62% of the total erosion, Holocene terrace deposits make up 23% of the total footage of erosion, and the remaining 15% of the total eroded length occurs in the remaining soils.

In the lacustrine sections of the reservoirs (RM 397 to RM 404, and RM 416 to RM 434), erosion occurs primarily in Pleistocene catastrophic flood deposits, with lesser erosion in alluvium and alluvial fans. Each of these soil deposits appear to be generally resistant to erosion, and mapped erosion sites are anticipated to change little over time. The resistance to erosion is primarily due to the very granular composition of these deposits. Each of these deposits appears to have a high internal friction angle (and angle of repose), allowing each to stand at a steeper angle when disturbed. Further, scarps in these deposits tend to become armored with larger gravel, cobbles, and boulders over time. One notable exception to this observation is at "black sand beach" (RM 417) where several feet of erosion have been observed each year (Grant PUD 2001 and Grant PUD 2002b).

The study finds that erosion in the lacustrine areas is primarily caused by waves induced by winds and boat traffic. The predominant wind direction at the Project is from between southwest and northwest. Typically, wind-generated waves exceed the magnitude of waves induced by boat traffic. Based on this fact, the predominant wind direction in the area, and direct observations made at the Project, the study finds that the primary cause of erosion in lacustrine areas along the left (east) bank is from wind-induced waves. Similarly, it finds that erosion on the right bank is primarily caused by waves induced by boat traffic.

The study finds that erosion in the riverine sections of the reservoirs (RM 404 to RM 416 and RM 434 to RM 453) is induced predominantly by littoral or riverine current, and by changes in water surface elevation. Erosion in these areas is especially aggravated by flood flow conditions, as would be expected; such increased erosion occurred during a surcharge pool event in 1997, which was the wettest year on record at the Project. During the 1997 surcharge event, the maximum forebay levels at Wanapum dam and Priest Rapids dam were elevation 572.3 ft and 488.4 ft, respectively, compared to the normal operating ranges of 560.0 to 571.5 for Wanapum and 481.5 to 488.0 for Priest Rapids. The peak daily flow for that event was 410,000 cfs.

Project operations may continue to cause active shoreline erosion during moderate to high flows at some of the active erosion site locations. Erosion processes generally consist of shoreline undercutting, bank toppling, and minor slumping associated with shallow surface erosion (less than about 6 ft in height) of exposed soils. Some of these sites may continue to erode until the beach projects to the top of the deposit. The amount of eroded material is considered small relative to flows in the Columbia River.

No conditions were documented by Grant PUD's studies that would suggest the potential for mass movement of the bedrock or soil that would affect operation or safety of the Project. Similarly, soils along the reservoirs pose very low to non-existent potential for larger-scale slope instability.

Grant PUD proposes to continue to monitor the reservoir shorelines and update erosion location, rate, and process information. Where new facilities are proposed that would involve land disturbance, Grant PUD proposes to implement sediment erosion and control measures as part of its construction management program.

CRITFC, the Yakama, and the Umatilla jointly recommend that Grant PUD be required to establish a cultural resources management program which includes an analysis and plan for erosion control at cultural resource sites within the area of potential affects and in the Hanford reach. The recommended plan would include monitoring and detailed mapping of sites, and a report describing recommended mitigation for site erosion.

Our Analysis

Continuing project effects on reservoir shorelines under a new license would consist of localized areas of shoreline erosion, especially during high flow events in the Holocene terrace deposits along the shores of the riverine sections of the impoundments. Some land-disturbing activities would occur as a result of Grant PUD's implementation of proposed protection, mitigation and enhancement measures that involve construction or maintenance of new facilities. To minimize erosion from construction activity, Grant PUD proposes to include the design and implementation of erosion and sediment control measures as part of its project construction management program.

In the Cultural Resources section, we discuss tribal concerns related to the potential for shoreline erosion to expose cultural resources, possibly including human remains. Identification and protection or documentation of shoreline areas most susceptible to erosion and most likely to contain cultural resource materials would help to avoid the potential for loss of such material or sites to erosion. We analyze Grant PUD's proposals for protection of cultural resources in the Cultural Resources section. Also, see section 3.9, *Recreation and Land Use*, for additional discussion.

Most of the reservoir shoreline consists of geologic formations and soil materials that are relatively stable and resistant to large scale erosion problems. Grant PUD's proposal to continue to monitor erosion along the reservoir shorelines would identify areas that may require structural soil stabilization measures where the project purposes or other uses of project resources may be compromised by active erosion. This monitoring program together with a plan for implementing structural measures where needed would adequately protect the shoreline geology and soils resources. For new construction projects, Grant PUD's construction management program includes provisions for the implementation of erosion and sediment control measures. For the protection of cultural resource material and sites along the reservoir shoreline, Grant PUD's Historic Properties Management Plan would provide a plan of action for sites subject to erosion.

We conclude that Grant PUD's proposed measures would protect geology and soils resources on project lands. As we discuss further in section 3.8, *Cultural Resources*, plans to resolve shoreline erosion on high-priority archeological sites would also be put into place after license issuance. As pointed out above, implementation of the final

HPMP would also provide for a more comprehensive approach to monitor and protect all remaining significant cultural resources against shoreline erosion in the project area. Overall, such plans would be consistent with CRITFC and the tribes' recommendation on establishing a cultural resource management program for the Project.

Hanford Reach

CRITFC, the Yakama, and the Umatilla jointly filed comments during NEPA scoping alleging that flow fluctuations in the Hanford Reach from Priest Rapids operations are eroding cultural resource sites in the Hanford Reach and that this issue should be evaluated in the draft EIS (May 7, 2004 letter from Olney Patt, Jr., Executive Director of CRITFC to Commission Secretary). On May 27, 2005, these same parties filed recommended terms and conditions in response to the Commission's March 30, 2005 Notice of Application ready for Environmental Analysis. Recommendation No. 19 recommends that Grant PUD be required to establish a cultural resources management program which includes an analysis and plan for erosion control at cultural resource sites in the Hanford Reach.

In its response to CRITFC and the tribes recommendation relative to sites in the Hanford Reach, Grant PUD maintains that the Hanford Reach is outside the Area of Potential Effects (APE) and Grant PUD would have no authority or obligation to implement comprehensive cultural resources programs there (July 8, 2005, letter from Laurel Heacock, Manager, Licensing and Regulatory Compliance to the Commission). In addition, Grant PUD says that flow patterns in the Hanford Reach are the result of operation of the entire Mid-Columbia system of dams and mitigation for the effects of these flow patterns is not the sole responsibility of the Project. Grant PUD says it is willing to work cooperatively with the other Mid-Columbia dam owners and interested parties to address cultural resources (in the Hanford Reach), with the understanding that responsibility must be shared.

Our Analysis

Triangle Associates, Inc. conducted an assessment of the causes and impacts of landslides along the White Bluffs in the Hanford Reach National Monument. The Triangle Associates assessment was based on information from interviews of people with knowledge of the White Bluffs landslides, published literature on the subject, and a series of technical workshops. The report by Triangle Associates concludes that most observers attribute the onset of recent landslide activity to the Columbia Basin Project, which developed the Columbia River for irrigation in the 1953-1964 time periods.[21] Irrigation

[21] Triangle Associates, Inc., White Bluffs Landslides Assessment Report, prepared for US institute for Environmental Conflict Resolution and US Fish and Wildlife Service for

increased the effective annual precipitation in this semi-arid region from an average of about 7 inches to 60 inches, in the early years, and 40 inches more recently with the advent of more efficient methods of irrigation.

The increase in surface water caused the groundwater table to raise an average of 200 feet. Over time, the elevated groundwater levels saturated the unconsolidated sediments on the steep slopes above the river, resulting in increased pore pressures, reduced shear strength, and slope failures. The Triangle Associates report also concludes that the cause of the White Bluff landslides is a complex interaction of three factors: (1) the underlying geologic composition of the Ringold Formation that makes steep slopes highly susceptible to sliding when wetted; (2) elevated groundwater levels (as a result of irrigation water) that saturate the soils of the Ringold Formation making them susceptible to landslide failure; and (3) erosion caused by the Columbia River washing away the toe of the steep bluffs, which undercuts and reduces the stability of the slope above.[22]

The report notes that the effect of the Columbia River is significant only in the Lock Island landslide area, where an existing landslide extends 150 yards into the river towards Lock Island. The narrowed channel on the east side of the island causes an increase in velocity and corresponding increase in erosion on the east shoreline. Erosion was particularly acute in the high flow years 1996 and 1997. Lock Island is located 34 miles downstream from the Project. Elsewhere, erosion of the bank by the Columbia River is not thought to play a role in recent landslide activity, since the upstream storage projects have eliminated or greatly reduced high river flows. The Triangle Associates report also states that erosion in the Locke Island landslide area is not caused by river level fluctuations from upstream power operations.[23]

Stream flows at the high end of the frequency distribution have the greatest capacity for stream bank erosion and sediment transport. The construction and operation of upstream storage reservoirs in the Columbia River Basin have greatly reduced the magnitude and frequency of high flow events in the Hanford Reach. So with respect to high flows, we conclude that upstream reservoirs have actually reduced the potential for shoreline erosion in the Hanford Reach relative to pre-development conditions.

With respect to flow fluctuations from project operations, the Triangle Associates report concludes that river level fluctuation from power operations is not the cause of the landslide at Locke Island. If future studies discover a relationship between flow fluctuations from upstream power operations and stream bank erosion, responsibility for mitigation of those effects should not be the sole responsibility of the Project. Flows in

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the Hanford Reach National Monument, March 2003.

[22] Triangle Associates, 2003, p.23.

[23] Triangle Associates, 2003, p.47.

the Hanford Reach are set by operating criteria established by the HCA for the entire system of Mid-Columbia projects as a unit. If future studies find that upstream dam operation is causing excessive stream bank erosion in the Hanford Reach, the Commission could require Grant PUD, as well as the other upstream hydroelectric projects under its jurisdiction, to provide appropriate mitigation and protection.

Sand Dunes

The Washington DNR commented during scoping for the EIS that damming of the Columbia and Snake Rivers has stopped the seasonal deposition of sand that served as a source for replenishment of existing sand dunes or formation of new dunes (April 16, 2004, letter from Rex C. Crawford, Ph.D, Natural Heritage Ecologist, Washington DNR). This, together with the loss of active dunes to agriculture and urban development, has greatly diminished sand dune habitat and associated rare plant and animal species. Washington DNR states that the loss of this habitat along the Columbia River following dam construction is contributing to the decline of many species and the contribution of the Project to this decline should be documented and an assessment made of potential mitigation.

Grant PUD is not proposing any specific mitigation for project effects on the amount of active sand dunes in the Columbia Basin. It is, however, proposing measures for the protection of sensitive dune habitat, which we discuss in the Terrestrial Resource and Recreation and Land Use sections.

Our Analysis

Clearly, the development of the Columbia River Basin water resources for agricultural irrigation and power generation has changed the geomorphology of the river and the vegetative cover of the Basin landscape in a manner that has reduced conditions conducive to forming and sustaining active sand dunes. The Columbia River impoundments and reservoirs, including the Project reservoirs may have inundated river channel sand deposits which could have contributed source sands to dune formation prior to dam construction. Some fairly large patches of dune sands overlay other deposits, predominately on the valley walls and terraces of the east bank of the river, above the current floodplain of the river (Grant PUD 2003, Volume TA 18).

The previously cited study by Bandfield et al concludes that the Columbia River is not a likely source of sands found in the Moses Lake dune field, which lies some 20 kilometers east of the river. The researcher’s conclusion is based on the physical distance of the river from the dune field and the mineral composition of the sands, which suggests that the Grand Coulee to the north is the more likely source of sands found at the Moses Lake dune field. The report does note several small dune fields immediately east of the

Columbia River appear to be migrating east toward the Moses Lake dune field. The river is the likely source of sands for these small dune fields.

We conclude that the Project adds to the cumulative effect of dam construction, land development and irrigation on the amount of active sand dune area in the Pasco Basin. We believe that the effects of the Project are small compared to the direct effects of man's efforts to convert arid lands to agricultural uses and prevent wind erosion by planting vegetation or building structural controls. We also conclude that there would be no practical way for Grant PUD to create active sand dunes to mitigate its contribution for the loss of this habitat. We analyze project effects on terrestrial and recreation resources at existing sand dunes within and adjacent to the project in the respective sections of this EIS.

3.3.3 Cumulative Effects

The Project would continue to have a small effect on the amount of lands occupied by active sand dunes under all of the alternatives: no action; proposed project; and proposed project with modifications recommended by the staff. We find the effect has occurred as a result of past actions (construction of the dams) and would not increase as a result of future actions under any of the alternatives.

3.3.4 Unavoidable Adverse Impacts

None.

3.4 WATER QUALITY AND QUANTITY

The EIS scoping process identified the following issues related to project effects on water quality and quantity resources: (1) effects of project flow modifications in combination with upstream project flow modifications on downstream (Hanford Reach) fish habitat; (2) effects of project operations and proposed replacement turbines on TDG concentration, including methods to comply with the total maximum daily load (TMDL) for TDG established by Washington DOE; (3) effects of project operations on water temperature, including methods to comply with any future temperature TMDL established by Washington DOE or Environmental Protection Agency (EPA); (4) effects of project operations on organics, metals, DO, fecal coliform, pH, and other parameters; and (5) effects of project operations on aquatic macrophyte growth, especially the invasive and non-native Eurasian watermilfoil, in project reservoirs. In this section, we describe the affected environment with respect to water resources and the environmental effects, including cumulative effects, of the project as related to these issues.

3.4.1 Affected Environment

The Columbia River is 1,214 miles long with 460 miles in Canada and 754 miles in the United States. The Columbia River watershed covers an area of approximately 260,000 square miles in the Pacific Northwest.

In Canada, the Columbia River is regulated through a series of storage and power generating facilities. The large storage reservoirs are at the Duncan, Mica, Revelstoke, and Keenleyside projects. Flows across the U.S.-Canadian border are regulated through the Columbia River Treaty.

The first two hydroelectric projects encountered on the Columbia River in the United States (traveling downstream from the United States-Canadian border) are Grand Coulee dam, located at RM 597 and Chief Joseph dam located at RM 544. Both are federally owned and operated.

The next five dams have comparatively little useable storage which is used for minor reshaping of the daily reservoir inflow for power and non-power purposes. The first is Wells dam at RM 516, owned and operated by Douglas County PUD, the second is Rocky Reach dam located at RM 474, the third is Rock Island dam, located at RM 453, with the latter two being owned and operated by Chelan County PUD. The next two dams comprise the Project, with Wanapum dam at RM 415 and Priest Rapids dam at RM 397. These dams are owned and operated by Grant PUD and are the subject of this final EIS.

There are approximately 157 tributary streams that flow into the Columbia River in the United States. Between Chief Joseph dam and the Project there are four significant tributaries - the Okanogan, Methow, Entiat, and the Wenatchee Rivers. In addition, 106 point sources with individual National Pollutant Discharge Elimination System permits directly discharge into the mainstem Columbia River above the Project.

Surface Water

Two U.S. Geological Survey (USGS) streamflow gages located in the vicinity of the Wanapum and Priest Rapids dams measure and record Columbia River flows in the Project area. For flows downstream from the project, Grant PUD contracts with the USGS to operate the Columbia River below Priest Rapids dam gaging station (USGS Gage No. 12472800) located approximately 2.6 miles below Priest Rapids dam (at RM 394.5). The total drainage area above the gage is approximately 96,000 square miles. Flows are recorded on a continuous basis and average daily flows are calculated and published by the USGS. The station has been in continuous operation at its present location since 1959.

Columbia River flows coming into the project are computed directly from operation records of the Rock Island dam. A USGS streamflow gage (Columbia River below the Rock Island dam, USGS Gage No. 12462600) located in the tailrace just downstream of the Rock Island dam (RM 452.4) was discontinued in 1988, but is still used to "spot check" the computed flows at Rock Island dam approximately six times per year.

Streamflow data for the Columbia River prior to the construction of the Project is also available from the now abandoned USGS gages at Wenatchee, Vernita and Trinidad. A non-recording gage was located at Wenatchee for the period January 1910 through December 1916, published as "at Wenatchee." A non-recording gage was located at RM 391.1, six miles downstream of Priest Rapids dam, during the period January 1917 to October 1930. This was published as "at Vernita." A water-stage recorder was located at RM 441.7 near Trinidad during the period October 1930 to May 1961 and was published as "at Trinidad."

The flow regime of the Columbia River in the project area is controlled primarily by releases at upstream storage reservoirs. This limits the potential for flood damage, and provides a relatively stable seasonal hydrograph to provide power when it is most needed by consumers. This is demonstrated by the average monthly flow data since construction of Priest Rapids dam (1960-2001). During this period of record, the lowest average monthly flow of 80 kcfs occurs in October, with peak monthly average discharge of 206 kcfs in June (Table 4). The relatively high average minimums across the year also demonstrate the effect of upstream storage.

Table 4. Summary statistics for monthly Columbia River flows (in kcfs) measured at USGS Gage No. 12472800 from 1960-2001.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	55.1	72.7	58.2	57.9	59.2	78.8	56.6	66.7	60.1	61.5	56.1	52.6
Maximum	168.4	195.0	201.8	189.1	271.7	461.4	294.3	191.0	126.7	118.3	121.2	163.9
Median	109.8	104.4	104.7	103.2	156.7	176.9	146.3	107.4	75.6	80.0	88.1	98.6
Average	107.7	111.5	109.6	117.0	163.4	206.5	157.3	111.4	80.9	80.3	88.3	101.1

Daily flow regimes for Priest Rapids and Wanapum reservoirs are controlled by hourly coordination of the seven dam system from Priest Rapids dam to Grand Coulee dam. A typical day begins with Grand Coulee dam releases at very low (0 to 20 kcfs) levels during the 0000 to 0600 hours period. From 0600 hours to 2200 hours, levels during the 0000 to 0600 hours period. From 0600 hours to 2200 hours, flows increase to relatively high levels, most often in the 150 to 200 kcfs range, before dropping again. This fluctuation is passed through Chief Joseph, Wells, Rocky Reach and Rock Island dams, with relatively small sideflow additions from the Okanogan, Methow, Entiat and Wenatchee rivers before reaching the project.

Typical water travel time[24] within each reservoir in the mid-Columbia River system, as provided in the HCA, ranges from 45 minutes at Priest Rapids to nearly three hours at Chief Joseph dam (Table 5). This creates a lag time of several hours before Grand Coulee releases reach Wanapum dam and keeps flows at higher levels into the evening. In addition, typical weekday flows from Grand Coulee dam may fluctuate significantly within a day, and are re-shaped to maintain minimum flows below Priest Rapids dam. The minimum flow is 36 kcfs from May through October, with higher minimums (ranging from 50 to 70 kcfs) set during the VBA operations from November into May.

Table 5. Water travel time estimates for mid-Columbia reservoirs as estimated in the Hourly Coordination Agreement (Source: Grant PUD 2003).

Project	Reservoir Length	Travel Time
Chief Joseph	52 miles	2 hr 45 min
Wells	29 miles	1 hr 15 min
Rocky Reach	38 miles	2 hr 45 min
Rock Island	21 miles	45 min
Wanapum	38 miles	1 hr 30 min
Priest Rapids	18 miles	45 min

Description of Project Reservoirs

Wanapum and Priest Rapids reservoirs are operated to meet a variety of power and non-power objectives. Typical power operations are geared towards meeting daily load requirements through assignment of coordinated generation under the HCA, as described in Exhibit B5.1.5 of the Application. Power and non-power operations are also

[24] Travel times represent the time it takes for a change in outflow from one dam to begin to affect the forebay level in another dam, all other factors being equal.

coordinated on a regional scale under the Pacific Northwest Coordination Agreement (PNCA; Application, Exhibit B5.1.3). Priest Rapids Project reservoirs are also operated to meet non-power demands including flood control surcharges, minimum flow requirements, flow re-shaping for fall Chinook spawning and rearing protection, and maintenance of reservoir elevations for recreation purposes. Key physical characteristics of each reservoir are summarized in Table 6.

Table 6. Estimated physical characteristics of Wanapum and Priest Rapids reservoirs (Source: Grant PUD 2003).

Characteristic	Wanapum reservoir	Priest Rapids reservoir
Surcharge elevation (ft)	575.0	491.5
Normal maximum operating elevation (ft)	571.5	488.0
Minimum operating elevation (ft)	560.0	481.5
Storage at normal maximum elevation (acre-feet)[1]	693,600.0	237,100.0
Surface area (acres)	14,680.0	7,725.0
Maximum depth (ft)	185.0	135.0
Mean depth (ft)	50.11	32.21
Mean width (ft)	3200.0	3440.0
Length (miles)	38.0	18.0
Shoreline (miles) at normal maximum elevation	124.1	73.9
Average flushing rate at 120,000 cfs (hours)	69.9	23.9

[1] Storage at normal maximum elevation (acre-feet) includes both the volume of the original channel storage plus the volume of the storage caused by impoundment.

The minimum operating elevation for Priest Rapids reservoir is 481.5 ft with a maximum surcharge elevation of 491.5 ft. The normal maximum operating elevation for Priest Rapids reservoir is 488.0 ft. Thus, Priest Rapids reservoir may fluctuate up to 6.5 feet during normal operations, although in practice fluctuations are typically much lower. The minimum operating elevation for Wanapum reservoir is 560.0 ft with a maximum surcharge elevation of 575.0 ft. The normal maximum operating elevation for Wanapum reservoir is 571.5 ft. Wanapum reservoir may have elevation fluctuations up to 11.5 ft. The widest fluctuations at each reservoir occur primarily as a result of non-power operations to re-shape flows under the VBA and Hanford Reach Agreement.

Sediment sampling during descriptive limnology surveys was used to classify substrate for the Project area. Substrate samples were taken in each reservoir, forebay and tailrace. These samples showed that cobble predominated in each tailrace with silt, sand and finer sediments more common in reservoir and forebay areas with some boulder and larger materials present (Table H-17 of Normandeau et al. 2000; Technical Appendix E-3.A).

Existing and Proposed Use of Project Waters

This section describes the anticipated use of project waters for the next license period. The primary project use is and will continue to be generation of electricity. Miscellaneous other water rights exist within the project area and are supported to varying degrees by continued operation of the project.

Project Water Rights

Grant PUD has water rights for non-consumptive use of 188,350 cfs for power generation purposes at Wanapum dam, and 192,500 cfs at Priest Rapids dam. These rights are for non-consumptive uses of the water and do not preclude or interfere with any other surface water rights. Grant PUD also holds additional water rights for impoundment of the reservoirs behind each development, in the amount of 541,000 acre-feet (AF) at Wanapum dam and 200,000 AF at Priest Rapids dam. According to Washington DOE guidelines at the time these water rights were acquired, the term "impoundment" was defined as the amount of water stored between the design operating level (normal maximum elevation) and the unimpounded river level at normal high water level. Grant PUD does not anticipate that additional water rights will be necessary to support future operation of project facilities.

Existing Minimum and Maximum Flow Releases

Since commencement of operations, Grant PUD has maintained a minimum release at Priest Rapids dam of 36,000 cfs at the Hanford Works of the Atomic Energy Commission in accordance with License Article 45[25] of the current project License. In the 1970s, after the Department of Defense no longer required continuous minimum flow levels, the Washington Public Power Supply System (now Energy Northwest) constructed a commercial nuclear electric generating facility, the Columbia Generating Station, on the Hanford Reservation. The cooling water intakes and discharge pipes for

[25] Article 45 states: "The Licensee shall so regulate the flow from Project No. 2114 that it will not result in flows of less than 36,000 cfs of water at the Hanford works of the Atomic Energy Commission except when conditions are beyond the Licensee's control."

the project were designed and installed based on a water level resulting from a flow of 36,000 cfs and a minimum water level elevation at McNary reservoir of 335 feet. The maximum flow of record on the mid-Columbia River occurred in June of 1894, when peak flows reached approximately 740,000 cfs at Trinidad. In 1948, flood flows reached 692,600 cfs at the Trinidad gage, with flows remaining above 600,000 cfs for 20 days. While peak flows since 1948 have been much lower, both Wanapum and Priest Rapids dams are designed to pass flows up to 1,400,000 cfs, corresponding to the Probable Maximum Flood for the Columbia River in the project area.

Habitat Protection Flows

Downstream of the Project, flows for the protection of fall Chinook were established in June of 1988 through a settlement agreement as part of the Mid-Columbia Proceeding. The agreement requires operations termed RLF in the fall Chinook spawning period and sets a minimum flow during hatching and emergence periods based on redd counts from the Vernita Bar area. Under the agreement, minimum flows from late fall through the end of emergence in the spring are set between 50 and 70 kcfs, depending on the elevation of spawning activity in a given year.

Since 1999, Grant PUD and upstream operators (BPA, U.S. Army Corps of Engineers (COE), and Chelan and Douglas PUDs) have implemented an experimental re-regulation operation to protect fall Chinook fry rearing downstream of Priest Rapids dam. This operation entails use of Priest Rapids and Wanapum storage to re-shape upstream flow fluctuations to within specified fluctuation limits.

Other Water Rights

Most water uses along the Columbia River in the project area are not metered or have only recently had meters installed. Actual water consumption is not quantified. Water rights and claims filed with the Washington DOE provide indicators of water use and demand. The Washington DOE water right tracking system indirectly provides data on water use for a variety of purposes by tracking surface water rights, including claims, permits and certificates.

The consumptive use of surface water within the project area is authorized by Washington DOE for the following purposes: (1) single and multiple domestic; (2) general domestic; (3) stock watering; (4) irrigation; (5) commercial, industrial & manufacturing; (6) fish propagation; (7) environmental quality; (8) heat exchange; and (9) frost protection.

The extent of use of water for these various purposes is provided in Table 7. The amount of water extracted is based on an assumption that recorded water rights and claims are fully used. Groundwater use or surface water withdrawals from sources outside of the Columbia River are not included in this table.

Table 7. Consumptive surface water rights within the Priest Rapids Project area of the Columbia River, Washington (Source: Grant PUD 2003).

Purpose	Total Flow (cfs)	Total Volume (ac-feet/year)	Total Irrigation (acres)	Number of Rights
Domestic Multiple	0.414	67.277	15.17	7
Domestic Single	0.142	18.93	3.847	5
Domestic General	N/A	N/A	73.40	6
Frost Protection (Orchards)	14.42	985.37	718.33	2
Fish Propagation	102.00	N/A	N/A	1
Irrigation	63.124	8,123.807	3,226.64	32
Stock Watering	1.572	282.857	89.310	11
Commercial & Industrial Manufacturing	N/A	1,433.00	N/A	1
Environmental Quality	31.92	4,016.00	1,583.343	2
Heat Exchange	0.18	28.55	N/A	1
Recreation and Beautification	0.18	28.55	N/A	1
Claims (specific use unknown)	0.28	1,488.00	409.00	33

Presently, the waiting period to obtain a new water right certificate in the state of Washington is several years. In 2003, the Washington State legislature approved legislation intended to provide greater certainty that existing water rights will meet existing and future municipal water supply purposes. Apart from Grant PUD, there are no surface water withdrawals for water supply to municipalities within the Project Boundary.

Power Generation

The day-to-day operations of the mid-Columbia River hydroelectric system are coordinated through a set of agreements and policies to optimize the power and non-power benefits of the seven dam system. The agreement that most directly affects day-to-day operation of the Project and the entire system is the HCA.

Under the HCA, power operations are coordinated to meet daily load requirements through the assignment of “coordinated generation” through Central Control at Grant PUD. Automatic control logic maintains preset reservoir levels in order to meet load requirements and prevent involuntary spill. These preset reservoir levels are maintained at each project through management of a positive or negative “bias” which assigns a project more or less generation depending on whether the reservoir elevation should be increased or decreased in order to maximize system benefits and minimize involuntary spill.

Involuntary Spill

Reservoir control and power operations decisions made by upstream operators may cause involuntary spill at the project in the following situations: (1) when project inflows exceed hydraulic capacity; and (2) when potential power generation from available water supplies exceeds demand. Grant PUD receives projected daily average flow information on a weekly basis at Chief Joseph dam. However, actual flows may vary significantly from the projections. Flows within each day may fluctuate widely. In order to stay within normal maximum operating elevations, project operators may be required to adjust discharge. This may require short periods of involuntary spill.

Fish Spill

Grant PUD currently spills water during the spring and summer to provide a non-turbine passage route for downstream migrating juvenile salmon, steelhead and lamprey. From 1994 through 1998, spill was provided pursuant to a Federal Energy Regulatory Commission (FERC) Interim Order issued May 25, 1994. This order required Grant PUD to spill water to ensure non-turbine passage of 70 percent of the spring migrants over 80 percent of the run, and 50 percent of the summer migrants over 80 percent of the run (67 FERC 61,225). With the listing of steelhead as endangered under the EESA, Grant PUD voluntarily increased spill rates in 1998. However, spill levels for fish passage are typically limited by existing water quality standards for TDG.

In July of 2000, Grant PUD entered into an MOA that defined spill levels designed to achieve 95 percent dam passage survival and 80 percent fish passage efficiency. The MOA establishes spring spill objectives of 61 percent at Priest Rapids and 43 percent at Wanapum with summer spill of 39 percent at Priest Rapids and 49 percent at Wanapum. Grant PUD was ordered to implement the MOA in the Order Amending License and Terminating Proceedings, issued December 16, 2004.

Flood Control

The Wanapum and Priest Rapids reservoirs provide storage space for flood control operations as required by Articles 34 and 35 of the current License.

Article 34 states: "The Licensee shall, each year before May 15, by direction of Grant PUD Engineer, Corps of Engineers, in charge of the locality, make available in the Priest Rapids and Wanapum reservoirs, storage space in the amount necessary to compensate approximately for valley storage that may be expected to be lost during the ensuing flood season: Provided that said required storage space may be provided in either or both of the reservoirs in such manner as to least affect the interests of power generation: Provided, Further, that refill of this storage space shall be as directed by Grant PUD Engineer on the basis of forecasts of time and magnitude of flood flows and may be allowed any time between May 15 and June 30."

Article 35 states: "The Licensee shall provide for flood control storage space in addition to that required to compensate for valley storage, as provided for in Article 34 up to a total of 500,000 acre-feet by additional drawdown as may be requested by the Corps of Engineers, such drawdown to be based on forecasts of peak flow and time of occurrence: Provided, that suitable arrangements have been made to compensate the Licensee for the use of the additional storage space and, Provided Further, that such compensation shall be determined by the Federal Power Commission, based on the value of the additional storage space for other uses or upon payment in kind for power loss, and at the discretion of the Commission."

Ground Water

There are two major groundwater sources in the project area. One lies within the Columbia River basalts and the other within the unconsolidated glacial and alluvial deposits contained within the river valley. These unconsolidated deposits include alluvial sand and gravel deposits and coarser-grained layers of sand and gravel within glacial outwash and drift.

Grant PUD uses groundwater sources for domestic and project purposes at both the Wanapum and Priest Rapids developments. Groundwater quantity is metered and the quality is monitored monthly in accordance with the requirements of the Washington State Department of Health. The largest volume of groundwater used for project-related purposes is taken from eight wells that provide a total flow of up to 9,450 gallons per minute (about 21 cfs) for use at the Priest Rapids Hatchery facilities.

Water Quality

Several reports cover water quality issues relevant to the Columbia River within the project area. Historical concentrations and trends for key parameters were based on samples collected monthly by the USGS and Washington DOE below Rock Island dam and at Vernita Bridge.

Normandeau et al. (2000) and Juul (2003) reviewed temperature, DO, pH, and turbidity data from 1961 to 2001. In 1999, Grant PUD prepared a limnological investigation of the reservoirs that measured over 21 parameters (Normandeau et al. 2000). Hourly temperature, TDG, pH, DO, and turbidity data from five fixed-monitoring sites, historical turbine scrollcase data, thermistor arrays, and water-column profile data at eight transects were examined in Juul (2003). The data in these studies were collected from 14 different sites within the project area (Table 8).

Table 8. Location by river mile of various water quality data sources (Source: Grant PUD 2003).

Location (Station Abbreviation)	Normandeau et al. (2000)		Fixed Monitoring Sites	Washington DOE/USGS	2001 Profiles/ Thermistors
Below Rock Island dam (RIST)	452.0		452.2	452.2	
Dry Gulch		451.0			451.5
Crescent Bar	440.0	440.5			440.2
Scammon’s Landing	428.0	428.0			427.5
Ginkgo Park	416.0	417.5			417.4
Wanapum dam Forebay (WANF)			415.8		
Wanapum dam Tailwater (WANT)	414.0	415.5			413.20
Beverly Bridge (WANT)			412.2		
Hanson Creek	406.0	405.5			404.2
Goose Island	398.0	398.5			398.1
Priest Rapids dam Forebay (PRDF)			397.1		
Priest Rapids Tailwater (PRDT)	396.0	396.0			396.2
Below Priest Rapids dam (PRDT)				394.5	
Vernita Bridge (PRDT)			388.1	388.1	

To evaluate project impacts on water quality, Perkins et al. (2002) conducted a computer simulation of reservoir temperatures and the COE Waterways Experiment

Station conducted pre- and post-deflector evaluations at Wanapum dam (COE 2001) and recently completed field work on a TDG study for Priest Rapids dam (COE 2003). This section summarizes these studies.

Physical Water Quality Parameters

Physical parameters describe water quality in terms of easily measured attributes and provide a way to compare and track seasonal and historical trends in water quality. Key physical parameters include temperature, TDG concentrations, DO concentrations, acidity (pH) and turbidity. Other physical parameters commonly collected from reservoirs are conductivity, alkalinity and light attenuation measurements. More detailed information on these parameters is provided in Normandeau et al. (2000; Technical Appendix E-3.A) and Juul (2003; Technical Appendix E-3.B).

Temperature

Temperature is one parameter that is almost always measured as part of any water quality assessment. Values are influenced by factors such as latitude, altitude, season, time of day, wind, cloud cover, water depth, and discharge. Temperature in turn affects the physical, chemical, and biological processes in lakes, streams, and reservoirs. For example, as water temperatures increase, the rate of evaporation and volatilization from the surface also rises. The solubility of gases such as O_2, N_2, and CO_2 decreases at higher temperatures while the rate of most chemical reactions increases. The metabolic rate of aquatic organisms is also directly related to temperature. Warm water increases respiration rates that can lead to increased oxygen consumption and decomposition of organic matter. Additionally, the growth rates of bacteria, phytoplankton, and aquatic macrophytes also increase up to a certain level and can lead to algal blooms and greater turbidity if other growth factors are not limiting.

The historical database for water temperature is more extensive than for any other parameter. The oldest source is the daily scrollcase data from Rock Island dam. It extends back to 1933 and provides insight into the annual temperature cycle of the water that enters the project. The data from 1933-1941 was combined to represent the period before Grand Coulee dam was completed (Juul 2003). The information showed that mean water temperatures were ≤ 4 degrees Celsius (^{o}C) between late December and early March, >18^{o}C from late July through early September, and peaked in August at close to 19^{o}C. Temperature data from 1943-1972 were also examined since it was recorded after the first phase of Grand Coulee dam was completed, but before significant changes occurred to the flow regime of the entire Columbia River. Two important outcomes arose from this analysis. First, summer temperatures were less, reaching daily means of 17.9^{o}C. Second, the water warmed up slower during the spring and early summer than during the earlier period and remained warmer after late September by up to almost 4^{o}C.

The final period considered was from 1975-1997. The annual cycle was similar to the one for the 1943-1972 period, but average August and September values again approached 19°C.

Temperature data within the project area was also recorded at the Washington DOE and USGS long-term monitoring stations. The data set collected downstream from Rock Island dam had a seasonally low mean of 3.6°C in January while the analogous values were close to 3°C in February below Priest Rapids dam. The highest monthly values consistently occurred in August when the calculated means were between 19.0 and 19.2°C (Table 9).

Hourly temperature measurements were recorded at the five fixed monitoring sites from 1995-2001 or 1997-2001 depending on the location. This data yielded information that was in many ways similar to the historical analysis, displaying average minimum temperatures in February that ranged from 2.8 to 3.5°C and peaked in August between 18.8 to 19.5°C (Table 9). The detailed fixed monitoring site data also provided insight into longitudinal trends within the project. Average monthly temperatures below

Table 9. Average monthly temperatures (°C) for fixed monitoring sites and long-term monitoring station data (Source: Grant PUD 2003).

	1971-1990 Washington DOE	1997-2001 Fixed Monitoring Stations					1961-2001 Washington DOE	1974-1993 USGS
	RIST	RIST	WANF	WANT	PRDF	PRDT	PRDT	PRDT
Jan	3.6	3.8	3.2	4.3	4.1	4.2	4.0	3.8
Feb	3.9	2.8	3.2	3.3	3.5	3.4	3.0	2.9
Mar	5.4	4.0	4.5	4.4	4.9	4.5	4.4	4.4
Apr	8.0	7.0	7.1	7.0	7.2	7.3	7.1	7.2
May	11.0	10.4	10.9	10.7	11.0	11.0	10.5	10.7
Jun	14.5	13.4	13.2	13.8	14.0	14.0	13.7	14.2
Jul	17.5	16.5	17.5	17.0	17.4	17.4	16.8	17.2
Aug	19.0	18.8	19.5	19.1	19.2	19.2	19.2	19.0
Sep	18.9	18.7	19.1	18.8	17.4	18.5	18.0	18.3
Oct	16.1	15.6	15.9	15.8	19.4	15.8	15.6	15.6
Nov	11.7	12.3	11.8	12.1	11.8	12.2	11.5	11.5
Dec	6.8	8.0	7.6	8.4	7.6	7.7	7.4	7.1

Wanapum dam were up to 0.5^{o}C less relative to the forebay during the summer, but there were no differences between the two sites on an annual basis. The only two locations where there was a perceptible difference were between Rock Island dam tailwater and Vernita Bridge, where the average annual increase for the 1997-2001 interval was 0.3^{o}C. The mean downstream temperature increase calculated for the 1961-1996 Rock Island dam and Priest Rapids dam scrollcase data using 7-day moving averages was determined to be 0.2 C.

The reservoirs did not stratify thermally during 1999 through 2002, although there was near-surface warming during the summer. The water-column data collected during these years showed that vertical temperature differences were typically <1^{o}C. Temperature data collected during the summers of 2000 and 2001 at 1 meter, 3 meter, and 5 meter had an average seasonal vertical temperature variability of 0.4^{o}C.

Cross-channel temperature differences and near-shore averages were also examined by Juul (2003) within the project area and found to be relatively small. The 1999 and 2001 profile data indicated that lateral differences did occur during the summer, but the location of the higher temperatures was not consistent with respect to the left bank, right bank, or thalweg. Average lateral differences at 0.5 meter were less than 1^{o}C, but did approach 4^{o}C during single field events at the forebay sites. Maximum differences at a depth of 1.0 meter were <2^{o}C. In 2000 and 2001 temperature differences at 1-meter depth had a cross-channel difference that was typically <1^{o}C.
Diurnal temperature fluctuations were summarized in Juul (2003). The data from the eight transects showed that diurnal fluctuations in the well-mixed reaches below the dams averaged 0.3 to 0.5^{o}C per day during the summer with minor distinctions with depth. Forebay sites, or other low-velocity reaches, had greater diurnal variability with monthly averages reaching 1.5 to 1.7^{o}C, and up to 2.7^{o}C on individual days. Daily maximum temperatures at the forebay sites were most frequent in the 1600 hours (hrs) to 2300 hrs interval.

Anglin et al. (2006) reported that 32.4 percent of the 934 entrapments[26] measured in the Hanford Reach had lethal temperatures (>23 ^{o}C) for juvenile Chinook salmon.

Total Dissolved Gas

TDG is the summation of the partial pressures of the individual gases in solution – primarily N_2, O_2, and CO_2. As water is spilled into the tailrace air becomes entrained. This air/water mixture is then forced to the bottom of the stilling basin and the increased

[26] Pools adjacent to the main channel created when project flows are reduced.

hydrostatic pressure forces the air into solution. The result is that water becomes supersaturated with those gases normally found in the atmosphere.

Continuous TDG has been measured within the project area since 1995. Early data collection at the five fixed monitoring sites focused on the fish spill season (typically April through August) but data is now collected year round (Juul 2003). Intensive near-field work, conducted immediately below the powerhouse and spillway locations, at Wanapum dam has been completed to evaluate the effects of system operations (COE 2001). Additionally, vertical TDG profiles were completed at mid-channel and near the banks during a synoptic study conducted in 1999 (Normandeau et al. 2000). Gas saturation during non-spill events was usually close to 100 percent throughout the project (Table 10). Monthly averages varied by ±3 percent between October and March and spatial patterns were not evident. Higher values that exceeded 110 percent were usually associated with elevated runoff events such as those that occurred in 1996 and 1997. During spill periods to aid migrating juvenile salmonids, TDG values entering the Wanapum pool were at or above 115 percent for the months of June, July, and August (Table 10).

Table 10. Average monthly TDG values (%) for the 1997-2001 fixed monitoring station data (Source: Grant PUD 2003).

	Rock Island Tailrace	Wanapum Forebay	Wanapum Tailrace	Priest Rapids Forebay	Priest Rapids Tailrace
Jan	N/A	99	99	100	101
Feb	N/A	101	101	102	101
Mar	N/A	102	102	103	103
Apr	110	109	110	110	110
May	117	114	116	115	118
Jun	115	112	114	113	116
Jul	115	112	114	114	115
Aug	113	110	110	111	113
Sep	106	104	103	105	105
Oct	N/A	99	100	100	101
Nov	N/A	98	98	98	99
Dec	N/A	98	98	99	99

The combined April through August data for 1997-2001 showed very similar TDG saturation at each of the tailwater fixed monitoring stations. The overall averages showed a slight reduction from 115 percent below Rock Island dam to 114 percent at Beverly Bridge, followed by a 1 percent increase at Vernita Bridge (Table 10). Monthly spill season differences between the project headwaters and Vernita Bridge ranged from a 0.2 percent increase in July to 1.7 percent in May, with a seasonal average of 0.7 percent. May was also the month when gas saturation was typically highest, with monthly averaging from 116 percent to 118 percent at the same three tailwater stations. Individual measurements did exceed 120 percent during some years at all three sites.

Flow deflectors were installed on Wanapum dam between September 1999 and March 2000. The available data indicate that gas saturation subsequently decreased below the dam. The forebay fixed monitoring stations had slightly lower averages than the tailwater reaches during the 5-yr period, but also showed a downstream increase. The mean for the station above Wanapum dam was 112percent and increased to 113percent at the next forebay station 19 miles downstream. Monthly differences between these two locations ranged from 1.1 percent in April to 1.9 percent in July, with a seasonal downstream increase of 1.3 percent.

Correlation coefficients between spill and tailwater TDG were 0.91 for the combined 1996-1998 data and decreased to 0.73 for the 2000-2001 data set. Additionally, regression analyses of the hourly data showed that downstream TDG values were lower during most spill conditions. The data points diverged at higher spill when the TDG levels for the most recent period were almost 10 percent less. This value is very similar to the 11 percent determined by the COE (2001) during a study conducted immediately below the powerhouse and spillway locations. Flow deflectors have not been installed at Priest Rapids dam, but a similar correlation coefficient/regression analysis was completed for that data set as a comparison. The correlation coefficients between spill and TDG at Vernita Bridge for the 1996-1998 and 2000-2001 periods were 0.81 and 0.82, respectively. The correlation coefficients for the entire 1995-2001 spill season data were also 0.81. The regression analyses for the hourly data were nonlinear and showed that TDG levels in the most recent set were about 3 percent lower for a given spill volume. It was also noted that when the 2000-2001 data sets for each facility were superimposed on each other they were very similar, demonstrating the effectiveness of flow deflectors for reducing TDG levels.

The 1999 survey by Normandeau et al. (2000) demonstrated that TDG values were essentially uniform throughout the water columns, but lateral differences were documented. Normandeau et al. (2000) found that the right bank between Wanapum dam and Priest Rapids dam had higher gas saturation than the corresponding mid-channel during spill events. Mid-summer differences of 13 percent were identified in the reach immediately below the dam, decreasing to 9 percent 17 miles downstream. The COE

(2001) commented on this difference and the fact that little gas dissipation occurs between the dams. The reach below Priest Rapids dam also displayed lateral differences. However, Normandeau et al. (2000) reported that higher gas saturation could occur either along the right bank or mid-channel. The location was a function of total flow and spill, and the extensive downstream assemblage of basalt outcrops and boulders appear to have a large influence on turbulence and degassing.

Dissolved Oxygen

DO is essential to all forms of aquatic life. The oxygen content of water varies with temperature, atmospheric pressure, turbulence, dissolved ions, and photosynthetic activity of algae and aquatic macrophytes. The solubility of oxygen decreases as temperature and ionic concentrations increase. Variations in DO can occur seasonally and diurnally in relation to temperature and biological activity. Biological respiration, including that related to decomposition, reduces DO concentrations.

The current DO standard indicates that concentrations must be >8 milligrams per liter (mg/L). Only two of the measurements from the long-term Washington DOE/USGS data sets were less than 8 mg/L. All of the measurements from the 1999 limnological study were also >8 mg/L (Normandeau et al. 2000). One percent or less of all measurements recorded at the fixed monitoring stations between 1995 through 2001 were <8 mg/L. The number of times when recorded values at the tailwater stations did not reach 8.0 mg/L was less than the thresholds calculated for the binomial distribution. This was true for the historical monthly Washington DOE/USGS data sets from below Rock Island dam and Vernita Bridge, as well as the hourly fixed monitoring station data.

pH

The parameter pH is a measure of the acid/base balance of a solution and can theoretically run from 0 to 14, with 7 representing a neutral solution. It is recognized that pH is an important variable that influences, and is influenced by, many chemical and biological processes within a water body. The photosynthetic activity of algae and aquatic plants removes CO_2 from the water and this leads to an increase in pH. Conversely, respiration and decomposition decrease the pH of the water. These effects can be observed on seasonal and diurnal scales.

Virtually all of the pH measurements from the 1999 synoptic survey were between 6.5 and 8.5 units ─ the only exceptions were surface measurements of 8.6 units recorded in Lake Geneva, located about 7 miles north of Ellensburg, WA, during August and September. One hundred percent of the 1999 and 2000 fixed monitoring station data points were within the allowable range at each station. The 2001 fixed monitoring station data showed some measurements >8.5 units, but a review of equipment and calibration techniques suggest that this was related to the calibration standard used.

Turbidity

Turbidity results from the scattering and absorption of incident light by suspended particles. Values can vary seasonally as a result of biological activity in the water column and surface runoff carrying soil particles. The water quality standard for turbidity states that turbidity should not exceed 5 nephelometric turbidity units (NTU) above the background when the background is 50 NTU or less. Juul (2003) estimated the background turbidity using the 1978 through 2001 Washington DOE/USGS Vernita Bridge data as 1.7 NTU.

The instrumentation used during recent studies had a detection limit of 5 NTU and a range of ±5 NTU. Most of the values recorded during the 1999 synoptic survey were <5 NTU. A few measurements at the bottom of the profiles at near-shore sites were higher but were probably influenced by re-suspension of sediments by the probe. The annual means for the combined 1999-2001 fixed monitoring station data were <5 NTU at all stations.

Light Attenuation

Light attenuation in the water column is related to incoming solar radiation and is measured by the depth of light penetration. Transparency is also affected by phytoplankton growth and suspended particulates; in turn, transparency affects macrophyte growth. Light attenuation was evaluated as part of the 1999 descriptive survey (Normandeau et al. 2000) through pelagic (open-water) and littoral (near-shore) measurements using a Secchi disc and underwater light meter.

The open-water and near-shore Secchi disc data showed several similarities. Both showed a temporal pattern but no significant longitudinal gradients. The thalweg system-wide averages were least in June (1.0 meter) during the spring run-off and greatest (5.3 meters) in the fall.

The photic zone is defined as that part of the water column where the photosynthetically available radiation is >1 percent of the light at the surface. Open-water photic zone depths displayed a mean longitudinal increase from Dry Gulch (7.5 meters) to Ginkgo Park (9.2 meters), followed by a subsequent decrease towards the Priest Rapids tailwater site (7.7 meters). The July through October data for the same three reaches displayed the same pattern, with calculated means of 9.4 meters, 10.7 meters, and 8.4 meters, respectively.

Conductivity

Specific conductance, or conductivity, is a measure of the capacity of water to conduct an electric current. Its magnitude is dependent on the concentration of the major ions in solution and total dissolved solids (TDS). The historical specific conductance data showed few changes over time (Normandeau et al. 2000). Average monthly values at Vernita Bridge ranged from approximately 122 to 152 µS/cm, with annual maxima and minima generally occurring during February and June, respectively.

Total Alkalinity

Alkalinity is the buffering capacity of the water to neutralize pH. Bicarbonates represent the major form of alkalinity, followed by carbonates ($CaCO_3$) and hydroxides. The geology of the watershed is the primary factor that determines total alkalinity, but the form the alkalinity takes can be influenced by the phytoplankton. Historical mean monthly alkalinity data followed a seasonal pattern that paralleled the conductivity data. Monthly averages at Vernita Bridge ranged from 53 mg $CaCO_3$/L in August to 63 mg $CaCO_3$/L, with the higher values usually occurring during the first three months of the year (Normandeau et al. 2000).

The total alkalinity results from the 1999 study tracked the historical conductivity data in several respects. First, the system-wide average decreased from a high of 74 mg $CaCO_3$/L in April to a low of 45 mg $CaCO_3$/L in June, and was 51 mg $CaCO_3$/L by November. Second, there was a slight trend during the growing season of increasing alkalinity from Dry Gulch (47 mg $CaCO_3$/L) to Ginkgo Park (52 mg $CaCO_3$/L). However, the combined near-surface data from the Wanapum and Priest Rapids reservoirs for the entire sampling period were both 55 mg $CaCO_3$/L.

Free CO_2

Carbon dioxide (CO_2) is very soluble in water. CO_2 in solution can originate externally from absorption at the air/water interface. Alternatively, it is produced internally via respiration by aquatic biota and decomposition of suspended or sediment organic matter. Free CO_2 was calculated for each alkalinity sample collected during 1999. The combined average for the Wanapum reservoir was 2.3 mg/L compared to the 1.9 mg/L determined for the Priest Rapids reservoir. Individual values ranged from <1 mg/L to 5.4 mg/L. At the locations where samples were collected at various depths through the water column, the samples from the deeper strata typically had higher CO_2 levels than surface samples.

Chemical Water Quality Parameters

Chemical parameters include the most common aquatic nutrients that are essential for aquatic life. However, excessive levels of these nutrients are indicative of polluted waters. This section describes nitrate-nitrite, phosphorous, TDS and total suspended solid (TSS) levels in project waters. In addition, this section describes the results of heavy metal and priority pollutant analyses. More detailed information on these parameters is provided in Normandeau et al. (2000; Technical Appendix E-3.A).

Nitrate-Nitrite

The nitrate ion (NO_3) is the common form of combined nitrogen in natural waters. Nitrite (NO_2) may be present as well, but is rapidly oxidized to nitrate. Natural sources of nitrate include igneous rock, land drainage, along with plant and animal debris.

Average monthly historical NO_2+NO_3-N concentrations at Vernita Bridge ranged from 0.04 to 0.17 mg/L (Normandeau et al. 2000). No differences were identified between sampling periods. Annual maxima occurred during the early winter, concentrations gradually declined throughout the spring and summer until August, and then increased during the remainder of the year.

Total Phosphorus

Phosphorus is an essential nutrient for living organisms and is often the limiting nutrient for algal growth. Natural sources of phosphorus are mainly the weathering of phosphorus bearing rocks and the decomposition of organic matter. Historical average monthly total phosphorus (TP) levels below Priest Rapids dam ranged from 0.02 to 0.05 mg/L. Data collected during 1976-1982 averaged approximately 10 to 15 mg/L higher than that collected during 1988-1992 and 1994-1997. Concentrations showed a bi-modal distribution, with peaks of 0.030 to 0.040 mg/L in May and early-to-mid-fall, and lower concentrations during the summer.

Water samples for TP analyses were also collected in conjunction with the ones for NO_2+NO_3-N during the 1999 study. The results were very similar to the nitrogen analyses with respect to specific sampling reaches and depths during any sampling event. The combined TP averages for the near-surface samples were the same for both reservoirs; 0.013 mg/L.

Total Dissolved Solids

Monthly estimates of historical TDS levels were only available for 1976-1982 and 1988-1992. The monthly averages for both periods ranged from 70 to 95 mg/L

(Normandeau et al. 2000). Maximum values were typically calculated for the months between February and April, and ranged from 83 to 93 mg/L. Monthly minimums usually occurred in July near 72 mg/L.

The 1999 TDS determinations displayed temporal and longitudinal trends that were analogous to the conductivity data. The near-surface average, based on all data points, for the Wanapum reservoir was 77 mg/L. The corresponding value for the reach below the dam was slightly higher at 81 mg/L. The data also showed a seasonal trend. The overall average for the 1 meter data peaked at about 90 mg/L in March and April, declined to 58 mg/L in November, and rose to 90 mg/L in December again. As with the suspended solids data, the near-bottom TDS concentrations were not significantly greater than near-surface data (Normandeau et al. 2000).

Total Suspended Solids

TSS, also known as non-filterable residue, are the particles retained on a glass-fiber filter and subsequently dried at 103-105 ^{o}C. The material that remains on the filter can be either inorganic (*e.g.*, soil particles) or organic (*e.g.*, detritus and plant material). Historical mean monthly estimates of TSS at Vernita Bridge ranged from 2 to 7 mg/L (Normandeau et al. 2000). Concentrations were typically highest in May and June during spring runoff and lowest in October through November.

Samples collected for TSS analyses during the 1999 synoptic study showed that both reservoirs were very similar, with annual averages of about 3 mg/L near the surface. The maximum monthly average for the surface samples collected above and below Wanapum dam was approximately 6 mg/L and occurred in June. The highest near-surface concentrations at individual stations also occurred during June but they did not differ from each other substantially (Normandeau et al. 2000).

Sediment Metals and Priority Pollutants

Sediment samples were collected in September 1999 (Normandeau et al. 2000). Eight cross-channel transects were evaluated between the reach below Rock Island dam and the one below Priest Rapids dam.

Cross-channel and deepwater sediments ranged from boulders down to sand and silt loam; large particles (coarse sand, cobbles, and boulders) were most common, although pockets of finer sediments were identified near shore, with one sample consisting of 97 percent sand and silt.

No priority pollutants were present in the open channel sediments of the Project. One priority pollutant, 4-methylphenol, was isolated in five of the twelve samples collected at the off-channel site near Crescent Bar at concentrations ranging from 2.4 to 5.7 mg/kg. No other littoral samples contained priority pollutants.

Sediment analyses were performed for a full range of heavy metals. The majority of the samples were within regional background ranges, with a few exceptions for copper and zinc. Sediment copper averaged 34, 21, 42, 43, and 50 µg/kg below Rock Island dam, Crescent Bar, Scammon's Landing, Ginkgo Park, and Goose Island, respectively. The zinc content of the sediments averaged 180, 182, 426, 456, and 715 µg/kg at the same five transects. As a comparison, sediment no-observable-effect concentrations (NOEC) for *Hyalella azteca*, an amphipod shrimp and common fish food item in shallow wetland and shoreline waters of the Columbia River system, were determined to be 1,300 µg Zn/g in other studies. The zinc concentrations within the project area were somewhat elevated at the fine sediment sites, but below sediment NOECs.

Biological Water Quality Parameters

Biological water quality parameters include measurements associated with many important aquatic organisms that serve as water quality indicators. The most important of these are fecal coliform bacteria that provide an index of pollution included in Washington's water quality standards. A description of various algae, zooplankton and aquatic insects found in the project area is also covered in this section.

<u>Fecal Coliforms</u>

Fecal coliforms (FC) are a group of bacteria used to indicate pollution in natural waters. These nonpathogenic microorganisms typically reside in the intestinal tract of humans and are egested with the feces. Pathologic bacteria and viruses that cause enteric diseases in humans can also originate in fecal discharges. Therefore, water contaminated by fecal pollution is considered to be potentially unsafe by the presence of the coliform bacteria. However, the correlation between coliforms and human pathogens is not absolute since these organisms can originate from any warm-blooded animal and even from the soil. Thus, the significance of fecal coliform testing results depends on knowledge of the river basin and the probable source of the observed coliforms.

Historical FC data were available from the Washington DOE long-term monitoring site at Vernita Bridge. Fecal coliform evaluations were also completed three times (June, July, and August) at five locations (Crescent Bar, Sunland Estates, Ginkgo Park, Lake Geneva, and at Desert Aire) during the 1999 study.

The standard for class A water is a geometric mean of 100 (coliform forming unit (cfu)/100 milliliter (ml), and less than 10 percent of the values used to calculate that mean can be greater than 200 cfu/100 ml. The monthly samples collected at Vernita Bridge by

Washington DOE between 1975–2001 had a geometric mean of 2 cfu/100 ml and a maximum of 63 cfu/100 ml; both below the threshold. The June, July, and August 1999 samples also had relatively low FC counts. The geometric means for these events ranged from 4 cfu/100 ml to 7 cfu/100 ml while discrete values ranged from 0 cfu/100 ml to 30 cfu/100 ml.

Chlorophyll *a*

Chlorophyll *a* is present in most photosynthetic organisms and provides an indirect measure of the trophic status of a water body. The chlorophyll *a* levels in the reservoirs were in the mesotrophic zone. The Washington DOE has also established a set of nutrient criteria that would place the project area between lower and upper mesotrophic states.

Chlorophyll *a* values averaged about 3 µg/L for the entire Priest Rapids data set but did show seasonality. Concentrations peaked in April, were lower and relatively stable from June through October, and then declined in December.

Phytoplankton

Phytoplankton, or algae, comprises the small plants or photosynthetic bacteria in the water column. They have a very limited, or in some cases, no ability to regulate their position in the reservoir, and their spatial orientation is dependent on water movement. They are important within the aquatic ecosystem not only because they form the base of the food chain, but also because the species composition is indicative of the physical and chemical environment.

Algal samples were collected at each station following the same regimen established for the Chlorophyll *a*. Cells were identified to species where practical and quantified (Normandeau et al. 2000).

Total algal biovolume in Priest Rapids reservoir was slightly greater than in Wanapum reservoir. However, the magnitude of the distinction varied depending on how the data were viewed. The combined average for algal data from above Wanapum dam versus downstream showed a 10 percent downstream increase. Seasonally, the documented biovolumes were highest during April and June and decreased by 50 to 70 percent during the last three sampling events.

The pelagic phytoplankton communities of both reservoirs were dominated by the Bacillariophyta (diatoms). Diatoms are characteristically most abundant in the spring and fall, and this was also the case in this section of the Columbia River.

As the year progressed, the biovolume and percentage of the division Cryptophyta (cryptomonads), increased in both reservoirs. Their biovolume in each reservoir during the first field event in April was ≤4 percent of the total, but their presence increased during the next series of sample events. The Chlorophyta (green algae) and Cyanophyta (blue-green algae) were everywhere but minor components of the algal community at both reservoirs. July was the only month when the green algae made a significant contribution to the total biovolume.

Zooplankton

Zooplanktons are secondary producers in the aquatic food web, foraging on items such as bacteria, detritus, algae, and other zooplankton. Any zooplankter can be consumed by fish, but fish are typically sight feeders and show a preference towards larger zooplankton species.

Photic zone samples for zooplankton analyses were collected in 1999 following the same schedule used for the phytoplankton. Samples were identified to species where possible (Normandeau et al. 2000). The structure of the zooplankton data, however, showed greater differences between the reservoirs and more longitudinal trends than the algal information did.

Despite the similar percent distributions, zooplankton biomass in the upper reservoir was noticeably greater than in the lower reaches. The reasons for some of the differences observed in the zooplankton communities in each reservoir were hypothesized to be due to zooplankton/phytoplankton interactions rather than zooplankton/fish interactions (Normandeau et al. 2000).

Attached Benthic Algae

The attached benthic algae (ABA) are, like the pelagic forms, at the base of the food web. Species composition varies seasonally, but is also influenced by factors such as light, temperature, substrate, nutrients, current velocity, and grazing. Since they are sessile and inhabit the interface between the abiotic and biotic components of the river they are also good water quality indicators. Their relatively short life cycle results in the ability to rapidly respond to changing environmental conditions. The extant communities are typically very representative of present conditions, as well as those of the recent past.

The ABA communities were evaluated during six months of 1999 between February and November (Normandeau et al. 2000). Natural rocks were dredged from the 0 to 2 meter and 2 to 6 meter zones at each end of eight transects. The sampled periphyton were subsequently analyzed for monochromatic chlorophyll *a*, pheophytin, trichromatic chlorophyll *a*, *b*, and *c*, and ash-free oven-dry weight. Autotrophic Indices for both monochromatic and trichromatic chlorophyll *a* values were calculated as well.

The ABA annual mean monochromatic chlorophyll *a* concentration for all sites was close to 19 mg/m^2 during 1999, placing the benthic algae in this reach of the Columbia River in the mesotrophic range.

The ABA Autotrophic Index was relatively high, averaging 462. The magnitude of this index suggests organic loading to the reach. The eight-fold ratio of oven dry weight to ash-free oven-dry weight was also high, further suggesting heavy inorganic siltation or loading of fine particles to ABA communities during the growing season.

Aquatic Macrophytes

Aquatic macrophytes, or plants, serve many purposes. Some of the beneficial uses include habitat for fish, invertebrates, and waterfowl, minimizing bank erosion and the resuspension of sediments, as well as adding oxygen to the system, while removing nutrients. However, in some cases, invasive species such as Eurasian watermilfoil can grow to the extent that they out-compete the native species and become a nuisance. Aquatic macrophytes were assessed at eight transects in early September 1999, the time of expected peak annual density.

Fourteen species of aquatic macrophytes were found in the littoral zones of Priest Rapids and Wanapum reservoirs. The plant community composition was dominated by the exotic Eurasian watermilfoil (*Myriophyllum spicatum*), at 42 percent of the littoral plant biomass. Samples containing 100 percent Eurasian watermilfoil and greater biomass were found in the upstream reaches of Wanapum reservoir.

Average macrophyte biomass was higher in the Wanapum reservoir. The upstream Wanapum reservoir averaged about 57 g/m^2 while the Priest Rapids reservoir was 10 g/m^2. Maximum density was also greater upstream, reaching 700 g/m^2 compared with 90 g/m^2 in the Priest Rapids reservoir.

Benthic Macroinvertebrate Community

Benthic macroinvertebrates (BMI) are invertebrates that are retained by a 500-µmeter mesh and are associated with the bottom habitats. There are at least two reasons why they are an important component of water quality studies. First, they form a fundamental link between organic matter resources (e.g., algae, detritus, and leaf litter) and the fish. Second, the life history characteristics of individual species show adaptations to specific environmental characteristics. The benthos are excellent environmental monitors that integrate information regarding their surroundings.

Oligochaetes and Chironomids dominated the BMI communities studied (Normandeau et al. 2000). A project maximum of 63,000 organisms/m^2 was reached at Crescent Bar while the minimum was 133 organisms/m^2 in the reach below Wanapum dam. In comparison, Normandeau et al. (2000) noted that previous studies found maximum Oligochaete densities in the lower Snake River were approximately 20,000 organisms/m^2 and that Columbia River Oligochaetes tended to be much smaller individuals than those found in the lower Snake River.

The molluscan community composition in the fine sediments was unremarkable. The forms found were representative of taxa previously identified above and below the Project reach.

Water Quality Standards

The Washington DOE has established surface water quality standards that contain numeric criteria and designated uses. This section compares measured values for key parameters with numerical criteria set by the state standards. Washington has defined criteria for fecal coliform bacteria, DO, TDG, temperature, pH and turbidity. Detailed information on these standards is also provided in this section.

Clean Water Act

Water quality standards consist of designated uses of the water body and the water quality criteria necessary to support those uses [33 USC§1313(2)(A)]. EPA regulations also added a third formal element, that of an anti-degradation policy [*See* 40 CFR §131.12, 42 USC §1313(d)(4)(B)], which is now incorporated in Washington Administrative Code (WAC)173-201A-300. Substantively, water quality standards, wherever attainable "shall be such as to protect the public health or welfare, enhance the quality of water and serve the purposes of this chapter" [33USC§1251(a)(2), 33USC§1313(c)(2)(A)]. In addition, §303(c)(2)(A) of the CWA states that: "such standards shall be established taking into account their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes, and also taking into consideration their use and value for navigation."

The CWA is implemented by the Washington DOE by authority of the State Water Pollution Control Act (WPCA), Revised Code of Washington (RCW) 90.48, and the Water Resources Act of 1971 (WRA), RCW 90.54. Both statutes explicitly state that industrial development, and specifically hydroelectric power generation, is in the public interest and will be given consideration in developing water quality standards that will meet public interest values associated with the use of Washington State waters for hydroelectric power generation, recreation, industrial uses, fish, and wildlife.

<u>Beneficial Uses</u>

Until recently, Washington established various classifications and criteria for surface waters of the state. The classifications include Class AA (extraordinary), A (excellent), B (good), C (fair) Lake Class, and Outstanding Resource Waters (WAC 173-201A-130). Washington DOE has designated the Columbia River from its mouth to RM 596 (Grand Coulee dam) as Class A, excellent [WAC 173-201A-130(20), (21)]. Above Grand Coulee dam to RM 745 (the U.S. – Canadian border), the water is classified as Class AA, extraordinary.

On July 1, 2003, the Washington DOE adopted new water quality standards and anti-degradation policy for waters within Washington State. These new standards are pending EPA approval. Under the new standards, Washington moved from a class-based format to a use-based format for identifying uses and criteria associated with water bodies in Washington. The key difference between these two approaches is the way in which uses are assigned. Rather than assigning waters having predetermined sets of beneficial uses (regardless of what the water body can actually support), Washington DOE would assign beneficial uses to a water body independently of each other. Washington DOE views this change as providing it greater flexibility in designating a combination beneficial uses for protection appropriate to the water body and particular localized conditions.

The new use designations for the Columbia River from the Washington Oregon border to Grand Coulee dam include: non-core salmon and trout migration, primary contact recreation, and water supply for domestic, agricultural, industrial and stock watering purposes. Miscellaneous uses include wildlife habitat, harvesting, commercial navigation, boating and aesthetics (WAC 173-201-602, Table 602).

Comparisons with Water Quality Criteria

Specific criteria for the surface waters of the State of Washington are set for temperature, TDG, DO, pH, turbidity and fecal coliform bacteria (WAC 173-201A-030). In addition, special conditions are set for temperature and TDG. Although the new criteria are pending EPA approval, a comparison of existing and new criteria is detailed in the sections below.

Temperature

Certain Columbia River segments have special temperature conditions that contain temperature criteria specific to that river segment. The special condition from the Washington-Oregon border to Priest Rapids dam is that temperature shall not exceed a one-day maximum of 20°C due to human activities. When natural conditions exceed 20°C, no individual increase will be allowed to raise the receiving water by more than 0.3°C nor shall the cumulative of such increases be allowed to exceed t = 34/(T+9) (WAC 173-201A-602, Table 602, Note 2). This does not reflect any change from the previous criteria for temperature.

Above Priest Rapids dam, the water temperature criteria changed from a daily maximum of 18°C to a 7-day average of the daily maximum (7DADMax) of 17.5°C (or within 0.3° of the criteria), due to human activities (WAC 173-201A-200). When natural conditions cause the receiving water to exceed the numeric criteria, then human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C [WAC 173-201A-200(1)(c)]. Incremental temperature increases resulting from point sources shall not exceed t=28/(T+5) (previously t=28/(T+7) [WAC 173-201A-030(2)(c)(iv)] but the criteria for non-point source activities did not change and permits a cumulative temperature increase from all non-point source activities not to exceed 2.8°C [WAC 173-201A-200(1)(c)(ii)(iii)]. Where previously an incremental temperature increase was allowed up to 0.3°C, the antidegradation policy defines a "measurable change" from any new or expanded action to be a temperature increase of 0.3°C or greater [WAC 173-201A-320(3)(a)]. Since the temperature standard includes reference to the "natural condition" of the river as in the previous standard and, as discussed below, the natural condition frequently exceeds the numeric criteria, the temperature standard applicable to the Columbia River in which the project is located has not materially changed.

Several segments of the Columbia River are listed on the state's 303(d) list for temperature. The Project, however, is located in Water Resource Inventory Areas 40 and 41, which are not included in the final 1998 §303(d) list. In response to those listings, the EPA is undertaking an effort to develop a TMDL for temperature for the Columbia and Snake Rivers. While the TMDL methodology is under development, it is anticipated that it will include those water body segments that are listed on Washington State's §303(d) list. Apart from the development of a TMDL, Grant PUD recognizes the importance of temperature monitoring and has developed a detailed program and will continue to participate in the refinement of its program. This program will be consistent with the new temperature monitoring regulations that specify temperature measurements shall be taken from well mixed portions of the rivers and streams and shall not come from stagnant backwater areas, within isolated thermal refuges, at the surface or at the waters edge [WAC 173-201A-(c)(vi)].

The oldest set of water temperature data available has been recorded at the Rock Island dam scrollcase between 1933 and 1997. Fifty-eight percent and 43 percent of the August and September daily values were >18°C, respectively, during the period from 1933 to 1996. The 1933-1941 data also showed that daily August values were >18°C for 80 percent of the time while 41 percent of the September values were above this threshold before construction of Grand Coulee dam, Chief Joseph dam, Rocky Reach dam, or the Project.

The USGS/Washington DOE long-term monitoring station data showed similar trends. Monthly data collected below Rock Island dam from 1971-1990 showed that 50 percent of July, 78 percent of August, and 69 percent of September temperature measurements were >18°C. The 1961 to 2001 monthly data from Vernita Bridge showed that 13 percent of the August values were >20°C, but in several of these cases the standard was only exceeded by a few tenths of a degree. Seven percent of the daily August USGS data collected below Priest Rapids dam (1974-1980) was >20°C, while July and September each exceeded the standard about 1 percent of the time.

Hourly data recorded at the fixed monitoring station sites and thermistor transects in the reservoirs provided the most recent and detailed picture of the temperature regimen in the reservoirs and how they relate to the standards. The combined 1997-2001 data from each of the five fixed monitoring station sites revealed that 20-25 percent of the measurements were >18°C. As with the monthly data, the percentage of data points >18°C was about 1 percent in June at any station.

Warmer temperatures in July, August, and September increased the amount of events that exceeded the standard. The July 1997-2001 fixed monitoring station and 2000-2001 thermistor transect data from the station farthest upstream were >18°C from 4-7 percent of the time. These averages increased downstream resulting in 23-32 percent of values >18°C below Wanapum dam. Overall, August was the warmest month of the year; fixed monitoring station data showed that water inflows to the project during that month surpassed 18°C 49 percent of the time in 1999 but 100 percent of the time in 1998. Water temperatures generally cooled slightly in September such that over the 5-yr period for the fixed monitoring station below Rock Island dam the value of 18 °C was exceeded about 67 percent of the time. The thermistor data from the same site, as well as both September data sets from below Wanapum dam averaged 83 percent >18°C. The number of measurements >20°C below Priest Rapids dam were typically <2 percent during the summer of any year. The one exception was the unusually warm year of 1998 when up to 98 percent of the values were >20°C.

Total Dissolved Gas

Prior Washington State water quality standards provided for a temporary special condition for TDG in the Columbia River to aid fish passage over hydroelectric dams. The temporary status has been removed in the new revisions. Both the former temporary and new standard states that when spilling water at dams to aid fish passage, TDG must not exceed an average of 115 percent as measured in the forebay of the next downstream dam and also must not exceed an average of 120 percent as measured in the tailrace of each dam [WAC 173-201A-200(f)]. These averages are based on the 12 highest consecutive hourly readings per day rather than the 12 highest hourly readings. In addition, the maximum one-hour average 125 percent TDG allowed in WAC 173-201A-200(f) is the same as in the former rule [WAC 173-201A-060(4)(b)]. Outside fish spill season, the standard remains at 110 percent TDG [WAC 173-201A-030(2)(c)(iii)]. In addition, the TDG standard does not apply when the total river flow exceeds the 7-day, 10-year frequency flood (7Q10) [WAC 173-201(f)(i)]. The 7Q10 flood flow for the project was estimated at 264,000 cfs at both Wanapum at Priest Rapids dams (Washington DOE In Press).

Hourly measurements recorded during the non-fish spill season between Wanapum dam forebay and Vernita Bridge in 1995 and from 1999–2001 were <110 percent saturation for more than 98 percent of the time. During the high flow period of 1996 and before installation of flow deflectors at Wanapum dam, up to 27 percent of hourly TDG measurements below Wanapum dam were >110 percent. Below Rock Island dam, from 6-30 percent of TDG measurements were >110 percent during 1999-2001. The maximum percentages ranged from 0-6 percent at the Project tailwaters during the same time period.

The TDG data from the fish spill periods also varied considerably. The 125 percent 1-hr maximum was surpassed 0-4 percent of the time at any location in 1995 and between 1998 and 2001. Three percent to 31 percent of the 1996 and 1997 data points were above this threshold when river discharge was high but less than the 7Q10. These were also the two years when the binominal distribution criteria at the tailwater stations were surpassed; Beverly Bridge and Vernita Bridge in 1996 and Beverly Bridge again in 1997. The highest percent exceedences of the 115/120 percent standard also occurred in 1996 and 1997 ranging from 28 percent to 83 percent. The 1998 through 2000 data sets had fewer values above these thresholds. The percentages were generally highest near the Priest Rapids dam facility where 25 percent to 42 percent of the forebay measurements were greater than the 115 percent standard and 18 percent to 23 percent were above the 120 percent mark in the tailwater. The COE (2001) study noted that the short travel time between the Wanapum dam tailrace and Priest Rapids forebay minimized reductions in gas saturation, and concentrations at the Beverly Bridge fixed monitoring station site would have to be below 116 percent to assure compliance with the

115 percent standard at Priest Rapids. The very low flows of 2001 reduced exceedences to between zero and 9 percent at all sites.

It is important to note that fish spill and TDG are monitored and managed by the PRCC[27] (Grant PUD) and the Mid-Columbia Coordinating Committee (MCCC) which includes representatives from Chelan and Douglas PUDs, NMFS, Washington State Department of Fish and Wildlife (Washington DFW), Washington DOE, Yakama, CRITFC and the Colville. Fish spill is adjusted regularly based on TDG monitoring but the approach has previously been geared towards maximizing spill which is presumed to aid fish passage survival rather than absolute compliance with TDG criteria. Thus, spill levels are often set based on the tailrace 120 percent criteria that can result in frequent exceedences of the 115 percent forebay criteria. While the analysis of historical data presented here reflects this spill management policy, the change in the standard to the 12 highest consecutive hourly readings is designed to improve compliance with the applicable TDG criteria. In this regard, the 12 highest consecutive hourly readings will be less likely to be affected by involuntary spill events that are beyond Grant PUD's control. Additionally, with a 12 consecutive hour metric and the use of real time data gathering techniques, Grant PUD and other operators will be in a better position to reduce spill before the standard is exceeded.

Dissolved Oxygen

The Washington State water quality criteria for DO has not changed. The criteria require that concentrations exceed 8 mg/L [WAC 173-201A-200(f)]. Only two of the measurements from the long-term Washington DOE/USGS data sets were less than 8 mg/L. All of the measurements from the 1999 limnological study were >8 mg/L (Normandeau et al. 2000). One percent or less of all measurements recorded at the fixed monitoring stations between 1995 through 2001 were <8 mg/L. Additionally, the number of times when recorded values at the tailwater stations did not reach 8.0 mg/L was less than the thresholds calculated for the binomial distribution. This was true for the historical monthly Washington DOE/USGS data sets from below Rock Island dam and Vernita Bridge, as well as the hourly fixed monitoring station data.

27 In the December 16, 2004 Order Amending License and Terminating Proceedings, the Commission required Grant PUD to implement NMFS' Reasonable and Prudent Alternatives of NMFS's Biological Opinion (BO), filed on May 6, 2004. To coordinate and monitor the implementation of the BO's conditions, Grant PUD was required to establish a PRCC, as described in the BO. The Order relieved Grant PUD's responsibility in participating in the MCCC. On February 10, 2006, Grant PUD filed The Priest Rapids Salmon and Steelhead Settlement Agreement, which includes establishing a PRCC.

pH

The Washington State water quality criteria for pH has not changed. The criteria requires pH values between 6.5 and 8.5 units [WAC 173-201A-200(f)]. Ninety-one percent of the historical monthly Washington DOE/USGS data collected below Rock Island dam were within this range, as were 97 percent of the analogous data from Vernita Bridge. Virtually all of the pH measurements from the 1999 synoptic survey were between 6.5 and 8.5 units - the only exceptions were surface measurements of 8.6 units recorded in Lake Geneva during August and September. One hundred percent of the 1999 and 2000 fixed monitoring station data points were also within the allowable range at each station. The 2001 fixed monitoring station data showed some measurements >8.5 units, but a review of equipment and calibration techniques suggest that this was related to the calibration standard used.

Turbidity

Washington State water quality standards for turbidity have also not changed. The criteria state that turbidity should not exceed 5 NTU above the background when the background is 50 NTU or less [WAC 173-201A-200(e)]. Juul (2003) estimated the background turbidity using the 1978 through 2001 Washington DOE/USGS Vernita Bridge data as 1.7 NTU. Only seven data points were greater than the 6.7 NTU threshold, well below the 36 prescribed by the 90 percent binomial distribution criterion.

The instrumentation used during recent studies had a detection limit of 5 NTU and a range of ±5 NTU. Most of the values recorded during the 1999 synoptic survey were <5 NTU and the highest mainstem value was 11 NTU. A few measurements at the bottom of the profiles at near-shore sites were between 15-21 NTU, but were probably influenced by re-suspension of the sediment by the probe. The annual means for the combined 1999-2001 fixed monitoring station data were <5 NTU at all stations.

Fecal Coliform

Washington State water quality standards for fecal coliform in freshwater are designated for the protection of recreational uses. Within the project area, primary contact recreation is the designated use and contains a criteria for fecal coliform which is the same as the previous standard [WAC 173-201A-200(2)]. This criterion requires that a geometric mean be less than 100 cfu/100 ml, and not more than 10 percent of the values used to calculate that mean can be greater than 200 cfu/100 ml [WAC 173-201A-200(2)(b)]. The monthly samples collected at Vernita Bridge by Washington DOE between 1975–2001 had a geometric mean of 2 cfu/100 ml and a maximum of 63 cfu/100 ml; both below the threshold. The June, July, and August 1999 samples also had relatively low FC counts. The geometric means for these events ranged from 4 cfu/100 ml to 7 cfu/100 ml while discrete values ranged from 0 cfu/100 ml to 30 cfu/100 ml.

Summary of Water Quality Criteria Comparisons

Washington DOE's Water Quality Program Policy 1-11 sets forth an approach for assessment of water quality compared to water quality criteria given the precision and accuracy of the sampling methods used as well as existing conditions. For TDG, pH and turbidity, Washington DOE's policy guidance is based on persistence at levels in excess of the water quality standard for 10 percent of the time. Analysis is based on use of a binomial distribution with a 90 percent confidence interval, to identify whether the true exceedence percentage is greater than 10 percent. If, for example, monitoring data were available for an entire year (365 samples), a parameter would need to exceed the criteria for 45 days to violate the standard. Juul (2003) applied this technique to analysis of available data.

For temperature and DO, Washington DOE examines periods of highest temperature and lowest DO. It is important to note, that under Washington DOE policy, an exceedence of a standard is not a violation if it results from natural conditions. For purposes of this comparison, temperature data are summarized based on comparisons to 1933-41 Rock Island temperature data as an indicator of natural conditions for temperature on the Columbia River.

Washington DOE's policy for evaluating fecal coliform data describes a violation as any exceedence of the geometric mean of 100 cfu/100 ml or 10 percent of available samples exceeding 200 cfu/100 ml when at least 5 samples were collected within an assessment period.

Grant PUD performed detailed comparisons of available water quality data with criteria for state standards. Juul (2003; Technical Appendix E-3.B) compared TDG, pH and turbidity to binomial distribution exceedence limits described in Washington DOE Policy 1-11. This comparison showed that TDG failed to meet the binomial distribution limits (Table 11), but pH and turbidity were well within the binomial distribution limits for all data analyzed. However, as noted earlier, one must understand that MCCC representatives attempt to maximize spill levels and manage for compliance with the 120 percent tailrace criteria while tending to deemphasize the 115 percent forebay criteria.

Washington DOE uses different comparison methods for fecal coliform bacteria, but all samples were well below the standard (Table 11). In addition, nearly all DO measurements were above 8 mg/L with only two historical measurements of 7.6 mg/L and 7.5 mg/L taken in 1969 and 1987, respectively. The remaining 457 measurements were all above 8.0 mg/L (Juul 2003).

Table 11. Comparison of Project water quality data with surface water quality standards of the State of Washington.

Parameter	Standard	Results of Studies
TDG	Non fish-spill ≤110%	<2% of values exceeded 110% (Juul 2003). Did not exceed binomial limits.
	Fish spill: 115% next forebay, 120% tailrace (12 highest consecutive hours per day), 125% 1 hr maximum	Did not exceed binomial limits for 125% criteria. Did not exceed binomial limits for 120% at WAN in 5 out of 7 years analyzed (Juul 2003; Table TDG-13). Did not exceed binomial limits for 120% at PRD for 2 out of 7 years analyzed (Juul 2003; Table TDG-13). Did not exceed binomial limits for 115% at PRD in 2001; limits exceeded in 1998, 1999 and 2000 (Juul 2003).
pH	Between 6.5 and 8.5	All data sets analyzed less than binomial limits (Juul 2003).
Turbidity	Not to exceed 5 NTU over background, or 10% over background of ≥50 NTU	All data less than binomial limits; only seven data points were greater than the 6.7 NTU threshold (Juul 2003).
Fecal Coliform	Not to exceed geometric mean of 100 cfu/100 ml, less than 10% of all samples exceeding 200 cfu/100 ml	All values less than criteria; geometric mean value was 2 cfu/100 ml; highest sample was 63 cfu/ml (Normandeau et al. 2000).
DO	Must exceed 8.0 mg/L	Only 2 of 459 measurements from 1961-2001 below 8 mg/L (Juul 2003).
Temperature	≤17.5°C above PRD ≤20°C below PRD	Natural conditions greater than 17.5°C in summer (Juul 2003). 0% >20°C from 1999-2001; 12%>20°C in 1998 (Juul 2003).

Comparisons of temperature data to standards are much more complex, because the standards contain both special conditions and exceptions for situations where natural conditions already exceed the standard. The 20°C special condition below Priest Rapids dam allowed for straightforward comparisons. From 1999 through 2001, over 22,000 hourly temperature measurements below Priest Rapids dam contained not one hourly measurement greater than 20°C; showing remarkable compliance with the special condition standard (Table 11). During warmer weather in 1995 and 1998, 12-13 percent of hourly measurements were in excess of 20°C, with maximum measurements being about 1°C above the 20°C special condition (Juul 2003). However, naturally warm water conditions are not considered violations of water quality standards.

Comparisons to the 18°C are not as simple because the policy guidance and temperature standard considers natural conditions. To estimate natural conditions, Juul (2003) used historical data from Rock Island dam during the 1933-41 time period when it was the only mainstem Columbia River dam and its very limited storage and low height would have minimal effects on temperature. Review of this data showed that high percentages of temperature readings were greater than 18°C with some July through

September periods showing nearly 100% of temperature measurements greater than the present-day standard. While large percentages of available data (Juul 2003) are greater than the 18^{o}C criteria, because of the natural conditions, these values are not considered violations of water quality standards.

3.4.2 Environmental Effects and Recommendations

This section describes the effects of the project on water quantity and quality identified during the scoping process (section 3.4); summarizes Grant PUD's proposed measures to protect and enhance water quantity and quality; describes the measures recommended by agencies and interested parties; and presents our staff analysis and conclusions regarding the effects of the alternative measures. The key water quality parameters of interest for the Columbia River are TDG levels and temperature. All other water quality parameter measurements are indicative of excellent water quality.

Project Effects on Total Dissolved Gas

Dissolved gas supersaturation is a condition that exists in many natural and man-made water bodies throughout the world. It occurs when partial pressures of atmospheric gases in solution exceed their respective pressures in the atmosphere. Water flowing over the spillway at hydroelectric projects can result in gas supersaturation of river water with atmospheric gases when the air bubbles are forced into solution at depth (Weitkamp and Katz 1980).

Temperature and pressure are the primary factors affecting gas solubility in water. As the temperature of a volume of water increases, the volume of TDG it will hold decreases. Increased pressure increases the solubility of gases in water. Because of the hydrostatic pressure found at depth, there is a greater capacity for dissolved gases to be held. Water plunging over a spillway entrains air bubbles; the gases are then forced into solution at depth. The result is water that is supersaturated with the gases normally found in the atmosphere.

Individual atmospheric gases (primarily oxygen, nitrogen, and trace gases such as argon and carbon dioxide) can often be supersaturated without adverse effects on fish or other aquatic organisms. However, when the sum of partial pressures of all of the gases exceeds the atmospheric pressure, there is the potential for gas bubbles to develop in water and in aquatic organisms that inhabit the water. This causes a condition known as gas bubble trauma (GBT) or gas bubble disease (GBD), which can be lethal or harmful to fish and other aquatic organisms (Weitkamp and Katz 1980).

Fish may not display adverse effects as a result of this phenomenon if the higher water pressures offset the elevated TDG levels passing through their gills. Fish that are able to sound to the gas pressure compensation point can avoid GBT symptoms. Each meter of depth creates additional pressure that increases the solubility of dissolved gases approximately 10 percent. The detrimental formation of gas bubbles is reduced as solubility increases. A fish at 2 meter would experience a 20 percent reduced effect of GBT. With TDG at 120 percent, fish below 2 meter would not experience adverse effects because they would be below the gas pressure compensation point.

Grant PUD conducted regular monitoring of GBT since 1996. These data show that 4-11 percent of spring migrating and 2-6 percent of summer migrating juvenile salmonids exhibit signs of GBT. Incidence of GBT is evident even in years with TDG levels under the 120 percent and 115 percent state standard levels for periods of fish spill (Table 12). There is no reliable methodology available to translate these samples of GBT incidence to mortality rates, although it is likely that the effects of GBT increase salmonid mortality with the severity of the symptoms observed (Weitkamp and Katz 1980). The severity of the symptoms observed is almost uniformly at the lowest level of detection (Duvall et al. 2002).

Table 12. Summary of gas bubble trauma incidence and average total dissolved gas levels for salmon and steelhead smolts monitored at Priest Rapids dam from 1996-2002 (Source: Duvall et al. 2002).

Year	Average Spring % TDG	Average Spring GBT %	Average Summer %TDG	Average Summer GBT %
1996	124	8.5	117	1.8
1997	130	11.1	116	2.3
1998	116	3.9	113	4.7
1999	114	3.7	113	1.7
2000	114	8.3	113	5.8
2001	112	3.2	110	2.7
2002	116	4.3	120	6.0

Effect of Operations on Total Dissolved Gas

Dissolved gas saturation can result from a wide variety of causes. While dams have received the most attention in the literature, excess TDG can also result from warm-water discharges, oxygen production by aquatic plants (enhanced by nutrients associated with industrial effluents, municipal discharges, and agricultural runoff), solar heating of water bodies, ingestion of air into pumping systems, supplemental oxygen in hatcheries, and air lift re-aeration systems.

Water flowing through turbines does not entrain air whereas spillway flows plunge to depth and force air into solution. Studies to date demonstrate that turbine operation does not contribute significantly to TDG supersaturation, based on unchanged TDG pressure for forebay and powerhouse tailrace measurements (COE 2003). However, low water conditions, such as minimum operating elevation, may result in vortex formation and dramatically increase air entrainment. Data available indicates that this not an issue at either Wanapum or Priest Rapids developments.

Wanapum dam

At Wanapum dam, the flow split between powerhouse and spillway shows that powerhouse turbine flows account for the majority of water passed. The period with the largest spill percentages occurs in June with a monthly average of 56 kcfs spill and average flow of 122 kcfs through the turbines. The estimated TDG level associated with this volume of spill is 124.1 percent.

Priest Rapids dam

At Priest Rapids dam, the period with the highest spill percentage occurs in May, with a monthly average of 89 kcfs through the spillway and 90 kcfs through the powerhouse. The estimated TDG level associated with this volume of spill is 120.5 percent. Both these estimates are in excess of water quality standards for fish spill.

Effect of Flow Deflectors on TDG

To address elevated TDG levels caused by spill, Grant PUD worked from 1996 through 2000 to develop spillway flow deflectors at Wanapum dam. The objective of the flow deflectors is to produce a skimming flow across the water surface instead of allowing spill to plunge. After testing several designs in consultation with the MCCC, FERC approved construction of a full set of 12 flow deflectors (1 for each spillbay) on November 15, 1999 (89 FERC 62,123). Construction was completed in time for 2000 fish spill operations.

Juul (2003) evaluated relationships between spill levels and TDG for pre- and post-deflector time periods at Wanapum dam. Prior to the installation of the flow deflectors, gas saturation increased non-linearly with spill. After the deflectors were installed, TDG levels were reduced by as much as 10 percent. Both pre- and post-deflector regressions explained a large percentage of observed TDG levels in the tailrace using the volume of spill as a predictor (Table 13).

Table 13. Estimated tailrace TDG levels for Wanapum and Priest Rapids spill up to 7Q10 flows (Source: Grant PUD, 2003).

Development	Regression	R^2	7Q10 Flow (kcfs)	Approximate Powerhouse Flow (kcfs)	Spill Volume (kcfs)	Estimated TDG %
Wanapum (1996-98)	%TDG=8.153ln (spill in kcfs) +91.308	0.85	264	160	104	129.2
Wanapum (2000-01)	%TDG=0.00007 $(\text{spill in kcfs})^2$ +0.106 (spill in kcfs)+108.39	0.73	264	160	104	120.2
Priest Rapids (1995-2001)	%TDG=93.782 $(\text{spill in kcfs})^{0.056}$	0.73	264	160	104	121.2

The spill/TDG relationships at Priest Rapids dam are somewhat different than Wanapum dam. During the 1996-1998 interval, TDG levels at Vernita Bridge below Priest Rapids dam were typically about 4-8 percent lower than those at Beverly Bridge below Wanapum dam. Average spill at Priest Rapids for this period of analysis was 41 percent compared to 26 percent at Wanapum, however the Vernita Bridge monitoring station is about 6 miles farther downstream of Priest Rapids dam than Beverly Bridge is of Wanapum dam and some TDG equilibration is expected to occur over this distance. The comparison after installation of Wanapum dam flow deflectors narrowed the difference to approximately 2 percent.

The regressions describing the relationship between spill volume and TDG provide a tool to estimate TDG levels expected at various spill volumes. The 7Q10 flow for Wanapum and Priest Rapids dams is estimated at 264 kcfs (Washington DOE 2002). The maximum flow capacity at both Priest Rapids and Wanapum dams is approximately 160 kcfs with nine units operating at each dam, so each dam has to spill up to 104 kcfs before reaching the 7Q10 flow volume. The regression relationships developed by Juul (2003) estimate tailrace TDG levels from a spill of 104 kcfs at Wanapum, with flow deflectors, at 120 percent (Table 13). Without flow deflectors, the same spill volume at Wanapum dam would have been nearly 129 percent. At Priest Rapids, 104 kcfs spill is expected to result in Vernita Bridge TDG readings just over 121 percent (Table 13).

Grant PUD also funded a near-field TDG study completed between Wanapum dam and Priest Rapids dam during late-April and early-May 2000. The objective of this study was to determine the performance of the 12 spillway deflectors installed on Wanapum dam during late 1999 and early 2000. This evaluation showed that installation of flow deflectors at Wanapum dam resulted in an average decrease in TDG saturation at Beverly Bridge of 11 to 11.5 percent over the entire range of conditions (COE 2001). The resulting volume of spill at Wanapum dam that would keep tailrace TDG levels below 120 percent increased to 100 kcfs with the installation of flow deflectors. Prior to the installation of the flow deflectors at Wanapum dam, the TDG values in Priest Rapids dam forebay were consistently above the 115 percent threshold. The rate of change in TDG saturation from Beverly Bridge to Priest Rapids forebay was nearly identical for both pre- and post-deflector conditions, but the flow-weighted TDG averaged 4 percent less at both locations during the post-deflector study. This effect also means that the Priest Rapids dam forebay standard was met for Wanapum dam spill of up to 40 kcfs after the deflectors were installed.

While the Wanapum flow deflectors appear to be quite effective at reducing TDG, there may be issues related to fish passage that create concern about fish passage survival. Although tests of direct mortality showed little injury to smolts, more recent evaluations suggest that skimming surface flow and edge effects associated with spill across the deflectors may expose smolts to bird predation that appears to lower survival rates below that of smolts passing through the turbines (Robichaud et al. 2003).

Total Dissolved Gas Exchange at Priest Rapids dam

To investigate the TDG exchange at Priest Rapids dam, the spatial and temporal patterns of TDG gas pressures were investigated in the region upstream and downstream of Priest Rapids dam during the weeks of July 21 – August 4, 2002 using an array of water quality logging instruments. Standard and alternative spill patterns were monitored during spillway releases ranging from 20.7 to 198.7 kcfs (COE 2003; Technical Appendix E-3.E).

The testing schedule for TDG exchange study at Priest Rapids dam encompassed a combination of spillway and powerhouse operating scenarios that were scheduled around routine project operations. The range of flow conditions targeted was based on a design spill rate required during the 7Q10 at Priest Rapids dam, which is approximately 264 kcfs. A powerhouse capacity of 164 kcfs was assumed, with the design spill discharge of about 100 kcfs required to pass the 7Q10 spill event. Spillway releases from Priest Rapids dam are managed to stay within TDG standards for river flows less than the 7Q10 flood flow.

The test schedule called for spillway and hydropower discharges to be systematically varied to achieve a range of operating conditions while maintaining commitments to hydropower production. The test schedule included a wide range of project operating conditions for tailwater elevation, spill pattern, unit spillway discharge, gate operation, and variations in powerhouse loadings. The duration of each test treatment or spill event was a minimum of 3 hours (COE 2003).

TDG saturation below the spillway was related to a number of factors including spill discharge, spill pattern, and tailwater elevation. During this evaluation, the maximum TDG saturation was consistently observed on a transect located immediately downstream from the center portion of the spillway. At this location the maximum instantaneous TDG saturation of 134.5 percent occurred (during a standard spill pattern) at 144.8 kcfs spill. COE (2003) found that the maximum TDG saturation attenuated quickly below the dam through the development of the mixing zone between powerhouse and spillway flows. The maximum TDG saturation observed during the study (in the mixing zone) was 124.4 percent.

Average TDG saturation immediately below the stilling basin was determined by averaging across all stations, except during the non-standard spill, where only the two bounding stations were used to represent the TDG content of spill. Of the 91 events identified during the study period, 22 events resulted in an average TDG saturation of greater then 125 percent, 63 events greater than 120 percent, and 80 events greater than 115 percent. The average change in TDG over the entire study period was 2.3 percent saturation (ranged from -1.1 to 10.6 percent). During two events, a small net reduction in the TDG saturation was caused by spill at Priest Rapids dam.

The relationship between total spillway discharge and average TDG saturation observed at the transect immediately below the stilling basin was poor. A general trend was apparent for the standard spill pattern. Spillway TDG exchange was related to TDG delta pressure increasing in direct proportion to total spill discharge up to about 100 kcfs (Figure 53 of Technical Appendix E-3.E).

The relationship between specific spill discharge or discharge per spillbay and average TDG saturation immediately below the stilling basin tended to account for many of the differences between the standard and non-standard spill patterns (Figure 54 of Technical Appendix E-3.E). The non-standard spill events generally tended to fall within the range of data defined by the standard spill events. These combined data define a loose relationship between unit spillway discharge and average spill TDG saturation. The TDG exchange in spillway flows was found to be an exponential function of unit spillway discharge. In addition, the effective stilling basin depth is a second determinant of TDG exchange. As the specific discharge increases, the TDG saturation becomes a function of the effective depth of aerated flow in the stilling basin and tailwater channel. For small discharges, the TDG exchange becomes much more dependent on the specific discharge.

The alternative spill patterns had a significant impact on the average TDG exchange associated with spillway flow. The higher specific discharges of these events generated larger TDG pressures when compared to comparable discharges using the standard spill pattern. Higher powerhouse releases were found to increase the TDG saturation at stations below the spillway while holding the spill discharge constant.

Higher powerhouse releases will increase tailwater elevation and the depth of flow in the stilling basin and adjoining tailwater channel. During the study period, a 10 kcfs increase in powerhouse flow resulted in a 0.6 percent saturation increase in the TDG content of a 50 kcfs spill. The entrainment of powerhouse flows into the aerated spillway releases is not a measurable source of TDG exchange at Priest Rapids dam. The training wall between the powerhouse and stilling basin reduces the interaction of these project flows.

In comparison to other projects, it was determined that the TDG exchange at Priest Rapids dam is similar to the TDG exchange at Lower Granite dam, which has been modified with spillway flow deflectors. This comparison was based on the spill discharge producing TDG levels of 115 and 120 percent in spillway flows. The moderate TDG exchange observed at Priest Rapids dam is likely attributed to the efficient energy dissipation in the shallow stilling basin and adjoining tailwater channel.

Grant PUD's Proposals to Improve TDG

Reservoir Management

Based upon the results of ongoing monitoring and evaluations, Grant PUD proposes to continue its reservoir management and maintenance operations, and the use of spill patterns to minimize ambient TDG levels at the project when feasible, subject to hydraulic conditions, total river flow, construction activity, maintenance requirements or other emergency conditions. Grant PUD intends to coordinate the spill program for the project with the spill activities of other projects through the PRCC.

Flow Deflectors at Wanapum dam

Grant PUD completed installation of spillway flow deflectors at Wanapum dam as provided in the existing TDG Abatement Plan approved by Washington DOE in April 2000. As indicated, Grant PUD will be proposing measures to reduce reliance on Taintor gate spill to aid fish passage; however, there will be times when such spill will be required. Based on existing information, Grant PUD plans to continue to operate each taintor gate with flow deflectors during the next license term.

Advanced Turbines at Wanapum dam

The turbines at Wanapum dam are approaching the end of their useful life and require replacement. Grant PUD is testing an Advanced Design turbine at Wanapum dam in 2005 with the installation of one new turbine. Based on testing results for fish survival and efficiency and other operational measures, Grant PUD anticipates that full installation of all ten turbines will be completed by 2012. The new turbines will increase plant hydraulic capacity to approximately 188 kcfs. This in turn, would reduce periods of involuntary spill and result in fewer turbine unit outages. Using TDG regressions from Juul (2003), this would provide an estimated TDG reduction from levels near 120 percent to approximately 117 percent (Table 14).

Table 14. Estimated tailrace TDG levels for Wanapum spills up to 7Q10 flows with existing and Advanced Turbines.

Turbine	Regression	R^2	7Q10 Flow (kcfs)	Approximate Powerhouse Flow (kcfs)	Spill Volume (kcfs)	Estimated TDG %
Existing	$\%TDG=0.00007(\text{spill in kcfs})^2 +0.106(\text{spill in kcfs})+108.39$	0.73	264	160	104	120.2
Advanced	$\%TDG=0.00007(\text{spill in kcfs})^2 +0.106(\text{spill in kcfs})+108.39$	0.73	264	188	76	116.9

Fish Passage Proposal – Wanapum

Grant PUD is proposing a new downstream fish passage measure for Wanapum dam that would replace the current spillway fish spill program with a 20 kcfs surface spill design located adjacent to the powerhouse. This proposal includes features specifically designed to reduce TDG levels by preventing the spill from plunging into the tailrace from the top of the spillway. Design of the proposed spill structure includes extending a submerged chute downstream and widening the discharge end to approximately 90-feet. The spreading spillway will allow the turbulent energy in bypass discharge to be reduced, thereby minimizing negative tailrace effects. Under the proposed construction schedule, this measure would be completed by August of 2008.

Spill Operations at Priest Rapids dam

Changes in spill operations at Priest Rapids dam will be based on the outcome of near field TDG studies performed in 2002. Grant PUD will continue to identify and implement experimental spill regimes as may be warranted to test opportunities for improving survivals with less spill flow and/or reducing TDG levels at either Priest Rapids or Wanapum Dams. These efforts will be designed, implemented and evaluated in coordination with the PRCC.

During fish spill periods, Grant PUD will monitor TDG levels in the Project area at its four existing fixed sites (an additional site is operated jointly with Chelan County PUD - Rock Island Tailrace). This monitoring will focus on the following objectives: 1) to manage TDG levels within the relevant operating criteria at the project; 2) to evaluate the success of the TDG Abatement Plan toward reducing ambient levels of TDG at the project; and 3) to evaluate alternative fish passage strategies and their effect on passage survivals and ambient TDG levels. Grant PUD also proposes to provide biological monitoring to determine the incidence of GBD symptoms in downstream migrating juvenile salmonids and continue development of its “real time” TDG monitoring system at the fixed sites.

Fish Passage Proposal - Priest Rapids

Grant PUD conducted a detailed analysis evaluating various downstream fish passage alternatives for Project (Voskuilen et al. 2003; Technical Appendix E-4.K). Results from the detailed design phase showed that the highest ranked concept at Priest Rapids was a full-open spillway gate passing approximately 60 kcfs. The next highest ranked concept for Priest Rapids was a split-spillbay concept.

The Priest Rapids fish bypass at Spillbay 22 consists of a new intermediate pier in Spillbay 22 and future tailrace enhancements, if required. This creates two smaller full-depth spillways, a 20-foot wide spillway on the powerhouse side (east side) and a smaller 12-foot wide spillway on the west side (Figure 5).

During full-open gate operations, the east bay can discharge as much as 25,000 cfs while the west bay can discharge as much as 15,000 cfs for a combined flow of 40,000 cfs. The key feature of the proposed Priest Rapids bypass is the downstream feature of an extended stilling basin with training walls. This feature will be designed based on use of physical model to produce a surface skimming flow that would prevent the 40 kcfs of surface spill from plunging to depth. Under the current plan of developing this system in 2 phases, the downstream features designed to reduce TDG levels would be completed in 2010. The expected TDG benefits of this proposal cannot be estimated at this time because numerous efforts have shown that TDG uptake cannot be accurately modeled. However, past experience has shown that developing surface skimming flows results in substantial (up to 10 percent) reductions in TDG. Once this is constructed, Grant PUD’s monitoring program would provide a more precise estimate of the effects on TDG levels.

Flow Deflectors - Priest Rapids dam

Grant PUD recognizes that flow deflectors are the most widely used and arguably the most effective measure for reducing TDG levels during periods of spill. Because TDG levels during spill at Priest Rapids are relatively modest (COE 2003) and because of concerns about the effects of flow deflectors on downstream passage survival of smolts (Giorgi et al. 2002), Grant PUD believes that other methods could be used initially at Priest Rapids dam. If the tailrace features designed for the Priest Rapids fish bypass system do not allow spill at Priest Rapids dam up to 7Q10 flows to remain within standards, Grant PUD could investigate use of flow deflectors at Priest Rapids dam, as

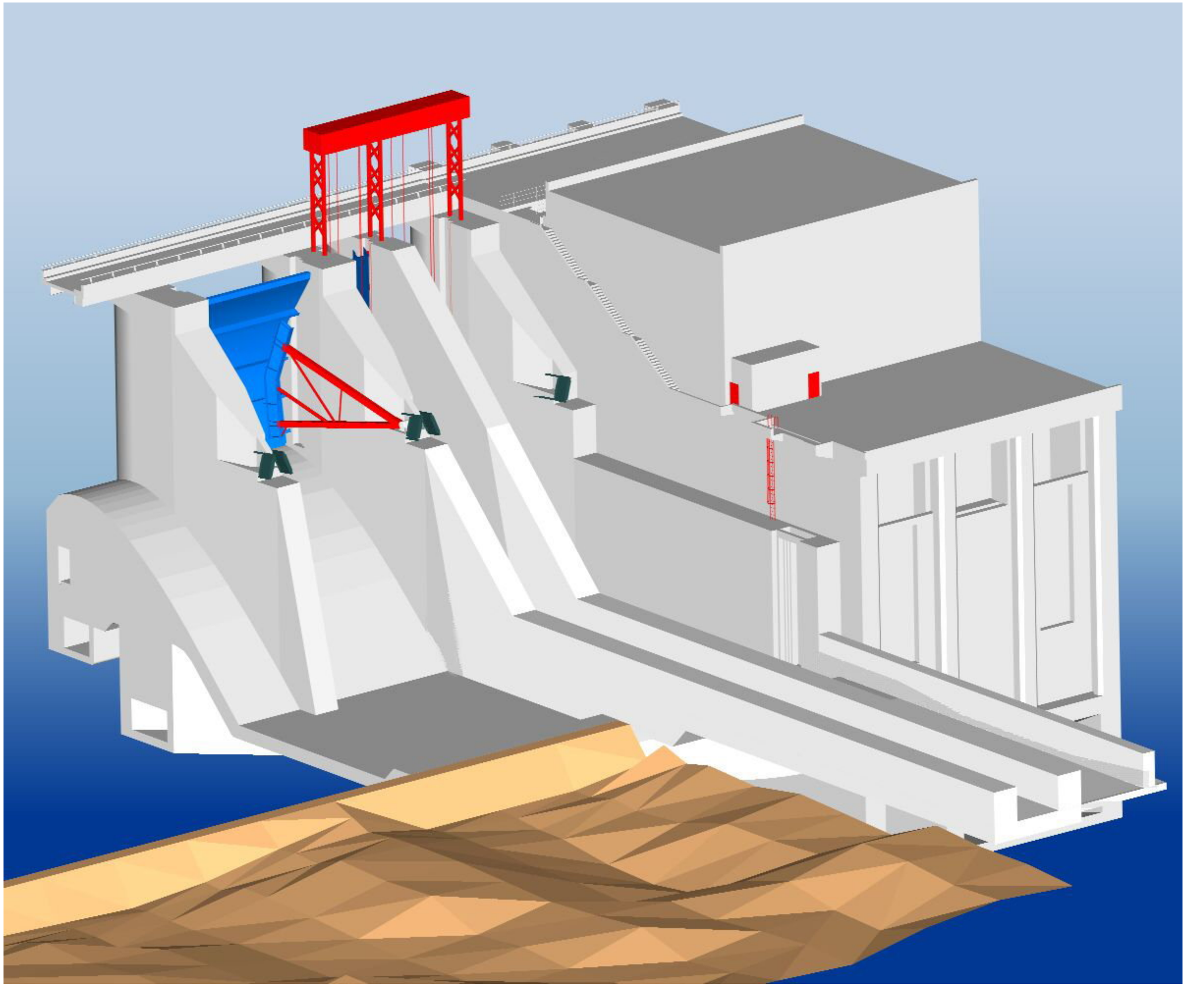
Figure 5. Graphical depiction of fish passage modification for Priest Rapids dam showing training walls and spillway apron additions designed to reduce TDG levels during operation (Source: Grant PUD, 2003).

necessary to meet the TDG standards.

Advanced Turbines at Priest Rapids dam

Since the turbines at Priest Rapids dam are in relatively good working order, installation of new turbines is proposed as part of a longer term replacement schedule. Similar to the situation at Wanapum dam, new turbines at Priest Rapids dam would also increase hydraulic capacity, which will eliminate many periods of forced spill and the resulting elevated TDG levels. For example, a hydraulic capacity increase to 184 kcfs would cut the amount of spill to reach 7Q10 flows by approximately 24 kcfs.

Agencies' Recommendations to Improve TDG

In its May 26, 2005, preliminary prescriptions for downstream fishways at Wanapum and Priest Rapids Dams, NMFS states that Grant PUD must construct a surface bypass facility in future unit 11 at Wanapum dam which is capable of spilling a maximum volume of 20,000 cfs. Until the new surface bypass facility is operational, Grant PUD must continue to maintain a spring and summer spill program at Wanapum dam for 95 percent of the run during the spring and summer fish passage seasons. The spill targets must be 43 percent of the river flow in the spring and 49 percent in the summer. At Priest Rapids dam, Grant PUD must continue to explore a juvenile bypass design. Until a new surface bypass facility is operational, Grant PUD must continue to maintain a spring and summer spill program at Priest Rapids dam for 95 percent of the run during the spring and summer fish passage seasons. The spill targets must be 61 percent of the river flow in the spring and 39 percent in the summer. Any new bypass facility at Wanapum dam must not violate the project's section 401certification. The facility's discharge at Priest Rapids must not create a plunging flow that would lead to TDG levels that violate the project's section 401 certification.

Our Analysis

Grant PUD is currently in the process of replacing the turbines at the Wanapum development with 10 new, fish friendly turbines. On July 23, 2004, the Commission issued an order[28] approving operation and testing of the previously authorized new advanced turbine in Unit No. 8. Replacement of the 9 remaining units was approved provided that the operating criteria and biological testing results indicate at least equal or better survival for migrating smolts over the existing turbines, and after Commission approval of the study results. Commission staff reviewed this proposal in its environmental assessment dated July 2004,[29] and concluded that replacing these generating units would have the potential benefits to water quality by increasing the hydraulic capacity of the powerhouse, thereby reducing uncontrolled spillage, and in turn TDG levels downstream of the dam.

In June 2004 Washington DOE and EPA developed a TMDL report for TDG in the mainstem Columbia River from the Canadian border to the Snake River confluence, near Pasco, Washington (EPA and Washington DOE 2004). Washington State issued the TMDL for state waters below Grand Coulee dam, including Wanapum and Priest Rapids Dams, which was approved by EPA in July 2004.

A TMDL is a planning tool, not a rule of law or other stand-alone enforceable

[28] 108 FERC ¶ 62,075.
[29] Attached to 108 FERC ¶ 62,075.

document, and can be used to condition 401 water quality certificates. The goal of the TMDL is to achieve all of the TDG criteria established within the state's water quality standards. Implementation of the TMDL is expected to be developed as each PUD project applies for new licenses from the Commission and section 401 water quality certificates from Washington DOE. Any allocation or exemption for fish passage may be used only after approval of a gas abatement plan. Washington DOE will consider the measures of Grant PUD's TDG Abatement Plan when it issues the 401 certificate for relicensing of the Project.

The Reasonable and Prudent Alternative (RPA) Actions of the BO filed May 6, 2004, require that Grant PUD implement project measures while maintaining water quality standards within TDG limits. Staff concludes that the measures proposed by Grant PUD, along with the requirements of the BO, and those that may be required based on the TDML report, assure that the project would meet the state's TDG standards.

Project Effects on Temperature

Several different comparisons of empirical data show that the average downstream increase of water temperature through the project area is 0.2°C (Juul 2003). A similar analysis using the Rock Island dam scrollcase and USGS daily average temperature data collected below Priest Rapids dam showed an overall increase of 0.1°C for the period 1975-1992. In addition, the 1997-2001 fixed monitoring station data showed that the overall temperature changes between forebay and tailrace monitoring stations were all < 0.1°C. In comparison, Washington DOE defines a "measurable" increase in water temperature as 0.3 °C or greater [WAC 173-201A-320(3)(a)].

While the data above may imply that the project causes a small but immeasurable increase in Columbia River water temperatures, staff believes this is not a correct interpretation because these data are not controlled for natural warming effects that occur in large rivers. To more accurately demonstrate the effect of Wanapum and Priest Rapids reservoirs on water temperature, Grant PUD funded model simulations using a one-dimensional unsteady flow and water quality model, Modular Aquatic Simulation System 1D (MASS1) for the reach of the Columbia River extending from the Canadian Border to McNary dam (Perkins et al. 2002; Technical Appendix E-3.C). The calibrated model simulated three hypothetical scenarios: current conditions; project reach with reservoir effects removed; and removal of the effects of all seven mid-Columbia reservoirs.

The period from 1973 to 2000 was simulated and the resulting daily mean and maximum water temperatures were compared statistically. With all seven Mid-Columbia reservoirs removed, water temperatures warmed up faster than under current conditions during the early summer, reached peak values at the beginning of August, and then decreased faster than under current conditions for the remainder of the year. The scenario with only the effects of project reservoirs removed was nearly identical to the current condition scenario. The results of this analysis show that the shift in seasonal water temperatures is caused by the impoundment behind Grand Coulee dam. Given the uncertainties of the simulation model, inflow temperatures, and meteorological data, the results showed little or no effect of project reservoirs on Columbia River temperatures.

Perkins et al. (2002) used seven-day moving averages to estimate temperature changes within the Project area under each scenario. The exercise revealed that during the period from March through August, the current conditions and seven-day moving average reservoir effects removed scenarios had average temperature increases of about 0.3°C. This compares with the water quality standard allowing cumulative increase from all nonpoint source activities up to 2.8°C. The model simulations estimated that the overall effect of the Project reservoirs on water temperature is near zero. Both of these values are well within the mean absolute error of the models, which is 0.3° to 0.9°C. This shows that the overall effect of Project reservoirs on water temperature was negligible.

The effects of the Project on exceedences of the current water temperature standards were also negligible when either the mean or maximum temperatures were modeled. With the seven reservoir effects removed, the frequency that the daily maximum temperature exceeded the standard at Priest Rapids dam was 10 percent of the time, with an average increase of 0.8°C above the standard. The same analysis shows that maximum temperatures with the effects of the project reservoirs removed is essentially unchanged, with temperatures exceeding the standard about 11 percent of the modeled time period and with an average increase of 0.9°C above the standard. Similarly, the average daily maximum simulated temperatures are actually slightly higher with the reservoir effects removed (Table 15). The differences are slight, but the smaller water volumes of the project area with no impoundment effects would result in smaller water volumes that would be more responsive to the thermal inputs of high ambient air temperatures during late summer.

Grant PUD also completed an analysis of water temperatures in the Priest Rapids and Wanapum fishways from early August 2002 through early December 2002 (Brush and Juul 2003; Technical Appendix E-3.D). Three temperature monitors were installed in both fishways at each facility – one at the top, a second near the middle of the passage, and a third at the bottom. The analysis included a comparison of temperatures at these three locations in each ladder to the forebay fixed monitoring stations of Priest Rapids and Wanapum.

The temperature information from each location, along with the data recorded by water quality monitors in each forebay was evaluated along different routes. First, the data from within each passage were examined for longitudinal and temporal trends.

Table 15. Comparison of simulated average daily maximum temperature by month under current conditions and with project reservoirs removed (Source: Perkins et al. 2002).

	Average Daily Maximum Temperature				
	Jul	Aug	Sep	Oct	Nov
Rock Island dam					
Current Conditions	17.3	19.3	18.8	15.8	11.3
Project Reservoir Effects Removed	17.3	19.3	18.8	15.8	11.3
Wanapum dam					
Current Conditions	17.6	19.4	18.7	15.5	11.0
Project Reservoir Effects Removed	17.6	19.5	18.8	15.7	11.1
Priest Rapids dam					
Current Conditions	17.8	19.5	18.6	15.3	10.7
Project Reservoir Effects Removed	17.9	19.7	18.9	15.5	10.9
Below Priest Rapids dam					
Current Conditions	17.8	19.5	18.6	15.3	10.7
Project Reservoir Effects Removed	17.9	19.7	18.9	15.6	10.9

Second, the combined averages from the two fish ways at each dam were compared to determine if there were cross-channel differences. Finally, the daily averages from each passage were compared to the information recorded by the nearest forebay fixed-monitoring site.

Water temperatures within the Wanapum and Priest Rapids ladders averaged less than 0.1 ^{o}C different than the fixed monitoring stations, which was less than the stated precision of the temperature meters used (Brush and Juul 2003). The primary trend observed in these data was the tendency to have greater temperature variability during later summer with the differences converging in the fall.

Mean temperature differences for the complete data sets recorded within the two Priest Rapids dam fish ladders and the left one at Wanapum dam were ± 0.1 °C. Some of the measurements from the right fish passage at Wanapum dam appeared questionable, but estimated daily differences ranging from -0.1°C to 0.2°C were consistent with the other three fish ladders and still within the instrument accuracy of ± 0.2°C. Temperature differences between the right and left ladders, as well as between the forebay water quality monitors and each fishway averaged ± 0.1°C. The primary trend observed in these data was the tendency to have greater temperature variability during later summer with the differences converging in the fall (Figure 6).

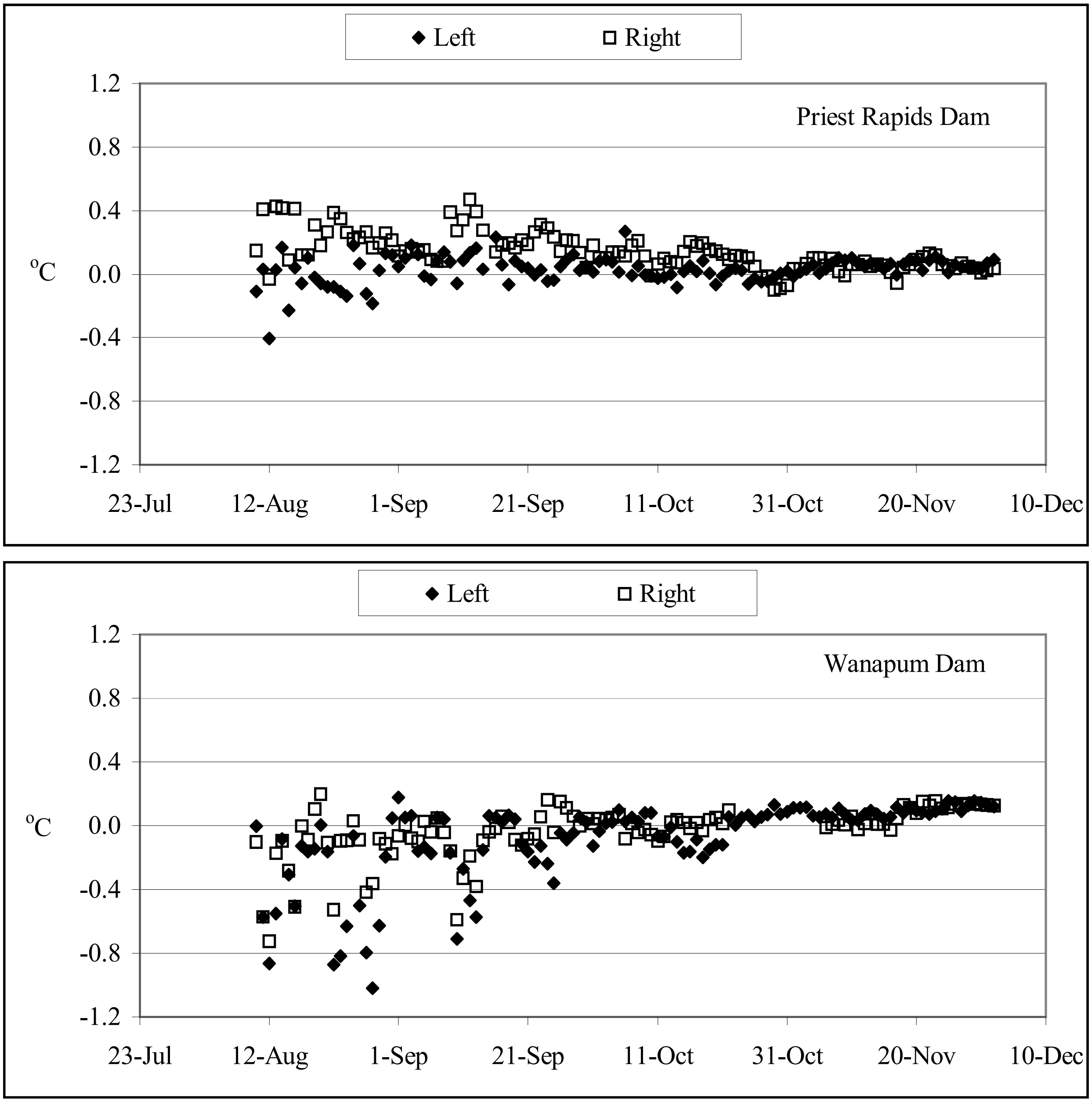

Figure 6. Daily average temperature differences for Priest Rapids and Wanapum fishways when compared to forebay fixed monitoring stations.

Grant PUD's Proposal to Improve Water Temperature

Priest Rapids Fishway

Grant PUD is proposing to modify the water supply for the Priest Rapids fishways, which currently receive a portion of their supply water from the reservoir by means of a gravity intake gate. The modification would involve installation of low head pumps in the tailrace to supply part of the fish attraction water requirements at the fishway entrance from the cooler (by approximately 0.3°C in late summer) tailwaters. This would improve ladder conditions, which are known to have elevated water temperatures.

Water Temperature Monitoring Plan

Grant PUD is proposing a water temperature monitoring plan at its four fixed sites (a fifth site is jointly shared with Chelan PUD in the Rock Island Tailrace[30]) to evaluate temperature in the portions of the Columbia River affected by the project. Grant PUD may also conduct additional monitoring necessary for specific construction projects. Grant PUD will report the results of these monitoring efforts to Washington DOE and to the PRCC on an ongoing basis.

Agencies' Recommendations to Improve Water Temperature

In its letter filed May 26, 2005, Washington DFW recommends that Grant PUD fund annual redd counts and carcass surveys for steelhead in the following streams, tributaries to the Columbia River within the Wanapum and Priest Rapids reservoirs: Colockum Creek, Tarpiscan Creek, N. Fk. Tarpiscan Creek, S. Fk. Tarpiscan, Trinidad Creek, Quilomene Creek, Brushy Creek (tributary to Quilomene Creek), and Skookumchuck Creek. Washington DFW recommends that Grant PUD fund the monitoring of water temperature and stream discharge for these survey streams throughout the year.

In its letter filed May 27, 2005, CRITFC recommends (recommendation no. 17) that Grant PUD complete all modeling and implement all project modifications needed to ensure that Washington state water quality standards will be met throughout the license period while achieving quantitative and qualitative standards and goals for salmon, steelhead, Pacific lamprey and white sturgeon. CRITFC's recommendation includes a provision that Grant PUD proceeds with the installation of TDG structures, and investigates methods and means to reduce water temperatures in the Hanford Reach.

In its letter filed May 26, 2005, FWS recommends that Grant PUD develop and implement a plan to monitor and evaluate the effects of project operations on primary and secondary productivity and resident fishes in the Hanford Reach. The plan should include measuring and quantifying Reach-wide water temperatures in entrapments from

[30] Grant PUD does not intend to monitor water quality parameters at this site in the future. Grant PUD collected water quality information at this site for baseline information for their final license application. Chelan PUD will monitor water quality parameters at this station in the future as part of their own monitoring requirements.

the start of emergence for fall Chinook salmon (about March 1) through October 31.

Our Analysis

Washington DOE and the EPA are working cooperatively to craft a TMDL for temperature in the Columbia River from the British Columbia border downstream to its mouth. Once the TMDL is finished, Washington DOE may require Grant PUD to devise a strategy for reducing the temperature increases at Priest Rapids and Wanapum dams to meet the requirements of the TMDL. This strategy, or temperature management plan, would also need to include a compliance schedule and a plan for follow-up monitoring. The temperature-monitoring program proposed in the Water Quality Management Plan (Water Quality Plan) should serve this purpose, but the details of the program would need to be consistent with the TMDL.

Staff disagrees with Washington DFW's recommendation that Grant PUD monitor water temperature and discharge for the streams where they are recommending that Grant PUD fund annual steelhead redd counts and carcass surveys (see Washington DFW's May 26, 2005, recommendation above). Staff believes there is no clear nexus between the project and Washington DFW's recommendation. Grant PUD should not be required to evaluate water quality parameters for streams that are affected by a wide variety of environmental factors beyond the PUD's influence or control.

Staff is unaware of any measures at the project that would result in reductions in downstream water temperatures. CRITFC suggested that selected cool water releases from Lake Roosevelt may decrease downstream water temperature. The water behind Grand Coulee does stratify during the summer months, but Grand Coulee dam is not equipped with selective depth-withdrawal facilities and Grant PUD has no control over the facilities and operations at Grand Coulee dam. Although the Columbia River is not currently listed as impaired by temperature within the project area, staff is aware that Washington DOE and EPA intend to develop a temperature TMDL for segments of the Columbia River Basin located above and below the project in the near future. Grant PUD intends to continue participation in the development of temperature TMDL to assure that major hydroelectric dams are part of the "natural condition" baseline. Additionally, temperature monitoring associated with the operation of the Project will meet the quality assurance and control guidelines established by Washington DOE. Grant PUD will also be coordinated with the PRCC to identify, implement and evaluate measures to contribute to the continued attainment of temperature standards at the project.

Staff concludes that the project does not affect the average water temperatures downstream of the Project. Model simulations conducted by Grant PUD estimated that the overall effect of the project reservoirs on downstream water temperature is near zero (Perkins et al. 2002). The modeling conducted by Grant PUD on the effects of all seven mid-Columbia dams showed that the shift in seasonal water temperatures is caused by the impoundment behind Grand Coulee dam, and that the Mid-Columbia dams have little or no effect on Columbia River temperatures.

Project Effects on Other Water Quality Parameters

The Project has minimal impact on most of the remaining water quality parameters. Downstream changes in physiochemical and biological factors are expected according to the river continuum concept. The concentrations of TSS and nutrients were found to be reasonably uniform throughout this reach of the Columbia River. There were some increases in conductivity, TDS, and alkalinity that were probably influenced more by irrigation return flow than reservoir effects. The increased residence time of the reservoirs facilitates algal development – particularly in the forebays or near the shore. The extent varies from year-to-year depending on river discharge, weather conditions, and the structure of the fish community. In turn, enhanced algal productivity can lead to elevated pH. One of the concerns associated with higher pH values is related to fish and ammonia toxicity. As temperature and pH increase, the ammonium ion shifts to ammonia that can be detrimental to fish. However, the majority of the 1994-2001 NH_3-N data reported by Washington DOE for the Vernita Bridge site were about 0.01 mg/L. As such, the potential for ammonia toxicity within the project area is very low.

Washington DOE provided detailed requests and comments on the draft license application concerning various measures to address project effects on water quality. Grant PUD responded to those comments in the final license application, which included a Water Quality Plan as an Exhibit of the application. In their comments on the draft license application, Washington DOE requested a Water Quality Plan be prepared to serve as a basis for the 401 water quality certification required for a new license. An eight-part Water Quality Plan was submitted with the final license application which covers the following subjects:

1. TDG abatement;
2. temperature;
3. monitoring for other parameters;
4. habitat protection flows;
5. aquatic plant monitoring;
6. zebra mussel monitoring;
7. construction, maintenance and emergency conditions; and
8. fixed site QAPP.

The following summarizes each of the above listed components of Grant PUD’s Water Quality Plan.

1. Proposed TDG Abatement Measures

Based upon the results of ongoing monitoring and evaluations, Grant PUD plans to continue its reservoir management and maintenance operations. The use of spill patterns to minimize ambient TDG levels at the project, when feasible, would be subject to hydraulic conditions, total river flow, construction activity, maintenance requirements or other emergency conditions. Grant PUD intends to coordinate the spill program for the project with the spill activities of other projects through the MCCC or its successor (anticipated to be the PRCC).

2. Proposed Temperature Measures

Grant PUD is proposing a water temperature monitoring plan at its four fixed sites (a fifth site is jointly shared with Chelan PUD in the Rock Island Tailrace) to evaluate temperature in the portions of the Columbia River affected by the project. Grant PUD may also conduct additional monitoring necessary for specific construction projects. Grant PUD will report the results of these monitoring efforts to Washington DOE and to the PRCC on an ongoing basis.

3. Proposed Monitoring for Other Parameters

Within the project area, fecal coliform, DO, pH, and turbidity all meet water quality standards developed by Washington DOE. With respect to fecal coliform specifically, all sanitary sewerage systems at the dams use contained septic systems with off-site disposal and do not contribute to loading of fecal coliform in the area affected by the project. Grant PUD intends to continue this measure.

Grant PUD also proposes to continue to monitor DO, turbidity and pH through use of HydroLab multi-probes installed at the four fixed site monitoring stations and Rock Island Tailrace during non fish-spill season (September 15 through April 1). Each of these parameters would be measured hourly with the results posted to Grant PUD's website.

4. Proposed Habitat Protection Flows

Grant PUD and upstream operators have been managing flow regimes downstream of the Project pursuant to the VBA since 1988 to protect fall Chinook salmon redds and pre-emergent fry. Upon reaching agreement with the upstream operators, Grant PUD proposes to continue to operate according to the terms of the VBA (see discussion and description of the Hanford Reach Agreement in sections 2.2.3 and 3.5.2, respectively). The purpose of this program is to manage flows to encourage fall Chinook spawning at elevations that can be protected by minimum flows ranging from 50 to 70 kcfs during the spawning to emergence periods (typically October to May). In addition, as part of the same agreement with the upstream operators, Grant PUD is proposing to expand VBA coverage to include rearing period operations. From 1999 to present, Grant PUD and upstream operators have been re-shaping flow fluctuations to protect rearing fall Chinook fry from being stranded due to water level fluctuations after their emergence. If successful in gaining upstream operator support, Grant PUD would continue to implement re-shaping operations to manage flow fluctuations.

Grant PUD proposes to maintain a minimum release of 36,000 cfs or inflow, whichever is less, from Priest Rapids dam, as measured at USGS Gage No. 12472800. This minimum flow would be maintained during all time periods except when Vernita Bar minimum flow requirements are in effect and require a higher minimum flow.

5. Proposed Aquatic Plant Monitoring

The overall biomass of aquatic macrophytes is not at nuisance levels within the Project area (Normandeau et al. 2000). However, Grant PUD proposes to develop a plan for managing nuisance aquatic plants at key recreation sites within the project area. This plan, to be developed within one year of license issuance, will include the use of biological, mechanical, and/or chemical control (depending on regulatory issues, such as ability to obtain necessary permits) at heavily-used boat launches and swimming areas where aquatic plants interfere with boating and swimming. This plan will also include information and signage intended to educate boaters and local residents about strategies to avoid spreading nuisance aquatic macrophytes to other waters.

Grant PUD also proposes to assess aquatic macrophyte density at eight transects within the Project every 4 years. Transects sampled in 1999 by Normandeau et al. (2000) as part of the evaluation of water quality and limnology for the Project area will be re-sampled every 4 years. A total of 24 Peterson dredge samples will be taken at each transect.

Oven dry weight (biomass), ash-free oven-dry weight (organic content), and species composition by percentage weight for each sample will be computed. Other information collected will be near-bottom water velocity and substrate particle size. Additional samples will also be collected between the eight transects and used to provide further information on the coverage of macrophyte distribution and density in the Project area to ensure coverage of the patchy distribution of aquatic macrophytes along the shorelines.

Photographic coverage of littoral areas will be obtained with a low-elevation over-flight during the peak aquatic macrophyte growth period (typically August) and will coincide with field sample collection. Full coverage of each side of the reservoirs will be obtained. This information will be used to extrapolate composition and density data to the project area. Information will to be incorporated into GIS maps of macrophyte coverage through the reservoirs.

6. Proposed Zebra Mussel Monitoring

Over the last three years Grant PUD has worked cooperatively with Washington DFW to monitor for zebra mussels (veliger monitoring) within the Project area. To date, all plankton samples collected from the Project Area have been negative. Grant PUD is committed to continue working cooperatively with the Washington DFW on this effort.

7. Proposed Construction, Maintenance, and Emergency Plans

Grant PUD has developed plans for consultation with, and notification of, resource agencies and tribes, as well as for standardized protection and monitoring actions associated with construction, maintenance, or emergency activities. The purpose of this plan element is to reduce or eliminate the impact of project-related maintenance, construction, and emergency activities on water quality parameters in order to ensure that the project continues to meet applicable water quality standards.

Grant PUD proposes the following measures to address potential short-term water quality impacts associated with construction activities at the project, emergency situations and routine maintenance activities:

- Before undertaking any new construction that might reasonably and significantly impair water quality (other than routine maintenance and operations or other new construction contemplated in this Application), Grant PUD will notify Washington DOE and develop, at Washington DOE's request and subject to its approval, specific protection monitoring and measures as may be warranted by such action.
- Properly dispose of construction debris in a manner such that materials and debris cannot enter into the Columbia River or impact the water quality of the Columbia River.
- Maintain and implement current Spill Prevention, Containment and Countermeasure (SPCC) plans for oil, hazardous materials, and non-hazardous materials prepared in accordance with the CWA requirements of 40 CFR 112. These plans shall address all locations at the project facilities where project operations may potentially result in a spill of these materials to the Columbia River. In the event of a spill or release or threatened spill or release to project reservoirs, Grant PUD shall immediately implement the site's SPCC plan and notify the Washington DOE Emergency Response system.
- Allow Washington DOE such access as necessary to monitor the project area and

project records required by the 401 Certification at reasonable times as necessary to monitor compliance with these conditions.

8. Proposed Fixed Site Quality Assurance Project Plan (QAPP)

Grant PUD currently operates and maintains four fixed site water quality stations that continuously monitor TDG, temperature (°C), DO (mg/l), pH (units), and turbidity (NTU's). These stations are located midway across the river channel in the forebay and tailrace of each dam. Grant PUD also maintains a fixed site monitoring station located near the tailrace of Rock Island dam from approximately September 1 through April 1 (during non spill periods) each year. The Public Utility District No.1 of Chelan County operates and monitors this site through during spring and summer spill seasons as part of their water quality data collection requirements.

Each station is equipped with a water quality monitor with multi-parameter probe (probe) enclosed in a submerged conduit or standpipe. The depth of each probe varies with site and river conditions, but generally ranges between 3-5 meters deep. The standpipes were modified in the spring of 2003 by increasing the length of them at each of the 4 sites. This was to allow the probes to be below the compensation depth, as well as to function in the event of a low water year.

Except for the Rock Island fixed site, which has a different data communication and data transmission system, these probes are connected to an automated system that allows Grant PUD to monitor water quality data on an hourly basis. Data is collected and recorded every hour seven days a week and is transmitted each hour via radio/antenna links to a PC at each dam. From the PC, the data is transferred to a database where daily reports can be generated and distributed. From these daily water quality reports, decisions are made regarding spill for fish passage and water quality issues.

Probe maintenance and calibration follow protocols and guidelines established by equipment suppliers, the USGS, and COE. Calibration is conducted in a controlled laboratory environment using certified equipment and recommended calibration standards. Detailed maintenance and calibration procedures are presented in Duvall et al. (2003; Technical Appendix E-3.F). Grant PUD proposes to develop additional details following issuance of the 401 Certification by Washington DOE.

Our Analysis

Grant PUD's proposed Water Quality Plan addresses monitoring of water quality parameters; habitat protection flows; aquatic plant monitoring; zebra mussel monitoring; construction, maintenance and emergency conditions; and a fixed site QAPP. The Water Quality Plan was proposed at the request of Washington DOE and is intended to serve as the basis for the 401 certification. Grant PUD has completed all modeling studies and all project modifications to ensure that the project meets Washington state water quality standards. Staff concludes that the Water Quality Plan would ensure that the project continue to meet the state water quality standards and provide an adequate means for addressing project-related water quality issues throughout the next licensing period.

Project Effects on Water Quantity

Water quantity 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. The project does not take water away from the river channel for power generation; therefore, there is no bypassed reach. The existing and proposed amount of water consumed by Grant PUD for project purposes is minimal.

Grant PUD's Proposals to Improve Water Quantity

Grant PUD proposes to continue operating the project under the HCA to optimize the management of flows and power generation through the seven dams from Grand Coulee to Priest Rapids. Grant PUD would also continue to abide by the VBA, or the Hanford Reach Agreement, which the parties propose to replace the VBA in a new license. The Hanford Reach Agreement allows use of active storage from the project reservoir to assist Grant PUD in meeting the discharge requirements for the Project. The HCA allows the Project to meet a high proportion of the peaking load of Grant PUD's power purchasers when the Priest Rapids and Wanapum developments are constrained by the Hanford Reach Agreement's fish stranding provisions.

Agencies' Recommendations to Improve Water Quantity

In its letter filed May 26, 2005, FWS recommends that Grant PUD control the flow releases from the Priest Rapids dam from RM 397 to RM 340 from March 1 through June 15 of each year to limit the magnitude of daily flow fluctuation (max Q – min Q) measured at Priest Rapids dam and coordinated at USGS Gage No. 12472800. This recommendation is designed to minimize the entrapment and stranding of juvenile fall Chinook salmon below Priest Rapids dam, to no more than 10 kcfs around the estimated weekly average outflow target. Grant PUD is to use the physical capabilities of only Priest Rapids and Wanapum developments to dampen flow fluctuations downstream into the Hanford Reach. The responsibility for meeting this recommendation is not be transferred to any federal hydroelectric facility through manipulation of the MCCC or other legal avenue.

In its letter filed May 31, 2005, CRITFC recommends (recommendation no. 7) that Grant PUD control the flow releases from the Priest Rapids dam from March 1 through June 15 of each year to limit the magnitude of daily flow fluctuation below Priest Rapids dam to no more than 10 kcfs around the estimated weekly average outflow target (similar to FWS recommendation above). CRITFC recommends that Grant PUD utilize the storage capacity of the Project, and coordinate with Douglas and Chelan PUDs as necessary to accomplish this protective flow criteria.

On May 6, 2004, NMFS filed its BO for Grant PUD's proposal to amend its license in order to implement an Interim Protection Plan (IPP), defining a set of short-term actions that would begin to immediately improve the survival of listed for Upper Columbia River (UCR) steelhead and UCR spring-run Chinook salmon. On December 16, 2004, the Commission issued an Order Amending License and Terminating Proceedings for the project which required Grant PUD to implement the RPA (Actions 1 through 25) contained in the BO, along with the summer spill provisions of the MOA, filed on September 13, 2000. The BO recommends other measures that influence how the project is operated, and includes an RPA action item for Grant PUD to establish a PRCC composed of NMFS, FWS, Washington DFW, the Colville, the Yakama, the Umatilla, and Grant PUD (Action 39). The PRCC would oversee the implementation of anadromous fish activities, water quality parameters associated with the fisheries activities, and the requirements of the BO.

The May 6, 2004, BO applies to the current license and to any annual license issued after the current license expires through December 31, 2013. The issuance of a new license would result in a new BO for the project.

NMFS worked closely during the pre-filing period with Grant PUD, other state and federal resource agencies, and Tribes in developing the water quality measures needed to protect, mitigate and enhance the anadromous fisheries in the project area. The results of these efforts are contained in the Water Quality Plan, filed in the final license application. NMFS agrees with Grant PUD's proposed water quality measures at the project.

The COE requested that conditions equivalent to those in the current License relating to flood control be included in the new license (see section 3.4.1, *Existing and Proposed Use of Project Waters, Flood Control*).

Washington DFW recommends that the Commission include NMFS's BO RPA's in the new license. The RPA water quantity and quality actions are discussed above in the section describing NMFS's recommendations.

Our Analysis

The current Hanford Reach flows result from a system that is operated to balance power generation, flood control, fisheries, and other beneficial uses. The current operation of the Project is largely driven by upstream releases from the federal Grand Coulee Project. As such, the Project buffers and moderates the flows that would otherwise affect downstream reaches.

The only way to implement FWS's recommended flow conditions would be for Grant PUD to use the active storage available in the project reservoirs. FWS's changes in flow levels may result in a periodic failure of the reservoirs to refill, with associated power and natural resource impacts.

Several agreements, treaties, and natural resource requirements govern how the project is operated and what flows pass below the project. These include the Columbia River Treaty, Columbia Storage Power Exchange, Canadian Entitlement Allocation Agreements and Extension Agreements, Non-treaty Storage Agreement, Pacific Northwest Coordination Agreement, Power Purchases Agreement, HCA, and the VBA.

In addition to the agreements and regulatory requirements discussed above, Grant PUD designed and implements a variety of other adjustments to their operations to protect and enhance water quality and fisheries resources at the project. Primary among these is the Hanford Reach Juvenile Fall Chinook Protection Program. The program is designed to address resource agencies' concerns about stranding of juvenile fall Chinook salmon in the Hanford Reach during the spring rearing period, identified in 1997 from on-going fisheries studies. Starting in 1999, the mid-Columbia licensees (Grant, Chelan, and Douglas PUDs) provided an experimental re-shaping program to limit flow fluctuations in the Hanford Reach, which has continued to evolve.

Operations to minimize juvenile fish stranding have been accomplished primarily through the use of available active storage at Priest Rapids and Wanapum reservoirs, which results in a reduction of peak generating capacity at these two developments. Peak generation requirements are then shifted to upstream projects under Hourly Coordination operations. The limited storage ability of the project often results in the inability to operate within the Hanford Reach Juvenile Fall Chinook Protection Program fluctuation limits. Without the use of coordinated operations from upstream projects under the HCA, this program would not be possible because the reduced peak generation and increased off-peak generation at the Project can't be brought into balance without upstream coordination. Implementation of the Hanford Reach Juvenile Fall Chinook Protection Program is a seven dam operation that even then can't always be successfully implemented.

Due to the nature of the mid-Columbia system, Grant PUD and the other regional utilities' needs are integrated into the operation of the entire mid-Columbia River. The flow releases from the upstream federal Grand Coulee Project affect the flow regime at each of the downstream dams, and ultimately the Hanford Reach. Graphs in Exhibit B of the license application (Grant PUD 2003) of comparisons between Grand Coulee and Priest Rapids releases show that Priest Rapids helps dampens fluctuations downstream into the Hanford Reach. Staff concludes that it is not Grant PUD's sole responsibility to dampen the flow fluctuations downstream into the Hanford Reach. This would disrupt the existing, highly coordinated operation of the mid-Columbia projects.

3.4.3 Cumulative Effects

The project's cumulative effects on water quality are dependent on the water quality of the inflows. Specific actions taken by Grant PUD will produce varying results, depending on the future condition of inflows.

TDG and temperature have exceeded the numeric criteria at varying times as Columbia River water entered the project from Rock Island dam. However, modeling of water temperature for the mid-Columbia River shows that the strongest effect on temperature is the effect of the large volume of water impounded by Grand Coulee dam. The net effect of Lake Roosevelt on water temperature is much greater than that of all downstream projects. Thus, the amount of solar radiation necessary to heat Grand Coulee reservoir appears to result in delayed springtime warming of Columbia River water downstream. By fall, the effect reverses itself, with river temperatures cooling more slowly than they would without the effects of Grand Coulee storage (Perkins et al. 2002). Similar effects are also observed at other large upstream storage projects in the U.S. and Canada.

Washington DOE is developing a TMDL temperature plan for the Columbia River Basin for water body segments above the project that may affect the condition of inflows to the Wanapum reservoir. This TMDL is intended to identify, evaluate and implement plans to improve the condition of the water for temperature entering the project so that it will attain appropriate targets identified in the TMDL.

TDG is also the subject of various regional efforts throughout the Columbia River Basin. The Transboundary Gas Group has developed a framework to facilitate and coordinate cooperative efforts to address TDG throughout the Columbia River Basin, including Canada. NMFS also coordinates water quality monitoring issues (Water Quality Team) and spill implementation and timing (Technical Management Team), primarily at federal projects.

3.4.4 Unavoidable Adverse Impacts

None

3.5 AQUATIC RESOURCES

The EIS scoping process identified the following issues related to project effects on aquatic resources: (1) effects on the upstream movement of migratory fish species (adult salmon steelhead, lamprey, bull trout, sturgeon and American shad); (2) effects on the downstream movements of migratory fish species (juvenile salmon and juvenile and adult steelhead, lamprey, and bull trout); (3) effects on adult and juvenile salmon and steelhead in the Hanford reach; (4) effects on white sturgeon in the project reservoirs and the Hanford Reach; and (5) effects on lamprey rearing within the project reservoirs; (6) effects on resident fish species; (7) effects of project-related hatchery programs on fish populations, including abundance and stock integrity; (8) effects on fish populations and fish habitat in tributaries to the project area; (9) effects of project-related predator control efforts on salmon, steelhead, and other fish species. In this section, we describe the affected environment and the environmental effects of the project, including cumulative effects, and address the issues listed above.

3.5.1 Affected Environment

The fish community of the Project area is composed of more than 40 species, including individuals from 14 of the 24 recognized families of North American freshwater fishes. Among these species are both anadromous and resident fishes. Families represented include the jawless fishes of Petromyzontidae (lampreys), the cartilaginous Acipenseridae (sturgeons and paddlefishes), and the class Osteichthyes, otherwise known as the bony fishes, Clupeidae (herrings), the widely distributed family Salmonidae (salmon and trout), and rare samples of the family Esocidae (pikes). The most abundant groups of fishes found in the Project area are Cyprinidae (minnows) and Catostomidae (suckers). Less common are the family Ictaluridae (catfishes) and Gadidae (cods). Also represented are the families Percopsidae (trout-perches), Centrarchidae (sunfishes), Percidae (perches), and Cottidae (sculpins).

Included among the species present in the Project area are two anadromous salmonid populations listed as endangered (spring Chinook salmon and summer steelhead) and one resident salmonid (bull trout) listed as threatened under the ESA.

Anadromous Fish

Six anadromous fish species are known to inhabit or migrate through the Project area. Four of these species are anadromous salmonids including: spring, summer, and fall Chinook salmon (*Oncorhynchus tshawytscha*); summer steelhead (*O. mykiss*); coho salmon (*O. kisutch*) and sockeye salmon (*O. nerka*). Of these, only fall Chinook salmon are known to both spawn and actively rear within the Project area. Spring and summer Chinook salmon, steelhead, coho salmon and sockeye salmon migrate through the Project area as adults returning to upriver spawning areas and the smolts of these species travel through the Project area on their downstream migrations. Pacific lamprey *(Lampetra tridentata*) follow migratory patterns similar to those of the anadromous salmonids. American shad (*Alosa sapidissima*) is an introduced species (Scott and Crossman 1971) that is currently restricted to the Columbia River below Priest Rapids dam because they do not use or are unable to negotiate the submerged orifices of the upper sections of Priest Rapids fishways. With the exception of American shad, the anadromous species listed above are endemic to the Columbia River and are considered culturally, economically, and commercially important. The following sections provide more detailed information on each species and focus on the abundance data available from Priest Rapids dam counts since 1960.

Sockeye Salmon

Sockeye salmon upstream of the Priest Rapids Project currently inhabit Lake Wenatchee of the Wenatchee River system and Lake Osoyoos of the Okanogan River system. Adult sockeye salmon return to the mid-Columbia River during the summer, with peak adult passage at Priest Rapids dam during mid-July. Peak spawning activity occurs in mid-September for Lake Wenatchee sockeye salmon, while peak spawning is during mid-October for Lake Osoyoos sockeye salmon. The difference in spawning time is most likely related to higher water temperatures in the Okanogan River system. Adult sockeye salmon spawn in lake tributaries and outlet streams, lake beaches, or deep-water rubble. The eggs and embryos incubate throughout the winter in the spawning gravel or in the cracks and crevices of larger substrates. The actual rate of development depends primarily on water temperature, with colder water temperatures requiring a longer incubation period prior to hatching. Typical incubation times for sockeye salmon range from 50 to more than 150 days under winter water temperatures ranging from 2 to 13°C.

Sockeye salmon from the Wenatchee and Okanogan river basins emerge from the gravel at night during the period from late March through April. The newly emerged fry typically migrate downstream to reach the rearing environment of Lake Wenatchee or Lake Osoyoos. Juvenile sockeye salmon spend the next one or two years feeding on zooplankton. Most juveniles emigrate from Lakes Wenatchee and Osoyoos during the spring of their second year of life. These young sockeye salmon then migrate downstream through the Wenatchee and Okanogan rivers to reach the Columbia River. Juvenile sockeye salmon from Lake Osoyoos must pass Wells, Rocky Reach, and Rock Island dams and reservoirs before passing the Project, whereas sockeye salmon juveniles from Lake Wenatchee only have to pass Rock Island dam before reaching the Project. The peak of the downstream migration of sockeye smolts past Wanapum and Priest Rapid dams occurs during mid-May, with a majority passing during the month of May.

The total number of sockeye salmon returning to the mid-Columbia River has varied significantly since counts began at Priest Rapids dam (Figure 7). The average number of sockeye passing Priest Rapids dam annually from 1960 to 2004 was 61,672. The highest number of sockeye returning to pass Priest Rapids dam was 170,071, which occurred in 1966, while the historical low was 9,216 in 1995. These total dam counts do not distinguish between Lake Wenatchee and Lake Osoyoos stocks of sockeye, but Lake Wenatchee sockeye were identified recently as the only healthy sockeye population in the Pacific Northwest (Huntington et al. 1996).

Adult sockeye salmon counts at Priest Rapids dam in 2004 and 2005 were 124,943 and 74,563, respectively.

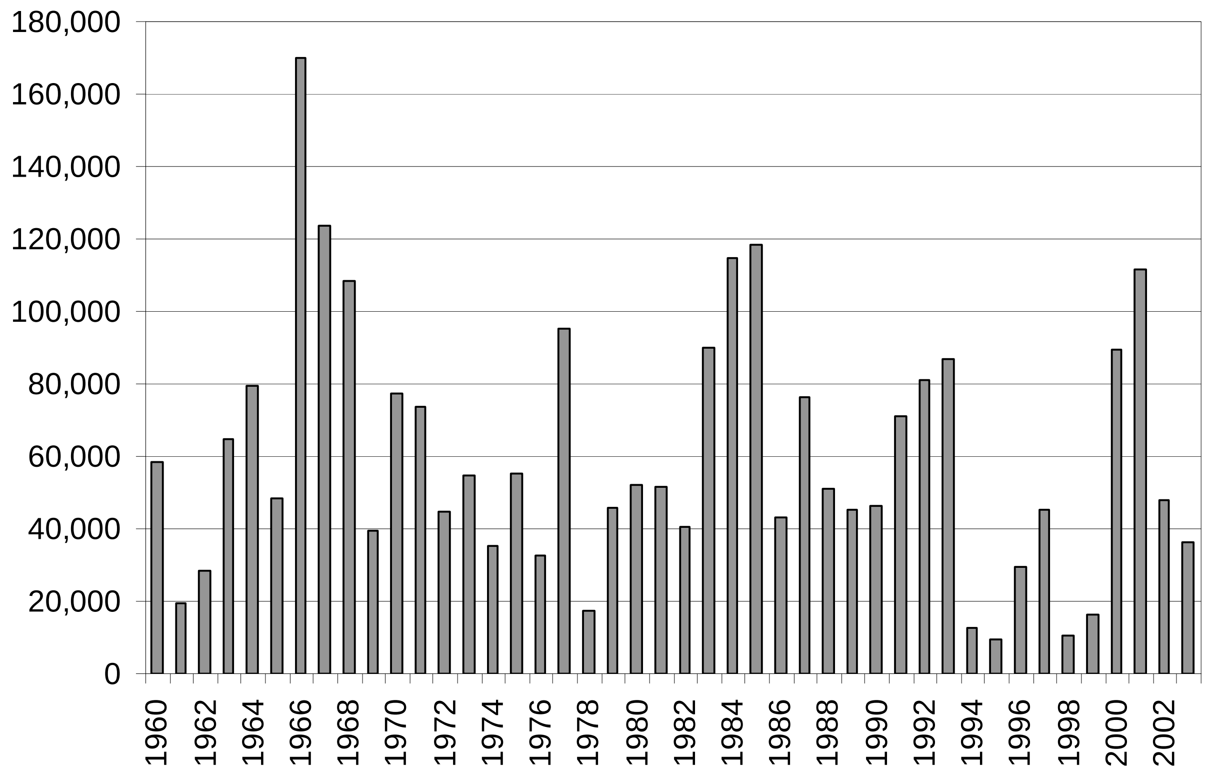

Figure 7. Annual number of sockeye counted past Priest Rapids dam from 1960 to 2003.

Steelhead

Steelhead are the same species as rainbow trout but have different life histories. Steelhead are anadromous, while rainbow trout generally remain in freshwater throughout their lives.

Steelhead life history is similar to that of the salmon, with some differences. Steelhead adults, like salmon, return to freshwater in the late summer with most passing Priest Rapids and Wanapum dams during August and September. However, steelhead spawn in the spring rather than the fall and not all adults die after spawning. While many steelhead adults die from the upstream migration or spawning, some adult steelhead survive and after spawning return downstream to the ocean. Post-spawn adult steelheads that are returning to the ocean are called kelts.

Spawning in tributary streams takes place from March through June, but may occur as late as July. The eggs incubate within the spawning gravel for four to seven weeks following spawning, and fry emerge from the gravel about two to three weeks after hatching. For most of the mid-Columbia steelhead streams, emergence occurs during the period from June through September. Juvenile steelhead remain in freshwater while they feed and grow to a smolt size of about 150-200 millimeters (mm) and make their spring-time outmigration to the ocean. It may take one to seven years to reach smolt size depending on growth rate and the productivity of the tributary stream, although the majority of steelhead smolts are two to three years of age. Most smolts migrate past Wanapum and Priest Rapids dams during the month of May, although considerable numbers may be migrating in late April or early June.

Adult steelhead returns have varied considerably since counts began at Priest Rapids dam (Figure 8). The average number of steelhead passing Priest Rapids dam from 1960 to 2004 was 11,370 fish, with the lowest return of 2,462 fish occurring in 1975 and a peak run of 34,589 fish in 1985. Prior to construction of Priest Rapids Project, steelhead passage was enumerated at the upstream Rock Island dam. Rock Island counts from 1933 to 1959 were typically between 2,600 and 3,700 fish, with most of these being wild or naturally spawned fish. Expanded hatchery production in the 1960s increased run sizes to approximately 6,700 fish. In the 1970s dam counts dropped to average about 5,400 then increased dramatically in the 1980s, and again from 2000 through 2002.

In order to address possible spawning and rearing by steelhead in project tributaries, Grant PUD conducted an evaluation to determine whether the genetic structure of redband/rainbow trout populations in the Project area is indicative of pure, native trout populations or indicative of populations that have undergone introgression with hatchery rainbow trout or steelhead. Tissue samples from fish collected from seven different project tributaries[31] were evaluated using standard DNA analysis techniques (Dresser et al. 2003). The results of these analyses showed no genetic similarity to steelhead reference samples. These genetic data suggest that all tributary streams with

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[31] Johnson, Skookumchuck, Whiskey Dick, Tarpiscan, Trinidad, Quilomene and Colockum Creeks; see Figure E4-10 in volume 3 of the license application for specific location of each of these tributaries.

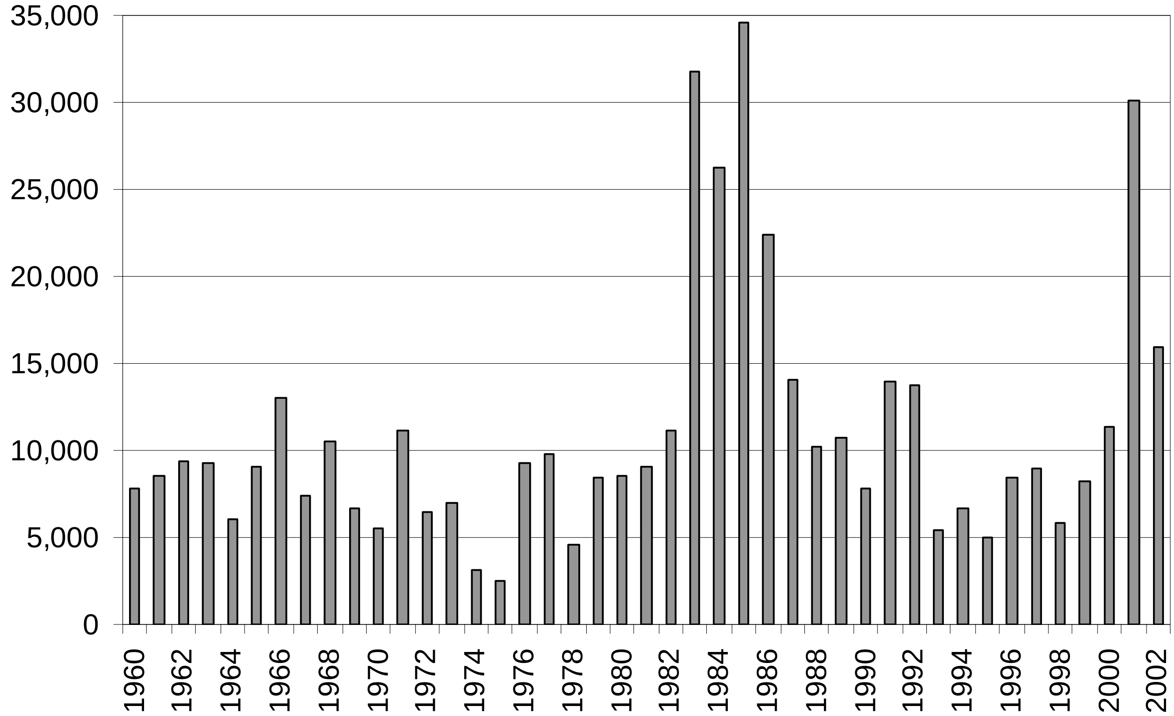

Figure 8. Annual number of steelhead counted past Priest Rapids dam from 1960 to 2002.

the exception of Johnson Creek contain rainbow trout populations derived from known populations of hatchery rainbow trout (Dresser et al. 2003). Johnson Creek showed unique genetic characteristics not similar to known rainbow, redband or steelhead populations.

NMFS classifies steelhead populations by "evolutionarily significant unit" (ESU). ESUs represent "distinct population segments (dps) of any species of vertebrate fish or wildlife which interbreeds when mature." The only ESU of steelhead that commonly occurs in the Project area is the UCR steelhead. UCR steelhead include fish from the mainstem Columbia River and its tributaries upstream of the confluence of the Columbia and Yakima rivers. On October 17, 1997, NMFS listed the Upper Columbia River steelhead ESU as endangered under the ESA.Adult steelhead counts at Priest Rapids dam in 2003, 2004, and 2005 were 17,652, 18,727, and 13,449, respectively.

Chinook Salmon

Chinook salmon exhibit more variability and variety in their life history and biology than other anadromous fishes of the mid-Columbia River. Chinook salmon in the project area are classified into three different runs based on the time of year that the adults pass Priest Rapids dam. Adult Chinook salmon returning from April 17 through June 13 are classified as "spring Chinook salmon," adults returning from June 14 through August 13 are "summer Chinook salmon," and adults returning from August 14 through November 15 are "fall Chinook salmon."

Similar to steelhead, NMFS has also applied ESU designations to Chinook salmon. Spring Chinook salmon found in the Priest Rapids Project area are part of the UCR spring-run Chinook salmon ESU. Summer and fall Chinook salmon found in the project area are treated as the same ESU and are called the UCR summer/fall-run Chinook salmon ESU.

Spring Chinook salmon are referred to as "stream-type" fish because they spawn and rear in tributaries that have cooler water temperatures and lower levels of productivity than the mainstem Columbia River or its larger tributary rivers (e.g., the Wenatchee River). Spring Chinook salmon spawn the earliest of the three runs, and the eggs incubate in the gravel the longest. After emerging from spawning gravels, spring Chinook salmon juveniles typically spend one year rearing in small tributary streams before migrating downstream to larger rivers and eventually reaching the Columbia River. Yearlings, referred to as smolts, outmigrate through the mid-Columbia River in April through June, with peak numbers typically passing Wanapum and Priest Rapids dams during mid- to late-May.

The number of spring Chinook salmon returning to the mid-Columbia region has generally fluctuated between 5,000 and 50,000 since counts began at Priest Rapids dam (Figure 9). The average annual return of spring Chinook salmon from 1960 to 2004 was 13,067 fish. The highest return occurred in 2001 when 51,133 adults passed Priest Rapids dam, while in 1995 the adult return was only 1,130. Low returns in the early to mid-1990s resulted in NMFS listing the UCR spring Chinook salmon ESU as endangered in March 1999.

Adult spring Chinook salmon counts at Priest Rapids dam in 2004 and 2005 were 14,541 and 14,663, respectively.

With the exception of the past three years when returns increased dramatically, summer Chinook salmon returns have been relatively stable since counts began at Priest Rapids dam (Figure 10). The average return from 1960 to 2004 was 23,498 fish. The lowest return was 9,564 fish in 1983 and the highest return was 97,781 fish in 2002.

Adult summer Chinook salmon counts at Priest Rapids dam in 2004 and 2005 were 72,673 and 63,125, respectively.

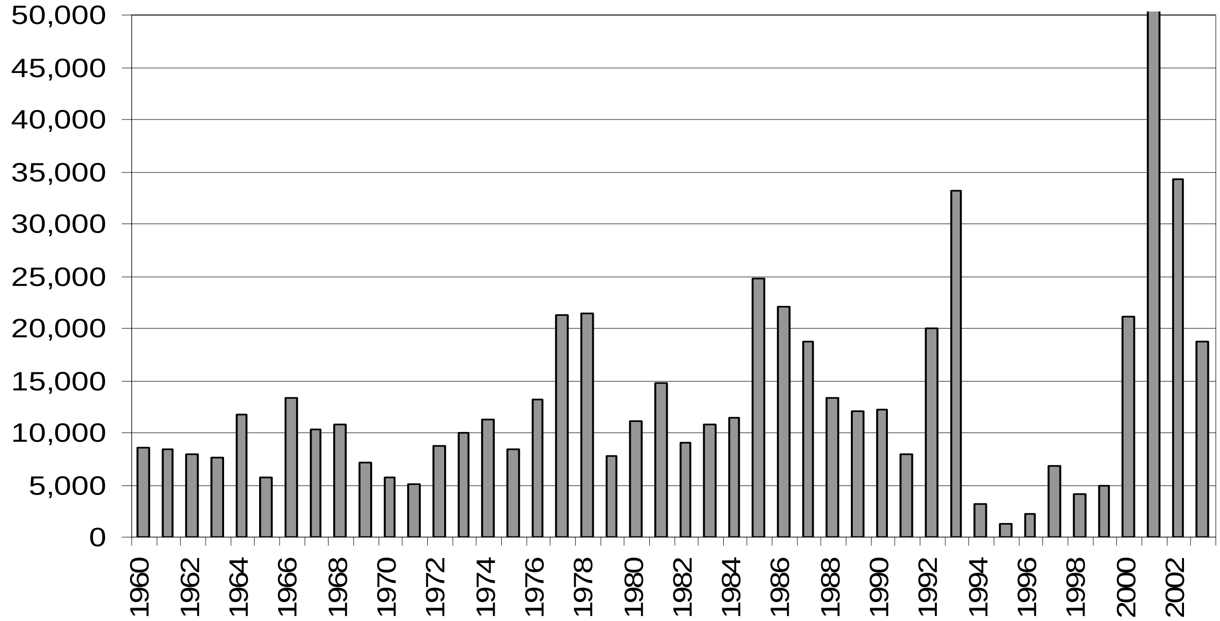

Figure 9. Annual number of spring Chinook salmon counted past Priest Rapids dam from 1960 to 2003.

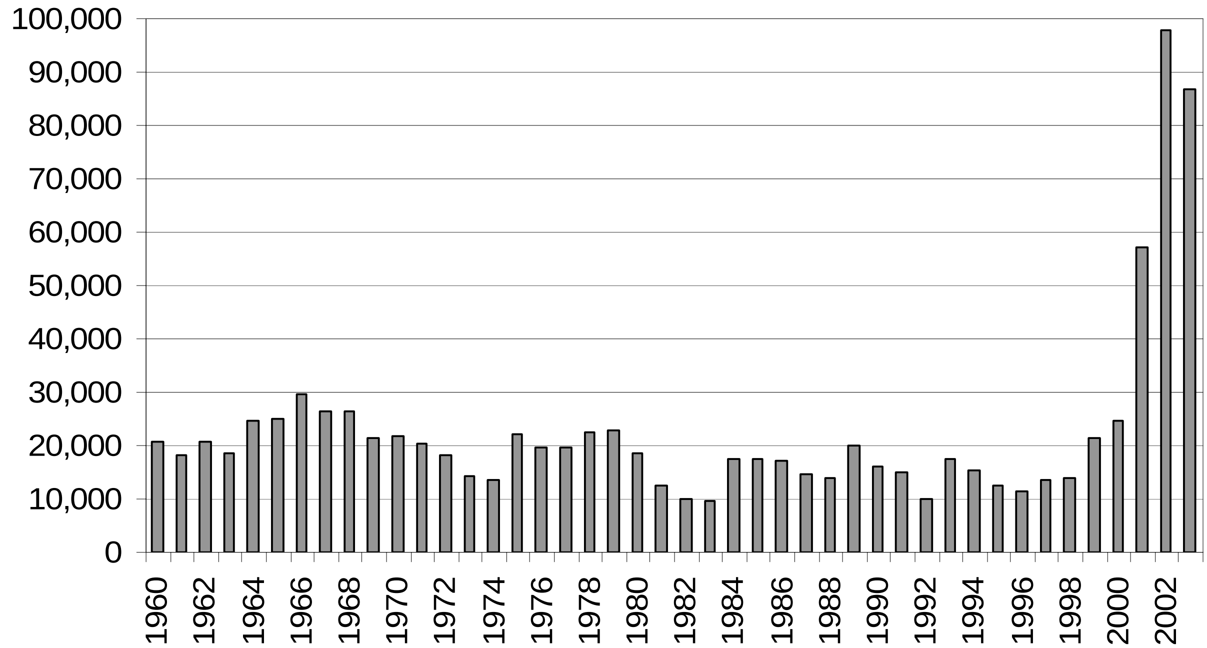

Figure 10. Annual number of summer Chinook salmon counted past Priest Rapids dam from 1960 to 2003.

With the exception of a period of increased abundance in the late 1980s and again in recent years, the number of fall Chinook salmon returning to pass Priest Rapids dam has been relatively stable since counts began (Figure 11). The average number of fall Chinook salmon passing Priest Rapids dam from 1960 to 2002 was 16,623 fish. The lowest return was 5,437 fish in 1981 and the highest return was 48,546 fish in 2003.

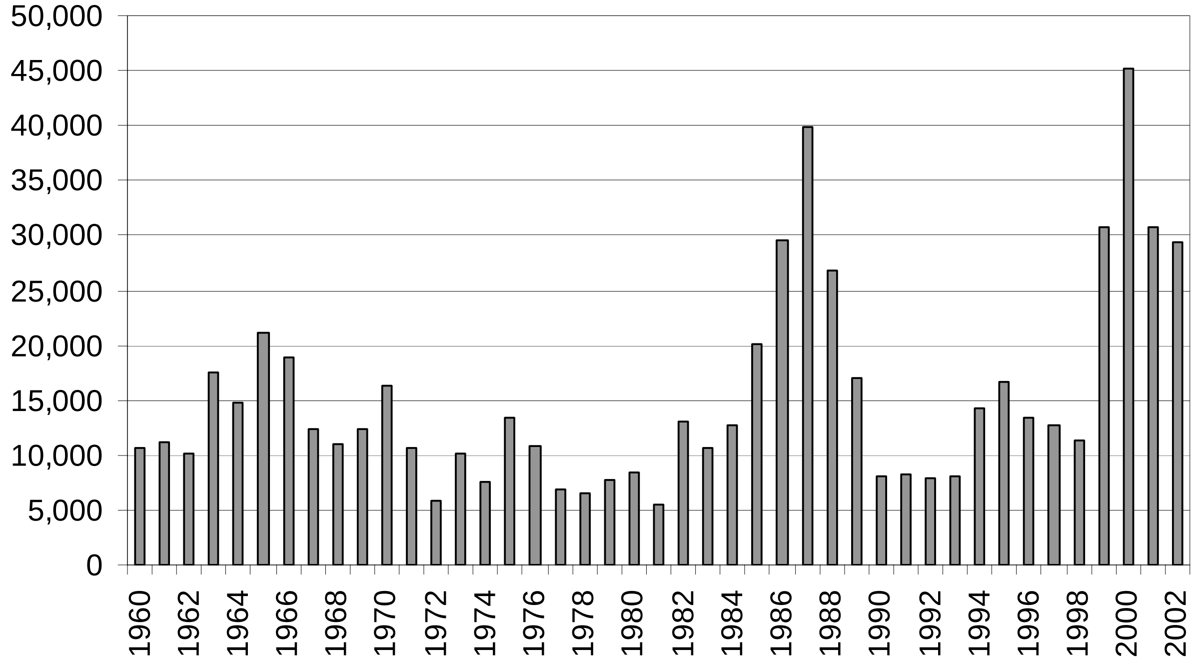

Figure 11. Annual number of fall Chinook salmon counted past Priest Rapids dam from 1960 to 2002.

In comparison to the fall Chinook salmon passing over Priest Rapids dam, a much larger number of fall Chinook salmon spawn in the Hanford Reach of the Columbia River downstream of Priest Rapids dam. The abundance of this stock has been increasing in recent years and it is considered the healthiest inland stock of Chinook salmon in the Pacific Northwest (Huntington et al. 1996). From 1964 to 1982 the average escapement of fall Chinook salmon (excluding jacks) to the Hanford Reach was 25,178, whereas from 1983 to 1996 the average escapement of fall Chinook salmon nearly doubled to 49,977. The exact reason for this increase is not known; however, it may be related to improvements in mitigation and protection programs for this stock. One such measure is the VBA which has been implemented from 1983 to the present. This measure increases the stability of spawning flows in the Hanford Reach and maintains a minimum flow with the intent of keeping a very high percentage of fall Chinook salmon redds inundated until after emergence. In addition to the VBA, the original Priest Rapids spawning channel was converted to a conventional hatchery that releases nearly 8 million fall Chinook salmon smolts annually. Many of these hatchery fish return and spawn in the Hanford Reach. Spawning by fall Chinook salmon in the Project area occurs primarily in the tailrace of Wanapum dam.

The downstream migration of juvenile summer and fall Chinook salmon is different than for juvenile spring Chinook salmon. Rather than migrating to the ocean as one year old fish, juvenile summer and fall Chinook salmon migrate to the ocean during their first year of life as sub-yearlings. Because of their early migration, these fish are referred to as ocean-type salmon. During their migration, sub-yearling ocean-type Chinook salmon use the mainstem Columbia River, including both reservoirs of the Project, as rearing habitat. The migration of ocean-type salmon typically begins in May and peaks during July.

Adult fall Chinook salmon counts at Priest Rapids dam in 2003, 2004, and 2005 were 54,804, 47,406, and 31,646, respectively.

Coho Salmon

The endemic stock of coho salmon from the mid-Columbia River is considered extinct (Nehlsen et al. 1991); however, coho salmon have been reintroduced through hatchery programs. Hatchery coho returned to the mid-Columbia region in considerable numbers in the late 1960s (Figure 12) with a 1968 peak return of 13,212 fish. During the 1970s and 1980s, the hatchery run declined dramatically, and in 1993 and 1994, no coho were counted at Priest Rapids dam. Reintroduction efforts have begun again in recent years and in 2001, over 10,000 coho were counted past Priest Rapids dam.

Adult coho salmon counts at Priest Rapids dam in 2003, 2004, and 2005 were 4,803, 4,830, and 1,173, respectively.

Pacific Lamprey

The Pacific lamprey is a prehistoric jawless fish with a cartilaginous skeleton. Pacific lamprey are anadromous, and their distribution encompasses the areas that have upstream passage in the Columbia River Basin. Adult lamprey begin an upstream migration in late summer and then overwinter in rocky areas of the river. During June and July, the adult lamprey spawn in sandy gravel on the upstream side of riffles. The male and female both dig a shallow nest of gravel that covers the eggs after spawning. The eggs incubate for two to three weeks, and the larval lamprey then emerge from the gravel and settle into backwater areas. The young larvae spend the next four to six years feeding on detritus, diatoms, and algae that are suspended above and within the substrate. These young lamprey, called ammocoetes, eventually migrate toward the ocean in much

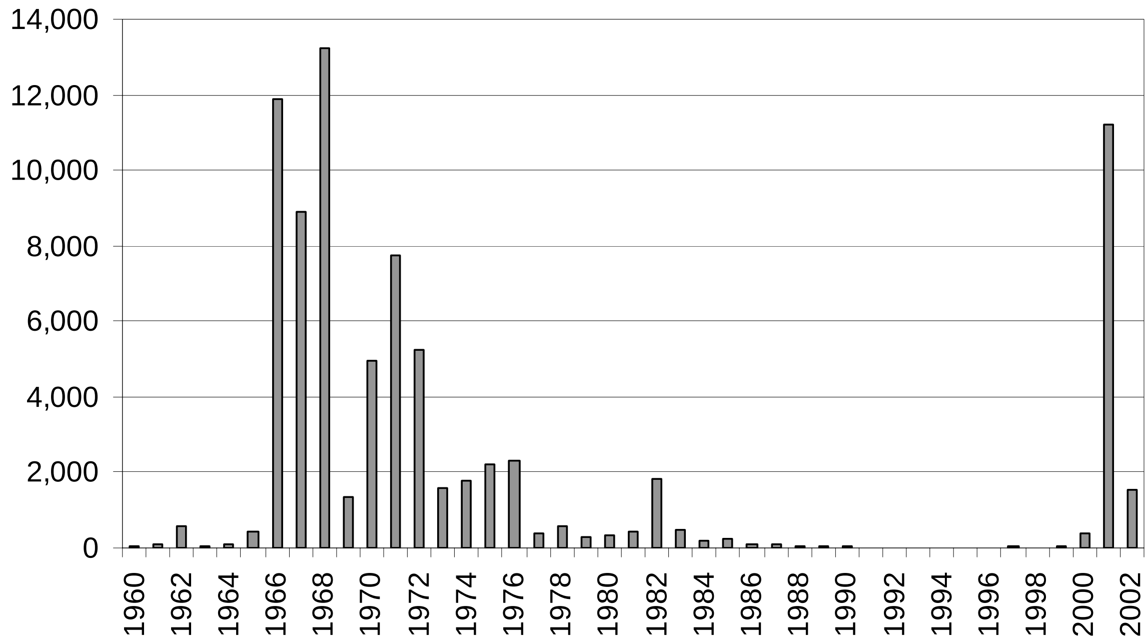

Figure 12. Annual number of coho salmon passing Priest Rapids dam from 1960 to 2002.

the same way as juvenile salmon. This ocean migration occurs in the spring and summer. Upon reaching saltwater, Pacific lamprey begin a transformation to parasitic feeding behavior. In the ocean Pacific lamprey attach to other fish and feed on the blood and body fluids. After a period of two to four years, the adult Pacific lamprey return to freshwater to spawn. Adult lamprey die within a month after spawning.

Pacific lamprey abundance in the Columbia Basin has declined over the past 40 years; however, the magnitude of this decline is difficult to determine. Historical dam counts for adult lamprey are not widely available and are affected by different counting methods and frequency of counting. Another primary reason for uncertainty regarding dam counts is the behavioral tendency for adult lamprey to avoid count boards or viewing windows during their upstream passage. Because of this all dam count data are likely to be biased low. Counts at Priest Rapids dam have shown increases compared to more than 10 years ago. In 1993 only 322 Pacific lamprey were counted at Priest Rapids dam but more recently passage numbers have been between 2,000 and 4,000.

The most consistent dam count data for Pacific lamprey are from Rocky Reach dam. Counts at Rocky Reach dam have shown a steady decline from over 17,000 fish in 1969 to counts continuously less than 500 during the 1970s, 80s and 90s. Counts at Rock Island dam show a similar decline. A combination of factors is associated with this decline, including poor habitat conditions, fish poisoning operations, water pollution, dam passage problems, ocean conditions, and food availability (Close et al. 1995).

American Shad

American shad were introduced to the Sacramento and Columbia rivers in 1871 (Scott and Crossman 1971) and have become widely established up and down the Pacific coast. American shad ascend freshwater rivers and streams in the spring to spawn. Spawning occurs in open water at temperatures from 12 to 20°C. Spawning probably occurs in the tailraces below Columbia River dams. Each female shad produces from 20,000 to 150,000 eggs. Fertilized eggs are carried by current and settle out to hatch in eight to 12 days. Adult American shad die after spawning in some locations, but may also return to the ocean and have been known to spawn as many as five times. The young shad spend one summer in freshwater and drift downstream to reach the ocean in the fall when they are two to three inches in length. American shad are plankton feeders, and adults grow to a size of 20 inches or more and weigh in excess of six pounds.

The total number of American shad returning to Priest Rapids dam increased dramatically in the 1970s and 1980s (Figure 13). The peak returns of American shad reached 121,806 in 1992, although returns over recent years have dropped to fewer than 10,000. The possible effects that introduced American shad have on native fishes are unknown, and it is generally believed that range expansions of non-native fishes should

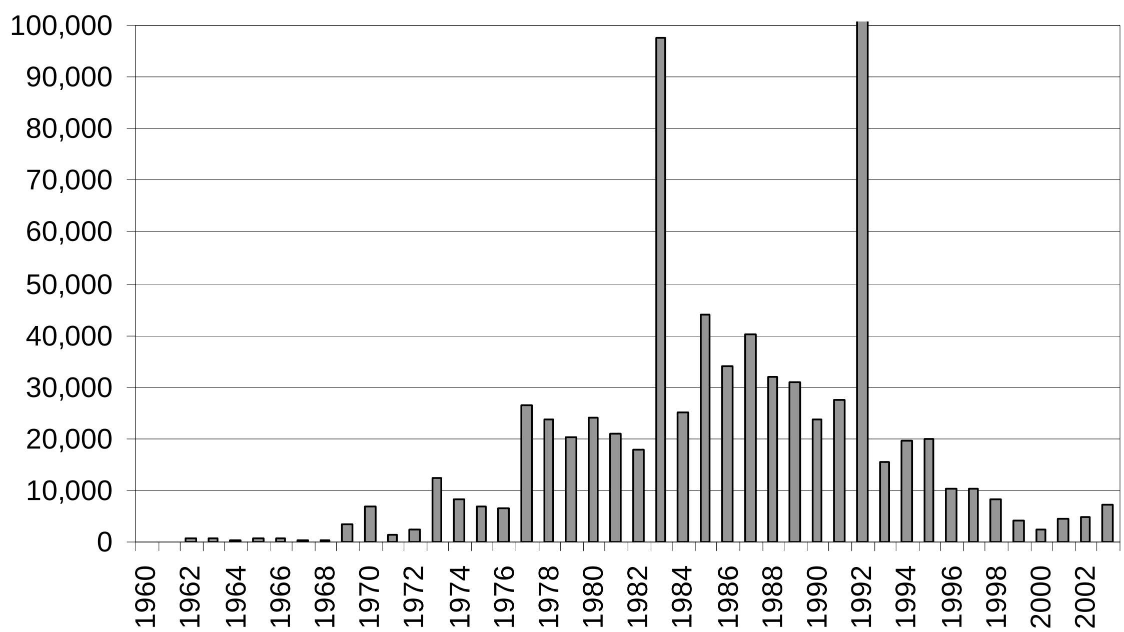

Figure 13. Annual number of American shad passing Priest Rapids dam from 1960 to 2003.

be limited if possible. American shad do not pass upstream of Priest Rapids dam as the submerged orifices of the fishway prevent them from reaching the upstream reservoir.

Summary of Anadromous Fish Resources for the Project Area

Adult anadromous salmonids migrate through the Project area from April through November (Table 16), although steelhead may overwinter in the Project area and there can be some movement during winter and early spring. Juvenile salmon and steelhead move downstream through the project area during spring and summer months, with most migrating downstream during the April through June time period (Table 16). The migration of fall and summer Chinook salmon is typically later in the summer during the June through August time period. Over 80% of all smolts pass Rock Island Project from April 15 to June 15 with over 95% of all smolts monitored passing by August 1 (Figure 14). The upstream and downstream migrations of Pacific lamprey are generally similar to that of anadromous salmonids.

Table 16. Summary showing average abundance and migration timing for anadromous fishes in the Priest Rapids Project area.

Species/Run	Avg. Return 1960-2002	Upstream Migration Timing	Downstream Migration Timing
Sockeye salmon	60,785	mid-May to mid-August	April through June
Steelhead	11,053	July through November	April through June
Spring Chinook salmon	12,923	mid-April to mid-June	April through June
Summer Chinook salmon	21,010	mid-June to mid-August	June through August
Fall Chinook salmon	15,255	mid-August through November	June through August
Coho salmon	1,878	September through November	April through June
Pacific Lamprey	1,195[1]	May through October	April through August
American Shad	17,704	June through August	No Juveniles above PRD

[1] This is a 1993-2002 average of the dam counts at Priest Rapids. It is very likely that this is an underestimate because many lamprey pass the count station undetected.

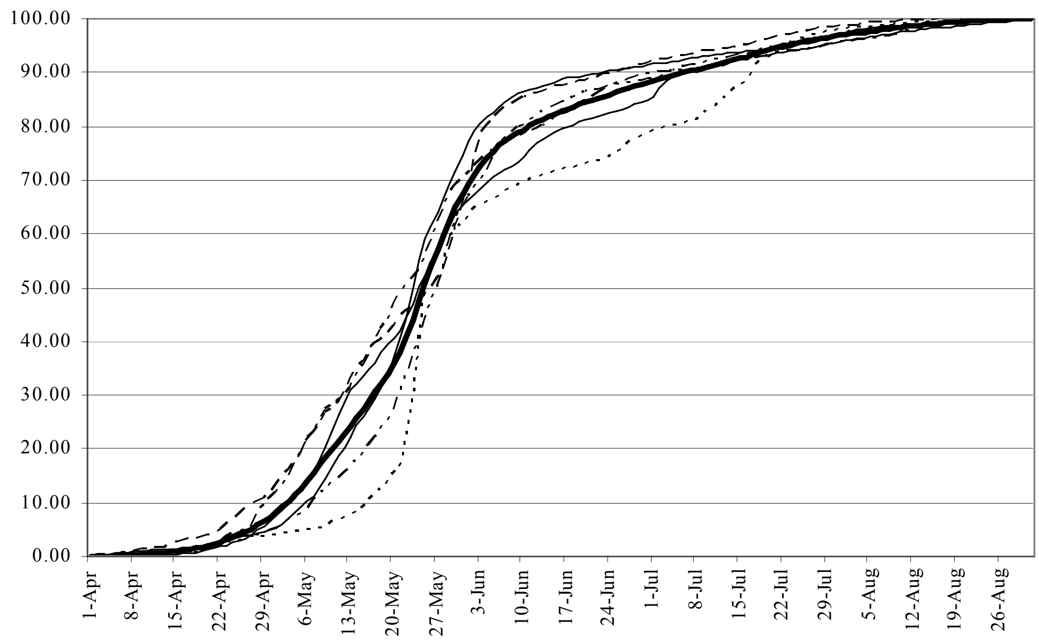

Figure 14. Cumulative frequency distribution of the mid-Columbia River composite smolt outmigration measured at Rock Island dam (solid black line represents average of index counts from 1997 to 2002).

The most abundant anadromous fish in the Project area is sockeye salmon with average annual returns of over 60,000 since counts began at Priest Rapids dam. Average returns of steelhead, spring, summer and fall Chinook to the Project area are somewhat similar, with abundance for these runs in the range of 10,000 to 20,000 fish per year (Table 16). Average abundance of Pacific lamprey is difficult to determine, but appears to be generally lower than the other species of anadromous fish returning to the mid-Columbia River.

Resident Fish

Resident fish species include a diverse mix of species that are native to the Columbia River and a variety of non-native fish that were introduced to the Columbia River. Resident fishes are important to the ecology and food web of the Columbia River and some species may serve as indicator species that help to describe the basic condition of the river ecosystem. Piscivorous resident fish, such as northern pikeminnow, walleye, and smallmouth bass, are important because they are known to prey on anadromous salmonid smolts. Resident game fish, such as walleye and smallmouth bass, supports recreational sport fisheries.

A total of 38 resident fish species are known to occur in the Project area. Grant PUD obtained resident fish presence data (Table 17) through an intensive multi-gear sampling effort conducted in 1999 (Pfeifer et al. 2001). The species in Table 17 can be divided into four groups: native game fish, native non-game fish, introduced (non-native)

Table 17. Resident fishes sampled in the Priest Rapids Project area during multiple gear surveys (Source: Pfeifer et al. 2001).

Common Name	Scientific Name	Species category and general abundance
White Sturgeon	*Acipenser transmontanus*	native game fish, common
Bull Trout	*Salvelinus confluentus*	native game fish, ESA threatened, rare
Rainbow Trout	*Oncorhynchus mykiss*	native game fish, common
Cutthroat Trout	*Oncorhynchus clarki*	native game fish, uncommon
Brown Trout	*Salmo trutta*	introduced game fish, uncommon
Mountain Whitefish	*Prosopium williamsoni*	native game fish, common
Lake Whitefish	*Coregonus clupeaformis*	native game fish, rare
Northern Pikeminnow	*Ptychocheilus oregonensis*	native non-game fish, abundant
Peamouth	*Mylocheilus caurinus*	native non-game fish, abundant
Chiselmouth	*Acrocheilus alutaceus*	native non-game fish, abundant
Redside Shiner	*Richardsonius balteatus*	native non-game fish, abundant
Longnose Dace	*Rhinichthys cataractae*	native non-game fish, common
Speckled Dace	*Rhinichthys osculus*	native non-game fish, common
Leopard Dace	*Rhinichthys falcatus*	native non-game fish, rare
Carp	*Cyprinus carpio*	introduced non-game fish, common
Tench	*Tinca tinca*	introduced non-game fish, uncommon
Bridgelip Sucker	*Catostomus columbianus*	native non-game fish, abundant
Largescale Sucker	*Catostomus macrocheilus*	native non-game fish, abundant
Longnose Sucker	*Catostomus catostomus*	native non-game fish, common
Channel Catfish	*Ictalurus punctatus*	introduced game fish, common
Black Bullhead	*Amiurus melas*	introduced game fish, uncommon
Burbot	*Lota lota*	native game fish, rare
Three-Spined Stickleback	*Gasterosteus aculeatus*	native non-game fish, abundant
Sandroller	*Percopsis transmontana*	native non-game fish, rare
Largemouth Bass	*Micropterus salmoides*	introduced game fish, common
Smallmouth Bass	*Micropterus dolomieu*	introduced game fish, common
Black Crappie	*Pomoxis nigromaculatus*	introduced game fish, common

Common Name	Scientific Name	Species category and general abundance
White Crappie	*Pomoxis annularis*	introduced game fish, common
Bluegill	*Lepomis macrochirus*	introduced game fish, uncommon
Pumpkinseed	*Lepomis gibbosus*	introduced game fish, uncommon
Torrent Sculpin	*Cottus rhotheus*	native non-game fish, common
Prickly Sculpin	*Cottus asper*	native non-game fish, common
Walleye	*Stizostedion vitreum*	introduced game fish, common
Yellow Perch	*Perca flavescens*	introduced game fish, common

game fish, and introduced non-game fish. There are six species of native game fish, 14 species of native non-game fish, 11 species of introduced game fish, and two species of introduced non-game fish inhabiting the project area. The six species of native game fish include: rainbow, cutthroat and bull trout, lake and mountain whitefish, and turbot. Of these species, rainbow trout and mountain whitefish are common throughout the project area, while the other species are either uncommon or rare.

The 14 native non-game species include seven cyprinid species, with the northern pikeminnow, peamouth, chiselmouth, and redside shiner being abundant throughout the project area. Also included in this group are three sucker species, with largescale and bridgelip sucker being abundant in the project area. Other native non-game species include several sculpin species and the three-spined stickleback.

The 11 introduced game species contain representatives from four families. Brown trout and brook trout are relatively rare, whereas the two catfish species, six sunfish species, and two percid species are more common in the project area. Of these species, the smallmouth bass and walleye are the most common.

Pfeifer et al. (2001) describes reservoir habitat use by resident fish species. Habitat within the Wanapum and Priest Rapids reservoirs appears to be different than some other Columbia River reservoir systems. Most species sampled were associated with finer substrates and shallower depths; however, some of the more abundant fish species in the Priest Rapids Project area are habitat generalists that can successfully complete their life cycles under either riverine or lacustrine conditions.

Bull Trout

Specific information regarding bull trout populations in the mid-Columbia River region is limited and the species is not abundant within the Project area. In a letter dated January 18, 2000, the FWS indicates that there are 16 subpopulations of bull trout inhabiting the mid-Columbia River region, primarily occurring in the Yakima, Wenatchee, Entiat, and Methow river basins. Historically, bull trout occurred in larger areas of these four river basins and the Columbia River; however, the FWS believes that bull trout have been extirpated from nine streams within the mid-Columbia area.[32]

Bull trout exhibit several life-history forms including migratory and resident forms; however, even resident bull trout are known to make seasonal movements to overwintering areas (Jakober, 1995 as cited in the FWS letter filed January 18, 2000). Migratory corridors link seasonal habitats for all bull trout life-history forms and the ability to migrate appears to be a significant factor affecting the persistence of local bull trout subpopulations (Rieman and McIntyre, 1993).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 155 miles (250 kilometers) to spawning grounds (Fraley and Shepard, 1989).

In 1999, Grant PUD completed an intensive survey of the Priest Rapids Project area using multiple gear types. During this survey, only two bull trout were sampled. Both were caught during boat electrofishing; on November 4, 1999, a 280-mm bull trout was captured in Priest Rapids reservoir about two miles above the dam, and on November 6, 1999, a 230-mm bull trout was captured in Wanapum reservoir at RM 430 (Pfeifer et al. 2001).

On June 10, 1998, the FWS listed the Columbia River population segment of bull trout as a threatened species under the ESA.

To describe the migration patterns and movements of bull trout past mid-Columbia hydroelectric projects, Chelan, Douglas, and Grant PUDs co-funded a telemetry evaluation of movement and distribution of bull trout in the mid-Columbia River (BioAnalysts 2003). All bull trout tagged for this study were trapped at Rock Island, Rocky Reach and Wells dams. The occurrence of bull trout at the Project was too low to allow for any tagging at this site. During the study no tagged bull trout passed through Wanapum or Priest Rapids dams; however, several fish entered the upstream end of the Wanapum reservoir (i.e., the Rock Island tailrace).

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[32] In a letter filed with the Commission on January 18, 2000, the FWS reported that bull trout have been extirpated from Satus Creek, Nile Creek, Orr Creek, Little Wenatchee River, Napecqua River, Okanogan River, Eightmile Creek, South Fork Beaver Creek, and the Hanford reach of the Columbia River.

White Sturgeon

White sturgeon inhabit most of the Columbia River and its larger tributaries, most notably the Snake River. White sturgeon can exhibit an anadromous life history, although due to isolation of dams and other factors many populations have adapted to an entirely freshwater life history. This is most likely the case for white sturgeon in the Project area.

The white sturgeon is the largest North American sturgeon species and may be the world's largest species of freshwater fish. White sturgeon can reach lengths greater than 10 ft, and there is a record of a white sturgeon weighing 1,387 pounds.

White sturgeon are spring spawners. Spawning in the project area occurs during the month of July in the tailraces of Wanapum and Rock Island dams. The Hanford Reach downstream of Priest Rapids dam also contains important white sturgeon spawning habitat. The eggs are brown and sticky and adhere to the bottom. Adults survive spawning and may spawn many times during their lives, which can last over 100 years. White sturgeon feed primarily on the bottom, although white sturgeon are often seen breaching the water's surface and are likely capable of a variety of feeding behaviors.

Grant PUD initiated a three-year study of white sturgeon in 2000. The results of this study show that sizable populations of white sturgeon reside in the Project area. A total of 115 white sturgeon were captured during set-line sampling, with 94 sampled in Wanapum reservoir and 21 captured in Priest Rapids reservoir (Porto et al. 2003). All of the 21 sturgeon sampled from Priest Rapids reservoir were sub-adult or adult, with no juveniles (fish <100 cm) observed in samples. Catches were greater in Wanapum reservoir, and 22 juvenile white sturgeon were sampled. These fish were as small as 20 inches length and two pounds in weight. The sex ratio for Priest Rapids sturgeon was skewed towards females, while the sex ratio for Wanapum was nearly 1:1. White sturgeon from 16 to 42 years of age were sampled from Priest Rapids reservoir, with sturgeon from 4 to 37 years of age from Wanapum reservoir.

Results of the study suggested that white sturgeon tend to occupy deep mid-reservoir areas and make periodic feeding or spawning movements to shallower and faster habitats. During the study, fish in Priest Rapids reservoir tended to use the Wanapum tailrace area year-round while Wanapum reservoir sturgeon tended to spend more time in deeper areas further away from Rock Island dam with late-spring movements upstream to spawning areas. Key overwintering areas were identified in both reservoirs at some of the deepest locations within the reservoirs.

The population of white sturgeon in Wanapum reservoir was estimated at 817 fish with a 95% confidence interval from 398 to 1,711. Too few fish were recaptured at Priest Rapids reservoir to allow calculation of a population estimate.

Spawning was documented at both the Wanapum and Rock Island tailraces through egg and larval collections in each year of this study. Multiple spawning events were documented in 2000 and 2002, with a lower level of spawning observed during the drought year of 2001. Spawning took place in late June through July at water temperatures ranging from 15-18°C. In 2002, sub-samples of the eggs collected were placed in incubation capsules to evaluate whether the eggs were fertilized. Successful hatching to the larval lifestage was observed at both spawning areas. These data show that reproduction is occurring in both reservoirs although the lack of juvenile fish in Priest Rapids reservoir suggests recruitment may be poor at this site.

3.5.2 Environmental Effects and Recommendations

Salmon and Steelhead – Passage Standards

As part of the SSA, Grant PUD proposes to provide 91 percent combined adult and juvenile passage survival through the project area, including 95 percent dam passage survival for juvenile fish moving downstream past the project. If Grant PUD can not achieve 95 percent dam passage survival, they would consult with the joint fisheries parties to improve survival through additional operational or structural modifications. Grant PUD proposes to compensate for unavoidable losses with hatchery supplementation (7 percent) and habitat mitigation (2 percent) which are evaluated below.

Under section 18 of the FPA, NMFS prescribes that Grant PUD make steady progress towards achieving a minimum 91 percent combined adult and juvenile salmonid survival performance standard at the Priest Rapids and Wanapum developments. NMFS prescribes that Grant PUD develop and implement a plan to achieve 93 percent juvenile salmonid project passage survival by 2010 and measure juvenile survival, as specified in the SSA, by 2013.

Under section 18 of the FPA, Interior prescribes that Grant PUD make progress towards achieving at least 91 percent combined adult and juvenile salmonid survival at each project dam by 2010. Interior indicates that 91 percent survival standard applies to each dam and includes achieving 95 percent dam passage survival and 93 percent combined dam and reservoir passage survival. Interior indicates that Grant PUD should have measures in place to achieve these performance standards by 2010 and shall have measured survival for UCR spring-run Chinook salmon and UCR steelhead by 2013.

Under section 10(j) of the FPA, Washington DFW recommends that the SSA be incorporated into any new license issued for the Project in its entirety. Washington DFW is essentially recommending the same measures proposed by Grant PUD and described above.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD be required to develop and implement a plan to meet a passage standard whereby direct and indirect juvenile salmon mortality through each reservoir, dam, and tailrace would not exceed 8.5 percent by 2013. CRITFC recommends that Grant PUD achieve 80 percent fish passage efficiency by 2013 and 90 percent fish passage efficiency by 2020.[33] CRITFC recommends that Grant PUD design and implement a plan to provide 97-98 percent quantitative survival for upstream and fallback passage of adult salmon and steelhead by 2013. CRITFC recommends that Grant PUD operate the fishways to achieve a median upstream passage time of 24 hours for salmon and steelhead at each dam. CRITFC recommends that Grant PUD develop a detailed fishery operations plan to meet the performance goals and objectives for salmon, lamprey, and other aquatic species.

Our Analysis

The project passage survival standards proposed by the Grant PUD, NMFS, Interior, and Washington DFW for anadromous salmon and steelhead survival are essentially the same standards being implemented as part of the HCPs for the upstream Rock Island, Rocky Reach, and Wells projects. These standards were developed based on the results of extinction risk modeling and are generally consistent with the performance standards included in the 2000 Federal Columbia River Power System biological opinion for the Lower Snake and Columbia River projects (NMFS; 2000).[34] These survival standards are a significant component of a region-wide effort to keep federally-listed fish species from becoming extinct and non-listed species from being listed.

The existing license for the Project was amended to require achievement of these survival standards on December 16, 2004.[35] In comments filed on July 8, 2005, Grant

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[33] Fish passage efficiency represents the proportion of fish passing a dam via non-turbine routes.

[34] In comments on the draft EIS, American Rivers indicated that the Federal Columbia River Power System biological opinion was rendered invalid and replaced by a 2004 biological opinion. The 2004 biological opinion was subsequently invalidated as well, but remains in place until a new one is issued.

[35] The survival standards were included as Action 1 of the reasonable and prudent alternative for interim operation of the Project in NMFS's May 3, 2004, Biological

PUD indicated that it has already begun to design and implement measures to meet the required performance standards.

The survival standards proposed by Grant PUD and the agencies include alternative means for measuring the achievement of the targeted survival levels. For instance, the 91 percent survival standard combines the adult and juvenile fish survival through the project; however, because it is not currently possible to conclusively differentiate hydro-related mortality from natural adult mortality, the survival standard would likely be measured through alternative means relative to juvenile fish passage. One approach would assume 98 percent adult survival through each development (dam and reservoir) which NMFS (2002) reports is reasonable based on the best available data throughout the region. To achieve the 91 percent combined adult and juvenile survival standard when adult survival is assumed to be 98 percent, the juvenile passage survival for each development would need to be at least 93 percent.[36] In comments filed on May 27, 2005, NMFS indicates that the 93 percent juvenile survival standard would include downstream passage through the reservoir and dam over 95 percent of the migration.

Various types of tagging studies have demonstrated that measurement of the juvenile passage survival through each development may be feasible; however, if Grant PUD were unable to measure juvenile survival through each development, Grant PUD and the agencies propose that juvenile dam passage survival could be measured instead. Grant PUD and the agencies indicate that to achieve the combined adult and juvenile dam passage survival standard, juvenile dam passage survival would need to be at least 95 percent.[37] NMFS (2002) reports that this measurement would not include indirect or delayed mortality resulting from project operations.

Achieving the combined adult and juvenile survival standard in combination with the proposed hatchery and habitat mitigation (both discussed below) would mitigate for project effects on anadromous salmon and steelhead stocks to the maximum extent practicable. NMFS (2002) reported that implementing the survival standards at all five PUD-operated dams would increase juvenile downstream passage survival by 116 and 135 percent. Implementation of the habitat improvements would further increase survival

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Opinion.

[36] Under this scenario adult mortality would be 2 percent and juvenile mortality would be 7 percent per development. The combined adult and juvenile mortality would be 9 percent (i.e., 2 + 7 = 9) which achieves the combined 91 percent adult and juvenile survival standard.

[37] This scenario assumes 2 percent adult mortality and 2 percent juvenile mortality per reservoir. At 95 percent survival, juvenile dam passage mortality would be 5 percent resulting in combined adult and juvenile mortality of 9 percent (i.e., 2 + 2 + 5 = 9) which achieves the combined 91 percent adult and juvenile survival standard.

to a total of between 123 and 149 percent of the recent survival levels. These increases should result in increased adult returns of all mid-Columbia River anadromous salmon and steelhead stocks and would reduce the extinction risk to federally-listed endangered UCR spring-run Chinook salmon and UCR steelhead.

For other mid-Columbia River projects, NMFS (2002) reported that if neither form of juvenile passage survival described above can be measured accurately, juvenile dam passage survival would be estimated based on the best available data. NMFS (2002) indicates that this process may be necessary for juvenile sockeye salmon and sub-yearling Chinook salmon since measuring dam passage survival for these species is not currently possible based on existing technology. During their outmigration, these fish are generally smaller than outmigrants of the other anadromous salmonid species and there are currently no effective methods for conducting a survival study of these species. Under section 18 of the FPA, NMFS prescribes that Grant PUD measure the survival of these species by 2013. This requirement suggests that NMFS anticipates some technological or methodological development will occur in the next few years that would allow passage survival testing of these species. To address this NMFS requires, as part of the section 18 prescription, Grant PUD to participate in regional efforts to develop survival study methods for juvenile sockeye salmon and sub-yearling Chinook salmon. It is not clear how Grant PUD would address this requirement if new survival methods are not developed, although it is possible that other parameters or methods may be used to address these species. One approach may be to approximate sockeye salmon and sub-yearling Chinook salmon survival estimates from measurements of yearling salmon or steelhead survival. This would be similar to the method currently used to calculate sub-yearling survival for the NNI fund included in the SSA. Another approach could include substituting fish passage efficiency for survival. As part of their preliminary prescriptions under section 18 of the FPA, NMFS recommended that Grant achieve 80 percent fish passage efficiency at each Priest Rapids Project dam for sub-yearling migrants.[38] Fish passage efficiency is the percentage of the run that passes the dam via non-turbine routes (i.e., spillways, sluiceways, and fishways)

At many hydroelectric projects, non-turbine passage routes generally provide higher survival rates than turbine passage routes. This appears to be the case for Priest Rapids dam; therefore, achieving an 80 percent fish passage efficiency would likely result in higher survival rates for these species than would occur if more fish were passing the dam via turbine routes. However, at Wanapum dam, English et al. (2001) present results suggesting that spillway passage survival may be lower than turbine

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[38] In its letter filed on May 27, 2005, NMFS uses the phrase “fish guidance efficiency” which it defines as the proportion of fish passed via non-turbine routes. This definition is the same as Grant PUD’s and CRITFC’s definitions for “fish passage efficiency”. For consistency, we use “fish passage efficiency” throughout this document.

passage survival. Additionally, in comments filed on May 27, 2005, NMFS stated that at Wanapum dam spill has consistently been the most lethal route to pass fish. Therefore, increasing the use of non-turbine passage routes such as spillways to achieve 80 percent fish passage efficiency may not increase the overall passage survival of these species at Wanapum dam. In comments on the draft EIS, NMFS indicated that Grant PUD should determine the cause of poor spillway survival. We address this recommendation below under *Salmon and Steelhead – Downstream Passage*.

The Yakama and Alaska DFG indicate that Grant PUD should be required to meet the survival standards within a reasonable, yet aggressive timeframe. They suggest that the survival standards should be met for all anadromous salmonid species by 2013. As indicated above, the SSA and NMFS section 18 prescriptions propose that Grant PUD would develop and implement a plan to achieve 93 percent juvenile salmonid project passage survival by 2010 and would measure juvenile survival of all species by 2013. If the survival standards are not met by 2013, Grant PUD would implement additional modifications to improve survival or implement additional mitigation or enhancements.

Alaska DFG also states that because the SSA does not include a deadline for achieving the survival standards, Grant PUD could operate the project without meeting the survival standards for the entire license term. While this conclusion is technically correct, it does not appear to be consistent with the spirit of the agreement. Under the terms of the settlement agreement, there would be no specific date that Grant PUD would be required to meet the survival standards; however, Grant PUD must “make steady progress” towards achieving the survival standards. To “make steady progress,” Grant PUD would continue to examine approaches to improve survival throughout the license term or until the standards would be met. It is not apparent that imposing a strict deadline would provide any additional certainty of achieving the survival standards, since under either scenario it would be possible that Grant PUD would never achieve the survival standard for a given species.

CRITFC recommends that Grant PUD be required to develop and implement a plan to meet a passage standard whereby direct and indirect juvenile salmon mortality through the reservoir, dam, and tailrace would not exceed 8.5 percent by 2013. CRITFC was unclear about whether this standard would be applied to the entire project or each development. We assume they intend for it to apply to each development, in which case it would be that same as achieving 91.5 percent juvenile passage survival at each development.

In comments filed on July 8, Grant PUD states that CRITFC’s recommended standard represents an unrealistic and extreme position that attempts to impose arbitrary, impossible standards on the project. Grant PUD provides no evidence why this standard is extreme or unrealistic and does not specifically address why they believe the standard is arbitrary or impossible.

There are two apparent differences between the survival standard recommended by CRITFC and the standard proposed by Grant PUD and the agencies. The standard proposed by CRITFC would include mortality in the reservoir, dam, and tailrace whereas the standard proposed by Grant PUD would address mortality within the reservoir and at the dam, but not necessarily in the tailrace.[39] Additionally, the survival percentage recommended by CRITFC is 1.5 percent lower than the standard proposed by Grant PUD and the agencies. CRITFC does not provide any discussion of the derivation of their recommended standard or any explanation why their standard differs from the agency standard. Including tailrace mortality would make the CRITFC standard somewhat more comprehensive; however, the CRITFC standard is more lenient in that it would allow 1.5 percent more mortality than the standard proposed by Grant PUD and agencies. It is unclear how much additional benefit, if any, there would be from adopting the survival standard proposed by CRITFC. Depending on the level of direct and indirect mortality that occurs within the tailrace, the CRITFC standard would be more or less protective than the standard proposed by Grant PUD and the agencies.

CRITFC also recommends that Grant PUD achieve 80 percent fish passage efficiency by 2013 and 90 percent fish passage efficiency by 2020. This standard would be in addition to achieving the survival standard recommended by CRITFC. As indicated above, spillway passage survival appears to lower than turbine passage survival at Wanapum dam; therefore, while achieving 80 percent fish passage efficiency would potentially increase juvenile survival at Priest Rapids dam, it would potentially decrease survival at Wanapum dam. Achieving 90 percent fish passage efficiency by 2020 could further increase downstream passage survival at Priest Rapids dam and further decrease survival at Wanapum dam.

CRITFC indicates that passage efficiency standards are necessary to address delayed mortality that is not accounted for by the survival standards. As part of this recommendation, CRITFC recommends that Grant PUD be required to assess delayed mortality. CRITFC and Umatilla indicate that delayed mortality associated with turbine passage is likely to be higher than through spill and surface bypasses. They provide survival estimates that suggest long-term survival after turbine passage is 2 to 16 percent lower than spillway survival (Gilbreath et al., 1993; Whitney et al., 1997). CRITFC presents several methods for assessing delayed mortality, including examining fish for post-passage injuries, holding balloon tag recoveries for 10 days, and comparing smolt-to-adult returns of PIT-tagged individuals released above and below the project. In

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[39] In comments on the draft EIS, NMFS indicates that some survival studies conducted by Grant PUD, such as radio tag studies, could provide a measure of tailrace survival.

response to CRITFC's recommendations, Grant PUD indicates that PIT-tags are the most reliable method for determining the combined effects of direct and indirect (delayed) mortality; however, they indicate that no known methodologies are available to partition direct and indirect mortality. Additionally, Grant PUD states that the notion of delayed mortality is speculative and there is no data to support the theory that delayed effects of turbine passage are greater than other routes.

While direct and indirect effects may not be distinguishable, conducting long-term survival studies would provide additional information regarding route-specific survival. However, because the spills currently provided by Grant PUD are often limited by TDG, it does not appear that modification of spill releases would be possible if the delayed mortality studies suggest fish passage efficiency (i.e., non-turbine passage) should be increased. In fact, Grant PUD's proposal to install the Wanapum future unit 11 bypass and investigate top-spill bypass designs for Priest Rapids dams is the only current proposal that appears to provide a feasible means for adjusting fish passage efficiency. We evaluate these passage proposals below in the section entitled *Salmon and Steelhead – Downstream Passage*.

CRITFC recommends that Grant PUD provide 97-98 percent quantitative survival for upstream and fallback passage of adult salmon and steelhead by 2013. In response to CRITFC, Grant PUD states that the suggestion of a passage standard of 97-98 percent is inconsistent with virtually every other plan for salmon and steelhead currently being implemented. Grant PUD also states that the CRITFC recommendation is an unrealistic and extreme position that attempts to impose arbitrary, impossible standards.

Measurement of adult passage survival through each development is currently limited by the available technology. Currently, the numbers of adult fish necessary for statistically valid survival estimates can only be tracked from dam to dam and various non-project-related factors may cause fish to "disappear" between adjacent dams. These factors include, but are not limited to, spawning within the reservoir, migration into tributaries for spawning, harvest, and natural mortality. At this time, NMFS suggests that assuming 98 percent adult survival through each development (dam and reservoir) is reasonable based on the best available data throughout the region. However, as newer technologies are developed, it may become possible to track large numbers of adult fish moving through the project area which could provide a method for accurately measuring adult survival. Providing 97 or 98 percent adult passage survival through each development would help Grant PUD achieve the combined adult and juvenile passage survival standard which would help to prevent extinction of the federally-listed endangered species and prevent listing of non-listed species.

CRITFC recommends that Grant PUD be required to achieve a median upstream passage time of 24 hours for each dam. CRITFC indicates that median passage times for adult salmon moving upstream past the project range from 12 to 36 hours, while median for most Columbia River mainstem dams is about 24 hours.

CRITFC indicates that excessive passage times may reduce adult salmon and steelhead energy reserves and reproductive viability; therefore, reducing upstream passage times would likely have some incremental benefit. Implementing the recommended travel time standard would potentially result in Grant PUD needing to implement measures to reduce upstream travel times at the project dams. This is consistent with what Grant PUD is already doing and proposing to do as part of the SSA. Recently Grant PUD addressed delay between the collection channel and the entrance to the left bank fishway at the Priest Rapids dam by closing the collection channel orifice gates and modifying the fishway entrance gate configurations. Additionally, as part of the SSA, Grant PUD is proposing to study methods to improve inadequate collection channel velocities which are a source of delay at both dams. Improvement of collection channel conditions should reduce passage delays and improve upstream passage times.

CRITFC recommends that Grant PUD develop a detailed fishery operations plan to meet the performance goals and objectives for salmon, lamprey, and other aquatic species. CRITFC indicates that this plan would address turbine operations, fishway operations, inspections, and modifications, spill gate inspections, and bypass system operations and inspections. Development and implementation of a fishery operations plan would ensure that protocols are developed for operation and inspection of project facilities. It would also consolidate all operational protocols and inspection procedures in a single document which would simplify any necessary reviews and updating. Implementation of such a plan would ensure that project facilities are operated in a manner to minimize project effects on fisheries resources.

Salmon and Steelhead – Upstream Passage

As part of the SSA, Grant PUD proposes to continue to operate and maintain two adult fishways at each dam, investigate methods for improving hydraulic conditions in the collection channels, junction pools, and entrance pools, and implement improvements based on monitoring and evaluation. Grant PUD would operate the sluiceways at both Priest Rapids and Wanapum dams to provide fallback routes for adult salmon and steelhead and downstream passage for kelts (i.e., post-spawned steelhead adults). Grant PUD would construct a new adult trapping facility at Priest Rapids dam. Grant PUD would fund fish counting at Priest Rapids and Wanapum dams and develop video monitoring capability for each fishway.

Under section 18 of the FPA, NMFS prescribes that Grant PUD be required to investigate methods for improving hydraulic conditions in the collection channels, junctions pools, and entrance pools of the project fishways. NMFS prescribes that Grant

PUD complete the construction of an off-ladder adult trapping facility in the left-bank fishway at Priest Rapids dam. NMFS prescribes that Grant PUD develop and install video monitoring capability for counting adult salmon and steelhead migrating through the right and left bank fishways at Priest Rapids and Wanapum dams. NMFS prescribes that Grant PUD operate the sluiceways at Priest Rapids and Wanapum dams continually from the end of summer spill to November 15 to provide a safe anadromous fish fallback route and a safe steelhead kelt passage route.

Under section 18 of the FPA, Interior prescribes that Grant PUD shall continue to construct, operate, maintain, and monitor all of the upstream passage structures, facilities, and devices contained in the existing license. Additionally, Interior prescribes that Grant PUD provide for the construction, operation, maintenance, and effectiveness monitoring of improvements to the Wanapum and Priest Rapids fish ladders. Interior prescribes that Grant PUD shall manage the project to provide effective upstream fish passage over the full range of river flows and that Grant PUD develop a fishway operation and maintenance plan.

Under section 10(j) of the FPA, Washington DFW recommends that the SSA be incorporated into any new license issued for the Project in its entirety. Washington DFW is essentially recommending the same measures proposed by Grant PUD and described above.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD develop and implement a measures-based upstream passage and fallback assessment and implementation plan. CRITFC recommends that Grant PUD provide safe, timely, and effective passage for steelhead kelts.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD investigate the impact of peaking operations on adult passage through the project dams.

In comments on the draft EIS, Umatilla recommended that Grant PUD should provide spill at Priest Rapids dam and spill or top-spill at Wanapum dam to protect adult fallbacks and kelts. Additionally, in comments on the draft EIS, American Rivers recommended that Grant PUD conduct adult salmon and steelhead downstream passage studies.

In comments on the draft EIS, Umatilla recommends that the hydrosystem apply restoration techniques to correct thermal problems in the river that affect adult sockeye salmon migration timing and potentially survival.

Our Analysis

Priest Rapids and Wanapum dams have fishways located on both the right (east) and left (west) sides of each dam. Grant PUD has conducted a variety of studies of upstream salmon and steelhead passage through these ladders. In the license application, Grant PUD reports that the majority of Chinook salmon passage occurs over the left bank fishways at both dams. Grant PUD reports that the amount of time required for adult salmon and steelhead to pass Priest Rapids and Wanapum dams has ranged from 8 to 45 hours. Some delay in passage appears to have historically occurred between the collection channel and the entrance to the left bank fishway at the Priest Rapids dam (Stuehrenberg et al.; 1995). In comments filed on May 27, 2005, NMFS indicates that fishway entrance delays associated with water elevation differentials were addressed by Grant PUD closing the collection channel orifice gates and modifying the fishway entrance gate configurations. In comments on the draft EIS, NMFS indicated that the majority of remaining passage delay at the project is associated with inadequate collection channel velocities, which Grant PUD is in the process of rectifying.

Grant PUD is proposing to operate and maintain the two adult fishways at each dam according to the existing Fishway Operating Plans. These plans where developed in coordination with the agencies and tribes and are being implemented under the existing license. The plans include: 1) measures to enhance entrance attraction at the fishway through planned operation of spill gates and turbines; 2) an investigation of modifications to improve the ability of the ladders to operate within the specified criteria; 3) modeling or other evaluations to determine the best action for correcting delay problems in the junction pool areas; 4) development of solutions and implementation of corrective actions in consultation with NMFS when adult passage problems are identified; 5) operation of spillways and sluiceways to provide downstream passage routes for kelts and adult fallback; 6) evaluation of steelhead passage using radiotelemetry, and 7) development and testing of a video fish counting system at Wanapum dam. Implementation of the Fishway Operating Plans would provide a mechanism for managing and monitoring the four project fishways and would maintain or improve upstream passage for adult salmon and steelhead at the project. We discuss several of the specific measures included in the plans below.

In comments filed on May 27, 2005, NMFS indicates that while delays to the left-bank entrance at Priest Rapids dam have been reduced, collection channel velocities do not meet standards used at other mainstem dams in the Columbia River basin. Consistent with the SSA, NMFS recommends that Grant PUD investigate methods to improve hydraulic conditions in the Priest Rapids collection channel, junction pool, and entrance pools. Specifically, NMFS recommends that Grant PUD maintain a water velocity of 1.5 to 4 feet per second in the powerhouse collection channel and a water surface differential of 1 to 1.5 ft among the entrance pools and the tailrace. Grant PUD is currently conducting an assessment to determine what modifications may be necessary to comply with these criteria. Improving hydraulic conditions in the Priest Rapids collection channel, junction pool, and entrance pools would improve the ability of fish to locate and enter the fishway thereby reducing the passage time at Priest Rapids dam for adult salmon and steelhead.

Fallback occurs when fish that have passed upstream of a project, return downstream. This can happen when fish migrate upstream past their intended spawning destination (i.e., overshoot) or when fish become disoriented and involuntarily return downstream (i.e., entrained passage through a spillway or turbine). In the license application, Grant PUD indicates that fallback rates vary from as much as 15-20 percent for spring and fall Chinook salmon to as low as 1-5 percent for summer Chinook salmon and sockeye salmon. Fallback rates are generally lower at Wanapum dam and other dams upstream of the Priest Rapids dam. Stuehrenberg et al. (1995) attributed some of the Priest Rapids dam fallback to returning adult fish overshooting the Ringhold Hatchery.[40] Grant PUD suggested that some of the fall Chinook salmon fallback may be fish that have overshot their destination within Hanford Reach.

In addition to fallbacks, a large proportion of adult steelhead move downstream past the Priest Rapids Project after spawning. These fish are referred to as kelts. English et al. (2001) estimated that approximately 34 to 69 percent of the steelhead run survives spawning and returns downstream through the project area as kelts.

No project specific survival estimates are available for adult salmon and steelhead passing downstream at the Project. In comments filed on May 27, 2005, NMFS reports that at the Snake River projects, fallback through spillways can result in 8 percent mortality and fallback through turbines can result in 14 to 26 percent mortality of adult fish. In the license application and in comments filed on July 8, 2005, Grant PUD indicated that the majority of steelhead and a large number of other adult salmonids use the project sluiceways for downstream passage. Grant PUD indicates that it has operated the project sluiceways for fallback and kelt passage since 1998. Additionally, Grant PUD has constructed a concrete chute at the Wanapum dam sluiceway to provide a smoother transition for downstream migrating adult fish. Currently, Grant PUD operates the project spillways and/or sluiceways continually from April 15 to November 15 each year to provide fallback and kelt passage.

As proposed in the SSA, Grant PUD would provide spill or top-spill flows at both dams for downstream passage of juvenile fish from April through the end of July or early

[40] The Ringhold Hatchery is located in the downstream end of the Hanford Reach near the cities of Richland, Kennewick, and Pasco, Washington

August depending on juvenile run timing.[41] During this time, these spills would also provide a safe downstream passage route for adult fallbacks and kelts. These spills would be available during the entire upstream migration of adult spring Chinook salmon and sockeye salmon and most of the upstream migration for summer Chinook salmon and steelhead. Upper Columbia River steelhead typically spawn from March through June; therefore, spring spills would provide a downstream passage route for any post-spawned steelhead that would be returning to the ocean (i.e., kelts). After completion of the summer spill program, Grant PUD would provide sluiceway flows until November 15 each year. These sluiceway flows would provide a downstream passage route for fallbacks of fall Chinook salmon and steelhead that may be moving upstream past the project dams at that time.

In comments on the draft EIS, Umatilla stated that sluiceway passage would not be adequate to protect adult fallbacks or kelts. Umatilla stated adult mortality through turbines is very high and sluiceway flows would be only a small fraction of total streamflow. Umatilla recommend that Grant PUD provide spillflows at Priest Rapids dam and spillflows or top-spillflows at Wanapum dam for protection of adult fallbacks and kelts. As indicated above, spillway flows would be provided for kelts during the time when they would be moving downstream. Additionally, spillway flows would be provided during a significant portion of the adult salmon and steelhead migration period (i.e., through late July or early August). Sluiceway flow would only be provided as a fallback route during a portion of the steelhead run and all of the fall Chinook salmon run. Umatilla did not indicate why providing sluiceway flows from August to mid-November would be inadequate for fall Chinook salmon and steelhead fallbacks nor did they indicate how much spillway flow would be needed to provide safe passage during this period. Without this information we are unable to evaluate the potential effects of Umatilla's recommendation.

In comments on the draft EIS, American Rivers recommended that Grant PUD conduct adult salmon and steelhead downstream passage studies. American Rivers indicates that they support the modifications proposed by Grant PUD to provide better adult downstream passage conditions; however, they state that there is a substantial information gap regarding adult downstream mortality and there must be scientifically credible data for determining whether the sluiceways provide a safe route for adult downstream passage. American Rivers did not specify how adult downstream passage survival through the project sluiceways should be measured.

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[41] In comments on the draft EIS, Grant PUD indicated that the spill program at Wanapum dam recently changed from a Taintor gate spring fish spill program to a gate 12 top-spill and sluiceway spill program.

It is possible that Grant PUD could conduct a traditional release and recovery survival study with adult salmonids passing through the project sluiceways; however, several factors would make this type of study complicated and potentially infeasible. To avoid effects on ESA listed salmon and steelhead, Grant PUD would need to obtain unlisted returning adult salmon from local hatcheries or from the Priest Rapids adult fish trap. It is likely that the health of these fish could influence the study results; therefore, a system for determining adult condition and the acceptability for use in the study would need to be developed. Because several hundred fish would likely be needed to derive a statistically valid survival estimate, large facilities would be needed to hold treatment (fish released down the sluiceway) and control (fish released directly in the tailrace) fish. These facilities could be constructed on the dam or a barge attached to the dam. If holding facilities are unavailable or infeasible, adult passage trials could be held sequentially on a daily basis as fish become available within the adult trap. Recovery of treatment and control fish would likely be problematic. Net collection would be possible for both treatment and control fish; however, historically net effects on fish survival and injury have confounded the results of these types of studies. Balloon tags, which are commonly used to studies with juvenile salmonids would not likely have enough buoyancy to allow recovery of adult fish. Radio tracking could be used to determine if fish continue moving downstream or return to the fishways to continue upstream movements; however, the actual condition of the fish including survival and injury rates would not be quantifiable. Lastly, the invasive handling that would likely be associated with an adult downstream passage study would likely eliminate the possibility of these fish from contributing to any natural spawning population and they may be less viable for use in hatchery reproduction.

Even if conducting adult downstream passage studies through the project sluiceways is feasible, it is not clear how the results would be used. American Rivers did not suggest a target downstream survival rate for adult fish and they did not suggest any modifications that could be implemented if survival rates failed to meet the target rates. At this time, there is no information to indicate that any project modifications would provide better adult downstream passage survival than use of the project spillway and sluiceways.

During the adult migration season, Grant PUD reports adult passage counts through the Priest Rapids fishways. Historically, Grant PUD has not reported adult counts at Wanapum dam. Recently Grant PUD has begun testing of video count systems in the project fishways. In comments filed on July 8, 2005, Grant PUD indicates that a video count system has been installed and is operational at Priest Rapids dam. Grant PUD indicates that further testing and refinement of the system occurred during the 2005 migration season. At Wanapum dam, Grant PUD is also developing a video counting system and refinement of this system is ongoing. Grant PUD and the agencies recommend that these video counts systems be used to provide adult passage counts at both project dams. Implementation of these systems would provide more accurate and reliable information for in-season fisheries management.

Grant PUD operates and maintains PIT tag detection equipment in the left and right bank fishways at Priest Rapids dam. This equipment provides NMFS and the other agencies with information regarding smolt-to-adult returns of UCR spring-run Chinook salmon and UCR steelhead. In comments filed on May 27, 2005, NMFS indicates that PIT tag detection equipment at Ice Harbor dam (first mainstem dam on the Snake River), McNary dam (first dam downstream of the confluence of the Snake and Columbia Rivers), and Priest Rapids dam comprises a “triangle of detection” that allows fisheries managers to conduct long-term assessments of adult survival and track adult straying. Continued operation and maintenance of this equipment would enhance the information available in regard to adult salmon and steelhead survival and allow valuable fisheries management studies to continue.

CRITFC recommends that Grant PUD install PIT tag detection equipment at Wanapum dam. CRITFC indicates that installation of PIT tag detection facilities at Wanapum dam would reduce critical uncertainties regarding fallback rates and the ultimate fate of adults passing Wanapum dam and would allow calculation of smolt-to-adult returns from returning adults from juvenile survival studies. In comments on the draft EIS, Alaska DFG indicates that PIT tag detection equipment at Wanapum dam would serve “as a check” for the data obtained at Priest Rapids dam.

Grant PUD indicates that installation of PIT tag detection facilities at Wanapum dam is unnecessary. Facilities already installed at Priest Rapids dam serve to provide accurate information regarding smolt-to-adult survival which is influenced by many factors that are indistinguishable from project effects. Installation of PIT tag detection facilities at Wanapum dam would allow tracking of individual adult fish that have passed from Priest Rapids dam to Wanapum dam. However, it would provide little additional insight regarding fallback or the ultimate fate of adults since many other factors such as natural mortality, harvest, or straying could not be accounted for by PIT tag detection alone.

In comments on the draft EIS, Alaska DFG states that natural mortality, harvest, and straying between Priest Rapids dam and Wanapum dam would be insignificant. They state that natural mortality in a natural system free of natural disasters is negligible and straying and harvest could be statistically accounted for or studied. The amount of natural mortality that occurs between Priest Rapids dam and Wanapum dam is currently unknown and cannot be measured. This is the primary reason why Grant PUD and the agencies have not attempted to estimate upstream passage survival and assess achievement of the adult passage standard. Additionally, it is likely that some level of natural mortality, harvest, and straying occurs over the 18 mile section of river between

Priest Rapids dam and Wanapum dam and failing to account for these losses would reduce the value of comparisons of Wanapum and Priest Rapids PIT tag data. While natural mortality, harvest, and straying could be accounted for statistically, this approach would only add error to the analysis and would significantly compromise the value of using Wanapum PIT tag data "as a check" of Priest Rapids PIT tag data.

CRITFC recommends that Grant PUD examine and correct fishway temperature problems within the project fishways. CRITFC provides no evidence to indicate that any water temperature problem exists within the project fishways. Normandeau (2003) monitored water temperatures within the project fishways and found no significant longitudinal temperature changes in any of the 4 ladders (i.e., less than 0.2°C). Grant PUD is proposing to modify the water supply for the Priest Rapids fishways. The modification would involve replacing a portion of the water supply to the ladders that comes from the gravity intake gate with water that would be pumped from the tailrace. Grant PUD suggests this would provide a slightly cooler water source (approximately 0.3 °C cooler) in addition to developmental benefits.

Grant PUD operates a fish trap on the left bank fishway at Priest Rapids dam. Originally, this was a temporary facility designed to trap outmigrating smolts for transportation studies from 1984 to 1992. Subsequently the facility was used by Washington DFW to trap summer steelhead migrating upstream and by the Yakama Nation to collect adult coho salmon for the reintroduction program. NMFS indicates that the temporary facility is obsolete and lacks acceptable fish handling facilities for continued collection of adult fish. They indicate that the existing trap should be replaced with an off-ladder adult trapping facility. This measure is also included as part of the SSA filed by Grant PUD. In comments filed on July 8, 2005, Grant PUD indicates that it is in the process of designing an off-ladder trap, in consultation with the agencies and tribes, for the left-bank fishway at Priest Rapids dam. Construction of an off-ladder trap would provide regional fishery decision-makers with an important management tool for upper Columbia River fisheries research, passage studies, and other management activities.

CRITFC recommends that Grant PUD develop and implement a measures-based upstream passage and fallback assessment and implementation plan for the project. They indicate that in addition to the measures discussed above, the plan should include: 1) an assessment of new fishway designs to decrease energy expenditure; 2) evaluation of extending the fishway exits into the project forebays to reduce fallback; 3) creation of additional attraction flows at ladder entrances to reduce adult tailrace delay; 4) evaluation of the effects of the surface bypass superstructure at the Wanapum sluiceway on fallback adults and kelts; 5) evaluation of extended spill periods for providing fallback and kelt passage; 6) investigation of the impacts of power peaking on adult passage; 7) implementation of measures that would allow independent operation of the left and right bank fishway water supply systems; and 8) estimation of adult salmon energy expenditure during upstream passage through the fishway.

In general, these studies and evaluations would increase the available information regarding upstream fish passage at the project and could result in some improvements that would increase the efficiency of the upstream passage facilities. However, CRITFC does not provide any evidence that the requested information is needed or how it would be used. Additionally, some of these measures appear to be unnecessary since other measures are already being implemented to address suspected project effects. Examples include extended operation of project sluiceways for adult fallback and kelt passage instead of extended spill and exploration of measures to improve hydraulic conditions at the fishway entrances which would reduce adult delays. Implementation of the studies recommended by CRITFC would result in collection of substantial amounts of new specific information; however, there is little evidence to indicate that this information is necessary to improve upstream passage conditions or to address project effects on upstream passage.

CRITFC recommends that Grant PUD study the effects of peaking operations on adult fish passage through the project dams. CRITFC suggests that increased powerhouse discharge increases adult passage delay and may increase adult mortality during upstream passage. Increases in project discharge could influence the ability of adult salmon or steelhead to locate collection channel entrances by creating confusing flow conditions that conceal fishway attraction flows. Grant PUD has studied adult passage at both dams and found that the most significant delay problems occurred due to inadequate velocities in the collection channels and water surface differentials at the fishway entrances. Grant PUD has addressed delays associated with the fishway entrance water elevation differentials and is continuing to study problems associated with inadequate collection channel velocities. The monitoring results collected by Grant PUD do not suggest there are delays associated with fluctuating flows. As part of the Fishway Operating Plans mentioned above, Grant PUD proposes to continue monitoring adult upstream passage and implement corrective actions if problems are identified. We would expect that any significant delay problems associated with adult passage, including any associated with peaking operations, would be identified through this monitoring.

In comments on the draft EIS, Umatilla indicated that annual maximum water temperatures within the Columbia River have been steadily increasing in the Columbia River mainstem since 1938 and these increases have resulted in changes in the timing of the adult sockeye salmon migration. Umatilla states that sockeye salmon have shifted their migration earlier to compensate for increased migration temperatures and the migration occurs at temperatures greater than historic conditions. Umatilla suggests that water temperatures are approaching lethal levels for adult sockeye salmon and they recommend that the hydrosystem apply restoration techniques to correct thermal problems in the river.

We address project effects on waters temperatures in section 3.4.2 and in that section we indicate that we are not aware of any measures that could be implemented at the project to reduce water temperatures. Umatilla provided no specific recommendations for the Priest Rapids Project and they did not provide any examples of “restoration techniques” that may result in reduced water temperatures. Without more specific recommendations, we are unable to assess the potential effectiveness of measures that could be implemented by Grant PUD. If water temperatures were reduced, we would expect that sockeye salmon would shift their migration timing later; however, we would not anticipate any change in adult survival since we have no evidence or documentation to demonstrate that current temperatures are resulting in adult mortalities.

Salmon and Steelhead – Downstream Passage

As part of the SSA, Grant PUD proposes to continue to provide spill at Priest Rapids and Wanapum dams until a better juvenile salmonid downstream passage alternative is designed, tested, and implemented. At Priest Rapids dam, Grant PUD is proposing to spill 61 percent of the river flow during the spring outmigration and 39 percent of the river flow during the summer outmigration. At Wanapum dam, Grant PUD is proposing to spill 43 percent of the river flow during the spring outmigration and up to the TDG limits during the summer outmigration. Grant PUD proposes to evaluate modifications to the spill regimes and spill patterns at both dams that could improve juvenile salmonid survival while remaining within applicable TDG limits. Grant PUD proposes to continue to study ways to improve downstream juvenile salmonid survival at Priest Rapids dam, including alternative application of top-spill concepts. To improve turbine passage survival at Priest Rapids dam, Grant PUD would develop and implement operating criteria to avoid settings that have been shown to result in poor survival and, in the future, install new Advanced Design Turbines. To prevent smolts from entering the emergency wheelgate or bulkhead slots in Priest Rapids dam, Grant PUD would install gatewell exclusion screens. To improve downstream passage survival at Wanapum dam, Grant PUD is constructing a downstream fish bypass consisting of an ogee-crested weir through the center of future unit 11. Grant PUD proposes to develop and implement additional passage strategies if the future unit 11 bypass fails to achieve 95 percent passage survival. To improve turbine passage survival at Wanapum dam, Grant PUD would develop and implement operating criteria to avoid settings that have been shown to result in poor survival and install new Advanced Design Turbines. To prevent smolts from entering the emergency wheelgate or bulkhead slots in Wanapum dam, Grant PUD would install gatewell exclusion screens.

Under section 18 of the FPA, NMFS prescribes that Grant PUD complete construction of the surface bypass facility in future unit 11 of Wanapum dam by the 2007 juvenile downstream migration season. NMFS prescribes that Grant PUD continue to explore a juvenile bypass design for Priest Rapids dam focusing on alternative application of top spill concepts. Until more biologically efficient and effective measures are designed, tested, and implemented, NMFS prescribes that at Wanapum dam, Grant PUD spill 43 percent of the average daily total river flow and up to the TDG limits for the summer outmigration. At Priest Rapids dam, NMFS prescribes Grant PUD spill 61 percent of the average daily total river flow for the spring outmigration and 39 percent of the river flow for 95 percent of the summer outmigration. NMFS also prescribes that Grant PUD identify and eliminate potential sources of injury at the Wanapum spillway. NMFS prescribes that Grant PUD operate the turbines at both dams to optimize survival during the spring and summer outmigrations.

Under section 18 of the FPA, Interior prescribes that Grant PUD shall continue to construct, operate, maintain, and monitor all of the downstream passage structures, facilities, and devices contained in the existing license. Interior prescribes that Grant PUD shall manage the project to provide effective downstream fish passage over the full range of river flows. Additionally, Interior prescribes that Grant PUD provide for the construction, operation, maintenance, and effectiveness monitoring of the future unit 11 bypass system at Wanapum dam, the proposed new spillbay 22 juvenile bypass at Priest Rapids dam (subject to approval by NMFS and Interior), the unit 8 fish-friendly turbine at Wanapum dam, and the potential 9 additional fish-friendly turbine units at Wanapum dam.

Under section 10(j) of the FPA, Washington DFW recommends that the SSA be incorporated into any new license issued for the Project in its entirety. Washington DFW is essentially recommending the same measures proposed by Grant PUD and described above.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD index-test all individual turbines at each dam and operate each individual turbine within its peak efficiency range to maximize downstream fish passage protection.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD investigate the impact of peaking operations on juvenile passage through the project dams.

Our Analysis

In this section, we only address downstream passage survival of juvenile salmon and steelhead at the project dams. Passage survival through the project reservoirs is addressed below in the section entitled S*almon and Steelhead - Predator Control*.

Juvenile salmon and steelhead move downstream past the Wanapum and Priest Rapids dams via three primary routes: turbines, spillways, and the sluiceways. Juvenile passage through the turbines is possible anytime the dams are generating electricity. Spillway passage occurs when river flows exceed the capacity of the project or when river flow is intentionally released over the spillway to provide an alternative to turbine passage. The project sluiceways are available for fish passage during the periods when spill flows are released to provide fish passage and at times when an accumulation of ice or debris is being passed via the sluiceways from the forebay to the tailwater of the dam.

Other less utilized routes include the fish ladders and gatewell collection and transport. Some juvenile salmon and steelhead move downstream past the dams through the fish ladders. It is believed that this route is used by relatively few juveniles compared to the routes listed above. Gatewell collection and transportation is another way that juveniles can access the tailwater. During the migration period, a portion of the fish moving through the turbine intakes become trapped in the intake gatewells due to the hydraulic conditions in these areas. Grant PUD nets the gatewells at regular intervals during the outmigration period and manually transports the juveniles to the tailwater for release.

In the license application, Grant PUD reported that the percentage of steelhead and Chinook salmon smolts passing through the turbines ranged from 8-30 percent at Priest Rapids dam, while a much higher percentage of smolts used turbine routes at Wanapum dam. A portion of the fish passing the project dams via turbines are injured or killed. Common external injuries include scale loss and damaged eyes, gills, or operculum. Common internal injuries include ruptured air bladders and hemorrhaged organs. Injuries that occur during turbine passage are believed to primarily occur from contact with moving parts of the turbine, exposure to rapid pressure changes, or exposure to hydraulic conditions with high shear forces. Some injuries are severe enough to result in immediate or delayed mortality, while others may have little effect on the survival of the smolt.

In the license application, Grant PUD presents data indicating that turbine passage survival for steelhead and Chinook salmon smolts at Wanapum dam ranges from 88 to 98 percent. At Priest Rapids dam turbine passage survival ranged from 81 to 99 percent.

Historically, fish management agencies have attempted to increase downstream survival of salmonid smolts by reducing the number of fish passing through hydroelectric turbines. Estimates of the proportion of outmigrating fish passing a dam through non-turbine routes are referred to as fish passage efficiency. At Priest Rapids and Wanapum dams, the primary non-turbine routes available for downstream passage are the project spillways and sluiceways.[42] In the license application, Grant PUD presents recent estimates of fish passage efficiencies at Wanapum and Priest Rapids dams. In 2000, passage efficiency[43] for steelhead smolts was 54 percent at Wanapum dam and 71 percent at Priest Rapids dam. For yearling Chinook salmon, passage efficiencies at Wanapum dam were 62, 41, and 29 percent in 2001, 2002, and 2003, respectively. Yearling Chinook salmon passage efficiencies at Priest Rapids dam were 85, 92, and 75 percent in 2001, 2002, and 2003, respectively.

Spillway passage survival at Wanapum dam tends to be lower than at Priest Rapids dam. Grant PUD reports that testing from 2000-2003 indicated that Wanapum dam spillway passage survival for steelhead and salmon smolts ranges from 85-89 percent. At Priest Rapids dam, spillway passage survival ranges from 95-98 percent. Sluiceway passage survival ranged from 84-93 percent at Wanapum dam and 92-93 percent at Priest Rapids dam.

Over the years, Grant PUD has explored a variety of approaches to providing safe and effective downstream passage to salmon smolts. These include installation of downstream passage structures, truck transport, and spillway releases. To date, the most effective technique for providing downstream passage has been unforced spillway releases (i.e., spillway releases that occur when river flows are below the capacity of the turbines). At Wanapum dam, annual average spill flows during the spring migration period generally range from 30-45 percent of the river flow and at Priest Rapids dam spill flows range from 50-60 percent of the river flow. These spill flows are primarily limited by total dissolved gas conditions within the river (see section 3.4, *Water Quality and Quantity*) and higher spill flows would result in exceedences of water quality standards that may harm migrating smolts or other aquatic resources. In addition to concerns and limitations associated total dissolved gases, unforced spills reduce project generation. Therefore, in an attempt to develop a more biologically effective and cost effective technique for passing smolts downstream of the project, Grant PUD, in consultation with the agencies, has experimented with top-spill passage facilities. These structures allow Grant PUD to concentrate releases through a single spillbay and draw water from surface portions of the forebay.

Testing of top-spill devices in 2002 and 2003 demonstrated high fish passage efficiencies at Priest Rapids dam (65-77 percent). Results at Wanapum dam were less

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[42] In addition to normal spillway and sluiceway operations, Grant PUD has been testing the effectiveness of top-spill devices at both dams since 2002. Top-spill devices are structural modifications to the project spillways that result in the release of water from the surface of the forebay.

[43] In comments on the draft EIS, Grant PUD indicated that these estimates include all non-turbine passage routes (i.e., spillways, sluiceways, fish ladders, and gatewells).

successful with fish passage efficiencies ranging from 15-27 percent. Using the information from the top-spill experiments and applying a general understanding of smolt behavior, Grant PUD designed downstream passage facilities for both Wanapum and Priest Rapids dams and included these designs in their license application. As part of the SSA, Grant PUD proposes to construct and operate the Wanapum design; however, they do not propose to construct the Priest Rapids design at this time and instead propose to continue to study ways to improve downstream juvenile salmonid survival at Priest Rapids dam. This proposal is the same as NMFS's prescriptions for Priest Rapids dam made under section 18 of the FPA.

At Wanapum dam, the downstream passage facility would consist of a surface bypass at the location of future unit 11. Future unit 11 is a turbine bay that was constructed as part of the original dam construction but was never occupied by a turbine. This unoccupied turbine bay is between the spillway and powerhouse, immediately adjacent to the operational turbines. The bypass would consist of a 20-foot-wide, ogee-crested weir through the middle of future unit 11. Flows passing through the opening would gradually accelerate to the highpoint of the ogee and then descend via a spillway-like structure to a submerged chute in the tailrace. The downstream opening of the tailrace chute would widen to approximately 90 feet. The Wanapum dam surface bypass would be constructed to release flows up to 20,000 cfs. This bypass design was reviewed and approved by the Commission in an order issued on December 16, 2004. The facility is currently under construction and is scheduled to be operational in the spring 2007.

In comments on the draft EIS, NMFS indicated that survival through the prototype Wanapum dam bypass was high and survival through the permanent facility is expected to be high, but may be less than the prototype. NMFS indicates that other factors, such as tailrace survival, may influence the ultimate downstream passage survival achieved with the Wanapum bypass. NMFS suggested that other measures, such as installing bird wires or constructing a bypass outfall, may be necessary to achieve the passage survival standards and allow Grant PUD to reduce spills.

At Priest Rapids dam, the ongoing spillway and sluiceway releases appear to provide safe and effective passage for downstream migrating smolts. These spilled flows result in relatively high fish passage efficiencies (i.e., 71-92 percent) and high passage survival rates (i.e., 95-98 percent). However, these spilled flows reduce generation and power sales and can result in increased total dissolved gases. To reduce spillflows and decrease adverse effects on total dissolved gases, Grant PUD is proposing to study ways to improve juvenile salmonid survival at Priest Rapids dam. Grant PUD indicates that they would study the application of alternative top-spill concepts, which would include consideration of the modifications to spillway 22. These studies could lead to development of a downstream fish passage facility for Priest Rapids dam that could improve downstream passage survival of smolts, assist Grant PUD in achieving the proposed downstream fish passage survival standards, decrease the dam's influence on total dissolved gases, reduce spills, and increase power generation. We do not evaluate construction of a downstream passage facility at Priest Rapids dam in this EIS. The effects of that action would be addressed and evaluated if it is proposed by Grant PUD during the license term.

As part of their modified fishway prescriptions, NMFS indicated that additional review and study of downstream passage proposals at Priest Rapids dam is needed. Interior's recommendation is consistent with NMFS's recommendation. NMFS's recommendations indicate that they are reasonably satisfied by the effectiveness of the ongoing spill program since they have recommended continuation of this program until a more biologically efficient and effective passage measure is designed, tested, and implemented.

Grant PUD indicates that it anticipates that the future unit 11 bypass would enable them to achieve the downstream passage survival standard at Wanapum dam; however, if monitoring demonstrates that the standard is not being met, Grant PUD would implement, in consultation with the agencies and tribes, an adaptive management approach to further increase downstream passage survival. The adaptive management approach would include a stepwise decision process that could result in modifications to the proposed facilities or construction of additional facilities or modifications to project operations. Grant PUD indicates that if the bypass is not passing all the fish near the opening of the bypasses, the entrance conditions could be modified to improve fish collection hydraulics. If these modifications fail to result in achievement of the passage standards, other more significant modifications would be considered such as installation of floor plates, construction of a J-block, or experimentation with different bypass flow volumes. If the passage standards are still not met after implementing these modifications, Grant PUD would consider installing a top-spill device along the left-bank (western side) of the Wanapum dam. Implementation of this adaptive management program would provide a logical and practical approach to ensuring that the proposed bypass designs evolve to meet the proposed passage standards.

As indicated above, no one is currently recommending a downstream bypass design for the Priest Rapids dam. Instead Grant PUD and the agencies are recommending continuation of the ongoing spill program, indicating that spill is a safe and effective means for providing downstream fish passage at Priest Rapids dam. This program results in relatively high fish passage efficiencies and survival rates (see above) and if the turbine survival rates are also high (studies in 2000 and 2004 reported 98-99 percent), Grant PUD may already be achieving the passage standards at Priest Rapids dam for each species.

As part of their modified fishway prescriptions, NMFS indicated that until a more biologically efficient and effective passage measure is designed, tested, and implemented, Grant PUD should continue the ongoing spill program to provide downstream passage for smolts. The best available survival data collected at the Wanapum dam suggests that juvenile salmonid passage survival through the turbines is higher than survival via the spillways. In general, spillway passage survival at Wanapum dam is approximately 85 to 88 percent while turbine passage survival is 88 to 98 percent. Additionally, in comments filed on May 27, 2005, NMFS indicated that spillway survival is lower than turbine passage survival and states that "spill has been consistently the most lethal route to pass fish" at Wanapum dam. In the draft EIS, we indicated that based on this information, it was not clear why NMFS would recommend continuation of the Wanapum spill program since it would seem that more fish would survive during downstream passage if the spill program would be discontinued and all fish passed the dam via the turbines. In comments filed on May 2, 2006, NMFS indicated that while existing data indicate that turbine survival exceeds spillway survival for yearling Chinook salmon, passage survival for other species such as sockeye salmon, sub-yearling Chinook salmon, coho salmon, and steelhead are unknown. NMFS clarified that it is recommending that Grant PUD continue the spillway passage program at Wanapum dam until testing is complete for all species and for the future unit 11 bypass. As part of its recommendation for fish passage at Wanapum dam, NMFS included language to allow adjustment of spill volumes, including the decision not to spill.

In comments on the draft EIS, Grant PUD indicated that the spill program at Wanapum dam was recently changed from a Taintor gate spring fish spill program to a top-spill and sluiceway spill program. In comments on the draft EIS, Washington DFW indicated that while Taintor gate spills have resulted in lower survival rates than turbine passage, top-spill and sluiceway spills provide much higher survival rates and allow Grant PUD to achieve the survival standards for spring outmigrants. Washington DFW recommended that the top-spill and sluiceway spills be continued at Wanapum dam until the future unit 11 bypass is operational and shown to achieve the survival standards for both spring and summer outmigrants. Continuation of the current spillway passage program at Wanapum dam would ensure that all available and potentially effective passage options would be used until other more effective or less costly passage measures, including the future unit 11 bypass, are shown to provide safe and effective passage for all juvenile salmonid species.

In comments filed on May 27, 2005, NMFS states that involuntary spills will continue at Wanapum dam even after the downstream bypass through future unit 11 becomes operational. These spills would not be intended to pass fish; however, it is likely that some smolts would pass via the spillways when they occur during the outmigration periods (i.e., spring and summer). We are unable to quantify how many fish would pass via the spillways during involuntary spills with the proposed downstream bypass at future unit 11 operating; however, it is probable that large spill volumes would attract significant numbers of smolts to the spillways and expose these fish to reduced survival rates.[44] As part of their preliminary fishway prescriptions, NMFS suggested that one possible source of poor survival associated with spillway passage at Wanapum dam may be the spillway gate seals and they recommended that Grant PUD investigate the effects of the seals on spillway survival. Subsequently, as part of their modified fishway prescriptions, NMFS indicated the Grant PUD should attempt to identify and eliminate sources of potential fish injury at the Wanapum spillway. Investigating and potentially eliminating the cause of poor spillway survival at Wanapum dam would increase dam passage survival during involuntary spills and could aid Grant PUD in achieving the passage survival standards.

In comments filed on May 27, 2005, CRITFC recommends that Grant PUD index-test all individual project turbines to identify peak efficiency ranges. CRITFC states that fish survival is generally higher when turbines are operated within 1 percent of peak efficiency and they recommend that the project turbines be operated at near peak efficiency to maximize fish passage survival. Under section 18 of the FPA, NMFS prescribed that Grant PUD optimize juvenile survival through the Priest Rapids and Wanapum dam turbines. Grant PUD indicates that any new turbines installed at Wanapum dam would be index-tested and this information would be used to operate the new turbines at near peak efficiency to maximize passage survival. At Priest Rapids dam, Grant PUD indicates that for the existing turbines they have developed a fish mode of operation based on the results of passage survival studies under varying conditions. Grant PUD did not indicate if it has developed a fish mode for operation of the existing turbines at Wanapum dam; however, in comments filed on May 27, 2005, NMFS indicated that the Wanapum turbines are operated in fish mode to maximize survival. Index-testing and operating the turbines at near peak efficiency as recommended by CRITFC may not result in a significant improvement of turbine passage survival at the project dams. The existing project turbines are already restricted to operating ranges intended to maximize survival and these ranges were derived from empirical passage survival data. We would expect these empirical data to be more reliable for maximizing survival than the more theoretical relationship between operating efficiency and survival that would be employed through index-testing. Based on this information, we conclude there would be little benefit, if any, to index-testing the existing project turbines. Index-testing of any new advanced turbines installed at the project would provide a basis for operating the turbines to maximize survival; at least until actual passage survival estimates are measured.

As part of it license application, Grant PUD proposed to improve downstream passage survival at Wanapum dam by replacing the existing turbines with new advanced design turbines which are expected to reduce smolt mortalities during turbine passage.

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[44] We are assuming that spillway survival would be less than turbine passage survival or survival through the proposed future unit 11 bypass.

Installation and operation of the 10 advanced design turbines at Wanapum dam was approved by the Commission in orders issued July 23, 2004, and December 14, 2005[45]. Grant PUD indicates that at Priest Rapids dam the turbines are in good shape and any necessary replacement would not occur until some time in the future. We do not address replacement of the Priest Rapids turbines in this EIS. The effects of that action would be evaluated when Grant PUD proposes replacement.

Smolts moving past the project dams can become trapped within the intake gate slots due to hydraulic conditions in these areas. Each year during the outmigration, Grant PUD nets the gatewells and collects smolts for release in the tailrace. On average, Grant PUD collects and transports 56,000 smolts from the Wanapum gatewells and 62,000 smolts from the Priest Rapids gatewells. In its license application, Grant PUD suggests that injuries and stress associated with gatewell collection and transport probably exceeds what occurs during turbine passage. Therefore, Grant PUD is proposing to install gatewell exclusion screens to prevent smolts from entering the gate slots. These screens would ensure that all smolts entering the intakes would pass through the project turbines. No specific survival rates are available for smolts that pass the project via gatewell collection and transport; however, it is reasonable to assume that turbine passage survival would be greater than smolt survival during gatewell collection and transport since stress from netting and handling is likely to be significant.

In comments on the draft EIS, NMFS indicated that before screens are installed at each gatewell, Grant PUD should test the screens to ensure they do not cause any smolt mortalities or injuries. Additionally, Umatilla indicates that similar screens have been shown to impinge juvenile lamprey[46] and that in laboratory studies 70-90 percent of juvenile lamprey became impinged upon screens with velocities similar to those found in the turbine and gatewell environment. Because they would be located along the turbine passage route, it is possible that the proposed gatewell exclusion screens would affect juvenile salmonid survival or impinge juvenile lamprey. However, the screens would essentially be installed parallel to the bulk of the flow heading into the turbine and we would expect relatively high sweeping velocities and some backflushing from water swirling within the gatewells. These factors should limit potential smolt or juvenile lamprey contact and/or impingement on these screens. Regardless, it is clear that in some areas of the gatewell opening, flows would pass across the screens entering the gatewell. Injuries and impingement of smolts and juvenile lamprey could occur in these areas. Installing screens in a single turbine bay would allow assessment of the effects on smolts and juvenile lamprey before the exclusion screens would be installed in each gatewell.

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[45] 108 FERC ¶ 62,075 (2004) and 113 FERC ¶ 62,205 (2005), respectively

[46] In order to address all of the effects of the gatewell exclusion screens in one location in the final EIS, we address the effects of these screens on juvenile lamprey within this section rather than as part of the Pacific lamprey section.

Additionally, it is possible that these studies would reveal potential modifications to the screens that could improve the design and reduce any adverse effects.

CRITFC recommends that Grant PUD study the effects of peaking operations on juvenile fish passage through the project dams. CRITFC suggests that decreased discharge that occurs during peaking operations increases delay in the downstream passage of juvenile salmonids and exposes them to increased predation mortality in the project forebay. CRITFC provides no details regarding the mechanism for this delay; however, it is possible that reduced flows (i.e., dam discharge) would reduce steering flows in forebay areas and cause juvenile fish to be unable to locate available passage routes. In comments on the draft EIS, Grant PUD indicates that it has already conducted numerous route-specific passage and survival evaluations under various flow conditions, operating conditions, and spill regimes. Grant PUD suggests that because this issue has already been thoroughly evaluated, additional route-specific passage studies are not needed.

Salmon and Steelhead – Predator Control

As part of the SSA, Grant PUD proposes to fund a northern pikeminnow removal program to improve smolt passage survival through the reservoirs and tailraces of Priest Rapids and Wanapum dams. Grant PUD would also fund and implement an avian hazing and control program to improve smolt passage survival through the tailraces of Priest Rapids and Wanapum dams.

Under section 18 of the FPA, NMFS prescribes that Grant PUD implement the protection, mitigation, and enhancement measures contained in the SSA, which would include the measures proposed by Grant PUD and described above.

Under section 10(j) of the FPA, Washington DFW recommends that the SSA be incorporated into any new license issued for the Project in its entirety. Washington DFW is essentially recommending the measures proposed by Grant PUD and described above.

Under section 10(j) of the FPA, Interior recommends that Grant PUD develop and implement an Avian Predator Control and Effectiveness Monitoring Plan that would include: 1) describing measures to control avian predators, 2) describe methods, techniques, and schedules for measuring the effectiveness of avian control measures, and 3) provide for modification of the measures based on effectiveness monitoring.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD determine what impact the northern pikeminnow removal program is having on resident fish. This recommendation is evaluated in the resident fish section.

Our Analysis

Predation by avian predators and piscivorous fish species likely influences the ultimate survival rate of juvenile salmon and steelhead moving downstream through the project area. In comments filed on May 27, 2005, NMFS indicates that up to 2 percent of smolts passing through the project area are consumed by avian predators at both Wanapum and Priest Rapids dams. NMFS indicates that California gulls are the primary avian predator of smolts.

NMFS states that smolts are concentrated in the dam forebays, which makes predation by piscivorous fish species more efficient. The northern pikeminnow is considered the primary piscivorous fish species that preys on smolts; however, other species such as smallmouth bass and walleye are also known to consume juvenile salmon and steelhead. In response to NMFS comments, Grant PUD states that past studies have found that northern pikeminnow densities are greatest in the dam tailraces and lowest in the dam forebay areas (Burley and Poe, 1994). Additionally, Grant PUD indicates that consumption indices[47] were very low in the dam forebay areas and were greatest in the dam tailraces.

Umatilla indicates that the river channel and east bank of the Columbia River was extensively modified during the construction of Wanapum dam. Umatilla indicates that these modifications reduced velocities in this area and provided conditions conducive for piscivorous predators of anadromous fish.

Regardless of where predators are most concentrated, reducing the number of predators or their ability to prey upon smolts would reduce predation mortality and likely increase smolt survival through the project area. To reduce or discourage avian predation, Grant PUD maintains wire arrays over the tailrace area downstream of each dam's powerhouse. Additional wires were added to the powerhouse arrays in 2004 at each dam and Grant PUD is exploring the potential for installing wire arrays below the spillway areas of each dam. Continued maintenance of the existing arrays would discourage avian predation of smolts in the area below the project powerhouses. The installation of wire arrays below the spillway areas would provide similar protection for smolts during times when spillways are used to provide alternatives to turbine passage or when flows are beyond the capacity of the powerhouses.

Grant PUD has conducted a northern pikeminnow removal program at the Project since 1995. In comments on the draft EIS, Grant PUD indicates that from 1995 to 2005 this program resulted in the removal of 275,387 northern pikeminnow from the project

[47] A consumption index is a relative measure of the number of smolts consumed by predators.

area. Continuation of this program would reduce the number of northern pikeminnow in the project area. These reductions in the abundance of northern pikeminnow would reduce predation on juvenile salmon and steelhead and likely increase survival rates during passage through the project reservoirs and tailraces.

Development and implementation of the Avian Predator Control and Effectiveness Monitoring Plan, as recommended by Interior, would provide documentation of the measures that should be implemented to control avian predators and outline methods for determining the effectiveness of any program modifications.

Salmon and Steelhead – Hatchery Programs

To help recover natural populations to self-sustaining and harvestable levels and to mitigate for 7 percent unavoidable losses for each development, Grant PUD proposes to fund and develop the hatchery facilities necessary to annually produce 600,000 yearling spring Chinook salmon, 833,000 yearling summer Chinook salmon, 1,143,000 sockeye salmon smolts, and 100,000 steelhead smolts. Grant PUD would upgrade and renovate the Priest Rapids Hatchery and annually produce 6,000,000 fall Chinook salmon smolts and 1,000,000 fall Chinook salmon fry. Grant PUD would consult on options to develop equivalent alternative mitigation programs if annual production of 1,143,000 sockeye salmon smolts is unattainable. As part of its hatchery program, Grant PUD proposes to develop and implement Hatchery and Genetic Management Plans (HGMP) for each of the species listed above.

Under section 18 of the FPA, NMFS prescribes that Grant PUD should develop and implement artificial propagation programs for spring, summer, and fall Chinook salmon, steelhead, and sockeye salmon. Under section 10(j) of the FPA, Washington DFW also recommended that Grant PUD develop and implement artificial propagation programs for spring, summer, and fall Chinook salmon, steelhead, and sockeye salmon. As part of the programs recommended by NMFS and Washington DFW, Grant PUD would develop separate HGMPs to rear up to 600,000 yearling UCR spring-run Chinook salmon, 833,000 yearling summer Chinook salmon, and 100,000 yearling UCR steelhead. NOAA Fisheries and WDFW recommend that the initial production levels specified in the HGMPs for steelhead, spring-run Chinook salmon, and summer Chinook salmon would be reviewed in 2013 and every 10 years thereafter. NMFS and Washington DFW recommend that Grant PUD continue to provide 5,000,000 fall Chinook salmon sub-yearling smolts annually and provide facilities at the Priest Rapids Hatchery to produce an additional 1,000,000 fall Chinook salmon sub-yearling smolts. NMFS and Washington DFW recommend that Grant PUD implement a program to produce and release 1,000,000 fall Chinook salmon fry into the project reservoirs annually and that Grant PUD update the existing HGMP for fall Chinook salmon. NMFS and Washington DFW recommend that Grant PUD write a HGMP and develop a hatchery program to produce 1,143,000 sockeye salmon smolts. NMFS and Washington DFW indicate that if the sockeye propagation program is not feasible, Grant PUD should use flow augmentation to improve instream conditions for sockeye salmon or conduct habitat improvements for increasing natural production of sockeye salmon. NMFS and Washington DFW recommend that the sockeye salmon HGMP should be reviewed in 2013 and every 10 years thereafter.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD establish hatchery management plans to improve existing facilities to state-of-the-art status, including bioengineering and other applicable methods and standards.

Under section 10(j) of the FPA, ADFG recommends that Grant PUD establish revised hatchery management plans and initiate funding of improved state-of-the-art facilities at the Priest Rapids Hatchery.

Our Analysis

In the license application, Grant PUD states that it annually produces 5,000,000 fall Chinook salmon smolts at the Priest Rapids Hatchery for mitigation for the effects of project construction. These hatchery releases supplement the fall Chinook salmon population that primarily spawns in the Hanford Reach and in the tailwaters of several mid-Columbia River dams. Grant PUD is proposing to increase the production capacity of the Priest Rapids Hatchery to accommodate an additional 1,000,000 fall Chinook salmon smolts and to begin producing 1,000,000 fall Chinook salmon fry for release into the Wanapum and Priest Rapids reservoirs. The total number of fall Chinook salmon smolts released annually would be 6,000,000 which Grant PUD indicates would meet the production objectives of the mid-Columbia River Hatchery Program (Bugert 1998). The annual release of 1,000,000 fall Chinook salmon fry would take advantage of available rearing habitat within the project reservoirs and would serve to mitigate for mortalities that occur within the Hanford Reach due to project operations.

Grant PUD is also proposing to annually release 600,000 yearling spring-run Chinook salmon, 833,000 yearling summer Chinook salmon, 1,143,000 sockeye salmon smolts, and 100,000 steelhead smolts. Grant PUD is exploring a variety of options for producing these fish, including the construction of new hatchery facilities or the use of existing facilities operated by other entities. These releases would supplement the existing populations of spring-run Chinook salmon, summer Chinook salmon, sockeye salmon, and steelhead and would meet the production objectives of the mid-Columbia River Hatchery Program (Bugert 1998).

Grant PUD, NMFS, and Washington DFW acknowledge that artificial propagation of Columbia River sockeye salmon could be unsuccessful. Grant PUD indicates that other entities have attempted to artificially propagate Columbia River sockeye salmon and it has been difficult, if not impossible, to develop the proper facilities. As part of the SSA, Grant PUD indicates that if it is unable to develop facilities or a program to meet the sockeye salmon production goal, they would provide flow augmentation to improve instream conditions and/or implement habitat improvements to increase natural production of sockeye salmon. Implementing alternative measures would be appropriate for mitigating for project effects on this species. If a strong flow versus survival relationship exists for sockeye salmon smolts, flow augmentation could increase survival of outmigrating sockeye salmon smolts. Additionally, if habitat conditions or availability is limiting sockeye salmon production levels, habitat improvements could increase sockeye salmon production. Other as-yet undefined measures may also be appropriate. The specific measures that would be employed should be developed in consultation with the agencies and tribes and should correspond to the magnitude of the project effects on sockeye salmon and the unachieved sockeye salmon production goals. Implementing these alternative measures would help to mitigate for project effects on sockeye salmon.

Grant PUD, NMFS, and Washington DFW indicate that HGMPs should be prepared and implemented for each hatchery production program. The HGMPs would describe hatchery practices for breeding and rearing each fish species. These plans would detail monitoring, evaluation, and performance indicators to address critical uncertainties associated with each program. Development and implementation of the HGMPs, in consultation with the agencies and tribes, would formalize the specific methods for production and monitoring of hatchery reared salmon and steelhead and help to maximize the physical and genetic condition of fish used to supplement that existing populations.

In the license application, Grant PUD indicates that achieving the various hatchery program objectives would have two purposes: 1) to help recover natural populations to self-sustaining and harvestable levels throughout the mid-Columbia River region; and 2) to mitigate for a 7 percent per development unavoidable loss of upriver stocks.[48]

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[48] Unavoidable losses are the portion of the adult and juvenile salmon and steelhead population that fail to survive passage through the project area due to project effects. Even if the 91 percent performance standard is achieved through implementation of all the project-specific mitigation measures, there would still be 9 percent unavoidable losses. Under the various proposals, a portion of these unavoidable losses would be mitigated through hatchery supplementation and the remainder would be addressed through habitat improvement projects. In multiple filings the applicant and agencies use language indicating that hatchery supplementation will "mitigate for a 7 percent per development unavoidable loss of upriver stocks" and the habitat account will "mitigate for a 2 percent per development unavoidable loss." For consistency we use similar language throughout this document. However, we note that the level of hatchery mitigation could also be described as addressing 78 percent (i.e., 7/9ths) of the unavoidable losses occurring at each project dam and the proposed habitat mitigation

Recovering populations to sustainable or harvestable levels may be a reasonable goal for fisheries management agencies, but because many non-project-related factors affect the fish species of the mid-Columbia River region, attaining sustainable or harvestable population levels is not a reasonable goal for defining appropriate mitigation for the effects of the Priest Rapids Project. The supplementation proposed by Grant PUD and recommended by the agencies, would serve to mitigate for unavoidable losses that occur within the project area and may indirectly help the agencies recover populations to sustainable or harvestable levels. However, failure of these populations to achieve sustainable or harvestable levels would not necessarily indicate that the proposed mitigation was inadequate since many other non-project-related factors influence their status.

In a letter filed March 8, 2006, Alaska DFG stated that the SSA fails to provide a rationale for the proposed hatchery production levels for yearling summer Chinook salmon. Alaska DFG indicates that the number of summer Chinook salmon released should be based on project impacts.

As explained above, hatchery releases would serve to mitigate for a 7 percent per development unavoidable loss of upriver stocks. Hatchery releases for each species were calculated using baseline adult return data covering a ten-year period from the early 1970s to the early 1980s and historical juvenile-to-adult survival rates for released hatchery fish. For summer Chinook salmon, the baseline adult return was estimated as 17,850 fish, which is the average annual count at Priest Rapids dam from 1974 to 1983. The adult mitigation level for each dam was calculated as 7 percent of baseline adult returns (i.e., 17,850 x 0.07), which is approximately 1,250 adult fish. Dividing 1,250 by the average yearling-to-adult survival for hatchery releases of summer Chinook salmon (i.e., 0.003) yields an estimate of the number of yearlings needed to produce 1,250 adults. This estimate is approximately 416,500 yearlings per dam or 833,000 total yearlings for both dams. Calculation of the hatchery production goals for the other anadromous salmonid species passing through the Priest Rapids Project area is explained in detail in Bugert (1998).[49]

Alaska DFG indicates that sub-yearlings typically comprise a portion of the outmigration; therefore, using yearling summer Chinook salmon as hatchery mitigation does not mimic the natural life history of summer Chinook salmon. Alaska DFG indicates that additional production of sub-yearlings should be required.

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would address 22 percent (i.e., 2/9ths) of the unavoidable losses at each dam, thereby resulting in 100 percent mitigation for unavoidable losses.

[49] See pages 7 and 8 in Bugert (1998).

As indicated above, the hatchery production goal is based on calculations presented in Bugert (1998) using measured survival rates for yearling-to-adult summer Chinook salmon hatchery releases. Bugert (1998) indicates that yearling summer Chinook salmon are generally released by hatcheries because these fish survive better than sub-yearling fish and, therefore, fewer fish need to be propagated to achieve compensation levels. Bugert (1998) did not provide survival estimates for sub-yearling-to-adult summer Chinook salmon hatchery releases. Because sub-yearling survival would be lower than yearling survival, more than 833,000 sub-yearlings would need to be released to provide 1,250 adult summer Chinook salmon per dam. While it would be possible to produce 1,250 adults using increased releases of sub-yearling fish, it is not clear what benefit would result from this action and Alaska DFG did not describe any benefits of this approach.

ADFG recommends that Grant PUD establish revised hatchery management plans and initiate funding of improved state-of-the-art facilities at the Priest Rapids Hatchery. CRITFC recommends that Grant PUD establish hatchery management plans to improve existing facilities to state-of-the-art status, including bioengineering and other applicable methods and standards. CRITFC recommends that these state-of-the-art facilities should be employed at the Priest Rapids Hatchery and essentially any other hatcheries used to produce fish as mitigation for the Priest Rapids Project.

The Priest Rapids Hatchery is a project facility that is located immediately downstream of Priest Rapids dam, within the project boundary. The hatchery was originally constructed as a spawning channel; however, it has been converted into a series of rearing ponds that annually produce over 6,000,000 fall Chinook salmon smolts.

Grant PUD acknowledges that many of the facilities at the Priest Rapids Hatchery are approaching the end of their useful life and Grant PUD is proposing to renovate the hatchery. Grant PUD's proposal includes construction of a new incubation and office building, an emergency power system to provide an uninterruptible water supply to the hatchery building, new early rearing raceways, an additional rearing pond, new adult trapping and holding facilities, a new weir on the return channel, predator control features, a pollution abatement settling pond, and up to three residences. These renovations would allow Grant PUD to produce the additional fall Chinook salmon discussed above and it would improve the functionality and efficiency of the hatchery. Many of the measures recommended by CRITFC and ADFG would be directly or partly addressed by Grant PUD's proposed renovations to the Priest Rapids Hatchery. Some measures proposed by CRITFC and ADFG appear to be operational measures that we would expect to be resolved as part of the development of the HGMP for fall Chinook salmon. Other measures appear to be exploratory measures such as investigating water chiller installation and use of ozone filtration. Improving the Priest Rapids Hatchery facilities to state-of-the-art technology could increase the efficiency of hatchery operations and may improve the condition of fish produced at the hatchery. However, we have no evidence to indicate that the condition of the fall Chinook salmon produced at the Priest Rapids Hatchery is unsatisfactory and the increased efficiency, capacity, and production of fall Chinook salmon proposed by Grant PUD would likely improve on existing conditions. Based on the available information, it is not apparent that state-of-the-art facilities are necessary to achieve the proposed production goals for fall Chinook salmon at the Priest Rapids Hatchery.

Grant PUD indicates that the hatchery production goals for spring-run Chinook salmon, summer Chinook salmon, sockeye salmon, and steelhead would likely be achieved by hatcheries located in other portions of the Columbia River watershed. These hatcheries are not owned or operated by Grant PUD and hatchery production at these facilities would likely be contracted by Grant PUD to some other entity. CRITFC suggests that the facilities at these hatcheries should be improved to state-of-the-art status. Implementing state-of-the-art measures would help to ensure that healthy fish are produced efficiently wherever they are raised. However, at this time Grant PUD appears to be exploring a variety of hatchery options for producing these fish. The hatcheries that are ultimately selected may include state-of-the-art facilities or, at least facilities capable of producing healthy fish that meet the targeted production goals in which case there would be no need for implementing state-of-the-art measures as suggested by CRITFC.

Salmon and Steelhead – Habitat Mitigation for Upriver Stocks

As part of the SSA, Grant PUD proposes to annually provide $1,096,552 to the Priest Rapids Project Habitat Fund to mitigate for a 2 percent per development unavoidable loss of upriver stocks. Grant PUD also proposes to develop and implement a habitat plan to direct the habitat mitigation program.

NMFS and Washington DFW recommend that Grant PUD establish a Priest Rapids Fish Habitat Conservation Account to fund fish habitat projects for mitigating for a 2 percent unavoidable loss of salmon and steelhead resulting from project operations. NMFS and Washington DFW recommend that Grant PUD develop a habitat plan to direct the habitat mitigation program. NMFS and Washington DFW recommend that Grant PUD use existing habitat evaluation and assessment tools and prioritization frameworks already developed for the upper Columbia region to target and efficiently spend funds from the habitat account.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD establish habitat management plans and provide funding for the implementation of these plans.

Our Analysis

Large areas of historic salmon and steelhead spawning and rearing habitat in the mid-Columbia River basin are currently either inaccessible or in degraded condition. Grant PUD proposes to make annual contributions to a habitat account that would be used to fund projects that would increase the amount of salmon and steelhead habitat in the mid-Columbia River basin. Grant PUD, NMFS, Washington DFW, and CRITFC indicate that contributions to the habitat account would be intended to provide habitat improvement programs that would mitigate for unavoidable effects of the project on salmon and steelhead. The proposed amount of funds to be annually contributed to the habitat account is based on the estimated cost of implementing habitat improvements that would offset a 2 percent per development unavoidable loss of upriver stocks. In comments filed on May 27, 2005, NMFS indicates that it is not possible to statistically demonstrate that habitat improvements would result in a 2 percent increase in salmon and steelhead production; however, they indicate that the program would be designed to ensure that funds are utilized in a beneficial, efficient, and effective manner.

Grant PUD, NMFS, and Washington DFW indicate that the habitat mitigation funds would be administered by the PRCC. Habitat improvement projects associated with the Priest Rapids Project would be coordinated with habitat mitigation efforts that are underway at the Rock Island, Rocky Reach, and Wells projects. Whenever feasible, the funding of projects would be coordinated with other programs to provide cost-sharing or matching funds. The selection and prioritization of habitat mitigation efforts would be based on the biological and cost effectiveness of each project. The use of habitat evaluation and assessment tools and prioritization frameworks that are already developed for the upper Columbia River region would be an efficient way to target specific sites and identify cost-effective projects.

In regard to specific habitat improvement projects, funds from the habitat account could be used provide access to blocked streams or oxbows, remove or modify irrigation/diversion dams and other barriers on tributary streams, improve or increase hiding and resting cover habitat, and improve instream flow conditions by correcting problematic water diversion or withdrawal structures. Implementing these measures would increase available salmon and steelhead habitat within the mid-Columbia River basin and would likely result in increased production of juvenile and adult salmon and steelhead.

Grant PUD, NMFS, Washington DFW, and CRITFC recommend that Grant PUD develop a habitat plan to direct the habitat mitigation program. The plan would include identification of goals and objectives, description of a process for coordination, and description of a process to identify and implement habitat projects. Development and implementation of a habitat plan would provide structure for the implementation of the habitat program and ensure efficient and effective use of the funds.

Salmon and Steelhead – No Net Impact

As part of the SSA, Grant PUD proposes establish and administer a No Net Impact (NNI) Fund to provide compensation during the near-term when annual survival rates for salmon and steelhead are less than the performance standards.

Under section 10(j) of the FPA, Washington DFW recommends that Grant PUD develop, fund, and implement comprehensive protection programs for fall Chinook salmon, summer Chinook salmon, and sockeye salmon. Washington DFW indicates that the objective of these comprehensive protection programs is to achieve NNI of the operations of the Priest Rapids Project on these species.

Under section 18 of the FPA, NMFS prescribes that Grant PUD should establish and administer a NNI Fund to provide compensation during the near-term when annual survival rates for salmon and steelhead are less than the performance standards. Washington DFW also recommends this measure under section 10(j) of the FPA.

Our Analysis

NMFS and Washington DFW indicate that they have a goal of NNI for the Priest Rapids Project. They indicate that NNI should be achieved through a combination of meeting project survival standards, habitat mitigation, and hatchery supplementation. Specifically, NNI would be achieved if combined adult and juvenile passage survival is 91 percent and the remaining 9 percent unavoidable loss is made up through 7 percent hatchery mitigation and 2 percent habitat mitigation. These are the same standards and goals used in the HCPs for the Wells, Rocky Reach, and Rock Island projects.

Grant PUD, NMFS, and Washington DFW also indicate that the passage survival standards may not be achieved through current operations for certain stocks; therefore, the project may fail to achieve NNI for these stocks. They recommend that Grant PUD contribute to a NNI fund to compensate for providing passage survival at rates less than the survival standards. They indicate that these funds would provide additional financial capacity to undertake measures to improve survival of stocks failing to meet the survival standards.

The NNI goal would consist of eliminating project effects to the greatest practical extent and then mitigating for any remaining project effects through hatchery supplementation and habitat mitigation. Achieving NNI or compensating for failure to achieve NNI through contributions to a NNI fund would essentially provide 100 percent mitigation for project effects on salmon and steelhead species affected by the project. Achieving these goals would result in increased adult returns of salmon and steelhead to the mid-Columbia River and would help to prevent extinction of federally-listed species and prevent listing of non-listed species.

At the time the draft EIS was written, NMFS and Washington DFW indicated that the existing data suggested that the project fails to achieve the passage survival standards for spring Chinook salmon, summer Chinook salmon, steelhead, and sockeye salmon and they recommended that Grant PUD annually contribute $2,562,206 to the NNI fund. In comments filed on the draft EIS, Grant PUD indicated that they had achieved the performance standard for yearling spring Chinook salmon and the contribution to the NNI fund, as described in the SSA would be $1,112,501.

The SSA, signed by Grant PUD, NMFS, Washington DFW, and others, indicates that the NNI fund would provide the settling parties with additional financial capacity to undertake measures to improve survivals of species covered by the agreement. It also indicates that expenditure of the funds would be done in consultation with the proposed PRCC. The SSA does not provide specific examples of how the funds may be used; therefore, we can not address how this fund would affect salmon and steelhead in the project area. However, the SSA does indicate that expenditure of the funds would be administered through implementation of annual plans. The annual plans may be developed as part of the annual habitat plans or they may include other measures or activities designed to improve salmon and steelhead survival and contribute to achievement of the performance standards.

In a letter filed on March 8, 2006, Alaska DFG stated that Grant PUD's annual contribution to the NNI fund does not account for the natural life history of summer Chinook salmon, which includes sub-yearlings. They suggest that Grant PUD should conduct studies of sub-yearling Chinook salmon survival and adjust the contribution to the fund accordingly.

As indicated above, Grant PUD is proposing to study sub-yearling Chinook salmon survival rates during the license term (years 2009 to 2011). After completion of these studies, the PRCC would use the survival estimates to adjust Grant PUD's contributions to the NNI fund for summer and fall Chinook salmon. These studies and adjustments of the NNI fund contributions would address Alaska DFG's concerns.

Salmon and Steelhead – Future Populations

As part of the SSA, Grant PUD proposes to address the need to provide mitigation for project effects on coho salmon when the PRCC determines a self-sustaining population exists. Grant also proposes to provide hatchery compensation for Okanogan spring Chinook salmon when the PRCC determines a long-term hatchery program has been developed for Okanogan spring Chinook salmon or a naturally producing threshold population exists.

Under section 10(j) of the FPA, Washington DFW recommends that the SSA be incorporated into any new license issued for the Project in its entirety. Washington DFW is essentially recommending the measures proposed by Grant PUD above.

Our Analysis

The endemic stock of coho salmon from the mid-Columbia River is considered extinct. Recent reintroduction efforts have resulted in the return of adult coho salmon, including over 10,000 adults in 2001. As part of their preliminary section 10(j) recommendations, Washington DFW recommended that if the coho salmon reintroduction is successful, Grant PUD should provide hatchery funding to mitigate impacts to juvenile coho salmon in the project area. As part of the SSA, Grant PUD proposes to address the need to provide mitigation for project effects on coho salmon when the PRCC determines a self-sustaining population exists.

Okanogan spring-run Chinook salmon are considered extinct. This run of Chinook salmon historically spawned in the Okanogan River, which is a tributary to the Columbia River that is upstream of the Project. Washington DFW indicates that there is an ongoing program to reintroduce spring-run Chinook salmon to the Okanogan River. Washington DFW states that as these efforts proceed, the same mitigation measures afforded to other upper Columbia River salmon and steelhead should be provided to spring-run Chinook salmon that are produced from the Okanogan River. Grant PUD indicates that the measures that would be implemented for UCR spring-run Chinook salmon would address impacts to any Okanogan River spring-run Chinook salmon. Washington DFW indicates that hatchery mitigation of 7 percent per dam would be necessary for Okanogan River spring-run Chinook salmon if the run establishes a threshold population. As part of the SSA, Grant PUD proposes to provide hatchery compensation for Okanogan spring Chinook salmon when the PRCC determines a long-term hatchery program has been developed for Okanogan spring Chinook salmon or a naturally producing threshold population exists.

The measures that would be implemented at the Project to protect and restore the existing salmon and steelhead populations would provide similar benefits for any reintroduced populations of coho salmon or Okanogan River Chinook salmon. If reintroduction efforts reach some as-yet unspecified threshold population level, hatchery mitigation may be warranted and would have some benefit towards maintaining or enhancing these populations. However, because there is no evidence that either population has established a threshold population, including a requirement for hatchery mitigation in any new license would have no immediate or near-term effects on either species and if reintroduction efforts are unsuccessful, it would ultimately have no effect on either species.

Salmon and Steelhead – Studies and Monitoring

As part of the SSA, Grant PUD proposes to operate and maintain PIT-tag detection equipment at the Priest Rapids fishways. Grant PUD proposes to use radiotelemetry or other techniques to evaluate upstream and downstream route-specific survival at Priest Rapids and Wanapum dams. Grant PUD would conduct survival studies using PIT-tag technology to obtain dam and project passage survival estimates.

As part of the SSA, Grant PUD proposes to develop and annually revise a downstream passage alternatives action plan (DPAAP) to contribute to achievement of the applicable performance standards at Wanapum and Priest Rapids dams. Grant PUD also proposes to develop and implement a performance evaluation program to assess the hatchery program, habitat program, and improvements to juvenile and adult passage survival. As part of this program, Grant PUD would produce annual progress and implementation plans to describe the implementation activities for spring-run Chinook salmon and steelhead and prepare a performance evaluation report that assesses the ability of each program to meet program objectives and contribute to achievement of performance standards.

Under section 18 of the FPA, NMFS prescribes that Grant PUD conduct biological evaluations to determine if the salmon and steelhead protection programs are meeting the performance standards, to assess passage through the Wanapum future unit bypass, and to determine if the new turbines are performing as expected with respect to juvenile survival. NMFS also prescribes that Grant PUD implement the measures proposed by Grant PUD in the SSA and described above.

Under section 18 of the FPA, Interior prescribes that Grant PUD develop plans for and conduct periodic evaluations of fishway effectiveness. Interior prescribes that Grant PUD conduct dam and reservoir passage studies to evaluate progress towards meeting survival standards. Interior also states that they retain the right to review and approve all biological testing methods for evaluating fishway effectiveness.

Under section 10(j) of the FPA, Washington DFW recommends that the SSA be incorporated into any new license issued for the Project in its entirety. Washington DFW is essentially recommending the same measures proposed by Grant PUD and described above.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD assess indirect mortality and injury rates for juvenile salmon and assess direct and indirect survival via smolt-to-adult evaluations. CRITFC recommends that Grant PUD contribute funding to regional evaluations of salmon stocks affected by the project, including life-cycle analyses, genetic assessments, and stock productivity and carrying capacity analyses.

Our Analysis

Grant PUD proposes and NMFS, Interior, Washington DFW, and CRITFC recommend that Grant PUD conduct a variety of studies to assess salmon and steelhead passage survival through the project area. These assessments would include studies of adult passage through the project fishways and studies of juvenile passage through the project reservoirs and various routes through the project dams. The results of these studies would be used to determine if the passage survival standards are being achieved and they would provide route-specific survival rates that could be used to review and refine of the operation of passage facilities and other project features used for fish passage (e.g. spillways). Juvenile survival through the project area and route-specific juvenile survival rates could be derived from PIT-tagging or radiotelemetry studies. Detection of PIT-tagged adults would allow for some estimation of smolt-to-adult survival rates and may provide additional information about juvenile route-specific survival. In general, the survival studies proposed by Grant PUD and the agencies are necessary for estimating achievement of the survival standards and they would provide useful information for any possible refinement that may be necessary to achieve these standards.

As part of the SSA, Grant PUD proposes to monitor the effectiveness of the hatchery programs for spring, summer, and fall Chinook salmon, sockeye salmon, and steelhead. To evaluate the success of these hatchery programs, Grant PUD would develop and implement a monitoring and evaluation plan within one year of license issuance and update the plan every 5 years. The monitoring and evaluation would ensure that the hatchery programs are mitigating project effects and meeting program goals. Sex, age, and coded wire tag sampling of hatchery returns would allow assessment of the contribution of hatchery fish to the natural population, the influence of hatchery strays, and population estimation. A monitoring and evaluation plan would be useful for tracking the success of the hatchery programs and would allow for any adjustments in hatchery production levels if the contribution of hatchery fish differs significantly (i.e., lower or higher) from what is expected.

As part of the SSA, Grant PUD proposes to develop a Performance Evaluation Program to assess improvements in passage survival, habitat mitigation, and the hatchery program. Grant PUD would summarize the Performance Evaluation Program in a Performance Evaluation Report every 3 years. Grant PUD would also produce annual

Progress and Implementation Plans describing the implementation of measures for anadromous fish.

NMFS indicates the Performance Evaluation Program would allow for measurement and evaluation of the effects of individual mitigation measures, assessment of the contribution of mitigation measures in meeting overall goals, and identification of new efforts or measures that would help to meet mitigation goals. They indicate that an annual Progress and Implementation Plan would enable use of an adaptive management approach by describing the results of measures that have been implemented and defining the measures that would be implemented during the upcoming year. They also indicate that the annual plans would include updates to the operation, inspection, and maintenance of all juvenile and adult fishways. Development of a Performance Evaluation Program including the preparation of annual Progress and Implementation Plans would help to ensure that progress is made towards achieving the project mitigation goals for salmon and steelhead and would allow effective implementation of an adaptive management approach.

CRITFC recommends that Grant PUD contribute funding to regional evaluations of salmon stocks affected by the project. They suggest that these funds could be used to perform life-cycle analyses, genetic assessments, stock productivity analyses, and carrying capacity analyses.

CRITFC states that these studies are needed to quantify or ground-truth the benefit of the passage survival standards proposed by Grant PUD and the agencies. They state that assessment of the survival standards is needed to determine if the standards are adequate for achieving regional productivity/escapement goals for salmon and steelhead.

Specific juvenile production or adult escapement levels may serve as goals for agencies and tribes managing these species; however, in the context of relicensing, they are not an appropriate means for identifying measures that serve project purposes or mitigate project effects. The specific benefits of achieving the passage survival standards, providing hatchery supplementation, and improving tributary habitat conditions as part of relicensing the Priest Rapids Project is discussed elsewhere in this section. In general, the combination of these efforts would mitigate for virtually all project effects on salmon and steelhead stocks, and as such, both NMFS and Washington DFW indicate that implementation and achievement of these measures would result in the Priest Rapids Project having no net impact.

The ability to achieve regional salmon and steelhead production goals or escapement goals encompasses numerous factors that are unrelated to effects of the Project; therefore, these goals have little utility in identifying or defining conditions for relicensing the project. Rather it is more useful to identify measures that mitigate for or eliminate project effects or measures that serve project purposes. The studies recommended by CRITFC would provide general biological information about salmon and steelhead stocks that occupy the project area but they have no specific nexus to the project because they are unrelated to identifying or mitigating project effects and they would not serve project purposes.

Salmon and Steelhead – Hanford Reach and Project Operations

In the license application, Grant PUD proposed several operational measures to reduce flow fluctuations and their effects on fall Chinook salmon in the Hanford Reach. Grant PUD also indicated that they were attempting to develop agreements with other mid-Columbia River dam operators to address the cumulative effects of dam operations on Hanford Reach flows.

On April 19, 2004, Grant PUD filed an offer of settlement and the Hanford Reach Agreement. The Hanford Reach Agreement is a component of the SSA. The Hanford Reach Agreement has been signed by Grant PUD, Chelan PUD, Douglas PUD, BPA, NMFS, Interior, Washington DFW, the Colville, and the Yakama. Under the Hanford Reach Agreement, Grant PUD would coordinate with the upstream dam operators to provide a minimum flow of 55 to 70 kcfs during the fall Chinook salmon spawning period. Through monitoring of redd locations on Vernita Bar,[50] Grant PUD would annually establish a Critical Flow for protection of fall Chinook salmon during the pre-hatch, post-hatch, and emergence periods. Flows within the Hanford Reach would be maintained at or above the Critical Flow by drafting water from Priest Rapids, Wanapum, Rocky Reach, and Wells reservoirs. Contributions from the Rocky Reach and Wells projects would be coordinated with Grant PUD's releases from the Project.

Additionally, the Hanford Reach Agreement provides that Grant PUD would coordinate dam operations with upstream operators to limit fluctuations in outflow from Priest Rapids dam during the fall Chinook salmon rearing period. The specific limits on day-to-day fluctuations are outlined on pages 4-142 and 4-143 of the license application. Generally, these limits restrict operations to small fluctuations (i.e., 20 kcfs) during periods of low flows and larger flow fluctuations (i.e., up to and exceeding 60 kcfs) during periods of high flows. Grant PUD would maintain a minimum flow of 36 kcfs in the Hanford Reach, although higher minimum flows would be released throughout much of the year to protect spawning, incubating, or rearing fall Chinook salmon. Grant PUD would also investigate the feasibility of habitat modifications in the Wanapum dam tailrace to increase the amount of high quality fall Chinook salmon habitat.

[50] Vernita Bar is an important spawning area for Fall Chinook salmon located in the Hanford Reach downstream of the Priest Rapids dam.

Under section 18 of the FPA, NMFS recommends that Grant PUD implement the protection, mitigation, and enhancement measures contained in the Salmon Settlement Agreement, which would include the flow regimes and river operations specified in the Hanford Reach Agreement.

Under section 10(j) of the FPA, Washington DFW recommends that the SSA be incorporated into any new license issued for the Project in its entirety. This is essentially the same as recommending that Grant PUD implement the flow regimes and river operations specified in the Hanford Reach Agreement.

Under section 10(a) of the FPA, CRITFC and Alaska DFG recommend that Grant PUD limit daily flow fluctuations from the Project to no more than 10,000 cfs around an estimated weekly average outflow target from March 1 to June 15 of each year. CRITFC and Alaska DFG recommend that the outflow target be derived using the Single Trace Procedure of the National Weather Service River Forecast System or a similar forecasting procedure. Under section 10(a) of the FPA, CRITFC and Alaska DFG also recommend that Grant PUD conduct annual surveys to assess stranding and entrapment.

Under section 10(j) of the FPA, Interior recommends that Grant PUD maintain flows from the Priest Rapids Project from October 15 through November 30 to provide suitable spawning habitat that would accommodate the expected escapement fall Chinook salmon in all spawning areas of the Hanford Reach. Interior also recommends that Grant PUD be required to maintain flow releases for the successful incubation of eggs in redds from November 30 to the end of fall Chinook salmon emergence. Under section 10(a) of the FPA, CRITFC also recommends these measures and states that Grant PUD should not release flows less than 50,000 cfs until after emergence.

Under section 10(j) of the FPA, Interior recommends that Grant PUD develop and implement a plan to conduct aerial orthophotographic surveys each year during the spawning season at all known spawning areas within the Hanford Reach. Under section 10(a) of the FPA, this measure is also recommended by CRITFC and Alaska DFG. Interior also recommends that Grant PUD develop and implement a monitoring plan to determine the effect of fluctuating flows on spawning behavior, redd placement, the extent of daytime and nighttime spawning, and the extent of deep-water spawning.

Under section 10(j) of the FPA, Interior recommends that Grant PUD develop and implement a plan to monitor and evaluate project effects on primary and secondary productivity and resident fish in the Hanford Reach. Under section 10(a) of the FPA, CRITFC also recommends this measure, although they did not indicate a need to study effects on resident fish.

Under section 10(j) of the FPA, Alaska DFG recommends that Grant PUD operate the project and conduct studies and monitoring as recommended in Anglin et al. (2005).[51] Alaska DFG recommends that new conditions be included in the license that reduce stranding and entrapment of juveniles and increase productive spawning habitat of Hanford Reach fall Chinook salmon. Alaska DFG recommends that Grant PUD provide suitable spawning conditions to accommodate expected adult escapement. Alaska DFG recommends that Grant PUD conduct additional research, monitoring, and evaluations to better assess the spawning needs of adult fall Chinook salmon.

Our Analysis

The Hanford Reach is the longest unimpounded portion of the mainstem Columbia River that is still accessible to anadromous salmon. This reach is important spawning and rearing habitat for fall Chinook salmon. Hanford Reach fall Chinook salmon are the largest and most productive population of wild salmon remaining in the Pacific Northwest (Huntington et al., 1996). Hanford Reach fall Chinook salmon are a component of the Upper Columbia River summer/fall Chinook salmon ESU, which is one of the few populations of Chinook salmon within the Columbia River system that has not warranted listing under the ESA.

Hanford Reach fall Chinook salmon support Columbia River Treaty Indian subsistence fisheries and commercial fisheries. Additionally, because these fish are abundant and not protected under ESA, they make significant contributions to non-Indian sport and commercial fisheries. In the ocean, Hanford Reach fall Chinook salmon migrate as far north as southeast Alaska. Hanford Reach fall Chinook salmon make significant contributions to sport and commercial ocean fisheries, making up a large percentage of the ocean Chinook salmon harvest occurring off the coast of Canada and southeast Alaska (7-16% of total catch; Anglin et al., 2006). Fall Chinook salmon are an indicator stock used by the Pacific Salmon Commission to regulate ocean salmon harvest under the Pacific Salmon Treaty.[52] As an indicator stock, increases or decreases in the

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[51] Anglin et al. (2005) was a draft report analyzing the effects of flows on fall Chinook salmon entrapment, spawning habitat, and rearing habitat in the Hanford Reach. A final version of this report (Anglin et al., 2006) was filed with the Commission on October 25, 2006. Where appropriate, we have updated our analysis using information from the final report. We have retained references to the draft report in instances where parties directly referred to Anglin et al. (2005).

[52] The Pacific Salmon Treaty is an agreement between the governments of the United States and Canada that established the Pacific Salmon Commission. The Pacific Salmon Commission advises the two counties on approaches for promoting the optimum production and equitable exploitation of Pacific salmon stocks.

abundance of Hanford Reach fall Chinook salmon can affect the magnitude of the ocean harvest recommended by the Pacific Salmon Commission to the United States or Canada.

Flows released from Priest Rapids dam influence the quantity and quality of fall Chinook salmon habitat within the Hanford Reach. Additionally, short-term flow fluctuations that occur within the Hanford Reach have been shown to result in stranding and entrapment of juvenile fall Chinook salmon (McMichael et al., 2003; Anglin et al., 2006).

During periods of high flows, spawning fall Chinook salmon create redds in areas of the Hanford Reach that may be dewatered or exposed at lower flows. Dewatered redds generally have lower hatch rates and survival rates and freezing or desiccation can result in loss of the entire redd. To reduce the likelihood of redd dewatering, Grant PUD, NMFS, and Washington DFW recommend implementation of the Hanford Reach Agreement. In general, the Hanford Reach Agreement includes guidelines for establishing a minimum flow (i.e., protection flow) for each spawning season. During the onset of spawning, Grant PUD would use reverse load factoring[53] or other methods to manipulate flows and encourage redd formation at elevations below the 70,000 cfs flow level. To determine the location and number of redds, a monitoring team composed of a Grant PUD biologist, a Washington DFW biologist, and one other biologist from another agency or tribe would survey portions of Vernita Bar. Additionally, the monitoring team would conduct aerial surveys of the Hanford Reach to identify spawning locations. Based on this information, the parties of the Hanford Reach Agreement would establish a minimum protection flow for the remainder of the spawning season. Monitoring and flow manipulation would minimize the formation of redds above the 70,000 cfs level and should prevent or reduce redd dewatering during spawning.

Interior, CRITFC, and Alaska DFG also make several recommendations for the fall Chinook spawning season which include 1) providing flows that would maintain enough suitable spawning habitat to accommodate expected escapement (i.e., returning spawners), 2) conducting aerial orthophotographic surveys of all spawning areas within the Hanford Reach, and 3) monitoring and studying the effects of flow fluctuations on spawning behavior, redd placement, spawning time (within-day), and the extent of deep-watering spawning. In comments filed on May 26, 2005, Interior suggests that redd superimposition[54] during the fall Chinook salmon spawning season reduces redd survival and limits overall juvenile production. They suggest that increasing the amount of

[53] In general, reverse load factoring is the intentional reduction of power generation during the day and increased power generation at night.

[54] Redd superimposition is when late arriving adult spawners spawn in the same locations as early spawners, thereby disturbing and potentially destroying the early spawner redds.

available habitat would reduce redd superimposition and improve red survival. Interior states that eliminating flow fluctuations and releasing constant flows from Priest Rapids dam would substantially increase the available spawning habitat within the Hanford Reach. They recommend that each year, fishery representatives from the agencies and tribes should use escapement and water availability predictions to establish a flow regime for the forthcoming spawning season.

Anglin et al. (2006) developed a model to predict fall Chinook salmon spawning habitat in the Hanford Reach. Using the habitat model to evaluate alternative discharge scenarios, Anglin et al. (2006) found that stable (steady state) flows would increase the quality and quantity of fall Chinook salmon spawning habitat in the Hanford Reach. Additionally, Anglin et al. (2006) reported that under some scenarios, reducing the average flow and the fluctuation range could increase spawning habitat in the Hanford Reach. However, neither Interior nor Anglin et al. (2006) provided any evidence that spawner success is related to available habitat. Additionally, there is no information in the record to indicate that available habitat is limiting production or that redd superimposition is a substantial factor influencing production. Lastly, some redd superimposition would likely occur regardless of amount of habitat available since late arriving spawners are likely to select the same preferred habitat areas that early spawners selected.

From a practical standpoint, it is not clear that providing steady state flows to accommodate predicted spawning escapement is possible. Interior suggests that by using predictions of water availability and escapement, fisheries managers could establish a flow level that would provide spawning habitat to accommodate the number of returning spawners. Anglin et al. (2006) developed a model to test the effects of alternative flow regimes on available spawning habitat in the Hanford Reach. Anglin et al. (2006) reported that the model was relatively accurate for prediction of total spawning habitat area within the Hanford Reach using data from 2004 and 2005.[55] However, as indicated by Anglin et al. (2006) additional testing and development would be necessary before the model could be employed as a management tool to regulate flows during the spawning season.[56] Without further refinement of the Anglin et al. (2006) model or development of a new model to predict habitat throughout the Hanford Reach, managers would be unable

[55] Anglin et al. (2006) reported that the overall accuracy of the model was 85.1 percent for 2004 and 86.2 percent for 2005.

[56] Anglin et al. (2006) states: 1) "[w]e have started development of a tool utilizing our predictive model(s) that will enable fishery and hydrosystem managers to evaluate a range of operations that will provide sufficient spawning habitat for the expected annual escapement to assist with in-season operational planning" and 2) "…the spawning habitat model we developed provides a sound basis for the next steps to complete model building work within each specific spawning area".

to determine the optimum flow level that would provide enough spawning habitat to accommodate the predicted number of spawners.

In addition to the lack of a reliable spawning habitat model, the current ability to predict escapement and is imprecise and unreliable. For the purpose of determining the allowable fishing harvest, the number of returning fall Chinook salmon is annually predicted before the season based on jack returns during the previous year. These numbers are often adjusted by fisheries managers during the season, indicating that preseason forecasts may be inaccurate. The University of Washington uses a predictive model to derive preseason estimates of fall Chinook salmon returns to Bonneville dam. A review of the 2002 to 2005 period shows that preseason estimates using this model generally underestimated actual counts by approximately 36 to 64 percent, which represented 168,000 to 390,000 adult fish.[57] Over- or under-estimating the number of returning spawners would result in selection of flows that would provide too little or too much spawning habitat for the actual returning adults. Additionally, while the ability to predict water availability is generally more reliable than escapement predictions, it is possible that inaccuracies in water prediction would also result in selection of inappropriate or even unachievable flow levels if actual flows are substantially different than predicted.

Lastly, the ability of Grant PUD to reregulate inflows from the upstream projects is limited. Inflows to the Project vary dramatically on an hourly, daily, weekly, and seasonal basis and the useable storage within the Project is generally not great enough to fully reregulate inflows from the upstream projects for the entire spawning season. To release steady state flows from Priest Rapids dam throughout the entire spawning season, modifications to the operation of some or all of the seven mainstem mid-Columbia River dams would need to be considered. While the operation of all seven dams could be modified to provide steady state flows to the Hanford Reach, these changes would affect the ability of the system to provide load following energy generation and they would likely have indirect effects on reservoir fisheries, recreation, and other resource areas.

Interior, CRITFC, and Alaska DFG also recommend that Grant PUD conduct aerial orthophotographic surveys at all known spawning areas within the Hanford Reach during the spawning season. They suggest these surveys should be conducted to help quantify the progression, extent, and geographic location of fall Chinook salmon redds within the Hanford Reach. Interior indicates that this information would provide managers with additional data regarding the physical conditions of the habitats selected by spawners and it could be used to fine-tune project operations.

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[57] http://www.cqs.washington.edu/crisprt/

Similar to the aerial surveys proposed by Grant PUD, the orthophotographic surveys recommended by Interior, CRITFC, and Alaska DFG would provide information useful for determining the timing and location of spawning and could be used to assess and adjust flow releases to the Hanford Reach. In comments on the draft EIS, Grant PUD indicated that orthophotographic surveys would include the use of video or photographic equipment that is geo-referenced and provides sub-meter measurements. It is not clear why the sub-meter level locations of redds would be necessary to manage flows during the spawning season and neither, Interior, CRITFC, nor Alaska DFG provided a justification for the level of detail that would be obtained from orthophotographic surveys. Additionally, they did not indicate why the aerial survey proposed in the Hanford Reach Agreement would be inadequate to monitor progression of salmon spawning within the Hanford Reach.

In comments on the draft EIS, Umatilla and Alaska DFG indicated that spawning surveys should focus on the White Bluffs area, since this is the primary fall Chinook salmon spawning area within the Hanford Reach. Under the Hanford Reach Agreement, three biologists would survey portions of Vernita Bar for the location and number of redds. Additionally, Grant PUD would conduct aerial surveys of the Hanford Reach to locate and count redds. The information from these two surveys would be used to select flow levels for the Hanford Reach. White Bluffs, is an important spawning location within the Hanford Reach downstream of Vernita Bar. This location could be used in place of Vernita Bar for selecting Hanford Reach flows. We would expect that once the relationship between flows and spawning locations is worked out for the White Bluffs area, the use of this survey location in combination with aerial surveys would provide the same protection for fall Chinook salmon in the Hanford Reach as using Vernita bar and conducting aerial surveys.

Interior, CRITFC, and Alaska DFG recommend that Grant PUD be required to monitor and study the effects of flow fluctuations on spawning behavior, redd placement, spawning time (within-day), and the extent of deep-watering spawning. Interior indicates that this information would be used to make management decisions regarding the specific hydrograph that would provide adequate amount of spawning habitat in the Hanford Reach.

While this information would be useful to fisheries managers, Interior has not provided any evidence that flow fluctuations adversely affect spawning behavior or site selection. Additionally, because flow fluctuations are the cumulative result of operations of the seven dam system, it is not apparent that the existing flow fluctuations are entirely related to project effects (i.e., if Grant PUD were required to operate the Project in run-of-river (ROR), substantial flow fluctuations would still occur within the Hanford Reach).

In comments on the draft EIS, Umatilla stated that Anglin et al. (2005) showed that spawning distributions at Vernita Bar and White Bluffs are a function of hourly flow fluctuations at those two sites. Umatilla suggested this information was evidence of flow effects on spawner behavior. The information provided by Anglin et al. (2005) shows that the larger flow fluctuations occurring at Vernita Bar make prediction of available spawning habitat more difficult at Vernita Bar than at White Bluffs. However, this information provides no indication of the effects of changing flows on spawning behavior or redd fidelity.[58] The information cited by Umatilla in Anglin et al. (2005) supports the theory that fluctuating flows influence the amount of available habitat but it provides no indication regarding the likelihood of redd abandonment or completion once a spawning site has been selected.

Umatilla also states that Grant PUD conducted a diel spawning behavior and redd site fidelity study at Vernita Bar in 2005. They suggest that this effort indicates that Grant PUD is concerned with this issue; therefore, Grant PUD should be required to conduct additional studies of spawning behavior. Umatilla provides no discussion of the results of the 2005 study or reasons why additional study would be necessary.

In comments on the draft EIS, Alaska DFG suggested that Grant PUD should continue studies like Anglin et al. (2005) and the diel spawning behavior and redd site fidelity study until the questions of whether or not flow fluctuations effect spawning can be answered. Continuation of these studies would provide information describing the effects of flow fluctuations on fall Chinook salmon spawning in the Hanford Reach.

In the Hanford Reach, fall Chinook salmon spawning generally takes place from October through December. The eggs incubate within the redds for several months before hatching as yolk sac fry, which are called alevins. Alevins remain within the redd for several more weeks or months until they have consumed the yolk sac and then emerge from the redd between late March and the end of May. The survival of eggs, alevins, and emerging fry can be reduced by exposure from dewatering during flow fluctuations. To address this, Grant PUD, NMFS, and Washington DFW recommend implementation of the Hanford Reach Agreement which includes several measures to reduce the potential of dewatering redds or emerging fry. These operational measures are the same as the terms of the VBA that has been implemented since 1988.

Under the Hanford Reach Agreement, Grant PUD would use storage within the Project to maintain the protection flow established by the monitoring team during the spawning season. Maintenance of the protection flow would keep redds inundated. Under the terms of the Hanford Reach Agreement, Grant PUD could reduce outflow

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[58] Anglin et al. (2006) also does not include any specific data describing the effects of changing flows on spawning behavior or redd fidelity.

below the protection flow to 36 kcfs for short periods of time.[59] Reductions in outflow to 36 kcfs would expose or dewater redds during the incubation period. While long-term exposures or dewatering could result in desiccation and freezing of redds and reduce egg survival, the shorter and less frequent exposures contemplated by the Hanford Reach Agreement would likely be less significant since bank storage should help to prevent desiccation or freezing by keeping redds wetted during the shorter exposure periods. These operations should generally protect eggs and redds from dewatering or the adverse effects of dewatering.

Under the Hanford Reach Agreement, the monitoring team would track the timing of hatching on Vernita Bar. Once hatching begins, Grant PUD would maintain the protection flow so that the intergravel water level is no less than 15 centimeters (cm; approximately 6 inches) below the protection flow elevation on Vernita Bar.[60] Flows maintained at or above this level would prevent exposure of alevins to desiccation or freezing. The 15 cm reduction below the protection flow level would still maintain protection of the redds since it corresponds to the approximate depth of the alevins within the shallowest protected redds.

Under the Hanford Reach Agreement, the monitoring team would track the timing of emergence at Vernita Bar. Once emergence begins, Grant PUD would maintain the protection flow in the Hanford Reach for the remainder of the emergence period.[61] Flows maintained at or above this level would prevent exposing emerging fry to desiccation or freezing.

To protect incubating eggs, alevins, and emerging fry, Interior, CRITFC, and Alaska DFG recommend that Grant PUD maintain flow releases for the successful incubation of eggs in redds from November 30 through the end of emergence. They indicate that the specific operations and flows would be determined by the agencies, tribes, and dam operators, which is similar to the approach proposed in the Hanford Reach Agreement. Interior, CRITFC, and Alaska DFG did not provide specific

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[59] The Hanford Reach Agreement specifies that reductions to 36 kcfs should be for no more than 8 hours on weekdays and 12 hours on weekends.

[60] The Hanford Reach Agreement provides that flows can be reduced to 15 cm below the 50 kcfs elevation when hatching has only occurred below this point. Once hatching occurs above the 50 kcfs elevation, the flows could only be reduced to 15 cm below the protection flow elevation.

[61] The Hanford Reach Agreement provides that flows can be reduced to the 50 kcfs elevation when emergence has only occurred below this point. Once emergence occurs above the 50 kcfs elevation, the flows could not be reduced below the protection flow elevation.

information on how the appropriate flows would be selected or how often they would be modified (i.e., once annually or multiple times per spawning season). It appears that the flows would be based on some form of ongoing seasonal monitoring, which is similar to the methods proposed in the Hanford Reach Agreement. Without additional specific information regarding the flow selection, we are unable to evaluate the specific effects of this recommendation, although it appears that it would provide similar or equivalent protection for incubating eggs, alevins, and emerging fry as the Hanford Reach Agreement.

After emergence, juvenile fall Chinook salmon spend several weeks or months rearing within the Hanford Reach before they begin their outmigration. During the rearing period, fluctuating flows within the Hanford Reach can result in stranding and entrapment of juveniles along shoreline areas. McMichael et al. (2003) estimated the number of fall Chinook salmon fry mortalities from stranding or entrapment in the Hanford Reach from 1999 to 2003. Over this time, annual mortality estimates averaged 1.62 million fry and ranged from 155,703 (2000) to 6,864,851 (2001) fry per year. McMichael et al., (2003) estimated that these mortalities represented 0.3 to 10.6 percent of fall Chinook salmon fry produced in each study year. Annual average fry mortality during the study period was 2.5 percent. Excluding the results from 2001, which was an extreme low flow year,[62] McMichael et al. (2003) estimated that the annual average fry mortality from stranding or entrapment in the Hanford Reach was 0.5 percent.

Anglin et al. (2006) indicated that several issues confound and limit the utility of the estimates reported by McMichael et al. (2003). Anglin et al. (2006) listed four criticisms of the McMichael et al. (2003) study, including: 1) sampling was only conducted in a portion of the reach, leaving the remaining portions of the reach unassessed; 2) the sampling plan specified the random selection of sites within areas defined by 40 kcfs flow bands without regard to the magnitude of the fluctuation; 3) the sampling plan did not explicitly incorporate the spatial and temporal dynamics of stranding and entrapment; and, 4) the sampling approach had problems detecting stranded fish. Anglin et al. (2006) suggested that problems with stranding detection are the most significant and because of these problems the stranding and entrapments estimates are likely biased low by McMichael et al. (2003). To address these potential problems, Anglin et al. (2006) derived their own estimates of stranding within the Hanford Reach.

Anglin et al. (2006) estimated that the number of fall Chinook salmon fry mortalities from entrapment in the Hanford Reach in 2003 was 1,297,104. This estimate is approximately 2.5 times greater than the 527,922 mortalities predicted by McMichael

[62] The March to June Columbia River flows recorded at the Dalles dam in 2001 were the second lowest since 1879.

et al. (2006) for the 2003 spawning season.[63] Anglin et al. (2003) also estimated that these entrapment mortalities for 2003 likely represented 5 to 42 percent of the fry production in the Hanford Reach. Anglin et al. (2006) predicted that the estimated fry losses from entrapment could reduce fall Chinook salmon returns from the 2003 spawning year by approximately 4,000 to 13,000 adults.

To reduce stranding and entrapment of juvenile salmon in the Hanford Reach, Grant PUD, Interior, Washington DFW, and NMFS recommend implementation of the rearing period operations specified in the Hanford Reach Agreement. Under the Hanford Reach Agreement, Grant PUD would limit flow fluctuations from Priest Rapids dam based on the anticipated inflow to the project area.[64] For example, when the anticipated inflow would be between 36 and 80 kcfs, releases from Priest Rapids dam would not fluctuate by more than 20 kcfs each day. As inflow estimates increase, the allowable fluctuation range would also increase.[65] At inflows greater than 170 kcfs, Grant PUD would maintain a minimum flow of 150 kcfs and there would be no limit on daily flow fluctuations. The Hanford Reach Agreement also specifies measures that would be implemented by Chelan PUD, Douglas PUD, and BPA to assist Grant PUD in achieving these flow fluctuation requirements.

McMichael et al. (2003) reported the daily flow conditions in the Hanford Reach from 1999 to 2003. A review of this data shows that occasionally flow fluctuations in the Hanford Reach have been as high as 140 kcfs during the rearing period. These appear to be somewhat uncommon events that primarily occur at higher flows (i.e., flows averaging 150 - 200 kcfs). Flow fluctuations in the 60-90 kcfs range appear to be more common and to some extent, fluctuations in this range appear to be independent of the magnitude of average daily flow. Fluctuations less than 60 kcfs were the most frequent type during 1999-2003.

McMichael et al. (2003) reported that higher numbers of fall Chinook salmon fry per unit area were entrapped or stranded from fluctuations of lower flows than from fluctuations at higher flows. Based on this information, reducing the range of fluctuations at lower flows would have more benefit than reducing fluctuations at higher

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[63] Anglin et al. (2006) indicate that their estimate includes only entrapment mortality, while the McMichael et al., (2003) estimate represents both entrapment and standing mortality.

[64] Specifically, the flow fluctuation range for Priest Rapids dam on weekdays would be determined by the previous day's average inflow to Wanapum reservoir. Weekend flow fluctuations would be based on the average of BPA's Friday Chief Joseph outflow estimates plus tributary inflow estimates for Saturday and Sunday.

[65] Specifically, allowable daily fluctuations would be 20, 30, 40, and 60 kcfs based on inflow ranges of 36-80 kcfs, 80-110 kcfs, 110-140 kcfs, and 140-170 kcfs, respectively.

flows. This conclusion appears to be the basis for the flow fluctuation protocol proposed in the Hanford Reach Agreement.

Prior to 2002, Grant PUD attempted to limit flow fluctuations to 40 kcfs or 60 kcfs depending on the average flow and the need for fish passage spills at Priest Rapids dam. However, in 2002 Grant PUD added additional fluctuation restrictions at lower flows that were essentially the same as the requirements of the Hanford Reach Agreement. These additional operational restrictions have been voluntarily implemented by Grant PUD since 2002. Without conducting a thorough hydrologic modeling analysis, it is difficult to determine how significant the operational changes were in reducing the potential flow fluctuations. However, the data presented by McMichael et al. (2003) suggests that in both 2002 and 2003, flow fluctuations were generally less than 20 kcfs during the early part of the rearing period. Later in the rearing period as average flows increased, the range of fluctuations also increased as allowed by the protocol. While year-to-year variations in flows conditions and energy needs make comparisons among years somewhat tenuous, the data presented by McMichael et al. (2003) suggests that the operational changes implemented by Grant PUD in 2002 and 2003 resulted in an increase in smaller flow fluctuations (i.e., less than 20 kcfs) during the rearing period.

The operational protocol proposed by Grant PUD in the SSA would require Grant PUD to limit flow fluctuations to 20 kcfs at flows less than 80 kcfs. This would be a significant restriction when compared to historic operations and would reduce the occurrence of stranding and entrapments within the Hanford Reach during low flows. Under the Hanford Reach Agreement, somewhat larger fluctuations would be allowed at higher flows. As indicated by McMichael et al. (2003), fluctuations at higher flows appear to be less significant in terms of stranding and entrapments; therefore, incremental increases in the allowable fluctuation range as flows increase should maintain adequate protection for rearing fall Chinook salmon fry and limit strandings and entrapments at these flows. While the operational changes proposed in the Hanford Reach Agreement would reduce stranding and entrapments of fall Chinook salmon fry in the Hanford Reach, these measures would not eliminate all mortalities caused by flow fluctuations. Therefore, to mitigate for losses in the Hanford Reach associated with operation of the Project, Grant PUD proposes to annually stock 1,000,000 fry in the project reservoirs. Umatilla and Alaska DFG suggest that 1,000,000 fry is inadequate to mitigate for project effects in the Hanford Reach. As indicated above, annual estimates of losses from flow fluctuations in the Hanford Reach range from 155,703 to 6,864,851 fry per year (McMichael et al., 2003; Anglin et al., 2006). These losses resulted from a mixture of less strict operational limits and voluntary implementation of the current proposal. It is likely that fewer losses would occur with full implementation of the Hanford Reach Agreement, including coordination with and participation by the upstream operators. Based on this information, it appears that the proposed level of hatchery mitigation is reasonable and would fully mitigate the Project's share of the impact on fry in the

Hanford Reach. We evaluate the benefit of the proposed hatchery mitigation earlier in this section under *Salmon and Steelhead – Hatchery Programs*.

A review of the flow data presented by McMichael et al. (2003) indicates that each year from 1999-2003, there were occurrences where Grant PUD's operation of the Project resulted in flow fluctuations that exceeded the limits specified in the operational protocol. Several of the exceedences were classified as a "narrow miss", meaning the fluctuation exceeded the allowable limit by a small amount (i.e., less than 5 kcfs) for a short period of time (i.e., 1 - 3 hours). A few exceedences resulted from dispatcher errors. The majority of the exceedences were caused by high inflows that could not be reshaped by the available storage of the Priest Rapids and Wanapum reservoirs (McMichael et al., 2003). While it is possible that some exceedences may occasionally occur under the Hanford Reach Agreement due to unforeseen circumstances, we would expect that Grant PUD's ability to comply with the flow fluctuation limits would improve if the Hanford Reach Agreement became a requirement of a new license. In part, this would be because Grant PUD's previous efforts to comply with the fluctuation limits were voluntary and Grant PUD likely treated the flow fluctuation limits as targets or guidelines as it experimented with protocols and systems for meeting these fluctuation limits. If the Hanford Reach Agreement became a requirement of a new license, we would expect that Grant PUD would have a strict and precise operational protocol in place to avoid problems with "narrow misses" and dispatcher errors. Additionally, and perhaps more importantly, problems with excessive inflows to the Project that exceeded Grant PUD's ability to store water would be addressed by measures in the Hanford Reach Agreement that would be implemented by Chelan PUD, Douglas PUD, and BPA. These measures include use of storage within the Rocky Reach and Wells projects and monitoring and coordination of generation needs and flow releases at Chief Joseph dam. Through these efforts, Chelan PUD, Douglas PUD, and BPA would help Grant PUD to meet its flow fluctuation obligations for the Project.

To limit entrapments and strandings in the Hanford Reach during the rearing period, CRITFC and Alaska DFG recommend that Grant PUD be required to limit flow fluctuations to no more than 10 kcfs around an estimated weekly average outflow target. Anglin et al. (2006) presented modeling results that predicted the number of fry entrapped under alternative operational schemes that restricted fluctuations to 10, 20, 30, and 40 kcfs. For each fluctuation range, Anglin et al. (2006) tested a fluctuation frequency of 5 and 10 fluctuations per week. Anglin et al. (2006) predicted that 10 fluctuations of 40 kcfs per week would entrap approximately 2,006,750 fry during the rearing period. Five fluctuations of 10 kcfs per week would entrap 82,365 fry during the rearing period and 10 fluctuations of 10 kcfs per week would entrap 98,742 fry (Anglin et al., 2006). These predictions suggest that smaller, less frequent fluctuations in the Hanford Reach would entrap fewer fall Chinook salmon fry during the rearing period. This predicted trend is reasonable and somewhat intuitive since complete elimination of fluctuations (i.e., release of a constant flow) would by definition eliminate shoreline dewatering and any corresponding entrapments. While the overall trend predicted by Anglin et al. (2006) is reasonable, the accuracy (i.e., predicted benefit) of the predicted entrapment estimates is less certain. Anglin et al. (2006) described the collection of field data and development of the entrapment model; however, they provided little explanation or evidence that the model was either validated or verified. In comments filed on July 8, 2005, Grant PUD listed concerns with the entrapment estimates included in the draft report (Anglin et al., 2005).[66] Grant PUD indicated that the analysis failed to: 1) randomize the selection of entrapment sites for sampling, 2) account for the location of entrapments within each flow band, 3) account for the duration of entrapment events, 4) differentiate daytime from nighttime events, 5) differentiate flow increases from flow decreases, 6) explain the selection of an entrapment mortality rate, and 7) "ground-truth" predicted individual entrapment events. Validation or "ground truthing" the predictability of individual entrapment events would substantiate the entrapment predictions provided by Anglin et al. (2006). Without validation, the accuracy of the entrapment predictions is unknown. Anglin et al. (2006) indirectly acknowledges the uncertainty associated with the entrapment estimates in stating that the methodology used to derive the estimates "provides a reliable <u>index</u> of entrapment mortality" (emphasis added).

In comments on the draft EIS, American Rivers provided responses to several of Grant PUD's concerns regarding Anglin et al. (2005). In response to Grant PUD's criticism that Anglin et al. (2005) did not randomize the selection of entrapment sites, American Rivers indicates that the report clearly describes that randomization was used to select river segments, sampling locations within river segments, and entrapments within sampling locations. In response to Grant PUD's criticism that Anglin et al. (2005) did not account for the location of entrapments within each flow band, American Rivers indicates that 10 kcfs flow bands were selected to provide fine-scale differentiation of dewatered areas and further differentiation would not significantly change entrapment event enumeration. In response to Grant PUD's criticism that Anglin et al. (2005) did not account for the duration of entrapment events, American Rivers indicates that duration was accounted for through assessment of entrapment fates. In response to Grant PUD's criticism that Anglin et al. (2005) did not differentiate flow increases from decreases, American Rivers indicates that the modeling temporally and spatially differentiated between increases and decreases in estimating entrapment events and re-inundation. In response to Grant PUD's criticism that Anglin et al. (2005) did not explain the selection of the entrapment mortality rate, American Rivers indicates that the report clearly describes the methods used for estimating the entrapment mortality rate.

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[66] Grant PUD has not filed comments on the final report (Anglin et al., 2006). Our review of Anglin et al. (2006) suggests that the final report was not revised to address Grant PUD's concerns.

CRITFC and Alaska DFG recommend a flow fluctuation range (i.e., 10 kcfs) that is lower than any of the fluctuation limits proposed in the Hanford Reach Agreement (i.e., 20 – 60 kcfs). Intuitively, it would seem that smaller and fewer fluctuations would reduce fall Chinook salmon fry stranding and entrapment; therefore, it is likely that 10 kcfs fluctuation limit would result in less stranding and entrapments than operations that would occur under the Hanford Reach Agreement. However, as indicated above, because of uncertainty associated with the Anglin et al. (2006) model, the incremental benefit of limiting fluctuations to 10 kcfs is unknown.

CRITFC and Alaska DFG recommend that flow fluctuations be no more than 10 kcfs around an estimated Priest Rapids weekly average outflow target. They suggest that the weekly average outflow target should be derived using the Single Trace Procedure of the National Weather Service River Forecast System or a similar forecasting procedure. A weekly average outflow target could be derived from either method; however, without coordination and involvement of both the federal and non-federal operators of the upstream projects, it is likely that Grant PUD would occasionally be unable to comply with the recommended fluctuation limits for the Hanford Reach. Grant PUD indicates that this is because the physical limitations of the Project (i.e., reservoir storage and release capacity) can be exceeded by flows that could be released by the upstream projects, including Grand Coulee dam. Grand Coulee dam is the furthest dam upstream and has the greatest total storage ability and generation capability of all seven dams. Grant PUD indicates that the maximum flow capacity of the turbines at Grand Coulee dam is significantly greater than that of each of the downstream hydroelectric projects. Therefore, to operate the system efficiently, a sophisticated operational plan was developed to allow all of the projects to achieve their operational purposes. Grant PUD indicates that these purposes include flood control, fish migration, navigation, agriculture, recreation, municipal and industrial use, cultural resources, thermal plant cooling water, and power generation and regional electrical system support.

In general, flows released from Grand Coulee dam vary depending on energy demands and the need to meet other project purposes. Through an operational scheme known as the HCA, the operation of Grand Coulee dam and the other six dams is coordinated to optimize hydropower generation and achieve other project purposes. As a result of Grand Coulee dam's physical capacity to store and release flows, flow fluctuations are often greatest in the mid-Columbia River immediately downstream of Grand Coulee dam. Through coordination of the seven dams, these fluctuations generally decrease as they pass downstream. Incrementally, each of the six downstream dams reshapes the flows released from Grand Coulee dam and cumulatively these coordinated operations generally result in lower flow fluctuations in the Hanford Reach than the fluctuations occurring in the upper reaches of the mid-Columbia River. Through coordination with the other mid-Columbia River dams, the Project helps to reduce flow fluctuations that originate upstream while optimizing project energy production. In comments filed on July 8, 2005, Grant PUD suggests that in order to efficiently operate the seven dam system and achieve project purposes while adhering to the 10 kcfs fluctuation limitation, there would need to be modifications to the coordination between Grant PUD and the other upstream operators, including the federal entities.[67]

In comments on the draft EIS, Umatilla states that the Project does not reduce flow fluctuations from upstream and they state that Anglin et al. (2005) reported that removal of Wanapum and Priest Rapids dams would result in a flatter, more protracted hydrograph then occurs with the project in place. We have reviewed Anglin et al. (2005; 2006) and we are unable to find where they reported that flows in the Hanford Reach would be flatter and more protracted without the Project. We would expect that the removal of the project would actually increase fluctuations in the Hanford Reach since it would reduce available generation capacity in the region. Assuming that no new generation is added to the system, the loss of Project generation would need to be made up with increased generation at existing hydroelectric projects. This would result in changes to the Hourly Coordination Agreement and increased generation at the five remaining projects. As a result, fluctuations between high and low generation periods would be divided among five dams, rather than the seven dams that are now used. We would expect that because of the increased demand per project, the frequency and magnitude of flow fluctuations would increase at all remaining mid-Columbia River projects and these changes in operations to meet electrical demand would increase flow fluctuations within the Hanford Reach.

With or without coordination with the upstream projects, complying with the 10 kcfs limitation would likely increase fluctuations in Priest Rapids reservoir levels since Grant PUD would need to use the active storage within the reservoirs to reregulate inflows. Without hydrologic modeling that incorporates potential changes to Priest Rapids Project operations or operation of the upstream projects, we are unable to quantify potential changes in reservoir fluctuations. However, it is apparent that additional use of the project's active storage to reregulate upstream flows would increase the frequency and magnitude[68] of reservoir fluctuations. These changes could adversely affect reservoir

[67] In a letter filed on December 5, 2005, BPA indicated that Grant PUD has the capability to re-regulate flows and accommodate the 10 kcfs restriction; however, BPA acknowledged that this reregulation would require use of the Priest Rapids Project's active storage which could have adverse effects on other resources and project purposes.
[68] We assume that the reservoir operating requirements would be unchanged; therefore, the total range of reservoir fluctuations would be unchanged. However, maintaining the 10 kcfs fluctuation limit would likely result in an increased frequency of the reservoirs fluctuating from the upper limit to the lower limit. Additionally, some small fluctuations that occur under current operation may need to be increased to adhere to the 10 kcfs restriction and could encompass the entire reservoir operating range (i.e., increased

resources in shoreline areas including fisheries habitat, recreational use, erosion, and cultural resources.

In several sections of the draft and final EIS, we indicate that the ability of Grant PUD to reregulate flows is limited by the physical storage capacity of the reservoirs. In comments on the draft EIS, American Rivers states that we failed to provide the relevant analysis to support this conclusion. In referring to the physical limitations of the project, we are referring to the actual physical structures and minimum and maximum operating levels for each reservoir. No one has suggested modifying the reservoir pool level requirements and while some modifications to these levels may be possible without affecting the structural integrity of the project or its ability to operate, modification of these requirements would likely have significant effects on project generation and environmental resources. Because no one has suggested these changes, we have assumed that Grant PUD would attempt to achieve the 10 kcfs restriction with the existing reservoir operating limits in place. As a result, the available storage within the reservoirs is constant[69] and the ability of the project to reregulate lows from upstream areas is by definition “limited”. No analysis is necessary to demonstrate that minimum and maximum pools levels limit project storage, thereby “limiting” Grant PUD’s ability to comply with the 10 kcfs restriction.

In comments on the draft EIS, American Rivers stated that Anglin et al. (2005) reported that Grant PUD has the capability to reregulate flows and accommodate the 10 kcfs restriction. American Rivers suggests that this demonstrates that the capability of Grant PUD to reregulate flows is not limited by the project’s physical capacity.

As indicated above, Grant PUD’s ability to reregulate flows is limited by the storage available within the project reservoirs. In spite of these limitations, we would expect that under a wide range of conditions Grant PUD’s could comply with the 10 kcfs restriction; however, under some circumstances, we would expect that available project storage would be inadequate to maintain the 10 kcfs limits. This is consistent with our conclusion (stated above) that without coordination and involvement of both the federal and non-federal operators of the upstream projects, it is likely that Grant PUD would occasionally be unable to comply with the recommended 10 kcfs flow fluctuation limits for the Hanford Reach. This conclusion is also consistent with modeling conducted by

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magnitude of fluctuation).

[69] For Wanapum dam, the normal operating range of the project is from elevation 560 to 571.5 feet which corresponds to 160,400 acre-feet useable storage. Additional, storage from elevation 571.5 to 575 feet is used for flood storage. At Priest Rapids dam, the normal operating range of the project is from elevation 481.5 to 488 feet which corresponds to 48,600 acre-feet useable storage. Additional, storage from elevation 488 to 491.5 feet is used for flood storage.

Anglin et al. (2005; 2006) which found that the ability of the project storage capacity to achieve a weekly target flow would be exceeded on multiple days during most modeled years.[70]

The fluctuation restrictions proposed in the Hanford Reach Agreement and the 10 kcfs restriction recommended by CRITFC, and Alaska DFG would improve conditions in the Hanford Reach during the rearing period for fall Chinook salmon. However, neither approach would completely eliminate the effects of Project operations on the Hanford Reach. To completely eliminate the effects of the Project on Hanford Reach flows, the project would need to be operated in a true ROR mode. In ROR mode, project outflows would essentially equal project inflows on a short-term basis and the project would have no effect on the flows conveyed to the Hanford Reach. While this mode of operation would eliminate project effects on flows, it would not improve conditions for rearing fall Chinook salmon in the Hanford Reach since fluctuations occurring upstream would be passed directly into the Hanford Reach rather than being reduced during passage through the Project. Conversely, implementing the Hanford Reach Agreement restrictions or the 10 kcfs restriction would result in positive (i.e., beneficial) project effects on releases to the Hanford Reach. Both approaches would utilize Project storage to reduce flow fluctuations before they enter the Hanford Reach.

In comments on the draft EIS, Alaska DFG suggested that Grant PUD should implement the 10 kcfs limit for several years to collect data that would be useful for defining tradeoffs between fluctuations and power generation. Implementing the 10 kcfs fluctuation limit experimentally would likely reduce stranding and entrapments below the levels of the Hanford Reach Agreement flows and it would allow for collection of stranding and entrapment data during actual 10 kcfs operation. Additionally, experimental implementation of this mode of operation would allow for quantification of Grant PUD's ability to comply with this flow restriction.

As part of the Hanford Reach Agreement, Grant PUD, Interior, NMFS, and Washington DFW propose that during the rearing periods of 2011, 2012, and 2013, follow-up monitoring would be conducted to estimate fry losses. This monitoring would use the protocols developed for the monitoring conducted by McMichael et al. (2003) during the 1999 – 2003 rearing periods. Monitoring during 2002 and 2003 essentially

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[70] Anglin et al. (2005; 2006) did not report the number or percentage of days where storage limitations would result in exceedence of the 10 kcfs restriction. Our review of their data finds that the 10 kcfs limit was often violated during each modeled season, including multiple violations over 40 kcfs. These violations primarily resulted from the simplistic approach used by the Anglin et al. (2005; 2006) model to abruptly transition from one weekly flow target to the next.

documented the effects of the Hanford Reach Agreement[71] Follow up monitoring would document the effects of the flow program and provide information that could be used to evaluate program effectiveness and consider modifications.

CRITFC and Alaska DFG recommend that Grant PUD conduct annual assessments to estimate fall Chinook salmon fry entrapment and stranding losses. In comments on the draft EIS, Alaska DFG suggested that stranding and entrapment surveys should be conducted annually until a clear picture of how dam operations affect salmon populations is developed. Similar to the monitoring proposed in the Hanford Reach Agreement, this program would document the effects of the flow program and provide information that could be used to evaluate program effectiveness and consider modifications. However, unlike the Hanford Reach Agreement proposal, the monitoring recommended by CRITFC and Alaska DFG would allow annual tracking and evaluation of program success. In general, the monitoring proposed by CRITFC, and Alaska DFG would be more labor intensive than the program described in the Hanford Reach Agreement.

Interior and CRITFC recommend that Grant PUD monitor and evaluate the effects of project operations on primary and secondary production and resident fish in the Hanford Reach. Interior specifies that Grant PUD should measure and quantify the effects of project operations on periphyton[72] and macro invertebrates. Interior also indicates that Grant PUD should use the techniques of Anglin et al. (2005) to derive entrapment estimates for resident fish. Interior indicates that this information is needed to determine the acceptable level of flow fluctuations that should be allowed during the June through October time period. Interior states that shoreline dewatering does not allow establishment of viable and persistent periphyton or macro invertebrate communities that serve as the primary food source for rearing fish. Interior also indicates that entrapment of resident species can result in mortality of these species due to elevated summer water temperatures.

In comments on the draft EIS, Umatilla states that the food base in the Columbia River has been altered in quality and quantity so that impacts on growth rates and survival are likely. Umatilla provide no support for this statement; however, they do provide a list of studies on food quantity, food quality, and fish nutrition that have been suggested by other researchers. Neither Interior, CRITFC, nor Umatilla provide any

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[71] Grant PUD implemented the terms of the Hanford Reach Agreement in 2002 and 2003; however, this implementation, including the efforts of Chelan PUD, Douglas PUD, and BPA to assist Grant PUD in meeting the flow requirements, was voluntary.

[72] Periphyton is an assemblage of microscopic organisms, primarily algae, which grow on substrate surfaces in the aquatic environments. In streams and rivers, periphyton production is often used as an indicator of primary productivity.

evidence that either fall Chinook salmon fry or resident fish within the Hanford Reach are food limited, of poor condition, or exhibiting poor growth rates. While it may be reasonable to assume that short-term flow fluctuations influence productivity along the river margins, there is no evidence that the available food supply is limiting fish growth or survival in the Hanford Reach.

As documented by McMichael et al. (2003) and Anglin et al. (2006), resident fish can be entrapped by receding flows. Dewatered entrapments or elevated water temperatures likely result in the mortality of some unknown proportion of these entrapped resident fish. However, while some mortality of resident fish may be occurring within the Hanford Reach, there is no evidence that any of the resident fish species inhabiting the Hanford Reach are declining in abundance as a result of stranding or poor food availability. Collection of this information may be useful for fishery managers as indicated by Interior; however, because there is no evidence that these potential effects are adversely affecting fall Chinook salmon fry or resident fish, it appears that the information is unnecessary.

Grant PUD proposes to investigate the feasibility for habitat modifications in the Wanapum dam tailrace area to increase the amount of high quality fall Chinook salmon spawning habitat. Grant PUD indicates that potential measures include scarification of cobble bars and creation of a new bar of cobble-sized material. Scarification would decrease imbeddedness and improve hyporheic conditions in the areas where fall Chinook salmon could spawn within the tailrace. Grant PUD also indicates that modeling indicates that flows from the proposed Wanapum downstream bypass would redistribute material in the tailrace and form a new bar of cobble-sized material. These actions could increase fall Chinook salmon spawning habitat downstream of Wanapum dam.

In comments on the draft EIS, Yakima County indicated that due to conditions in the Hanford Reach and the cumulative effect of upstream storage projects on flow, the ability to increase the habitat area in the Hanford Reach and downstream of Wanapum dam is limited. Yakima County suggests that the lower Yakama River is the only feasible location for mitigating project effects on fall Chinook salmon habitat loss caused by construction and operation of the project. Yakima County did not recommend any specific habitat projects for the lower Yakama River; however, it is likely that a wide range of projects could be implemented that would increase habitat for Yakama River fall Chinook salmon. Yakama River fall Chinook salmon are a component of the upper Columbia River fall Chinook salmon stock that also occurs within the Hanford Reach and Project area. At this time we have no information to indicate that available habitat within the lower Yakama River is limiting production; however, increasing habitat for lower Yakama River fall Chinook salmon could increase juvenile production and potentially adult returns if the amount of spawning or rearing habitat is currently limiting reproductive success.

Bull Trout

Under section 18 of the FPA, Interior prescribes that to provide for bull trout passage, Grant PUD should operate the Project upstream and downstream fish passage facilities as prescribed for salmon and steelhead.

Under section 10(j) of the FPA, Interior recommends that Grant PUD develop and implement a monitoring plan for bull trout and Grant PUD should provide an annual report of monitoring results.

Under section 10(j) of the FPA, Washington DFW recommends that Grant PUD develop a bull trout plan that incorporates the terms and conditions proposed by the FWS for bull trout and consistent with the FWS' bull trout recovery plan. Washington DFW specifies that the plan should include a monitoring and adaptive management element.

Our Analysis

Available information suggests that the bull trout abundance in the Project area is extremely low. Pfeifer et al. (2001) conducted an extensive multi-gear, multi-season fish sampling survey of the project area and reported collecting only two juvenile bull trout among more than 58,000 fish that were collected. One of the bull trout collected by Pfeifer et al. (2001) was collected in the Priest Rapids reservoir, approximately 2 miles upstream from the dam, and the other was collected within the Wanapum reservoir. In a letter filed on July 8, 2005, Grant PUD indicated that there have been "only a handful" of documented fishway observations of bull trout within the project area over the past 43 years. Grant PUD participated in a combined effort with Chelan and Douglas PUDs to study bull trout movements in the mid Columbia Region. The effort focused on collecting bull trout passing through the project fish ladders, implanting the fish with radio-tags, and tracking their movements after release. During this study (BioAnalysts; 2003), no bull trout were collected from the Priest Rapids or Wanapum fish ladders. All tagged fish were collected from the fish ladders at the upstream Rock Island, Rocky Reach, and Wells dams. A small number of the tagged bull trout were recorded using the upper portion of the Wanapum reservoir (*i.e.*, the first few miles downstream of Rock Island dam) during the winter period (BioAnalysts; 2003). These data suggest that a portion of the mid-Columbia River bull trout population may overwinter in the upstream portions of the Wanapum pool.

In a letter dated January 10, 2000, Interior indicated that bull trout are thought to have been extirpated from the Hanford Reach. However, in comments filed in late May

2004, Interior and Washington DFW indicate that bull trout from the Snake River dps could occur within the Hanford Reach downstream of the Priest Rapids Project. In comments on the draft EIS, Washington DFW indicated that project waters serve as a migratory corridor between Yakima River and upper Columbia River subpopulations of bull trout. Washington DFW suggests that movement of individuals between the upper Columbia River dps and the downstream dps's (*i.e.*, Snake River and Yakima River dps's) is critical to supporting genetic diversity and repopulation; however, they provide no evidence that mixing of the two dps's occurs or that the project impedes passage. In fact, they state that the effect of the project on the ability of fish to move between the dps's is unknown. Other migratory salmonids readily utilize the fish ladders at both project dams and based on bull trout movements through the upstream ladders at the Chelan and Douglas PUD projects, we would expect that bull trout from downstream areas would be able to access upstream areas inhabited by upper Columbia River bull trout.

Interior prescribed, under section 18, that Grant PUD provide safe, timely, and effective upstream and downstream passage for bull trout by operating the project's upstream and downstream passage facilities in accordance with the measures required for salmon and steelhead. Measures that would be implemented to maintain or improve upstream salmon and steelhead passage would likely benefit bull trout moving upstream or downstream through the project area; however, because all available information suggests that very few bull trout actually move past the project dams, this measure would have no apparent effect on the Yakama, Snake, or upper Columbia River dps's.

Both Interior and Washington DFW propose that Grant PUD develop and implement a bull trout monitoring plan. Washington DFW suggests the plan should include monitoring and an adaptive management element that would provide for studies of project effects on bull trout when their numbers increase within the project area. Interior specifically suggests that the monitoring plan should track the presence of bull trout in the project area by reporting observations of bull during video counting at fishways, fish bypass activities, gatewell dipping, turbine maintenance activities, fish ladder maintenance activities, hatchery activities, northern pikeminnow control program, and other related activities. Interior and Washington DFW specify that Grant PUD should provide an annual report that would include the results of monitoring.

A bull trout monitoring plan would be useful for documenting the presence of bull trout in the project area. While bull trout abundance within the project area appears to be extremely low at this time, it is possible that Grant PUD would observe bull trout during other project activities such as video counting in the fishways, fish bypass activities, gatewell dipping, turbine maintenance activities, fish ladder maintenance activities, hatchery activities, or northern pikeminnow control program. Annually summarizing the observations of bull trout in the project area would provide information that could be used to qualitatively track changes in the abundance of bull trout in the project area. Initially, we would not expect many observations of bull trout in the project area; however, if recovery efforts for bull trout are successful within the mid-Columbia River, it is likely that the number of bull trout within the project area would increase and there would be a corresponding increase in observations.

Due to the low numbers of bull trout within the project area, studies of project effects on bull trout are infeasible at this time. However, increased numbers of bull trout within the project area due to recovery efforts could allow statistically valid analysis of project effects on bull trout in the future. Washington DFW recommends that as part of the bull trout monitoring plan, Grant PUD should periodically review bull trout abundance within the project area and assess the feasibility of conducting studies of project effects on bull trout. Evaluating project effects on bull trout may be appropriate if recovery efforts result in increased numbers of bull trout within the Project area.

Pacific Lamprey

As part of its license application, Grant PUD proposes to modify diffusion chambers on both fishways at Priest Rapids to improve adult lamprey passage. Grant PUD also proposes to modify the design of the fish count stations at Priest Rapids and Wanapum dams to improve adult lamprey passage and enumeration. If appropriate, Grant PUD would reduce fishway flows at night to improve adult lamprey passage.

Under section 10(j) of the FPA, Washington DFW recommends that Grant PUD develop, fund, and implement a Pacific Lamprey Plan with the goal of assessing project effects on Pacific lamprey and rebuilding Pacific lamprey populations within the project area. Washington DFW recommends that Grant PUD be required to achieve adult lamprey passage efficiency standards similar to the best standards experienced at other, similar projects on the Columbia River hydroelectric system. Washington DFW also recommends that Grant PUD exchange information and coordinate Pacific lamprey management activities with Washington DFW and other relevant entities. Washington DFW recommends that the PLMP should include a plan to use four-month life-span radio tags to track adult lamprey movements within the project boundary. Lastly, Washington DFW recommends that Grant PUD fund a qualified biologist to participate in the development and implementation of the Pacific Lamprey Plan and regional coordination activities related to Pacific lamprey management.

Under section 18 of the FPA, Interior prescribes that for upstream Pacific lamprey passage, Grant PUD should operate the Project upstream fish passage facilities as prescribed for salmon and steelhead. Additionally, Interior prescribes that Grant PUD complete the formulation of the adult upstream passage elements recommended in the Pacific Lamprey Plan described below. Interior does not prescribe downstream passage measures for lamprey at this time because they conclude that the methods to evaluate downstream passage and survival of lamprey are still under development and the form and function of an effective downstream fishway for juvenile lamprey is unknown based on available evidence.

Under section 10(j) of the FPA, Interior recommends that Grant PUD develop and implement a Pacific Lamprey Plan that includes: 1) monitoring and evaluation of juvenile lamprey rearing in the reservoirs, outmigration timing, and downstream passage route selection and survival, 2) modifying existing structures and project operations to improve juvenile and adult lamprey passage survival, and 3) sharing information and participating in and funding regional efforts to establish adult survival standards, develop techniques for juvenile lamprey radio-tagging, identify lamprey habitat use, and habitat mitigation.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD refine, fund, and implement a Pacific Lamprey Plan to meet qualitative and quantitative performance goals for juvenile and adult lamprey passage. CRITFC recommends that Grant PUD develop and provide a plan to implement structural and operational modifications to the Project to protect, mitigate, and enhance adult Pacific lamprey during upstream passage. CRITFC specifies that Grant PUD should achieve 80 percent adult lamprey dam passage effectiveness by 2013 and 97-98 percent dam passage effectiveness by 2030. CRITFC recommends that Grant PUD fund adult lamprey studies to evaluate passage improvements and to assess adult lamprey passage from the project into upstream tributary spawning areas.

Under section 10(a) of the FPA, CRITFC indicates that Grant PUD should provide safe, timely, and effective downstream passage for juvenile lamprey. CRITFC recommends that Grant PUD meet downstream passage standards for juvenile lamprey once they are developed by regional fisheries managers. CRITFC recommends that Grant PUD assess indirect and direct mortality and injury rates for Pacific lamprey.

Our Analysis

The numbers of adult Pacific lamprey entering the Columbia River have declined over the past 40 years or so (Grant PUD; 2005a). These declines have been attributed to a variety of factors including poor habitat conditions, past fisheries management practices including poisoning operations, water pollution, dam passage problems, ocean conditions, and food availability.

Priest Rapids and Wanapum dams include fish ladders that were designed for salmon and steelhead passage, but are also used by adult lamprey for upstream passage. Nass et al. (2003) conducted two years of monitoring radio-tagged lamprey during upstream passage through the project fish ladders. Overall, the median time for successful passage through the Priest Rapids and Wanapum dam fish ladders was between 1.1 and 1.8 days. Nass et al. (2003) reported that a large proportion of the radio-tagged lamprey failed to enter the fish ladders and several areas within the ladders appeared to cause delays or terminate[73] lamprey migrations. At Priest Rapids dam the areas of delay include the visual counting stations and the first orifice walls. At Wanapum dam, the only area where delay occurred appeared to be the visual counting station in the left-bank fishway (i.e., no areas of substantial delay in the right-bank fishway).

Nass et al. (2003) reported that while diffusion gratings in the fish ladders appeared to delay lamprey passage at Bonneville dam, the gratings in the Project ladders did not cause any measurable delay. Nass et al. (2003) reported that lamprey encountering a visual counting station were more likely to terminate their migration or be substantially delayed compared to any other location within the project fishways. Moser et al. (2002) attributed delays at counting stations to bright lighting and disrupted water flow conditions. Nass et al. (2003) also suggested that the combination of high velocities and passage through an orifice at the first orifice wall may cause delays.

Grant PUD is proposing to bolt aluminum plating along the edges of the diffuser gratings in the project fish ladders to provide better attachment areas for adult lamprey moving upstream. This measure is also prescribed by Interior under section 18. While Nass et al. (2003) did not report measurable delays in the areas around the diffuser gratings, it is possible that providing the grating would either increase lamprey movements through these areas or reduce energy expenditure thereby enhancing upstream passage efficiency for adult lamprey.

Grant PUD also proposes to modify the areas around the visual counting stations to improve upstream passage conditions for lamprey. Specifically, Grant PUD would eliminate the spaces between the counting board and counting window and the areas between the frame and concrete orifice wall. These modifications would create more laminar flow through the counting area and remove gaps where lamprey apparently become trapped or confused by irregular flows. Grant PUD also proposes that upon approval of a video count system, they would remove the counting stations including the picket leads and trashracks. These modifications would likely reduce delays of upstream

[73] Lamprey either moved downstream from this point in the fish ladder or remained in place throughout the completion of the data collection period. Lamprey can remain in place for prolonged periods because their mouths function as a suction disk and allow lamprey to attach to smooth areas within the ladders. Using this technique lamprey can remain in areas of relatively high velocities for prolonged periods of time without expending significant amounts of energy.

lamprey movements in these areas. Lastly, Grant PUD proposes to consult with the agencies to determine the benefit of reducing fishway flows at night when lamprey movements are greatest. While this may reduce passage conditions for salmon and steelhead, these species are generally less active at night and the overall potential benefit to lamprey may outweigh any minor effects on salmon and steelhead passage.

Under section 18, Interior prescribes that Grant PUD modify the fish ladders for lamprey by improving orifices for passage, rounding sharp edges, constructing rest areas in front of submerged orifices, reducing diffuser grating spacing, and installing collection devices for adults. As indicated below, the corners of the fish ladder are already rounded; however, there may be other areas of sharp edges that could be rounded consistent with Interior's prescription. While it is possible that rounding all sharp edges would somehow benefit adult lamprey within the fish ladder, we have no evidence to indicate that sharp edges result in either delayed lamprey movements through the fish ladder or harm to lamprey. Construction of rest areas in front of submerged orifices may allow lamprey to regain energy before swimming through a submerged orifice. Nass et al. (2003) reported that the submerge orifice has a high velocity profile that may delay lamprey passage or cause lamprey to turn around. Providing resting areas in these areas may reduce delays or improve passage efficiency. Reducing the diffuser grating spacing would have similar benefits to adding the aluminum plating as described above; however, as indicated by Nass et al. (2003) the diffuser grating did not appear to impede upstream migration at either dam. Lastly, Interior recommends installing collection devices for adults. Interior provides no explanation why such a device would be needed or how it would address project effects or project purposes.

CRITFC recommends that Grant PUD pursue actions to achieve 80 percent dam passage effectiveness by 2013 and 97 percent dam passage effectiveness by 2030. CRITFC does not provide any substantial evidence to support these goals. Based on data collected by Nass et al. (2003), the 80 percent passage effectiveness appears to be potentially achievable; however, there is no evidence in our record to indicate that a 97 percent passage effectiveness goal is attainable. More importantly, it is not clear what level of dam passage effectiveness is necessary for successful reproduction of adult lamprey in the upper Columbia River system. Hatch et al. (2001; as cited by Nass et al.; 2003) reported that unlike salmon and steelhead, lamprey do not appear to have strong homing tendencies and will stray to other locations during their migration. In comments on the draft EIS, Washington DFW indicated that lamprey probably do not home to a specific natal stream; however, Washington DFW stated that it is becoming evident that migration to their winter hold-over area is direct and fishways are an impediment. Additionally, Washington DFW indicated that passage studies in the lower Columbia River indicated that individual lamprey would make repeated attempts to ascend fishways and lamprey that successfully passed upstream rarely moved downstream. Washington DFW suggests that these data indicate the importance of providing safe and effective upstream passage for adult lamprey. While the information provided by Washington DFW suggests that lamprey have a strong desire to move upstream, there is no evidence in the record to indicate that adult lamprey that fail to move upstream are unable to contribute to the viability of the lamprey population. It is possible that adult lamprey that fail to pass the project dams, either by failing to enter fishways or by returning to the tailwater after partially ascending a fishway, move downstream into project tributaries or other areas to spawn. Recent annual returns to the project area range from about 1000-4000 adult lamprey. We have no evidence in the record to suggest that the habitat in areas downstream of the dams is either unsuitable or inadequate to support the numbers of lamprey that occur within the project area and may fail to pass the project dams. More importantly, we have no information to indicate that 80 percent or 97 percent passage effectiveness is necessary for the successful maintenance or restoration of Pacific lamprey in the upper Columbia River basin.

Interior prescribed, under section 18, that Grant PUD evaluates the feasibility of a capture-and-haul program. Interior indicates capture-and-haul would be implemented if modifications to the fish ladders do not provide adult lamprey passage rates similar to the best passage rates found at other hydroelectric project in the Columbia River Basin. Washington DFW also recommended that Grant should be required to achieve the best passage rates found at other Columbia River hydroelectric projects. "Best passage rates at other projects" appears to be an arbitrary standard since the agencies did not provide any biological justification for this standard and they did not specify how it would be calculated. It is unknown if the standard would be based on a single year of data from a single fishway or if it would be an average of several years of data for all possible routes at a given dam. Additionally, the fact that the agencies did not provide a specific number representing the current best passage rate at other projects is an indication that currently available information is insufficient to calculate such as number. Lastly, "best passage rates" would be a moving standard that would increase as more information becomes available and improvements are made to other dams. This is additional evidence of the arbitrary nature the standard since it would be based entirely on what can be achieved at another project rather than the biological requirements of the species.

Development of a capture-and-haul program would benefit adult lamprey if passage through the modified fish ladders is inadequate and habitat downstream of the project dams is either unsuitable or inadequate to support the numbers of lamprey that fail to pass the project dams. However, as we indicated above, the agencies have not provided any evidence to indicate what level of passage success, if any, is necessary to support or increase the lamprey population. While lamprey appear to have an innate behavior that drives them to attempt upstream passage through the project fish ladders and occupy habitats throughout their natural range, there is no evidence in our record to indicate that unsuccessful passage at the Project is either limiting reproductive success or population numbers of lamprey returning to the upper Columbia River. Additionally, there is no evidence in our record that the existing habitat downstream of the project dams is either unsuitable or unavailable to support the current numbers of lamprey that fail to pass the project dams.

Interior prescribes under section 18 that Grant PUD develop a plan to install additional or new adult lamprey volitional passage facilities in year 8 of the new license in the event that modifications to the existing fish ladders and implementation of the capture-and-haul program do not achieve the best passage rates found at other hydroelectric projects in the Columbia River Basin. As indicated above, it is unclear what level of passage success would be necessary for maintenance or growth of the lamprey population inhabiting the upper Columbia River and there is no evidence in our record to indicate that achieving the "best passage rates" is either necessary or adequate to achieve this goal. Regardless, of the lack of biological evidence to support Interior's passage standard (i.e., "best passage rates"), Interior's prescription for lamprey passage facilities suggests that effective lamprey-specific upstream passage designs would be developed within the next few years and includes potentially problematic timing constraints.

At this time, we are not aware of any lamprey-specific upstream passage facilities that have been constructed at dams comparable in size to the Project dams. CRITFC indicates that lamprey auxiliary passage systems have been used at Bonneville dam to allow lamprey passage around difficult areas in the existing fish ladders. The auxiliary passage systems consist of long, fabricated metal boxes which are used to move lamprey around serpentine weirs and wall dividers. In comments on the draft EIS, Umatilla suggests that these auxiliary passage systems could be used to construct lamprey-specific passage facilities at Priest Rapids and Wanapum dams. While these auxiliary passage systems appear to provide effective lamprey passage for short sections within the Bonneville dam fish ladders, we have no evidence that they could be used to construct a full-scale volitional passage facility that would effectively provide lamprey passage over Priest Rapids and Wanapum dams. Additionally, there is no evidence in our record to indicate auxiliary passage systems or any other design could achieve Interior's and Washington DFW's "best passage rate" standard. Lastly, there is no evidence in our record to suggest that lamprey-specific upstream passage facilities would outperform existing facilities located at the Project. Interior's prescription appears to rely on development of a new, highly effective upstream passage facility design for adult lamprey within the next 3-5 years.

Interior prescribes that Grant PUD complete preliminary design work and develop a plan to install the lamprey-specific upstream passage facilities by year 5 of a new license. This requirement would likely require Grant PUD to perform preliminary design of upstream lamprey facilities during the first 1-3 years of the license and then draft the plan and formalize the final designs in consultation with the agencies during years 4 and

5 of the new license. Grant PUD would be implementing and monitoring the effects of modifications to the existing passage facilities during these first 5 years. As written, Interior's prescription appears to require Grant PUD to conduct preliminary design work and development of the plan regardless of what progress may be made toward achieving Interior's passage goals using the existing facilities. Additionally, Interior prescribes that Grant PUD implement the capture-and-haul program in year 5 of a license and construct the lamprey specific fish passage facilities in year 8 of a new license. This schedule does not appear to allow adequate time for testing and refinement of the capture-and-haul program, since Interior's prescription specifies that Grant PUD must complete installation of the new facilities by year 8 of a new license (i.e., begin construction in year 6 or 7). In general, the stepwise decision sequence for measures prescribed by Interior appears to be hasty or rushed. Providing more time between critical decisions (e.g. implementation of the capture-and-haul program and construction of the new fish passage facilities) would allow adequate time for testing and refinement of existing measures and would ensure that unnecessary measures are not implemented prematurely.

Interior recommends that Grant PUD assist in regional efforts to establish upstream passage survival standards for adult lamprey. While development of regional passage standards may be useful for fisheries managers, it would not address project effects and would not result in the identification or mitigation of project impacts on lamprey.

Washington DFW recommended that Grant PUD round all corners within the fishway that are problematic for adult lamprey. Washington DFW provided no evidence that any corners are problematic for lamprey. Additionally, Grant PUD indicates that all corners in the Priest Rapids and Wanapum fishways are already rounded.

Washington DFW recommends that Grant PUD perform further analysis of the data collected by Nass et al. (2003) to identify problem areas, identify causes, and implement solutions. We would anticipate that any existing data, including the data collected by Nass et al. (2003), would be considered during development and implementation of any upstream passage measures that might be considered as part of the Pacific Lamprey Plan (discussed below). Consideration of all existing data would be appropriate in any effort towards improving conditions for lamprey and would thereby benefit the species.

Interior prescribes under section 18 and Washington DFW recommends under section 10(j) that Grant PUD conduct radio-telemetry studies to measure the effectiveness of any measures implemented to improve upstream lamprey passage. Modifications made to the fishways or their operation would likely have some uncertainty associated with them. Occasionally monitoring upstream passage efficiency would be beneficial to lamprey by identifying effective, ineffective, or adverse passage measures.

CRITFC recommends that Grant PUD use radio-telemetry to track adult lamprey movements through the reservoir and into tributaries. As part of its modified recommendations under section 10(j) of the FPA, Washington DFW recommended that the Pacific Lamprey Plan should include a plan to use long-lived radio tags to track adult lamprey movements within the project boundary. Nass et al. (2003) demonstrated that lamprey moved freely through the project reservoirs with migration speeds ranging from 1.9 to 6.6 miles per day. We have no evidence to suggest that the project adversely effects lamprey movements through the reservoir and it is unclear how the recommended study would reveal any project effects if they exist. Washington DFW states that adult lamprey travel times through the project reservoirs is slower than at other Columbia River projects and they believe this may be an indication of a project effect. However, neither CRITFC nor Washington DFW provided any information to suggest a possible project-related mechanism that would influence migration rates. Additionally, they did not specify how the tracking data could be used to identify any potential project effects or develop measures to mitigate for any potential project effects. Tracking of lamprey movements into tributaries upstream of the project, as recommended by CRITFC, may benefit fisheries managers by identifying occupied habitats or key spawning areas; however, there is no apparent nexus between this information and the project since the project has no apparent effect on the movements of adult lamprey in tributary habitats.

Washington DFW recommends Grant PUD develop a monitoring plan using radio-telemetry to evaluate lamprey fishway passage every ten years after achievement of their recommended passage efficiency goal. While it is both reasonable and appropriate to test the effectiveness of modifications made to the fish passage facilities, these tests should be performed in response to the changes to structures or operations rather than based on an arbitrary recurrence interval of once every ten years. In other words, if no significant changes to fishway structures or operations are made over a ten year period there would not necessarily be any need to conduct effectiveness testing. Conversely, if several major changes are made to fishway operations over a period of several years it may be reasonable to conduct effectiveness during each season that new measures are being implemented. Regardless of the frequency of effectiveness testing, this effort would be beneficial to lamprey by identifying effective, ineffective, or adverse passage measures.

Interior prescribed, under section 18, that Grant PUD conducts a hydraulic study of fish ladder entrance conditions, diffusion areas, and submerged orifices. Interior indicates that these results would be used to implement modifications to the fish ladders to improve upstream passage conditions. Nass et al. (2003) indicated that lamprey movements through the areas with diffuser gratings did not appear to be delayed; however, entrances and submerged orifices were associated with some apparent delays. Studying the hydraulic conditions in areas that may be challenging to lamprey would allow for quantification of modifications (*e.g.*, such as Grant PUD's proposal to reduce flows at night) that are being considered.

In comments on the draft EIS, Grant PUD indicated that tracking actual adult lamprey migration and behavior within the fishways using radio-telemetry would be more beneficial than conducting a hydraulic evaluation. Both evaluations would attempt to identify adult lamprey passage problems within the fishways. Radio-telemetry tracking would provide direct observation of adult lamprey passage through the fishways, including direct identification of problem areas where lamprey passage is blocked or delayed. A hydraulic study would provide information regarding flow characteristics within the fishways; however, to identify problem areas the actual hydraulic measurements would need to be linked to theoretical information regarding lamprey passage abilities. In general, we would expect direct observation from radio-tracking to provide more reliable information for identifying problem areas than a hydraulic study.

Interior prescribed and Washington DFW recommended that Grant PUD develop a protocol for lamprey salvage during fish ladder dewatering. Dewatering would typically occur during seasonal inspections and maintenance, but could also occur in response to emergency conditions or to perform unanticipated and critical structural repairs. Few lamprey would be expected within the ladders during the typical time for seasonal inspections (January or February); however, emergency dewatering could occur during peak migration periods. Developing a protocol to address possible stranding of lamprey within the fish ladders during dewatering would likely reduce any mortalities potentially associated with these events.

Interior prescribes under section 18 that Grant PUD continues to enumerate adult lamprey passage through the project fish ladders. Grant PUD has proposed to continue counting all species passage through the fish ladders and is in the process of switching to a video count system that would, as described above, allow for modification of the counting stations and may improve adult lamprey passage through these areas.

Downstream passage at the Project may occur via several routes including the turbines, spillways, gatewell slots, or fish ladders. In its additional information response filed on October 15, 2004, Grant PUD indicates that the tendency of juvenile lamprey to travel low in the water column may result in high turbine entrainment rates. However, Grant PUD suggests that turbine passage survival is likely at least as high as for juvenile salmonids passing through the project dams (i.e., generally greater than 90 percent). Moursund et al. (2000; 2001) simulated the effects of turbine passage on lamprey and reported no injuries or deaths from exposing lamprey to either high shear stress water velocities or abrupt pressure spikes. Bleich and Moursund (2006) stated that these results suggest that direct turbine survival is probably high for juvenile lamprey.

Grant PUD is proposing to implement a variety of measures to improve downstream passage for salmon and steelhead. These measures include construction of downstream fish bypasses in spillbay 22 of Priest Rapids dam and future unit 11 of Wanapum dam, installation of new advanced design turbines at both dams, implementation of optimum turbine settings, installation of gatewell exclusion screens and continued spill until other downstream passage measures achieve passage survival goals. While all of these measures are being implemented to improve downstream passage conditions for salmon and steelhead, it is possible that they would indirectly benefit lamprey through improved downstream passage survival. However, because it is likely that a large proportion of lamprey pass the project via the project turbines and already experience generally high survival rates (i.e. likely greater than 90 percent), these measures would likely only result in a minor improvement, if any, in downstream passage survival of lamprey.

Washington DFW recommends that Gant PUD evaluate lamprey downstream passage routes using PIT tags and hatchery-raised lamprey, if available. Interior also recommends that Grant PUD study passage routes, although they do not specify what techniques should be used. Grant PUD indicates that PIT tag technology has not been proven as an effective means for addressing juvenile lamprey passage. Grant PUD indicates that studies with lamprey and PIT tags at the Willamette Falls Project (FERC No. 2233) were inconclusive because of extremely low recovery of tagged individuals (6 percent or less with live animals). In its letter filed on May 26, 2005, Interior also indicated that the methods to evaluate juvenile lamprey passage and survival are still under development. Grant PUD also indicates that aquaculture techniques for Pacific lamprey are not currently known; therefore hatchery-raised lamprey are not currently available. While a study of downstream lamprey passage and survival would be useful in regard to identifying project effects and possibly measures for improving lamprey survival, it does not appear that a reliable method, including PIT tagging, exists at this time.

Interior recommends that Grant PUD develop and implement techniques to estimate juvenile lamprey survival through the project. Development of such techniques could be useful to quantify project effects on juvenile lamprey survival. However, in general, the risks of technology development include consumption of vast resources that may either result in failure or results that have no direct or indirect benefits to lamprey. More importantly, available information suggests that experimentation to develop methods to assess juvenile lamprey survival may be unnecessary since available information suggests the project may have little effect on juvenile lamprey passage survival.

In comments on the draft EIS, Washington DFW indicated that the technology, methodology, and source of hatchery-reared juvenile lamprey (i.e., test fish) are not available at this time to assess juvenile lamprey passage survival at the Project. Washington DFW stated that efforts to develop juvenile lamprey tagging technology are ongoing and it is reasonable to expect that an effective technology would become available during the term of any license that may be issued for the Priest Rapids Project. Recent studies conducted at McNary dam provided promising results and suggest that with some modification of standard techniques used for salmonids, PIT tags may be an effective means to test juvenile lamprey survival (Bleich and Moursund, 2006). Based on this information, Washington DFW recommends that Grant PUD be required to periodically (every three years) evaluate the need for and feasibility of conducting juvenile lamprey passage route and survival studies. Periodically reviewing available technologies and methodologies for conducting juvenile lamprey survival studies would ensure that such studies would be conducted when appropriate and feasible.

Interior recommends that Grant PUD identify the timing of juvenile lamprey outmigration through the project. Washington DFW recommends that Grant PUD develop a plan to assess juvenile lamprey out-migration timing characteristics through the project area, including the reservoirs, in relation to flows. Neither agency provides any evidence to indicate that the timing of lamprey out-migration is related to stream flow or project effects. Mainstem flows may have some unknown effect on the timing of lamprey out-migration; however, it is unclear how knowledge about this relationship could be used to improve juvenile lamprey survival or to benefit the species. Regardless, Grant PUD indicates that flows in the project area are the result of cumulative effects of upstream storage dams and the coordinated operation of the seven dam system (i.e., Grand Coulee, Chief Joseph, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids). Because the Project is only partly responsible for the magnitude and timing of flows in the project area and there is no evidence of a relationship between flow and outmigration timing, there appears to be little or no nexus between the operation of the Project and juvenile lamprey out-migration timing.

Washington DFW recommends that Grant PUD conduct an assessment of the relative abundance of juvenile lamprey in the project reservoir and its tributaries. In comments on the draft EIS, Washington DFW indicated that annual abundance information would be useful for determining the relative effect of the Project operations on juvenile lamprey rearing within the Project boundary. Washington DFW also indicated that the technology to track juvenile lamprey movements and assess relative abundance is not currently available; therefore they recommended that Grant PUD periodically evaluate if it would be appropriate and feasible to assess juvenile lamprey abundance within the Project boundary.

It is unclear how a ‘relative’ project effect could be determined from tracking the annual changes in abundance of juvenile lamprey within the Project reservoirs. We would expect that year-to-year variation in reservoir abundance of juvenile lamprey would be significant and potentially unrelated to Project effects. We would expect that juvenile lamprey abundance in the mid-Columbia River would be strongly influenced by factors unrelated to the project such as adult lamprey spawning population size and climatic conditions. Washington DFW did not indicate how project effects would be separated from other factors that could influence reservoir abundance of juvenile lamprey. Annual abundance indices are a common fisheries tool used to monitor fish populations and track the success of management practices and this information may be useful to Washington DFW in addressing its management responsibilities towards Pacific lamprey; however, it does not appear that annual abundance surveys would be useful or necessary to identify or address project effects or project purposes. Additionally, while the technology to conduct these studies may be developed during the term of any license issued for the Project, there would be no benefit to requiring Grant PUD to periodically review the feasibility to conduct these studies since they would not identify or address project effects or project resources.

Interior and Washington DFW recommend Grant PUD identify and map the extent of suitable juvenile lamprey habitat within the Project reservoirs. The agencies do not indicate how this information would be used to benefit lamprey. Additionally, Grant PUD indicates that the agencies have not provided evidence or established a nexus between the impacts of the project on juvenile lamprey and available habitat in the reservoir. It appears that this information is not necessary to address project effects or project purposes.

Interior and Washington DFW recommend Grant PUD evaluate the effects of reservoir fluctuations on lamprey rearing areas and evaluate options for avoiding or eliminating detrimental effects. The agencies provide no specific information or evidence to indicate that the reservoir contains substantial rearing habitat or that fluctuations affect this habitat. In fact, the wording of Washington DFW's recommendation (i.e., "Evaluation of effects …, if any") suggests there may be no project effects on juvenile lamprey rearing habitat. If juvenile lamprey rearing habitat in the reservoir is adversely affected by project operations, it is possible that changes in project operations could result in reduced effects on juvenile habitat. However, at this time there is no evidence to suggest a relationship exists between project operations, available juvenile lamprey habitat, and juvenile lamprey survival.

CRITFC recommends that Grant PUD be required to meet downstream passage standards that are currently being developed by regional fisheries managers. CRITFC provides no evidence to indicate that current passage conditions for juvenile lamprey are inadequate. To the contrary, available information (Moursund et al., 2000; Moursund et al., 2001; Bleich and Moursund, 2006) suggests that the project likely has little or no effect on downstream passage survival of juvenile lamprey. Because the recommended standards are in development and because there is no evidence of adverse project effects on juvenile lamprey, there is no way to assess the benefit, if any, of achieving these standards on the lamprey population. As a result, there would be no benefit at this time to requiring Grant PUD to comply with undetermined passage standards.

Interior, Washington DFW, and CRITFC recommend that Grant PUD develop and implement a Pacific Lamprey Plan. Grant PUD proposes to develop a Pacific Lamprey Plan in consultation with the resource management agencies, tribes, and other stakeholders. The agencies and CRITFC provided a list of specific upstream and downstream passage measures and studies to be performed as part of the Pacific Lamprey Plan. We discuss and evaluate these measures above. Goals, objectives, or non-specific measures recommended for inclusion in the Pacific Lamprey Plan are described below.

In regard to the goals of the Pacific Lamprey Plan, Interior indicates that the Pacific Lamprey Plan should be designed to direct the improvement of adult upstream passage and juvenile downstream passage through the project. Washington DFW indicates that the plan should address providing safe and effective juvenile and adult lamprey passage, mitigating for project effects on passage and habitat, and rebuilding populations to levels that would sustain harvest. Grant PUD indicates that rebuilding the lamprey population to harvestable levels is an inappropriate goal for the PLMP because several factors other than the Project have contributed to the decline of lamprey. Non-project-related factors such as overharvest, habitat degradation, and migration barriers have contributed to the decline of lamprey throughout the Columbia River system; therefore, while attaining harvestable levels may be a reasonable goal for the agencies in their management of Pacific lamprey, this goal appears to be unrelated to the magnitude of project effects on the resource.

It would be more appropriate for the goals of the Pacific Lamprey Plan to include identifying and quantifying the projects effects on the resource while simultaneously developing and implementing measures to mitigate for these effects. Many of the actions recommended by Washington DFW, Interior, and CRITFC would be useful in identifying project effects or appropriate mitigation measures and may be appropriate for inclusion in the Pacific Lamprey Plan; however, achieving harvestable population levels, as suggested by Washington DFW, goes beyond addressing the effects of continued operation and maintenance of the Project.

In addition to the measures listed above, Washington DFW recommends that the Pacific Lamprey Plan include several “elements” for Grant PUD to implement during the first ten years of any new license. These elements consist of three additional plans, including a plan to assess migration timing as it relates to flow and temperature, a plan to evaluate whether flow alterations would assist outmigration, and a plan to conduct off-site mitigation for project impacts. We address the need to study project effects on migration timing above. In regard to evaluating the effect of flow alterations on outmigration, Washington DFW has provided no evidence to indicate that such a relationship might exist or to explain how the project may currently be affecting juvenile outmigration through project effects on flows. Grant PUD indicates that flows in the project area are the result of cumulative effects of upstream storage dams and the coordinated operation of the seven dam system (i.e., Grand Coulee, Chief Joseph, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids). Because the Project is only partly responsible for the magnitude and timing of flows in the project area and there is no known relationship between lamprey outmigration and flow, there appears to be little or no nexus between the operation of the Project and juvenile lamprey out-migration.

Interior recommends that Grant PUD develop schedules or implementation dates for modifying existing structures or operations to address project effects on lamprey. The timing of actions is generally determined as part of the Commission approval of the action. In this case, any actions not approved at relicensing, but anticipated as part of future actions could be described in a Pacific Lamprey Plan and accompanied by a schedule. This effort would have little or no direct or indirect benefit to lamprey, but it would likely be useful for tracking and documenting possible future actions.

Interior and Washington DFW also recommend that the Pacific Lamprey Plan include off-site mitigation, such as habitat improvements, to mitigate for the adverse impacts of project operations that cannot be addressed at the project. While offsite mitigation could be beneficial to lamprey if available habitat is limiting, the agencies have not described any specific effects of the Project that are not otherwise mitigated or addressed through other measures. Additionally, there is no information to indicate that the available habitat is inadequate or limiting lamprey population numbers. It is possible that current population levels are well below the numbers that could be supported by available habitat; therefore, offsite habitat mitigation may have little or no benefit. Regardless, because there are no known project effects that would not be addressed through other mitigation or enhancement and we have no evidence that habitat is limiting, there appears to be no benefit to requiring Grant PUD to implement offsite mitigation.

Washington DFW, Interior, and CRITFC recommend that Grant PUD coordinate Pacific lamprey mitigation efforts with regional experts and managers. Washington DFW specifically suggests that Grant PUD seek cost sharing, matching funds, and integrate project efforts with regional lamprey programs. Some coordination of lamprey mitigation efforts with Washington DFW, Interior, and CRITFC would be inherent in implementing lamprey mitigation measures. Additionally, consultation with Washington DFW, Interior, and CRITFC would likely be required by the Commission as part of the development of the Pacific Lamprey Plan if it is adopted in the license. However, coordination with regional experts and managers and integrating project efforts with regional lamprey programs would not be necessary to address or mitigate for project effects on lamprey. Additionally, while cost-sharing and matching funds could be helpful in reducing costs to Grant PUD or in the implementation of measures beyond those required by the Commission, requiring Grant PUD to seek cost-sharing and matching funds would not be necessary to address or mitigate for project effects on lamprey.

Washington DFW recommends that Grant PUD fund a qualified biologist to participate in the development and implementation of the Pacific Lamprey Plan and regional coordination activities related to lamprey management. A biologist with expertise in lamprey biology could potentially benefit lamprey populations affected by project operations by evaluating data and making lamprey management recommendations. However, the benefit of funding a biologist for a resource cannot be quantified or qualified with any degree of certainty.

White Sturgeon

As part of its license application, Grant PUD proposes to address the effect of the Project on white sturgeon and construct a white sturgeon conservation facility at the Priest Rapids Hatchery. White sturgeon broodstock would be obtained from the Hanford Reach or Wanapum reservoir and the conservation facility would be designed to produce yearling white sturgeon for stocking into the Project reservoirs. This effort would include experimentation with hatchery supplementation to develop optimal rearing and release strategies and to monitor and evaluate the effectiveness of hatchery releases.

Under section 10(j) of the FPA, Washington DFW recommends that Grant PUD develop, fund, and implement a White Sturgeon Management Plan (White Sturgeon Plan) with the objective of increasing the white sturgeon population to levels commensurate with available habitat within the project area. Washington DFW specifies that the plan should include details describing acquisition of broodstock, breeding and hatchery procedures, and evaluation of hatchery success, natural reproductive success, emigration rates, and carrying capacity. Washington DFW also recommends that Grant PUD exchange information and coordinate sturgeon management activities with Washington DFW and other relevant entities. Lastly, Washington DFW recommends that Grant PUD fund a qualified biologist to participate in the development and implementation of the White Sturgeon Plan and regional coordination activities related to white sturgeon management.

Under section 10(j) of the FPA, Interior recommends that Grant PUD develop and implement a White Sturgeon Plan to increase white sturgeon populations in Wanapum and Priest Rapids reservoirs and the Hanford Reach commensurate with available habitat. Interior indicates the plan should include: 1) monitoring to determine natural and hatchery survival of egg, larval, juvenile and adult white sturgeon, 2) evaluation of natural recruitment rates in the project reservoirs and the Hanford Reach, 3) determination of year-class distributions, 4) genetic analysis, 5) measurement of growth rates, condition factors, and sex ratios, 6) implementation of measures to increase white sturgeon populations in the project reservoirs and the Hanford Reach, and 7) coordination with regional white sturgeon experts and managers. Interior also recommends that Grant PUD develop and implement a White Sturgeon Conservation Aquaculture Plan (WSCAP) to be incorporated into the White Sturgeon Plan. Interior indicates that the WSCAP would include a schedule whereby Grant PUD would design, fund, construct, operate and maintain a white sturgeon hatchery facility that would be operational within 4 years of license issuance and begin supplementing the project reservoirs with white sturgeon within 5 years of license issuance.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD establish white sturgeon action plan to rebuild white sturgeon populations in the project area that are impacted by the project. CRITFC recommends that the white sturgeon action plan include the same measures specified by Washington DFW in their recommended White Sturgeon Plan.

Our Analysis

Throughout much of the Columbia River, the numbers of white sturgeon are considered to be lower than they were prior to the construction of the mainstem dams. Declines in white sturgeon numbers have been attributed to a variety of factors. Dam-related factors include fragmentation of the contiguous population into numerous apparently isolated populations, reduced diversity of white sturgeon habitat by creating a series of homogenous reservoirs, reduced seasonal variation in habitat by controlling flows, and reduced or eliminated access to different habitat types by limiting fish movements. Non-dam factors associated with reduced numbers of white sturgeon include overfishing, prolonged droughts, and reduced water quality.

We have reviewed the information provided by Grant PUD, the federal and state agencies, and CRITFC to identify effects of the project on white sturgeon. Washington DFW suggests that there is a need to immediately intercede with hatchery supplementation to mitigate for the detrimental effects of the ongoing project operations but does not describe any specific effects of the project on white sturgeon. Interior states that mid-Columbia River white sturgeon require immediate action and suggests that the species has been in an ongoing decline; however, while they indicate hatchery supplementation would offset the project's continuing effects, they do not specifically identify any of these effects. CRITFC states that the white sturgeon population in the Hanford Reach is imperiled and states that the populations within the project area must be supplemented in order to continue to exist over the next license term; however, CRITFC does not identify any specific effects of the project on white sturgeon within or downstream of the project area. Grant PUD's license application states that the proposed measures for white sturgeon are intended to address the potential effect of the Project on limiting sturgeon recruitment, yet they provide no specific information as to how the project effects recruitment.

In regard to white sturgeon abundance in the Project area, the populations of white sturgeon are estimated to be 134 fish in Priest Rapids reservoir and 551 fish in Wanapum reservoir. The 95 percent confidence intervals for these estimates (48 – 2680 for Priest Rapids and 314 – 1460 for Wanapum) indicate the lack of precision in the population estimates and suggest that the actual numbers of sturgeon inhabiting the reservoirs could be lower or much higher. We are not aware of any information estimating the numbers of white sturgeon within the Hanford Reach.

Based on these numbers it is difficult to determine the actual status of white sturgeon within the project area and downstream. It is entirely possible that white sturgeon are in a state of decline and their numbers are greatly reduced at this time. However, with no evidence to the contrary, it is also entirely possible that white sturgeon numbers have been stable at the current levels for many years. In comments filed on July 8, 2003, Grant PUD indicated that in the mid 1990s Washington DFW changed the white sturgeon sport fishing regulations in the project area (i.e., upstream of Priest Rapids dam) from allowing harvest to catch-and-release only. In comments on the draft EIS, Washington DFW indicated that this change in regulations resulted from concern for the viability of the impounded white sturgeon populations. Washington DFW indicated that at the time there were no population estimates; however, white sturgeon sport catch suggested low abundance and inadequate white sturgeon recruitment. This information confirms that the abundance of white sturgeon in the project area has been a concern for at least a decade and that other factors, including harvest, may have contributed to the decline of white sturgeon. This information, however, provides no indication of whether the existing populations are stable or continuing to decline.

Grant PUD, the agencies, and CRITFC suggest that primary issue related to white sturgeon abundance in the project area is low or infrequent recruitment of juvenile sturgeon. The year-class composition of white sturgeon within Priest Rapids reservoir suggests that no fish have been recruited to the population since the mid 1980s (Golder; 2003). In Wanapum reservoir there appears to have been some recruitment through the 1997 year class;[74] however, only approximately 20 percent of the population consisted of juvenile fish (Golder; 2003) which is probably less than would be expected in a healthy sturgeon population.

In comments on the draft EIS, Washington DFW suggested that the white sturgeon populations in both project reservoirs are slowly dying out. They indicate that the age-composition, particularly the low ratio of juveniles to adults, suggests that both populations suffer from frequent recruitment failures. Washington DFW suggests that

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[74] Golder (2003) reported that the sampling gear used in this study was likely only effective on fish spawned through 1997; therefore, the lack of data from later year classes may not indicate a lack of recruitment but rather a lack of effective sampling of these potential year classes.

recruitment is insufficient to sustain the populations and the populations are gradually declining. Information presented by Washington DFW suggests that if left alone, the populations would 'zero-out' over the next 50-100 years.

It is unclear what factors are limiting white sturgeon recruitment in the project area. Golder (2003) collected data to indicate that some successful spawning takes place within both reservoirs, suggesting that suitable spawning habitat and viable adult sturgeon exist within both reservoirs. Additional, testing by Golder (2003) demonstrated that the eggs produced during spawning hatched within the time required for normal embryo development. This information suggests that reduced survival during the larval or early juvenile stage (rather than reproduction or incubation) may be influencing recruitment.

Golder (2003) presented several theories to address poor recruitment in the project area. Golder (2003) suggested that after hatching, white sturgeon larvae originating in the upper end of Priest Rapids reservoir may actively seek river currents and due to a lack of a substantial settling area within the Priest Rapids reservoir, the larvae may pass through the entire reservoir and be lost to the Hanford Reach or areas downstream.[75] This would explain the poor recruitment within the Priest Rapids reservoir; although it seems unlikely that no larvae would remain within reservoir and that no larvae from upstream areas would enter the reservoir. Golder (2003) also suggested that there may be a lack of suitable juvenile rearing habitat within Priest Rapids reservoir.

Golder (2003) noted that recruitment within Priest Rapids reservoir apparently ceased at the time the juvenile salmonid spill program began in the mid 1980s. While the timing of these events does appear to be somewhat correlated, we are unable to identify a mechanism associated with the spill program that would be responsible for reduced survival of larval or juvenile white sturgeon and Golder (2003) did not provide any additional speculation regarding the possible causes of this association.

Golder (2003) found that recruitment from the mid 1980s to the mid 1990s was generally poor in both project reservoirs. During this period, recruitment was apparently also poor for white sturgeon inhabiting the Snake River upstream of Hells Canyon dam. Lepla and Chandler (2001) suggested that the poor recruitment upstream of Hells Canyon corresponded to a prolonged period of drought from 1987 to 1994. Golder (2003) suggested that basin-wide conditions, such as a prolonged drought, may have influenced recruitment in the project area during this same period.

In comments on the draft EIS, Washington DFW suggested that white sturgeon recruitment in the project area is poor because of significant predation on inadequately

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[75] Apparently this would be less likely to occur in Wanapum reservoir since it is a larger and longer body of water than the Priest Rapids pool.

dispersed eggs and larvae. Washington DFW indicated that the slower moving environment of the reservoirs has increased the abundance of predators of white sturgeon eggs and larvae. Additionally, Washington DFW suggests that the slow flows through the reservoirs inadequately disperse eggs and larvae, making them susceptible to predation. Washington DFW indicates that lowering the reservoir surface elevations would increase the water surface gradient and lead to increased water velocities and turbulence within the project reservoirs. They indicate that in addition to dispersing eggs, reducing predation, and increasing egg-to-early-juvenile survival, increased water velocities would increase available spawning habitat within the project area.

In addition to the suggestions made by Golder (2003) and Washington DFW, other factors such as available food supply or competition for habitat may be influencing the survival of the larval or juvenile life stages, although it is not clear that the project is affecting these factors. In comments on the draft EIS, Washington DFW indicated that while the current status of white sturgeon may not be entirely attributable to effects of the project, the project does directly affect white sturgeon movements and the availability of white sturgeon habitat. We address these project-related effects below.

Construction of the two dams and creation of the project reservoirs has affected, at least to some extent, the ability of white sturgeon to move upstream and access other available habitat. White sturgeon have been observed within both the Priest Rapids and Wanapum fish ladders. Golder (2003) reported that one tagged fish from the Priest Rapids reservoir was documented to move 37 miles upstream to a spawning location within the Wanapum reservoir. This is evidence that white sturgeon are capable of moving upstream through the Wanapum fish ladder. The ability of white sturgeon to pass upstream through the Priest Rapids fish ladders or how often and efficiently sturgeon may use the ladders at either dam is unknown. The information provided by Golder (2003) suggests that the dams may not be absolute barriers to upstream movements; however, it is likely that they inhibit the ability of sturgeon to access upstream areas. Washington DFW indicates that the inability of white sturgeon to readily move upstream into the project area from downstream areas, such as the Hanford Reach, is a significant project effect on population viability. They state that because white sturgeon cannot move into the project areas from downstream areas, reproduction is dependent on existing individuals trapped within each impoundment.

Construction of the dams likely modified habitat within the project area, primarily by increasing depths and reducing velocities within the project reservoirs. We have no information to indicate how much change in available habitat may have occurred or which habitat types increased or decreased in availability. However, sampling by Golder (2003) revealed that both project reservoirs contain spawning, overwintering, and feeding habitat for white sturgeon. Wanapum reservoir also appears to contain suitable juvenile rearing habitat. Because they did not collect any juvenile sturgeon within Priest Rapids reservoir, Golder (2003) was unable to conclusively identify any juvenile rearing habitat within Priest Rapids reservoir; however, they speculate that some suboptimal[76] juvenile rearing habitat may exist at three locations within the reservoir.

In addition to the continuation of the effects described above, project-related effects of relicensing the project may include habitat modification through flow regulation and turbine entrainment and mortality. Flows from the Wanapum and Priest Rapids dams vary in response to inflow and project operating requirements. Changes in flows can influence available white sturgeon habitat by increasing or decreasing depths and velocities in the project reservoirs and the Hanford Reach. Golder (2003) described spawning, overwintering, rearing, and feeding habitat within both reservoirs. Based on Golder (2003), the depths and velocities of overwintering, rearing, and feeding habitat for white sturgeon can be generally described as deep (greater than 30 feet) and slow or moderate velocity (less than 2 ft/s). Spawning habitat, however, appears to be shallower (less than 30 feet) and provide greater velocities (generally more than 2 ft/s; Golder, 2003). Short-term, project-related flow fluctuations would change depths and velocities throughout the reservoir and would likely have some effect on all white sturgeon habitat types; however, we would expect the effects would be most pronounced in shallow, high velocity areas that white sturgeon use for spawning. In these areas, hourly or daily changes in flow would result in changes in depths and/or velocities that could make previously suitable spawning habitat less desirable or perhaps unusable and, to the contrary, unsuitable habitat may be become useable. Because deeper, slower velocity areas generally occur in areas of less channel confinement, they respond more slowly to changes in flow. Therefore, we would expect that the effects of project-related flow fluctuations on overwintering, rearing, and feeding areas would be less significant than the effects on spawning habitat.

Daily and seasonal flow fluctuations within the reservoirs and the Hanford Reach are primarily the result of the coordinated operation of the seven mainstem dams in the mid-Columbia River. As part of this coordinated system, the Priest Rapids Project has some influence over the flows within and downstream of the project area; however, the projects upstream of the Priest Rapids Project control the amount of inflow to the project area and thereby dictate much of the operation of the Priest Rapids Project due its limited storage capabilities and the need to coordinate generation with the other projects. Flows entering the project area often vary on an hourly basis and while Grant PUD can utilize some storage in the project reservoirs to reregulate these flows, efficient operation of the project in coordination with the other projects do not generally correspond to complete reregulation of upstream flow fluctuations (i.e., flattening hydrologic pulses). As a result, only part of the flow fluctuations that occur within the Project area can be attributed

[76] Golder (2003) described three locations within Priest Rapids reservoir that may serve as juvenile rearing habitat, although they suggested that velocities in each of these areas may be at the upper end of the preferred range and that the substrate sizes may be larger than preferred.

directly to Grant PUD and much of the flow-related effects on white sturgeon habitat are attributable to the coordinated operation of all seven mainstem projects.

It is likely that some entrainment of white sturgeon occurs at each project dam, although the frequency or consequences of these events are not known. The trash racks at each dam have a 7.375 inch clear spacing which would likely exclude large adult sturgeon, but allow smaller juvenile and sub-adult fish to pass through. We have no project-specific estimates of the amount of entrainment or turbine passage survival rates for white sturgeon; however, based on general patterns and trends seen in other species we would expect reasonably high survival of larval and small juvenile sturgeon and lower survival rates for larger juvenile and sub-adult fish. Some fish that survive turbine passage may be capable of returning upstream through the project fish ladders; however, most fish passing downstream through the turbines are probably permanently lost from the reservoir population whether they survive or not. It is possible that similar events would occur at upstream reservoirs and result in some replenishment of lost individuals to the project reservoirs. As indicated above, it is likely that some turbine entrainment of white sturgeon occurs at the Project; however, we have no information to indicate the overall magnitude or significance of this effect.

To address the potential effect of the Project on white sturgeon, Grant PUD proposed to construct and operate a white sturgeon conservation facility at the Priest Rapids Hatchery to produce yearling white sturgeon for stocking in the Project reservoirs. Grant PUD proposes that through experimentation they would develop optimal rearing and release strategies and monitor and evaluate the effectiveness of hatchery releases. As part of the license application, Grant PUD filed the WSCAP that outlines a conceptual plan for the development of a mid-Columbia River white sturgeon conservation facility and population supplementation.

In comments on the draft EIS, Washington DFW recommended that prior to modifying the Priest Rapids Hatchery for sturgeon production, Grant PUD should assess the ability of the Priest Rapids Hatchery to meet the needs of the sturgeon program and other ongoing programs. Washington DFW implies that other locations or facilities may provide a more efficient means to rear white sturgeon. Additionally, Washington DFW indicates that coordination of the supplementation program with other entities interested in rearing white sturgeon could help to avoid inefficient use of the limited broodstock. Conducting an evaluation of hatchery program needs and potential hatchery sites would help to identify the most cost-effective and efficient approach to developing a white sturgeon hatchery program and could avoid potential adverse interactions between the white sturgeon hatchery program and other ongoing programs. This evaluation could be performed as part of updating and finalizing the conceptual WSCAP that was filed with the license application.

Construction and operation of a white sturgeon hatchery facility that produces yearling fish for release into the project area would likely improve white sturgeon recruitment and lead to an increase the abundance of adult white sturgeon in the project area. While no specific cause for poor recruitment has been identified, the greater size and swimming ability of yearling fish, as compared to larval fish, would likely enhance their chances of survival in the project reservoirs. When compared to larval or sub-yearling sturgeon, we would not expect yearling sturgeon to be as vulnerable to predation or being flushed through the Priest Rapids reservoir as was suggested by Golder (2003). Additionally, yearling fish would likely be better able to avoid entrainment if they approach areas near the penstock openings. Grant PUD has indicated that it would use broodstock from the project reservoirs to the extent possible. The use of local broodstock would aid in maintaining any potential genetic uniqueness of the existing stock and could perhaps take advantage of any genetic adaptation that the local stock may possess for this portion of the Columbia River. Monitoring by Grant PUD would be useful for establishing the effectiveness of these releases and may provide valuable information that could be used to shape the future direction of the hatchery program. Finalization of the WSCAP, in consultation with the agencies and tribes would ensure adequate consideration of management goals and hatchery design and logistics.

Washington DFW, Interior, and CRITFC[77] recommend that Grant PUD develop and implement a White Sturgeon Plan. In comments on the draft EIS, Washington DFW stated that this White Sturgeon Plan should be patterned after the White Sturgeon Plan developed for the Rocky Reach Project. Washington DFW, Interior, and CRITFC each outlined actions that they believe should be implemented as part of the White Sturgeon Plan. These measures include actions such as 1) monitoring to determine natural and hatchery survival of egg, larval, juvenile and adult white sturgeon; 2) evaluation of natural recruitment rates; 3) determination of year-class distributions; 4) genetic analysis; 5) measurement of growth rates, condition factors, and sex ratios; and 6) implementation of measures to increase white sturgeon populations. In a letter filed May 27, 2005, Washington DFW stated that through monitoring and evaluation of effects of project operation and facilities on white sturgeon, a White Sturgeon Plan would allow for the identification of ongoing project-related impacts. In a letter filed July 8, 2005, Grant PUD indicated that they agreed that any project impacts should be addressed through a White Sturgeon Plan; however, they also suggested that the goals laid out by Washington DFW, Interior, and CRITFC do not appear to correspond to or be related to mitigating project effects.

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[77] CRITFC calls their plan a white sturgeon action plan; however, it appears to be the same recommendation as Washington DFW and Interior. For the purpose of our analysis, we assess the effects of CRITFC's recommendation along with the plan recommended by Washington DFW and Interior.

As part of the White Sturgeon Plan, both Washington DFW and Interior indicate that Grant PUD should be responsible for increasing sturgeon abundance to levels commensurate with available habitat. Additionally, Washington DFW and CRITFC suggest that Grant PUD should increase sturgeon abundance to levels that can support reopening a harvest-based fishing season. While these may be reasonable goals for Washington DFW, Interior, and CRITFC in their management of white sturgeon, they appear to be unrelated to the magnitude of project effects on the resource.

In regard to relicensing the Project, it would be more appropriate to establish goals for the White Sturgeon Plan that include identifying and quantifying the projects effects on the resource while simultaneously developing and implementing measures to mitigate for these effects. Many of the actions recommended by Washington DFW, Interior, and CRITFC as details of the White Sturgeon Plan would be useful in identifying project effects or appropriate mitigation measures and may be appropriate for inclusion in the White Sturgeon Plan; however, the overall goals suggested by Washington DFW, Interior, and CRITFC go beyond addressing the effects of continued operation and maintenance of the Project.

Washington DFW, Interior, and CRITFC recommend that Grant PUD coordinate white sturgeon mitigation efforts with regional experts and managers. Washington DFW specifically suggests that Grant PUD seek cost sharing, matching funds, and integrate project efforts with regional white sturgeon programs. Some coordination of white sturgeon mitigation efforts with Washington DFW, Interior, and CRITFC would be inherent in implementing white sturgeon mitigation measures. Additionally, consultation with Washington DFW, Interior, and CRITFC would likely be required by the Commission as part of the development of the White Sturgeon Plan if it is adopted in the license. However, coordination with regional experts and managers and integrating project efforts with regional white sturgeon programs would not be necessary to address or mitigate for project effects on white sturgeon. Additionally, while cost-sharing and matching funds could be helpful in reducing costs to Grant PUD or in the implementation of measures beyond those required by the Commission, requiring Grant PUD to seek cost-sharing and matching funds would not be necessary to address or mitigate for project effects on white sturgeon.

Washington DFW recommends that Grant PUD fund a qualified biologist to participate in the development and implementation of the White Sturgeon Plan and regional coordination activities related to white sturgeon management. A biologist with expertise in white sturgeon biology could potentially benefit sturgeon populations affected by project operations by evaluating data and making sturgeon management recommendations. However, the benefit of funding a biologist for a resource cannot be quantified or qualified with any degree of certainty.

Resident fish

Grant PUD proposes to provide funding for upgrades, improvements, and operating costs at the Columbia Basin Hatchery which currently raises 1.4 million fish for stocking in roughly 140 lakes throughout the region (the majority of the lakes are within Grant County, WA). Grant PUD also proposes to enhance and improve fisheries and fishing opportunities in the lower five miles of Crab Creek (a tributary that enters the Columbia River in the project area).

Under section 10(j) of the FPA, Washington DFW recommends that Grant PUD develop and implement a Resident Fish Plan with a goal of producing 137,000 pounds of fish to support recreational fisheries. Washington DFW recommends that the plan include a production program, stocking program, and a monitoring and evaluation program.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD conduct population analyses of resident fish stocks in the project reservoirs. CRITFC recommends that Grant PUD determine what impact the northern pikeminnow removal program is having on resident fish.

Our Analysis

Effects of the Project on resident fish are not well documented or described; however, project effects likely include turbine entrainment and effects on shoreline habitat within the reservoirs and tailwater areas due to hydropower operations. It is likely that both native and introduced resident fish species occasionally become entrained at the project turbines. Grant PUD reported that resident young-of-the-year cyprinids (minnows) and catostomids (suckers) and large numbers of stickleback were collected during limited fyke net sampling of the turbine intakes at Priest Rapids dam. Similar sampling at Wanapum dam resulted in very few resident fish being collected. Grant PUD speculated that the higher rates at Priest Rapids dam may result from the presence of Goose Island immediately upstream of the turbine intakes. Goose Island likely provides littoral resident fish habitat, whereas no similar feature exists at Wanapum dam. Grant PUD reported that large resident fish were rarely collected at either dam.

Some fish that are entrained at the project dams are likely killed or injured. The remainder either continue moving downstream or become part of the existing resident fish community of the downstream area. We would expect that few resident fish return upstream via the ladders. The loss of resident fish from the reservoir communities has been ongoing during the current license with no documented effect. It is likely that resident fish are recruited to the project area from upstream projects, which may help to offset any losses that occur at the project dams. Regardless, based on the entrainment information reported above, we would expect the loss of stickleback and young-of-the-year minnows and suckers to have little affect on the overall health or size of the reservoir fish communities.

Flows within the project area fluctuate on an hourly, daily, and weekly basis. These flow effects are the result of the Project operations in combination with upstream operations at 5 other mainstem dams including Grand Coulee dam. These flow fluctuations can influence water depths and velocities in shoreline areas typically inhabited by resident fish. Rapid changes in these parameters may affect feeding or spawning behavior, dewater nests, or expose juvenile fish to increased predation. These effects have been ongoing during the current license term and there are no documented adverse effects on resident fisheries. Grant PUD is proposing some modifications to project operations to improve conditions for fall Chinook salmon in the Hanford Reach (discussed above). These modifications generally consist of providing an increased minimum flow and reducing the magnitude of fluctuations during portions of the year. CRITFC and Alaska DFG have recommended more substantial operational modifications that would greatly reduce fluctuations in the Hanford Reach, but would likely have more significant effects on reservoir fluctuations. No specific information is available to quantify the effect of these potential operational changes on resident fish habitat within the reservoirs; however, the more substantial operational changes recommended by CRITFC and Alaska DFG would likely result in greater changes in shoreline depths and velocities, thereby having a greater potential to influence the suitability of shoreline resident fish habitat within the project reservoirs.

Grant PUD proposes to fund improvements to the Columbia Basin Hatchery and develop and implement a Columbia Basin Hatchery Management Plan. The Columbia Basin Hatchery is located near Moses Lake, Washington, outside the project boundary.

In comments on the draft EIS, Washington DFW indicated that during the original licensing of the Project, annual pre-construction catch of all game fish within the Project reservoirs was estimated at 64,000 fish from Priest Rapids reservoir and 36,000 fish from Wanapum reservoir.[78] Washington DFW reports that to mitigate for project effects on fisheries resources, rainbow trout were raised at the Columbia Basin Hatchery and stocked in the project reservoirs and lakes throughout the project service area. Washington DFW reports that from 1961 to 1965, approximately 300,000 catchable rainbow trout were annually stocked within the project reservoirs and another 250,000 catchable rainbow trout were stocked outside of the project boundary, but within the project service area. Washington DFW indicates that 300,000 fish should have been enough to establish a 'fair' fishery within the project reservoirs; however, the fish stocked

[78] Washington DFW did not clarify if these estimates included resident fish only or anadromous and resident fish.

within the project area disappeared and no fishery developed within the reservoirs. Washington DFW reports that the off-site stocking was successful and this program continues to support some of the best fisheries in Washington State. In comments on the draft EIS, Washington DFW indicates that upgrading the Columbia Basin Hatchery and enhancing recreational fishing opportunities in lakes located throughout the adjacent counties would be the most cost effective and efficient means to mitigate project effects on resident fish.

Upgrading the Columbia Basin Hatchery and developing and implementing a hatchery management plan would modernize the operation of the hatchery and increase the production of healthy fish for stocking in the local lakes. However, because the fish reared in the hatchery would be stocked in lakes outside the project boundary, there would be no benefit to fish or recreational resources within the project area.

Washington DFW recommends that Grant PUD develop and implement a Resident Fish Plan with a goal of producing 137,000 pounds of fish to support recreational fisheries. As part of their justification for the plan, Washington DFW indicates that the plan would provide resident fish enhancements that are currently provided by the Columbia Basin Hatchery for ongoing project effects on resident fish. In general, such a plan would likely provide some enhancement of recreational fishing opportunities; however, without further information regarding stocking locations and size and species of fish to be stocked, we are unable to evaluate the specific benefits of this measure.

Washington DFW did imply that fish would not be stocked within the project area since historically these efforts were unsuccessful. Additionally, Washington DFW indicated that because of potential interactions with federally-listed threatened and endangered fish species, getting approval for stocking resident fish within the project area would likely be difficult, if not impossible. This information suggests that Washington DFW anticipates that fish raised as part of the Resident Fish Plan would be stocked in lakes outside the project boundary. As indicated above, these stocking efforts would have no benefit to fish or recreational resources within the project area.

Grant PUD proposes to improve fish resources and fishing opportunities in the lower 5 miles of Crab Creek. We have no information that indicates that the operation or maintenance of the project has any effect on resident fisheries resources within Crab Creek. It appears that Grant PUD is proposing this measure to provide fisheries enhancements or mitigation in the project area that would offset ongoing project effects to resident fish and sport fisheries. In its AIR response filed on January 14, 2005, Grant PUD indicated that while some measures may be implemented in Crab Creek, the primary measures they are now considering include enhancing the stocked trout program and installing recreational fishing enhancements at Burkett Lake. Burkett Lake is a 78-

acre lake that lies entirely within the project boundary and is located adjacent to Crab Creek. Implementation of these measures would improve fishing opportunities within the project area and would provide fisheries enhancements that could offset ongoing project effects on resident fish.

In comments on the draft EIS, the Port of Warden indicated that establishing salmon and steelhead in Crab Creek could impact Columbia Basin irrigators and the local agricultural industry. Grant PUD's current proposal for improving fish resources and fishing opportunities in the Crab Creek area does not include establishing salmon or steelhead in Crab Creek. Instead, Grant PUD's current proposal includes installing recreational fishing enhancements and enhancing the stocked trout program in nearby Burkett Lake. We would not expect these measures to adversely affect Columbia Basin irrigators.

CRITFC and Washington DFW recommended that Grant PUD conduct a population analyses of resident fish stocks in the project reservoirs and determine what impact the northern pikeminnow removal program is having on resident fish. CRITFC states that Grant PUD should conduct these assessments to determine the ecological effect of removing significant portions of the pikeminnow population. They suggest that the "true impact" of pikeminnow predation impacts on salmonids needs to be re-examined and compared to the potential ecosystem impacts on other native species.

Grant PUD has not performed a population analysis of resident fish stocks; however, they did conduct a fisheries survey of the project area (Pfeifer et al.; 2001) that included many of the population parameters requested by CRITFC (i.e., catch per unit effort, condition, length and weight relationships). CRITFC suggests that Pfeifer et al. (2001) is inadequate for assessing effects of the pikeminnow removal program on resident fish and suggests that Grant PUD needs to conduct a more scientifically rigorous study that would provide population projections. The type of study requested by CRITFC would be extremely labor intensive and because the project area is not a closed system and annual physical conditions (such as temperature and flow) vary widely, it is unlikely that accurate population estimates could be obtained.

Washington DFW indicates that reservoir-wide population estimates would not be necessary for predation evaluations and that rigorous application of bioenergetics models to localized areas of the reservoir, such as a trophic dynamics study could be performed instead. Washington DFW indicates that a trophic dynamics study would remedy the lack of knowledge concerning current status and potential effects of future actions. A trophic dynamics study would provide some information that could be used to determine the effects of the pikeminnow removal program on resident fish instead of the population study requested by CRITFC.

We evaluate the effects of the pikeminnow removal program on anadromous salmonids elsewhere in this section and conclude that it likely increases survival of outmigrating smolts. In regard to effects on resident fish, CRITFC suggests that because pikeminnow are the major predator of white sturgeon egg predators, their removal indirectly results in increased predation of sturgeon eggs. CRITFC does not specify which species that are considered sturgeon egg predators might benefit from pikeminnow removal. While it is apparent that white sturgeon reproduction within the project reservoirs is low or unsuccessful, we have no specific evidence to indicate that this is the result of egg predation.

In spite of the fact that the intent is to reduce predation on anadromous salmonids, it is probable that the pikeminnow removal program has some indirect effects on the abundance of other species within the project area. Likely effects would include increased abundance of likely pikeminnow prey species such as resident salmonids and other soft-rayed fishes (e.g. minnows and suckers). Other predator species that may compete with pikeminnow, such as smallmouth bass and walleye, may also increase in numbers as they fill in the niche opened by the removal of pikeminnow. While these changes in abundance could have some minor cascading effects within the reservoir ecosystem, there is no evidence that pikeminnow removal has significantly harmed any other species or that the proposed studies would have the accuracy to identify such effects if they were occurring.

Administrative and Procedural Recommendations

As part of the SSA, Grant PUD proposes to implement and assess anadromous fish measures using an adaptive management process that would include establishment of a PRCC, formation of various technical committees, and a dispute resolution process. Grant PUD would continue to use Standard Operating Procedures at both dams to provide operators with turbine operating criteria, spill patterns for use during downstream passage operations, fishway operation criteria, and other criteria pertaining to upstream and downstream passage of salmon and steelhead.

Under section 10(j) of the FPA, NMFS and Washington DFW recommend that Grant PUD establish a PRCC, including a hatchery subcommittee and a habitat subcommittee. Under section 10(j) of the FPA, Washington DFW also recommends that Grant PUD be required to establish a Fishery Forum to share information, coordinate efforts, and make recommendations regarding bull trout, resident fish, white sturgeon, and Pacific lamprey management plans.

Under section 10(a) of the FPA, CRITFC recommends that Grant PUD establish a PRCC that would: implement protection, mitigation, and enhancement measures; guide the adaptive management process for Pacific lamprey, sturgeon, Chinook salmon, coho salmon, sockeye salmon, and steelhead; and coordinate the 401 requirements.

In comments on the draft EIS, Yakima County indicated that the SSA should be rejected unless a comprehensive and collaborative process is created to involve stakeholders that did not sign the settlement agreement.

Our Analysis

Grant PUD proposes to implement an adaptive management process for achieving the salmon and steelhead passage standards discussed elsewhere in this section. Grant PUD proposes and NMFS, Washington DFW, and CRITFC recommend that Grant PUD establish a PRCC that would include various technical committees. Comments filed by NMFS on May 27, 2005, indicate that a PRCC already exists and is currently addressing a variety of salmon and steelhead-related issues. Continuation of PRCC meetings would provide a forum for review and discussion of monitoring and study results that would be necessary to determine if the salmon and steelhead passage standards or other goals are being achieved. A PRCC would also serve as a forum for discussing potential changes in project operations or facilities that need to be implemented to improve salmon and steelhead passage conditions.

Washington DFW recommends that Grant PUD establish and convene a Fishery Forum to share information, coordinate efforts, and make recommendations regarding non-salmon and steelhead management plans. The forum recommended by Washington DFW would provide a means for managing fisheries programs for bull trout, resident fish, white sturgeon, and Pacific lamprey.

Grant PUD proposes to provide operators at both dams with Standard Operating Procedures for turbine operations, spillway passage operations, fishway operations, and other facilities that affect upstream and downstream passage of salmon and steelhead. Providing standardized procedures to dam operators would help to ensure that intended measures for providing safe and effective passage conditions for salmon and steelhead would be implemented in a timely and efficient manner.

In comments on the draft EIS, Yakima County indicated that local, non-signatory stakeholders should be involved in decision-making associated with implementation of the SSA. The Commission could require that Grant PUD consult with local, non-signatory stakeholders on actions that would be implemented under the SSA. This consultation would provide an opportunity for non-signatory parties to comment on proposed actions prior to Commission approval.

3.5.3 Cumulative Effects

The Project contributes to cumulative effects on salmon, steelhead, bull trout, Pacific lamprey, and white sturgeon. Other factors that affect these species include other dams within the Columbia River system, commercial and sport fisheries, agriculture, human development, and changes in environmental conditions. The cumulative effect of dams, fisheries harvest, agriculture, human development, and environmental changes has generally reduced the abundance of these species within the mid-Columbia River system.

In general, dams in the mid-Columbia River influence upstream fish movements, downstream passage survival, available habitat, water quality, and downstream flows. Commercial and sport fisheries remove adult fish from the spawning populations. Agriculture generally influences water quality and water quantity. Human development can influence water quality, water quantity, available habitat, and fish movements. Changes in environmental conditions, such as global climate change, can influence water quality and quantity. The effects of all of these other factors are accounted for in our baseline description of salmon, steelhead, bull trout, Pacific lamprey, and white sturgeon populations in the mid-Columbia River in section 3.5.1.

In section 3.5.2, we describe the effects of the Project on salmon and steelhead and we describe how each proposed or recommended measure would change the project effects. In general, implementing the measures proposed in the SSA would reduce the project effects on salmon and steelhead within the mid-Columbia River, thereby reducing cumulative effects on these species. Similarly, the measures recommended by the agencies and tribes would reduce cumulative effects on salmon and steelhead by reducing project effects. More specifically, the proposed and recommended measures would reduce cumulative effects by improving upstream and downstream fish passage conditions and survival, restoring and improving existing habitat, improving water quality, and improving flow conditions within the Hanford Reach.

As indicated in section 3.5.2, few bull trout occur within the Project area and the Project has little effect on bull trout. Regardless, the improvements proposed for salmon and steelhead and improvements to water quality could reduce project effects on any bull trout that may incidentally occur within the project area, thereby reducing cumulative effects on this species.

Measures proposed by Grant PUD would improve water quality and upstream Pacific lamprey success, which would reduce project effects on this species. Measures recommended by the agencies and tribes would improve water quality, upstream passage success, and, if successful, improve downstream passage survival at the project. Both the proposed and recommended measures would reduce cumulative effects on Pacific lamprey.

The measures proposed by Grant PUD and recommended by the agencies and tribes would improve water quality within the project area which would reduce project effects on white sturgeon, thereby reducing cumulative effects on this species.

3.5.4 Unavoidable Adverse Effects

The proposed and recommended actions considered in section 3.5.2 would reduce fisheries losses associated with operation and maintenance of the Priest Rapids Project; however, adverse project effects would not be eliminated and some unavoidable adverse impacts would continue. Specifically, unavoidable adverse impacts on fisheries resources would include 1) continued entrainment and mortality of fish through the project turbines, 2) continued upstream passage delays, and 3) continued flow fluctuations in the Hanford Reach that affect habitat availability and quality and potentially dewater redds or fry. In comments on the draft EIS, Yakima County indicated that the construction of the project resulted in changes in the habitat of the mid-Columbia River that adversely affected fall Chinook salmon. Specifically, mainstem spawning and rearing habitat used by fall Chinook salmon was inundated by the project reservoirs during construction of the project. This unavoidable adverse effect was addressed during the initial licensing of the project and would continue under any new licenses.

3.6 TERRESTRIAL RESOURCES

The EIS scoping process identified the following issues related to project effects on terrestrial resources: (1) effects of daily and seasonal pool level fluctuations and downstream flow fluctuations on riparian and wetland habitats, and the wildlife dependant on these habitats; (2) effects of daily and seasonal pool level fluctuations, downstream flow fluctuations, and transmission line corridor maintenance on the spread of noxious weeds; (3) effects of recreation and other project-related human activities on riparian and upland wildlife habitats and wildlife dependant on these habitats; (4) avian collision and electrocution along project transmission lines; (5) effects of project operations (daily and seasonal pool level fluctuations, downstream flow fluctuations, transmission line maintenance) on populations of state-listed and rare plants and animals, including northern wormwood and persistent sepal yellowcress. In this section, we describe the affected environment with respect to terrestrial resources and the environmental effects, including cumulative effects, of the project as related to these issues.

3.6.1 Affected Environment

Historical accounts[79] of the Columbia River Basin recognized the importance of

[79] H.R. Doc. No. 81-531, at 2874-2878 (1950); H.R. Doc. No. 87-403, at 99 (1962).

fish and wildlife resources to trappers and settlers in the social and economic development of the river basin. Game and fur animals provided food and clothing, and served as a medium of exchange. With the exception of antelope that inhabited the sage-brush, other big-game species (*e.g.*, mule deer, black bear, mountain bighorn sheep, and Rocky Mountain elk) inhabited the mountainous and timbered sections of the river basin. Muskrat, beaver, river otter, and raccoon occurred throughout the river basin; nesting and resting grounds for migrating waterfowl and upland game birds inhabited the lowland and cultivated areas.

Although the number of native grouse (*e.g.*, blue, ruffed, and sage grouse) decreased due to loss of shrub-steppe habitat, agriculture resulted in the development of habitat favorable to introduced game birds (*e.g.*, ring-necked pheasants, valley and bob-white quails). Wooten (no date) notes past (pre-settlement ca. 1850) and current shrub-steppe habitat in Washington State. The estimated original extent of shrub-steppe was 24,437 square miles. An estimated 11,315 square miles of shrub-steppe habitat remain. In a recent study, Washington DFW (2003) notes that Washington State's historic shrub-steppe vegetation has been adversely affected by habitat conversion for crop production, roads, power-lines, and fences; overgrazing; invasion by exotic plants; and changes in fire frequency.

Vegetation

The existing Project boundary consists of the Priest Rapids and Wanapum developments and an estimated 12,000 acres of shoreline. The project boundary encompasses 58 miles of the Columbia River, from Chelan Public Utility District Rock Island dam at RM 453 downstream to the tailrace of Priest Rapids dam at RM 395. The Wanapum development is located at RM 415. We also include, in our analysis, areas likely to be affected by project operations; in this instant, Hanford Reach. Thus, an estimated total distance of 107 miles, from the tailrace of Rock Island dam to the lower end of Hanford Reach, has been identified for our cumulative effects analysis.

The Project is located in the Palouse Grassland Province as defined by Bailey (1980). This province includes central Washington, extending to eastern Oregon, and is characterized as a steppe ecosystem with short grass and shrubs. The vegetation is tolerant of semi-arid conditions; precipitation is a limiting factor, in that, precipitation usually occurs between November and April. The driest season occurs from July through September with an average of less than one-half inch of precipitation per month. Wooten (no date) notes that the height of the Cascade Range to the west presents a barrier to prevailing coastal moisture systems, leaving the east side of the mountains in a rain-shadow. "The effect of the rain-shadow is low precipitation and relative humidity in the Columbia [River] Basin, with some areas receiving only 6 inches per year" (Wooten, no date: page 7). Soils in the Columbia River Basin have been formed under grassland or shrub-steppe vegetation and vary from sands to fine sandy loams, and silt loams developed on alluvial, lacustrine, and glaciofluvial (glacial river) materials (BOR, 1998). For further discussion see section 3.3, *Geology and Soils*.

In 1999, a Habitat Based Terrestrial Inventory, conducted by Grant PUD, summarized available wildlife and botanical literature and also included a field effort to identify known populations of rare, threatened, or endangered plants. During 2000 and 2003, additional wildlife and botanical evaluations were conducted, including a Terrestrial Habitat Assessment (Framatome ANP, 2003). Survey results indicate the vegetative community within the Project area is diverse and can be characterized as: upland (shrub-steppe)[80]; riparian, wetland, and mesic; and developed cover types (see Table 18). Upland cover types (80.2 percent of the project area, not including rivers and streams) and developed cover types (16.7 percent of the project area) occupy most of the project area.

As identified inTable 18, there are three primary shrub-steppe cover types (loamy, sand, and lithosol) and a minor shrub-steppe cover type (alkaline). Habitat at some of the sites surveyed included both loamy and lithosol shrub-steppe cover types. Steep slopes, cliffs, or insufficient soils limit the extent of riparian vegetation adjacent to the Project reservoirs. When present, riparian habitat supports Siberian elm, black cottonwood, white alder, and tree-of-heaven. The most common shrub adjacent to the reservoirs is coyote willow. Understory plant species include Baltic rush, reed canarygrass, meadow fescue, and red-osier dogwood.

Grant PUD (2003) notes that due to groundwater seepage or flow some cliffs within the project area form "hanging gardens" that support Himalayan blackberry, purple-stemmed monkey flower, and yellow monkey flower.

To identify unique habitat for fish and wildlife resources and guide management of such areas, Washington DFW developed priority habitat designations.[81] Using these designations, Washington DFW identified four priority habitats located within the Project

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[80] Plant communities of shrub-steppe are usually recognized according to the dominate shrub and grass species found within the community. Typical shrubs include sagebrush species, rabbitbrush, and bitterbrush. Dominate grasses include bluebunch wheatgrass, needle-and-thread grass, and Sandberg's bluegrass. Different shrub-steppe cover types exist according to climatic and topographic conditions, soil type and depth, and land disturbance history (Sackschewsky and Downs, 2001).

[81] A priority habitat must have at least one of the following characteristics: the area has high wildlife density or high species diversity; the area is an important breeding habitat, seasonal range, or migration corridor; the habitat is limited in availability or highly vulnerable to alteration; and the habitat has unique or dependent species.

Table 18. Summary of Cover Types and Distributions in the Priest Rapids Project Area (Source: Framatome ANP, 2003b).

Cover Type	Description	Distribution in Project Area
Upland Cover Types:		
Loamy shrub-steppe	Deep loamy soils (sometimes with sand, rock, or silt component) supporting upland vegetation exceeding 18" in height. Typically dominated by big sagebrush and bluebunch wheatgrass.	Widespread throughout the Project area.
Sand shrub-steppe	Deep sandy soils supporting upland vegetation exceeding 18" in height. Typically dominated by rabbit-brush (green or gray), Indian ricegrass, and needle-and-thread. Includes some areas of bare dunes.	Well represented on east side of Priest Rapids reservoir, but uncommon elsewhere. Often occurs in mosaics with other types.
Lithosol shrub-steppe	Shallow soils supporting upland vegetation less than 18" in height. Typically dominated by stiff sagebrush, desert buckwheat, and Sandberg's bluegrass.	Concentrated east of the Project, especially Lower Crab Creek drainage and Babcock Bench.
Alkaline shrub-steppe	Deep alkaline soils supporting upland vegetation exceeding 18" in height. Typically dominated by black greasewood, Great Basin wildrye, and saltgrass.	Uncommon, limited to Lower Crab Creek drainage and small patches on YTC. Small areas may also occur on Babcock Bench.
Rock/talus	Rock and talus slopes or patches with limited vegetative cover. Sub-types are vegetated (spiny hopsage and serviceberry are typically dominant) and non-vegetated.	Most prevalent on east side of Wanapum reservoir. Large talus slopes on west side of Priest Rapids reservoir are outside of mapped area.
Cobble/cobble bar	Cobble-sand soils in river corridor supporting sparse upland and riparian vegetation. Occasionally to frequently flooded. Found in Columbia River below Wanapum and Rock Island Dams.	Uncommon, limited to Priest Rapids reservoir between Wanapum dam and Lower Crab Creek, and Gravel Bar Island south of Rock Island dam.
Riparian, Wetland, and Mesic Cover Types:		
Tree-shrub mosaic (TSM)	Shrub or tree cover exceeding 48" in height, in riparian or wetland, seasonal drainage, or upland setting.	Widespread, especially along Columbia river shoreline and major tributaries. Large patches on east bank of Priest Rapids reservoir
Palustrine emergent wetland	Emergent vegetation in wetland areas. Tule, cattail, Baltic rush, common spike-rush, and purple loosestrife are typical dominants. Sites vary by inundation duration (short to long duration) and alkalinity (freshwater or alkali).	Widespread at margins of open water (large patches on Goose Island and at the Irrigation Return Channel) and in depressions outside of riparian influence (numerous in Lower Crab Creek corridor and on Babcock Bench).

Cover Type	Description	Distribution in Project Area
Open water	Permanently inundated lands, sometimes supporting aquatic plants. Sub-types are palustrine and riverine.	Riverine includes Columbia River, Lower Crab Creek, Sand Hollow Creek, and Johnson Creek. Palustrine includes West Bar Slough, Quilomene Island Pond, Irrigation Return Channel, Moran Slough, and portions of other large ponds in Lower Crab Creek corridor and on Babcock Bench.
Riparian or wetland herbaceous	Herbaceous areas under riparian, wetland, or groundwater influence.	Narrow strips adjacent to the reservoir shoreline, tributaries, or ponds.
Mesic herbaceous	Herbaceous upland areas under riparian, wetland, or groundwater influence	Narrow strips partially removed from the reservoir shoreline, tributaries, or ponds. Occurs in larger patches in shallow, non-wetland basins and areas of elevated groundwater (*e.g.*, Lower Crab Creek corridor).
Unconsolidated shoreline	Frequently or usually inundated, poorly vegetated mudflats and cobble shores	Occurrence varies with water level, but present on both shores of Priest Rapids and Wanapum reservoirs
Developed Cover Types:		
Agricultural	Cultivated lands, including orchards	Widespread, but concentrated on east side of Priest Rapids reservoir.
Other Developed	Roads, railroads, mines and quarries, commercial and industrial areas, riprap, residential developments, and developed recreation sites.	Widespread, but concentrated on east side of Wanapum reservoir.

boundary and vicinity: riparian; wetlands; cliffs, caves, and talus[82]; and shrub-steppe. For a description of the priority habitats, see Grant PUD (2003) at exhibit E5, section 5.4.1. While we identify some federal and state listed species associated with these habitats see section 3.7, *Threatened and Endangered Species*, for further discussion.

Wanapum Development

Grant PUD (2003) notes that shrub-steppe cover type is predominate throughout the Wanapum development area. Riparian vegetation is located around the mouths of creeks and the shores of West Bar, Quilomene Bar, Quilomene Island, Crescent Bar, and an area near the Town of Vantage. Black cottonwood, coyote willow, and Siberian elm are present. The vegetative community also includes cattail, tule, reed canary grass, and various forbs (*e.g.*, showy milkweed, knapweed species).

[82] A cliff is defined as any vertical rock face greater than 25 feet high. Talus is predominately sand, gravel, cobble and boulder-sized particles of basalt that form a slope at the base of basalt cliffs.

There are 10 islands in Wanapum reservoir greater than one acre. The largest island is Quilomene Island (approximately 184 acres) composed of shrub-steppe, riparian vegetation, and an estimated 8-acre pond (Quilomene Island Pond). A state sensitive plant, Hedgehog cactus, occurs throughout the shrub-steppe interior of Quilomene Island (Framatome ANP, 2003b). A state-sensitive plant, shining flatsedge (*Cyperus bipartitus*), occurs on Quilomene Island and Crescent Bar, in addition to perennial tributaries. Other islands, ranging in size from 2 to 50 acres, are located near Crescent Bar, West Bar, Stockdale Slough, and south of Rock Island dam. West Bar contains the largest area of sand shrub-steppe in Wanapaum reservoir (Framatome ANP, 2003b) and a shallow depression that is a semi-permanently flooded emergent wetland (West Bar Slough). High cliffs occur along the southwest edge of West Bar. The Crescent Bar area, designated as a riparian priority habitat, provides habitat for wintering bald eagles (*Haliaeetus leucocephalus*), a federal and state-listed species. See Table 19 for the Crescent Bar area and other riparian priority habitats.

Table 19. Summary of Washington DFW Riparian Priority Habitats in the Priest Rapids Project Area (Source: adapted from Washington DFW, 2002).

General Location	Description
Wanapum reservoir:	
Sand Hollow area (RM 418.5-419.5)	Most of this area has limited riparian vegetation due to heavy use (recreational camping), but includes a small stand of dense willows. A few small trees occur.
RM 425.9-424.6 (left bank along Babcock Bench)	Thinly distributed riparian shrubs and very few small trees. Used by a variety of tree-nesting passerines.
RM 429.0 (adjacent to Sunland Estates)	Small tract of sandy riparian habitat (willows). May be used by game birds and shrub-nesting passerines.
Crescent Bar area	Narrow, but dense riparian habitat along eastern and western shore of Crescent Bar, with cottonwoods, water birch, and willows. Wintering bald eagle habitat used by 2-3 bald eagles annually.
Mouth of Trinidad Creek	Stand of Siberian elm at mouth of creek and a band of shrubby willows along the creek. Used by a variety of tree-nesting passerines.
RM 452.4-451.8 (left bank below Rock Island dam)	Small stand of willows. May be used by shrub-nesting passerines, game birds, and furbearers.
Priest Rapids reservoir:	
Goose Island	Riparian habitat consists of stands of common reed, bulrush, and willows. Scattered large cottonwoods occur in the interior of the island along with upland habitats. Supports a variety of nesting water birds including gulls, great blue heron, black-crowned night heron, and Canada goose.

General Location	Description
Buckshot Ranch	Dense woody riparian habitat dominated by Russian olive and multiflora rose. The area is designated for wheel chair accessible hunting, is adjacent to a Canada goose forage area, and is likely used by upland game birds.
Irrigation Return Channel (IRC)	The IRC receives irrigation wastewater and is permanently flooded. A relatively narrow band of riparian vegetation encircles the IRC, including willows, common reed, and bulrush. Used by waterfowl and other water birds, including shorebirds during periods of low water.
RM 412.8-411.9 (left bank at Beverly)	Riparian habitat consists of Siberian elm, mulberry, willow, juniper, and occasional cottonwoods. Used by a variety of tree-nesting passerines.
North side of Lower Crab Creek (RM 0 to 2.75)	Riparian stands primarily consisting of willows and Russian olive between sand dune area and creek. Area supports upland game, tree-nesting passerines, beaver, and other species.

Priest Rapids Development

At Priest Rapids development, the approximate 80-acre Goose Island contains riparian habitat, shrub-steppe cover type, and stands of black cottonwood and coyote willow trees with scattered snags. The riparian habitat associated with Goose Island is a designated priority habitat that supports a variety of nesting water birds, including black-crowned night heron (*Nycticorax nycticorax*), a Washington State monitor species. See Table 19. Vegetation includes southern mudwort, pigmy-weed, smartweed, and needle spike rush. The area supports state-sensitive plants (*e.g.*, awned halfchaff sedge (*Lipocarpha aristulata*) and shiny flatsedge). Common reed, cattail, and forbs (*e.g.*, western goldenrod and hemp dogbane) are present. The 33-acre Railroad Island is primarily cobble or gravel, sparsely vegetated by herbaceous species or shrubs. Gray rabbitbrush is the dominant shrub with white sweet-clover, spike bentgrass, and reed canarygrass interspersed. The periodically flooded cobble sand peninsulas and gravel bars upstream from Railroad Island support northern wormwood (*Artemisia campestris* var. *wormskioldii*), a federal candidate and state-listed plant (Framatome ANP, 2003a).

To the east of Priest Rapids reservoir, there are two tributaries: Lower Crab Creek and the Irrigation Return Channel. Lower Crab Creek, of which an estimated 5 miles lies within the project boundary, is a riparian corridor that contains a diversity of species - - peach-leaf willow, coyote willow, and black cottonwood; native species (*e.g.*, Baltic rush, common spike-rush); non-native species (*e.g.*, common cocklebur, diffuse knapweed, and purple loosestrife); tule; hornwort, and other floating aquatic plants. A state-sensitive plant, Grand redstem (*Ammannia robusta*), occurs near the mouth of Lower Crab Creek (Grant PUD, 2003). Also, the sandy shrub-steppe cover type supports the state-sensitive plant, Geyer's milk-vetch (*Astragalus geyeri*) (Framatome ANP, 2003a).

As identified in Table 20, a portion of Lower Crab Creek is a wetland priority habitat because the area represents high quality habitat for upland game, waterfowl, and other species. To the north of Lower Crab Creek, there are numerous ponds, including shallow alkaline playas and pothole ponds. To the south of Lower Crab Creek, Saddle Mountains is present - - an area of cliffs, extensive talus slopes, and shrub-steppe cover type. The Washington DFW considers the steep slopes with cliffs, talus, and shrub-steppe vegetation of Saddle Mountains as priority habitat because the area provides quality habitat for breeding raptors and non-game species. See Table 21and Table 22.

Table 20. Summary of Washington DFW Wetland Priority Habitats in the Priest Rapids Project Area (Source: adapted from Washington DFW, 2002).

General Location	Description
<u>Priest Rapids reservoir:</u>	
Moran Slough	Emergent wetlands dominated by cattails and bulrush, and open water areas. Used by an assortment of passerines, raptors, waterfowl, other water birds, and beaver.
Lower Crab Creek area (beginning at RM 4.5)	Numerous depression emergent wetlands (including alkali wetlands) dominated by cattails, bulrush, spikerush, and saltgrass; some with associated Russian olive. Represents high quality habitat for upland game, shorebirds, waterfowl, furbearers, amphibians, etc.
<u>Wanapum reservoir:</u>	
Sand Hollow	The lower part of the creek is impounded and is fringed by a small stand of cattail and reed canarygrass. This site is adjacent to a busy road and habitat values are limited.
Babcock Bench (left bank 0.5 miles south of Casey Creek)	A single short-duration emergent wetland (vernal pond).
Babcock Bench (left bank, three scattered sites by Ancient Lake Road)	Five permanently flooded depression emergent wetlands supported by irrigation seepage. Dominated by cattail and bulrush. Possible waterfowl breeding sites and used by tiger salamanders and bullfrogs (at two of the sites).

A narrow band of riparian vegetation composed of willow, common reed, and bulrush occurs at the Irrigation Return Channel (Grant PUD, 2003). As identified in Table 19, the Irrigation Return Channel is a designated riparian priority habitat. Hanson Creek, a perennial tributary, is located to the west of the Priest Rapids reservoir and supports state-sensitive plants, such as Beaked spike-rush (*Eleocharis rostellata*) and porcupine sedge (*Carex hystericina*) (Framatome ANP, 2003a). Washes (Corral Canyon, Cow Canyon, and Sourdough Canyon) cut through the hills of the west bank along the reservoir, but only contain water during the winter and spring (Grant PUD, 2003).

Table 21. Summary of Washington DFW Cliff and Talus Priority Habitats in the Priest Rapids Project Area (Source: adapted from Washington DFW, 2002).

General Location	Description
<u>Wanapum reservoir:</u>	
Lower Babcock Ridge (from 1.3 miles south of dam to Sand Hollow area)	Low basalt cliffs and outcrops. Provides habitat for upland game, non-game birds, and reptiles (whipsnake and night snake).
Babcock Bench (from Sand Hollow to Crescent Bar area)	Series of cliffs flanking the river (left bank) and edge of Babcock Bench. Used by a wide array of cliff-associated raptors, passerines, and bats.
Ginkgo Petrified Forest State Park	High cliffs flanking the river (right bank). Area includes three prairie falcon nests.
High cliffs on right bank (RM 426.4 to 430.8)	Discontinuous high cliffs flanking the river (right bank). Area includes prairie falcon and peregrine falcon nest sites.
Quilomene Creek and Quilomene Bar area	High cliffs on west edge of Quilomene Bar and north of Quilomene Creek. Suitable habitat for prairie falcon and golden eagle.
Tekison Creek	Band of cliffs extending along the north side of Tekison Creek (most of this area is more than 1 mile from the Project). Includes golden eagle territory.
West Bar	High cliffs along southwest edge of West Bar. Includes golden eagle territory and prairie falcon nests.
Colockum WA	High cliffs along the river and on west edge of bench between Colockum Creek and Tarpiscan Creek. Includes a golden eagle nest.
Moses Coulee area	Cliffs and talus slopes at the terminus of Moses Coulee and north and south of the coulee. Provides habitat for an array of game species, raptors, and cliff-associated species.
<u>Priest Rapids reservoir:</u>	
Saddle Mountains (left bank including south of Lower Crab Creek, and right bank)	Steep slopes with cliffs, talus and shrub-steppe vegetation, provides quality habitat for breeding golden eagle, prairie falcon and other raptors, chukar, deer, and other non-game species.

Other priority habitat areas include the dune complexes in the lower Crab Creek area (Beverly Dunes off-road vehicle [ORV] Park) and south of Moran Slough (Vernita Dunes) known for unusual plant communities and the sand dunes' vulnerability to disturbance (Grant PUD, 2003).

Hanford Reach

As discussed in this final EIS, the 51-mile-long Hanford Reach and the approximate 195,000-acre Hanford Reach National Monument (Monument) are unique regional resources due to relatively undisturbed habitats that contribute to the diversity of

Table 22. Summary of Washington DFW Shrub-Steppe Priority Habitats in the Priest Rapids Project Area (Source: adapted from Washington DFW, 2002).

General Location	Description
Priest Rapids reservoir:	
Priest Rapids WA	Mostly poor quality shrub-steppe. Used for hunting and other recreational activities.
Saddle Mountains	Good condition shrub-steppe on steep slopes. Provides habitat for deer, chukar, and shrub-steppe passerines.
Babcock Bench	Extensive unbroken area from north of I-90 Bridge to Crescent Bar area, including Frenchman Coulee and Potholes Coulee. Remnant shrub-steppe habitat in nearly undisturbed condition.
Babcock Ridge (east of Sunland Estates)	Remnant shrub-steppe habitat in area otherwise converted to irrigated agriculture.

aquatic and terrestrial resources.

Within the Hanford Reach there is gradation of aquatic, riverine, cobble, riparian, wetland, bluff, and shrub-steppe habitats (U.S. National Park Service (NPS), 1994). Specialized habitats that also contribute to the biodiversity of the Hanford Reach include basalt outcrops, cliffs, and sand dunes. The Hanford Reach area represents one of the largest undisturbed tracts of native shrub-steppe cover type in the State of Washington (DOE, 2003; Sackschewsky and Downs, 2001). Washington DFW (2003) identifies three large blocks of remaining shrub-steppe cover type: (1) 400,000 acres on the Yakima Reservation in Yakima County; (2) 378,000 acres on and around the DOE Hanford Site in Benton County; and (3) 124,000 acres on the U.S. Army Yakima Training Center in Yakima and Kittitas Counties. Of these areas sage grouse are found only on the Yakima Training Center lands.

The 25,000-acre River Corridor Unit of the Monument includes the Hanford Reach of the Columbia River along with the Columbia River islands and the Hanford Dunes. The sand dunes rise approximately 10 to 16 feet above the ground, creating sandy habitats raging in size from 2.5 acres to several hundred acres. The predominate vegetation are scurf pea and thick-spike wheatgrass. The Nature Conservancy (TNC) (2003) notes the Monument has a diversity of lichen and moss that occur in shrub-steppe plant communities, as well as in a variety of other habitats. Microbiotic soil crusts, which are complex groupings of lichens, moss, algae, and bacteria living on the surface of the soil, are found in the Monument's shrub-steppe plant communities. The microbiotic soil crusts help stabilize the soil, retain water, decrease erosion, and promote reseeding of grasses and shrubs.

The shrub-steppe cover type is dominated by big sagebrush, which occurs on soils characterized as loams and sandy loams. Shrubs include gray rabbitbrush, green rabbitbrush, antelope bitterbrush, threetip sagebrush, and black greasewood (Sackschewsky and Downs, 2001). Plant communities on sandy soils and stone-loams are characterized by bitterbrush and desert buckwheat (TNC, 2003). Soils characterized as sand and loamy sand support Indian ricegrass and needle-and-thread grass. Common native forbs include Carey's balsamroot, long-leaved phlox, and daisy fleabane. Riparian vegetation is primarily limited to portions of the Columbia River shoreline, islands and sloughs, and wetlands created by irrigation run-off. Riparian areas include black cottonwood, white mulberry, coyote willow, and a variety of grasses and forbs. Upland habitat includes dunes and bluffs. The cliffs at White Bluffs, composed of clay stone and siltstone, abut the Columbia River on the eastern shore; a large, relatively flat area of shrub-steppe occurs on the western side (Demarchi, *et al.*, 2003).

During 2002, surveys conducted at the Hanford Site and the Monument documented more than 100 rare plant populations of 31 different taxa. Of these plant species, two are proposed as candidates for federal listing: Umtanum desert buckwheat (*Eriogonum codium*) and White Bluff's bladderpod (*Lesquerella tuplashensis*) (Searing, *et al.*, 2002; Caplow, 2003). Umtanum desert buckwheat and White Bluffs bladderpod occur, respectively, within the McGee Ranch-Riverlands Unit and the Wahluke Unit of the Monument. Persistent-sepal yellowcress, a state-threatened and federal species of concern, occurs in the Hanford Reach. See our discussion on Species of Special Concern below.

Transmission line Corridor

Shrub-steppe cover type (big sagebrush-bluebunch wheatgrass) primarily occurs within the project transmission line corridor. Additional plant associations include stiff sagebrush-Sandberg's bluegrass or stiff sagebrush-round headed desert buckwheat. Sandy soils support shrubs (*e.g.*, gray rabbitbrush and green rabbitbrush) and grasses (*e.g.*, Indian rice grass and needle-and-thread). Although not common, saline soils support saltgrass, giant wildrye, and greasewood (Framatome ANP, 2003h). Pothole ponds are located under or adjacent to the transmission line corridor. Survey results (Framatome ANP, 2003a) indicate occurrences of federal candidate and state-listed plant species (*e.g.*, Geyer's milk-vetch) within the corridor.

Invasive Species

In this final EIS we refer to noxious weeds, other exotic plant species, and invasive species (*e.g.*, zebra mussels) as invasive species. Noxious weeds are defined as those plants listed by the Washington State Noxious Weed Control Board under WAC 16-750 and adopted by local county boards. Noxious weeds are classified according to current distribution and degree of threat; however, numerous plant species have been identified to be too widespread to control (*e.g.*, cheatgrass) and are not listed (Grant PUD, 2003).

Table 23 identifies noxious weeds and other exotic plant species known to occur within the project and surrounding areas, some of which are known to occur near rare plants (Framatome ANP, 2003b). Within the project transmission line, noxious weeds were concentrated near agricultural and private lands. Noxious weeds and exotic plant species, such as purple loosestrife and Russian olive, have been linked either to seed dispersal from agricultural lands via Lower Crab Creek (Mastrogiuseppe, 1991) or as a windbreak and wildlife enhancement.

Wildlife

Diverse vegetative cover types, cliffs and talus slopes, as previously identified, provide habitat for breeding wildlife; perching and roosting sites for raptors; hibernacula where snakes den during winter; and protected crevices for roosting bats. In mesic habitats (riparian, wetland, and cottonwood stands), moist ground, leaf litter, and decaying woody debris provide protection from predators and food sources for wildlife.

As identified in Table 18, developed cover types consist of agricultural and other developed areas. Common wildlife species, which occur in the agricultural areas, include Great Basin pocket mouse, deer mouse, northern pocket gopher, burrowing owl, western meadowlark, and barn swallow (BOR, 1998).

Based on wildlife surveys (Framatome ANP, 2003) and Grant PUD agency consultations, an estimated 251 wildlife species are known to or may occur within the project area: amphibians (8 species); reptiles (9 species); waterfowl (30 species); water birds (52 species); birds of prey (27 species); upland game fowl (7 species); passerines (57 species); and mammals (61 species), which include big-game, furbearers, and bats.

Table 24 identifies some of the common wildlife species that occur within the project area. By letter filed May 26, 2005, Interior states that mammals utilizing the riparian habitat supported by the project include muskrat, beaver, river otter, raccoon, long-tailed weasel, and mink. See Grant PUD (2003) for a complete list of species.

Federally listed species also occur in the project area. See our discussion in the Threatened and Endangered Species section.

Breeding habitat for amphibians (*e.g.*, Pacific treefrog) is generally standing or slow-moving water that persists until at least early summer (occasionally as early as late May) (Framatome ANP, 2003c). The non-native bullfrog has colonized most of the

Table 23. Noxious Weeds and Other Exotic Plant Species Recorded During 1999-2001 Surveys in the Priest Rapids Project Area (Source: Grant PUD, Washington, 2003).

Common Name *(Latin Name)*	2002 County Classifications[1]	Habitat and Project Area Occurrence
Russian knapweed *(Acroptilon repens)*	B (Grant, Kittitas); B designate (Yakima); Unlisted (Benton); C (Chelan)	Mesic transition areas between riparian and shrub-steppe habitat. Common to dominant in appropriate habitats throughout the Project and surrounding area.
Diffuse knapweed *(Centaurea diffusa)*	B (Grant, Kittitas); Education (Yakima); Unlisted (Benton); C (Chelan)	Grazed or otherwise disturbed shrub-steppe; rarely found in undeveloped or minimally used areas. Common in appropriate habitats in the Project and surrounding area.
Rush skeletonweed *(Chondrilla juncea)*	B (Grant); B designate (Yakima, Benton, Chelan)	Upland shrub-steppe, especially sandy areas. A single infestation found on Project lands in 2001.
Canada thistle *(Cirsium ravense)*	C (Grant, Kittitas); Education (Yakima, Benton), B (Chelan)	Wetland and riparian areas. Common in appropriate habitats throughout the Project and surrounding area.
Common St. John's wort *(Hypericum perforatum)*	C (Grant, Kittitas, Chelan); Unlisted (Yakima, Benton)	Wetland and riparian areas. Common in appropriate habitats throughout the Project and surrounding area.
Yellow flag *(Iris pseudacorus)*	Unlisted (Grant, Kittitas, Benton, Chelan); C (Yakima)	Wetland and riparian area. Common in appropriate habitats throughout the Project and surrounding area.
Mexican-fireweed *(Kochia scoparia)*	B (Grant, Kittitas, Yakima); Education (Benton); C (Chelan)	Grazed or otherwise disturbed shrub-steppe, often in alkaline areas. Rarely found in undeveloped or minimally used lands. Common in appropriate habitats throughout the Project and surrounding area.
Broadleaved pepperweed *(Lepidium latifolium)*	B (Grant, Kittitas, Yakima, Chelan); unlisted (Benton)	Wet to mesic soils in riparian and wetland areas. Common and locally dominant in appropriate habitats in Lower Crab Creek.
Oxeye daisy *(Leucanthemum vulgare)*	B (Grant, Kittitas); B designate (Yakima, Benton, Chelan); C (Chelan)	Mesic or agriculturally developed areas; also occurs in riparian habitats. Uncommon in the Project area.
Dalmatian toadflax *(Linaria dalmatica)*	B (Grant, Kittitas Yakima, Chelan); B designate (Benton)	Disturbed rangelands, fields, and roadsides. Uncommon in the Project area, but widespread in the inland Northwest.
Purple loosestrife *(Lythrum salicaria)*	B (Grant, Kittitas); B designate (Yakima, Benton, Chelan)	Wetland and riparian habitats. Common to dominant in appropriate habitats throughout the Project and surrounding area.
Eurasian watermilfoil *(Myriophyllum spicatum)*	B (Kittitas); Unlisted (Grant); B designate (Yakima, Benton, Chelan)	Aquatic habitats. Common throughout Priest Rapids and Wanapum reservoirs.
Reed canarygrass *(Phalaris arundinacea)*	Unlisted (Grant, Kittitas, Benton, Chelan); C (Yakima)	Wetland and riparian areas. Common but rarely dominant in appropriate habitats in the Project and surrounding area.

Common Name *(Latin Name)*	2002 County Classifications[1]	Habitat and Project Area Occurrence
Alkali swainsonpea *(Sphaerophysa salsula)*	B (Grant, Yakima, Chelan); Unlisted (Kittitas, Benton)	Wet to mesic soils in riparian and wetland areas. Uncommon, but locally dominant in parts of Lower Crab Creek.

[1] Douglas County's Noxious Weed Control Board is currently inactive, but state designations and requirements apply.

B = Limited distribution, but well established in some parts of the state. Control required in uninfested areas (B designate); containment required in already infested areas (B non designate).

C = Widespread. Management requirements are determined locally.

Education = Widespread. Local education efforts are encouraged.

Table 24. Common Wildlife Species in the Priest Rapids Project Area (Source: Grant PUD, Washington, 2003, as modified by staff).

Common Name *(Latin Name)*	Occurrence
Great Basin spadefoot toad (*Spea intermontanus*)	Breeds in floodwater pools along Lower Crab Creek, and also reportedly occurs in Vantage area, Sand Hollow, and Ginkgo State Park.
Pacific treefrog (*Hyla regilla*)	Widespread and common in seasonal to semi-permanently flooded wetlands in Lower Crab Creek area, Babcock Bench, Quilomene Island Pond, West Bar Slough, Wanapum substation. Also breeds in Tekison and Quilomene Creeks.
Bullfrog (*Rana catesbeiana*)	A non-native species. Found at flooded ponds in Lower Crab Creek area and on Babcock Bench; heard calling at Irrigation Return Channel, Priest Rapids Wildlife Recreation Area (WRA), and Moran Slough.
Side-blotched lizard *(Uta stansburiana)*	Found in shrub-steppe cover type with loam or sandy loam soils. Found in Lower Crab Creek area.
Yellow-bellied racer (*Coluber constrictor)*	The most commonly observed snake in the project area. Found in shrub-steppe and riparian habitats.
Gopher snake *(Pituophis catenifer)*	Widespread species. Found in both shrub-steppe and riparian habitats.
Western rattlesnake *(Crotalus viridis)*	Relatively common and conspicuous. Found in shrub-steppe, riparian, and mesic habitats. Found in Lower Crab Creek area.
Canada Goose *(Branta Canadensis)*	Breeding. Found on and near Goose Island; Priest Rapids WRA, Lower Crab Creek.
American wigeon *(Anas Americana)*	Non-breeding, migrant. Found on Goose Island.
Mallard *(Anas platyrhynchos)*	The most abundant species of dabbling duck in the project area. Mallard pairs observed in Moran Slough, Lower Crab Creek, and in riparian habitats along the project reservoirs.
American avocet *(Recurvirostra Americana)*	Migrant. Water bird documented to have bred in project area (Smith *et al*, 1997).

Common Name *(Latin Name)*	**Occurrence**
Common merganser *(Mergus merganser)*	Breeding. Found throughout the project area.
Lesser scaup *(Aythya affinis)*	Non-breeding, migrant.
American coot *(Fulica Americana)*	The most abundant waterbird in the project area. Occurs primarily during winter on the reservoirs, with small numbers remaining to breed.
Killdeer *(Charadrius vociferous)*	The most common shorebird species.
California gull *(Larus californicus)*	Breeding. Abundant in the Wanapum development area (Demarchi, *et al*., 2003).
Red-tailed hawk *(Buteo jamaicensis)*	Most commonly observed bird of prey. Nest records documented for the species throughout project area.
American Kestrel *(Falco sparverius)*	Most commonly observed falcon. Found in riparian, shrub-steppe, grassland habitats, residential and agricultural areas.
Prairie falcon *(Falco mexicanus)*	Associated with cliffs, shrub-steppe habitat.
Great horned owl *(Bubo virginianus)*	Breeding. Found in Lower Crab Creek, Quilomene Creek, Columbia and Midway Substations, and other areas. Nests on cliffs, in riparian habitats, and in old barns and building.
Barn owl *(Tyto alba)*	Breeding. Nests on cliffs, in riparian habitats, and in old barns and building.
California quail *(Callipepla californica)*	Breeding. Found in shrub-steppe habitat.
Rock wren *(Salpinctes obsoletus)*	Resident. Found in shrub-steppe habitat with rocky outcrops.
Common nighthawk *(Chordeiles minor)*	Breeding. Found in lithosol shrub-steppe habitat. Nests in sparse, open shrub-steppe habitat (Framatome ANP, 2003e).
Dark-eyed junco *(Junco hyemalis)*	Common winter. Found in mesic habitat.
Western meadowlark *(Sturnella neglecta)*	Found in shrub-steppe habitat. Among the most common nesting species in the river basin.
Rocky Mountain elk *(Cervus elaphus)*	Found on the western side of Wanapum reservoir.
Mule deer *(Odocoileus hemionus)*	Found on the western side of the project area and on Goose Island. Occurs primarily in shrub-steppe habitat.
Beaver *(Castor canadensis)*	Found along the project reservoirs.
River otter *(Lutra Canadensis)*	Found along the project reservoirs.

Common Name *(Latin Name)*	Occurrence
Deer mouse *(Peromyscus maniculatus)*	Found in both mesic and shrub-steppe habitats.
Northern pocket gopher *(Thomomys talpoides)*	Found in shrub-steppe habitat. Requires loose soils for burrowing.
Great Basin pocket mouse *(Perognathus parvus)*	Found in shrub-steppe habitat. Requires loose, sandy soils for burrowing. Forages on cheatgrass and other winter annuals.
Yuma myotis *(Myotis yumanensis)*	Found at Babcock Bench and Quilomene Creek. Found at a bridge site utilized as a night roost. Potentially breeding.
Little brown myotis *(Myotis lucifugus)*	Recordings determined presence of species at Priest Rapids WRA and Moran Slough. Found at a bridge site utilized as a night roost.

flooded ponds in the Lower Crab Creek area and on Babcock Beach (Grant PUD, 2003). In addition to the reptiles listed in Table 24, western painted turtles were observed at three sites: Lower Crab Creek; in a pond along the transmission line corridor on Babcock Beach; and near a pond in Potholes Coulee (Framatome ANP, 2003d).

Birds migrating between breeding grounds in the northern latitudes of Canada and wintering grounds in the U.S. and Central and South America utilize the Columbia River corridor (Grant PUD, 2003). During migration and in winter (from mid-October to February) waterfowl are abundant on the project reservoirs and associated wetlands. The Washington DFW identified 15 waterfowl and American coot concentration areas on Wanapum reservoir (10 areas) and Priest Rapids reservoir (five areas).

Relicensing studies conducted by Grant PUD for avian species consisted of the following: (1) a breeding bird survey (2002); (2) a migratory bird survey (autumn-winter 2001 and spring 2002); and (3) a Project transmission line avian study (from February to November 2001). Furthermore, based on consultations with the FWS, Grant PUD notes more than 42,000 (up to 72,000) diving ducks (*e.g.*, lesser scaup) and more than 70,000 (up to 250,000) dabbling ducks (*e.g.*, American wigeon, mallard) were recorded during each winter census (from October to January).

American white pelican (*Pelecanus erythrorhynchos*), a Washington State endangered species, Caspien tern (*Sterna caspia*) and black-crowned night heron, both Washington State monitor species, and great blue heron are known to nest in clustered and identifiable locations, typically referred to as colonies (Smith, *et al*., 1997; Northwest Power and Conservation Council, 2004).

California gulls and ring-billed gulls are abundant in the Wanapaum development area. Colonies of Caspien terns were located near Wanapaum development, at Goose

Island, and at other islands within the Columbia River. Study results (Demarchi, *et al.*, 2003; Searing, *et al.*, 2002) indicate that these species and other fish-eating birds consume Chinook salmon smolts along a stretch of the Columbia River. The authors note that assuming predation rate on other species of salmon (for which the authors recognize no available data), coho salmon, steelhead, and sockeye salmon also would be consumed by birds.

In the Priest Rapids reservoir, Goose Island supports the only known great blue heron rookery in the project area. Goose Island, as with other islands, is used by waterfowl (*e.g.*, Canada goose, American wigeon, and California gull) for resting, foraging, and nest sites. Other species known to occur on or near the island include American white pelican, bald eagle, great horned owl, red-tailed hawk, mule deer, yellow-bellied racer, and beaver.

Moses Islands, which are gravel bar islands in the upper Priest Rapids reservoir, and a sandy island near Crescent Bar are used by foraging bald eagles and used or possibly used by nesting Canada geese. Gulls and double-crested cormorant have been observed on these islands.

Cliffs, caves, and talus slopes provide unique habitat for birds and reptile species (Northwest Power and Conservation Council, 2004). Along the Columbia River, cliffs and adjacent shrub-steppe cover type provide nesting and foraging areas for these species, as well as, provide potential roost sites for bats. Survey results (Framatome ANP, 2003f) identified four bat species within the project area: Yuma myotis, little brown myotis, pallid bat (*Antrozous pallidus*), and spotted bat (*Euderma maculatum*). The pallid bat and spotted bat are Washington State monitor species.

Passerine (*e.g.*, rock wren, western meadowlark) and non-passerine (*e.g.*, northern flicker, common nighthawk) birds occur within the project area. Some species are residents, while other species only occur during the breeding season or wintering period. Upland game fowl (*e.g.*, mourning dove, California quail) are managed by the Washington DFW for hunting purposes. For further discussion, see section 3.9, *Recreation and Land Use*.

Survey results (Framatome ANP, 2003g) identified eight species of small mammals in which deer mouse and Great Basin pocket mouse were the most abundant species. Generally, deer mouse occurred in both mesic and shrub-steppe, whereas the Great Basin pocket mouse occurred in shrub-steppe. In the shrub-steppe habitat at Lower Crab Creek, deer mouse, Great Basin pocket mouse, and Ord’s kangaroo rat were found.

Hanford Reach

The Hanford Reach supports an estimated four species of amphibians, nine species of reptiles, 200 species of birds, 42 species of mammals, 1,500 species of insects, and 44 species of fish (DOE, 1999; FWS, 2003). See section 3.5, *Aquatic Resources*, for a discussion on the fishery resources. From 1994 to 2000 the Hanford Site was surveyed for insects. While numerous insect species are awaiting identification, a total of 1,679 species had been identified, primarily moths and beetles. Four new species of moths were discovered on the sand dunes and in the Wahluke Wildlife Area (Zack, *et al*., 2003). A darkling beetle not found in previous studies, a ground beetle and a rare beetle were discovered at the White Bluffs Ferry site (TNC, 2003).

Some of the wildlife species that occur within the Project area also occur at the Hanford Reach section (*e.g.*, side-blotched lizard, gopher snake, Great Basin pocket mouse, western meadowlark, little brown myotis, and mule deer). Black-tailed jackrabbits occur within the sagebrush. Coyote are also common. Although the islands associated with Hanford Reach are utilized by Canada geese and mule deer for nesting and fawning habitat, respectively, coyotes are a primary cause of destruction for the nests of Canada geese on the islands (DOE, 1999). Wetlands provide habitat for a variety of waterfowl, such as mallard, green-winged teal, and bufflehead. Migratory species include the long-billed curlew, loggerhead shrike, sage thrasher, and Brewer's sparrow.

Four species of colonial nesting birds occur in the Hanford Reach area: Forester's tern (*Sterna forsteri*), a Washington State monitor species; California gull; ring-billed gull; and great blue heron. The black-crowned night heron formerly nested in the area and may re-establish a colony in the future (NPS, 1994). The Hanford Reach provides habitat for several federal and state-listed threatened and endangered species. In particular, the reach provides habitat for wintering bald eagles.

Transmission line Corridor

The avian transmission line study (Framatome ANP, 2003h) assessed the use of habitats by raptors and waterfowl along the project transmission line. The study was conducted during the spring 2001 migration period (February to March), nesting period (April to early-May), summer (July to August), and fall/winter migratory period (mid-September to November). Results identified 88 species of birds, some of which are raptors (*e.g.*, red-tailed hawk, American kestrel, prairie falcon, and northern harrier); waterfowl (*e.g.*, Canada goose, mallard, American wigeon); "swimmers" (*e.g.*, American coot, pied-billed grebe); passerines (*e.g.*, cliff swallow, western meadowlark) and non-passerines (*e.g.*, rock dove, northern flicker); and aerialists (*e.g.*, California gull, Caspian tern, Forster's tern); wading birds (such as, great blue heron); and shorebirds (*e.g.*, killdeer, spotted sandpiper). The variety of species can be attributed to the diverse vegetative community, including associated wetlands.

The study (Framatome ANP, 2003h) also found raptors (*e.g.*, red-tailed hawk, American kestrel) and other birds (*e.g.* common raven) use transmission towers as nest sites along the Priest Rapids transmission lines. Further, the study found red-tailed hawk, American kestrel, house finch, white-throated swift, or doves perched on the towers, the wires associated with the transmission line, substations, etc., or other items, such as vegetation, fences or posts, and cliffs.

Species of Special Concern

From 2000 to 2002 Framatome ANP (2003a) conducted surveys and documented several occurrences of 20 different rare plant species located in the vicinity of the Project. Results indicate one Washington State endangered species, four threatened species, 11 sensitive species, and four species under review. Four of the state-listed species are considered federal candidate. See Table 25.

Table 25. State and federal vascular plants documented during surveys of the Priest Rapids Project Area (Source: Framatome ANP, 2003a).

Name	Federal Status	State Status	Occurrence in Project Area
Grand redstem *Ammannia robusta*	--	T	One occurrence in the T-Line ROW near the mouth of Lower Crab Creek.
Northern wormwood Artemisia campestris var. wormskioldii	C	E	One occurrence on BOR land.
Columbia milkvetch *Astragalus columbianus*	SOC	S	One occurrence on Grant PUD land.
Geyer's milkvetch *Astragalus geyeri*	--	T	Two occurrences in T-Line ROW on private, federal, and Grant PUD land.
Dwarf evening-primrose *Camissonia pygmaea*	--	T	Two occurrences in the T-Line ROW on Grant PUD land.
Porcupine sedge *Carex hystericina*	--	S	Five occurrences distributed across both project reservoirs, wetlands in the T-Line ROW, and a partially vegetated gravel pit near Priest Rapids dam.
Annual paintbrush *Castilleja exilis*		SR	Occur at three separate locations within the T-Line ROW and at two seeps near the Columbia River. Also documented in the Lower Crab Creek area, outside the project boundary.
Gray *cryptantha* *Cryptantha leucophaea*	SOC	S	Six occurrences in the T-Line ROW on federal, Grant PUD fee-owned and private land. One population on dunes to the south of SR 26.
Miner's candle *Cryptantha scoparia*	--	S	One occurrence in T-Line ROW on Washington DFW land.

Name	Federal Status	State Status	Occurrence in Project Area
Shining flatsedge *Cyperus bipartitus*	--	S	Seventeen occurrences, although boundaries unclear. On Priest Rapids reservoir, wetland complex, sloughs of Priest Rapids WA, west side of Goose Island; On Wanapum reservoir, east side of Crescent Bar; Quilomene Bar.
Beaked spike-rush *Eleocharis rostellata*	--	S	Four occurrences in Moran Slough (two populations), near Borden Springs and Buckshot Slough.
Giant helleborine *Epipactis gigantean*		S	Thirteen occurrences documented in the project area; suitable habitat is widespread in the project area.
Sagebrush stickseed *Hackelia hispida var. disjuncta*	--	S	One occurrence in T-Line ROW on private land.
Awned halfchaff sedge *Lipocarpha aristulata*	--	T	Three occurrences: Goose Island (Washington DFW land), Feather Slough (Grant PUD land), and south of Priest Rapids dam.
Hoover's desert-parsley *Lomatium tuberosum*	SOC	S	One occurrence in the T-line ROW on Grant PUD land.
Suksdorf's monkeyflower *Mimulus suksdorfii*	--	S	Two occurrences in the T-Line ROW on federal and private land.
Small-flowered nama *Nama densum var. parviflorum*		SR	Eight occurrences found in T-Line ROW below Priest rapids dam on federal, private, and Grant PUD fee-owned land.
Coyote tobacco *Nicotiana attenuate*	--	S	One occurrence in the T-Line ROW near Frenchman Coulee.
Brittle pricklypear *Opuntia fragilis*	--	SR	One occurrence in the T-Line ROW near Frenchman Coulee.
Hedgehog cactus *Pediocactus simpsonii* var. *Robustior*	--	SR	Two occurrences: one in T-Line ROW near Babcock Bench on private land; one on Quilomene Island.

E = Federal status is endangered, Washington State status is endangered

T = Federal status is threatened, Washington State status is threatened

C = Federal status is candidate species

SOC = Federal status is species of concern

S = Washington State sensitive

SR = Washington State review

Although the staff preliminary identified the state-threatened and federal species of concern persistent-sepal yellowcress (*Rorippa columbiae*) as potentially occurring in the Project area, survey results (Framatome ANP, 2003a) indicate the plant does not occur within the project area. Persistent-sepal yellowcress occurs in the Hanford Reach on islands. Habitat for persistent-sepal yellowcress is inundation for part of the year, seasonal fluctuation of water level, wet soil into the growing season, and open habitats with low cover of competing vegetation. The plants grow and reproduce in late summer and early fall, when water levels are lowest (Caplow, 2003). Survey results (Caplow, 2003) indicate plants are submerged during daylight hours on the lower Hanford Reach even after RLF begins in mid-October, due to the 6 to 8 hour lag time from Priest Rapids dam to the lower Hanford Reach. Caplow (2003) notes RLF is a river management strategy designed to keep river levels low over Vernita Bar to allow for redd counting, and it begins in mid-October and continues until mid-November. See section 3.5, *Aquatic Resources*, for further discussion. Caplow (2003) notes hydrologic changes on the Hanford Reach and possible impacts on persistent-sepal yellowcress are unknown at this time.

By letter filed May 3, 2005, the FWS identified two candidate species, Washington ground squirrel (*Spermophilus washingtoni*) and northern wormwood (*Artemisia campestris ssp. Borealis* var. *wormskioldii*), and a species of concern, Pacific lamprey (*Lampetra tridentate*) that may occur in the vicinity of the Project. See section 3.5, *Aquatic Resources*, for our discussion on the Pacific lamprey.

Washington Ground Squirrel

The Washington ground squirrel (*Spermophilus washingtoni*) is a federal candidate species. In Washington, the species is listed as a State candidate. Historically, the species occurred in shrub-steppe habitat of southeastern Washington and northeastern Oregon, but its range has decreased due to habitat loss. Decline of the Washington ground squirrel has been attributed to poisoning and/or shooting (Rulofson *et al*., 1993). Ongoing agricultural conversion eliminates Washington ground squirrel habitat, resulting in fragmentation of habitat and isolation of colonies (Nolin, 2005; and Betts, 1990, 1999 In: FWS, 2004).

The Washington ground squirrel occurs at sites with greater vegetative cover, but soil type may be the most important feature. The species selects soil with high silt content, such as Warden Soils, and very deep, allowing for deeper burrows that would maintain their structure compared to sandy or shallow soils (U.S. Department of Agriculture, 1983).

The Washington ground squirrel is diurnal and spends much of its time underground. Adults emerge from hibernation between January and early March, depending on the elevation and microhabitat conditions (Sherman, 2000 In: FWS, 2004). The species is known to feed on bluebunch wheatgrass, needle-and-thread grass, Sandberg bluegrass, and cheatgrass. Crops (*e.g.*, cabbage, peas, and oats) and insects are also consumed when available (Bailey, 1936; Howell, 1938; Carlson *et al*., 1980 In: FWS, 2004).

Although suitable habitat exists, the Washington ground squirrel is not known to occur in the Project area (Grant PUD, 2003). Currently, Washington ground squirrels occur east of the Columbia River in two populations in the State of Washington and one population south of the Columbia River in the State of Oregon. The three populations are separated by an estimated 30 miles of unoccupied land (FWS, 2004). However, an increased number of detections in the populations suggest the species is more broadly distributed throughout its range than was previously known. Recent, site-specific studies (Sherman, 2001; Musser *et al*., 2002 In: FW, 2004) indicate the Washington ground squirrel occurring on the BLM Wenatchee Resource Area, located in Douglas and Grant Counties and on the federal Columbia National Wildlife Refuge and State Seep Lakes Wildlife Management Area, near Othello, Washington. The BOR (1998) notes eight occurrences of the Washington ground squirrel on scattered tracts; however, the records are old (circa 1950) and unconfirmed.

Northern Wormwood

Northern wormwood (*Artemisia campestris ssp. borealis* var. *wormskioldii*), a perennial, is a federal candidate species and is considered endangered in Washington. Historically, the distribution for northern wormwood was known from sites along the banks of the Columbia River near the mouth of the John Day River in Wasco County, Oregon to the vicinity of Hood River County, Oregon, a distance of approximately 50 miles (McCarthy, 2004). Construction of dams and subsequent flooding of habitat, and possibly railroad and highway construction resulted in the loss of habitat as well as individuals and populations (Carlson, 1997). Recent factors contributing to an impact on the species include recreation (ORV use, trampling of plants), competition of non-native plant species (*e.g.*, diffuse knapweed), thereby displacing native vegetation, and other factors (*e.g.*, winds known to scour the area, river levels and flow patterns).

Habitat for northern wormwood is exposed basalt, cobble-sandy terraces, and sand habitat along the banks of the Columbia River at an elevation ranging from 160 feet to 500 feet. The species' flowers are noticeable usually between mid-April and the first week in May.

Currently, northern wormwood occurs only at two sites: (1) Miller Island, in the lower Columbia River, Klickitat County, Washington- -population occurs on National Forest land, managed by the Columbia River Gorge National Scenic Area of the Gifford Pinchot National Forest; and (2) the Beverly site, upstream from the Hanford Reach, Grant County, Washington- -population occurs on land owned and managed by the BOR along the shore of the Columbia River and on several islands. These two populations are separated by an estimated 200 miles of the Columbia River; Priest Rapids dam, McNary dam, and John Day dam are located between the two sites.

At the Miller Island site existing information documents 109 plants in 1995, a substantial increase from the 75 plants reported earlier in 1989; however, the population has fluctuated with 87 plants recently documented in 2004. At this site, the northern wormwood population is immediately adjacent to an area suitable for landing a boat, which is used as a beach. The small size of the population and its proximity to the boat landing site make it vulnerable to trampling of the plants (McCarthy, 2004). The Beverly site supports the largest known population of northern wormwood (Caplow, 2003), with 1,260 plants (McCarthy, 2004).

Caplow (2003) surveyed the islands in the Hanford Reach for northern wormwood in 2002. The area surveyed included all the islands from Richland upstream to Vernita Bridge, except for one island in the vicinity of Coyote Rapids and one island upstream of Locke Island (both of which have some contamination issues). No populations of northern wormwood were found. TNC (2003) concludes no existing populations of northern wormwood were found in surveys along the Hanford Reach. Potential habitat for the species occurs on several islands and is mapped as potential reintroduction sites.

In 2001 Framatome ANP (2003i), on behalf of Grant PUD, surveyed the Project area for northern wormwood, including Gravel Bar, parts of Quilomene Island, Railroad Island (and unnamed islands to the south), various shoreline areas, and the vicinity of the Beverly population. In 2000 and 2001 the shorelines of Priest Rapids and Wanapum Reservoirs were surveyed. Two separate extensions of the Beverly population were found, numbering over 250 individuals. The combined northern wormwood population at Beverly is estimated between 1,500 and 2,000 individuals.

In 2001 Grant PUD initiated a multi-year demographic modeling study to describe population changes of northern wormwood at Beverly. Results would be used to guide future efforts to protect northern wormwood. Further, Grant PUD worked cooperatively with BOR to eliminate vehicular access to the area of the Beverly population because of recreation impacts; approximately 5,000 linear feet of fencing was installed. Other efforts to protect the Beverly population of northern wormwood include invasive plant species control measures (*e.g.*, hand-pulling diffuse knapweed) and funding various research efforts (*e.g.*, ground water investigations, germination and propagation testing, and mapping) (letter filed July 8, 2005, from Laurel Heacock, Grant PUD, responding to Interior’s May 26, 2005 comments).

Grant PUD proposes to develop and implement a northern wormwood conservation plan to protect and monitor populations within the Project area that would include: continuing annual demographic monitoring for 10 years; working with BOR to maintain 5,000 linear feet of fencing to eliminate vehicular access; and funding of ongoing noxious weed control, access control, data management, taxonomic investigations, and research to support long-term conservation of the species in the amount of $40,000 per year.

3.6.2 Environmental Effects and Recommendations

In this section, we assess the effects of daily and seasonal pool level fluctuations and downstream flow fluctuations on terrestrial resources, including species of special concern. We assess the project transmission line corridor on avian collision and electrocution and maintenance of the corridor on the spread of noxious weeds and other exotic plant species. The effects of public recreation on terrestrial resources are discussed in section 3.9, *Recreation and Land Use*.

Vegetation

In its license application, Grant PUD proposed several measures to enhance wildlife resources and offset indirect and cumulative affects of recreation and development on wildlife and wildlife habitats. These included the following habitat improvement measures: providing for enhancements in the lower Crab Creek and Priest Rapids Wildlife Area (lower Crab Creek Management Plan), funding of protective measures for rare plants in the transmission line corridor rights-of-way, providing for enhancements in the upper Wanapum reservoir (Upper Wanapum Management Plan), undertaking measures to preserve the Beverly population of northern wormwood, and developing a long-term plan to monitor RTE plants in the project area. Grant PUD also proposes to provide Washington DFW with $60,000 per year to support a fire suppression program on Washington DFW lands (Colockum, Quilomene, Whiskey Dick, Priest Rapids, Crab Creek, and Buckshot Wildlife Management Areas) near the reservoirs; assuming that the funds would be used to suppress fires that start on or near Project land. Fire suppression funds not used at the end of the year would be allocated for habitat rehabilitation that would reduce fuel loads. The program would also include provisions for signage at key locations that describe the hazards and costs of wildfire.

Grant PUD proposes to assess aquatic macrophyte density at eight transects within the Project every 4 years. Samples collected between eight transects would be used to provide information on the coverage of macrophyte distribution and density in the Project area. Photographic coverage of littoral areas would be obtained with a low-elevation over-flight during the peak aquatic macrophyte growth period (typically August) and would coincide with field sample collection. The estimated cost of this program conducted at 4-year intervals is $100,000 (letter filed July 8, 2005, Laurel Heacock, Manager, Licensing and regulatory Compliance Manager, Grant PUD, Washington).

To enhance riparian/wetland habitat within the lower 5 miles of Crab Creek and the Priest Rapids Wildlife Area, Grant PUD proposes the following items: (1) provide funding in the amount of $30,000 per year for O&M related to the enhancement measures and provide funding in the amount of $7.2 million for capital costs, including associated materials and labor; (2) rehabilitation of existing vegetation to the extent practical; (3)

enhancement of waterfowl migration, wintering, and breeding habitat; (4) wetland development through re-connection of side channels; and (5) controlling unregulated ORV access. Recreational fishing enhancements would also be provided.

Washington DFW believes that Grant PUD's proposed measures are inadequate to maintain existing habitat conditions on lands acquired and provided to Washington DFW for impacts of original project construction and to mitigate impacts of project-related recreation and development, particularly for lands affected by residential and recreation development on Crescent Bar. Pursuant to section 10(j) of the FPA, Washington DFW recommends that the licensee: (1) make available $15 per acre per year to Washington DFW for O&M of Washington DFW lands within the Project boundary, for lands conveyed by the licensee to Washington DFW in the original license, for Washington DFW wildlife area lands in the vicinity of the project, and for lands acquired for mitigation under the new license; (2) make available to Washington DFW $2,160,000 for the replacement of the lost wildlife values associated with the section of land along Wanapum reservoir known as Crescent Bar; (3) make available to Washington DFW $6,500,000 to fund implementation of habitat restoration and enhancement projects as mitigation for on-going project impacts as a result of project operations and project-related recreation impacts; (4) provide to Washington DFW $4,500,000 for the purpose of acquiring wildlife resource lands to (a) ensure the protection of the wildlife and recreation values associated with the original mitigation lands, and (b) to preserve quality habitats and wildlife; and (5) develop, implement, and fund a Project habitat management and monitoring plan in order to guide and facilitate the management of habitat and associated wildlife on lands within the project boundary and on land conveyed to Washington DFW as mitigation in the original license. In response to the draft EIS, Washington DFW modified its recommendation for habitat restoration projects (item 3 above). Washington DFW now recommends that Grant PUD fund implementation of the following habitat improvement projects:[83] Royal Lakes Excavation Project—excavate about 15 closed ponds and wet meadows to provide an additional 87 acres of quality waterfowl habitat; Crab Creek Water Diversion Project—flood several low areas with irrigation project wastewater to produce about 100 surface acres of quality mid-winter waterfowl habitat; and Lower Crab Creek Farm Ground Renovation—rehabilitate 110 acres of existing irrigated (groundwater/well) agriculture land that currently produces alfalfa and wheat to produce wildlife food crops.

Washington DFW also recommends, pursuant to section 10(j), that the licensee make available to the Washington DFW $120,000 annually for obtaining professional fire suppression services and for Washington DFW fire suppression services. Washington DFW states that Colockum, Quilomene, and Whiskey Dick Wildlife Areas border the

[83] The three projects were included in Washington DFW's initial recommendation as examples of the types of projects that could be implemented with the requested funding.

western shore of Wanapum reservoir for approximately 38 miles. The wildlife areas provide winter and spring habitat for Rocky Mountain elk, mule deer, big horn sheep, cougar, California quail, and other species. Washington DFW has records of eight wildfires on these areas, which can be correlated with recreational use or the Fourth of July celebrations.

In a filing of July 8, 2005 and in response to Washington DFW comment on the $15 per acre per year, Grant PUD notes the ambiguity of the recommendation in that Washington DFW provides no indication as to the specific activities covered by the funding level. Further, Grant PUD notes that in 1963 it conveyed lands to the State as mitigation for project construction and inundation. Grant PUD also notes it provided to the State $150,000 for O&M and up to an additional $20,000 per year for 20 years for reimbursement to the State for monies spent on mitigating game losses. The term of the agreement ended in 1983. Consequently, Grant PUD argues that it has already satisfied its requirement for mitigation in the prior license term.

Regarding Crescent Bar Island, Grant PUD notes that Washington DFW's comments pertains to pre-project impacts and that Crescent Bar was not set aside strictly for wildlife use. From Wanapum dam to Crescent Bar the distance is 24 miles; the majority of the shoreline is vertical basalt bluffs with approximately 3 miles of sandy beaches. To address indirect effects of development and recreation at Crescent Bar Island and other cumulative effects, Grant PUD proposes to provide $1 million for land acquisition and other enhancements for terrestrial resources. Also, Grant PUD proposes funding of $288,500 per year for O&M, monitoring and research associated with various capital improvements. The draft Shoreline Management Plan stipulates Crescent Bar Island be managed under two land classifications: (1) 105 acres as "planned development" and (2) 65 acres as "conservation land". An additional 47 acres of immediate adjacent lands (small islands and the mainland shore) would be classified as "conservation". See section 3.9, *Recreation and Land Use*, for a discussion of the land use classifications.

By letter filed January 14, 2005, Grant PUD revised its proposed wildlife measures. Grant PUD now proposes to develop and implement a single habitat management plan, rather than two separate plans (Upper Wanapum management plan and Lower Crab Creek management plan), that would cover Grant PUD, state, and federal lands within the project boundary. The single habitat management plan would include five separate programs: (1) habitat maintenance; (2) habitat restoration and enhancement; (3) rare, threatened, and endangered species protection; (4) land acquisition and preservation; and (5) resource integration and coordination. Measures related to fire suppression, noxious weeds, other exotic plant species, invasive species, and recreation management would be identified. In a response letter to Washington DFW filed July 8, 2005, Grant PUD reiterated its proposal for a habitat management plan in that following submittal of its final license application for the Project, Grant PUD and the stakeholders determined that a single plan would be more appropriate for the project rather than two separate plans.

Grant PUD proposes to coordinate the development of the Habitat Management Plan with the Recreation and Shoreline Management Plans to minimize effects on terrestrial resources from recreation. Interior recommends the coordination of the Recreation Plan and Habitat Management Plan to provide maximum benefit to project and non-project lands and resources. Washington DFW recommends Grant PUD develop a Habitat Management and Monitoring Plan that builds on Grant PUD's Shoreline Management Plan and Recreation Plan, but adds a monitoring component. Washington DFW recommends that the plan include (1) an accurate land use designation map of lands in the project vicinity; (2) management goals and strategies for each land use designation; (3) a monitoring strategy that ensures project lands are being managed in a manner consistent with stated land use goals, including signage and outreach and education, methods for identifying actions inconsistent with stated goals, timelines and actions to restore damaged habitat to pre-existing conditions, and staff and costs for implementing the plan; (4) a provision to develop a mitigation plan to address impacts to Washington DFW resource lands from recreation development and dispersed recreation effects identified through the monitoring efforts; and (5) an annual reporting requirement.

In response to Washington DFW's request for $120,000 annually for fire suppression, Grant PUD notes that Washington DFW provides no rational for its request and states that Washington DFW's estimated cost of fire protection at the Colockum Wildlife Area was $39,855 annually for the period from 1997 to 1999; costs for Quilomene Bay and Whiskey Dick Wildlife Areas were not provided. Grant PUD notes the summer 2001 fire at Quilomene Bay was 50 acres and estimated to cost $24,640.

Invasive Species

Potential impacts of invasive species on environmental resources include, but are not limited to, the following: (1) out-compete natives and dominate undisturbed native communities; (2) reduce or eliminate resources (*e.g.,* food, cover, nesting sites) used by native animals; (3) inhibit root growth of neighboring plants; (4) decreased water quality; and (5) stunted fish populations due to dense biomass of introduced species (TNC, 2003; Washington DFW, 2001). As previously discussed, noxious weeds and other exotic plants are known to occur within the project boundary and surrounding areas, some of which occur near rare plants. For example, diffuse knapweed is known to occur near the federal candidate species northern wormwood. Although not found in the project area, yellow starthistle, an invasive plant, has been observed on the Hanford Site, and suitable habitat is widespread for this species in the mid-Columbia River Basin. Project effects on yellow starthistle are limited to the dispersal vector by Grant PUD vehicles (Framatome ANP, 2003a). Another invasive plant, rush skeletonweed, was found on project lands south of Priest Rapids dam in 2001, near an occurrence of the state-listed gray cryptantha (*Cryptantha leucophaea*). All of the rush skeletonweed were hand-pulled in 2001.

As a component of its draft Recreation Plan, Grant PUD proposes to develop and implement an aquatic plant nuisance management program for the project area. The program would include information and signage about noxious weeds and other exotic plant species at key recreation sites to educate boaters and local residents about strategies to avoid spreading nuisance aquatic macrophytes (or other species) to other waters. The program also contains a provision for review and selection of prioritized sites where aquatic nuisance plant control efforts would be located, such as Crescent Bar swimming area and boat launch. The costs for this program would be $15,000 (equipment lump sum) and $350,000 annual labor.

Grant PUD also proposes to continue to monitor for zebra mussels (*Dreissena polymorpha*) within the Project area. Grant PUD notes that at present all plankton samples collected from the Project area have been negative for zebra mussels. Grant PUD's estimated cost to monitor for zebra mussels is $2,000 annually.

Washington DFW, pursuant to section 10(j) of the FPA, recommends the licensee develop, fund, and implement a mid-Columbia River Aquatic Invasive Species (AIS) Prevention Program. In response to the draft EIS and section 10(j) meeting, Washington DFW modified its request. Washington DFW now recommends that the AIS Prevention Program include the following provisions:

1. Identify boat access points and distribute educational materials for distribution during the peak boating season (May 1 - October 30 each year) to educate boaters, conduct voluntary boater surveys, direct voluntary boat inspection demonstrations, and document the findings. Actions shall include:
   a. Expand distribution of educational materials and increasing signage postings to increase boater awareness of dangers of spreading AIS, including the methods one can take to decrease the spread of AIS (*e.g.*, clean the weeds off the boat and drain the live well before going to a new waterbody)
   b. Explain to boaters at boat ramps the requirements of the AIS program and conduct voluntary boat inspection demonstrations for the purpose of identifying and removing AIS from boats and trailers
   c. Hand out prepared surveys to boaters, asking for their participation in filling out and submitting the surveys, and explaining the purpose and benefit of the survey
2. Measures to prevent the movement of AIS into and out of Project boundary waters as transported on recreational watercraft
3. Descriptions of existing control, monitoring measures, and potential methods for

mitigating impacts of AIS infestations

4. Proposed additional prevention, control, and containment measures necessary to prevent infestations and minimize the impact of AIS
5. An implementation schedule and provisions for periodic monitoring to track progress toward meeting the goals of the plan
6. An Early Detection and Rapid Response component to include the following elements:
   a. Reporting the type, location, and extent of AIS infestations within the Project boundary
   b. Measures to identify new introductions and monitor the spread of existing AIS
7. By March 1 of each year, submit an annual report to Washington DFW and Ecology to include: the number of boats inspected; the number of boats detected carrying non-native aquatic invasive flora or fauna; a description of new infestations of AIS; a description of existing infestations; a summary of progress made in reducing or eliminating infestations; recommendations for modifying the plan as needed, and information regarding boat travel to and from other water bodies. As part of the plan, Washington DFW also recommends various components, including a recommendation for Grant PUD to fund an AIS program inspector at an estimated cost of $6,000 per year. In addition to the salary, Grant PUD should also provide office space and storage area.

Our Analysis-Vegetation

Project operations result in daily water level fluctuations within the reservoirs and below Priest Rapids dam (see section 3.4.1). These fluctuations are in response to coordinate agreements established to meet numerous objectives on the Columbia River. The fluctuations can influence the development and species composition of riparian and wetland habitats. Daily fluctuations would continue in the future under the various operating agreements, thus we do not expect to see a significant change in the composition or distribution of riparian and wetland habitats over the next license period as result of continued project operations. Nonetheless, because the project is located in one of the driest regions of Washington, the riparian and wetland vegetation that has developed along the reservoir margins, sloughs, and backwater areas is particularly distinctive and valuable and supports species assemblages that could not occur otherwise. These wetlands and riparian habitats will continue to be important to a variety of wildlife and their protection from other anthropogenic influences (*i.e.* recreation and wildfire) will be important.

Adjoining upland shrub steppe communities are not influenced by project operations, but can be affected by project-related recreation, spread of noxious weeds, and maintenance activities. These communities are also sensitive to disturbance and can take many years to recover from disturbance.

Recommendations by Grant PUD and others to protect and maintain wildlife habitats focus primarily on controlling the indirect and cumulative effects of recreation and other maintenance actions on wildlife habitats and on enhancing habitat conditions on surrounding lands. Broadly, Grant PUD's recommendations involve acquiring additional lands, implementing habitat improvements on existing and any acquired lands, protecting sensitive plants, and coordinating and monitoring recreation effects to minimize impacts on terrestrial resources.

To offset the effects of residential and recreational development at Crescent Bar, Grant PUD proposes to allocate $1 million for land acquisition, which may be applied to the purchase of private or Washington DNR lands within or adjacent to the Washington DFW wildlife areas, or to purchase additional shrub-steppe habitat near the project. Grant PUD would also use some portion of the $7.2 million it would set aside for capital enhancement activities in lower Crab Creek and Priest Rapids Wildlife Areas to acquire private in-holdings within the lower five miles of Lower Crab Creek as they become available. Grant PUD proposes to work cooperatively with the agencies and stakeholders to identify specific lands for acquisition.

In its letter filed July 8, 2005, Grant PUD reiterates that acquisition of private in-holdings within the lower 5 miles of Crab Creek would preserve lands for wildlife and provide for more efficient management of the Lower Crab Creek and Priest Rapids Wildlife Areas. Potential enhancement measures include the acquisition of two privately-owned parcels of land: (1) the 98-acre Crab Creek in-holdings; and (2) the 37-acre Johnson Creek/Getty's Cove. Both parcels consist of shrub-steppe habitat and palustrine wetlands. Species of special concern (*e.g.*, loggerhead shrike, chukar, common loon) are known to inhabit the areas. The parcels were selected based on proximity to the Project; the ability to provide contiguous public ownership; and the value for public access for recreation. The Crab Creek in-holdings would increase protected habitat along Lower Crab Creek; Johnson Creek/Getty's Cove would increase protected habitat along Wanapum shoreline.

By letter filed January 14, 2005, Grant PUD states that specific parcels to be acquired would be selected based on owner's willingness to sell and because they best meet stakeholder interest (Laurel Heacock, Manager, Licensing and Regulatory Compliance, Grant PUD, Washington). Grant PUD has allocated $1 million for land acquisition.

In contrast, Washington DFW recommends that Grant PUD provide $4.5 million to Washington DFW to acquire lands to (1) insure protection of wildlife and recreation values associated with the original lands purchased to mitigate the effects of project construction, and (2) acquire habitat to preserve the quality habitat and the wildlife they support in the face of increasing recreation pressures associated with the project. Parcels that might be acquired from willing sellers include on the eastside of the Columbia River: 880 acres of private inholdings and 815 acres of Washington DNR lands within the Lower Crab Creek Wildlife Area; on the westside of the Columbia River they would include 2,483 acres of private in-holdings and 5,072 acres of Washington DNR lands. These lands are predominately upland arid lands supporting shrub steppe vegetation that are, in Washington DFW's opinion, prime candidates for conversion to other uses incompatible with wildlife (residential or leisure time shares, agriculture, etc). The remaining parcels support either grazing leases on Washington DNR lands, represent unique habitats (*i.e.* cliffs), or offer buffers for future recreation development. The Crab Creek in-holdings include those identified by Grant PUD, but also other upland tracts located away from the project. Washington DFW indicates that consolidating in-holdings within the Lower Crab Creek Wildlife Area will enhance the agency's ability to manage the areas consistent with maintaining wildlife benefits to mitigate the lost wildlife and recreation values as a result of the development of the Project 40 years ago.

As noted above, the 98-acre in-holding along Crab Creek identified by Grant PUD includes important habitats reasonably connected to the project reservoir and lands; they are mostly within the current project boundary. Although Grant PUD has not specifically defined management actions that would be conducted on these lands, the area offers an opportunity to manage and protect a more contiguous block of project lands to enhance waterfowl and wetland habitats, rehabilitate vegetation affected by ORV use, improve stream functions and fisheries habitats, and to control recreation at the project. In contrast, the Crab Creek parcels identified by Washington DFW are located many miles from the project boundary. Although including these parcels in the Crab Creek Wildlife Area would improve Washington DFW's ability to manage a more contiguous block of land within the bounds of its wildlife area and offer benefits to wildlife, the connection between these lands and the resources they support and the project becomes much more tenuous. We have not identified any project effects on these lands.

Grant PUD has not specifically defined the management actions it would undertake at the 37-acre Getty Cove site. Acquisition would provide opportunities to protect a sheltered bay and shoreline on the Wanapum reservoir used by waterfowl, would increase protected habitat along the Wanapum shoreline, and offer opportunities to reconfigure the existing developed recreation site to better protect wildlife habitats. The westside parcels identified by Washington DFW appear to be mostly upland shrub steppe habitats located well away from the project. With the exception of recreationists potentially accessing these sites from the project reservoir, the project is not affecting these lands. There appear to be opportunities to enhance habitat conditions on lands within and immediately adjacent to the project to benefit wildlife without pursuing the acquisition of lands far-a-field.

We note that from the maps provided by Grant PUD in its letter filed January 14, 2005, it appears that the two above-mentioned parcels it proposes for acquisition are located partially inside and outside the Project boundary. If the above lands are acquired, they will need to be brought into the project boundary to fulfill project purposes of protecting and conserving these lands for their wildlife and recreational values. If other lands are ultimately identified and acquired they also may need to be brought project boundary if they require routine maintenance and management.

In addition to seeking funds to acquire lands to improve habitat conditions, Washington DFW recommends Grant PUD provide funding for O&M of existing wildlife lands purchased and provided to Washington DFW to mitigate the effects of original project construction as well as funding for maintenance on any acquired lands. The Washington DFW-owned lands that it seeks O&M funding for in the amount of $15 per acre per year include: (1) project east-side lands- -Lower Crab Creek (includes Priest Rapids WA and vicinity and Quincy WA, Grant County); and (2) project west-side lands--Colockum, Whiskey Dick, and Quilomene WA, Kittitas County and vicinity. For project east-side lands, the estimated current acreage of Washington DFW-owned lands within the Lower Crab Creek Wildlife Area is 14,300 (including the Priest Rapids Wildlife Area at 2,250 acres). The acreage recommended for acquisition is 880 acres of inholdings and 815 acres of Washington DNR-owned land. The estimated current acreage of the Quincy Wildlife Area is 7,600 acres. In total and for the existing project east-side lands we estimate 21,900 acres, not factoring in any potential land acquisition. For project west-side lands, the estimated current acreage of Washington DFW-owned lands within Colockum, Whiskey Dick, and Quilomene Wildlife Areas is 46,000 acres, 17,000 acres, and 13,100 acres, respectively. The acreage recommended for acquisition is 2,483 acres of private holdings and 5,072 acres of Washington DNR-owned lands within the project boundary or adjacent to the project. In total and for the existing project west-side lands we estimate 76,000 acres, not factoring in any potential land acquisition. Washington DFW states that mitigation potential as intended has not been realized. Washington DFW states the level of funds previously agreed upon 40 years ago for the term of the license are inadequate to provide for O&M activities such as weed control, road maintenance, fencing, litter pick-up, and signage.

Grant PUD objects to the proposed funding levels, noting that the funds sought are a means to subsidize the state’s budget and are not based on project effects. Grant PUD instead proposes to provide $70,000 per year for O&M in the Colockum, Whiskey Dick, and Quilomene Wildlife Areas, and $30,000 O&M for enhancements at the lower Crab Creek. Grant PUD does not explain the basis of these funding levels, but notes that only about 2,490 acres of land within the project boundary are owned and managed by the Washington DFW. In addition to providing $1 million for land acquisition to provide a more contiguous management block in the Colockum, Whiskey Dick, and Quilomene Wildlife Areas and $70,000 per year for O&M, Grant PUD proposes to provide $2 million over the course of the license for capital expenditures to support noxious weed control; re-activate the agricultural program in the Colockum area or to rehabilitate agricultural lands to native bunch grasses; improve wetland conditions at West Bar slough; develop mountain meadows and maintain existing meadows; fertilize summer and winter big game ranges; and develop water sources (springs, cisterns, pond, etc), in the management areas.

The upland habitats that would be subject to Grant PUD’s or Washington DFW’s management actions are located predominately outside the project boundary on state-owned lands purchased with funds provided by Grant PUD to mitigate the loss of land inundated by the original construction of the project. The major management focus on these lands is to provide for upland species dependant on shrub steppe habitats. These habitats provide important functions including winter habitat mule deer, elk, and other upland species, which is particularly critical along the reservoirs and tributary creeks in severe winters, important forage and thermal refugia in both winter and summer, and refugia from human disturbance.

Project operations do not affect these upland habitats. The primary basis for both Washington DFW’s and Grant PUD’s proposed actions in to address indirect and cumulative effects of recreation and residential development (Crescent Bar Island, see below) on wildlife. While recreationists visiting project facilities are known to access the wildlife areas, it is difficult to attribute all recreational impacts on the wildlife areas to project-related recreation because Washington DFW also encourages public recreation use of its lands. Although Grant PUD fulfilled its responsibilities under the terms of the original license, the measures it proposes would help improve upland habitats adjacent to and including some project lands and would help achieve the state’s management objectives for these lands. Moreover, most of the land within the project boundary consists of a narrow strip along the project reservoir, thus there are very limited opportunities to improve shrub steppe habitat within the current project boundaries.

Nonetheless, developing a management strategy that focuses on finding compatible uses of project lands and adjoining wildlife lands is important to ensuring that intended wildlife benefits are achieved. Washington DFW recommends that Grant PUD develop, implement, and fund a habitat management and monitoring plan for lands within the project boundary and for lands conveyed to Washington DFW as mitigation in the original license. According to Washington DFW, the plan should include a monitoring strategy that ensures project lands are managed consistent with stated land use goals and outlines timelines and actions appropriate to restore damaged habitat to pre-existing conditions. Washington DFW does not specifically define its desired monitoring protocols, or provide any costs associated with its recommendation, but does state that the monitoring efforts described in Grant PUD’s Recreation Plan are not robust enough to determine recreation effects on wildlife habitats within and adjoining the project. This is because the efforts focus on providing adequate new facilities and upgrading existing facilities to meet future recreation capacity needs.

Grant PUD intends to coordinate implementation of the Wildlife Plan with its Shoreline and Recreation Plans. Grant PUD has in consultation with stakeholders developed guidelines and mapped land use classifications within the project boundary in its Shoreline Management Plan (see section 3.9, *Recreation and Land Use*) that are intended to reflect the management goals of participating stakeholders and reflects the multi-use objectives that the project must provide including recreation and conservation of natural areas. Signage, education and outreach, which is also a component of Grant PUD's recreation plan, would help ensure that project-related recreation does not extend beyond current project boundaries and adversely affect wildlife. However, the project land use map does not identify adjoining land uses. Knowledge of adjoining land uses can help guide management decisions, whether that be locating recreation facilities or implementing wildlife management improvement projects, within the project boundaries.

Monitoring, however, will also need to be included as part of the management strategy to identify when corrective actions are needed. Grant PUD's recreation plan includes a monitoring framework based on modified limits of acceptable change and periodic surveys. The limits of acceptable change vary by land use classification and management setting (*i.e.*, resource protections). For example, at undeveloped dispersed shoreline recreation sites—sites where the majority of Washington DFW's concerns originate—Grant PUD would periodically survey shoreline areas and record the amount and type of user impact. This would include qualitative data such as the amount of bare ground, excessive litter, sanitation problems, and habitat/vegetation damage. The recreation plan also identifies potential corrective actions if significant site impacts are observed or the number of new dispersed shoreline sites increase (except Quilomene Dune and Bay). These actions include erecting barriers to prohibit vehicular access, defining site boundaries, providing site cleanup, closing the site to all access and use, providing more hardened sites, and providing sanitation facilities. We find that these types of corrective actions would likely be appropriate at stemming project-related recreation effects, but the specific actions would need to be determined on a site-specific basis. Furthermore, these actions would not necessarily rehabilitate the site. However, because the state also promotes public use of its lands, it may be difficult to discern how much adverse recreation-related affects on wildlife and wildlife habitats are attributable to the project and how much might be associated with the agencies access policies. These considerations will need to be considered on a case-specific basis.

Although the concepts and potential corrective actions are consistent with Washington DFW's objective of identifying actions inconsistent with project land use goals, the proposed monitoring methods are subjective and need to be better developed with wildlife needs in mind. However, restoring all lands to pre-existing conditions, even if this could be defined, may not be practical, consistent with Commission policies, or the complete responsibility of the project given Washington DFW's own access policies.

In addition, Washington DFW states that the majority of Crescent Bar Island no longer provides the wildlife mitigation benefits originally intended. Washington DFW requests its standard mitigation practice of four-to-one replacement ratio to mitigate for lost wildlife values. Based on the approximate area of Crescent Bar, post inundation to be 600 acres, Washington DFW estimates the Crescent Bar replacement cost over a 50-year license totals $3,960,000 ($2,160,000 (600 acres x 4 x $900 per acre) plus $1,800,000 O&M). The Commission's baseline for assessing project environmental measures is the environment as it exists today. The remaining habitat around Crescent Bar still provides valuable wildlife habitat for waterfowl, shorebirds, and bald eagle. Although Grant PUD proposes to set aside 111 acres (including adjacent islands and mainland shorelines) as conservation lands at Crescent Bar, permitting only uses compatible with the protection and conservation of wildlife, any further development in the area would likely significantly diminish existing habitat values. See section 3.9, *Recreation and Land Use*, for further discussion regarding the Shoreline Management Plan. Curtailment of any future residential and commercial development beyond the existing foot print would protect remaining valuable habitats.

The Washington DFW initially recommended Grant PUD make available to Washington DFW $6,500,000 to fund implementation of habitat restoration and enhancement projects as mitigation for ongoing project impacts that result from operations and project-related recreation. Washington DFW identified 9 potential projects that could be implemented with the funding. In response to the draft EIS, Washington DFW modified its recommendation to include 3 specific projects: Royal Lakes Excavation at a estimated cost of $181,000; Crab Creek Water Diversion at an estimated cost of $230,000, plus annual O&M of $5,000; and Lower Crab Creek Farmland Renovation at an estimated $110,000 (costs for upgrading the irrigation system were not available). The Washington DFW states that restoration and enhancement projects identified in the Lower Crab Creek WA would restore and enhance wildlife areas and provide recreation opportunities lost as a result of project development for which the Lower Crab Creek WA was originally intended to mitigate. Funds provided under the terms of the original license proved to be inadequate to meet O&M costs. Further, Washington DFW states that during high-density recreation use periods (*e.g.*, holiday weekends) recreationists "spill-over" from the Project to the mitigation lands (wildlife areas) originally conveyed to Washington DFW by Grant PUD in the 1960's, resulting in a loss of wildlife benefit values. See section 3.9, *Recreation and Land Use*, for further discussion on effects of public recreation use on undeveloped dispersed recreation sites.

Washington DFW's proposed projects would be located near the eastern edge of the Crab Creek Wildlife Area, about 14 miles east of the current project boundary. The current project boundary extends about 5 miles upstream from the confluence of Crab Creek and the Columbia River. The lands on which the projects would be implemented are owned by Washington DFW or on BOR lands which Washington DFW manages under a newly signed 25-year lease (personal communication Greg Fitzgearld, August 25, 2006). The wetland habitat improvements are intended to improve wintering waterfowl habitat, while the upland habitat improvements are intended to improve food crops for pheasants and other wildlife.

Grant PUD purposes to improve habitat conditions in the lower five miles of Crab Creek through rehabilitation of existing riparian vegetation, enhancing waterfowl migration, wintering, and breeding habitat, enhancing wetland/riparian plant species diversity, wetland development through re-connection of side channels, enhancing wildlife viewing opportunities, controlling unregulated off-road vehicle access, and as noted above, acquiring private in-holdings within the lower five miles as they become available.

Daily reservoir fluctuations may cause some wintering waterfowl to shift their foraging and resting activities as habitats become exposed or inundated. Operational measures that have been implemented to flatten flows in the Hanford Reach to protect salmon and steelhead are likely to result in some changes in the frequency of reservoir fluctuations relative to historic conditions. However, only part of the flow fluctuations that occur within the Project area can be attributed directly to Grant PUD and much of the flow–related effects on waterfowl habitat are attributable to the coordinated operation of the upstream mainstem projects. Regardless, the fluctuations are expected to remain within existing operation limits. Thus, it is unlikely that there will be a discernable change in the composition and distribution of wetlands used by waterfowl at the project. The riparian and wetland habitats associated with Crab Creek are heavily used by migrating and wintering waterfowl (Framatome ANP, 2003). Changes in the hydrology of Crab Creek from implementation of the Columbia Basin Project have resulted in an incised channel where the riparian zone is no longer hydrologically connected to the now permanent stream. Uncontrolled ORV use has degraded remaining riparian habitats. In concept, undertaking habitat improvement projects within the lower five miles of the Crab Creek and coordinating those with the shoreline and recreation plans would benefit a variety of wildlife at the project and enhance recreational opportunities. However, sufficient detail has not been provided to determine specifically what actions would be undertaken, when, or where.

Details of Washington DFW's proposed measures are also sketchy. If the measures recommended by Washington DFW could be successfully implemented and maintained, they would provide 187 acres of winter waterfowl habitat and 110 acres of wildlife food crops for upland wildlife. The lands on which these measures would be applied are located more than 5 miles away from the Project and no project effects on these lands has been established.

In Grant PUD's proposed habitat management plan, fire suppression would be addressed under its habitat maintenance program. Given the arid climate of the mid-Columbia River Basin we recognize the importance in having fire suppression measures in place. Survey results (Newell, 2003) indicate that subsequent to a 2000 wildfire and 2 years later revealed an impacted stream and riparian zone (Rattlesnake Spring of the Columbia River). The wildfire burned the riparian vegetation and deposited ash and charred material into a stream. Newell (2003) notes that vegetation not burned was killed by the heat and the material fell into the stream channel. With the loss of riparian habitat, winds blew sand, silt, ash, and dead vegetation into the stream, resulting in increased sedimentation and reduced flow velocities. Such sediments could disrupt populations of filter filters and smother certain species (*e.g.*, *Pisidium* clams). Grant PUD's proposed fire suppression measures, including provisions for signage at key locations that describe the hazards and costs of wildlife and habitat management measures to reduce fuel loads, could reduce fire incidents.

See section 5.0, *Staff's Conclusions*, for a discussion on Washington DFW's above recommendations, including its request for $120,000 annually for fire suppression.

Aquatic Invasive Species

We note Washington DFW efforts to coordinate aquatic nuisance species management practices in partnerships with private and public entities, and tribes. In its plan, Washington DFW (2001) proposes to publish an aquatic plant identification manual for Washington State. The manual would enable lake residents and managers to identify non-native aquatic plant species, as well as common native plant species. Further, TNC (2003) adopts an integrated approach that addresses invasive species issues for the Monument.

In section 3.9, *Recreation and Land Use*, we discuss the effects of recreation use (*e.g.*, boating) and the potential to spread aquatic invasive plant species. The aquatic nuisance management program, as proposed by Grant PUD in its draft Recreation Plan, could compliment the efforts of Washington DFW; and, therefore, reach a broader range of the public through information to prevent, eradicate or control introductions of aquatic nuisance plants more effectively. Instead of an aquatic nuisance management program as a component of a final Recreation Plan, we find that a separate AIS plan for the Project would be more effective in addressing invasive species (*e.g.*, zebra mussels). Elements of the plan could include a summary of baseline surveys conducted for noxious weeds and other exotic plant species; monitoring methods; monitoring schedule; a schedule for providing monitoring results to the agencies; consultation with the agencies; information and signage about invasive species at key recreation sites; training Grant PUD staff on noxious weeds, other exotic plant species, and invasive species; and an identification of measures to control such species that would be consistent with other licensees and entities within the mid-Columbia River Basin.

Further, Grant PUD proposes to continue to work cooperatively with Washington DFW and monitor for zebra mussels. The Washington DFW (2001) states that the most probable path of introduction for zebra mussels into Washington is either from adult mussels attached to the hull of boats transported from affected areas or from larvae found in untreated bilge water in these transported vessels. The Columbia River is a likely location for such an introduction. Grant PUD's monitoring efforts for zebra mussels, therefore, could be a component of an invasive species plan.

Increasing public awareness of the problems associated with AIS and with the methods for controlling the spread AIS is critical to preventing their spread in the project area and is consistent with Ecology's freshwater aquatic weed control program. Washington DFW's recommendations include various actions that focus on prevention by addressing pathways for invasion of aquatic invasive flora and fauna. We interpret their recommendations to be limited to efforts that increase public awareness of the problems associated with spreading AIS. These include, but are not limited to, developing and distributing educational materials at project boat ramps that explain the dangers of spreading AIS and the proper methods of cleaning boats to prevent their spread, and conducting demonstration projects to show how to properly implement the control procedures. Washington DFW also recommends surveying boaters and explaining the purpose and benefit of the survey. It is unclear from the agencies explanation what the survey would entail or its purpose. We assume that it is an effort to ensure that the awareness message is being effectively transmitted and that it would serve as additional means of identifying potential outbreaks by identifying boaters that may be coming from other areas that are known to be infested with AIS.

The AIS control plan should also annually document Grant PUD's monitoring efforts, control measures, and any additional contingency measures that would be implemented if AIS are found to minimize their further spread. However, Washington DFW also recommends annual reporting of the number of boats inspected, the number of boats detected carrying non-native aquatic invasive flora or fauna, and information regarding boat travel to and from other water bodies. Such reporting would help identify and timely implement appropriate control measures. However, policing all boats for compliance with cleaning measures is beyond the scope of applicant's responsibility.

With respect to Washington DFW's recommendation that Grant PUD fund the services of an AIS program inspector position to implement the tasks required in Washington DFW's IAS protection program, we note the recommendation cannot be quantified or qualified with any degree of certainty. We address this issue further in section 5.0, *Staff's Conclusions*.

Wildlife

Grant PUD proposes to develop and implement a transmission line avian collision protection plan; and, provide capital funding in the amount of $500,000 over the term of the license to support the measures including marking transmission lines, over-head ground wires at specific crossings.

Interior's recommendation no. 12, pursuant to section 10(j) of the FPA, recommends Grant PUD develop and implement an avian protection plan within 2 years of license issuance to protect against collisions by waterfowl and raptors with the project's transmission lines and structures. The plan would include measures for installing power line identifiers on transmission line and overhead ground wires and/or guy wires at the following sensitive sites: Midway crossing located on the Columbia River below Priest Rapids dam; North and South Moran Slough; Crab Creek crossing; the Wanapum dam tailrace; the Wanapum switchyard; Frenchman Coulee; and Moses Coulee.

Grant PUD, in a filing of July 8, 2005, states that the Recreation Plan and habitat management plan would be coordinated to ensure adequate monitoring and management of recreation impacts on terrestrial resources. A monitoring program is already included in its draft Recreation Plan. Required funding and timelines would be included in its habitat management plan.

Our Analysis-Wildlife

Based on surveys conducted during the relicensing and other information, at least 24 species of raptors (*e.g.*, red-tailed hawk, State-listed northern goshawk and peregrine falcon, federally-listed bald eagle) and 40 species of waterfowl (*e.g.*, ring-necked duck, bufflehead, common loon) have been documented or potentially occur in the vicinity of the Project transmission line corridor. The species include residents and migrant species that potentially breed in the project area. Habitats (*e.g.*, wetland, riparian, cliff) utilized by these species have been identified along the transmission line corridor. Over the last 12 years Grant PUD employees have observed 25 to 35 waterfowl collide with the transmission lines at South Moran Slough (Framatome ANP, 2003h). Framatome ANP (2003h) observed species adjusting their altitudes and maneuvering to avoid striking the overhead ground wires.

As summarized in a study (Framatome ANP, 2003h), Table 26 identifies eight sites where Grant PUD should evaluate the feasibility of installing line markers in order to reduce the potential for avian collisions. In particular, since the Columbia River is a

Table 26. Sites where tranmission line marking should be considered at the Priest Rapids Project (Source: Framatome ANP, 2003h).

Site	Number of Overhead ground wires	Comments
Midway Crossing (Site 24)	8	High number of transmission lines cross Columbia River; numerous water-associated birds; high number of altered flights.
Wanapum Switchyard	18	Transmission lines cross wetlands (waterfowl habitat); numerous waterfowl and other water-associated birds.
Moses Coulee (Site 1)	2	Transmission lines ascend cliffs with updrafts (raptor habitat); numerous raptors.
Frenchman Ponds (Site 12)	0	Transmission lines cross over ponds and wetlands (waterfowl habitat); numerous waterfowl and other water-associated birds.
Wanapum dam (Site 14)	6	High number of transmission lines cross Columbia River; numerous waterfowl and other water-associated birds.
Lower Crab Creek (Site 16)	0	Transmission lines cross Crab Creek (waterfowl and raptor habitat); numerous waterfowl and raptors.
North Moran Slough (Site 21)	2	Transmission lines cross open water and wetlands (waterfowl habitat); numerous waterfowl; altered flights.
South Moran Slough (Site 23)	3	Transmission lines cross open water and wetlands (waterfowl habitat); numerous waterfowl; reports of avian collisions.

major migratory pathway, two points where the transmission lines cross the river (Midway Crossing and Wanapum dam) should be considered for marking.

Grant PUD proposes to develop and implement a transmission line avian collision protection plan, including marking transmission lines, over-head ground wires at specific crossings. Framatome ANP (2003h) states that Grant PUD transmission lines are among Bonneville Power Authority transmission lines, and therefore the effectiveness of marking the transmission lines remain uncertain. Nonetheless, marking some of the lines would increase the visibility of project transmission lines, and possibly help alert birds to BPA's as well, reducing the potential for collisions. We find a transmission line avian collision protection plan is necessary for the Project.

Noxious weeds and invasive non-native plants are a growing threat throughout the west. Invasive plants are known occur in the Project area and the project can influence invasive plant species populations via maintenance activities along the transmission line corridor. Grant PUD proposes to include noxious weed control as part of its habitat management plan. Without management, weeds would continue to spread in the project area, because of their abundance on adjacent lands, tolerance of a variety of soil and moisture conditions, and ability to out-compete native plants. Project operations and human activity, in addition to wind, water, and animal transport, would continue to serve as vectors for spreading weeds. Weeds will likely continue to spread, even with an appropriate management plan in place, but on-going, coordinated efforts would help to slow this process. Projects to control invasive species outside the project boundary, such as improvements to mule deer and mountain goat winter habitat, may not be directly linked to project effects. However, such efforts recognize the fact that weeds spread across ownership boundaries, and that in some cases, control measures outside the project boundary may be even more effective in preventing the spread of weeds than treatment inside the project boundary would be. This coordinated effort, along with agency consultation, could minimize invasive plant seed dispersal, thereby limiting their distribution.

We identified the effects of daily and seasonal pool level fluctuations and downstream flow fluctuations on riparian, wetland habitats, and associated wildlife as a cumulative effect. Such effects can occur as a result of the complex and interrelated set of operating regimes, as discussed in section 2.0, *Proposed Action and Alternatives*. The typical daily power operations of both Wanapum and Priest Rapids include a drawdown of approximately 1 to 3 feet below the normal maximum pool elevation. The reservoirs are typically restored to maximum reservoir elevations overnight and may be drafted again the following morning.

Riparian, wetland habitats, and associated wildlife occur throughout the Project area and along the Hanford Reach. See our previous discussion under riparian and wetland priority habitats, as identified by Washington DFW. Based on existing information, riparian and wetland habitats within the project area appear to be adapted to the water-level fluctuations associated with project operation and other upstream operating regimes. Mastrogiuseppe (1991) suggests that shining flatsedge, a Washington State sensitive species, has increased in numbers in response to the Project reservoir conditions. The plant species occurs in wetlands and mouths of perennial tributaries.

The shoreline riparian habitat in the project area and in the Hanford Reach provides wildlife species nesting, feeding (*e.g.*, terrestrial and aquatic insects), and foraging opportunities. Waterfowl that feed over aquatic vegetation in shallow water must adjust to shifts in the location of suitable foraging habitats. Although foraging habitat for waterfowl may be reduced, increased access to areas by waterfowl that are usually too deep may benefit certain species (Public Utility District No.2 of Grant County, Washington, 2003). The NPS (1994) finds different species use the riparian habitat of the Hanford Reach in winter than in summer, indicating that the shoreline riparian communities are important year round in maintaining wildlife populations. In addition, after the irrigation season ends in October, some of the smaller wetlands dry out, and water levels of the lakes and larger wetlands recede, leaving exposed shoreline as resting areas for migrating and wintering waterfowl.

Grant PUD proposes to develop and implement a single habitat management plan instead of developing and implementing two plans (Upper Wanapum management plan and Lower Crab Creek management plan). Proposed measures included installation and maintenance of 48 wood duck (*Aix spona*) boxes around the project reservoirs; maintenance of 12 structures for raptors, and installation of up to 50 waterfowl nesting platforms. Although the details of Grant PUD's new proposed habitat management plan are not clearly defined, we assume the wildlife-related structures would be a component of the habitat management plan. Grant PUD estimates O&M costs for wildlife-related structures at $15,500 per year. To be effective, the structures should be maintained and monitored and if necessary, modified accordingly. We find Grant PUD's proposal to develop and implement one plan instead of two plans would accomplish the same goals of protection and enhancement for wildlife and associated habitat affected by daily and seasonal reservoir fluctuations and downstream flow fluctuations. The measures originally proposed as part of Grant PUD's Upper Wanapum management plan and Lower Crab Creek management plan should be considered in a habitat management plan. Grant PUD's original efforts for noxious weed control on elk, mule deer, and bighorn summer and winter ranges should be factored into a separate invasive species plan. See our discussion under Invasive Species.

With respect to Washington DFW's recommendation that Grant PUD develop and implement a habitat management and monitoring plan, see section 5.0, *Staff's Conclusions*.

Species of Special Concern

Grant PUD proposes to fund a rare, threatened, and endangered botanical species protection plan that could include (a) budgeting $7,000 per year to defray O&M costs in order to address potential habitat disturbances resulting from maintenance activities within the project transmission line corridor and any future modifications or additions in the number and/or configuration of transmission lines and structures; (b) a construction schedule of any future projects to avoid disturbance of rare, threatened, and endangered species; (c) a provision for conducting pre-construction surveys; (d) an identification of measures to protect any rare, threatened, and endangered botanical species found during the surveys; (e) an implementation schedule; and (f) a monitoring plan to evaluate the effects on rare, threatened, and endangered species and their habitat.

Grant PUD proposes to develop a long-term plan to monitor rare, threatened and endangered plants within the project area that could include (a) a description of the methods to be employed, (b) a provision to map and quantify population trends, (c) an implementation schedule, (d) a provision and schedule for reporting and consulting with appropriate agencies regarding the monitoring results, and (e) providing $13,500 per year to the Washington DNR-Natural Heritage Program for funding and management of research information to further the knowledge of the ecology of rare plants in the Project area. Grant PUD estimates the cost of program at $35,000 per year.

Pursuant to section 10(j) of the FPA, Interior recommends (recommendation no. 10) Grant PUD develop and implement a northern wormwood conservation plan. Although Interior concurs with Grant PUD's proposal to develop and implement such a plan, Interior recommends the plan be developed and implemented within 90 days after license issuance.

Pursuant to section 10(j) of the FPA, Interior recommends (recommendation no. 11) Grant PUD develop and implement a rare, threatened, and endangered botanical monitoring program. Interior concurs with Grant PUD's proposal to develop and implement such a plan.

Pursuant to section 10(a) of the FPA, BOR recommends that the licensee develop a protection and monitoring plan for any and all listed and candidate species on BOR-administered lands within the Priest Rapids Project boundary. BOR states that such a plan would ensure that populations of plants that may become listed under the ESA be provided to help preserve the species, in particular northern wormwood.

Our Analysis

As noted by Interior, the loss of rare, threatened, and endangered plant species can occur as a shrub community develops and herbaceous areas are invaded by woody vegetation, including noxious weeds and other exotic plant species. Grant PUD proposes to develop and implement a rare, threatened, and endangered botanical species protection plan for the Project transmission line corridor. Access through the transmission line corridor by Grant PUD service equipment and maintenance of the transmission line could spread invasive species and adversely affect species of special concern. Although the specificity of a rare, threatened, and endangered botanical species protection plan would be identified in consultation with the resource agencies and affected tribes, we find such a plan would compliment agencies' efforts toward recovery of identified plant species and as a result, protect and enhance the species and its habitat.

Grant PUD proposes to develop a long-term plan to monitor rare, threatened and endangered plants within the Project area, which would provide a measure of protection for the botanical resources. Detailed monitoring and reporting methods still need to be developed, but should include a methodology for monitoring various rare, threatened, and endangered plant populations in the project area; provisions to map and quantify population trends; a schedule for agency consultation; and provisions for funding and management of research information. Interior concurs with Grant PUD's proposal. We find a monitoring plan for rare, threatened, and endangered plants at the Project would compliment Grant PUD's above-mentioned rare, threatened, and endangered botanical species protection plan, thereby affording additional protection to the identified species.

We note BOR's recommendation for a protection and monitoring plan focuses on botanical resources, in particular the northern wormwood. BOR states that its recommendation is to protect BOR interests if the plan proposed by Grant PUD were not adopted in a new license. We find BOR's interests would be met by Grant PUD's proposed measures to protect and enhance rare, threatened, and endangered species, including a separate plan for the northern wormwood.

Environmental effects on terrestrial resources, including species of special concern primarily result from recreation (*e.g.*, ORV use) and other project-related activities, which we discuss in section 3.9, *Recreation and Land Use*.

Northern wormwood

Hydrologic investigations conducted in 2002 indicate that inundation and scour are unlikely to pose an immediate threat to the Beverly population of northern wormwood (Grant PUD, 2003).

In addition to competition with invasive plant species, recreation-related impacts (*e.g.*, trampling of plants, camping, ORV use) on the Beverly population of northern wormwood and subsequent loss of habitat has been identified. Although the site is entirely fenced to exclude ORV use, the site is still accessible to boats (McCarthy, 2004). In separate but related actions, TNC's efforts and Grant PUD's proposal to remove invasive plant species from sites occupied by and that are potential habitat for northern wormwood could enhance the species and its habitat, thereby potentially increasing the population.

Development and implementation of a northern wormwood conservation plan would protect the northern wormwood populations and associated habitat. Although Grant PUD proposes to develop and implement the plan in consultation with BOR, we find that Grant PUD should also consult with the FWS and Washington DNR Natural Heritage Program on the plan. A coordinated approach would further the Grant PUD's and the agencies' efforts in protecting the northern wormwood and its habitat.

3.6.3 Cumulative Effects

We identified terrestrial resources as a resource that could be cumulatively affected by relicensing the Project. The cumulative effects of grazing, agriculture production, ORV recreational use, hydroelectric developments, residential development and infrastructures, and invasive species infestations have resulted in wildlife habitat loss and fragmentation in the mid-Columbia River Basin.

Relicensing the Project with protection and enhancement measures would result in a negligible loss of wildlife habitat from constructing and operating public access and recreation facilities. While project lands generally provide a buffer along the shoreline, thereby preventing bank erosion and loss of riparian vegetation, public use (*e.g.*, recreational boating) can contribute to the potential spread of invasive plant species and subsequent loss of habitat due to access at public recreation sites. However, adverse effects would be minimized by Grant PUD's proposed measures and staff-recommended additional measures. Implementing an invasive species plan, along with other project-related specific plans, could protect rare, threatened, and endangered species; therefore, a cumulative beneficial effect on the species and their habitats could occur over existing conditions.

Under the no action alternative habitat would be maintained under existing conditions. There would be no plans to ensure protection and enhancement of vegetation, wildlife, and associated habitat. There would not be any plan to address invasive species, thereby potentially preventing the spread of, eradicating or controlling introductions of invasive species.

3.6.4 Unavoidable Adverse Impacts

None

3.7 THREATENED AND ENDANGERED SPECIES

The EIS scoping process identified the following issues related to project effects on federally-listed species and proposed critical habitat: (1) effects of project operations on federally-listed salmon, steelhead, and bull trout; and (2) effects of project operations (daily and seasonal pool level fluctuations, downstream flow fluctuations, transmission line maintenance) on the federally-listed bald eagle.

By letter filed April 26, 2005, NMFS indicated that two species of endangered anadromous fish occur in the Project area: (a) UCR spring-run Chinook salmon

(*Oncorhynchus tshawytscha*), and (b) UCR steelhead (*Oncorhynchus mykiss*). Critical habitat was proposed for both species on December 14, 2004. The project occurs within the area proposed for critical habitat designation.

By letter filed May 3, 2005, the FWS indicated the following federally-listed and candidate species, and proposed critical habitat may occur in the vicinity of the Project and could be potentially affected by the project: (a) endangered: pygmy rabbit (*Brachylagus idahoensis*); (b) threatened: bald eagle (*Haliaeetus leucocephalus*); bull trout (*Salvelinus confluentus*); Ute ladies'-tresses (*Spiranthes diluvialis*); (c) proposed: critical habitat for the Columbia River dps of the bull trout; and (d) candidate: Washington ground squirrel (*Spermophilus washingtoni*) and northern wormwood (*Artemisia campestris ssp. Borealis var. wormskioldii*). We discuss the Washington ground squirrel and northern wormwood in section 3.6, *Terrestrial Resources*.

3.7.1 Affected Environment

Upper Columbia River Spring-run Chinook Salmon

UCR spring-run Chinook salmon were listed as endangered on March 24, 1999 (64 FR 14307). Critical habitat for this species was designated on September 2, 2005 (70 FR 52630). We describe the affected environment for this species in section 3.5.1.

Upper Columbia River Steelhead

UCR steelhead were listed as endangered on August 18, 1997 (62 FR 43937). Critical habitat for this species was designated on September 2, 2005 (70 FR 52630). We describe the affected environment for this species in section 3.5.1.

Bull Trout

The Columbia River dps of bull trout was listed as threatened on June 10, 1998 (63 FR 31647). Critical habitat for this species was designated on October 6, 2004 (69 FR 59996). We describe the affected environment for this species in section 3.5.1.

Pygmy Rabbit

The pygmy rabbit was federally-listed as endangered on November 30, 2001 (66 FR 59734) and the State of Washington re-classified the species as State endangered in 1993. The distribution of the pygmy rabbit is within the range of the Washington ground squirrel, a federal candidate species (FWS, 2004). Historically, the pygmy rabbit occurred in dense shrub-steepe region of the Great Basin and likely included portions of Montana, Idaho, Wyoming, Utah, Nevada, California, Oregon, and Washington. The population in Washington is disjunct from those which occur in the other states (Washington DFW, 1995; Washington Department of Game, 1987). During the 1900's, pygmy rabbits probably occurred in five Washington counties: Adams, Benton, Douglas, Grant, and Lincoln.

A significant decrease in the pygmy rabbit populations has occurred as a result of habitat loss, disease, predation, and loss of genetic heterogeneity (Warren, 2001). Predators of pygmy rabbits include long-tailed weasels, coyote, great horned owls, prairie falcons, and northern harriers.

The pygmy rabbit occurs in dense sagebrush cover, and is highly dependent on sagebrush to provide both food and shelter throughout the year. The winter diet of the pygmy rabbit is composed of primarily sagebrush; grasses (*e.g.*, native bunch-grasses), forbs, and sagebrush are part of its spring and summer diet. Pygmy rabbit burrows are found in relatively deep, loose soils and occasionally use burrows abandoned by other species (Warren, 2001). During winter the pygmy rabbit has a small home range (approximately 98 feet from its burrow), and in spring and summer, a larger home range. Pygmy rabbits may travel up to 0.75 mile from their burrows (Washington DFW, 1995).

Pygmy rabbits are not known to occur in the Project area. The only known populations in Washington exist in pockets of suitable habitat in Douglas County. Surveys in 1987 and 1988 discovered five small colonies of pygmy rabbits in southern Douglas County; three occurred on State lands and two on private lands (Washington DFW, 1995). A 1997 annual report for the Hanford Site concludes the pygmy rabbit is not likely occurring on the site [84] and there was no record of species occurrence within the Columbia Basin Project Area (BOR, 1998). The Columbia Basin Project Area encompasses the scattered tracts that we discuss in this final EIS.

Bald Eagle

On July 12, 1995, the FWS re-classified the bald eagle from endangered to threatened in the lower 48 States. The bald eagle remained classified as threatened in five States, including Washington (43 FR 6233, February 14, 1978). In 1999 the bald eagle was proposed for removal from the list of threatened and endangered species because recovery goals had generally been met or exceeded through its range (64 FR 36543). That decision is pending. The bald eagle historically ranged throughout North America except extreme northern Alaska and Canada, and central and southern Mexico. A major decline in the bald eagle population probably began in the mid- to late-1800's, which coincided with declines in numbers of water-birds, shorebirds, and other prey species. Direct bald eagle killing, loss of nesting habitat, and accumulation of dichloro-

[84] http://www.hanford.gov/docs/annualrp97/appf.pdf, accessed September 28, 2005.

diphenyl-trichloroethane (DDT) in individual bald eagles from ingesting contaminated food (thus inducing thin egg shells and reproductive failure) contributed to its decline (Millar, 1995). Since use of DDT was stopped and recovery management plans were implemented, the bald eagle population is increasing.

The bald eagle inhabits aquatic ecosystems; however, such areas must have an adequate food base, perching areas, and nesting sites support bald eagles. In winter, bald eagles often congregate at specific wintering sites that are generally close to open water and offer perch trees and night roosts (Millar, 1995).

The Columbia River is a primary spawning area for fall-spawning Chinook salmon and a wintering area for waterfowl, primarily mallards. The bald eagle is known to winter in the Project area. In addition, the bald eagle is a winter resident along the Hanford Reach and forages on dead salmon and waterfowl; it does not nest at the Hanford Site. The bald eagle uses groves of trees (*e.g*., black locust, white poplar, and Siberian elm) along the Hanford Reach for winter perching, night roosts, and nesting sites (DOE, 1999). Roost sites are generally in the tallest, most dominant trees that provide unobstructed views of the surrounding landscape (Anthony, *et al*., 1982). A communal night roost consisting of black locust and white poplars occurs on the White Bluffs Peninsula. This grove of trees is the site of a great blue heron nesting colony, and in the winter, the herons move from the site and bald eagles use the abandoned nests and trees for night roosts (DOE, no date).

In 1991 a bald eagle nest was constructed near the White Bluffs boat launch; no eggs were laid. In 1993 bald eagles exhibited nest building behavior at the same location (DOE, no date). The reasons for nest failure are uncertain, but may be related to human disturbance. The DOE (no date) states a 2,600-foot buffer and restriction in recreation use at White Bluffs boat launch from January through March could encourage the bald eagle to potentially construct a nest again. If bald eagles nest at the site, the restriction would apply until August 15. The DOE (no date), however, notes that recreational boating occurs primarily in summer and fall, which is prior to bald eagle use. A similar conclusion was drawn for recreational fishing. Usually the salmon fishing season occurs from mid-August through mid-to-late October; sturgeon season from mid-June through mid-to-late October (FWS, 2002).

During 2001 and 2002 there were 14 sightings of bald eagles in riparian habitat along the Priest Rapids reservoir or its tributaries (Grant PUD). Four of the sightings were juvenile bald eagles. No bald eagles were observed during the summer and no nesting behavior was observed. Approximately 10 to 15 bald eagles typically winter along the Priest Rapids reservoir. Other documented sites include Quilomene Bay, Scammon's Landing, Wanapum State Park, Sunland Estates, Frenchman Springs, Stockdale's Ranch, Petroglyph Island, and Goose Island (Duke Engineering & Services, Inc., 2000).

Ute Ladies'-tresses

Ute ladies'-tresses, a perennial orchid, was federally-listed as threatened on January 17, 1992 (57 FR 2048). The species is listed as threatened in Washington State. Ute ladies'-tresses is the common name given in recognition that the species' historic range coincides with the ancestral home of the Ute Indian Tribe (57 FR 2048). Historically, Ute ladies'-tresses was found in riparian areas in Colorado, Nevada, and Utah (England, 1992). Factors contributing to the species decline include urban development, stream channelization, increased demands for agricultural, municipal, and industrial water, recreation, and competition of non-native plant species, thereby displacing native vegetation (FWS, 1995).

The preferred habitat of Ute ladies'-tresses is low elevation riparian meadows, including perennial streams, floodplain, and open vegetative areas. The FWS (1995) notes 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. The species' flowers are noticeable usually from the end of July until early September (BOR, 2004).

Subsequent searches of potential habitat for the Ute ladies'-tresses revealed a greater number of populations and individual plants than was known. The species occurs in Colorado, Idaho, Montana, Nebraska, Nevada, Utah, Washington, and Wyoming (BOR, 2004). In Washington, the species occurs at two sites, one of which is on the Columbia River on Rocky Reach reservoir, approximately 35 RM upstream from the Project. In a letter filed October 31, 2005, pursuant to the Rocky Reach Project No. 2145, Interior states that a new discovery of an additional population of Ute ladies'-tresses occurs in the Rocky Reach Project area. This new discovery increases the number of sub-populations of this plant that exist in the Rocky Reach Project area from three to four (letter from Preston A. Sleeger, Regional Environmental Officer, U.S. Department of the Interior, Portland, Oregon).

At the Project, surveys for rare plants including Ute ladies'-tresses were conducted in 1981, 1991, 2000, and 2001. Although suitable habitat exists, rare plant surveys did not locate Ute ladies'-tresses within the project area (Grant PUD, 2003).

3.7.2 Environmental Effects and Recommendations

Our Analysis

Upper Columbia River Spring-run Chinook Salmon

Our analysis of the project effects on UCR spring-run Chinook salmon is presented in section 3.5.2. In section 3.5.2 we describe the effects of the proposed project on upstream passage and downstream passage of this species. In addition, we describe the effects of the proposed hatchery programs, habitat mitigation efforts, predator control programs, and biological monitoring and studies. Overall, the proposed project operations and the associated mitigation efforts would reduce adverse project effects on UCR spring-run Chinook salmon. Under each of the scenarios evaluated, upstream and downstream passage conditions would be improved, adult returns would be increased due to hatchery supplementation, available habitat would be increased or improved, and predator abundance or the ability of predators to access the species would be reduced. These efforts would increase the numbers of both juvenile and adult UCR spring-run Chinook salmon and would help to prevent extinction of this species.

In spite of the benefits of these measures, the proposed project would likely adversely affect UCR spring-run Chinook salmon because various proposed or continuing actions would result in take of this species.[85] Under the each alternative, individual fish could be: 1) killed or wounded during downstream passage over or through the project dams; 2) killed or wounded during upstream passage through the project fishways; 3) killed, wounded, or harassed due to fluctuations in the project reservoirs or within the Hanford Reach; 4) harmed, killed, wounded, trapped, captured, or collected during biological studies and monitoring; 5) killed, wounded, or harassed during construction of the proposed bypass facilities or modifications to the project fishways or other facilities; and/or 6) harassed during habitat mitigation efforts.

Designated critical habitat for UCR spring-run Chinook salmon that could be affected by the proposed O&M of the Project includes the Columbia River corridor. The primary constituent element of this designated critical habitat is to serve as a freshwater migration corridor. Implementation of the proposed measures would increase adult and juvenile survival of UCR spring-run Chinook salmon during upstream and downstream migrations through the Project area. Specifically, passage survival would be improved through a combination of spill, bypass system operations, predator control measures, and fishway modification and adjustments. Overall these measures would improve the ability

[85] The definition of take is to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct; may include significant habitat modification or degradation if it kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. http://www.fws.gov/endangered/glossary.pdf

of the designated critical habitat within the project area to serve as a freshwater migration corridor. Based on this information, we conclude that the proposed O&M of the Project would not likely adversely affect any designated critical habitat for UCR spring-run Chinook salmon.

In a letter issued on March 2, 2006, Commission staff informed NMFS that relicensing the project with staff's recommended measures would likely adversely affect UCR spring-run Chinook salmon but would not destroy or adversely modify any critical habitat for this species. In a letter filed on April 11, 2006, NMFS indicated that they had all information required to initiate consultation and they stated they expected to provide their biological opinion by July 19, 2006. On June 20, 2006, NMFS filed a letter requesting an extension of time to provide their biological opinion by September 18, 2006. In a letter issued on July 6, 2006, Commission staff granted the request to extend the deadline. To date, no biological opinion has been filed by NMFS.

Effects of relicensing the Project on essential fish habitat for UCR spring-run Chinook salmon is addressed throughout section 3.5.2. In a letter filed on April 11, 2006, NMFS indicated that the consultation for UCR spring-run Chinook salmon would consider effects on essential fish habitat.

Upper Columbia River Steelhead

Our analysis of the project effects on UCR steelhead is presented in section 3.5.2. In section 3.5.2 we describe the effects of the proposed project on upstream passage and downstream passage of this species. In addition, we describe the effects of the proposed hatchery programs, habitat mitigation efforts, predator control programs, and biological monitoring and studies. Overall, the proposed project operations and the associated mitigation efforts would reduce adverse project effects on UCR steelhead. Under each of the scenarios evaluated, upstream and downstream passage conditions would be improved, adult returns would be increased due to hatchery supplementation, available habitat would be increased or improved, and predator abundance or the ability or predators to access the species would be reduced. These efforts would increase the numbers of both juvenile and adult UCR steelhead and would help to prevent extinction of this species.

In spite of the benefits of these measures, the proposed project would likely adversely affect UCR steelhead because various proposed or continuing actions would result in take of this species. Under the each alternative, individual fish could be: 1) killed or wounded during downstream passage over or through the project dams; 2) killed or wounded during upstream passage through the project fishways; 3) killed, wounded, or harassed due to fluctuations in the project reservoirs or within the Hanford Reach; 4) harmed, killed, wounded, trapped, captured, or collected during biological studies and monitoring; 5) killed, wounded, or harassed during construction of the proposed bypass facilities or modifications to the project fishways or other facilities; and/or 6) harassed during habitat mitigation efforts.

Designated critical habitat for UCR steelhead that could be affected by the proposed O&M of the Project includes the Columbia River corridor and the mouths of lower Crab Creek. The primary constituent element of this designated critical habitat is to serve as a freshwater migration corridor. Implementation of the proposed measures would increase adult and juvenile survival of UCR steelhead during upstream and downstream migrations through the Project area. Specifically, passage survival would be improved through a combination of spill, bypass system operations, predator control measures, and fishway modification and adjustments. Overall these measures would improve the ability of the designated critical habitat within the project area to serve as freshwater migration corridor. Based on this information, we conclude that the proposed O&M of the Project would not likely adversely affect any designated critical habitat for UCR steelhead.

In a letter issued on March 2, 2006, Commission staff informed NMFS that relicensing the project with staff's recommended measures would likely adversely affect UCR steelhead but would not destroy or adversely modify any critical habitat for this species. In a letter filed on April 11, 2006, NMFS indicated that they had all information required to initiate consultation and they stated they expected to provide their biological opinion by July 19, 2006. On June 20, 2006, NMFS filed a letter requesting an extension of time to provide their biological opinion by September 18, 2006. In a letter issued on July 6, 2006, Commission staff granted the request to extend the deadline. To date, no biological opinion has been filed by NMFS.

Effects of relicensing the Project on essential fish habitat for UCR steelhead is addressed throughout section 3.5.2. In a letter filed on April 11, 2006, NMFS indicated that the consultation for UCR steelhead would consider effects on essential fish habitat.

Bull Trout

Our analysis of the project effects on the Columbia River dps of bull trout is presented in section 3.5.2. Based in this analysis, we conclude that a portion of the mid-Columbia River bull trout population may over winter in the upstream portions of the Wanapum reservoir. No specific project effects on these fish have been identified in our record and our analysis suggests there would be no project effects on these fish from the proposed action. There is some evidence that bull trout occur downstream of the over wintering area. Pfeifer et al (2001) conducted a comprehensive fish survey of the project area and reported collecting only two bull trout; one 2 miles upstream from the Priest Rapids dam and the other in the Wanapum pool. Grant PUD reports that "only a handful" of bull trout have been recorded within the Priest Rapids fish ladders over the past 43 years. Grant PUD has conducted numerous fisheries studies in the project area and other than the few observations mentioned above, there is little evidence that bull trout regularly occupy the Project area beyond the upstream end of the Wanapum pool. We conclude that the occurrence of bull trout in the downstream portion of the Wanapum pool and the Priest Rapids reservoir is incidental and rare.

Bull trout that occur within apparent over wintering area would not be affected by the proposed action. Bull trout that incidentally occur downstream of the over wintering area would likely benefit from some of the measures being implemented for salmon and steelhead. These measures would include improved upstream and downstream passage conditions, reduced predator abundance, and habitat mitigation. There is no evidence that any of the proposed measures would harm bull trout. Based on this information, we conclude that any effects on bull trout would be discountable or entirely beneficial and the proposed action would not likely adversely affect bull trout.[86]

The final rule designating critical habitat for bull trout excluded the mainstem Columbia River and all waters impounded behind dams (reservoirs and pools). As a result, no habitat within the project area or habitat that could be directly affected by O&M of the Project was designated as critical habitat. Therefore, the proposed action would not affect designated critical habitat for bull trout.

In a letter issued on March 2, 2006, Commission staff informed Interior that relicensing the Project with staff's recommended measures would not likely adversely affect bull trout or destroy or adversely modify designated critical habitat for this species. In a letter filed on March 27, 2006, Interior indicated that they did not concur with staff's determination for bull trout. Interior indicated that they had all the information required to initiate consultation and they would provide their biological opinion no later than August 14, 2006.

In a letter filed on October 5, 2006, Interior informed the Commission that it could not issue its Biological Opinion until the Commission provides a written request for initiation of formal section 7 ESA consultation. In a letter issued on October 12, 2006, Commission staff requested initiation of formal section 7 ESA consultation for bull trout.

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[86] The Endangered Species Consultation Handbook (FWS and NMFS; 1998) indicates that "not likely to adversely affect" is the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Discountable effects are described as extremely unlikely to occur. Beneficial effects are described as contemporaneous positive effects without any adverse effects to the species.

Pygmy Rabbit and Ute Ladies'-tresses

Based on the best available information, we conclude that relicensing the Priest Rapids Project with our recommended measures would not affect the endangered pygmy rabbit because of the lack of habitat at the project and because they are not known to occur in the project area. We also find that relicensing the project will not affect the threatened Ute ladies'-tresses because they are not known to occur in the project area even thought suitable habitat is present. Grant PUD's proposed rare plant monitoring program and plans to develop threatened and endangered species protection plan would alert Grant PUD and the FWS to any changes in distribution of these species in the project area, such that appropriate measures could be undertaken to avoid adverse effects if they are found to occur in the project area in the future. In response to our March 2, 2006, request for concurrence, the FWS responded on that it did not have the statutory authority to concur with a "no effect" determination, but had no basis to disagree with the conclusion (letter filed April 10, 2006).

Bald Eagle

Pursuant to section 10(j) of the FPA, Interior recommends (recommendation no. 13) Grant PUD develop and implement a bald eagle perching and roosting tree protection and enhancement program. Interior concurs with Grant PUD's proposal to develop and implement such a plan.

To protect the bald eagle, Grant PUD proposes the following measures: (1) develop and implement a bald eagle perching and roosting tree enhancement and protection program; and (2) future modification to existing and/or new transmission lines and structures would be accomplished in accordance to the guidelines set forth in Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996 (Avian Power Line Interaction Committee, Edison Electric Institute).

Grant PUD's proposed bald eagle perching and roosting tree enhancement and protection program includes measures that would be consistent with, and complement, its draft Shoreline Management Plan, dated August 2003. In the draft Shoreline Management Plan, Grant PUD defines land use classifications in which one, Conservation, would retain and preserve a character of undeveloped, natural open space, thereby protecting fish and wildlife resources. There are approximately 3,021 acres (or 23 percent) of project lands classified as Conservation.

As part of its bald eagle perching program Grant PUD proposes to protect existing perching and roosting trees from beaver effects, and initiate tree enhancement through riparian plantings. Framatome ANP (2003) notes much of the shoreline along the project reservoirs is composed of cliffs, steep slopes, and narrow strips of riparian vegetation.

The majority of riparian vegetation, totaling an estimated 1,490 acres, is located in lower Crab Creek, Priest Rapids WRA, Moran Slough, and the eastern shoreline of Priest Rapids reservoir. An estimated 405 acres of riparian vegetation (tree/shrub mosaic) is associated with Wanapum reservoir. Within the project area there are three ponds hydraulically connected to the project reservoirs: (1) West Bar Slough, (2) Quilomene Island Pond, and (3) a small pond located at RM 406 within Priest Rapids WRA. Within these various habitats, bald eagles were observed.

As noted by Interior's section 10(j) recommendation the continual fluctuation of water levels in the Project reservoirs influences the development of shoreline vegetation, including the development of large cottonwood trees. Grant PUD's proposal to protect existing perching and roosting trees, initiate tree enhancement through riparian plantings, and retain identified project lands under a Conservation land use classification would enhance bald eagle habitat. An increase in availability and distribution of perches would allow bald eagles to utilize more areas along the project reservoirs. As discussed in section 3.5, *Aquatic Resources*, fishery enhancement measures should benefit the bald eagle by enhancing its prey base. Therefore, a bald eagle perching and roosting tree protection and enhancement program would protect and enhance the bald eagle and its habitat, thus contributing to a beneficial effect on the species.

In the project area, study results indicate that recreational boating and fishing occur primarily in summer and fall, which is prior to bald eagle use. However, to minimize effects on the bald eagle resulting from the construction of recreation facilities, Grant PUD should consult with the FWS and Washington DFW, along with Washington State Parks and Recreation Commission (Washington SPRC), BOR, and appropriate county, in developing and implementing its final Recreation Plan.

Pursuant to section 10(j) of the FPA, Interior recommends (recommendation no. 12) Grant PUD develop and implement an avian protection plan. Interior states that transmission lines pose a hazard to passerines, waterfowl, and raptors, including the federally-listed bald eagle.

We previously address Interior's recommendation for an avian protection plan. To protect the bald eagle and other raptors, any future modification to existing and/or new transmission lines and structures for the Project should be accomplished in accordance to the guidelines set forth in Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996 (Avian Power Line Interaction Committee, Edison Electric Institute).

By letter filed October 5, 2006, the FWS indicated that it concurred with our not likely to adversely affect the bald eagle determination because potential impacts do not coincide with the timeframes in which bald eagles are present in the project area. No further action pursuant to the ESA is required for this species.

3.7.3 Cumulative Effects

The cumulative effects of project operations on UCR spring-run Chinook salmon, UCR steelhead, and bull trout are addressed in section 3.5.

The cumulative effects of project operations on the persistent-sepal yellowcress, northern wormwood, Ute Ladies'-tresses, bald eagle, Washington ground squirrel, and pygmy rabbit are addressed in sections 3.6 and 3.7.

3.7.4 Unavoidable Adverse Impacts

Unavoidable adverse impacts to UCR spring-run Chinook salmon, UCR steelhead, and bull trout are addressed in section 3.5.4.

Unavoidable adverse impacts to the identified fish could be to the benefit of the bald eagle by providing a larger food base.

3.8 CULTURAL RESOURCES

In this section we address cultural resources within the context of the following issues identified during the scoping process that relate to project effects on cultural resources: (1) effects of the project operation, implementation of protection, mitigation, and enhancement measures, and other events (such as wind-induced waves or loss of vegetation along the shoreline) on historical and archaeological resources within the project's APE; and (2) combined effects of upstream dam operations on bank erosion and resulting disturbance of cultural resource sites in the Hanford Reach. A comprehensive overview of cultural resources located within the Project, including the prehistory and history of the mid-Columbia Region can be found in Exhibit E6 of the license application (Grant PUD, 2003) along with other supporting documents.

3.8.1 Affected Environment

Section 106 of the National Historic Preservation Act of 1966, as amended, requires that the Commission evaluate the potential effects on properties listed or eligible for listing in the National Register of Historic Places (National Register). Such properties listed or eligible for listing in the National Register are called historic properties. In this document we also use the term "cultural resource" for properties that have not been evaluated for eligibility for listing in the National Register. Cultural resources represent things, structures, places, or archeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic. Section 106 also requires that the Commission seek concurrence with the State Historic Preservation Officer (SHPO) on any finding involving effects or no effects to historic properties, and allow the Advisory Council on Historic Preservation (Council) an opportunity to comment on any finding of effects to historic properties. If Native American (i.e., aboriginal) properties have been identified, section 106 also requires that the Commission consult with interested Indian tribes that might attach religious or cultural significance to such properties. In this case, the Commission must take into account whether any historic property could be affected by a proposed new license within the Project's APE, and allow the Council an opportunity to comment prior to issuance of any new license for the Project.

For cumulative effects, the Commission staff took into account the potential downriver effects that the Project may have on historic properties in the Hanford Reach area. It is important to note that the Hanford Reach area has been designated as a National Monument; National Register-eligible cultural resources are contributing elements to the Monument. The primary effect on cultural resources in the Hanford Reach that the Project may contribute to is shoreline erosion on National Register-eligible archeological properties.

The Project's Area of Potential Effects

The APE for the Project has been defined as including lands within the Project boundary as delineated in the current FERC license and lands outside the Project boundary where Project operations may affect the character or use of historic properties. The FERC Project boundary for the Project encompasses close to 60 miles of the Columbia River from the tailrace of Rock Island dam to the tailrace below Priest Rapids dam, in addition to roughly 5 miles of lower Crab Creek drainage, and approximately 60 miles of transmission lines (Bruce et al. 2001:1.2; Shive, et al. 2004:7). The total estimated acreage for the APE is 12,236 acres; 3,806 in the Wanapum Development, 7,305 in the Priest Rapids Development, and 1,125 in the transmission line corridors (Shive et al. 2004:15). Approximately 40 percent of the APE is owned by Grant PUD, 20 percent is federal land, 20 percent is state lands, and the remaining 20 percent is privately owned.

Archeological Research and Background

The 60 mile stretch along the Columbia River that falls within the Priest Rapids FERC Project boundary has been extensively researched for more than 100 years, and contains a wealth of archeological information involving aboriginal occupations spanning thousands of years from roughly 11,000 years ago through the period of Euro-American contact and settlement. As a result, a large amount of published archeological research has been generated, and since 1955, Grant PUD has provided financial support to these endeavors due to their stewardship of Priest Rapids and Wanapum hydroelectric developments. The following synopsis of archeological research in the Project area has been summarized from Vera Morgan in Bruce et al. 2001 (pages 4.1 – 4.46).

Pre-project archeological investigations

Archeological research in the vicinity of the Project began as far back as 1903 with Harlan Smith of the American Museum of Natural History (Smith 1910). Along this section of the Columbia basin, Smith located and recorded a number of aboriginal archeological sites, including a pit house village at Priest Rapids, and other related sites such as shell middens, lithic scatters, and petroglyphs. In 1920, F.S. Hall of the Washington State Museum followed up on Smith's research and excavated several cemeteries and village sites, recovering large quantities of cultural material for the State Museum, some of which were ultimately returned back to the Wanapum in later years (Bruce et al. 2001:4.8). Hall's work was never systematically recorded or published, and very little information on site location, provenience of artifacts and features is available from his investigations. In the mid to late 1920s, Herbert Krieger from the Smithsonian Institution excavated and mapped a number of archeological sites in the middle and upper Columbia River, and integrated some of Hall's materials from the Priest Rapids area, along with the collections of artifacts found by amateur collectors associated with the Washington State Historical Society (Historical Society) who were now actively searching the area for archeological relics. From 1927 through 1938, Harold Cundy of the Historical Society recorded a number of rock art sites in the middle Columbia River area, including 11 sites in the Project area (Bruce et al. 2001:4.9).

Investigations related to the development of the Project

Stemming from the initial planning for hydroelectric development in the Priest Rapids area, Louis Caywood in 1948 conducted a brief archeological reconnaissance survey of the Priest Rapids area for the COE. This was followed by more systematic work in 1950 by John Campbell's Smithsonian River Basin Survey. Systematic archeological excavations on sites in the Project began in the late 1950s and continued into the early 1960s through the research of Earl Swanson and direction of Robert Greengo at the University of Washington (Bruce et al. 2001:4.11-4.18). Much of this work was the product of the Priest Rapids-Wanapum Archaeological Salvage Project which resulted in the recordation of nearly 200 sites of which many were excavated. The Priest Rapids-Wanapum Archaeological Salvage Project was a contract-sponsored university program involving field schools and scores of professional archeologists, students, and amateurs who in turn published a series of contract archeology reports over two decades.

Archeological investigations and excavations continued after the Priest Rapids and Wanapum developments went into operation in 1961 and 1964, respectively. Additional sites were located below Priest Rapids dam in the late 1960s by David Rice and members of the Mid-Columbia Archaeological Society and later by Richard McClure in 1978. In 1981, Randall Schalk and other archeologists from Washington State University located 60 sites as a result of intensive surveys in the Priest Rapids flood pool where the water level was to rise an additional three and a half feet to increase power generation (Schalk 1982, Bruce et al. 2001:4.27). Fifteen of these 60 sites were summarily excavated by Glenn Hartmann and others associated with Eastern Washington University in 1981.

Investigations related to Grant PUD's relicensing effort

Preliminary archeological investigations in preparation for Grant PUD's license application were begun by Susan Freiberg in 1993 and continued into 1996 (Freiberg 1993 and 1997a, b, and c). Freiberg was contracted to relocate 169 sites in the project area, and in the process, she also discovered a number of unrecorded sites (Bruce et al. 2001:4.29). From September 2001 to March 2003, Grant PUD contracted Earth Imaging Associates, Inc. to conduct a comprehensive cultural resources inventory within the entire project boundary (Hackenberger et al. 2003).

Archeological Chronology

Based on the above research, a general archeological chronology can be established for the Project area which essentially corresponds to the prehistory of the mid-Columbia Plateau (Nelson 1969, Galm et al. 1981). The archeological framework represents a continuum of aboriginal occupations along the mid-Columbia River and adjacent environs which can be subdivided into phases, the later of which are basically defined by distinctive and chronologically-sensitive spear and arrow points in association with other types of artifacts. The general socio-economic trend represented by these archeological phases over time depicts a transition from small nomadic bands of hunter-gatherer into more complex sedentary tribal groups consisting of large concentrations of populations living in settled villages, augmented with smaller satellite camps and staging areas used for specialized activities. Movements of different population groups from inside and outside the mid-Columbia Plateau also occurred which accounted for some cultural change as well. Nevertheless, fishing for salmon and other aquatic resources was probably one the most important social and technological developments involving peoples of the mid-Columbia Plateau that began thousands of years ago and which manifested into a common cultural theme shared among Indian tribes living in the region today.

The earliest evidence for occupation in the study area begins with the Paleo-Indian period dating sometime prior to 11,500 BP. However, to date, no intact archeological deposits dating to this initial period presently exist within the project area. This is probably attributed to the catastrophic floods associated with Lake Missoula (that began in 12,700 BP) and other subsequent flooding events, which scoured much of the Columbia River basin. Nevertheless, Clovis points (associated with the earliest Paleo-Indian occupations in North America) have been found near Wenatchee farther upriver, and one such point was recovered at the surface near the confluence of Crab Creek, as well as other related Clovis type material in other portions of the project area (Bruce et al. 2001:5.34). Other later Paleo-Indian point types have also been found in the project area, as well. Populations associated with the Paleo-Indian period generally consisted of highly mobile small bands of hunter-gatherers who were associated with the hunting of Pleistocene big game animals such as mammoth and bison.

The Windust phase (ca. 11,000 to 8200 B.P.) defined by straight or contracting stemmed points and unifacial and biface lanceolate-shaped spear points, represents the earliest documented archeological manifestation in the Priest Rapid Project area where social groups practiced a broad-based hunting and gathering strategy focusing on large game animals supplemented with collecting of plant and aquatic resources. After the Windust phase, is the Vantage- phase (ca. 8200 to roughly 5200 B.P.) that essentially correlates with the Cascade phase further to the east on the Snake River. This phase is represented by leafed-shaped (Cascade points), stemmed (Mahkin Shouldered points), and large side-notched (Cold Springs) spear points. At this time, populations begin to focus more on extracting salmon in the Columbia River, and intensify their exploitation of plant resources. Subtle cultural changes occur during the mid part of this phase as a result of the massive Mt. Mazama eruption (resulting in present-day Crater Lake) that took place around 6740 B.P. Pithouses appear around 5100 B.P., indicating some trends towards permanent settlements. The next phase is called the Frenchman Springs phase (ca. 5200 to 2800 B.P.). This phase represents increases in sedentism and more focused scheduling of economic activities that may be related to a drying trend in the region. Diagnostic projectile points characterized by this phase include stemmed, leaf-shaped, notched, and triangular points which are relatively smaller and less carefully made than in the earlier phases. Ground stone artifacts for the processing of plants become more prevalent in this phase in concert with an increase in storage pits and pithouses, the latter of which were covered with tule mats. Following the Frenchman Springs phase, is the Cayuse phase (ca. 2800 BP to 250 BP), which represents a more diversified and prolific cultural manifestation that reflects a developed strategy of salmon fishing, upland root gathering, bow and arrow hunting (signified by smaller projectile points), inter-tribal territoriality and trading, and settled village life (larger village congregations occurring during winter, and dispersing into smaller settlements during summer) that persisted into the period of Euro-American contact. The Cayuse phase essentially resembles the traditional cultural complexion of modern-day tribal groups presently living in the mid-Columbia region prior to acquisition of the horse. Nevertheless, the introduction of the horse, coupled with the spread of European diseases dramatically changed the life patterns of indigenous cultures associated with the Cayuse phase, just prior to European contact.

Ethnographic Background

Towards to the latter millennia prior to Euro-American contact, the mid-Columbia River in the Project area was inhabited by two basic linguistic groups, one associated with interior Salish speakers, and the other with Sahaptin speakers (Miller 1998:253-282; Schuster 1998:327-351). Most of the Salish-speaking tribes who inhabited the mid-Columbia Plateau in the Priest Rapids vicinity are presently associated with the Colville, and were principally made up of the Sinkayuse (also referred to as the Moses Columbia Tribe or mid-Columbia) and to a lesser extent the Wenatchee. These Interior Salish speakers occupied the mid portion of the Columbia River and extended southward into the northern half of the project area probably past the present-day town of Vantage south of the Saddle Mountains. South of this area, Sahaptin speakers, principally associated with the modern-day Wanapum, occupied the southern half of the project area. Overall, there are strong indications of some overlapping of territories between these two language groups in this portion of the Columbia River; however, the Crab Creek and Saddle Mountain area of the Project seems to be a general boundary between these two groups (Bruce et al. 2001:6.4-6.13). Sahaptin speakers affiliated with the modern-day Yakama, also occupied areas just to the south of Priest Rapids dam, but probably entered into the project area from time to time.

In general, aboriginal peoples of the mid-Columbia Plateau region were heavily dependent on the catching of different species of salmon, in addition to other aquatic fish such as sucker and sturgeon. Although subsistence on salmon was central to these particular groups, other foods were exploited ranging from the hunting of wild game, to berry picking and the collecting of roots. Large groups of people congregated in the shallower rockier reaches of the river where access into the river was easiest and where salmon were plentiful during the spring and fall salmon runs. The Priest Rapids was one of the primary locations on the mid-Columbia for salmon fishing. Salmon were extracted in a number of ways, but principally by gill nets or by harpooned-tip spears, where bands of native fishermen would assemble complex scaffolds over a series of rocks in the river to catch and dispatch the fish. During the seasonal fish runs, a number of activities would be performed among the native peoples, ranging from catching the salmon in the river, to processing and drying of the flesh along the shoreline, where the fish meat would be used for consumption throughout the year and traded to other groups outside the Columbia Plateau. Thus, the fishing and processing of salmon was a strong social and cultural tradition with the mid-Columbia peoples, a tradition which exists today, despite the significant depletion of the salmon resource over the years.

Near the traditional fishing areas and close to confluence of tributaries emptying into the Columbia River, aboriginal groups established large permanent and semi-permanent villages. Living quarters in the main village tended to be semi-subterranean circular structures ranging from 6 to 10 meters in diameter, or longhouses consisting of timber frames covered with tule mats. These conical-roofed circular and pitched-roofed rectangular tule mat houses were very characteristic of villages along the mid-Columbia Plateau region. Satellite seasonal encampments with less permanent dwellings would be found in the higher elevations on the terraces above the river or up into the lateral drainages. Other sites were designated as special places used in ceremonies and other related social events.

The Lewis and Clark Expedition of 1804-1806 represents the first time aboriginal peoples of the mid-Columbia Plateau came in direct contact with Euro-Americans. Although Lewis and Clark did not travel into the Project area, it is almost certain that they encountered representatives of the Wanapum, among other groups of Indians, at the confluence of the Columbia and Snake Rivers on their way back east in 1806 (Coues, ed. 1964:637; Bruce et al. 2001:6.3, :7.1). At this time, horses were introduced into the region and tribal groups became increasingly dependant on them for trade and transportation. Prior to Lewis and Clark, small pox epidemics were breaking out as early as the 1770s, devastating aboriginal populations in the Columbia Plateau and adjacent areas along the Northwest Coast, in the Great Plains and Rocky Mountain areas (Boyd 1985: 78; Bruce et al. 2001:6.1). Such epidemics persisted into the early 1800s through the 1840s resulting from fur trading in the region which added additional impacts to already significantly reduced populations who were in and adjacent to the Priest Rapids area.

When the Washington Territory was established in the 1850s by the United States, the Wanapum were grouped with the affiliated bands of the Yakama, the latter of which were reduced to about 600 persons (Bruce et al. 2001:7.1). After violent clashes between incoming white settlers and Native Americans in the Plateau region, a treaty among the bands associated with the Yakama was formulated in 1855 by Governor Stevens–the first governor of the newly formed Washington Territory. At this time, the Yakama were moved to their present-day reservation south of the Project area. As part of the 1855 Treaty, the Yakama agreed to cede much of their traditional territory (including all of Project area) with the promise that they could continue to use these lands for hunting and fishing--a treaty right the Yakama maintain and exercise today. Groups associated with the Columbia and Wanapum never formally organized with the other affiliated bands of the Yakama, which signed the treaty in 1855. Instead, the Wanapum continued to occupy their principal villages which now extended throughout the Project area south of Crab Creek. The Wanapum lived in peace with the white settlers who arrived in the Priest Rapids vicinity after the 1855 Treaty. The effects of ranching and agriculture diminished the natural fishing areas and hunting of the Wanapum and they were reduced (stemming from some members relocating to other nearby reservations) to living in a single village at Priest Rapids by the late 1800s, where they remain today.

After a series of hostile engagements with the U.S. military, the Salishan Columbia under the leadership of Chief Moses were removed from their former homeland in the mid-Columbia River to the Colville Reservation which was established by a series of executive orders beginning in 1872 through the 1880s (Kennedy and Bouchard 1998:250-251; Bruce et al. 2001:10.9-10.11). The original Coleville Reservation had been more extensive, but was reduced several times during this period, ending in the present-day boundaries along the north and west side of the Columbia River extending from Chief Joseph dam to the Kettle Falls area. Prior to this, the Salishan peoples associated with the Columbia River were living throughout the mid and upper Columbia basin on both sides of the river extending northward into Canada and to the south past present-day Vantage. Prior to being removed to the Colville Reservation, the Columbia were adjacent to the Wanapum, engaging in the fishing of salmon and living in villages along the Columbia River near Crab Creek and north of the Saddle Mountains. Some of these Columbian peoples managed to stay in the northern part of the project area up until the 1880s (Bruce et al. 2001:9.9).

Historic Background

Shortly after the Lewis and Clark expedition, David Thompson of the North West Company (NWC) set out from his trading post at Spokane House in the search of new fur grounds and navigated down the Columbia River, passing through the Project area on his way to the Pacific Ocean in 1811. In July 1811, Thompson and his entourage camped at an important fishery at Cabinet Rapids situated in northern limits of the project area below the rapids at Rock Island (Bruce et al. 2001:7.3). There he encountered Columbia Indians associated with the Wenatchee and noted a longhouse more than 200 hundred feet long. Upon leaving, Thompson was informed that people south of Crab Creek spoke a different language, thus indicating the boundary between Salish and Sahaptin-speaking tribes. On his way south, Thompson and his group navigated a series of rapids that later became known as Priest Rapids. There, he encountered a large village (probably affiliated with the Wanapum) consisting of 60 families of which it was noted that the people spoke Sahaptin. A month later moving up the Columbia River from the south, Alexander Ross of the NWC encountered the same village at Priest Rapids. About a week later, 30 miles upriver from Priest Rapids, he encountered another group of Salish-speakers--later affiliated with the Columbia Indians of Chief Moses--at a place later identified as Gualquil Rapids.

In the first two decades of the nineteenth century, Priest Rapids became a rendezvous with other fur traders and different groups of Indians where tobacco and other European products were traded for fish (Bruce et al. 2001:7.4-7.15). Unlike trading establishments set up along the Columbia River at Fort Okanogon, Colville, and Fort Nez

Perce, no established European settlement occurred in the Priest Rapids area, or in the other adjacent areas along the Columbia River between the Okanogon and Walla Walla Rivers. In the 1830s, European contact with Indians of the mid-Columbia basin began to change in character due to the diminishing fur trade in the region--a result of over-hunting, and Americans began to focus on the Northwest Territory (still considered British) for permanent settlement (Bruce et al. 2001:9.1-9.5). In 1836, the American Board of Commissioners for Foreign Missions sent Samuel Parker to evangelize Indian groups within the territory, where he passed through the Priest Rapids area. He was followed by a scientific expedition sponsored by the United States Exploring Expedition led by Lieutenant Charles Wikes in 1838 where they mapped parts of the Northwest Territory associated with the Columbia Plateau, including the interior portions of the mid-Columbia River. In the beginning of the 1840s, the United States pressed for stronger claims in the Northwest Territory, precipitating a small but steady advancement of Anglo-American settlers into the region. This eventually lead up to the Treaty of 1846, where the boundary between the United States and Canada was established at the 49^{th} Parallel, and the new Washington Territory came into existence.

Engineers associated with the Northern Pacific Railroad surveyed and examined the terrain for travel routes through the region (Bruce et al. 2001:9.2). However, the region in and around the Priest Rapids area was desolate and unattractive, and was bypassed for early rail development, which began more earnestly in the 1880s in the Yakima River Valley to the south, and through Wenatchee and Stevens Pass in the north. The shrub-steppe environment of the Priest Rapids area lacked good stands of forests for timbering, which made other areas in the mid-Columbia Plateau more attractive for settlement and development. Resulting from the trade associated with the emerging grain market in the Yakima Valley, steamboats were making landings upriver at Priest Rapid at this time, where wagon routes existed through the project area to transport grain on the way north to Wenatchee and other parts of Washington (Bruce et al. 2001:11.2). In fact, some of these wagon routes were established earlier as a result of the Canadian gold rush in the late 1850s. The gold rush had also spurred periodic cattle drives from Oregon, en route to Canada, through the project area, but the region remained sparsely settled. With the decline of the gold mining industry, and by the end of the 1800s, sheep ranching replaced cattle drives in the project area.

Small-scale agriculture was also being done at this time in the project area, where local inhabitants, including indigenous peoples such as the Wanapum grew vegetables for home use and other crops, such as alfalfa, to support their livestock (Bruce et al. 2001:13.1). Irrigation projects for larger scale agricultural practices were planned and implemented at the turn of the century, with varying degrees of success. The conveyance of water from the Columbia River for agricultural needs spurred interest for utilizing the river for hydropower in the Priest Rapids area. By the beginning of the 1900s, communities such as Vantage began to develop, many of them establishing themselves around one of the several ferry crossings in the region. The Vantage ferry in particular became a popular place for automobiles crossing the Columbia River in early 1900s, utilizing one of the first auto routes in the area where present-day I-90 now exists. Shortly afterwards, a bridge was built across the river at Vantage. The old town of Vantage persisted through the twentieth century as a small community, supporting a Civilian Conservation Corp camp in the 1930s. In the 1960s, the old town was inundated by the construction of Wanapum dam.

Cultural Resources Identified within the Project's Area of Potential Effect

In order to identify cultural resources within the Project APE, a comprehensive inventory was conducted from September 2001 to March 2003 (Hackenberger et al. 2003). The cultural resources inventory was done by a standard pedestrian survey where crews of 3 to 5 individuals walked along parallel transects spaced 10 meters apart. Areas within the APE that were not systematically walked over included sections of riverbank that were rip-rapped, areas that were covered over by structures, areas under agricultural production, places where slopes were greater than 30 degrees, and private property where landowners did not grant permission to have their lands surveyed (Hackenbeger et al. 2003:46). In high probability areas where ground cover was greater than 50 percent, subsurface probes or soil auguring was used to find cultural materials not visible on the surface. More than 7,900 individual shovel probes were dug within the APE. The majority of these shovel tests were placed on Holocene period terraces situated above the riverbanks (close to 4,000 were excavated along Crab Creek) where there were higher probabilities of finding buried archeological deposits.

A total of 680 archeological sites were documented, of which 419 were located in the Wanapum Development, 218 in the Priest Rapids Development, and 42 along the transmission line corridors (Shive et al. 2004:17). Of these sites, 193 had been previously recorded involving past archeological investigations discussed above. The remaining 486 sites, along with 571 isolated artifact finds, were newly discovered as a result of the systematic surveys for this relicensing. Of the total archeological sites in the APE, approximate 70 percent are Native American in origin; the remaining 30 percent are Euro-American. The Native American sites consist of lithic scatters, shell middens, village sites, cemeteries, rock shelters, and associated petroglyphs. Many of the aboriginal sites have multiple components (represented by specific archeological phases) spanning thousands of years, including some that have both Native and Euro-American components. The Euro-American sites, tend to be less substantive, representing the remains of farmsteads, trash dumps, construction sites, tent camps, irrigation features, staging areas, roads, and trails. Grant PUD is currently working with the Wanapum, Colville, and Yakama in order to locate traditional cultural properties (TCP) in the APE. In June of 2006, the Colville submitted a preliminary report that identified a number of village sites, place names, and archeological sites that are deemed to be of cultural and traditional importance to the Colville.

Cultural Resources that are considered Eligible for the National Register of Historic Places

Only two cultural resources in the APE have been listed in the National Register. One consists of the Beverly Railroad Bridge (built in 1909), and the other is a portion of the Wa Pai Xie Archeological District (consisting of aboriginal archeological sites) which lies on property under the jurisdiction of U.S. Army Yakima Training Center (Shive et al. 2004: 21). Grant PUD has chosen to categorize the remaining archeological sites located in the APE as properties that are potentially eligible for inclusion in the National Register (Shive et al. 2004:23-24). Grant PUD proposes to formally evaluate these sites after license issuance to determine National Register eligibility. Nevertheless, Grant PUD was asked by Commission staff to identify 20 of the most significant archeological sites in the APE that can be determined eligible for inclusion in the National Register and are in eminent danger of being severely damaged or destroyed. In March 2005, Grant PUD submitted to the Commission 20 sites. All 20 sites represent aboriginal occupations that contain significant cultural information. Twelve of these sites consist of habitations ranging from dense lithic scatters to village sites. Four others are rock shelters, and the remaining are burial grounds.

Cultural resources within the Hanford Reach

Hanford Reach consists of approximately 585 square miles in total size and encompasses 51 miles of the Columbia River downriver from the Priest Rapids dam. Stemming from investigations beginning in the 1920s, approximately 1,447 cultural resource sites and isolated finds have been documented there, in addition to 531 historic buildings and structures (PNNL 2004:4.93). The range of cultural resources in the Hanford Reach span more than 8000 years of human occupation reflecting similar chronologies and sequences as noted in the Project area to the north. Eight archeological historic districts associated with the Native Americans have been defined in Hanford Reach, along with three other historic districts associated with the development of the U.S. nuclear weapons program during and after WWII. A total of 459 aboriginal archeological sites have been located in the Hanford Reach, of which 70 contain historic occupations associated with early Euro-American settlement (HCRMP 2003:3-27). TCPs are also present at Hanford Reach reflecting a broad spectrum of natural landscapes, archeological sites, ceremonial places, plant gathering areas, and trails (HCRMP 2003:2-28).

The most critical cultural resources that are in danger of being damaged or destroyed within the Hanford Reach are the archeological sites, especially those which have aboriginal deposits dating to the pre-contact period. These particular sites are located along the edges of the Columbia River, as well as along exposed sand bars within the river. Such critical areas include the White Bluffs locality, and the archeological districts of Locke, Salvage, and Wooded Island.

3.8.2 Environmental Effects and Recommendations

In this section we highlight the particular management measures that Grant PUD proposes to resolve identified project-related adverse effects to significant cultural resources located within the Project's APE. We also point out comments from the various agencies and tribes in response to our analysis of Grant PUD's proposals in the draft EIS, along with our concluding analysis in the final EIS on what measures are needed to insure that project-related effects to historic properties will be adequately resolved for the term of the new license.

Grant PUD's Proposal for Resolving Adverse Effects to Historic Properties for the Term of a New License

Historic Properties Management Plan (HPMP)

In December 2000, Commission staff authorized Grant PUD to initiate section 106 consultation on the Commission's behalf pursuant to the relicensing of the Project. Earlier, in August 1999, Grant PUD organized a Cultural Resources Solution Group (CRSG) for the relicensing effort and was later formulated into a CRWG in May 2002 due to sensitive-related cultural resource issues (Shive et al. 2004:2-4). Principal participating members in the CRWG included the Wanapum, Colville, Yakama, BLM, Grant PUD, Washington SHPO or Department of Archaeology and Historic Preservation (DAHP), FWS, DOE, and Commission Staff. Test excavations of the archeological sites and the inadvertent discoveries of culturally sensitive materials during Grant PUD's effort to inventory the Project's APE in 2001, led the Colville to express concern with the Project relicensing effort.[87] From 2002 through 2004, Commission staff, Colville, Grant PUD, and the Washington State Office of Archaeology and Historic Preservation (OAHP) met to address the concerns raised by the Colville regarding the development of protocols for notification and disposition of culturally sensitive material, and improvement of the section 106 consultation process between the Colville, Grant PUD, and other members of the CRWG. In order to resolve these issues, Grant PUD met separately with tribal representatives of the Colville, Yakama, and Wanapum, and cooperated with the tribes to return culturally sensitive material in the appropriate places. Based on the established protocols, Grant PUD continues to consult with these three tribes involving the repatriation of culturally sensitive material. Nevertheless, as of April

[87] Human remains were discovered on some of the archeological sites when Grant PUD was conducting its archeological field inventory.

2006, Colville wishes for Grant PUD to consult with them further on the repatriation of items of concern to them, pursuant to the Native American Graves Protection and Repatriation Act.

As a result of collaboration and efforts of the CRWG, Grant PUD produced several draft versions (November 2003 and June 2004) of an HPMP and a final draft HPMP (August 2004) to resolve potential project-related adverse effects to potential and National Register-eligible properties located in the Project's APE (Shive et al. 2004).[88] In their final draft HPMP, Grant PUD proposed after license issuance to determine formal National Register eligibility to all potential historic properties (i.e., the 680 properties identified in the Project's APE) and then determine the degree and extent of project-related effects to National Register-eligible properties (Shive et al. 2004:24-25, 33-44).

In order to facilitate National Register evaluations of all the potential historic properties located within the APE, Grant PUD proposed to use a multiple property documentation process. This process would streamline the documentation process where multiple sites could be organized and registered under one National Register form based on common site characteristics, as opposed to each site being listed on individual National Register forms. Upon license issuance, Grant County PUD also proposed in their final draft HPMP to continue their ongoing efforts in maintaining their established cultural resource programs and practices which includes: (1) the Wanapum River Patrol, (2) Wanapum dam Heritage Center, (3) Wanapum dam Heritage Center Repository, (4) Wanapum Native American Discovery Unit, (5) Natural and Cultural Resources Review Process, (6) developed protocols for the treatment and disposition of human remains, and (7) compliance with specific state and federal laws in the protection and preservation of exposed and threatened cultural resources.

In the final draft HPMP, Grant PUD also proposes after license issuance to continue to work with the Wanapum, Colville, and Yakama in the identification and National Register evaluation of TCPs, and sponsor the requisite studies needed to identify, evaluate, and propose measures to resolve any project-related adverse effects to National Register-eligible TCPs (Shive et al. 2004:23). Table 27 shows Grant PUD proposed schedule (originally formulated in 2004) for carrying out the various responsibilities discussed in their final draft HPMP. As a part of their 2005 response to our AIR (see discussion below), Grant PUD resubmitted this table, showing their proposed schedule for completing National Register eligibilities/assessments of

[88] As Colville, Yakama, and DAHP have pointed out in their comments involving our analysis in the draft EIS, there were many issues involving the HPMP and inventory report that were not resolved on a satisfactory level among CRWG participants, including the level of analysis and methods on how Grant PUD proposed to protect significant cultural resources.

Table 27. Proposed protection measures for 20 high priority cultural resources sites in the Priest Rapids area of potential affects (Source: Grant PUD, Washington, 2005).

Site	Potential Project Associated Effects	Proposed Treatment/Mitigation	Timing/Schedule
1. 45KT1096	Erosion	Monitoring levels 1-3 and formal erosion analysis	Immediate action Annual monitoring
2. 45GR65	Erosion	Monitoring levels 1-3 and formal erosion analysis	Immediate action Annual monitoring
3. 45GR685	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
4. 45GR131	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
5. 45DO532	Erosion	Monitoring levels 1-3 and formal erosion analysis	Immediate action Annual monitoring
6. 45DO2	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
7. 45CH4	Erosion	Monitoring levels 1-3	Immediate action Annual monitoring
8. 45CH1	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
9. 45KT382	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
10. 45KT1	Erosion Recreation	Monitoring levels 1-3 and formal erosion analysis	Immediate action Annual monitoring
11. 45KT6	Erosion Recreation	Monitoring levels 1-3 and formal erosion analysis	Immediate action Annual monitoring
12. 45GR688	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
13. 45KT44	Erosion Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
14. 45KT377	Erosion Recreation	Monitoring levels 1-3 and formal erosion analysis	Immediate action Annual monitoring
15. 45GR50	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
16. 45KT20	Recreation.	Monitoring levels 1-3	Immediate action Annual monitoring
17. 45GR686	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
18. 45KT12	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring
19. 45KT372	Erosion Recreation	Monitoring levels 1-3 and formal erosion analysis	Immediate action Annual monitoring
20. 45KT48	Recreation	Monitoring levels 1-3	Immediate action Annual monitoring

remaining cultural resource. Grant PUD also proposes to curate all collected cultural resource material in the Wanapum dam Heritage Center Museum, and continue their program for public outreach including their sponsorship of the annual October archeology and heritage celebrations, of which involves many tribal participants from the Wanapum, Colville, and Yakama, along with other cultural resource experts from state and federal agencies, and visitors from the public (Shive et al. 2004:27-29). Finally, Grant PUD proposes to implement a training and information program to personnel that have O & M responsibilities involving day-to-day operation of the Project facilities, in order to insure the continued protection and preservation of significant cultural resources (Shive et al. 2004:29).

Grant PUD Responses to Commission Staff Additional Information Requests

In July 2004, the Commission staff requested that Grant PUD submit the following items: (1) a description and maps of the APE, (2) a short list of sites (ca. 20) that would be considered eligible for the National Register and suitable for treatment of adverse effects at the highest level of priority, and (3) copies of all of the individual site record forms (ca. 680) to FERC and OAHP. In August 2004, Grant PUD provided the Commission with a description and maps of the APE, a list of 20 high-priority National Register-eligible sites, and 680 Washington State Archeological Site Inventory Forms.

In October 2004, the Commission staff requested that Grant PUD submit a cultural resource document (Harvey, D.W., Historic, archeological, and TCPs of the Hanford Site, Washington) that would aid in the Commission's staff analysis of the effects of project operations together with upstream dam operations on cultural resources in the Hanford Reach. This was related to Commission staff's request that Grant PUD provide additional information in regards to a December 24, 2003, FWS request for information on downstream project-related affects (i.e., streambank erosion) on cultural resources in the Hanford Reach National Monument. In January 2005 Grant PUD responded that the information was unavailable. By letter dated January 12, 2005, Grant PUD noted that five non-sensitive documents relevant to the Hanford Reach National Monument had been posted on Grant PUD's website, and that sensitive documents were provided separately to the Commission staff. Grant PUD noted that streambank erosion in the Hanford Reach National Monument was not due solely to project operations, but that the rate and timing of water releases involving the upstream Grand Coulee Project governed the amount of water Grant PUD released through the Wanapum and Priest Rapids Dams. Grant PUD also noted that some of the erosion occurring on archeological sites could be attributed to the natural processes of river currents, flows, wind, and shoreline runoff, in addition to wave action caused by recreational boating.

The Commission staff by letter dated November 24, 2004, requested that Grant PUD submit additional information describing: (1) potential historic properties that may be eligible for the National Register, (2) project-related effects on historic properties, and (3) proposed measures to resolve project-related adverse effects to historic properties. In compiling this information, Commission staff instructed Grant PUD to produce a report that focused its effort on 20 significant archeological sites that had been previously targeted as 'high-priority' for resolving adverse effects, and propose management measures. Commission staff also instructed Grant PUD to provide a schedule for completing National Register eligibility determinations on the remaining 660 cultural resource sites presently inventoried in the Project's APE. On January 28, 2005, Grant PUD filed a report (Narrative Report, dated March 15, 2005) and associated site descriptions of the 20 targeted archeological sites. Table 27 lists the 20 sites and shows the potential effects, proposed mitigation and schedule for implementation.

Of the 20 sites listed above, Grant PUD identified four that are adversely affected by streambank erosion, 11 that are being affected by recreation-related activities, and the remaining five that are being affected by a combination of streambank erosion and recreational activities. Grant PUD also determined that all 20 sites need immediate attention in order to resolve project-related adverse effects occurring at each site. On all sites Grant PUD proposed to monitor sites by boat (level 1), on-site inspection (level 2), and intensive on-site inspection (level 3). Grant PUD also proposed to monitor all sites being affected by erosion on a monthly basis (Grant PUD 2005b:8). They also propose to conduct erosion analysis on some of the archeological sites, in order to assess what appropriate protective measures need to be taken for each of the affected sites (Heacock 2005b:7). Table 28 shows Grant PUD's proposed schedule for determining National Register eligibility and assessing/addressing adverse effects on all remaining cultural resource properties so far inventoried. Grant PUD's proposed schedule shown in Table 28 is essentially the same schedule they proposed in their 2004 draft final HPMP.

Input from other Agencies and Tribes on Grant PUD's Proposed Measures for Cultural Resources and Our Analysis in the draft EIS

On our draft EIS, we received comments from the Colville, Yakama, Wanapum, Umatilla, DAHP or Washington SHPO, and Grant PUD. The DAHP, Grant PUD, Yakama, and the Council made additional comments on our draft PA that was sent out after issuance of the draft EIS. We will address specific comments involving our draft PA when we issue our final PA. As it will become more apparent below, the results of our final analysis in the final EIS (based on our responses to the agencies and tribes above), will essentially address the comments made on our draft PA, which in turn will be reflected in our final PA.

Colville Tribes

In a letter dated April 18, 2006, the Colville commented that they: (1) questioned

Table 28. Proposed schedule for completing National Register eligibilities/assessment of adverse effects on remaining cultural resource (Source: Grant PUD, Washington, 2005).

Goal	Potential Historic Property Prioritization	Target Schedule
1. Develop multiple property documentation format for NRHP evaluations.	For all potential historic properties on the project	Complete 1 year from execution of the Programmatic Agreement (PA).
2. Identify potential historic properties potentially affected by project operation.	Primary priority potential historic properties Secondary priority potential historic properties	Conduct studies concurrent with item 1. and complete within 1.5 years from execution of PA.
	Tertiary priority potential historic properties	Complete within 2 years from execution of PA.
3. Prepare and submit documentation for consensus determinations of eligibility.	Primary priority potential historic properties	Complete 2.5 years from execution of PA.
4. Draft proposed measures to address effects on historic properties from project operation.	Primary priority potential historic properties	Complete 3 years from execution of PA.
5. Prepare and submit documentation for consensus determinations of eligibility.	Secondary priority potential historic properties	Complete 3.5 years from execution of PA.
6. Draft proposed measures to address effects on historic properties from project operation.	Secondary priority potential historic properties	Complete 4 years from execution of PA.
7. Prepare and submit documentation for consensus determinations of eligibility.	Tertiary priority potential historic properties	Complete if or when needed due to changes in project operations or the proposal of specific project-associated actions which could affect such potential historic properties.
8. Implement measures to address effects.	Primary, secondary and tertiary priority potential historic properties	Post licensing

whether Grant PUD had contributed substantial financial support for archeological research prior to their involvement with the relicensing, (2), noted some confusion and inconsistencies with our description of the archeological sequence, (3) contend that we gave a false impression that the Colville agrees with Grant PUD’s conclusions involving their inventory report, HPMP, and the level of protection and mitigation they propose for archeological sites involving a new license, (4) have not consulted with Grant PUD involving future plans for handling human remains and related items of cultural patrimony (pursuant to the Native American Graves Protection and Repatriation Act), (5) are concerned that all appropriate actions to mitigate and protect cultural resources would not begin until after the signing of the PA and implementation of the new license, (6) question Grant PUD's ability to carry out such actions, and (7) are troubled with our analysis attributing erosion effects on archeological sites to natural causes.

Yakama

In a letter dated May 2, 2006, the Yakama commented that they: (1) like the Colville, are concerned about Grant PUD not being able to mitigate or protect archeological sites that are currently in danger of being damaged or destroyed until after license issuance, (2) contend that there are many more significant archeological sites that need to be protected or mitigated against project-related effects beyond the targeted 20 sites slated for immediate action, (3) take issue that no traditional cultural places have been identified in the APE, (4) take issue that protection or mitigation measures will only be taken on sites designated eligible for the National Register, disregarding other categories of significant cultural sites, (5) contend that there was no legal or scientific basis to select 20 archeological sites for immediate attention from the remaining body of more than 650 sites, (6) are concerned that protection and mitigation measures proposed for cultural resources during the term of the new license are woefully inadequate, (7) point out that there is no discussion on how reductions in flow could alleviate adverse effects to archeological sites along the shoreline, (8) point out that we do not address other cumulative effects such as recreational impacts occurring on archeological sites, (9) point out that we do not address the effects of boat wakes on archeological sites, and (10) contend that issuance of the draft PA was premature without addressing many of the outstanding issues that have been raised by the Yakama and DAHP.

Wanapum

In a letter dated May 2, 2006, the Wanapum commented that we incorrectly grouped all of their concerns under the rubric of cultural resources and to have Grant PUD carry out all of the Wanapum's interests through the implementation of the final HPMP. The Wanapum were especially concerned that we were intending to merge and program all elements involving the original 1957 agreement between them and Grant PUD in the HPMP. Contrary to this, the Wanapum request that we create a separate license article to address their needs, pursuant to the 1957 agreement, and would like for us to incorporate specific language they provided to us for this particular article.

Umatilla

In a letter dated May 2, 2006, the Umatilla state that our conclusion in the draft EIS about Grant PUD's final HPMP will be consistent with tribal recommendations involving reducing flows to protect cultural resources is false.

DAHP (Washington SHPO)

In a letter dated March 7, 2006, the DAHP commented that: (1) they take issue with our analysis implying that erosion along the main-stem of the Columbia River is comparable to natural stream bank erosion, (2) Grant PUD has submitted key documents involving site record and determinations of eligibilities that are missing or containing incorrect critical information, (3) Grant PUD intends to use monitoring techniques in lieu of active protection measures on affected archeological sites, (4) Grant PUD has not provided any concrete needs for the protection of archeological sites that contain human remains, (5) Grant PUD should commit to providing specific protection measures on all National Register-eligible sites where erosion has been documented within six months after license issuance and execute such measures within one year after license issuance, (6) Grant PUD should commit to evaluating all remaining archeological sites for National Register eligibility and specify treatment plans for all eligible sites within two years after license issuance, (7) Grant PUD is not intending to implement a public education and training program for the appreciation and protection of cultural resources, (8) the final HPMP would need to address the protection of cultural resources in the APE and provide more detail, accordingly, (9) a more robust schedule needs to be presented overall (and which can be incorporated into the final HPMP) that illustrates when all remaining National Register evaluations would be completed and the implementation of measures for all National Register-eligible archeological sites and other eligible cultural resources, and (10) to reiterate their request for Grant PUD to incorporate relevant points and items they think are necessary into the final HPMP.

Grant PUD

In a letter dated May 2, 2006, Grant PUD commented that: (1) like the Wanapum, they were concerned that all aspects of their 1957 agreement with the Wanapum would be implemented through the final HPMP, (2) the APE definition differentiates between historic properties and TCPs, (3) the utility in using both Tables 27 and 29 (as depicted in the draft EIS and which are essentially identical) is somewhat questionable, (4) they are not sure about what incident we are referring to involving inadvertent discoveries involving tribally-sensitive materials, and (5) the Hanford Reach National Monument Federal Planning Advisory Committee, created by the Secretary of the Interior, is no longer in existence; its charter expired January 11, 2005. Grant PUD, however, favors reestablishing such an approach.

Our Analysis

Response to the Colville

In response to Colville's comment (1), we note the Colville's comment and have deleted the word "substantial" from section 3.8.2 of the final EIS. In response to comment (2), we have made corrections and changes to the archeological chronology of the area.[89] In response to comment (3), we have added in the appropriate places in the text that Colville and others do not agree with all of the measures and recommendations that Grant PUD proposes in their draft HPMP, along with other items and measures they discussed in their inventory report. In response to comment (4), we have noted that the Colville wishes to consult further with Grant PUD, involving items of concern associated with the Native American Graves Protection and Repatriation Act. In response to comment (5), Grant PUD would be required to carry out the recommended protection measures for cultural resources after a new license has been issued for the Project. Nevertheless, in consultation with the CRWG, Grant PUD could carry out protection measure prior to license issuance. In response to comment (6), the Commission's Division of Hydropower Administration and Compliance would enforce the provisions of a new license, including the final HPMP.

In response to comment (7), we do point out that the shoreline erosion that affects archeological sites is attributed to the Project. Our point, however, is to show that other factors, such as large volumes of water being passed from Grant Coulee dam downriver through the other projects, in addition to waters being discharged for irrigation use or wave action generated by wind or by boats, also contribute to shoreline erosion noted on archeological sites. Nevertheless, we find that Grant PUD's proposed measures with staff-recommended measures would protect National Register-eligible archeological sites that are being affected by shoreline erosion in the APE.

Response to the Yakama

In response to the Yakama's comment (1), we recognize their concern in making sure that Grant PUD immediately implement protection measures to all high priority archeological sites that are being affected by the project. As we have discussed above, we encourage Grant PUD to take the necessary steps as soon as possible. In response to comment (2), we recognize that there are more than 20 archeological sites that can be considered eligible for the National Register without further evaluation. It is our objectives to have Grant PUD prioritize the 20 sites for immediate attention, knowing that many more archeological sites will also need to be treated after the 20 first-priority sites. We discuss in greater detail below measures and steps needed to be taken for Grant PUD to address the 20 designated archeological sites, in addition to other significant

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[89] This information was summarized directly from the archeological chronologies used in the Priest Rapids Project cultural resources overview (Bruce, *et al*. 2001, pages 5.34-5.45).

cultural resources, as recommended by the Yakama, Colville, and DAHP. In response to comment (3), it was our point to emphasize that no specific traditional cultural places had been identified at the time of the draft EIS. We certainly recognize that such places exist within the APE, and that many of the aboriginal archeological sites identified in the APE can also be considered as traditional cultural places. We also further emphasized that Grant PUD is in the process of working with the Colville, Yakama, and Wanapum in consolidating more information on known traditional cultural places. The Colville has recently submitted a preliminary report (dated June 2006) that identifies a number of such places within the APE. In response to comment (4), the most effective way to determine whether cultural resource are significant is to use the four basic criteria for determining National Register eligibility as defined through 36 CFR Part 63 and as mandated by section 106 (through 36 CFR Part 800). Using such criteria effectively covers all cultural resources that might be affected by the Project, ranging from architectural structures to archeological sites and traditional cultural places. Once such properties have been evaluated as eligible for the National Register, the section 106 regulations provide steps to be taken in order to protect or mitigate such sites from project-related adverse effects. All unevaluated properties under this approach are also considered eligible until proven otherwise, and afforded the same protection under section 106. In response to comment (5), we estimated that Grant PUD could resolve adverse effects to 20 sites that were most significant and in the most danger of being destroyed or severely damaged. In our assessment, we concluded that 20 sites are a reasonable number that could be protected or mitigated within the first year after license issuance.

In response to comment (6), as discussed with Colville's comment (5), we cannot require Grant PUD to take any measure to protect or mitigate a National Register-eligible property that is currently being affected by the project, until after a new license has been issued for the Project. Nevertheless, Grant PUD could implement measures prior to license issuance, in consultation with the DAHP and others in the CRWG. In response to comment (7), we have addressed how Grant PUD would take measures (such as, reducing flows and leveling-off rapid flow fluctuations) to reduce project-induced erosion to cultural resources in the appropriate sections of the final EIS. In response to comment (8), we contend that shoreline erosion is a cumulative effect on cultural resources resulting from various combinations of natural processes, project operations, and wave action generated by wind or by boat wakes. In contrast to this, we find that effects to cultural resources caused by recreational use are directly related. That is, such effects to cultural resources stem from persons recreating within the Project boundary. In response to comment (9), we recognize in the draft EIS and herein that boat wakes causes adverse effects to cultural resources situated along the shoreline and such effects and proposed measures are discussed in the Recreation and Land Use section. In response to comment (10), we would issue a final PA for signature based on comments we have received on both the draft PA and draft EIS.

Response the DAHP

In response to comment (1), we have modified the particular subsection in the final EIS where DAHP has taken issue with our concept that streambank erosion along the mainstem of the Columbia River is a result of natural process. In response to comment (2), we recognize DAHP's concern with missing and incomplete information associated with the determination of eligibility forms submitted to DAHP from Grant PUD, and find the eight points (bulleted on page 2 in DAHP's filing of March 7, 2006, reasonable, and as a result, Grant PUD should provide this information within 3 months after license issuance. In response to comments (3), (5), and (6), Grant PUD, in consultation with DAHP and others in the CRWG, should: (a) develop specific protection/mitigation measures for the 20 National Register-eligible archeological sites listed in Table 27 within six months after license issuance; (b) execute the specified protection/mitigation measure on each affected archeological site within 1 year after license issuance; (c) determine National Register eligibility for all remaining inventoried archeological sites[90] within 2 years after license issuance; (d) identify all site-specific project-related effects to all National Register-eligible archeological sites[91] within 2.5 years after license issuance; and (e) develop long term treatment plans and associated schedule for carrying out remaining site-specific protection/mitigation measures on National Register-eligible archeological sites within 3 years after license issuance. In response to comment (4), Grant PUD should identify all archeological sites containing known human remains within six months after license issuance and propose measures to adequately protect such sites be carried out within 1 year after license issuance.[92] In response to comment (7), we did find that Grant PUD provided some provisions for training of personal and education of the public in their draft HPMP. Nevertheless, we conclude that Grant PUD should consult further with DAHP and others in the CRWG during development of their final HPMP regarding the procedures and protocols for its proposed educational and training programs. This program could compliment the Interpretation and Education program that would be part of a final Recreation Plan. In response to comments (8) and (9), we agree with DAHP that Grant PUD should be more specific in their final HPMP, detailing the goals and protection of affected cultural resources in the Project APE. As a result, Grant PUD should expand the text their final HPMP that should satisfy these concerns, in addition to adding the specific tasks and

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[90] This task also needs to include the evaluation of other identified cultural resources, such as traditional cultural places.

[91] This task also needs to include all other cultural resources determined eligible for the National Register.

[92] If, it is determined that humans remains need to be removed and reburied, Grant County will consult with the appropriate parties and DAHP, and determine the appropriate protocols and carry out the agreed upon measures within the same period of time.

timetables expressed in our response to DAHP's comments (3), (5), and (6), as appropriate.

In response to comment (10), DAHP provides edits and other comments on finalizing the HPMP, as listed on pages 5 through 9 in its filing of March 7, 2006. In particular, DAHP recommends enhancement funding, which we discuss in section 5.0, *Staff's Conclusions*. DAHP also comments that annual reports should be provided to any signatory of the PA or any party requesting a copy. As a signatory to the PA, the Commission staff does not require an annual report be filed with the Commission, which is reflected in the PA at Stipulation II.E. Grant PUD, however, should address DAHP's comments in their final HPMP. It is important to note that by addressing these points, Grant PUD could also satisfy other similar comments made on the HPMP by the Colville, Yakama, and Umatilla. If Grant PUD does not adopt a recommendation, the final HPMP should include Grant PUD's reasons, based on project-specific information.

Response to Grant PUD and the Wanapum

Based on comments on the draft EIS from Grant PUD and the Wanapum, we separated the 1957 memorandum of agreement between them from the HPMP (see section 5.1.2 for further discussion of the memorandum of agreement). We recognize that TCPs are a particular kind of historic property and we have rephrased our definition of the APE, accordingly. We agree with the redundancy of using Table 27 and Table 29 in the draft EIS and have removed the former table from the final EIS. We have elaborated more in the final EIS about the inadvertent discoveries made during the field inventory. We acknowledge that the Hanford Reach National Monument Federal Planning Advisory Committee no longer exists, but we recommend Grant PUD reconvene such a committee (or a facsimile, thereof) within six months after license issuance in order for them to jointly propose measures to resolve project-related shoreline erosion effects to archeological sites in the Hanford Reach. Grant PUD should also integrate the CRWG with this committee. Grant PUD should also incorporate in their final HPMP procedures and protocols for the continuance of such a committee over the term of the new license.

Potential Effects of the Project on the Hanford Reach National Monument

Commission staff has ascertained that approximately 1,447 cultural resource sites and isolated finds have been located within the Hanford Reach National Monument (PNNL 2004:4.93). It is important to note that less than half of the 51-mile stretch of the mid-Columbia River that falls within the Hanford Reach National Monument has been systematically inventoried for cultural resource sites (HCRMP 2003:3-51).

In addition, as discussed in the Geology and Soils section of this final EIS, upstream storage projects have resulted in a reduction of the magnitude and number of extreme high flow events, which significantly contributes to shoreline erosion. In fact some geomorphic studies conclude that most of the recent landslide activity in the Hanford Reach National Monument is attributed to the development of irrigation along the Columbia River Basin between 1953-1994 that has resulted in elevated groundwater levels, which in turn has caused slumping and slope failures of valley walls (for more discussion on this see the Geology and Soils section 3.3). Thus, the overall effects of erosion on archeological sites downstream from Priest Rapids dam are cumulative in nature, resulting in the release of water through several hydroelectric projects, including the Project.

Grant PUD has proposed various measures to enhance water quality and aquatic resources downstream from Priest Rapids dam that, by dampening the magnitude and frequency of flow fluctuations that would probably decrease the effects of streambank erosion on archeological sites in the Hanford Reach National Monument (see discussions along these lines in the other appropriate resource sections). As mentioned above, Grant PUD had participated in the Hanford Reach National Monument Federal Advisory Committee. The committee had made recommendations and had assisted the FWS on management goals for the Hanford Reach National Monument. Since the committee's termination, no other work has been planned. Nevertheless, we conclude that a committee similar to the previous one should be revitalized. Such a committee could help to facilitate a continued coordinated effort in formulating and executing protection and mitigation measures for affected archeological sites in Hanford Reach. Members of the CRWG could be included in such a committee. In comments on the draft EIS, Grant PUD supports this concept.

On extending the Project's APE into the Hanford Reach, we cannot discern project-related effects solely attributable to the Project, since much of the water being released through the Project is based on the amount of water being released from other hydroelectric projects further upstream on the mid-Columbia River. Nevertheless, under the initiative of Grant PUD, formulating an interagency committee, as discussed above, would aid in resolving shoreline-related erosion effects to affected archeological sites in the Hanford Reach. Grant PUD and the committee could work cooperatively toward the protection or mitigation of cumulative adverse effects on cultural resources attributable to stream bank erosion in the Hanford Reach.

Execution of a PA, Implementation of HPMP, and Other Measures to Complete the Section 106 Process

In order to resolve adverse effects to National Register-eligible cultural resources and complete the section 106 process, Commission staff intends to execute a final PA with the Washington SHPO and the Council.[93] In the event the Commission issues a new license for the Project, Commission staff would stipulate in the PA that Grant PUD, in consultation with DAHP and the CRWG, file for Commission approval a final HPMP within one year after license issuance. Other associated tasks involving Grant PUD's effort in finalization of the HPMP would include: (1) developing procedures and protocols for a training and education program; (2) formulating a committee similar to the Hanford Reach National Monument Federal Advisory Committee to address archeological sites being affected by project-related shoreline erosion in the Hanford Reach; (3) within 3 months after license issuance, providing DAHP with the missing and incomplete information associated with submitted site record and determination of eligibility forms;[94] (4) within six months after license issuance, developing specific protection/mitigation measures for the 20 archeological sites listed in Table 27 and all other archeological sites known to contain human remains; (5) within one year after license issuance, executing the specified protection/mitigation measure on the targeted archeological sites mentioned above; (6) within 2 years after license issuance, determining National Register eligibility for all remaining inventoried archeological sites and other cultural resources located within the APE; (7) within 2.5 years after license issuance, identifying all site-specific project-related effects to all National Register-eligible cultural resources; and (8) within 3 years after license issuance, developing long-term treatment plans and associated schedule for carrying out remaining site-specific protection/mitigation measures on all National Register-eligible archeological sites located within the APE.

In order to facilitate Grant PUD's effort in crafting the final HPMP, we recommend that Grant PUD consult with the CRWG and come up with a short list of professional contractors to choose from, to which Grant PUD would make a final choice on which contractor will carryout the task of crafting the final HPMP. We also recommend that Grant PUD create (in close consultation with the CRWG) a local archeological peer review panel to directly oversee all work involved the specified tasks listed above, in addition to reviewing the effort on crafting the final HPMP.

3.8.3 Cumulative Effects

Effects on cultural resource sites located along the mid-Columbia River shoreline, both within the APE and below the Project in the Hanford Reach, are subject to cumulative effects from erosion caused by the Project, other upstream dam operations, agreements (*e.g.*, Hanford Reach Agreement to protect fall Chinook salmon), natural processes, and wave action generated by wind or by boat wakes. Grant PUD's proposed

[93] In response to our draft PA, the Council, in a letter dated April 4, 2006, said that they will participate in the PA

[94] As itemized on page 2 in DAHP's filing of March 7, 2006.

measures for protecting the cultural resources, along with our additional measures, would provide increased protection for cultural and other environmental resources. By formulating a committee, similar to the previous Hanford Reach National Monument Federal Advisory Committee, Grant PUD and the committee members could work cooperatively toward mitigation of cumulative adverse effects on cultural resources attributable to project-related streambank erosion in the Hanford Reach.

3.8.4 Unavoidable Adverse Impacts

Adoption and implementation of a HPMP would provide for the phased documentation and protection of sites, but would not totally eliminate the possibility of the loss of some cultural resource materials and sites caused by stream bank erosion. Due to such unavoidable adverse effects as streambank erosion occurring on some archeological sites, data recovery ultimately may be the last resort to effectively resolve some of the adverse effects in these circumstances. Data recovery in and in itself, is considered an adverse effect, and should only be done after all other protective measures have been exhausted.

3.9 RECREATION AND LAND USE

The EIS scoping process identified the following issues related to project effects on recreation resources: (1) effects of public recreation use on undeveloped dispersed recreation sites that could contain: (a) cultural sensitive area(s) of concern to the Yakama, other federally recognized tribes and the Wanapum, or (b) species of special concern; (2) effects of project operations and facilities on recreational fishing; (3) effects of fluctuating impoundment surface elevations on recreation access, specifically boat ramps, at the Project; (4) effects of project operation and operation of upstream developments on special designated areas, such as the Hanford Reach National Monument and wildlife areas managed by Washington DFW; (5) trails and project role in the restoration of Beverly Bridge to serve as part of the John Wayne Pioneer Trail; and (6) need for and project role in the development of horseback riding amenities. In this section, we describe the affected environment with respect to recreation resources and the environmental effects, including cumulative effects, of the project as related to these issues.

3.9.1 Affected Environment

In the Columbia River Basin, the Columbia River can be divided into three sections: the tidal or lower section extending from the mouth to a point about 140 miles from the mouth; the middle section extending from the head of tidewater to the mouth of Snake River, a distance of about 180 miles; and the upper section extending from the mouth of Snake River to the U.S.-Canada border, about 424 miles (letter to the Speaker of the House of Representatives, from Mr. Elwood Mead, Commissioner, War

Department, March 29, 1932).

The project, located in the middle section of the Columbia River (or mid-Columbia River), includes two developments- -Wanapum and Priest Rapids. The existing project boundary includes 58 miles of the Columbia River extending from RM 453 to RM 395. The Wanapum development is located at RM 415.8; its approximate 38-mile-long impoundment extends upstream from the dam to Rock Island dam at RM 453.4. The Priest Rapids development is located at RM 397.1; its approximate 18-mile-long impoundment extends upstream from the dam to the Wanapum development. The project boundary extends approximately 2 miles below the Priest Rapids dam into the upper portion of the free-flowing Hanford Reach (Grant PUD, 2003). The Columbia River flows through the 51-mile-long Hanford Reach to its confluence with the Snake River, which we also include in our analysis of potential project-related effects.

As part of the relicensing efforts for the project, Grant PUD conducted 10 recreation-related studies or surveys. See Grant PUD (2003) Exhibit E-7, section 7.10, of the license application for a summary of the recreation-related studies or surveys. In addition, an analysis of aesthetics/visual resource was conducted, which compliments the recreation-related studies or surveys. See Grant PUD (2003) Exhibit E-8.A for the aesthetics/visual characteristics of the general region and the project area.

Regional Recreation Resources

The Columbia River and its tributaries offer a wide range of recreational opportunities for Washington residents and visitors. Recreational opportunities include boating, fishing, hunting, hiking, camping, horseback riding, picnicking, sight-seeing, and wildlife observation. A recent survey (Interior *et al.*, 2002) indicates that among anglers, hunters, and wildlife-watchers, there is a considerable overlap in activities. In 2001, 71 percent of hunters also fished, and 27 percent of anglers hunted. If we look at one recreational activity for Washington State, the data shows that 12,841,000 days of fishing (residents and nonresidents) occurred in 2001. For Washington State, the total expenditure[95] for fishing in 2001 was $853,761,000. Expenditures included trip-related (*e.g.*, food and lodging), equipment, and other (*e.g.*, membership dues). During 2001, a total of 2,496,000 people in Washington State participated in wildlife-watching and, as a result, the total expenditure for wildlife-watching was $979,730,000. These expenditures can contribute toward jobs in industries that support wildlife-related recreation. Further, funds generated by licenses and taxes on hunting and fishing equipment can contribute

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[95] Expenditure - money spent in 2001 for wildlife-related recreation trips in the United States and wildlife-related recreational equipment purchased in the United States. Expenditures include both money spent by participants for themselves and the value of gifts they receive (U.S. Department of the Interior, *et al.*, 2002).

toward conservation efforts.

Fourteen regional recreation resources, located approximately 30 to 90 miles from Wanapum development, offer a variety of facilities, public access, and recreational opportunities similar to those available at the Priest Rapids development (see Table 29). Associated with some of these regional recreation resources are scattered parcels of land managed by BOR. Known as “scattered tracts”, this land consists of approximately 308 parcels scattered throughout the Columbia River Basin with an estimated total of 90,000 acres (BOR, 1998). The area includes Adams, Franklin, and Grant Counties, with a portion in Walla Walla County located south of the Snake River. Scattered tracts are discussed in the Land Use section below.

Special Designated Areas and the Hanford Reach

There are no federally designated Wild & Scenic River sites within the project boundary. Approximately 45 miles of “eligible” Columbia River flows through the Hanford Reach National Monument (Monument),[96] located downstream from the project (Grant PUD, 2003). Interior recommended that Congress designate federally owned and privately owned lands within 0.25 mile of the Columbia River, on both riverbanks from RM 396 to RM 346.5 as a Recreational River under the Wild and Scenic Rivers system; and, the portion of the Hanford Site that lies north of the river as a National Wildlife Refuge to be managed by the FWS. The actions are pending (DOE, 1999).

The Monument, located in Adams, Benton, Franklin, and Grant Counties, is managed by the FWS. The land is part of the 586 square mile-Hanford Reach Nuclear Reservation (Hanford Site) located in Benton County and administered by DOE. A portion of the Hanford Site and Monument lands that lie within the Project boundary are associated with project transmission lines that cross over the Columbia River into BPA’s Midway Substation.

The FWS (2002) notes that the natural features of the Monument and the historical importance of the area provide both opportunities and constraints to recreational activities and development at the Monument. Recreational opportunities include fishing, hunting, observation, hiking, and horseback riding. Both motorized and non-wildlife motorized

[96] The Hanford Reach National Monument was established by Presidential Proclamation on June 8, 2000.

Table 29. Regional Recreation Resources (Source: Grant PUD, Washington, 2003; EDAW, Inc., 2000).

Development	**Provided By**	**Recreation Facilities**	**Recreational Use**
Rock Island reservoir	Chelan PUD; Washington SPRC	Wenatchee Confluence State Park- (with 59 campsites); trails; 4 picnic areas; 2 boat launches	Camping; picnicking; swimming; hiking
Lake Entiat	Chelan PUD; Washington SPRC; Cities of Chelan Falls and Entiat; Port of Douglas County	276 campsites; 7 boat launches; 7 picnic areas; visitor center with fish viewing room	Camping; picnicking; swimming; boating; walking
Lake Chelan	Chelan PUD; NPS; Forest Service	435 campsites; 6 boat launches; 13 private marinas; 9 picnic areas	Camping; boating; fishing; hiking
Lake Pateros	Douglas PUD; Cities of Brewster, Pateros, and Bridgeport	43 campsites; 8 boat launches; 5 picnic areas; Wells dam Overlook	Camping; picnicking; boating; swimming
Rufus Wood Lake	Corps; Washington SPRC	Bridgeport State Park- (with 42 campsites); boat launch; 3 picnic areas; 2 visitor centers	Camping; picnicking; boating; swimming
Franklin D. Roosevelt Lake (lies within Lake Roosevelt National Recreation Area)	NPS; Colville; Spokane Tribe of Indians	1,000 campsites; 24 boat launches; 9 picnic areas; 2 interpretive facilities	Camping; boating; fishing
Sun Lakes Area	Washington SPRC; private	Sun Lakes State Park- (with 202 campsites); 8 boat launches; picnic area; interpretive facility	Camping; picnicking; boating; fishing; hiking; wildlife observation; horseback riding
Billy Clapp Lake	BOR; Washington DFW;	boat launch; picnic area	Boating; fishing; picnicking

Development	Provided By	Recreation Facilities	Recreational Use
	Washington SPRC		
Moses Lake	City of Moses Lake; Moses Lake Parks & Recreation Department; Washington DFW; Moses Lake Irrigation District	346 campsites; 7 boat launches; picnic area	Camping; boating; fishing; swimming; picnicking
Potholes reservoir	BOR; Washington DFW; private	326 campsites; 10 boat launches; 2 picnic areas	Camping; boating; fishing; swimming; picnicking
Lake Wallula	Corps; Washington SPRC; Benton and Franklin Counties; FWS; Cities of Pasco and Kennewick; private	135 campsites; 13 boat launches; 18 picnic areas; visitor center	Camping; boating; fishing; swimming; picnicking; hiking
Lake Sacajawea	Corps	158 campsites; 7 boat launches; 7 picnic areas; interpretive facility	Camping; boating; fishing; swimming; picnicking; hiking
Lake West	Corps; Port of Columbia; Washington SPRC	110 campsites; 5 boat launches; 2 picnic areas	Camping; boating; fishing; swimming; picnicking; hiking

(canoeing and kayaking) recreational boating occurs along the entire Hanford Reach.

Based on existing information and comments filed on the project, the Hanford Reach and associated habitat, along with the Monument, is a unique regional recreation resource due in part to its relatively undisturbed natural setting, migratory waterfowl, and its bass, salmon, sturgeon, and steelhead trout angling. Peak recreation use during the year occurs in the April to May fishing season; the August to October fishing season; and the fall (mid-October to mid-January) hunting season; however, other peak recreation use occurs during the summer sturgeon fishing season (Grant PUD, 2005). By letter filed December 30, 2003, the FWS states that recreational fishing opportunities for Pacific salmon, white sturgeon, and steelhead trout in the Hanford Reach draw an estimated 75,000 visitors annually. The Washington Department of Fisheries, *et al*. (1990) drew a similar conclusion regarding steelhead trout angling opportunities in the Hanford Reach.

Future (year 2020) participation in various recreation activities at the Monument indicates an increase, except for hunting which shows a minus 16 percent change. From 2000 to 2020 sightseeing (30 percent), camping (25 percent), hiking (24 percent), and fishing (14 percent) revealed positive changes in participation rates (FWS, 2002).

Public access to the Monument is limited to four of the six administrative units - - the Wahluke Unit; Vernita Bridge Unit; McGee Ranch/Riverlands Unit; and the River Corridor Unit. Big game and waterfowl hunters use certain areas of the Monument (primarily the Wahluke and River Corridor Units) for the fall hunting season. There are four boat launches that provide public access to the Columbia River: Vernita Bridge Unit; McGee Ranch/Riverlands Unit; and, the remaining two access points located within the Wahluke Unit at White Bluffs boat launch and at Parking Lot 7. The 800-acre Vernita Bridge Recreation Area, just north of the Vernita Bridge, is managed by the Washington DFW. The Vernita Bridge Recreation Area provides river access for fishing and boating. The White Bluffs boat launch has a single-lane concrete ramp and a developed parking area. The other boat launches are unimproved (gravel and/or dirt ramps) (FWS, 2002; Benton County Planning Department, 1998). Downstream from the Monument, public boat launches provide access to the 25,000-acre River Corridor Unit.

The Pacific Crest National Scenic Trail is located approximately 50 miles west of the Project. The State-designated Cross-State Trail route (known locally as the John Wayne Pioneer Trail) abuts the project boundary near the Town of Beverly (EDAW, Inc. 2000a). The trail extends approximately 110 miles from King County to the Columbia River just south of Wanapum dam, primarily along the former Chicago, Milwaukee, and St. Paul Railroad rights-of-way. The trail ends at the Beverly Junction approximately 2 miles south of Wanapum dam. In May 2002 the John Wayne Pioneer Trail was designated as a National Recreation Trail, which recognizes the trail as part of the United States national system of trails (Grant PUD, 2003). Besides hiking and other recreational opportunities, the trail is used for horseback riding. The Washington SPRC manages the John Wayne Pioneer Trail, while the Beverly Bridge and its components east of the Columbia River are managed by the Washington DNR.

By letters filed May 3 and 31, 2005, the Washington State Office of the Interagency Committee (IAC) and Washington DNR, respectively, comment that the .5-mile-long Beverly Bridge is a link between the western and eastern portion of the John Wayne Pioneer Trail, and due to current bridge conditions and concerns for public safety, the bridge is closed to public use. Interstate-90 (I-90) is the only other public crossing of the Columbia River. The IAC (1995) identified walking as the most popular and rapidly-growing outdoor recreation activity, and a need for connecting non-motorized trails, such as the Cross-State Trail.

The Gorge Amphitheater is situated on a high bluff above Wanapum reservoir and outside the existing Project boundary. The Gorge Amphitheater has 20 to 25 concerts or events per year in which an estimated 20,000 visitors attend per concert or event, thereby contributing to the recreational use of the region. A new campground, located adjacent to the amphitheater, will provide up to 7,800 campsites with limited facilities (portable toilets, no hook-ups) (EDAW, Inc., 2000). Grant PUD (2003) notes that a new outdoor concert venue, the White River Amphitheater located in Auburn, Washington, provides a second venue for concerts or events in the Pacific Northwest. Thus, a shift in future visitors from the Gorge Amphitheater to the White River Amphitheater may occur, thereby causing a decrease in visitors to the project area.

Public access to the regional recreation resources, as well as to the local recreation resources discussed below, is available via I-90, SR 243, SR 24, and SR 26. Grant PUD (2005) notes that Washington Department of Transportation (Washington DOT) manages a highway rest stop on SR 24 along the Columbia River and adjacent to Vernita Bridge. Facilities include parking, restrooms, picnic area, and informational signs. A user-defined pedestrian access to the river is also provided. Access to and use of Wanapum reservoir is concentrated in the I-90 corridor and at Crescent Bar Resort and Sunland Estates. Downstream from Wanapum dam, the Columbia River flow through Sentinel Gap, which is a geological landmark formed by the river through Saddle Mountains, and continues parallel to SR 243.

Recreation Resources within the Priest Rapids Project Area

The Priest Rapids Project area[97] contains developed and undeveloped recreation

[97] For recreation resources, the term “project area” includes all lands within the existing

sites, of which 23 sites are located along Wanapum reservoir and 12 sites are located along Priest Rapids reservoir. The sites are described in detail in the Final Recreation Site and Facility Inventory conducted by EDAW, Inc. (2000a). The undeveloped dispersed recreation sites provide day-use for picnicking, hiking, boating, fishing, hunting, and swimming (EDAW, Inc., 2000a). At some of these recreation sites, boaters also camp (EDAW, Inc., 2001). EDAW, Inc. (2000a) notes that Sentinel Gap was excluded from the inventory because the majority of users are migrant farm workers camping at the site; thus, use of this site is not related to recreation as an activity. Beverly Dunes ORV Park also was excluded because recreation at the site is not related to the project. In comments on the draft EIS, Washington DNR states that Beverly Sand Dunes ORV Park provides a campground, restrooms, trash receptacles, and areas for picnicking, horseback riding, and ORV use. Washington DNR believes the park is associated with the project because of the recreational opportunities it provides.

Developed Recreation Facilities

At Wanapum reservoir there are 11 developed recreation facilities, including parking. In particular, the Wanapum dam Overlook is situated on a hill overlooking Wanapum dam and the surrounding landscape. Views from this location are panoramic and spectacular (Grant PUD, 2003). An interpretive center, which is part of the Ginkgo/Wanapum State Park, also overlooks Wanapum reservoir and the landscape. At the state park, there is a 3-mile-long interpretive hiking trail through a prehistoric lakebed, a portion of which exhibits petrified wood (EDAW, Inc., 2002). These facilities and some of their amenities are listed below.

(1) Wanapum dam Picnic Area (Grant PUD)
(2) Wanapum dam Heritage Center (Grant PUD)
- museum, fish ladder with viewing room, restrooms, trash receptacles

(3) Wanapum dam Upper Boat Launch (Grant PUD)
(4) Wanapum dam Overlook (Grant PUD)
(5) Getty's Cove Campground and Boat Launch (privately owned and operated)
- 130 campsites, restrooms, boat launch, swimming area with beach

(6) Ginkgo/Wanapum State Park (Washington SPRC operated/Grant PUD owned)
- 50 campsites, restrooms, picnic area, boat launch, concession stand, interpretive center

(7) Kittitas County Boat Launch (Kittitas County operated/Grant PUD owned)
- boat launch, picnic area, restrooms, 2 vault toilets, trash

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Priest Rapids Project boundary. In addition to developed recreation sites, there are shoreline dispersed undeveloped day use and overnight sites that are included in the project area (Public Utility District No.2 of Grant County, Washington, 2003, at page E7-3).

receptacle/dumpsters

(8) Riverstone Resort Campground and Marina (privately operated/Grant PUD owned)
- 32 tent sites, restrooms, marina, playground area

(9) Frenchman Coulee Boat Launch (Grant PUD/Washington DFW)
- boat launch, signs.

(10) Sunland Estates Boat Launch (Washington DFW operated/BLM owned)
- boat launch, portable toilet, signs

(11) Crescent Bar Resort (privately operated/Grant PUD owned)
- 35 tent sites, picnic area, beach, boat launch and fuel dock, restrooms.

At Priest Rapids reservoir there are three developed recreation facilities, including parking. These facilities and some of their amenities are listed below. EDAW, Inc. (2000a) notes that migrant farm workers camp at Buckshot Ranch, located at the Priest Rapids Wildlife Area.

(1) Desert Aire (privately operated/Grant PUD owned)
- 34 campsites, 2 boat launches, swimming area and beach, portable toilet

(2) Buckshot Ranch (Washington DFW operated/Grant PUD owned)
- day-use area, boat launch, dispersed camping area

(3) Wanapum dam Lower Boat Launch (Grant PUD)
- provides boater access to Wanapum dam tailrace area and Priest Rapids reservoir; contains a boat launch, 2 portable toilets, signs.

Undeveloped Dispersed Recreation Sites

Public use of undeveloped dispersed recreation sites consists primarily of individuals who access the shoreline for picnicking, wildlife observation, swimming, or fishing. For example, the Priest Rapids tailrace area and the river reach extending outside the existing project boundary are used during the fall Chinook salmon fishing season. Three sites (Sand Hollow-South, Sand Hollow-North, and Crab Creek) contain various facilities, such as portable toilets (on a seasonal basis), trash receptacles, and dispersed campsites.

There are seven undeveloped dispersed recreation sites at or near Wanapum reservoir: (1) Black Sand Beach (Grant PUD); (2) McCumber Beach (Grant PUD); (3) Sand Hollow-South (Grant PUD); (4) Sand Hollow-North (BOR), just upstream from Sand Hollow-South; (5) Rocky Coulee (Grant PUD, Washington SPRC), accessed by Old Highway 10 West; (6) Quincy Wildlife Area (Washington DFW), located north of Sunland Estates; and (7) Quilomene Dune and Bay (Washington DFW). Black Sand Beach and Quilomene Dune and Bay are located on the western shoreline of Wanapum reservoir; both McCumber Beach and Sand Hollow-South are located on the eastern shoreline.

Four undeveloped dispersed recreation sites at or near Priest Rapids reservoir include: (1) Priest Rapids Tailrace (Grant PUD); (2) Goose Island (Washington DFW), about 1 mile upstream from Priest Rapids dam; (3) Haystack Rocks (BLM), just north of Sentinel Gap; and (4) Crab Creek (Grant PUD), near the town of Beverly. Grant PUD (2005) states that only the lower 5 miles of Crab Creek and its confluence with the Columbia River lies within the Project boundary.

Lower Crab Creek (RM 411) is a perennial stream that flows into the Columbia River. The lower Crab Creek area supports emergent wetlands and pond communities not observed elsewhere in the project vicinity (Framatome ANP, 2003). Various fish species occur within the Crab Creek sub-basin that provides angling opportunities. See section 3.5, *Aquatic Resources*, for a discussion. Recreation and ORV use occur throughout lower Crab Creek, which can exacerbate local noxious weeds infestations. See section 3.6, *Terrestrial Resources*, for further discussion.

Recent improvements to Crab Creek include the installation of wooden posts to limit vehicle access to the shoreline area, thereby protecting riparian habitat. EDAW, Inc. (2000a) notes that migrant farm workers camp at Crab Creek.

Recreation Use within the Priest Rapids Project Area

EDAW, Inc. (2000b), on behalf of Grant PUD, conducted a recreation study to identify and characterize recreation use within the Project boundary. The study area was defined as waters and adjacent lands within the project boundary and recreation facilities within and adjacent to the project boundary. The study area also included four privately operated recreation areas- -Crescent Bar Resort, Getty's Cove Campground and Boat Launch, Riverstone Resort Campground and Marina, and Desert Aire. EDAW, Inc. also compared the 1999 data with earlier survey data collected in 1996.

The findings from the 1999 survey indicate that: (1) Wanapaum reservoir is both the larger and more heavily used of the two reservoirs -- over 900 boats were observed on Wanapum reservoir during one day of the July 4 weekend; in contrast, 21 boats were observed on Priest Rapids reservoir; (2) although recreational use in the study area is high at times, visitors to the area did not feel overly crowded; (3) Crescent Bar Resort and the boat-in site at Quilomene Dune were perceived to be more crowded than other sites; (4) the most common activities included swimming (82 percent) followed by resting/relaxing (70.4 percent), camping (61.7 percent), power-boating (54.0 percent), picnicking (51.8 percent), and water-skiing (46.7 percent); and (5) the majority of visitors surveyed live in the Central Puget Sound area (King, Kitsap, Pierce, and Snohomish Counties), with King

County residents leading in visitation at 42 percent. Sixteen percent of the visitors surveyed came from the counties within and bordering the study area.

Hunting and fishing are popular recreation activities in the project area, particularly during the fall season at which time, fish runs (primarily Chinook salmon and steelhead trout) and waterfowl hunting occur. In the Priest Rapids tailrace salmon fishing is popular with 1,050 recreation visitor days[98] (1996 data). The 1996 estimate includes an approximate 210 overnight stays. At waterfowl hunting areas, an estimated 300 recreation visitor days occurred on Priest Rapids reservoir and 700 recreation visitor days occurred on Wanapum reservoir (Grant PUD, 2003).

Some major findings in comparing the 1999 data with earlier survey data collected in 1996 indicate that: (1) the percentage of visitors from the Central Puget Sound area has increased from 51 percent to 73 percent; (2) overall recreational use has increased accordingly since 1996- -campgrounds (32 percent); car accessible day use sites (13 percent); boat accessible day use sites (105 percent); and boat use on Wanapum reservoir (111 percent); and (3) there were an estimated 294,800 recreation visitor days in the study area in 1999- -a 24 percent increase in recreation visitor days (1996-1999).

EDAW, Inc. (2000c), on behalf of Grant PUD, conducted a recreation capacity analysis to assess recreation capacity and identify limiting factors at 15 representative sites. The study area was defined as the Priest Rapids reservoir and Wanapum reservoir and the recreation facilities and sites immediately adjacent to the reservoirs.

In relation to the findings from the 1999 survey (EDAW, Inc., 2000b) discussed above, the recreation capacity analysis finds that 65 percent of the boating activity on Wanapum reservoir occurred at Crescent Bar and Quilomene Dune and Bay areas. Boating use, therefore, was not evenly dispersed on the reservoir. Survey results also indicate that recreation use of Wanapum reservoir is higher than that at Priest Rapids reservoir, due in part to the reservoir's size, proximity to I-90 and The Gorge Amphitheater, and more existing recreation facilities. Other findings of the survey indicate that: (1) the primary limiting factor at Wanapum reservoir is facility capacity (*e.g.*, the number of existing parking spaces, campsites); (2) of the 15 representative sites assessed, use levels at most facilities (9 sites or 60 percent) were below or approaching their capacity levels; of the remaining sites, one site (under 7 percent) was at capacity and five sites (33 percent) were exceeding capacity; and (3) most of the sites analyzed had more than one limiting factor (*e.g.*, physical/facility) for recreation capacity.

The six sites where use levels were at or exceeding capacity are: Getty's Cove

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[98] Recreation user day/night - each visit by a person to a development for recreational purposes during any portion of a 24-hour period.

Campground and Boat Launch; Wanapum Recreation Area; Ginkgo/Wanapum State Park (campground and day-use area); Sand Hollow-South; Quilomene Dune; and Crescent Bar Resort (campground). For further discussion, see EDAW, Inc. (2000c).

In a filing of December 29, 2003, the Yakama comment that the heaviest recreational use area in the project, Quilomene Dune, was and remains one of the most culturally sensitive areas of concern to the Yakama. Further, the Yakama state that Quilomene Dune is located on the west side of the Columbia River and somewhat protected from the wind and wave erosion occurring on the east side of the river; however, allowing the number of boats in the area without any regulation for wake size creates significant and on-going shoreline erosion.

In comments on the draft EIS, Pat Kelleher referenced recreation use within the project boundary as noted on Grant PUD's 2002 FERC Form-80 Recreation Report. The recreation user day/night figures are as follows: (1) at Wanapum development (a) 241,563 day visits and (b) 112,280 night visits; and (2) at Priest development (a) 43,925 day visits and (b) 24,005 night visits. Thus, the total number of visitors to Wanapum development is 353,843 and to the Priest development is 67,930, for a combined total of 421,773.

Land Use

There are seven hydroelectric projects and appurtenant facilities located on the mid-Columbia River. These projects, from upstream to downstream, are: (1) Grand Coulee dam; (2) Chief Joseph dam; (3) Wells dam; (4) Rocky Reach dam; (5) Rock Island dam; (6) Wanapum dam; and (7) Priest Rapids dam (Washington Department of Fisheries, *et al*., 1990). Numerous transmission lines traverse the region, carrying electricity from the mid-Columbia hydropower projects to the metropolitan areas (Grant PUD, 2003).

Much of the region, however, is lightly developed or undeveloped and retains a natural setting. Section 3.6, *Terrestrial Resources*, herein discusses the vegetative cover types and distributions that contribute to the land use and aesthetic character. Climate and topography can have an influence on the aesthetic characteristics of the region, as well as, land uses can influence the region's aesthetic character. Since the development of Grand Coulee dam and the Columbia Basin Irrigation Project, numerous wetlands have been created by impoundments, rising water tables, seepage, and irrigation activities (BOR, 1998).

In addition to the hydroelectric projects, some of the other land uses include residential communities and/or commercial development; a 261,000-acre U.S. Department of the Army, Yakima Training Center (located to the west of the Hanford

Site); recreation facilities and public access; livestock grazing; and agriculture. Over 600,000 acres of agricultural land in the Columbia River Basin are irrigated by the BOR Columbia Basin Irrigation Project. See section 3.10, *Socioeconomics*, for further discussion.

The Hanford Site consists of mostly undeveloped land, with industrial buildings located along the western shoreline of the Columbia River and in the interior of the site. The industrial buildings are interconnected by roads, railroads, and electric transmission lines. The major facilities and operations support occupy an estimated 6 percent of the total available land area (DOE, 1999).

There are six residential communities adjacent to the project reservoirs: Crescent Bar, Sunland Estates, and Vantage are located near Wanapum reservoir, while the communities of Beverly, Schwana, and Desert Aire are located near Priest Rapids reservoir. Public recreation facilities are provided at or near the residential communities (Grant PUD, 2003). The Wanapum Village occupies land adjacent to Priest Rapids dam. See section 3.10, *Socioeconomics*, for further discussion.

Private homes at Sunland Estates have been constructed in close proximity to the boundary of the Wanapum development, 100 feet to 300 feet from the high water elevation of the reservoir. The town of Vantage is situated on a high cliff above Wanapum reservoir. Public recreation facilities include a RV campground, an interpretive center, and the Kittitas County boat launch. The Riverstone Resort Campground and Marina is a popular campground on Wanapum reservoir. The resort currently has a permit that allows use of Grant PUD-owned shoreline within the project boundary for recreation use. At Desert Aire the RV campground and boat launch are both operated under permit from Grant PUD to the Desert Aire Home Owner's Association.

Grant PUD-owned land within the project boundary consists of 4,490 acres. Grant PUD (2003) manages these lands and waters for the project facilities and issuances of permits, leases, and easements to other agencies and individuals for use and occupancy of project lands or waters consistent with project operation. The project occupies an estimated total 3,103.69 acres of federal land and 2,804 acres of state land (Table 30).

Also, there are an estimated 2,291 acres of private shoreline land, within the project boundary, which for most of it Grant PUD maintains flowage easements for project operations.

Grant PUD (2003b) assigned a land use classification to all lands and waters within the existing project boundary. These classifications include the following: (1) Project Facilities- -lands primarily used for electric power generation, transmission, and

Table 30. Federal and State lands within the Priest Rapids Project Boundary (Source: Grant PUD, Washington, 2003).

Federal Lands	**Acres**
BOR	1,874.79
BLM	748.85
U.S. Department of the Army	378.98
FWS	49.83
DOE	51.24
Total Federal Lands	3,103.69
State Lands	
Washington DFW	2,490.0
Washington DNR	290.0
Washington SPRC	24.0
Total State Lands	2,804.0

associated project-related facilities, and lands with the potential for such uses in the future; (2) Conservation- -contains fish, wildlife, scenic, historic and/or archaeological resources that have exceptional and specific value(s) that require protection; (3) Agriculture- -lands used for commercial agricultural purposes; (4) Public Recreation (dispersed)- -includes dispersed recreation use sites; (5) Public Recreation (general development)- -lands with developed recreation facilities that are used by the public and lands identified as appropriate for future public recreation development as needed; (6) Single-family Residential- -lands adjacent to existing or planned future residential areas not designated as planned development; and (7) Planned Development- -lands where intensive residential, vacation home, and/or commercial development have occurred (or could occur in the future) within or adjacent to the project. The acres for each classification are listed in Table 31.

EDAW, Inc. (2002) notes there are six Washington DFW wildlife areas (WA) adjacent to or in close proximity to the Columbia River and within the project area: (1) Colockum WA; (2) Quilomene WA; (3) Whiskey Dick WA; (4) Quincy WA; (5) Priest Rapids WA; and (6) Lower Crab Creek WA. While the Washington DFW manages wildlife areas to protect specific wildlife species or habitats, opportunities for fishing, hiking, wildlife observation, camping, and picnicking occur. Most of the areas have undeveloped dirt roads, and undeveloped trails for hiking. See section 3.6, *Terrestrial Resources*, for further discussion.

Some of the land use on or in the vicinity of the BOR “scattered tracts” include wildlife habitat, agriculture, livestock grazing, material extraction (clay, sand, and gravel), and recreation. Hunting (waterfowl and upland game) and fishing are the primary recreational uses. The BOR finds that the visual quality of the scattered is

Table 31. Land Use Classifications in the Priest Rapids Project Boundary (Source: Grant PUD, Washington, 2003b).

Land Use Classification	Acres
Project Facilities	4,710[99]
Conservation	3,021
Agriculture	1,124
Public Recreation – Dispersed	3,250
Public Recreation - General Development	375
Single-family Residential	112
Planned Development	361

influenced by the: (1) size of the tract; (2) type of land cover; (3) condition of the habitat; (4) land use practices, such as livestock grazing, material extraction, and ORV use; and (5) surrounding land use, such as the presence of other undeveloped land (BOR, 1998). The scattered tracts range in size from 0.27 acre to 6,400 acres. Of the estimated total 308 scattered tracts, 200 scattered tracts totaling 62,000 acres provide access for agriculture, livestock grazing, material extraction, and recreational activities. Further, BOR (1998) notes that livestock grazing is a primary land use in which large areas of open land occur (primarily shrub steppe/grassland) are used for grazing.

Grant PUD (2003) states that six scattered tracts are adjacent to the project reservoirs. Several other parcels are traversed by the project transmission line right-of-way corridor. In particular, Grant PUD states that the scattered tract located near Sand Hollow-North (BOR-owned parcel) has been identified for future recreation use in its draft Recreation Plan. The Sand Hollow-North scattered tract is known to have high quality shrub-steppe habitat, thereby possibly limiting future recreation development. At Sand Hollow-North, the shoreline in the area is managed for dispersed recreation use and resource protection.

At the scoping meeting, Ron Sawyer, who owns two marinas- -one in Moses Lake and one in Pasco- -stated that the Columbia Basin Hatchery was constructed to mitigate for fish lost as a result from construction of the Project and commented on the need to improve the hatchery.

In response to Washington DFW, filed July 8, 2005, Grant PUD notes the primary use of the Columbia Basin Hatchery is for the enhancement of recreational trout fisheries

[99] We note that a difference in acres may exist for Project Facilities because Grant PUD (2003) cites 4,490 acres and in its 2003(b) document cites 4,710. In comments on the draft EIS, Grant PUD clarified the 4,490 acres refer to the acres in fee title ownership, not to lands classified as Project Facilities in its draft Shoreline Management Plan.

not associated with the Project. Washington DFW owns and operates the Columbia Basin Hatchery. Grant PUD proposes a 1:1 match up to $100,000 per year in order to increase and improve the facility. The funding for the hatchery, as included in the original license, was agreed upon by Grant PUD and Washington DFW. For further discussion see section 3.5, *Aquatic Resources*.

By letter filed May 10, 2004, Grant County Tourism Commission comments that Grant PUD has included the Columbia Basin Hatchery and other facilities and programs that mitigate impacts attributed to the Project. This entity further recognizes the importance of the fishing industry that provides jobs and contributes to the local economy. Grant County Tourism Commission views Grant PUD as its partner in economic viability.

At the scoping meeting, Bill Burke spoke on behalf of Grant County Tourism Commission and stated that an estimated 45 percent of visitors to Grant County fish and an estimated 2,500 jobs in the county are created through tourism. Bill Burke noted the importance of fishing to the tourism industry of Grant County. Local taxes raised amount to an estimated $1.8 million. Other commentors at the scoping meeting spoke on the importance of fishing to Grant County and surrounding areas, as well as its tax base derived from recreation-related expenditures. In comments on the draft EIS, the Port of Mattawa stated that development of new recreation facilities, as proposed by Grant PUD, would encourage people to visit the area and as a result, employment opportunities could be realized. For further discussion see section 3.10, *Socioeconomics*.

3.9.2 Environmental Effects and Recommendations

Although the project is located within an area that offers a wide range of recreational opportunities, data (Interagency Committee for Outdoor Recreation, 2002) indicates that most recreation use generally occurs close to home; however, as previously discussed, an estimated 73 percent of recreation users at the project are from the Central Puget Sound area. As a result, existing recreation facilities are being utilized to capacity, while at the same time the public expresses a need to preserve larger parcels of natural settings for dispersed recreation, and habitat for salmon and wildlife.

Recreation Needs

A study (EDAW, Inc. 2001a) identified recreation needs, both existing (current to 2005) and future (2005 to 2035, in 10-year increments). The study area included all waters and adjacent lands within the existing project boundary and all recreation resources within and adjacent to the project boundary. The study included developed and dispersed recreation sites, public and private managed sites. In summary, results indicate that the following additional facilities would be needed by 2035 to accommodate future demand: (1) an estimated total 226 campsites; (2) a total of 65 picnic sites; (3) a total of approximately four to six new boat ramp lanes; (4) one new designated swimming area; (5) interpretive signs and programs at campgrounds and day-use sites; (6) designated trails; (7) one to three new fishing piers; (8) designated wildlife viewing areas, such as Watchable Wildlife Sites; and (9) barrier-free facilities.

The public views lack of physical access to land and water as a more critical issue than lack of supply (Interagency Committee for Outdoor Recreation, 2002). The IAC (1995) finds that development of water access should address pedestrian facilities, such as footpaths or trails, picnic sites, hand launch facilities, and view points with interpretive features.

Terry Garrick, in a filing of May 31, 2005, refers to the angler community who supports a need for the fishing access site and boat launch at Huntzinger Road, as well as, recommends a boat launch and fishing pier in the Crab Creek/Beverly area. In addition, the filing recommends a fishing pier at each of the project's two reservoirs and boating access to the tailrace of Priest Rapids dam. Terry Garrick also states that while the "angler community" supports improvements at the Lenice/Nunnally/Burkett Lakes area such improvement does not fulfill a recreational need for a fishing pier and boat launch access on Priest Rapids reservoir. In comments on the draft EIS, Terry Garrick reiterated his comments. In particular, he states the proposed barrier-free fishing pier at the Huntzinger Road Fishing Access Site would bring relief to anglers, who because of age or health concerns find launching a boat is no longer practical.

By letter filed May 10, 2004, Barry Truman requests that grant PUD mitigate for the loss of whitewater boating opportunity as a result of the construction and operation of the project. Mr. Truman states that the construction of the Project inundated 56 miles of the Columbia River.

In comments at the staff's April 19, 2006, public meeting and on the draft EIS, Pat Kelleher lists 10 recreation sites that need improvement: (1) Airstrip Site: (a) develop as a day-use park and (b) provide a trailhead at the site to Wanapum State Park trail; (2) Huntzinger Road Boat Launch: identify the boat launch in recreational surveys and on the FERC Form-80; (3) Priest Rapids Tailrace Boat Launch: (a) extend the project boundary to include the boat launch and (b) provide O&M costs; (4) Beverly Bridge deck/trail head/Crab Creek: (a) deck the Beverly Bridge, (b) provide a trailhead at State Highway 243, (c) provide a kiosk for the Ice Age Floods, (d) provide an information kiosk as a gateway to the Crab Creek recreation area, fishing at Burkett Lake, Lenice, Mary, Nunnually, and Washington DNR ORV Park, and (e) develop a small park; (5) Kittitas County Boat Launch: (a) extend the boat launch and (b) extend the project boundary to accommodate additional parking; (6) Desert Aire; (7) Huntzinger Road Fishing Access Site: construct a fishing pier; (8) Apricot Orchard Boat Launch: harden dispersed camp sites; (9) Wanapum State Park: (a) extend the project boundary to include the state park and Black Sand Beach, (b) provide for boat-in camping at Black Sand Beach to relieve pressure at Quilomene Bay, and (c) provide a trailhead at the site to Airstrip Site; and (10) Sand Hollow-South: (a) continue to manage the site as a primitive campsite; (b) harden trails and dispersed campsites; (c) initiate an annual public clean-up day; and (d) provide potable water. Further, Grant PUD should install signs at the project including along the project shoreline that denote sites for public access (*i.e*., at Burkett Lake) and identify recreation sites (*i.e*., Apricot Orchards Boat Launch) on project-related recreation signs.

In comments on the draft EIS, Tom Foster noted the importance of the Ice Age Floods in the topography of the project area and suggested numerous interpretive opportunities at the project that could depict the Ice Age Floods. For example, an interpretive sign could describe the Ice Age Floods role in creating the opportunity for water storage above the project dams, as well as, its role in providing the materials used to construct the dams.

Our Analysis

We assess recreation needs and address Terry Garrick's, Pat Kelleher's, and Tom Foster's comments throughout the Recreation and Land Use section. In response to Barry Truman's comment, our environmental analysis takes into account past, present, and reasonably foreseeable future actions, pursuant to NEPA. The discussion of past effects is in the context of historical changes in the resource where existing information exists; recognizing the data describing past conditions are usually scarce, the analysis of past effects is often qualitative. In a relicense the Commission evaluates and considers the appropriateness of requiring enhancement measures in the context of today's environment and in relation to today's needs and problems, not in the context of the world as it existed 50 years ago.[100] Therefore, the basis for our enhancement measures are evaluated and developed in the context of the existing project and the environment. We, therefore, do not find it necessary for Grant PUD to mitigate for the loss of whitewater boating opportunities.

Grant PUD's Proposed Measures

A Recreation Opportunities and Constraints Analysis (EDAW, Inc., 2001) was conducted to identify potential sites for accommodating existing and/or future recreation needs at the project and in the project vicinity. The results of the study were taken into account during development of the draft Recreation Plan, dated August 2003, and the subsequent measures are identified below.

[100] 47 FERC 61,225 (1989).

To enhance the recreation resources and to address future recreation needs, Grant PUD proposes to finalize its draft Recreation Plan for the project. The draft Recreation Plan was developed based on stakeholder input and on various studies conducted. The plan contains six programs: (1) recreation facility development; (2) recreation operations and maintenance; (3) recreation monitoring; (4) resource integration and coordination; (5) plan review and revision; and (6) interpretation and education. In particular, the Interpretation & Education Program would provide a system of interpretive and educational signs, kiosks, and brochures, and therefore improve public information.

The draft Recreation Plan identifies recreation opportunities and needs along the mid-Columbia River, within or adjacent to the existing project boundary. In a filing of July 8, 2005, and in response to Washington DNR and Washington SPRC, Grant PUD proposes to contribute an estimated $300,000 per year in O&M toward cooperating with local, state, and federal agencies in developing, operating, and maintaining facilities for recreational use of public land administered by those agencies adjacent to the project.

Table 32 identifies the proposed recreation measures. Crescent Bar Resort, Desert Aire, Getty's Cove Campground and Boat Launch, and Riverstone Resort Campground and Marina are privately operated recreation areas.

The 300-acre Beverly Sand Dunes ORV Park, owned and operated by Washington DNR, is a popular destination for ORV riders with peak use occurring in spring. Camping and picnicking may occur along with ORV use. Grant PUD proposes to contribute up to $3,000 per year for O&M at the Beverly Sand Dunes ORV Park, which Washington DNR supports. This effort would entail periodically monitoring Beverly Sand Dunes ORV Park for containment of ORV use, impacts of overnight use, and litter control. Grant PUD would also cooperate with Washington DNR to maintain fencing, barriers and/or signs (as needed) where ORV use may access sensitive shoreline areas and potentially cause damage outside the park (letter filed July 8, 2005, responding to Washington DNR from Laurel Heacock, Manager, Licensing and Regulatory Compliance, Grant PUD, Washington).

The proposed recreation facilities (Table 32) are summarized in Table 33 by activity. There are restrooms with showers and vault toilets. These facilities are in addition to the existing public access sites and recreation facilities. Study results (EDAW, Inc., 2001) indicate that by the year 2035 demand for interpretation and education is projected to increase significantly, *e.g.* 87 percent for visiting interpretive displays. Most of the existing interpretation and education facilities are underutilized. Increased visitor awareness of these facilities, through additional signs, brochures, and programs, could improve the overall recreational experience.

Table 32. Proposed Recreation Measures for the Priest Rapids Project (Source: Grant PUD, Washington, 2003, as modified by Staff).

Recreation Site	New Developed Campsites	New Primitive Campsites	Boat Launches	New Picnic Sites (Tables)	New Swimming Areas	New I&E Program Signs/Kiosks	Other New Facilities or Comments
Airstrip Site	100	10	1	25	1	2 kiosks 1 sign	Located south of the Vantage Bridge in Kittitas County, Washington; barrier-free fishing pier; reroute entrance road to south; vault toilets; restroom with showers; trail connection.
Apricot Orchard Boat Launch			Renovation			1 sign	1 single-vault toilet.
Beverly Sand Dunes OHV Park							Work with Washington DNR to provide monitoring and management assistance at Beverly Dunes OHV Park; provide site barriers.
Buckshot Ranch Boat Launch						1 sign	1 hand boat launch;1 single vault toilet; provide barrier-free hunting blind and trail on north end of site.
Crab Creek Corridor						2 kiosks, Watchable Wildlife sites (WW)	2 hand boat launches; 2 single vault toilets; barrier-free fishing pier; a water trail from the Crab Creek 5-mile bridge to a take-out at Crab Creek Park; interpretive loop trail and connections to Nunnally Lake and the Milwaukee Road Corridor (1 mile from Beverly).

Recreation Site	New Developed Campsites	New Primitive Campsites	Boat Launches	New Picnic Sites (Tables)	New Swimming Areas	New I&E Program Signs/Kiosks	Other New Facilities or Comments
Crescent Bar Resort	-6		Renovation, extension	15	Expansion	2 kiosks	1 restroom with shower; vault toilet; fuel dock renovation; improve access roads & parking lots; stripe & asphalt boat launch parking lot; channel dredging; trail connection.
Desert Aire			Renovation, extension			1 sign	Located 12 miles from Beverly; campground and day-use area; 1 double-vault toilet; new jetty; trail connection.
Frenchman Coulee Boat Launch			Renovation	5		1 sign	1 single vault toilet; improve jetty; trail connection.
Getty's Cove Campground and Boat Launch	-130				1	1 sign	1 hand boat launch; 1 double vault toilet; moorage next to launch trail connection. Assumes the 130 existing campsites are reconfigured to protect habitat.
Huntzinger Road Boat Launch			1			1 sign	1 single vault toilet; boat launch extended to low pool for year-round access (requires further study).
Huntzinger Road Fishing Access Site						1 sign	1 single vault toilet; barrier-free fishing pier; formalize gravel pullout for parking.
Kittitas County Boat Launch			Renovation	5		1 sign	Expand parking; existing (new) toilets/restroom; trail connection.
Wanapum dam Lower Boat Launch			Renovation, extension			1 sign	1 single vault toilet; boat launch extended to low pool

Recreation Site	New Developed Campsites	New Primitive Campsites	Boat Launches	New Picnic Sites (Tables)	New Swimming Areas	New I&E Program Signs/Kiosks	Other New Facilities or Comments
							for year-round access (requires further study); provide boarding float.
Mattawa RV/Farm Worker Campground	70					1 sign	Located less than 8 miles from Beverly; Grant PUD proposes to provide funding for a shared use RV/Farm Worker Campground on Port of Mattawa-owned land; 3 restrooms with showers.
Priest Rapids Park				15	1	1 sign	Located 10 miles from Beverly; day-use area; 1 double vault toilet; trail linkage to Desert Aire.
Rocky Coulee		10		5		1 kiosk	1 hand boat launch; vault toilets; trail connection.
Sand Hollow-North				10		1 kiosk, 1 sign	1 double vault; improve parking and internal trails.
Sand Hollow-South	30	10		5	1	1 kiosk	4 double vault toilets.
Sunland Estates Boat Launch			Renovation			1 sign	1 double vault toilet; improve access road & parking.
Priest Rapids Tailrace		10				1 sign	Located along the eastern shoreline below Priest Rapids dam; 2 single vault toilets; improve road access.
Sunland Estates Day Use Area				5	1	1 sign	1 double vault toilet; new gravel access road & parking; resolve access rights.
Wanapum dam Upper Boat Launch			Renovation			1 sign	1 single vault toilet; expand parking at boat launch; barrier-free boarding float.
Riverstone Resort	75						New fuel dock/moorage; all

Recreation Site	New Developed Campsites	New Primitive Campsites	Boat Launches	New Picnic Sites (Tables)	New Swimming Areas	New I&E Program Signs/Kiosks	Other New Facilities or Comments
Campground and Marina							actions by private owner; trail connection.
Wanapum dam Heritage Center							Improve barrier-free access; interior of existing museum may be renovated.
Wanapum dam Overlook				3		1 sign	1 single vault toilet; improve road & parking area.
Wanapum dam Picnic Area				5		1 sign	1 double vault toilet; new gravel parking.
Wanapum Recreation Area	70		Renovation, extension	25	Expansion & barrier-free	2 kiosks, 1 sign	Located 4 miles south from Kittitas County Boat Launch; 3 restrooms with showers; 3 single vault toilets; potential day use expansion north of boat launch; expand boat launch lane to low pool level; trail connection.
Dispersed Shoreline Sites		Potential hardening, if needed (or closure)					Potential toilets, if needed.

Table 33. Summary of Proposed Recreation Facilities by Activity for the Priest Rapids Project (Source: Grant PUD, Washington, 2003a, as modified by the staff).

Recreation Activity	**Summary of Recreation Facilities**
Boating	2 new boat launches with 4 lanes, 9 renovations, 4 extensions; 5 hand boat launch sites; new directional and informational signs
Swimming	5 new swimming areas, 2 expanded swimming areas, 1 barrier-free swimming area.
Fishing	3 new fishing piers or platforms; 2 new boat launches with 4 lanes, 8 renovations, 3 extensions.
Hiking, biking, and other non-motorized trail uses	30 new miles of trail in 7 areas with connections to 12 existing or proposed recreation sites.
Interpretation & Education Facilities	11 new kiosks, 22 new signs.
Camping	Up to approximately 209 new developed RV and tent campsites, 40 new primitive walk-in sites, 4 new group sites with 64 total campsites, and barrier-free campsites.
Picnicking	128 new picnic tables.
Hunting, wildlife observation, and other uses of open space	Maintenance and management of shoreline access sites; 1 barrier-free hunting blind, hunting blind management, new directional and informational signs.

By letter dated May 27, 2004, CRITFC recommendation no. 19 states that Grant PUD should, as a component of a public awareness program, place signs regarding protection of cultural resources in heavily used recreation areas, such as campgrounds,boat launches, as well as dispersed recreation sites within the project area and the Hanford Reach. In addition, Grant PUD should make an effort to discourage use of dispersed recreation sites that are known to impact cultural resources.

In a filing of March 24, 2006, Interior recommends, pursuant to section 10(a) of the FPA, that Grant PUD implement a Recreation Plan [101] on BOR administered lands within the existing project boundary in order to protect terrestrial resources at Sand Hollow-North, in the vicinity of Wanapum dam, and along Crab Creek. A provision of the plan would exclude ORV use in these areas because of increased visitor use and excluding ORV use would minimize adverse environmental effects. BOR through Interior states that if Grant PUD's Recreation Plan is not adopted then BOR's said recommendation would protect its interests.

Our Analysis

Grant PUD's proposed recreation measures would enhance 15 recreation sites, as well as maintenance at and monitoring of publicly-owned areas where dispersed recreation occurs. Grant PUD (2003) proposes an estimated $20 million for recreation measures at the project and in its vicinity over a period of 30 years. The estimated costs do not include costs associated with land acquisition or capital facilities costs for years 2036-2055 of the new license (years 31 to 50). The proposed measures would also entail a project-wide Interpretation & Education Program and support for law enforcement at the project.

Furthermore, Grant PUD's proposed recreation measures with additional staff-recommended measures, as discussed herein, would help meet Washington Department of Game's (1987) objectives for improving fishing access because: (1) existing sites (*e.g.*, Crescent Bar Island boat launch) would be redeveloped where inadequate size limits use; (2) additional bank fishing access would be developed (*e.g.*, installation of a barrier-free fishing pier at Huntzinger Road Fishing Access Site); and, (3) existing and new recreation facilities and public access sites would be maintained.

An estimated 1,874.8 acres of BOR-administered land are located within the project boundary. A separate Recreation Plan on BOR-administered lands within the project boundary would not be necessary because Grant PUD would develop and implement a final Recreation Plan for the project. The BOR's interests, therefore, would be met. We agree with BOR that a provision of Grant PUD's final Recreation Plan should be to exclude ORV use in agreed-upon identified areas in order to protect terrestrial resources and potential historic properties; however, we recognize that Grant PUD has direct management over only those lands within the existing project boundary that is Grant PUD-owned. See our discussion concerning Effects of Public Recreation

[101] In its March 24, 2006, filing, Interior's recommendation no. 3 is entitled, Shoreline Management Plan; however, Interior's justification for recommendation no. 3 is solely for a recreation plan. Since Interior previously recommended, in a May 26, 2005, filing pursuant to section 4(e) of the FPA, and provided justification for a recreation plan, we interpret Interior's recent recommendation is for a recreation plan.

Use on Undeveloped Dispersed Recreation Sites herein.

As part of Grant PUD's proposal to develop and implement an Interpretation & Education Program, we find CRITFC's recommendation reasonable; therefore, Grant PUD could install sign(s) at identified recreation sites within the existing project boundary to improve public awareness of and the need to protect cultural resources. Interpretive sign(s) could be implemented in conjunction with the interpretive component of the HPMP, which is a stipulation of the PA. The effort to discourage use of dispersed recreation sites that are known to impact cultural resources could be coordinated during implementation of the HPMP.

As previously discussed in section 3.3, *Geology and Soils*, the distinct geological features in the project area are a significant part of the project's appeal and aesthetic character. Therefore, we find the numerous interpretive opportunities offered by Tom Foster to depict the Ice Age Floods at the Project could assist Grant PUD, in consultation with the Land Use, Recreation, and Aesthetics Solution Group or a comparative work group established post-licensing, in developing and providing interpretation on the Ice Age Floods as a component of its Interpretation & Education Program. Consequently, a cumulative beneficial effect on recreation could occur by expanding upon existing coordinated Ice Age Floods interpretive programs within the mid-Columbia River Basin.

The Washington DFW-owned and managed Quilomene Dune and Bay is a popular recreation area with a boat-in site at Quilomene Dune. An estimated 1,000 to 1,500 visitors have been documented at the site. Boating capacity is an issue in the river reach, including Quilomene Dune and Bay (Grant PUD, 2003). To assist Washington DFW in managing Quilomene Dune and Bay as a day-use site, Grant PUD proposes to provide: (1) periodic monitoring and site clean-up and (2) annual O&M costs. In response to the Yakama comments on recreational use at Quilomene Dune and potential effects on culturally sensitive areas of concern to the Yakama, we recognize the projected increase of recreational use for the area and the need to protect environmental resources and potential historic properties. While we find that a final HPMP would take into account such impacts and those impacts would be lessened through measures, Grant PUD's final Recreation Plan would incorporate its proposal and, through a cooperative effort with Washington DFW, address recreational use at Quilomene Dune and Bay. For further discussion see section 3.6.2 and see section 5.0, *Staff's Conclusions*, for our recommendation.

The final Recreation Plan would be filed with the Commission for approval, and upon Commission approval, Grant PUD would be required to implement the plan. As part of the final Recreation Plan we suggest a map(s) be provided that would clearly delineate all public access and recreation facilities in relation to the existing project boundary. Based on comments on the draft EIS, we find that current signs denoting public access at project recreation sites should be re-evaluated for accuracy of information and updated, accordingly. Interpretive signs should be repaired, if necessary. Also, based on comments on the draft EIS, some project recreation sites may not have adequate signs to denote public access, such as at Burkett Lake. Therefore, Grant PUD should, in consultation with the Land Use, Recreation, and Aesthetics Solution Group or a comparative work group established post-licensing, re-evaluate the current project-related signs, including interpretive signs, and install signs at identified project recreation sites that would denote public access to the sites.

The final Recreation Plan would effectuate a continued effort among Grant PUD, BOR, Washington DFW, FWS, Washington SPRC, the affected tribes, and appropriate county to improve and enhance public access sites and recreation facilities. Through this coordinated effort, sensitive species and potential historic properties could be protected. The measures would help meet the projected demand for future recreation needs, as previously discussed. Consequently, a cumulative beneficial effect on recreation resources at the project and within the mid-Columbia River Basin would occur. Our recommendation regarding the Recreation Plan is discussed in section 5.0, *Staff's Conclusions*.

Pursuant to section 10(a) of the FPA, Interior through BLM recommends that Grant PUD: (1) develop a coordinated recreation and wildlife management plan; and (2) develop a recreation monitoring plan for intermingled lands that BLM administers and which are affected by project operations. An estimated 748.8 acres of BLM administered land is located within the project boundary. We discuss Interior's recommendation for a coordinated recreation and wildlife management plan in section 5.0, *Staff's Conclusions*.

Interior's recommendation for developing a recreation monitoring plan specifically for BLM-managed lands may provide a basis to address recreational use of federal lands within the existing project boundary. Recreational use monitoring and assessment of project-related effects on BLM lands as a component for gathering data for FERC Form 80-Recreation Report would allow Grant PUD and the interested parties to consider measures and address potential environmental and cultural resources concerns due to project-related recreational use.

Due to the potential for increased recreation demand at the project and due to the proximity of the project to nearby population centers, Grant PUD should monitor recreation use to determine the adequacy of the proposed facilities to meet recreation demand. Information collected and filed pursuant to the reporting requirements for FERC Form 80-Recreation Report, section 8.11 of the Commission's regulations, may be used in the monitoring program.

The IAC recommends, in its filing of May 3, 2005, that the Recreation Plan be reviewed and amended, at a minimum, every 15 years through the life of the license. We note on page 8 of the draft Recreation Plan that Grant PUD proposes to review and update, if necessary, the Recreation Plan every 12 years. We find that reviewing and updating the Recreation Plan every 12 years would provide an opportunity to factor in two cycles of recreation data collected and filed with the Commission every 6 years, pursuant to the reporting requirements for FERC Form 80-Recreation Report, section 8.11 of the Commission's regulations. Grant PUD's timeframe, therefore, is reasonable and should satisfy the IAC.

Existing Priest Rapids Project Boundary

In a filing of May 31, 2005, Pat Kelleher provided a variety of recommendations, including 20 measures specific to RM 460 (Columbia River Siding Area) through RM 397 (Priest Rapids dam tailrace). In general and regard to the existing project boundary, Pat Kelleher recommends that Grant PUD purchase Kittitas County land holdings adjacent to the existing project boundary and expand the project boundary to include such holdings (RM 421). Regarding Sand Hollow-North (RM 420), Pat Kelleher recommends that Grant PUD purchase land from BOR, extend the project boundary to SR 26, and develop two 50-car parking lots for day use. Pat Kelleher also recommends that Grant PUD extend the existing project boundary to include Wanapum State Park and Black Sand Beach (RM 418). Further, Pat Kelleher asserts that Grant PUD should enter into an agreement with Washington DOT to use other adjacent land for vehicle trailer overflow and overnight parking of boat trailers only (RM 421). Regarding the Airstrip Site (RM 420), Pat Kelleher recommends Grant PUD acquire public access road rights from Huntzinger Road to the Airstrip Site through Washington DOT owned property and develop the site as a day-use from May through September that would support 300 vehicles.

In reply comments filed July 8, 2005, Grant PUD disagrees with Mr. Kelleher's comment that the project boundary should be extended, in particular, at Wanapum State Park. The lands in this location are owned by Grant PUD and Washington SPRC, and Grant PUD does not believe that a project boundary change is warranted.

Our Analysis

We note that Pat Kelleher does not provide a map that clearly identifies the land holdings or other land in relation to the existing project boundary. Also, Pat Kelleher does not provide the necessary information or justification to support his recommendations for expanding the existing project boundary.

It is our understanding that Grant PUD does not intend to expand the existing project boundary; therefore, those access sites and recreation facilities that currently lie outside the project boundary would remain outside. In particular, we note Columbia River Siding Area (RM 460) is located approximately 63 RM upstream from Priest Rapids dam (RM 397.1). Based on the best available information, including our review of U.S. Geological Topographic maps, we find that expanding the existing project boundary to include the sites identified by Pat Kelleher, along with the recreation facilities identified in his letter, is not warranted. We address Mr. Kelleher's other comments throughout the appropriate sections herein.

In addition, we refer the reader to section 3.6, *Terrestrial Resources*, which discusses Grant PUD's proposed land acquisitions in order to protect and enhance terrestrial resources. If proposed land acquisitions would occur, then those land(s) may need to be brought into the project boundary resulting in a change in the existing project boundary.

Public Access and Developed Recreation Facilities

The community of Beverly recommends that Grant PUD add a community park, beach swimming area, boat ramp, and developed campground to the Recreation Plan. The community of Beverly states that there are no developed recreational facilities in its community. Pat Kelleher filed comments regarding the need for recreation facilities (*e.g.*, a boat launch, a barrier-free fishing pier) in Beverly (RM 412). Pat Kelleher notes that Beverly is the only community that does not have project recreational facilities.

In a response filed July 8, 2005, Grant PUD summarizes the proposed recreation measures that would contribute to meeting local recreation needs in the Beverly vicinity and nearby areas. These measures would improve four sites (Crab Creek Corridor, including Burkett Lake; Desert Aire boat launch; Mattawa RV/Farm Worker Campground; and Priest Rapids Park), which are located 1 mile to 12 miles from Beverly (Table 32). Consideration of potential effects on historic properties and limited public-owned land within the project boundary were taken into account for the proposed recreation measures.

EDAW, Inc (2001; 2000d) concludes that the Kittitas County boat launch at Vantage is currently the most heavily utilized boat launch in the study area (90 percent) because of its location (directly adjacent to Interstate 90) and a fee is not required. The boat launch provides access to Wanapum reservoir. The studies identified existing needs at the site, such as repairs to the parking area, providing barrier-free facilities, and improving maintenance (trash collection) to alleviate the litter problem. In particular, the dock does not adhere to accommodating disabled persons in that the low railings at the edges of the dock should be revised accordingly.

Grant PUD (2003) states Frenchman Coulee boat launch (RM 424) is currently underutilized. Although Frenchman Coulee boat launch is not close to I-90, shifting recreation use to this boat launch could decrease use at the more highly utilized boat launches near I-90. Grant PUD also states that by making visitors aware of Frenchman Coulee boat launch and other less utilized sites, existing recreation use could be more evenly distributed. In comments on the draft EIS, Pat Kelleher provided the 1999 FERC Form 80-Recreation Report estimated recreation visitor data for Frenchman Coulee boat launch: 5,630 persons.

The Kittitas County boat launch is operated and maintained by Kittitas County under a land use permit issued by Grant PUD. By letter filed May 1, 2006, Kittitas County recommends that Grant PUD: (1) provide an upgrade at the boat launch, including expansion of parking; (2) dredge and lengthen the boat launch to allow boaters the opportunity to launch year round; (3) construct an additional boat ramp with a dock; (4) provide O&M costs for existing and new recreational infrastructure; and (5) provide one FTE Sheriff Deputy, two staff members from May through October, and a vessel for public safety.

In comments on the draft EIS, Kittitas County does not believe that Grant PUD's proposed $15,000 O&M costs for the Kittitas County boat launch is a significant amount based on 2004 and 2005 O&M costs ($13,703 and $14,896, respectively) and projected increases during the term of the license. Of these O&M costs, the primary cost is for trash removal ($7,100 in 2004 and $7,741 in 2005).

Pat Kelleher commented on the Kittitas County boat launch (RM 421) in that according to the 1999 FERC Form 80-Recreation Report an estimated 31,880 recreation visitors utilized the area. Currently, the area has a boat launch, parking area, and a restroom. Pat Kelleher states a need exists for improving the existing recreational facilities by extending the boat launch 558 feet and expanding the project boundary to allow for additional parking at the site.

In addition, Pat Kelleher recommends that Wanapum dam lower boat launch (RM 415) should be closed because it is in a poor location, in poor condition and dangerous. Pat Kelleher suggests relocating the boat launch to the JWT crossing. In its response filed July 8, 2005, Grant PUD disagrees with Pat Kelleher's assessment of the boat launch.

In a response filed July 8, 2005, Grant PUD states the draft Recreation Plan includes measures to improve the Kittitas County boat launch at Vantage, including expansion of the parking lot, five additional picnic sites, interpretation at the boat launch, and considering the needs of the disabled in the site renovation. Grant PUD proposes to contribute an estimated $139,000 for capital improvements and contribute $15,000 per year for O&M at Kittitas County boat launch subject to the Commission determination that such an effort would be appropriate, and looks to partnering with an entity, such as Kittitas County, at the boat launch.

Yakima County commented that the county has received no economic, environmental, recreational or other human benefits from the Project. Further, the county notes the area surrounding the Priest Rapids dam is closed to public access due to the Department of the Army, Yakima Training Center.

Our Analysis

Regarding comments received from the community of Beverly, we find that the proposed improvements at the four sites are appropriate measures and would provide recreational opportunities that are needed for the Beverly vicinity and nearby areas. Further, an indirect effect on the local economy should occur resulting from the influx of construction workers to construct the recreation facilities as well as from the public who would use the completed recreation facilities; both of whom would probably purchase items from local stores, restaurants, and gas stations.

Although we find Grant PUD's proposed measures to improve Kittitas County boat launch, as identified in its draft Recreation Plan, are appropriate and would significantly improve public recreation use, we find Kittitas County's recommendation for dredging and lengthening the boat launch may have merit. See our discussion on the boat launch under Effects of Fluctuating Impoundment Surface Elevations and section 5.0, *Staff's Conclusions*, for our recommendation. Grant PUD's contribution for O&M at the boat launch would help address a need for general maintenance (trash collection). Also, a "carry-in/carry-out" policy should reduce costs associated with trash removal. See our discussion under Effects of Recreation Use Areas on Aesthetic Resources and Other Issues. We discuss the funding for FTE enforcement officers and a vessel in section 5.0, *Staff's Conclusions*.

In comments on the draft EIS, Kittitas County commented that the expanded parking would occur on its property, which is outside the existing project boundary. The county would give favorable lease terms to the use of property, but believes the project boundary should be amended to include the expanded area. See section 5.0, *Staff's Conclusions*, for further discussion.

Regarding Pat Kelleher's recommendation to close the Wanapum dam lower boat launch, we find that Mr. Kelleher does not provide sufficient evidence to support his recommendation to close the facility. Further, we assume Mr. Kelleher's reference to the "JWT crossing" is the "John Wayne Trail". We note, however, that a study (EDAW, Inc., 2000a) conducted indicates the Wanapum dam lower boat launch is narrow and deteriorating at the end and recommends installation of a new, wider ramp. Further the study recommends a barrier-free parking space, barrier-free portable toilets, and installation of a sign on Highway 243 to indicate the presence and location of the boat launch. Based on the best available information, including Commission-approved comprehensive plans, we find such recommendations for the Wanapum dam lower boat launch may be warranted. However, measures contained in the study (EDAW, Inc., 2000a), along with an analysis of whether to close the facility rather than improve it, could be assessed during development of the final Recreation Plan.

EDAW, Inc. (2000a) concluded that Frenchman Coulee boat launch was difficult to find, unknown to visitors in the area, and underutilized. As previously noted, Grant PUD drew a similar conclusion. Providing better publicity and signs about the location of Frenchman Coulee boat launch could shift some recreational use from the concentrated boat launches to the Frenchman Coulee boat launch. As a result, recreation use at the boat launches could be evenly distributed and project-related recreation effects on aquatic and terrestrial resources should lessen, thereby allowing the affected areas to revegetate.

Regarding Yakima County's comment on the lack of public access due to the Department of the Army, Yakima Training Center, we recognize the geographical constraints. However, according to existing information, the Washington Wildlife & Recreation Program (http://www.wildliferecreation.org) has assisted counties in central Washington, including Yakima County, in which the Project is located. The program provides funds for recreation-related facilities that should benefit the counties, including Yakima County. Further, we note Hoover's desert-parsley (*Lomatium tuberosum* Hoover), a species of special concern, occurs on the Yakima Training Center lands (Alverson and Sheehan, 1986). Although the reproductive biology of Hoover's desert-parsley is not known, literature indicates pollination may be by insects and seed dispersal may be transported by animals, water, or by wind. Hence, minimizing public access could protect suitable habitat for this plant. In regards to Yakima County comments on the lack of economic benefits, see our discussion in section 3.10, *Socioeconomics*.

Survey results (EDAW, Inc., 2000a) indicate that recreation use at Beverly Sand Dunes ORV Park is not related to the project. The Beverly Sand Dunes ORV Park is located in the lower Crab Creek corridor and lies adjacent to the project boundary. See section 3.6.2 for a discussion on the wetland and riparian habitats associated with Crab Creek and effects from recreational use. As previously discussed, Grant PUD proposes to contribute up to $3,000 per year for O&M at the Beverly Sand Dunes ORV Park, which Washington DNR supports.

Effects of Public Recreation Use on Undeveloped Dispersed Recreation Sites

We identified the effects of public recreation use on undeveloped dispersed recreation sites that could contain cultural sensitive area(s) of concern to the Yakama, the

Colville, other federally recognized tribes, and the Wanapum or species of special concern.

Within the project area[102] there are seven undeveloped dispersed use shoreline areas at Wanapum reservoir: (1) Black Sand Beach (Grant PUD); (2) McCumber Beach (Grant PUD); (3) Sand Hollow-South (Grant PUD); (4) Sand Hollow-North (BOR); (5) Rocky Coulee (Private; Washington SPRC; and Grant PUD); (6) Quincy WA (Washington DFW); and (7) Quilomene Dune and Bay (Washington DFW). There are four undeveloped dispersed use shoreline areas at Priest Rapids reservoir: (1) Priest Rapids dam tailrace and lower river (Grant PUD); (2) Goose Island (Washington DFW); (3) Haystack Rocks (BLM); and (4) Crab Creek (Grant PUD). Thus, there are a total of 11 undeveloped dispersed use shoreline areas. .

EDAW, Inc., (2000a) notes that there is a loss of vegetation throughout certain undeveloped dispersed recreation sites and soil erosion is evident. Soil erosion occurs at the sites associated with user-defined trails. At Wanapum reservoir, public recreation use at Black Sand Beach, McCumber Beach, Sand Hollow-South, Sand Hollow-North, and Quilomene Dune and Bay was heaviest during the peak recreation season when the sites are occupied by boaters or by people attending a concert at The Gorge Amphitheater.

The study (EDAW, Inc., 2000a) noted that trash accumulation was an issue at some sites, particularly after a concert in which Grant PUD-contracted clean-up crews remove debris. However, the condition at Quilomene Dune and Bay was generally good given the high level of use that it receives. At this site, there are five dispersed campsites with user-defined rock fire ring, beach, and small shade trees. A concern at Sand Hollow-South is the continued development of new campsites, trails, and roads through existing vegetation near the shoreline and elsewhere (EDAW, Inc., 2000a). Similar to Sand Hollow-South, informal campsites, roads, and parking areas occur at Sand Hollow-North, which is located upstream. In reply comments filed July 8, 2005 to Washington DFW, Grant PUD states visitor impacts on Quilomene Dune and Bay were found to be limited to the immediate shoreline and dune area.

At Priest Rapids reservoir, overall public use at Priest Rapids dam Tailrace and Lower River was light, although use increased during the fall Chinook salmon fishing season. Goose Island and Haystack Rocks had few signs of recreation use; most visitors to Crab Creek were likely from the local area (EDAW, Inc., 2001). To minimize effects on the resource from public recreation use, some measures suggested in the study include periodically monitoring recreation use levels to determine if use exceeds the physical and

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[102] The project area for the study (EDAW, Inc., 2001) is identified as all waters and adjacent lands within the existing Priest Rapids Project boundary and all recreation resources within and adjacent to the project boundary.

ecological capacity of the site; formalizing dispersed camping by designating sites in suitable locations; and periodic site cleanup.

To provide public access to the river and protect project facility security and sensitive environmental resources, Grant PUD (2005) proposes to continue managing the left bank shoreline (below Priest Rapids dam) within the project boundary for dispersed recreation use. Grant PUD proposes to improve the site by adding 10 primitive walk-in campsites and (2) two single-vault toilets. Improvements to road access, signage, and litter clean-up and removal are also proposed.

By letter dated October 29, 2004, the Washington SPRC does not foresee impacts on current recreation use on the Hanford Reach, including fishing, dispersed primitive vehicle access camping and nature-based float trips from future Project operations (Jim Harris, Eastern Region Manager, Washington SPRC, Wenatchee, Washington).

Our Analysis

As discussed in section 3.6, *Terrestrial Resources*, recreational ORV use can result in an adverse effect on terrestrial resources, including state-listed plant species such as Geyer's milk-vetch. Such recreational ORV use may have extirpated Geyer's milk-vetch from previously suitable habitat (*e.g*., at the Beverly Sand Dunes) (Grant PUD, 2003). While Grant PUD (2003) states that it would consider supporting a coordinated management effort to address ORV and All Terrain Vehicle use in the project area, we find that such an effort is warranted to protect terrestrial resources, especially species of concern. This measure would also comport with Interior's section 10(a) recommendation to exclude ORV use in agreed-upon identified recreation areas.

A monitoring program, as a component of the draft Recreation Plan, would address recreational use patterns and associated effects on sensitive resources. The monitoring program, contained in the draft Recreation Plan, identifies potential management options, *e.g.*, redistribute boating use by providing information about alternative sites; develop alternative campground sites, in order to shape decisions regarding current and future recreation use. While we are unclear whether potential historic properties are known to occur at the undeveloped dispersed recreation sites, the staff-recommended HPMP would take into account the potential for undiscovered properties. The HPMP, along with the associated cultural resource inventory reports and TCPs studies, would realize potential effects on a historic property or an important cultural resource site resulting from a proposed recreational development. We would ensure that both the Recreation Plan and HPMP would have the requisite provisions to allow for the level of coordination between Grant PUD, the consulted agency, and affected tribes.

Grant PUD's proposal to develop and implement project-related soil erosion and sediment control measures, as discussed in the Geology and Soils section, would minimize affects from current and future public recreation use on undeveloped dispersed recreation sites. Grant PUD also proposes to finalize its draft Shoreline Management Plan, dated August 2003. This plan is a result of Grant PUD updating its 1992 Priest Rapids/Wanapum Land Use Plan and the relicensing effort among Grant PUD and the stakeholders, which we previously discussed. This plan, with staff-recommended additional measures, could be implemented in concert with Grant PUD's other management plans, thereby offering further protection and enhancement measures to the resources.

Effects of Project Operations and Facilities on Recreational Fishing

To enhance an existing stocked trout fishery program, Grant PUD (2005) envisions working cooperatively with Washington DFW at the 78-acre Burkett Lake. Burkett Lake lies within the Project boundary and BOR's Columbia Basin Project, adjacent to Lower Crab Creek. Burkett Lake receives inflow from Nunnally Lake, one of three seepage lakes upstream from Burkett Lake. The Washington DFW operates the three seepage lakes as a trout fishery. As identified in Table 32, Grant PUD proposes to install a barrier-free fishing pier at the Crab Creek Corridor. The proposed fishing pier would combine the Burkett Lake advantages of accessible terrain and relatively stable water levels to provide for an accessible fishery. For a discussion on Crab Creek, see the subsection entitled *Resident Fish* under the Aquatic Resources section.

To address a need for boating access to the tailrace of Priest Rapids dam, Grant PUD proposes to improve the undeveloped dispersed recreation site at the Priest Rapids tailrace (Table 32). Survey results (EDAW, Inc., 2000a) indicate that recreational use is heavy at the Priest Rapids tailrace area and at the river reach extending outside the project boundary during the fall Chinook salmon fishing season.

Pat Kelleher commented that: (a) Mattawa RV/Farm Worker Campground has no nexus to the project and should be deleted from the draft Recreation Plan; (b) Buckshot Ranch (RM 403) should be sold to Washington DFW and managed according to conservation standards; and (c) Apricot Orchard boat launch (RM 445) should be improved by constructing two small parking areas at the north and south end connected by a 3.2-mile-long trail with five to 10 campsites. In comments on the draft EIS, Pat Kelleher reiterated his recommendation that Buckshot Ranch should be managed according to wildlife objectives, rather than for public recreation facilities or camping, because the area is isolated and unsafe.

In a response filed July 8, 2005, Grant PUD reiterates the cost-share provision for the Mattawa RV/Farm Worker Campground and defers the matter of Buckshot Ranch to stakeholder input during the final Recreation Plan. In the same filing, Grant PUD reiterates the proposed measures to improve Apricot Orchards boat launch by renovating the site.

Grant PUD proposes to cost-share for upgrades or relocation of the Vernita Bridge boat launch subject to completion of the Hanford Reach National Monument EIS. This facility is located at RM 388, approximately 8 miles below the existing project boundary and would provide safe boating access to project waters below Priest Rapids dam (letter filed July 8, 2005, Laurel Heacock, Manager, Licensing and Regulatory Compliance, Grant PUD, Washington). In a response to NMFS filed July 8, 2005, Grant PUD notes that during mid-October to early December each year, approximately 40,000 to 80,000 adult fall Chinook salmon return to the Hanford Reach to spawn. See section 3.5, *Aquatic Resources*, for further discussion.

The NPS (1994) concludes that the Hanford Reach is an important area for migratory waterfowl and other birds and is a major spawning area for fall Chinook salmon in the main-stem of the Columbia River. Sport fishing and flat-water recreation were identified as regionally significant features within the Hanford Reach. In addition to fall Chinook salmon, anglers seek steelhead trout, sockeye salmon, Coho salmon, and summer Chinook salmon, which spawn and migrate through the reach. Hunting opportunities exist with over 150,000 waterfowl that migrate through or winter in the reach.

Regarding the Hanford Reach and the Monument, increased recreational use associated with the potential designation as a Recreational River under the Wild and Scenic Rivers system and recreation land-use designations could result in cumulative impacts on wildlife and habitats that are not currently accessible by the public. Human-related activities include habitat modification or destruction and habitat fragmentation. When habitat fragmentation occurs, biodiversity is affected because the smaller undisturbed areas may not be capable of supporting the same number of species (DOE, 1999).

Visitors primarily access the Monument by vehicle or by boat on the Columbia River. Visitors can also access the Monument by horse, walking, or by bicycle. Off-road vehicles are not permitted in the Monument. The White Bluffs boat launch area has been and continues to be used as trailhead for trailer-in horse users.

By letter dated May 27, 2004, CRITFC recommendation no. 19 requests that Grant PUD provide for increased treaty fishing access in the project area. In its response filed July 8, 2005, Grant PUD states that although Grant PUD has no authority to regulate or manage fishing, Grant PUD's proposed measures provide for adequate treaty fishing access to the project facilities and waters.

The NPS (1994) recognizes that the Yakama, Umatilla and the Nez Perce Tribe, under separate treaties (12 Stats., 945, 951 and 957) with the United States, have the right to fish at traditional fishing sites. All three tribes have access rights to the Columbia River. The NPS (1994) states the Hanford Reach contains traditional fishing sites, known as "usual and accustomed places". Each spring ceremonial salmon are taken from Hanford Reach and each spring the salmon's return is recognized by a religious ceremony. The Monument preserves cultural resource sites and sensitive areas, including TCPs that are significant to the three tribes, and to the Colville and Wanapum (FWS, 2002). Therefore, existing and potential future public use areas and facilities should consider tribal concerns.

Our Analysis

Although we identified the effects of project operations and facilities on recreational fishing as a resource that could be cumulatively affected, we recognize other project-related recreation activities, as well as effects on the Hanford Reach. To address the need for fishing piers, Grant PUD proposes to develop three fishing piers or platforms within the project area to be located at the Crab Creek Corridor, Huntzinger Road Fishing Access Site, and Airstrip Site. These sites, as Grant PUD evaluated, are based on site topography and configuration that lend to fishing pier design accessible at all reservoir levels.

In particular, improvements at the Huntzinger Road Fishing Access Site would include a barrier-free fishing pier/platform, a single-vault toilet, an information sign, and improving the parking off Huntzinger Road. Improvements to the Huntzinger boat launch would include a one-lane concrete or concrete tie boat launch (with ramp extended to low pool), a single vault toilet, and an information sign. We find such improvements especially considering the needs of the disabled and providing a barrier-free fishing pier/platform would address a fishing-related need and significantly enhance the recreation opportunities at the Huntzinger Road Fishing Access Site and Huntzinger Road boat launch.

The proposed 150-acre Airstrip Site would also include a barrier-free fishing pier and other amenities, including 100 new developed campsites. See Table 32. However, the proposed Airstrip Site is a fall and winter waterfowl concentration area. Washington DFW notes the area has a high quality riparian habitat. If recreation development were to occur at this site, seasonal closure of portions of the site may be appropriate. Due to Washington DFW's concerns, the final Recreation Plan should consider Pat Kelleher's comment for developing the Airstrip Site as a day-use area, rather than for camping. We assume developing the site for day-use, rather than for camping, would require installation and use of fewer amenities, fewer provisions for O&M activities (such as, trash removal), and could reduce fire incidents caused by campfires given the arid climate. Crepuscular species[103] may be disturbed less by recreationists using a day-use site. We agree with Washington DFW that seasonal closure of portions of the site may be appropriate. To protect sensitive habitats, species of special concern, and minimize adverse effects on terrestrial resources, Grant PUD should develop and implement a final Recreation Plan in consultation with the resource agencies, affected tribes, and other appropriate parties.

Regarding the proposed Mattawa RV/Farm Worker Campground, Carol Conley spoke on behalf of the Port of Mattawa at the scoping meeting. Carol Conley stated that the Port of Mattawa is very poor and primarily an agricultural-based economy. Carol Conley further stated that there is a shortage of RV sites in the area to support both harvest workers that come to the area during fruit harvest and anglers who come to the area during the fall Chinook salmon runs in October and November each year.

The draft Recreation Plan and the Port of Mattawa (2003) identify a coordinated effort between Grant PUD and the Port of Mattawa on the duel use of Mattawa RV/Farm Worker Campground in order to address future recreation demand and to support seasonal farm-workers. EDAW, Inc. (2000a) notes that seasonal farm-workers also camp at Buckshot Ranch, which has a boat ramp, parking area, and two portable toilets. A Recreation Needs Analysis (EDAW, Inc., 2001) assessed Buckshot Ranch and recommended options for the site based on current low utilization, topography; the boat launch is not consistent with the existing project's land use plan.

One of the goals and objectives of the Port of Mattawa (2003) plan is "to ensure recreational potential, environmental integrity and high quality of life" by "providing necessary recreation services/infrastructure." We do not, therefore, find any basis for Pat Kelleher's recommendation to delete Mattawa RV/Farm Worker Campground from the draft Recreation Plan because: (a) Grant PUD and the Port of Mattawa have initiated a cooperative effort to improve the site; (b) anglers are afforded an opportunity to utilize the site; and (c) the proposed RV campground with an estimated 70 developed campsites could address a local need within a community (see section 3.10, *Socioeconomics*).

We agree with Grant PUD's assessment that a long-term plan and goal for Buckshot Ranch should be identified because Buckshot Ranch was permitted to Washington DFW in order to manage for wildlife, though Grant PUD retained ownership. The long-term plan and goal for Buckshot Ranch should, at a minimum, take into account the following: (1) the results from EDAW, Inc. (2001) Recreation Needs Analysis study; (2) Pat Kelleher's comments on the draft EIS that the area be managed

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[103] Crepuscular refers to those species (*i.e.*, little brown bat, pallid bat, spotted bat, and common nighthawk) that become active at twilight or before sunrise. In the Priest Rapids Project area, the pallid bat and spotted bat are Washington State monitor species.

according to wildlife objectives, rather than for public recreation facilities or camping; and (3) consideration of a local need within a community (seasonal farm-workers camp at Buckshot Ranch). The proposed measures for Apricot Orchards boat launch could improve the site and meet a recreation need.

By letter filed November 22, 2002, the FWS stated that the Hanford Reach fall Chinook salmon is of economic and cultural importance to commercial, sport, and tribal fisheries. At the scoping meeting the FWS commented on fall Chinook salmon and mentioned the Pacific Fishery Management Council under the Pacific Salmon Treaty with Canada and the Columbia River Fish Management Plan. The FWS reiterated the importance of the Hanford Reach fall Chinook salmon. For further discussion see section 3.5, *Aquatic Resources* and section 3.10, *Socioeconomics*.

Because the treaty fishing access measure is a component of CRITFC's recommended cultural resource management program for cultural resources within the project boundary and in the Hanford Reach, see section 3.8, *Cultural Resources*, for further discussion.

Potential recreation impacts from boating and foot traffic on species of special concern and sensitive habitats could likely occur resulting from public use associated with the designation of the 45-miles of "eligible" Columbia River as a Recreational River under the Wild and Scenic Rivers system. Increased recreational use could result in impacts on historic properties from vandalism and losses to shoreline and island erosion from boat wakes.

Effects of Fluctuating Reservoir Surface Elevations on Recreation Access

The current operation of the project is influenced by actions (*e.g.*, upstream releases at the Grand Coulee dam) and agreements (*e.g.*, the 1988 VBA), including the coordinated operations of the seven-dam system. The VBA provides for minimum flow releases below Priest Rapids dam for the protection of fall Chinook salmon spawning areas on Vernita Bar. In responses to the parties, filed July 8, 2005, Grant PUD notes that upstream from the project water management decisions influence the rate and timing of downstream flows. See section 2.0 for a description of the project operation and its integral part of this system.

There are 10 boat launch facilities in the study area with a total of 18 boat ramp lanes. Seven of the boat launches are located on Wanapum reservoir; three are located on Priest Rapids reservoir. Grant PUD operates two boat launch facilities, while the other facilities are managed by Washington DFW, Washington SPRC, Kittitas County, or private entities.

EDAW, Inc. (2001a; 2000a) finds that at full pool all 10-boat launches meet the standard 3-foot minimum water depth requirement at the toe of the ramp. Survey results indicate that during the recreational use season (May to September), pool levels were maintained at a level that maintained minimum depth at all ramps, with the exception of a brief period in mid-May when pool levels decreased. Generally, pool levels were maintained near full for the majority of the recreation season. At low pool levels in late spring (early April to mid-May) and in late fall (mid-October to late November), none of the boat launches met the minimum standard. The study recommends at least one boat launch should be usable at each reservoir during the entire year for off-season use (October to April), which could be accomplished by lengthening an existing boat launch or constructing a new one.

Kittitas County recommends that Grant PUD dredge and lengthen the Kittitas County boat launch at Vantage in order to allow boaters the opportunity to launch year-round. In comments on the draft EIS, Kittitas County stated the boat launch is visible from I-90 and provides easy access onto the highway. In response to Kittitas County Grant PUD notes the draft Recreation Plan proposes four boat launches (two on each project reservoir) that would be lengthened to accommodate lower pool conditions: (1) Desert Aire; (2) Huntzinger Road; (3) Wanapum Recreation Area; and (4) Crescent Bar. As a result boaters would have the opportunity to launch at varying reservoir levels.

Grant PUD recently partnered with Washington SPRC to lengthen the boat lanes at the Wanapum Recreation Area, which is located 4 miles south of the Kittitas County boat launch. This work has been completed, with Grant PUD's contribution of $50,000 to support the effort (letter filed July 8, 2005, Laura Heacock, Manager, Licensing and Regulatory Compliance, Grant PUD, Washington).

By letter dated October 29, 2004, the Washington SPRC notes that recreation within the Project has been impacted by the mitigation of biological need of anadromous fish in the Hanford Reach. These mitigation measures, while appropriate, have caused lower water levels within the reservoir and higher flow velocities during high use recreation periods (Jim Harris, Eastern Region Manager, Washington SPRC, Wenatchee, Washington).

Another recreation site located below the Priest Rapids dam is White Bluffs boat launch, which receives high recreational use during the fall Chinook fishing season. The White Bluffs boat launch is a developed concrete launch usable at all river flows and has a steeper incline, which facilitates easier launching of trailer boats. The boat launch is closed from November 1 until June 30 to provide winter waterfowl sanctuary. For non-motorized boats, the boat launch is usable at all river flows (Grant PUD, 2005). See section 3.7, *Threatened and Endangered Species*, for our discussion on the White Bluffs boat launch and effects on the federally-listed bald eagle.

Our Analysis

In light of the coordinated operations and agreements of the seven-dam system, Grant PUD proposes to address the effects of fluctuating impoundment surface elevations on recreational boating by lengthening certain boat launches. Grant PUD's proposal would result in a significant improvement to recreation access. We find Grant PUD's approach reasonable, which would compensate for the operational effects of the mid-Columbia River Basin system on recreation access. Grant PUD should consider the needs of the disabled in the design and implementation of its proposal.

As previously discussed, EDAW, Inc. (2000) finds the Kittitas County boat launch at Vantage is a heavily used boat launch on Wanapum reservoir. Although Grant PUD already proposes to improve the Kittitas County boat launch, as well as, lengthen certain boat launches to provide access during lower water elevations we discuss Kittitas County's recommendation for dredging and lengthening the boat launch in section 5.0, *Staff's Conclusions*. As noted in Grant PUD's draft Recreation Plan, engineering studies may be needed to determine whether extending the boat launches, as proposed, would be feasible.

Grant PUD (2005) states that minimum flow in the Columbia River below the Priest Rapids dam is 36,000 cfs; thus, the river reach is accessible for boating at all times. At the Vernita Bridge, launching a trailer boat is feasible during river flows ranging at least from 50,000 cfs up to 200,000 cfs. However, Grant PUD notes that varying flows present certain hazards (*e.g.*, shallow areas, eddies and other dangerous currents, submerged objects). To improve access to the river below Priest Rapids dam, Grant PUD proposes to provide cost-share funding to Washington DFW/FWS for capital facility upgrades or relocation of the Vernita Bridge boat launch. Public use facilities at the boat launch consist of minimal entrance signs and a partial gravel road. There are no restrooms and no potable water.

The Vernita Bridge boat launch receives high recreational use, especially during the fishing seasons. Consequently, recreation use of the area has resulted in impacts on cultural and natural resources. Grant PUD proposes to cooperate in the upgrades or relocation of the Vernita Bridge boat launch. We note diffuse knapweed, an invasive species, occurs at the Vernita Bridge boat launch. Development and implementation of an invasive species plan for the project could compliment the overall efforts by Washington DFW and TNC to control the spread of noxious weeds, other exotic plant species, and invasive species (*e.g.*, zebra mussels) within the river basin, including at the Vernita Bridge boat launch.

Effects of Project Operation and Operation of Upstream Developments

In responses to the parties, filed July 8, 2005, Grant PUD notes the operation of the mid-Columbia River system has resulted in a coordinated effort to optimize the use of water for flood control, fish mitigation, navigation, agriculture, recreation, municipal and industrial use, power generation, etc. The current operation of the project is primarily driven by upstream releases from Grand Coulee dam, combined with other operational agreements. See section 2.0, *Proposed Action and Alternatives*, for further discussion.

Because of the inter-relatedness of the environmental resources, we address the effects of project operation and operation of upstream developments within the appropriate environmental resource sections. We also recognize that operation of the upstream developments might contribute to a direct or indirect effect on an environmental resource associated with the project, including potential historic properties, and we take those effects into account, including measures proposed by Grant PUD and measures recommended by the parties.

Trails and Project Role in the Restoration of Beverly Bridge

A study (EDAW, Inc., 2002) indicates there are seven existing trails within the project vicinity: (1) Ginkgo Petrified State Park; (2) John Wayne Pioneer Trail; (3) Quincy Wildlife Area Shoreline Access; (4) Dusty Lake Trail; (5) Rocky Coulee; (6) Milwaukee Road Corridor; and (7) Nunnally Lake. In another study (EDAW, Inc., 2000a) hiking/walking was ranked among the top 10 primary recreation activities. One of the potential suitable areas for new non-motorized trail development includes the John Wayne Pioneer Trail corridor with feeder trails. Longer, continuous trails could link with other regional trail resources, such as the John Wayne Pioneer Trail. Construction of short trails could link existing recreation sites (EDAW, Inc., 2001a). A need exists for non-motorized trails that connect populated areas to rural and remote areas, such as the Cross-State Trail (John Wayne Pioneer Trail) and its major spur routes (Interagency Committee for Outdoor Recreation, 1995).

In addition to the John Wayne Pioneer Trail, the study (EDAW, Inc., 2001a) identified six potential trail routes at: Crescent Bar (5.5 miles); Frenchman Coulee (1.0 mile); Vantage Area (2.4 miles); Vantage-Wanapum Recreation Area-John Wayne Pioneer Trail (9.2 miles); Crab Creek Corridor (7.4 miles); and Mattawa-Desert Aire (3.1 miles). The total length of all trail segments is 30.1. For the Crab Creek Corridor, the total length includes 1.6 miles of land trail and 5.8 miles of water trail.

Pat Kelleher recommends a trail segment from the Airstrip Site to Wanapum Trail (RM 419) and a shoreline trail at Frenchman Coulee (RM 424), which would replace Grant PUD-permitted exclusive use road for the adjacent property owner. Pat Kelleher also recommends a developed campground at the Frenchman Coulee site. In a response filed July 8, 2005, Grant PUD reiterates its proposed measure for trails at the project and within the project vicinity. Also, Grant PUD proposes to develop a non-motorized 1-mile-long shoreline trail at Frenchman Coulee, along with other measures such as, repairing and improving the access road and parking lot; providing one barrier-free single-vault toilet, a picnic area, and interpretation; and repairing the boat ramp toe or replacing the concrete ramp. Because Frenchman Coulee is difficult to find and unknown to visitors in the area (EDAW, Inc., 2000a), installing a sign(s) on a nearby road(s), where feasible, would inform visitors of the site and location.

Grant PUD proposes to provide a non-motorized trail (referred to as the Vantage Area Trail) linking the community of Vantage with recreation sites. Grant PUD proposes to contribute an estimated $67,250 for capital construction of the Vantage Area Trail and $5,000 per year for maintenance after the trail is constructed.

Grant PUD proposes to provide funds to develop a 9.2-mile-long non-motorized trail linking Vantage-Wanapum Recreation Area-John Wayne Pioneer Trail. The trail would link the town of Vantage and the Wanapum Recreation Area. The trail would also provide access to the Kittitas County boat launch and Ginkgo Museum. Grant PUD proposes to contribute an estimated $308,500 for capital construction of the Vantage Area-Wanapum Recreation Area-John Wayne Pioneer Trail. Grant PUD notes that these costs are included in the proposal for the Wanapum Recreation Area. Grant PUD proposes to contribute an estimated $1.85 million for infill and expansion capital improvements at Wanapum Recreation Area (including the Vantage Area-Wanapum Recreation Area-John Wayne Pioneer Trail) (letter filed July 8, 2005, in response to the Washington Interagency Committee for Outdoor Recreation from Laurel Heacock, Manager, Licensing and Regulatory Compliance, Grant PUD, Washington). Grant PUD looks to partnering with Washington SPRC at Wanapum Recreation Area.

The IAC, by letter filed May 3, 2005, recommends Grant PUD: (1) cost-share maintenance and operation of Airstrip Site and Getty's Cove Group Site; (2) fully fund the rehabilitation and on-going maintenance and operation costs for the Beverly Bridge trestle of the John Wayne Pioneer Trail; and (3) provide O&M funding for Vantage Area Trail, Vantage Area-Wanapum Recreation Area-John Wayne Pioneer Trail, and Wanapum Recreation Area.

During relicensing, studies were conducted to identify an alternative to public use crossing of the Wanapum dam. The studies identified the 0.5-mile-long Beverly Bridge, part of the John Wayne Pioneer Trail, as the preferred Columbia River crossing due to natural and potential historic properties constraints associated with alternative routes, as well as public safety. The John Wayne Pioneer Trail is located adjacent to the project boundary near the town of Beverly. The IAC and Washington DNR state that Interstate

90 is the only other public crossing of the Columbia River within the project area. The IAC, Washington DNR, and Pat Kelleher recommend that Grant PUD fully fund the restoration and maintenance of the Beverly Bridge for use as the Columbia River crossing and thereby link the John Wayne Pioneer Trail. The Washington DNR states that the Beverly Bridge is the link between the western and eastern portion of the John Wayne Pioneer Trail; however, due to current bridge conditions and concerns for public safety, the Beverly Bridge is closed to public use.

In a response filed July 8, 2005, Grant PUD proposes to contribute an estimated $445,000 for capital improvements at the John Wayne Pioneer Trail crossing (Beverly Bridge) of the Columbia River, subject to the Commission determination that such an effort would be appropriate. The IAC supports Grant PUD's proposal to rehabilitate the Beverly Bridge trestle that would include adding safety measures (*e.g.*, new decks, rails, and gates); however, Grant PUD should fund the rehabilitation and on-going O&M costs. Grant PUD believes that the trail segment would best and most appropriately be maintained by the entities responsible for the 300-mile-long cross-state trail corridor of which the Beverly Bridge is a critical link.

Our Analysis

Commentors noted that prior to the events of September 11, 2001, Grant PUD allowed the public to cross the Columbia River by using a service road across Wanapum dam. Since that time, additional security measures required by the Commission has closed access to the public. The commentors note the only other bridge to cross the Columbia River in the project area is I-90.

Due to public use restrictions at Wanapum dam and due to the location of the Beverly Bridge in relation to the project we find an indirect effect exists between project operation and potential recreational use of the trail segment. We find Grant PUD's proposal to cooperate in the John Wayne Pioneer Trail crossing (Beverly Bridge) of the Columbia River appropriate, which would re-connect a 0.5-mile-long link in the trail system and allow safe public access across the river. Demand for non-motorized hiking is projected to increase 89 percent by 2035 (EDAW, Inc., 2001). Improving the Beverly Bridge would help meet this projected demand. Although we find Grant PUD's proposal appropriate, we recognize the potential for sensitive species or historic properties that may occur in the area and, therefore, Grant PUD should coordinate development of the Columbia River crossing (Beverly Bridge) with the FWS, Washington DFW, Washington DNR-Natural Heritage Program, Washington SPRC, affected tribes, and Washington SHPO. For further discussion see section 5.0.

Although the Washington SPRC states that it would continue to provide O&M at sites owned and operated by Washington SPRC (Wanapum Recreation Area and John

Wayne Pioneer Trail) with respect to its budget authority, we suggest Grant PUD, Washington SPRC, IAC, Washington DNR, and/or other appropriate authority consider and perhaps define a cooperative approach for operating and maintaining the Beverly Bridge. As Grant PUD has stated in its responses to parties' comments, user fees, maintenance grants, and other sources should be sufficient to offset O&M costs.

As noted in the Oregon SCORP (Oregon State Parks and Recreation Department, 2003), which we find relevant in this instant, there may be a direct correlation between increasing use of recreation user fees and lower use by low-income families and household. Thus, it is important to ensure the region's low-income residents are not priced out of local recreational opportunities. The Commission's regulations at 18 CFR 2.7 allow a licensee to charge a reasonable fee to users of recreation facilities to help defray the cost of constructing, operating, and maintaining such facilities. Given the socioeconomics of the counties affected by the project, and at the same time, the ability to institute user fees, we will take into consideration Grant PUD's proposed project-related recreation measures recognizing the potential for Grant PUD to consider reasonable fees charged for public use and justification of those fees.

Overall, we find Grant PUD's proposed measures to develop an estimated 30 new miles of trail to be located within and adjacent to the project would contribute to a beneficial cumulative effect on recreation resources at the project and within the mid-Columbia River Basin. Development of the trails would address a need for non-motorized trails identified by the State of Washington SCORP (Interagency Committee for Outdoor Recreation, 2002; Washington SPRC, 2005). We suggest, where appropriate, that Grant PUD consider the needs of the disabled during the design of its proposed trails for the project. The proposed trails would provide recreational opportunities for disabled persons and help to meet the projected demand for non-motorized hiking.

We note several species of special concern (*e.g.*, miner's candle, coyote tobacco, brittle picklypear) occur near Frenchman Coulee. Although new recreational facilities may be installed at Frenchman Coulee, any such facilities should be developed and implemented in consultation with the resource agencies and affected tribes to protect the species and its habitat.

Other Recreation Facility Measures

Three recreation facilities (Airstrip Site (new), Getty's Cove Group Site, Wanapum Recreation Area, John Wayne Pioneer Trail) occupy lands that lie within and immediately adjacent to the project boundary. By letter filed May 31, 2005, Washington SPRC expressed concern that the draft Recreation Plan identifies Washington SPRC as the entity to provide O&M at these sites. The Washington SPRC is unclear about the level of commitment by Grant PUD. The Washington SPRC recommends that either Grant PUD makes available to Washington SPRC $8 million for new recreation facilities, identified in the draft Recreation Plan or Grant PUD commits to all costs associated with development of specific recreation facilities.

Grant PUD cites the draft Recreation Plan contemplates partnerships and agreements with Washington SPRC and other entities responsible for certain public access and recreation facilities in the project vicinity. Grant PUD reiterates this cooperative approach in a response letter to Washington SPRC, filed July 8, 2005, wherein Grant PUD proposes to cost-share and cooperate with Washington SPRC at the three recreation facilities- -Airstrip Site, Getty's Cove Group Site, and Wanapum Recreation Area.

The IAC agrees with Grant PUD in its proposal to fund another entity for development of a new recreation area at the proposed Airstrip Site and to investigate the acquisition of and improvement to Getty's Cove Group Site. The IAC recommends Grant PUD also cost share O&M costs at these two sites and provide O&M costs at the Vantage Area Trail and Wanapum Recreation Area.

Grant PUD reaffirms its commitments to Airstrip Site, Getty's Cove Group Site and Wanapaum Recreation Area in a separate filing of July 8, 2005, to the IAC. In that letter, Grant PUD states that should demand studies indicate the need for the Airstrip Site, Grant PUD proposes to contribute an estimated $7.89 million for construction. In addition, Grant PUD proposes to contribute an estimated $512,000 for capital improvements at Getty's Cove Group Site, subject to the Commission determination that such an effort would be appropriate. Grant PUD further states that revenue generated at the sites, grants, and other sources of funding could offset O&M costs.

Our Analysis

In its letter filed July 8, 2005, Grant PUD appears to propose two license articles. The first one would include a requirement for Grant PUD to commit an estimated $10.3 million for the development, renovation, and operation of Airstrip Site, Getty's Cove Campground and Boat Launch, and Wanapum Recreation Area. The second one would include a provision for a recreation management plan to provide guidance for implementing the recreation enhancement measures at Airstrip Site, Wanapum Recreation Area, and John Wayne Pioneer Trail. We note, however, that while both proposed license articles identify Airstrip Site and Wanapum Recreation Area, each proposed article then identifies Getty's Cove Group Site or John Wayne Pioneer Trail. We would assume the second proposed license article should compliment the first proposed license article; yet, the recreation sites differ.

As previously discussed, Washington DFW has concerns regarding Airstrip Site (a fall and winter waterfowl concentration area; riparian habitat) and Wanapum Recreation Area (high quality shrub-steppe Priority Habitat). Although Grant PUD's comments on the draft EIS did not clarify the proposed two license articles, we assume the proposed license articles to be a suggestion only because Airstrip Site, Getty's Cove Campground and Boat Launch, Wanapum Recreation Area, and John Wayne Pioneer Trail are addressed in Grant PUD's draft Recreation Plan, which provides guidance for implementing all recreation enhancement measures. In section 3.6, *Terrestrial Resources*, of this final EIS, we also discuss Grant PUD's proposed measures to enhance terrestrial resources and offset indirect and cumulative affects of recreation on terrestrial resources. We agree with Grant PUD's intent to coordinate development of a habitat management plan with the recreation and shoreline management plans to minimize effects on terrestrial resources.

Need For and Project Role in Development of Horseback Riding Amenities

At the scoping meeting Crab Creek Riders, Backcountry Horsemen of Washington commented that development and maintenance of designated horseback riding areas would be beneficial, both financially and aesthetically, to Grant County.

In comments on the draft EIS, Washington DNR stated that the Milwaukee Road Corridor Trail portion of the John Wayne Pioneer Trail and the Beverly Bridge have the potential to fulfill a recreation need in the Town of Beverly. The Beverly Bridge is a critical link to the Milwaukee Road Corridor Trail. Washington DNR commented that any improvements made to the Milwaukee Road Corridor on the east side of the Beverly Bridge in the Town of Beverly could potentially provide an area for equestrians, additional camping, and picnic areas.

According to Washington SPRC and Washington State Tourism, equestrian trails are established in 10 Washington State Parks. One of these trails, Steamboat Rock, offers 10 miles of equestrian trails in Central Washington and traverses sagebrush and basalt cliffs. Other designated equestrian trails are located in Ellensburg and Vantage. In particular, the John Wayne Pioneer Trail and Quilomene Creek offer equestrian trails.

The FWS (2002) notes unrestricted horseback riding occurs on the Wahluke Unit of the Monument. Equestrian use continues to be a popular activity. There are no designated horse trails or horse-specific developed facilities (*e.g.*, parking, water, portable toilets). The FWS identifies a need to assess the current supply and demand for horseback riding facilities on nearby and adjacent lands to the Monument. The FWS notes that there may be options and alternatives for use of trails by multiple users (*e.g.*, hikers, horseback riders) and for horseback riders only.

Our Analysis

We recognize the importance of the John Wayne Pioneer Trail and find Grant PUD's cooperation for rehabilitating the Beverly Bridge trestle, including safety improvements, would allow public use as a non-motorized trail bridge across the Columbia River. The proposed measure would significantly improve the John Wayne Pioneer Trail and enhance recreational use, including equestrian.

Grant PUD's proposal to improve the Beverly Bridge segment of the John Wayne Pioneer Trail should provide recreational use of a trail by multiple users. We find that if a license is issued for the Project data collected and filed pursuant to the reporting requirements for FERC Form 80-Recreation Report may identify a need for project-related horseback riding amenities during the term of the license. Consequently, such a need could be re-assessed at that time.

Effects of Recreation Use Areas on Aesthetic Resources and Other Issues

As a component of its draft Recreation Plan, Grant PUD proposes to provide periodic monitoring and site clean-up at six boat-in shoreline dispersed areas: (1) Goose Island; (2) Haystack Rocks; (3) McCumber Beach; (4) Quilomene Dune and Bay and West Bar; (5) Black Sand Beach; and (6) Quincy Wildlife Recreation Area. Other possible options that Grant PUD cites include site closure, new use restrictions, or new "hardened" recreation facilities (*e.g.*, tent pads, picnic tables, and designated hunting blinds).

The Washington DFW developed and implemented a State-wide aquatic nuisance species management plan. The plan identifies various objectives and tasks to control and/or eradicate aquatic invasive plant species. The plan notes Washington DOE is currently working with Washington DFW and the Washington SPRC to develop signs that would be placed at all boat launches in Washington State warning boaters of aquatic nuisance plant and animal species and encouraging boaters to clean their boats, trailers, and fishing gear.

Our Analysis

We identified the effects of recreation use areas and associated vegetation disturbance, soil erosion, and/or trash accumulation on aesthetic resources. Grant PUD proposes and the staff would recommend various management plans for the Project that would protect and enhance environmental, recreation, and cultural resources at the project, thereby contributing toward a beneficial effect on aesthetic resources. One of these plans, an invasive species plan, could protect species of special concern, the biodiversity of the area, and enhance the aesthetic resources of the area. Some measures contained in the draft Recreation Plan would retain the primitive character of the recreation site with minimal improvement.

Although providing periodic monitoring and site clean-up at recreation sites would address adverse effects on environmental resources and improve the aesthetic resources of the area, costs are incurred with recreation site clean-up. To minimize such costs- -in this instant, borne by Grant PUD, federal and state resource agencies, affected tribes, and counties- -Grant PUD should assess a "carry-in/carry-out" policy. The "carry-in/carry-out" policy would entail identifying and removing certain existing trash receptacles and installing containers with appropriately-sized plastic bags for people to carry out their trash. We are aware of similar efforts at national parks and other areas that encourage people to carry out their trash; the results are generally favorable. The identification and removal of certain trash receptacles and subsequent placement of containers at key public access and recreation sites could be coordinated with the agencies, affected tribes, and counties whose lands are located within or adjacent to the existing Project boundary, as well as with other entities (*e.g.*, anglers, Crab Creek Riders, Back Country Horsemen of Washington) that utilize the facilities, including areas in the Hanford Reach. We envision this measure would compliment the Interpretation & Education Program as identified in the draft Recreation Plan.

Land Use

Grant PUD proposes to develop public access and recreation facilities in areas that are compatible with its draft Shoreline Management Plan, Priest Rapids Hydroelectric Project, dated August 2003. The plan includes general land use practices, land use classification, and public access. The measures contained in the plan would also protect the scenic quality of the mid-Columbia River and its surrounding landscape. Within this plan, Grant PUD proposes to manage the approximate 160-acre Crescent Bar Island, situated within Wanapum reservoir, under two land classifications: (1) 105 acres as "planned development" and (2) 112 acres as "conservation land" (including small islands and the mainland shore).

Washington DFW expressed concern with the loss of wildlife and associated habitat resulting from private and public development on Crescent Bar Island. During the term of the current license, however, the southern portion of Crescent Bar Island has remained undeveloped. In comments on the draft EIS, Washington DFW states that Grant PUD's proposed activities on Crescent Bar Island would further reduce the original mitigation values for the island. In comments on the draft EIS, Grant PUD states there are no original mitigation lands at Crescent Bar Island. See section 3.6, *Terrestrial Resources*, for further discussion.

Also in comments on the draft EIS, Grant PUD notes that in 1962 it entered into a lease agreement ("1962 lease") with the Port of Quincy for recreational and commercial development of Crescent Bar Island. Grant PUD entered into the 1962 lease under Article 25 of its current Project license, which was issued in 1955. The 1962 lease expires June 1, 2012. At the staff public meetings and in comments on the draft EIS, Pat Kelleher commented that, through various permits issued by Grant PUD, Crescent Bar Island has been transformed into a residential community whereby public access is restricted.

Pat Kelleher recommends that Grant PUD address its policy on land use permits. In its response filed July 8, 2005, Grant PUD notes that it currently manages 132 non-exclusive land use permits issued to adjoining landowners since the original license. Since 1987 land use permits have been issued, by Grant PUD, in conformance with the Commission's standard land use article. The permits will expire with the current Commission license on October 31, 2005. Grant PUD states that in its draft Shoreline Management Plan, Grant PUD proposes a shoreline permitting policy.

Pat Kelleher recommends that Grant PUD convert the existing feedlot at the Columbia River Siding Area (RM 460) to a public day use park and swimming area. In a response filed February 17, 2005, Grant PUD states that the feedlot is partially located on private property in Douglas County, Washington near RM 450.5 on the Wanapum reservoir. Cattle are restricted to the feedlot area and can not access the shoreline. A portion of the feedlot was authorized by a Grant PUD permit that will expire coincident with the existing license. Grant PUD does not anticipate renewing the permit. Furthermore, Grant PUD states that the shoreline area adjacent to the feedlot is publicly accessible via Douglas County Road 195 and from the Wanapum reservoir via boat.

Pat Kelleher recommends that Grant PUD develop the Auvil Area (RM 406) for boat-in camping in order to address recreation use at Goose Island. Pat Kelleher states the Auvil Area currently is used for commercial business, while excluding free public access. Pat Kelleher submits a similar comment for Sentinel Gap (RM 408).

By letter filed October 19, 2005, Mr. Ken Jacobson states that he recently entered into a purchase and sale agreement to purchase approximately 58 acres adjacent to the Project boundary at the proposed Airstrip Site. Mr. Jacobson states that the current draft Recreation Plan includes extensive encroachment on his intended purchase. He also states that there is a high existing need for an increase in public recreation opportunities at the Airstrip Site.

In a response to Mr. Jacobson, filed November 8, 2005, Grant PUD does not view the concepts proposed in its draft Recreation Plan as encroachments. The draft Recreation Plan and final license application for the project were available in October 2003, prior to Mr. Jacobson's purchase and sale agreement for the property adjacent to the Airstrip Site. Public meetings, beginning in 1999, provided opportunities for the stakeholders and public to comment. Grant PUD disagrees that there is a high existing need for development of the Airstrip Site; other recreation sites with expansion or infill potential have a higher priority over the generally undeveloped Airstrip Site. The draft Recreation Plan provides for a phased approach to recreation facilities in order to address future recreation needs, with existing site expansion occurring first and new site development occurring as needed thereafter.

Our Analysis

Through a series of leases (since 1962) and sub-leases, Grant PUD enabled private and public facilities to be constructed on Crescent Bar Island. Private facilities include a 110-unit residential and hotel condominium complex, a recreational vehicle park and a 20-to-40 wide landscape perimeter. The outer edge of the condominium complex is only 20 feet from the island's shoreline. Public facilities include 35 tent sites, a picnic area, beach, boat launch and fuel dock, and restroom. There are also various small business establishments. In 1998, Grant PUD stated that Crescent Bar Island is used for project purposes that include: (1) reservoir surcharge;[104] (2) public recreational access and development; and (3) the protection of the Project's environmental and scenic values. In 1999, the Commission found Grant PUD owns the underlying lands in fee, and the lease agreements are subject to the terms and conditions of the Project license. The lease agreements reserve to Grant PUD a perpetual flowage easement over all of the lands. Although the Commission found these lands are needed for project purposes, the Commission anticipated that, during the relicensing process, the matter would be revisited.[105]

In comments on the draft EIS, Grant PUD states no further development is proposed on Crescent Bar Island; however, we note the 105 acres proposed as "planned development", identified in Grant PUD's draft Shoreline Management Plan, could allow for future development. For further discussion on Crescent Bar Island and our recommendation see section 5.0, *Staff's Conclusions*.

We find Grant PUD's response to Pat Kelleher on its land use permit policy adequate. Grant PUD's referral to its permitting policy can be found in section 4.3 of its draft Shoreline Management Plan, which generally outlines permitting and the conveyance of leases, easements, and fee title.

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[104] A reservoir's surcharge storage capacity accommodates flow inflow. It is the volume of water in the reservoir between the normal full pool elevation and the maximum water surface elevation for which the associated dam is designed. 88 FERC ¶ 61,012 (1999).
[105] 88 FERC ¶ 61,012 (1999) and 89 FERC ¶ 61,177 (1999).

As stated in the draft Shoreline Management Plan, the land use policies will not prohibit members of the Wanapum from hunting and fishing within the project and maintaining the right at all times to gather wild roots, herbs, and berries. We also note that Grant PUD proposes to review the Shoreline Management Plan's goals, policies, land use classifications, etc. every 6 years. This review could be coordinated with the recreation monitoring required by the filing of the FERC Form 80-Recreation Report. We find this timeframe appropriate because recreation data collected can be used to modify the Shoreline Management Plan, accordingly.

No public recreation use occurs in the shoreline area adjacent to the feedlot (Duke Engineering & Services, Inc. 1997; EDAW, Inc., 2001). Project lands in the vicinity of the feedlot are designated "Public Recreation-Dispersed" in Grant PUD's draft Shoreline Management Plan. This designation would provide opportunities for hiking, hunting, fishing, river access, and scenic viewing. We, therefore, find Grant PUD's response adequate.

Regarding public access, Grant PUD is not obligated to provide free public access to all project lands and waters especially in light of balancing public access with protection of sensitive resources.[106] Sentinel Gap was excluded from a recreation study because the majority of users are seasonal farm-workers who camp at the site; therefore, use of the site is not related to recreation as an activity (EDAW, Inc., 2000a). Sentinel Gap is owned and managed by Grant PUD for resource protection and public (pedestrian) access.

We acknowledge Mr. Jacobson's comments on the proposed Airstrip Site and discuss the site throughout this final EIS.

Other Measures

Grant PUD proposes to provide funding for 1.0 full-time employee (FTE) for the Washington DFW enforcement program, in part to field additional Washington DFW enforcement officers in the project area during peak recreation use. Grant PUD also proposes to provide funds to the Kittitas County and Grant County Sheriff's Offices for 1.0 FTE (funds to be divided equally between the two county sheriff's offices).

Grant PUD currently provides a boat at Wanapum dam for use by local law enforcement officers and proposes to continue this practice during the new license. Grant PUD notes the Wanapum River Patrol program is a field-based monitoring program in order to provide patrols of the Project area on a daily basis by boat and/or vehicle. The program monitors and reports on the effects on historic properties and helps prevents

[106] Order Dismissing Complaint. 99 FERC ¶ 61,363 (2002).

looting and vandalism. The program also provides for visitor management.

Kittitas County recommends that Grant PUD fund 1.0 FTE Sheriff Deputy, fund two staff members from May through October, and a vessel for public safety. Pat Kelleher recommends that Grant PUD fund 1.0 FTE and a vessel for Kittitas County Sheriff's Department. Washington DFW, pursuant to section 10(j) of the FPA, recommends the licensee provide to the Washington DFW enforcement program funds for 2.0 FTE Washington DFW enforcement officers, including administrative costs, and funds to Kittitas County and Grant County Sheriff's Offices for 1.0 FTE, including administrative costs.

CRITFC recommendation no. 19 stipulates that Grant PUD contract with local law enforcement personnel to enforce laws that protect cultural resources within the Project area and Hanford Reach.

In comments on the draft EIS, the Yakama recommend Grant PUD provide funds for tribal recreational and cultural experts to protect the cultural and natural resource sites at undeveloped campsites.

Our Analysis

We address the law enforcement officer and associated issues in section 5.0, *Staff's Conclusions*.

3.9.3 Cumulative Effects

We identified recreation as a resource that could be cumulatively affected by relicensing the project. The proposed public access sites, recreation facilities, and additional environmental measures would contribute to a cumulative beneficial effect on recreation resources at the project and within the mid-Columbia River Basin. A critical link (Beverly Bridge) would connect the John Wayne Pioneer Trail, a National Recreation Trail, and provide safe public access across the Columbia River. Barrier-free public access sites and recreation facilities would provide disabled persons with new recreational opportunities. Continued project operation would also benefit recreation by enhancing the aquatic resources (fisheries) of the mid-Columbia River, and providing continued opportunities for boating, fishing, and other "on-water" recreational pursuits.

Under no-action the additional recreation enhancements would not be required at the Project, resulting in no enhancement of opportunities for disabled persons. The no-action would forego maintenance and improvements of public access and recreational facilities at the project.

3.9.4 Unavoidable Adverse Impacts

Proposed recreation development at the Airstrip Site could result in an unavoidable adverse impact on wildlife because the area is a fall and winter waterfowl concentration area and riparian habitat occurs in the area. Environmental measures contained in a staff-recommended Wildlife Plan and other project-related plans, as well as a requirement for Grant PUD to coordinate its efforts to develop and implement the various plans with resource agencies, affected tribes, and applicable interested parties, could minimize project-related recreation impacts on wildlife and associated habitat.

3.10 SOCIOECONOMICS

The EIS scoping process identified one issue related to project effects on socioeconomic resources: effects of the Project on local, tribal and regional economies. In this section, we describe the affected environment with respect to socioeconomic resources and the effects, including cumulative effects, of the project as related to these issues.

3.10.1 Affected Environment

The Columbia River and its tributaries are susceptible of being developed into the greatest system for water power to be found anywhere in the United States (letter to the Speaker of the House of Representatives, from Mr. Elwood Mead, Commissioner, War Department, March 29, 1932). One of the 10 sites identified in 1932 as promising for development is described herein, the Project.

Before non-native settlement and development efforts along the Columbia River, several Indian tribes lived in the area. "The basis of these tribes' livelihoods and cultures was anadromous fish, particularly salmon. The spring, summer, and fall runs of salmon and steelhead trout from the Pacific Ocean to ancestral spawning grounds in the riverbeds were enormously productive" (Ortolano and Cushing, 1999: Section 3.1). The tribes' economy also consisted of intertribal trade, livestock, trade with fur companies, and hunting, fishing, and gathering. In 1805 Meriwether Lewis and William Clark (Lewis and Clark) traveled up the Columbia River from the mouth of the Snake River to the mouth of the Yakima River, approximately 7 miles from the Hanford site. The Nez Perce Tribe provided Lewis and Clark with food, shelter, and sent guides along to assist them on part of their expedition to the Pacific Coast. Lewis and Clark's travels began the exploration and subsequent European settlement of the region, and ultimately, the Hanford Reach (DOE, 2003).

During the late 19th century industries were developed on the Columbia River. In 1866, R.D. Hume established the first salmon cannery on the Columbia River. From

1880 to 1900, orchards were established at Hood River and Wenatchee on the Columbia River and along the Yakima and Okanogan Rivers. In the early 1880s the first commercial apple orchard in Chelan County is believed to have been planted. Orchardists dumped their blemished or deformed apples into the Columbia River. In 1916 a Chelan businessman purchased these apples from local orchardists and sold the apples to juice processing and fruit canning operations. Eventually, the Wenatchee Packing Corporation (now known as Wenatchee Canning Company) became the first fruit cannery established in Chelan County (Washington State Employment Security Department, 2002b).

From 1860 to 1882 the Oregon Steam Navigation Company dominated steamboat transportation on the lower and middle Columbia River. In 1877, a wagon road was constructed from Ellensburg to the foot of Priest Rapids, descending to the Columbia River down Haunsen Canyon. In 1882, an approximate 42-mile route between Yakima and Priest Rapids was constructed primarily for a freight terminal; however, both wagon roads were abandoned soon after a railroad was constructed (Grant PUD, 2001). Between the late 1800s and early 1900s, the railroad contributed to the growth and development of the region. For further discussion on the historical context see the Cultural Resources section herein; Grant PUD (2003).

Regional Economy

The State of Washington’s arable lands, mild climate, and unique growing season contribute to its recognition as a leading exporter of food and agricultural products. The Trade Development Alliance of Greater Seattle note the Columbia and Snake River systems provide a water route for agricultural products in the eastern portion of the State to be shipped to worldwide markets through ports in western Washington. Smaller ports in eastern Washington contribute to food processing and distribution facilities.

Although the region supports nonagricultural industries (mining, construction, manufacturing, transportation, retail, services, and government), agriculture is a major component in the State of Washington's economy. The primary commodities are apples and potatoes; other commodities include corn, cherries, grapes, pears, asparagus, beets, spinach, and cantaloupes. Wheat, cattle, and dairy products also contribute to the economy.

In 2002, the estimated number of farms in Washington was 35,939 totaling 15,318,008 acres. Of that figure, the total cropland was 8,038,469 acres. Other farms were livestock and poultry (U.S. Department of Agriculture, 2004). As an example, cherries, grapes, and pears, combined, account for 34,443 acres (Schotzko, n.d.). As noted in the 2002 Census of Agriculture report, the number of farms in Washington decreased approximately 10 percent from 40,113 farms in 1997 to the current as stated.

The market value of agricultural products sold[107] was estimated at $5.3 billion, of which $3.6 billion accounted for crop sales; livestock, poultry, and their products accounted for $1.7 billion (U.S. Department of Agriculture, 2004). Despite a decrease in the number of farms, the market value of agricultural products sold increased 8 percent.

The BOR's Columbia Basin Irrigation Project[108] land includes portions of Adams, Franklin, Grant, Lincoln, and Walla Walla Counties, with some northern facilities located in Douglas County, Washington. In January 1969, the BOR transferred the operations and maintenance for much of the project to three irrigation districts: East Columbia Basin Irrigation District; Quincy-Columbia Basin Irrigation District (Quincy District); and South Columbia Irrigation District (Northwest Power and Conservation Council, 2004).

Various agri-businesses spoke at the Commission staff scoping meetings conducted in April 2004 regarding the BOR's Columbia Basin Irrigation Project and how the businesses began as a result of the irrigation project. For example, Basic American Foods began operations in 1965. Further, the Quincy District delivers irrigation water to approximately 247,000 acres, of which 90,000 acres are return flows into lower Crab Creek.

At the scoping meeting the Washington DFW stated that UCR steelhead (federally-listed endangered) and summer Chinook salmon utilize Crab Creek. By letter filed May 3, 2004, Washington State Potato Commission comments that the Grant County agricultural community is heavily reliant upon Crab Creek for irrigation. By letter filed January 20, 2005, NMFS state that UCR steelhead and summer/fall Chinook salmon occur in the Crab Creek watershed. For further discussion on Crab Creek and its aquatic resources see the Aquatic Resources section.

Several companies in the region provide significant employment: Solar Grade Silicon, LLC; Chemi-Con Materials Corporation; Eka Chemicals; Moses Lake Industries; two potato processing facilities at Port of Warden; Basic American Foods; National Frozen Foods Corporation; and J.R. Simplot Company. The first four companies are

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[107] Market value of agricultural products sold represents the gross market value before taxes and production expenses of all agricultural products sold or removed from the place regardless of who received the payment. Market value is equivalent to total sales (U.S. Department of Agriculture, 2004).

[108] The BOR's Columbia Basin Irrigation Project was authorized for construction by the Rivers and Harbors Act and approved August 30, 1935 (49 Stat. 1028, 1039-1040, Public Law 74-409). The authorized purposes are for flood control, navigation, regulation of stream flow, storage and delivery of stored water for reclamation of lands and other beneficial uses, and the generation of electric energy.

foreign-owned that have production facilities in other countries (letter filed May 5, 2004, David K. Jones, President, Board of Commissioners, Port of Moses Lake, Moses Lake, Washington).

At the scoping meeting Washington State Potato Commission stated that potato growers in Washington State operate on an estimated 165,000 acres. In 2003 Washington State potatoes had a production (farm gate) value of approximately $500 million, ranking as the second largest crop in the State behind apples. In eastern Washington and northeastern Oregon, where much of the potato production occurs, the total regional employment related to potato production and processing is 28,000 jobs. The Washington State Potato Commission cited a 2001 report by Holland and Yeo in which potato farming and related processing contribute an estimated $3 billion annually to the Washington economy. Consequently, the employment provided by the potato industry is significant.

National Frozen Foods Corporation, by letter filed April 15, 2004, states that it farms over 25,000 acres in the Columbia River Basin and employs several hundred people. One of its plants, located in Moses Lake, Washington, produces approximately 300 million pounds of frozen vegetables annually.

Columbia Basin Vegetable Seed Association (CBVSA) represents 50 farms that raise seed crops, such as carrot, onion, radish, and parsley, on 5,000 acres. Of the seeds produced, approximately 50 percent is used domestically and 50 percent is exported. The CBVSA notes that these crops represent $5 million at the farm gate (letter filed May 7, 2004, from Pat Stevens, Columbia Basin Vegetable Seed Association, Quincy, Washington).

By letter filed May 26, 2004, Pacific Northwest Vegetable Association notes the region and favorable climate of the State of Washington contribute to quality crops grown, such as asparagus, onions, peas, and sweet corn, and the processing industry represents the purchaser of vegetables from Grant County and the state. Washington vegetable crops have a farm gate value of $343 million and Grant County produces about 20 percent of the total. The processing industry represents the largest purchaser of vegetables from Washington State and Grant County.

Between 1970 and 2004, the total civilian labor force[109] in Washington grew from 1.4 million to 3.2 million people. The State expects to gain an additional 1 million

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[109] Civilian labor force is defined as persons 16 years of age and older in a specified geographic area who are either employed (either part-time or full-time) or actively seeking employment. Individuals in nursing homes, prison, or the armed forces are not considered part of the labor force (State of Washington, 2005).

workers by the year 2030 (State of Washington, 2005). This report indicates that from 2005 to 2010 the State's workforce is expected to increase at a 1.6 percent annual rate; from 2010 to 2030 the growth rate will decrease to 0.9 percent annual rate due to the aging of the population.

As discussed below, the existing Project is located in a portion of Benton County. Benton and Franklin Counties comprise the Tri-Cities (Richland, Kennewick, and Pasco) Metropolitan Statistical Area. The Tri-Cities area economy is supported by agriculture, food processing, and related industries. The DOE's operations at Hanford, located in Benton County, provide for specialized professional and technical occupations. For example, the engineering and management services employ approximately 6,240 persons. Research indicates that these industries will continue to provide a substantial employment base (Washington State Employment Security Department, 2001).

The unemployment rate for Washington State in 2003 was 7.5 percent; an increase from 6.4 percent in 2001. Historically, the unemployment rate in Washington has been higher than the U.S. average due to a relatively high concentration of resource-based industries in the State (State of Washington, 2004). Columbia Basin Consultants (2000) reach similar conclusions regarding unemployment rates.

Economy of the Project Area

The region surrounding the existing Project is lightly developed or undeveloped. The Project is located in portions of Benton, Chelan, Douglas, Grant, Kittitas, and Yakima Counties, Washington. These counties define the environment for socioeconomic resources that may be affected by the Project.

At the Commission staff scoping meetings the agri-businesses mentioned the irrigation system with its dams and canals - -an important infrastructure in the project area. See Table 34 for the acres of irrigated land for the counties.

The primary counties for agricultural sales are Benton, Grant, and Yakima (Washington State Department of Agriculture, 2004). Crops grown in Benton County include wheat, potatoes, asparagus, grapes, and cherries. Data for Benton County indicate the 2002 market value of agricultural products was $400,571,000, an increase of 30 percent from 1997. Of this total, crop sales accounted for $366,342,000 (U.S. Department of Agriculture, 2004). Grant County produces potatoes, corn, green peas, and wheat. In 2002 the market value of agricultural products was $881,756,000, an increase of 6 percent from 1997. Of this total, crop sales accounted for $626,501,000 (U.S. Department of Agriculture, 2004). Yakima County produces cherries, asparagus, apples, and wheat. In 2002 the market value of agricultural products was $843,871,000, a decrease of 6 percent from 1997. Of this total, crop sales accounted for $508,254,000 (U.S. Department of Agriculture, 2004).

Table 34. Acres of irrigated land for counties in the Project area (Source: U.S. Department of Agriculture, 2004).

County	Acres of Land Irrigated
Benton	188,340
Chelan	34,705
Douglas	24,049
Grant	485,459
Kittitas	91,944
Yakima	269,127
Washington (State Total)	1,823,155

For Washington, the 2002 market value of livestock, poultry, and their products was approximately 1.7 billion; the project area counties' market value of said commodities ranged from $4,888,000 (Chelan County) to $355,617,000 (Yakima County).

By letter filed May 17, 2004, Alice Parker of P & P Farms comments that, as a farmer in Grant County, crop production from the area exceeds $600 million each year. With processing and packaging the economic value exceeds $6 billion annually.

Over a 31-year period (1970 to 2001) the civilian labor force for the project area fluctuated due to several factors, such as a slow regional economy, severe cold weather in 1985 adversely affected fruit and crop production, a shift in the population (*e.g.*, in-migration, residents leaving a county), and a shift in employment trends. For example, the increases in asparagus, apple, and cherry production in 1983 resulted in an increase in migrant workers to Yakima County (Washington State Employment Security Department, 2002c).

Recent information (Glenn, 2004) supports the data regarding a shift in employment trends. For example, while Yakima County lost agricultural employment in fruit trees, hay, and other miscellaneous farming, Benton and Grant Counties gained agricultural workers in fruit trees, as well as cattle ranching and crop production. In Grant County, employment in crop production accounted for 5,900 jobs and food processing-related employment accounted for 3,300 jobs (Grant PUD, 2003). The shift in employment trends is noted by Meseck (2005) - - between April 2004 and April 2005, nonagricultural employment in Yakima County grew by 1.3 percent (1,300 more jobs), primarily in the packing, sorting, and shipping-related processes for the 2004 apple crop.

For Kittitas County, the largest employing sector is in crop production, including tree fruits, oats, hay, and potatoes. Kittitas County is the largest producer of oats and hay in the State. Data for the county indicate the 2002 market value of agricultural products was $56,364,000, a decrease of 31 percent from 1997. Of this total, crop sales accounted for $38,432,000 (U.S. Department of Agriculture, 2004). The trade, services, and government sectors also contribute to the county's economy. In 2000, approximately 5,470 people were employed in the services and trade sector (*e.g.*, restaurants, tourist and recreation-related industries). The government sector employed approximately 3,700 people (Washington State Employment Security Department, 2002a).

The Chelan-Douglas Counties is part of the north central area, which also includes Kittitas and Okanogan Counties. Research indicates that this area is a top producer of apples, cherries, and pears. For example, the 2001 cherry crop was valued at over $150 million (Washington State Employment Security Department, 2002b). Data for Chelan and Douglas Counties indicate the 2002 market values of agricultural products were $169,406,000 and 124,348,000, respectively, (U.S. Department of Agriculture, 2004), which showed an increase from 1997. Of these totals, crop sales accounted for $164,518,000 for Chelan County and $118,186,000 for Douglas County. The agricultural sector employed an estimated 11,440 persons in 2000 (Washington State Employment Security, 2002b).

At the scoping meeting, representatives from the Port of Warden and Port of Mattawa, located in Grant County, noted that based on 2002 data the average annual income for their communities is $22,077 and $15,137, respectively, which is below both Grant County and Washington State. Further, they commented on the unemployment rate for Port of Warden is 18.1 percent (year 2000) and for Port of Mattawa, 16.2 percent (year 2001). In Mattawa approximately 86 percent of public school students are eligible for the free lunch program.

Also at the scoping meeting, healthcare representatives commented that healthcare is an important employer in Grant County with an estimated total 730 people. They also stated that the agricultural business that supports the community also employs the uninsured and underinsured workers. Approximately 65 to 70 percent of the people receiving health care at the hospitals qualify for low income support.

Some of the other employers in the project area include Moses Lake School District, Grant County PUD, Samaritan Hospital, Quincy School District, Sunfresh (vegetable packer), Allen Produce (vegetable/fruit packer), and Lamb Weston (food processing) (Grant PUD, 2003).

Regarding the Port of Warden and Port of Mattawa scoping comments our analysis takes into account the various cities, towns, and communities within the Project area. Nearby population centers include: (1) East Wenatchee; (2) Ellensburg; (3) Ephrata; (4) Kittitas; (5) Mattawa; (6) Moses Lake; (7) Moxee; (8) Prosser; (9) Quincy; (10) Richland; (11) Yakima; and (12) Wenatchee. See Table 35 for a comparison in resident civilian labor force and employment by county. The unemployment rate is also shown. Although not reflected in the annual employment numbers, the unemployment rate among the counties can vary according to the predominance of agriculture and seasonality of its employment. For example, we looked at Chelan County's 2001 unemployment rate by month. As noted by Washington State Employment Security Department (2002b) the 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. The Yakima County employment rate showed a similar trend, with the highest unemployment rates in January or February, then decreasing in June or July with the asparagus and cherry harvests and increasing again at the end of the harvests.

Table 35. Employment statistics for 1990 and 2001 for the counties in the Priest Rapids Project Area (Source: Washington Employment Security Department, April 2002).

	Benton	Chelan	Douglas	Grant	Kittitas	Yakima	Washington (State Total)
1990							
Civilian Labor Force	60,600	30,980	16,350	27,070	12,590	102,300	2,538,000
Total Employment	57,000	28,360	15,150	24,760	11,630	91,400	2,412,800
Total Unemployment	3,700	2,630	1,200	2,310	960	10,900	125,100
Percent Unemployment	6.1	8.5	7.3	8.5	7.7	10.7	4.9
2001							
Civilian Labor Force	71,800	33,850	18,830	36,340	14,920	108,000	2,995,700
Total Employment	67,100	30,630	17,410	32,610	13,940	95,800	2,804,100

	Benton	Chelan	Douglas	Grant	Kittitas	Yakima	Washington (State Total)
Total Unemployment	4,700	3,220	1,430	3,730	970	12,200	191,600
Percent Unemployment	6.5	9.5	7.6	10.3	6.5	11.3	6.4

For year 2000, Table 36 shows three economic parameters: median household income, per capita income, and the percent of families below the poverty level. Of the six counties within the project area, Benton and Kittitas Counties are not classified as economically distressed counties. The four other counties are classified as economically distressed counties, which make them eligible for some preference in bidding for government contracts and distressed area tax incentives for manufacturing (Washington State Employment Security, 2002). By letter dated May 26, 2005, Yakima County comments that because of its poverty the county received a federal designation as a rural enterprise community.

Table 36. Household and per capita income for counties in the Priest Rapids Project Area (Source: U.S. Census Bureau, 2000).

County	Median Household Income	Per Capita Income	Families Below Poverty Level (%)
Benton	$47,044	$21,301	7.8
Chelan	$37,316	$19,273	8.8
Douglas	$38,464	$17,148	11.2
Grant	$35,276	$15,037	13.1
Kittitas	$32,546	$18,928	10.5
Yakima	$34,828	$15,606	14.8

In comments on the draft EIS, the Port of Warden and Port of Mattawa state that both communities are poor. Future economic growth is dependent on affordable and stable electric rates. Grant County Economic Development Council, in comments on the draft EIS, states that any significant increase in electric rates would make local industries non-competitive with other industries that are closer to major markets.

Regional Population

The State of Washington (2004) estimates Washington's population for 2004 is 6,167,800, an increase of 4.64 percent from the year 2000 (5,894,143 people). Various reports indicate that migration is a major component of the State's growth. From 2000 to 2004, Benton and Kittitas Counties exhibited a population increase of 8.86 percent and 7.31 percent, respectively, which is higher than other counties for the project area: Douglas County at 4.90 percent; Grant County at 4.82 percent; Chelan and Yakima Counties are 2.68 percent and 2.21 percent, respectively. We assume population increases will continue. In Grant County, population is estimated to increase from 78,300 in 2004 to a population of 95,715 in 2020 (Grant County Economic Development Council, 2005).

Table 37 shows the population and population change (2000-2004) for the cities, towns, and communities within the Project area. East Wenatchee is located in Douglas County; Ellensburg and Kittitas are in Kittitas County; Ephrata, Mattawa, Moses Lake, and Quincy are in Grant County; Moxee and Yakima are in Yakima County; Prosser and Richland are in Benton County; and Wenatchee is located in Chelan County.

Table 37. Recent population changes (2000-2004) for cities, towns, and communities in the Priest Rapids Project Area (Source: State of Washington State, 2004).

Population Area	2000 Population	2004 Population	Population change (Percent) 2000-2004
Washington State	5,894,143	6,167,800	4.64
East Wenatchee	5,757	8,255	43.4
Ellensburg	15,414	16,390	6.3
Ephrata	6,808	6,890	1.2
Kittitas	1,105	1,130	2.3
Mattawa	2,609	3,265	25.1
Moses Lake	14,953	16,110	7.7

Population Area	2000 Population	2004 Population	Population change (Percent) 2000-2004
Moxee	821	895	9.0
Prosser	4,838	4,985	3.0
Quincy	5,044	5,255	4.2
Richland	38,708	42,660	10.21
Yakima	71,845	79,480	10.6
Wenatchee	27,856	28,760	3.2

n Washington State, persons age 65 and over will represent 19.7 percent of the population in 2030, an increase from 11.2 percent in 2000. With the exception of Benton County, persons age 65 or over represented an estimated 12.0 percent of the population in the other counties. For Benton County the elderly population was 10.3 percent (State of Washington, 2004).

Indian Tribes

From a 1997 initiative through the Washington Governor's Office of Indian Affairs, Tiller and Chase (n.d.) find that federally-recognized Indian tribes contributed an estimated $1 billion annually to the Washington State economy. Tribal enterprises employ approximately 14,375 people full-time, including non-tribal persons. The authors note that among Indian tribes in Washington State, fishing, hunting, and gathering of natural resources have been central activities for thousands of years and remain important to the tribes for subsistence, economic, and ceremonial purposes.

Salmon was the principal source of food, primarily taken during the annual spring run. “Dried on open air racks, the fish would be stored for winter food or used for trading with other tribes” (Washington State Employment Security Department, 2001, p.4). The Nez Perce, *et al*. (1995) state that salmon fishing maintained over 60,000 jobs and the net value of the northwest’s salmon fishing in 1990 was estimated at $279 million. The CRITFC, by letter filed May 27, 2004, state that “anadromous fish, including Pacific lamprey, have significant cultural and religious significance to tribal members, provide members with subsistence for health and well-being, and contribute to a critical share of tribal commerce in an area of limited economic opportunity” (p. 3).

Currently, the Yakama, Umatilla, Confederated Tribes of the Warm Springs Reservation of Oregon (Warm Springs), and the Nez Perce Tribe co-manage along with various resource agencies the fishery resource to protect and restore anadromous fish throughout their lands.[110]

Tribal governments have initiated other activities that provide employment, thereby contributing to both the tribes' and state economy.[111] The State of Washington's Office of Indian Affairs and Office of Trade and Economic Development note that tribes are utilizing tourism as a source of economic development.

For the Project we identified six Indian tribes that have an interest in the project relicensing: (1) the Colville; (2) Yakama; (3) Wanapum; (4) Umatilla; (5) Warm Springs; and (6) Nez Perce. See the Cultural Resources section herein and Smithsonian Institution (1988) for further information on the tribes.

The Coleville reservation, located in north-central Washington, is approximately 1.4 million acres and its estimated enrollment in 2000 was 8,398. Persons age 65 and over represent 6.2 percent of the tribal community. The economy of the Colville consists of agriculture, forestry, construction, manufacturing, recreation/tourism, such as the Rainbow Beach Resort (with vacation cabins, RV spaces, and boat rentals), and casinos. The Confederated Tribal Services Corporation, a general contracting/construction firm, has projects throughout Washington State that earned revenues of $1.6 million in 2000 (Barney & Worth, 2001). The tribe also operates health clinics. Based on U.S. Census Bureau data, the Colville has an estimated employment of 5,878. Table 38 shows several economic characteristics of the Indian Tribes. Please note the data reflects the year 1999.

Data indicates an unemployment rate for the Colville at 11.9 percent, which is 6.7 percent higher than Washington State (5.2 percent in 2000).

The Yakama reservation, located in south-central Washington, is approximately 1.1 million acre and its estimated enrollment in 2000 was 8,337. Persons age 65 and over represent 4.7 percent of the tribal community. The economy of the Yakama consists of agriculture, forestry (such as, Yakama Forest Product), manufacturing, andrecreation/tourism (such as, the Yakama Nation Museum of the Cultural Heritage Center). Other tribal income is derived from leasing tribally-owned farming and

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110 See Joint Response of the Yakama Nation, Umatilla and the CRITFC Contesting the Offer of Settlement, dated May 10, 2004, for the Priest Rapids Hydroelectric Project No. 2114.

111 Selected information available at: www.umatilla.nsn.us; www.ohwy.com/wa/y/yakamana.htm; www.inlandnwregion.org; www.ihs.gov; www.edforco.org; and www.critfc.org.

Table 38. Median household and per capita income of the Indian Tribes (Source: U.S. Census Bureau, 2000a).

Tribe	Median Household Income	Per Capita Income	Families Below Poverty Level (%)
Colville	$29,830	$11,805	19.9
Yakama	$30,714	$9,564	28.7
Wanapum	unavailable	Unavailable	Unavailable
Umatilla	$37,827	$15,158	12.0
Warm Springs	$28,203	$7,467	26.8
Nez Perce Tribe	$27,696	$12,817	17.5

grazing lands. In addition, the tribe operates health facilities and clinics. Based on U.S. Census Bureau data, the Yakama has an estimated employment of 5,548. Data indicates an unemployment rate of 12.3 percent, which is 7.1 percent higher than Washington State.

The Wanapum[112] once occupied villages from near Vantage, southward, 80 miles to Pasco, including portions of the Hanford site. The Wanapum subsisted on local game and salmon migrating up the Columbia River, and gathered roots, berries, and wild carrots. The Crab Creek drainage is an important part of the Wanapum past, and continues to serve the tribe's subsistence and ceremonial needs (Northwest Power and Conservation Council, 2004). In its filing of May 27, 2005, the Wanapum comment that their homes, ceremonial longhouse and village site were relocated onto land adjoining the Priest Rapids dam. The Wanapum and Grant PUD have continued their cooperative efforts in monitoring and protecting cultural resources (letter filed May 7, 2004, Laurel Heacock, Grant PUD, Washington). This effort is evident in the Wanapum Traditional Cultural Program and Wanapum River Patrol established in order to continue the tribal traditions and protect tribal lands, respectively.

The Umatilla, located in northeastern Oregon, is approximately 172,000 acres and its estimated enrollment in 2000 was 2,927. Persons age 65 and over represent 11.1 percent of the tribal community. The economy of the Umatilla consists of agriculture,

[112] "History and Cultural Programs" pamphlet. Wanapum dam Cultural Center.

forestry, retail, and recreation/tourism, such as the Wildhorse Casino and Resort (with a hotel, RV spaces, and 18-hole golf course). The tribe operates a health clinic. The Umatilla, along with the State of Oregon, operates fish propagation facilities to restore salmon runs. In the Grande Ronde watershed, the Umatilla and Nez Perce Tribe, along with resource agencies, developed a salmon restoration plan for the U.S. Forest Service (Nez Perce, *et al*., 1995). Based on U.S. Census Bureau data, the Umatilla has an estimated employment of 2,139 people. Data indicates an unemployment rate of 4.7 percent.

The Warm Springs reservation, located in north-central Oregon, is approximately 600,000 acres and its estimated enrollment in 2000 was 3,190. Persons age 65 and over represent 2.5 percent of the tribal community. The Warm Springs's economic development includes continued co-operation of the Pelton-Round Butte Hydroelectric Project No. 2030 and other industries such as agriculture, forestry, manufacturing, retail (*e.g.*, Warm Springs Clothing Company), and recreation/tourism (such as, Kah-Nee-Ta Resort). The tribe operates the Warm Springs Health & Wellness Center. In 1992, the Warm Springs established a Small Business Development Center that offers a grant program for tribal members (Barney & Worth Inc., 2001). Based on U.S. Census Bureau data, the Warm Springs has an estimated employment of 1,848 people. Data indicates an unemployment rate of 14.7 percent.

The Nez Perce reservation, located in northern Idaho, is approximately 750,000 acres. The tribe's estimated enrollment in 2000 was 4,082. Persons age 65 and over represent 6.8 percent of the tribal community. The economy of the Nez Perce Tribe consists of agriculture, forestry, construction (Nez Perce Limestone Enterprise), manufacturing, and retail. In addition, the tribe employs approximately 50 staff in their fish program (Nez Perce, *et al.*, 1995). Based on U.S. Census Bureau data, the Nez Perce Tribe has an estimated employment of 2,998. Data indicates an unemployment rate of 7.5 percent.

3.10.2 Environmental Effects and Recommendations

Grant PUD proposes environmental protection measures that would indirectly affect socioeconomic conditions in the vicinity of the Project. Measures that are proposed for the protection and enhancement of fish, wildlife, recreation and cultural resources would have a positive effect on socioeconomic conditions by providing jobs and increasing tourism. The cost of implementing such measures would increase the cost of Project power, which would have a negative effect on socioeconomic conditions by decreasing the production cost advantage of the food growing and processing industries that are an important part of the regional economy. In its license application, Grant PUD states that it proposes a comprehensive environmental protection, mitigation and enhancement package that would preserve its ability to provide low-cost, reliable power for the benefit of Grant County customers and the millions of electric customers outside the County that are served through long-term power sales contracts (Grant PUD, 2003, Exhibit E1, Volume 2).

During the relicensing process, many commentors expressed the concern that costly protection, mitigation, and enhancement measures at the Project would impact the project's ability to continue to provide low-cost, reliable power. To sustain the agri-business economy of the mid-Columbia River Basin the commentors stated that electric power rates in Grant County must be kept significantly below market rates, which are largely driven by the cost of non-renewable fossil fuels. They say that low-cost electricity is critical to the local economy and the social welfare of the community. Among the commentors at the scoping meetings, the Port of Mattawa stated that long-term stable electric rates are essential in attracting new industry to the area.

In its motion for intervention, Yakima County stated that Grant County has not shared the many economic benefits related to its ownership of the Project with Yakima County. In response, Grant County Economic Development Council noted that a privilege tax paid by Grant PUD into the State General Fund is distributed back into all 39 Washington State counties, including Yakima County (July 11, 2005, letter from Grant County Economic Development Council). Information filed by Grant PUD shows that Yakima County has received over $900,000 from Grant PUD's privilege tax payments since 2000. In addition, Grant PUD pointed out that PacifiCorp, the major electricity supplier to Yakima County, purchases a share of Project power at a cost-based rate of less than one cent per kWh and sells electricity to its Yakima County residential customers at about the same rate as Grant PUD charges Grant County residential customers. Hence, the Council and Grant PUD believe that Yakima County does receive significant benefit from the Project.

CRITFC (undated) notes the cumulative effects of dam construction to produce electricity, irrigation for agriculture, and navigation have transferred potential wealth in the river basin from salmon on which the tribes depend to non-Indians. The tribal traditional subsistence economy is broad-based, which includes fishing, hunting, gathering of berries and medicinal plants, and livestock grazing (U.S. Department of Agriculture, Forest Service, Interior, BLM, 1996).

The Yakama has commented on numerous occasions to the effect that Grant PUD should make available to its on-Reservation utility, Yakama Power, a "fair share" of project power at, or below the cost of production.[113] This recommendation would represent a direct economic benefit to the Yakama, both by providing an economical

[113] Yakama Nation's Motion to Intervene and Supporting Memorandum in Grant PUD's Application for New License, Project No. 2114-116, January 5, 2005.

source of power for use by the Yakama and, potentially, a source of income through the sale of a portion of that power at market rates to other customers of Yakama Power.

In its comments on scoping[114], the Yakama recommends further that any license issued to Grant require the economic benefits of the project to be redistributed by means of a "public benefits charge," pursuant to which:

> (1) Ten percent of the project's gross revenues would be "taken off the top" as a "public benefits charge" and paid in various portions to Yakama and to Grant, Yakima, Kittitas, and Benton Counties. The payments would be made with the understanding that they would be used for energy and water conservation, and renewable resources purposes, preferably related to project effects.
>
> (2) From any remaining economic benefits after the "public benefits" charge is deducted, Grant would receive ten percent "off the top," and the remaining 90 percent would be distributed to Yakama and the four abovementioned counties in the same proportions as the public benefits charge.

Yakama characterizes the public benefits charge as satisfaction of a debt owed by Grant for project impacts during the initial license term. The recommended allocation of remaining economic benefits appears to be based on Yakama's belief that the FPA was intended to ensure that the economic benefits of licensed projects are broadly shared and because Yakama and the neighboring counties have experienced losses of fish, wildlife, and cultural resources as a result. Although this recommendation raises legal questions more appropriately addressed in the Commission's license order, we acknowledge the recommendation in this EIS and briefly discuss the merits for such a proposal as mitigation for past and future environmental effects in our analysis.

Our Analysis

Although Grant PUD made no proposals that pertain directly to socioeconomic resources within the project boundary, many of Grant PUD's proposed measures would have a positive effect on the socioeconomic resources of the counties, communities and tribes in the region or receiving power (either directly from Grant PUD, or indirectly from the purchasers) from the Project. Those proposals include capital investment in facility improvements totaling about $113 million for anadromous fish and $20 million for recreation.

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[114] Letter filed May 7, 2004, from Tim Weaver, Attorney, Yakama Nation to Commission Secretary.

In addition, the project is a source of low-cost power, which provides an economic benefit to residents and businesses located in Grant County, as well as, the other jurisdictions served by purchasers of project power. This low-cost power has had a positive socioeconomic effect on the region's agricultural, food processing, basic metals (aluminum) manufacturing, tourism, and recreation industries. Grant PUD's proposal to replace the existing turbines over the term of a new license with more efficient units at a cost of about $280 million would increase the generating capacity by about 12 percent and is expected to result in lower mortality for downstream fish passage and improved water quality with respect to TDG downstream from the project dams. The cost for Grant PUD's proposed enhancements would increase the cost of generation, but still provide a relatively low cost source of power compared to the fossil fueled generating resources, which hydropower replaces in the region.

Our baseline for considering socioeconomic effects is the existing conditions of the project, rather than pre-project conditions. There is no indication on the record that a new license would contribute to any wealth transfer from area tribes by further reducing the quality of the salmon fishery in the project. In contrast, many of the proposed measures would improve future conditions for anadromous fish within the project and downstream in the Hanford Reach. Insofar as proposed environmental measures protect and enhance anadromous fish, Grant PUD's proposal would have some positive effect on tribal socioeconomic conditions.

With respect to the Yakama's recommendation for Grant PUD to allocate a portion of the project output to the Yakama and neighboring counties, the Commission's policy is not to require compensation on relicensing for alleged impacts experienced during the term of the original license as a result of construction and operation of the project consistent with the terms of its license. In any event, there is no evidence that neighboring counties have been negatively affected by the project. Yakima County asserts generally that the project detrimentally impacts fish and wildlife resources and shorelines within its boundaries, and adversely affects recreational opportunities for its citizens (Yakima County's Motion to Intervene, filed May 7, 2005). It also states that the project should benefit the public on a regional basis, and asserts that it has not received any such benefits (Yakima County's May 27, 2005 response to the Commission's Notice of Application ready for Environmental Analysis). Yakima County does not, however, make any specific allegations of harm.

The project's effects on fish and wildlife are discussed elsewhere in this document in great detail, and appropriate mitigation measures are recommended. As to recreation, the project area includes many recreation sites to which citizens of the Yakima County have easy access via Interstate 90 and connecting roads. There are no project-related facilities in Yakima County, but this is most likely because the U.S. Army's Yakima Training Center, which is used for military training, restricts access to the eastern portion of Yakima County bordering the Priest Rapids reservoir.

Kittitas County receives economic benefits from the project because Public Utility District No. 1 of Kittitas County receives low-cost project power as a preference party pursuant to Public Law No. 83-544. There are also several developed and undeveloped recreation facilities wholly or partially within the project boundary in Kittitas County operated by Grant or others. *See* Application, Volume 5, Exhibit E7 at section 7.3.1-2 and Figure E7-3. The great majority of Kittitas County residents also have easy access to project area facilities via I-90. The Kittitas County Department of Public Works recommends various recreational improvements, several of which Grant has agreed to undertake and which we are recommending be included in any new license issued.

As to Yakama itself, its allegations of past and continuing harm from the project related to fish and wildlife and cultural resources are discussed elsewhere in this document, which makes many recommendations for mitigation and enhancement measures.

Benton Rural Electric Association filed comments asserting merely that its consumer-owners have an interest in environmental issues related to the project because of their proximity to it, and states its desire for a short-term arrangement under which it purchases project power to be converted to a long-term arrangement (Benton Rural Electric Association's Motion to Intervene, filed January 6, 2004). Grant County's power sales agreements are not a matter for consideration in the license except to the extent that its obligations under Public Law 83-544 are implicated. Grant PUD's compliance with that statute, as discussed below, will be considered in the Commission's order dealing with the merits of Grant PUD's applications.

Finally, Pat Kelleher states that because Grant receives most of the economic benefits of the project, its retail rates are dramatically lower than those of some other neighboring counties. He contends that the public interest requires the project to be treated as a regional resource, with the economic benefits shared by all of the counties in the project area. To this end, he recommends a license article requiring Grant to sell most or all of the project power pursuant to a nondiscriminatory market-based mechanism (Comments filed February 17, 2004, May 3, 2004, and May 17, 2005).

It is the Commission's long-standing and consistently applied policy not to require a licensee to allocate project power in the absence of a legislative directive to the contrary. *Power Authority of the State of New York*, 109 FERC ¶ 61,092 (2004) The only expression of legislative intent with respect to this project is the Congressional determination in P.L. 83-544 that economic benefits should be shared through the Reasonable Portion allocation. As required by prior orders of the Commission, Grant PUD has submitted with its application a marketing plan for making a portion of the

Project power available to the region (Grant PUD, 2003). Whether the marketing plan is in compliance with P.L. 83-544 and the Commission's prior orders is a matter for consideration in the merits order on Grant PUD's application.

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. There would be no significant change to the existing environmental setting or project operation. No new environmental measures 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 non-developmental resources in the basin. At any point in the future, project facilities and operations could be modified or removed and any future or ongoing effects altered. There is no 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 9,754,000 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 and adverse effects on downstream fish habitat in the Hanford Reach. By constraining power operations to protect and enhance fish habitat, the Project sacrifices short term energy benefits to mitigate the cumulative effects of all the Mid-Columbia Projects on fish. 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.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Project's use of the Columbia River for hydropower purposes to see what effect various environmental measures would have on the Project's costs and power benefits. Consistent with the Commission's approach to economic analysis, the "power benefit" of the project is defined as the cost of obtaining the same amount of energy and capacity using the likely alternative generating resources available in the region. The "power value" is the unit cost of the selected alternative generating resource and is usually expressed in terms of dollars per megawatt hour ($/MWh) for energy and dollars per kilowatt-year ($/kW-yr) for capacity. The combined value (or cost) of energy and capacity can also be expressed in terms of $/MWh for a given amount of energy and capacity. Reducing the cost of licensing alternatives to an average cost per unit of electricity generated provides a convenient metric for assessing the public benefit of the project for power production.

In keeping with Commission's policy as described in Mead, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.[115] Our analysis includes: (1) an estimate of the net power benefit of the Project for each of the licensing alternatives, and (2) an estimate of the cost of individual measures considered in the EIS for the protection, mitigation and enhancement of environmental resources affected by the Project.

To determine the net power benefit for each of the licensing alternatives, we subtract the cost of producing power at the Project from the total power benefit, which, as we said above, is the cost of obtaining the same amount of power using a likely alternative source of power. For any alternative, a positive net annual power benefit indicates that the Project costs less than the current cost of alternative generation resources; a negative net annual benefit indicates that project power costs more than the current cost of alternative generation resources. The net benefit helps to support an informed decision concerning what is in the public interest with respect to a proposed licensing alternative, or proposed license condition. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

In the comprehensive development section, we use the estimated cost of individual measures to help us decide if the environmental benefit to the resource (usually described

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[115] See Mead Corporation, Publishing Paper Division, 72 FERC ¶61,027 (July 13, 1995). In most cases electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

in qualitative, or non-dollar valuation terms) justifies the cost of the measure. For this purpose, we convert the capital and annual cost of individual measures to equal annual amounts spread over a 30-year period of analysis.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECT

For the Project, we assume the energy value is similar to the cost of purchasing the equivalent generation from BPA at its new resource rate for firm power.[116] 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/MWh. We use BPA's new resource capacity demand rate schedule to value the project's 1,535,000 kW of dependable capacity at $24 per kW per year (kW-yr). Using the average energy value of $34/MWh and a capacity value of $24/kW-yr, the combined power value is $39/MWh based on the current average annual net generation of 8,608,799 MW.

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.

Table 39 summarizes the assumptions and economic information we use in our analysis. Most of this information was provided by Grant PUD in its license application. We find that the values provided by Grant PUD are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal O&M cost; and Commission fees.

Table 39. Summary of key parameters for economic analysis of the Priest Rapids Project (Source: as noted).

Parameter	Value	Source
Existing Capacity/Net Dependable Capacity:		
Wanapum (MW)	1038/842	Grant PUD[a]
Priest Rapids (MW)	855/805	
Total (MW)	1,893/1,647	

[116] Bonneville Power Administration, 2002 Wholesale Power Rate Schedules (Revised May 2004).

Parameter	Value	Source
Proposed Capacity/Net Dependable Capacity:		
Wanapum (MW)	1038/842	Grant PUD[a]
Priest Rapids (MW)	956/900	
Total (MW)	1,994/1,742	
Existing Average Annual Generation:		
Wanapum (MWh/yr)	5,121,289	Grant PUD[b]
Priest Rapids (MWh/yr)	4,558,338	
Less Rock Island Tailwater benefit	-639,993	
Total (MWh/yr)	9,039,634	
Proposed Average Annual Generation:		
Wanapum (MWh/yr)	5,121,289	Grant PUD[b]
Priest Rapids (MWh/yr)	5,258,690	
Less Rock Island Tailwater benefit	-626,301	
Total (MWh/yr)	9,753,677	
Energy value	$34/MWh	Grant PUD/staff [c]
Capacity value	$24/kW-year	Staff [c]
Overall cost of money	7 percent	Grant PUD/Staff
Discount rate	7 percent	Staff
Term of financing	20 years	Staff
Period of analysis	30 years	Staff
Annual Operation & Maintenance cost	$35,745,586	Grant PUD/staff [e]
Net Investment	$416,904,355	Grant PUD[f]

[a] From Exhibit B of license application; net dependable capacity is based on summer flow and load conditions.

[b] From Exhibit B of license application; adjustment compensates for Wanapum reservoir encroachment at Rock Island Project's tailwater.

[c] Based on BPA's new resource energy and capacity rate schedule.

[e] From Grant PUD's 2004 Annual Report: $17,606,837 for Wanapum (p. 140) and $18,138,749 for Priest Rapids (p.109).

[f] Net plant investment estimated by staff from information contained in Grant PUD's 2004 Annual Report; includes total plant investment less accumulated depreciation for Priest Rapids and Wanapum ($142,029,777 and $160,886,947, respectively), plus costs for construction in progress ($62,107,121) and licensing costs ($51,880,510), all as of December 31, 2004.

4.2 COMPARISON OF ALTERNATIVES

Table 40 summarizes the annual cost, power benefits, and annual net benefits for the three alternatives considered in this final EIS: no-action, Grant PUD's proposal, and the staff alternative.

Table 40. Summary of the annual cost, power benefits, and annual net benefits for three alternatives for the Priest Rapids Hydroelectric Project (Source: staff).

	No Action	**Grant PUD's Proposal**	**Staff Alternative**
Installed capacity (MW)	1,893	1,994	1,994
Annual generation (MWh)	9,039,634	9,753,677	9,753,677
Annual power value	$329,546,000	$377,346,000	$377,346,000
($/MWh and mills/kWh)	38.28	38.69	38.69
Annual cost	$69,341,000	$146,722,690	$145,669,980
($/MWh and mills/kWh)	8.06	15.04	14.93
Annual net benefit	$260,205	$230,623,310	$231,676,020
($/MWh and mills/kWh)	30.22	23.64	23.75

4.2.1 No-Action Alternative

Under the no-action alternative, the project would continue to operate as it does now. On July 23, 2004, the Commission issued an order[117] amending Grant PUD's license and authorizing the replacement of the 10 turbines at the Wanapum development with ten new, upgraded turbines over a period of about 8 years. The order authorized the replacement of one turbine, followed by a study to test the effect of the advanced turbine design on fish passage survival. Replacement of the remaining 9 turbines would be allowed to proceed only after the Commission informed the licensee that test results were satisfactory. On October 11, 2005, Grant PUD filed a report on fish survival through the first installed turbine and, subsequently, on December 14, 2005, the Commission issued an order[118] authorizing the installation of the remaining nine advanced design hydro turbines. The new turbines increase the capacity of each turbine generator set by 13.8 MW. The Commission's order approving the installation of the remaining 9 turbines increased the authorized capacity of the Wanapum Development from 900 to 1,038 MW. Grant PUD expects to replace the remaining 9 turbines at the rate of about one every 9 months. The capacity and average annual generation for the no-action alternative in this final EIS represents the conditions after replacement of all approved turbine units at the Wanapum Development. Likewise, the cost of the Wanapum turbine replacements is included in the no-action alternative. Grant PUD estimates it will cost $124,630,387 to replace the Wanapum turbines with the advanced design turbines.

[117] 108 FERC ¶ 62,075 (2004).
[118] 113 FERC ¶ 62,205 (2005)

Under the no-action alternative, the planned replacement of the 9 remaining turbines at the Wanapum Development would occur, but Grant PUD would not replace the turbines at the Priest Rapids Development or implement new environmental measures. Upon completion of the approved turbine replacements at Wanapum, the project would have a total authorized installed capacity of 1,893 MW and annually generate an average of 9,039,634 MWh of electricity. 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 $346,876,000 (about $38.4/MWh). The average annual cost of producing this power would be $78,380,000 (about $8.7/MWh), resulting in an average annual net benefit of $268,495,000 (about $29.7/MWh).

4.2.2 Grant PUD's Proposal

Grant PUD proposes to replace the 10 existing turbines at the Priest Rapids development with the same advanced turbine design being used for the Wanapum Development. Based on its assessment of the remaining useful life of the existing Priest Rapids turbines, Grant PUD proposes to replace the turbines beginning in 2017 and extending through 2023. The total cost of Priest Rapids turbine replacement is estimated at $155,374,804. We include this cost and the resulting capacity and generation increases in the proposed action alternative. Upon completion of the replacement of all 10 turbines, the total capacity at the Priest Rapids development would increase from 855 to 955.6 MW, the rated capacity of the existing generators.

Upon completion of the proposed turbine replacement upgrades at both developments, the total Project capacity would increase to about 1,994 MW, an increase of about 225 MW from the current installed capacity of 1,768.8 MW. With a total capacity of 1,994 MW, a dependable capacity of 1,742 MW and an average annual generation of 9,753,677 MWh, the Project would have an annual power value of $377,346,000 ($38.69/MWh), an annual production cost (levelized over the 30-year period of our analysis) of $146,722,690 ($15.04MWh), and an annual net benefit of $230,623,310 ($23.64/MWh).

4.2.3 Staff Alternative

The staff alternative includes the same developmental upgrades as Grant PUD's proposal and, therefore, would have the same capacity and energy attributes. Based on a total capacity of 1,994 MW, a dependable capacity of 1,742 MW and an average annual generation of 9,753,677 MWh, the Project would have an annual power value of $377,346,000 ($38.69/MWh). Since the staff alternative includes costs of additional measures, the annual production cost (levelized over the 30-year period of our analysis) is about $145,669,980 ($14.93/MWh), yielding an annual net benefit of about $231,676,020 ($23.75/MWh).

4.3 COST OF ENVIRONMENTAL MEASURES

Certain measures proposed by Grant 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. Other measures would affect the project's power production capability or average annual generation. Table 41 summarizes the costs of environmental measures proposed by Grant PUD, staff or others. For measures where all or a portion of the cost is based on the cost of replacing project power benefits, the amount and assumed value of foregone power is given in the table footnotes. Measures that do not greatly affect the project economics or have unknown costs are *not* listed in the table.

Table 41. Cost of environmental protection, mitigation and enhancement measures proposed by Grant PUD, resource agencies, others, and staff for the Priest Rapids Hydroelectric Project (Source: Grant PUD, 2003a, modified by staff.)

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Water Quantity and Quality				
TDG and GBT monitoring (part of Water Quality Monitoring Plan)	Grant PUD, Staff	N/A	$48,000	$48,000
Temperature monitoring plan(part of Water Quality Monitoring Plan)	Grant PUD, Staff	N/A	$140,000	$140,000
Aquatic macrophyte monitoring plan (called AIS plan in Terrestrial Resource section and part of Water Quality Monitoring Plan)	Grant PUD, Staff, Washington DFW	N/A	$25,000	$25,000
Nuisance aquatic macrophyte removal (part of AIS and Water Quality Monitoring Plans)	Grant PUD, Staff, Washington DFW	N/A	$7,000	$7,000
Zebra mussel monitoring (part of AIS and Water Quality Monitoring Plans)	Grant PUD, Staff, Washington DFW	N/A	$2,000	$2,000
Tailrace pumping to replace gravity fishway attraction water supply	Grant PUD, Staff	$3,676,450	N/A	$296,000
Aquatic Resources				
Develop a detailed fishery operations plan	CRITFC, Staff	$7,500	N/A	$600

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Adult trapping facilities at Priest Rapids	Settlement Parties[1], Staff	$980,878	$5,000	$84,000
Hatchery effectiveness monitoring	Settlement Parties[1], Staff	N/A	$100,000	$100,000
Fishways automation, improvements and junction pool modifications	Settlement Parties[1], Staff	$2,700,000	N/A	$217,600
Video fish counting systems at both dams	Settlement Parties[1], Staff	$1,250,000	$200,000	$300,700
Downstream bypass system at Wanapum dam	Settlement Parties[1], Staff	$26,874,403	$11,124,864[3]	$13,290,000
Sluiceway spill for fallback at Priest Rapids and Wanapum dams	Settlement Parties[1], Staff	N/A	$2,204,370[2]	$2,204,370
Study of Wanapum gate seals	Staff	$50,000	N/A	$4,030
Northern pikeminnow removal program	Settlement Parties[1], Staff	N/A	$199,990	$199,990
Gatewell exclusion screen study	NMFS, Staff	$100,000	N/A	$8,060
Avian predator control program	Settlement Parties[1], Staff	N/A	$166,520	$166,520

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Biological assessment and management plan program development and ancillary facilities	Settlement Parties[1], Staff	$9,000,000	$200,000	$925,300
Priest Rapids habitat mitigation fund	Settlement Parties[1], Staff	N/A	$1,096,550	$1,096,550
Habitat mitigation plan (part of habitat mitigation fund)	Settlement Parties[1], CRITFC, Staff	$5,000	N/A	$430
Adult PIT-tag facilities at Priest Rapids dam	Settlement Parties[1], Staff	$319,830	$10,000	$35,800
Anadromous fish monitoring and evaluation studies	Settlement Parties[1], Staff	N/A	$2,000,000	$2,000,000
Spill at both dams for downstream passage	Settlement Parties[1], Staff	N/A	$18,000,000 (temporary)	Unknown
Fall Chinook spawning habitat modifications at Wanapum dam	Settlement Parties[1], Staff	N/A	$50,000	$50,000
Hanford Reach Agreement	Settlement Parties[1], Staff	N/A	$4,346,610	$4,346,610
Bull trout monitoring plan	Washington DFW, Staff	$5,000	N/A	$430

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Fishway telemetry study (part of the Pacific lamprey management plan)	Interior, Washington DFW, Staff	$200,000 (four instances at $50,000 each)	N/A	$16,100
Modify diffusion chambers on fishways at Priest Rapids to improve adult lamprey passage	Grant PUD, Staff	$219,122	$10,000	$27,700
Priest Rapids and Wanapum fishways	Settlement Parties[1], Staff	N/A	$771,690	$771,690
Fishway stranding protocol (part of the Pacific lamprey management plan)	Interior, Staff Washington DFW	$5,000	N/A	$430
White sturgeon management plan	Interior, CRITFC, Washington DFW, Staff	N/A	$50,000	$50,000
Final white sturgeon conservation aquaculture plan	Staff	$7,500	N/A	$600
Spring Chinook hatchery supplementation program	Settlement Parties[1], Staff	$10,722,172	$700,000	$1,564,000
Summer Chinook hatchery supplementation program	Settlement Parties[1], Staff	$8,756,339	$800,000	$1,505,000
Priest Rapids hatchery fall Chinook program	Settlement Parties[1], Staff	$11,754,801	$881,166	$1,828,000

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Sockeye hatchery feasibility or alternative program	Settlement Parties[1], Staff	$12,119,304	$218,834	$1,195,000
Steelhead hatchery supplementation program	Settlement Parties[1], Staff	$3,870,181	$200,000	$511,900
Acclimation and broodstocking facilities	Settlement Parties[1], Staff	$9,939,694	N/A	$801,000
White sturgeon restoration & enhancement program	Grant PUD, Staff	$1,905,368	$150,000	$303,550
Priest Rapids fisheries forum	Washington DFW, Staff	N/A	$5,000	$5,000
Crab Creek/Burkett Lake enhancement plan	Staff	$20,000	N/A	$1,720
PIT tag detection at Wanapum	CRITFC, Alaska DFG	$319,830	$10,000	$35,800
Study of peaking effects on passage	CRITFC	$200,000	N/A	$16,100
Adult fallback and kelt passage studies	American Rivers	$500,000-$1,000,000	N/A	$40,300-$80,590
No Net Impact fund	Settlement Parties[1]	N/A	$1,112,500	$1,112,500
Flows to protect rearing fall Chinook salmon (10 kcfs fluctuation limit)	CRITFC Yakama	$46,200,000[4]	$112,500,000[4]	$136,000,000

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Annual orthophotographic spawning surveys	Interior, CRITFC, Alaska DFG	$100,000	N/A	$8,060
White Bluffs spawning surveys	Umatilla, Alaska DFG	$20,000	N/A	$1,720
Spawning behavior studies	Interior, CRITFC, Alaska DFG	$200,000	N/A	$16,100
Primary and secondary production studies	Interior, CRITFC	$450,000	N/A	$36,200
Conduct annual stranding and entrapment surveys in Hanford Reach	CRITFC, Alaska DFG	N/A	$150,000	$150,000
Develop and implement a bull trout management plan	Interior, Washington DFW	$575,000	N/A	$46,300
Pacific lamprey studies	Interior, CRITFC, Washington DFW	$1,200,000	N/A	$96,720
Lamprey management plan – Hydraulic study	Interior	$100,000	N/A	$8,060
Lamprey management plan – Modifications to fish ladders	Interior	$700,000	N/A	$56,400
Alternative lamprey passage methods – dedicated fishway	Interior	$2,000,000	Unknown	$161,200

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Alternative lamprey passage methods – capture and haul	Interior	N/A	$80,000	$80,000
Lamprey biologist	Washington DFW	N/A	$30,000	$30,000
Regional coordination and white sturgeon biologist	Washington DFW, Interior, CRITFC	N/A	$30,000	$30,000
Columbia basin hatchery funding	Grant PUD	$1,000,000	$100,000	$180,600
Pikeminnow removal/resident fish study	CRITFC	$600,000 (3 year study)	N/A	$48,300
Gatewell exclusion screens at both dams	Grant PUD	$500,000	$20,000	$60,300
Trophic dynamics study	Washington DFW	$750,000	N/A	$60,430
Terrestrial Resources				
Development of Wildlife Habitat Management Plan which includes:	Staff	$2,000 every 5 years	N/A	$960
Lower Crab Creek management plan	Grant PUD, Staff	$7,200,000	$30,000	$610,200
Colockum, Whiskey Dick, and Quilomene wildlife areas enhancements	Grant PUD, Staff	$2,000,000	$70,000	$231,200
Land acquisition fund for wildlife areas	Grant PUD, Staff	$1,000,000	N/A	$80,600

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Fire suppression program	Grant PUD, Staff	N/A	$60,000	$60,000
Perch pole and duck box maintenance	Grant PUD, Staff	N/A	$15,500	$15,500
Fund Washington DFW operation and maintenance of wildlife area lands ($15/ac)	Washington DFW	$0	$1,494,750	$1,494,750
Fund replacement of Crescent Bar habitats	Washington DFW	$2,160,000	$36,000	$673,000
Habitat mitigation projects: a) Royal Lake excavation project; b) Crab Creek water diversion project; and c) Lower Crab Creek farm ground renovation project	Washington DFW	a) $181,000 b) $230,000 c) $126,000	a) $5,000[5] b) $5,000 c) $5,000 [5]	a) $15,000 b) $ 19,000 c) $10,000
Habitat acquisition fund	Washington DFW	$4,500,000	N/A	$363,000
Wildlife Habitat Monitoring and Information & Education Program	Washington DFW, Staff	$15,000[5]	N/A	$1,000
Transmission line avian protection measures	Grant PUD, Staff	$500,000	N/A	$40,300
Northern wormwood conservation plan	Grant PUD, Staff	N/A	$40,000	$40,000
Transmission line RTE botanical protection	Grant PUD, Staff	N/A	$7,000	$7,000
RTE plant monitoring programs	Grant PUD, Staff	N/A	$35,000	$35,000
RTE plant research programs	Grant PUD, Staff	N/A	$13,500	$13,500

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Bald eagle perch and roosting tree enhancements	Grant PUD, Staff	N/A	$17,500	$17,500
Implement AIS plan (as proposed by Grant PUD in Water Quality) with 3 additional components: Identifying and recommending any additional measures for detecting future AIS infestations, detailed information and education program, and implementation schedule	Washington DFW, Staff	$10,000[5]	$7,000	$8,000
Cultural Resources				
Implementation of the HPMP, associated additional Staff-recommended tasks, and maintain cultural resource management facilities	Grant PUD, Staff	$20,000,000	$3,750,000	$5,362,000
Recreation Resources				
Implementation of Recreation Plan which includes:	Grant PUD, Staff	N/A	$26,000	$26,000
Interpretation and education plan	Grant PUD, CRITFC, Staff	$86,100[6]	$8,000	$14,930
Recreation monitoring (including recreation monitoring on 748.8 acres of BLM-administered land in the Project area)	Grant PUD, BLM, Staff	$225,000[7]	N/A	$21,150
Dispersed recreation site maintenance/ management	Grant PUD, Staff	$15,000	$3,000	$4,200

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Airstrip site (New)	Grant PUD, Staff	$7,892,500	N/A	$636,000
Apricot orchard boat launch	Grant PUD, Staff	$156,400	$2,000	$14,600
Beverly sand dunes OHV park	Grant PUD, Staff	$5,000	$3,000	$3,400
Buckshot ranch boat launch	Grant PUD, Staff	$42,200	$1,500	$4,900
Crab Creek corridor	Grant PUD, Staff	$452,320	$8,000	$44,450
Crescent Bar	Grant PUD, Staff	$1,800,850	$12,500	$157,600
Desert Aire	Grant PUD, Staff	$705,450	$3,250	$60,100
Frenchman Coulee boat launch	Grant PUD, Staff	$224,100	$1,500	$19,600
Getty’s cove	Grant PUD, Staff	$511,750	N/A	$41,240
Huntzinger Road boat launch	Grant PUD, Staff	$684,000	$3,000	$58,100
Huntzinger Road fishing access site	Grant PUD, Staff	$88,500	$2,000	$9,100
Kittitas County boat launch	Grant PUD, Staff	$138,900	$15,000	$26,200
Wanapum dam lower boat launch	Grant PUD, Staff	$64,000	$3,000	$8,100
Mattawa RV park (New)	Grant PUD, Staff	$830,410	$2,500	$69,400
Priest Rapids park (New)	Grant PUD, Staff	$656,500	$11,000	$63,900

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Quilomene dune and bay/West Bar	Grant PUD, Staff, CRITFC, Yakama	N/A	$3,000	$3,000
Rocky Coulee	Grant PUD, Staff	$193,700	$6,000	$21,600
Sand Hollow – North	Grant PUD, Staff	$127,000	$3,000	$13,200
Sand Hollow – South	Grant PUD, Staff	$1,223,500	$13,000	$111,600
Shoreline below Priest Rapids dam	Grant PUD, Staff	$96,000	$3,000	$10,700
Sunland estates boat launch	Grant PUD, Staff	$90,900	$6,000	$13,300
Sunland estates day-use area (New)	Grant PUD, Staff	$412,500	$4,000	$37,200
John Wayne pioneer trail river crossing (50% of total capital cost)	Grant PUD	$445,000	N/A	$35,900
Vantage area trail	Grant PUD, Staff	$67,250	$5,000	$10,400
Wanapum dam upper boat launch	Grant PUD, Staff	$71,400	$3,000	$8,800
Vernita bridge boat launch	Grant PUD, Staff	$500,000	N/A	$40,300
Wanapum dam heritage center	Grant PUD, Staff	$112,000	$4,000	$13,000
Wanapum dam overlook	Grant PUD, Staff	$66,500	$2,000	$7,400
Wanapum dam picnic area	Grant PUD, Staff	$80,900	$4,000	$10,600

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Wanapum recreation area	Grant PUD, Staff	$1,853,300	N/A	$149,300
In a final Recreation Plan, include a provision (*e.g.*, signs) at Quilomene Dune and Bay to address wake size by boaters	CRITFC, Yakama, Staff	$3,000	N/A	$240
Provide funding for 1 FTE to Washington DFW enforcement program and 1 FTE to be divided equally between Grant PUD and Kittitas County Sheriff's offices; continue to provide a boat at Wanapum dam for local law enforcement officers.	Grant PUD	N/A	$100,000	$100,000
Provide funding for 2 FTE law enforcement officers to Washington DFW and funding for 0.5 FTE each to Kittitas and Grant County sheriffs	Washington DFW	N/A	$270,000	$270,000
Provide to Washington DFW $73,500 for a reservoir patrol vessel, $2,200 for a trailer, and replace on 10-year cycle	Washington DFW	N/A	$18,000	$18,000
Provide funding to Kittitas County for 1 Sheriff Deputy, 2 staff (May-Oct), and a vessel	Kittitas County	N/A	$100,000	$100,000
Dredge and lengthen the Kittitas County boat launch at Vantage	Kittitas County, Public Works, Pat Kelleher, Staff	$200,000[8]	N/A	$16,100
Fund 100% of the restoration and maintenance of the Beverly Bridge (John Wayne Pioneer Trail)	Washington DNR, Pat Kelleher, IAC	$890,000	$26,000	$102,540

Environmental Measure	Recommending Entities	Capital and One-time Costs	Annual Costs, Including O&M	Total Annualized Cost
Land Use				
Shoreline Management Plan	Grant PUD, Staff, Pat Kelleher	N/A	$300,000	$300,000

[1] Settlement Parties include: Grant PUD, NMFS, Interior, Washington DFW, the Yakama, and the Colville.
[2] Based on the cost of replacing 59,578 MWh of power at $37/MWh.
[3] Based on the cost of replacing 300,672 MWh of power at $37/MWh.
[4] Based on the cost of providing 1,320-MW Simply Cycle Combustion Turbine for operation from March 1 - June 15 and gas prices of $4/MMBtu (currently gas prices are over $6/MMBtu). See, also pages 57-58 of Grant PUD's July 8, 2005 letter responding to Interior's recommended terms and conditions.
[5] Staff estimated cost.
[6] Cost includes 2 interpretive displays/kiosks of $13,000 each.
[7] Required every 12 years at $75,000/survey; assumed by staff to occur 3 times over the 30-year period of our analysis.
[8] Grant PUD estimated cost from draft Recreation Plan.

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), their economic viability (section 4.0), 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 Grant 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 Grant PUD to continue to operate the project as a dependable source of electric energy for its customers; (2) the 1,768.8-MW project, which Grant proposes to expand to a capacity of 1,993.6 MW by replacing the project turbines with more efficient and higher capacity turbines, 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.

5.1.1 Recommended Environmental Measures

Based on the preceding analyses (sections 3.0 and 4.0), we recommend including the following environmental measures (Grant PUD's proposal minus measures we are *not* recommending, and Staff's additional measures and modification to Grant PUD's proposal) in any license issued for this project because they contribute to the best comprehensive use of the Columbia River water resources, exhibit sufficient nexus to project environmental effects, and would result in benefits to non-power resources that would be worth their cost. We discuss the environmental benefits of the measures in section 3.0 and the power and economic benefits of the project in section 4.0. Section 5.0 presents our rational in balancing the developmental and non-developmental values and our recommendations. In some instances, Grant PUD has proposed funding for measures, whereas staff is recommending the measure itself. Thus, any cost listed herein should be considered as an estimate or guide, rather than an absolute spending cap.[119]

Geology and Soils Resources

- Continue to monitor the project impoundment rims for indications of instability and erosion.
- Develop and implement erosion and sediment control measures related to project land-disturbing activities.

Water Quantity and Quality

- Implement a Water Quality Monitoring Plan (401 Application) that includes:
    - Continued reservoir management and maintenance operations, and monitoring of spill patterns to minimize ambient total dissolved gas levels.
    - A water temperature monitoring plan at four fixed sites.
    - Monitor dissolved oxygen (DO), turbidity, and pH at the four fixed monitoring sites during the non fish-spill season (September 15 through April 1).
    - Operating according to the terms of the Hanford Reach Agreement.
    - A plan for managing nuisance aquatic plant species at key recreation sites within the Project area, including information and signage and assessing aquatic macrophyte density at eight transects within the Project every four years, and incorporating aerial photos into GIS maps of macrophyte coverage through the

[119] See *Policy Statement on Hydropower Licensing Settlements*, issued September 21, 2006.

reservoirs; as well as continuing to monitor for zebra mussels cooperatively with Washington DFW (see also Terrestrial Resources section).

- Addressing potential short-term water quality impacts associated with construction activities at the Project, emergency situations, and routine maintenance activities.
- Developing additional details for calibrating its four water quality monitoring sites following issuance of the 401 certificate.

* Coordinate the spill program for the project with the spill activities of other projects through the Priest Rapids Coordinating Committee (see also Aquatic Resources section).
* Continue to operate each Taintor gate at Wanapum dam (see also Aquatic Resources section).
* Continue to identify and implement experimental spill regimes as may be warranted to test opportunities for improving fish survivals with less spill flow and/or reducing TDG levels at either Priest Rapids or Wanapum Dams (see also Aquatic Resources section).
* Provide biological monitoring to determine the incidence of GBD symptoms in downstream migrating juvenile salmonids and continue development of its "real-time" TDG monitoring system at the fixed monitoring sites.
* Provide tailrace pumping to replace gravity fishway attraction water supply.

Aquatic Resources

* Implement and assess anadromous fish measures using an adaptive management process that would include establishment of a PRCC, various technical committees (includes hatchery and habitat subcommittees), and a dispute resolution process. This measure is part of the SSA.
* Make steady progress towards achieving a minimum 91 percent combined adult and juvenile salmonid survival performance standard at the project. This measure is part of the SSA.
* Develop and annually revise a DPAAP to contribute to achievement of the applicable performance standards at Wanapum and Priest Rapids dams. This measure is part of the SSA.
* Develop and implement a performance evaluation program to assess the hatchery program, habitat program, and improvements to juvenile and adult passage survival. This measure is part of the SSA.
* Produce annual progress and implementation plans to describe the implementation activities for spring-run Chinook salmon and steelhead. Prepare a performance evaluation report that assesses the ability of each program to meet program objectives

and contribute to achievement of performance standards. This measure is part of the SSA.

- Evaluate modifications to the spill regime and spill pattern at each dam to improve juvenile salmonid survival while remaining within applicable TDG limits. This measure is part of the SSA.
- Continue to operate and maintain two adult fishways at each dam according to Fishway Operating Plans and investigate methods for improving hydraulic conditions in the fishway collection channels, junction pools, and entrance pools. This measure is part of the SSA.
- Use the spill and bypass programs for juvenile downstream passage to provide fallback passage routes for adult spring and summer Chinook salmon. Operate the sluiceways at both Priest Rapids and Wanapum dams to provide fallback routes for steelhead and fall Chinook salmon. This measure is part of the SSA.
- Construct, operate, and maintain an off-ladder adult trapping facility in the left-bank fishway at Priest Rapids dam. This measure is part of the SSA.
- Operate and maintain PIT-tag detection equipment at the Priest Rapids fishways. This measure is part of the SSA.
- Fund fish counting at Priest Rapids and Wanapum dams and provide daily fish counts for both facilities. Develop video monitoring capability for counting adults in fishways at both dams. This measure is part of the SSA.
- Modify diffusion chambers on both fishways at Priest Rapids to improve adult lamprey passage. Modify the design of the fish count stations at Priest Rapids and Wanapum dams to improve adult lamprey passage and enumeration. If appropriate, reduce fishway flows at night to improve adult lamprey passage.
- Continue to study possible ways to improve downstream juvenile salmonid survival at Priest Rapids dam, including alternative application of top-spill concepts. This measure is part of the SSA.
- Continue to provide spill (61 percent of river flow in spring and 39 percent in summer) for downstream passage at Priest Rapids dam until a better downstream passage alternative is designed, tested, and implemented. This measure is part of the SSA.
- Continue to provide spill (43 percent river of flow in spring and up to TDG limits in summer) for downstream passage at Wanapum dam until a better downstream passage alternative is designed, tested, and implemented. This measure is part of the SSA.
- To improve turbine passage survival at Priest Rapids and Wanapum dams, develop and implement operating criteria to avoid settings that have been shown to result in poor survival and, in the future, install new Advanced Design Turbines. This measure is part of the SSA.

- Construct a downstream fish bypass at Wanapum dam consisting of an ogee-crested weir through the center of Unit 11 and a submerged tailrace chute. This measure is part of the SSA.
- If the proposed downstream bypass for Wanapum dam fails to achieve 95 percent dam passage survival, consult with the joint fisheries parties to improve survival through additional operational or structural modifications.
- Fund a northern pikeminnow removal program to improve smolt passage survival through the reservoirs and tailraces of Priest Rapids and Wanapum dams. This measure is part of the SSA.
- Fund and implement an avian hazing and control program to improve smolt passage survival through the tailraces of Priest Rapids and Wanapum dams. This measure is part of the SSA.
- As part of anadromous fish monitoring and evaluation studies, use radiotelemetry or other techniques to evaluate upstream and downstream route-specific survival at Priest Rapids and Wanapum dams.
- As part of anadromous fish monitoring and evaluation studies, conduct survival studies using PIT-tag technology or other suitable study methods to obtain dam and project passage survival estimates.
- Develop and implement an HGMP for spring, summer, and fall Chinook salmon, steelhead, and sockeye salmon. This measure is part of the SSA.
- To help recover natural populations to self-sustaining and harvestable levels and to mitigate for 7 percent unavoidable losses for each development, fund and develop the hatchery facilities necessary to annually produce 600,000 yearling spring Chinook salmon, 833,000 yearling summer Chinook salmon, 1,143,000 sockeye salmon smolts, and 100,000 steelhead smolts. Upgrade and renovate the Priest Rapids Hatchery and continue to annually produce 6,000,000 fall Chinook salmon smolts and 1,000,000 fall Chinook salmon fry. Consult on options to develop equivalent alternative mitigation programs if annual production of 1,143,000 sockeye salmon smolts is unattainable. This measure is part of the SSA.
- Annually provide $1,096,552 to the Priest Rapids Project Habitat Fund to mitigate for a 2 percent per development unavoidable loss of upriver stocks. Develop a habitat plan to identify goals, objectives, a process for coordination, and a process by which habitat projects would be identified and implemented. This measure is part of the SSA.
- Investigate the feasibility of habitat modifications in the Wanapum dam tailrace to increase the amount of high quality fall Chinook salmon habitat.
- Implement operating agreements with the BPA, Douglas County PUD, and Chelan County PUD to address the cumulative effects of operations at the seven main stem dams (Priest Rapids to Grand Coulee) that control flows and result in flow

fluctuations in the Hanford Reach. This measure is part of the Hanford Reach Agreement.

- Provide a minimum flow of 55 to 70 kcfs in the Hanford Reach during the fall Chinook salmon spawning period. This measure is part of the Hanford Reach Agreement.
- Through monitoring of redd locations on Vernita Bar within the Hanford Reach, annually establish a Critical Flow for protection of fall Chinook salmon during the pre-hatch, post-hatch, and emergence periods. Flows within the Hanford Reach would be maintained at or above the Critical Flow subject to the constraints of the 3.7 foot draft limit for the Priest Rapids reservoir and the 2 foot draft limit for the Wanapum reservoir. Additional water beyond Grant PUD's ability to maintain the Critical Flow would need to be obtained from upstream operators, which could be coordinated as part of the operating agreements described above. This measure is part of the Hanford Reach Agreement.
- Within the constraints of the HCA, limit fluctuations in outflow from Priest Rapids dam during the fall Chinook rearing period within the Hanford Reach. This measure is part of the Hanford Reach Agreement.
- Maintain a minimum flow of 36 kcfs in the Hanford Reach during all times outside the fall Chinook salmon spawning, pre-hatch, post-hatch, and emergence periods. This measure is part of the Hanford Reach Agreement.
- Continue to use Standard Operating Procedures at both dams to provide operators with turbine operating criteria, spill patterns for use during downstream passage operations, fishway operation criteria, and other criteria pertaining to upstream and downstream passage of salmon and steelhead.
- To address the effect of the Project on white sturgeon, construct a white sturgeon conservation facility at the Priest Rapids Hatchery. Broodstock would be obtained from the Hanford Reach or Wanapum reservoir and the conservation facility would be designed to produce yearling white sturgeon for stocking into the Project reservoirs. This effort would include experimentation with hatchery supplementation to develop optimal rearing and release strategies and to monitor and evaluate the effectiveness of hatchery releases.
- Develop a detailed fishery operations plan.
- Investigate the gate seals at Wanapum dam as a source of juvenile salmonid mortality.
- Study the effects of gatewell exclusion screens on juvenile salmonid and lamprey passage.
- Develop and implement a bull trout monitoring plan to document occurrences of bull trout in the project area.
- Prepare a Pacific Lamprey Management Plan that includes the measures proposed by Grant PUD, an evaluation of ladder improvements proposed by Interior, criteria for

conducting lamprey passage studies, a lamprey salvage protocol, and periodic (10 year) updates of the plan.

- Develop and implement a White Sturgeon Management Plan.
- Prepare a final White Sturgeon Conservation Aquaculture Plan.
- Establish a Priest Rapids Fishery Forum.
- Develop a Crab Creek/Burkett Lake Enhancement Plan.

Terrestrial Resources

- Develop a Wildlife Habitat Management Plan (Wildlife Plan) that fully describes the actions that would be implemented in the first five years of any license and includes provisions for updating the plan every five years thereafter. The plan should identify the projects that would be implemented, where they would be implemented, how they would be implemented, how they would be maintained and monitored to ensure their continued success, and a schedule for their implementation—habitat improvement projects should identify and give priority to projects that address shrub steppe, riparian, and wetland habitats within and immediately adjacent to the project and should consider access controls.
- Develop and implement a Wildlife Habitat Monitoring and Information & Education Program to monitor the indirect effects of project-related recreation on wildlife and sensitive wildlife habitats. The wildlife monitoring and information and education program, coordinated with the Shoreline Management Plan and the Recreation Plan, should describe the methods that would be employed to educate the recreating public about the potential adverse affects of dispersed recreation on sensitive habitats and a detailed methodology for assessing recreation impacts on wildlife habitats and identifies potential corrective actions.
- Enhance riparian/wetland habitat within the lower five miles of Crab Creek and the Priest Rapids Wildlife Area; provide funding in the amount of $30,000 per year to support operations and maintenance related to the enhancement measures and capital funding in the amount of $7.2 million over the course of the license term.
- Develop a transmission line avian collision protection plan; provide capital funding in the amount of $500,000 over the course of the license to support the measures including marking transmission lines, over-head ground wires at specific crossings.
- Enhance wildlife habitat in the Colockum, Whiskey Dick, and Quilomine Wildlife Areas, provide annual O&M funding of $70,000, $1 million for land acquisitions, and capital funding over the term of the license of $2 million to support:
  - Development of the plan.
  - Noxious weed control on big-game winter range.

- Re-activation of agriculture program in the Colockum area and/or rehabilitation of agricultural lands to native bunch grasses.
- Improvements to riparian/wetland areas at West Bar Slough.
- Development of mountain meadows and maintenance of existing meadows.
- Fertilization of summer and winter ranges.
- Development of water sources.
- Land acquisitions to consolidate land holdings.

• Continue current programs of installation and maintenance of: 48 wood duck nest boxes around the project shoreline; maintenance of 12 raptor nesting, roosting, and perching structures; and installation of 50 waterfowl nesting platforms (mallard nest baskets and goose nesting tubs).

• Provide $60,000 per year to Washington DFW to support a fire suppression program in the Colockum, Quilomene, Whiskey Dick, Priest Rapids, Crab Creek, and Buckshot Wildlife Management Areas. Any unused funds at the end of the year would be allocated for habitat rehabilitation.

• Implement an AIS plan (same as nuisance aquatic plan proposed by Grant PUD) with three additional components:
  - Provisions for identifying and recommending any additional measures for detecting future AIS infestations;
  - A detailed information and education program that includes identifying boat access points and distributing education material during peak boating season (May 1 – October 30 each year), conducting voluntary boat inspection demonstrations to explain the AIS program and proper methods of cleaning boats, and distributing voluntary boater surveys prepared by Washington DFW; and
  - An implementation schedule.

Rare, Threatened and Endangered Species

• Develop a rare, threatened and endangered botanical species protection plan that includes:
  - Budgeting $7,000 per year to defray operations and maintenance expenses to address potential habitat disturbances resulting from maintenance activities within the project transmission line corridor and any future modifications or additions in the number and/or configuration of transmission lines and structures.
  - A provision for developing a construction schedule of any future projects to avoid disturbance of rare species.
  - A provision for conducting pre-construction surveys.
  - A provision for identifying measures to protect any species found during the surveys.

- A provision for developing an implementation schedule for protective measures.
- A provision for developing a monitoring plan to evaluate the effects on rare species and habitat.

- Develop a long-term plan to monitor rare, threatened and endangered plants within the project area that includes:
  - A description of the methods to be employed.
  - A provision to map and quantify population trends.
  - An implementation schedule.
  - A provision and schedule for reporting and consulting with appropriate agencies regarding the monitoring results.
  - Providing $13,500 per year to the Washington DNR's Natural Heritage Program for funding and management of research information to further the knowledge of the ecology of rare plants in the project area.
- Develop a bald eagle perching and roosting tree enhancement and protection program.
- Develop a northern wormwood conservation plan to protect and monitor populations within the Project area that would include: continuing annual demographic monitoring for 10 years; working with BOR to maintain 5,000 feet of fencing to eliminate vehicular access; and funding of ongoing noxious weed control, access control, data management, taxonomic investigations, and research to support long-term conservation of the species in the amount of $40,000 per year.

Cultural Resources

- Continue its commitments to the Wanapum reflected in the agreement entered on January 8, 1957, and subsequently modified, and through any future modifications agreed to by the parties.
- File with the Commission a Memorandum of Agreement between Grant PUD and the Wanapum, which may include any relevant portions of past agreements, to protect cultural resources of significance to the Wanapum.
- Develop a multiple property documentation format for National Register of Historic Places evaluation.
- Implement a proposed schedule for determining National Register eligibility and assess/address adverse effects on remaining cultural resource properties so far inventoried.
- Within one year of license issuance and in consultation with the established CRWG, finalize and implement an HPMP.
- Provide DAHP with the missing and incomplete information associated with the submitted site record and determination of eligibility forms.
- Develop and implement protection/mitigation measures for the 20 archeological sites

listed in Table 27 (see section 3.8, *Cultural Resources*) and all other archeological sites within the Project APE known to contain human remains.

- Determine National Register eligibility for all remaining inventoried archeological sites and other cultural resources located within the Project APE.
- Identify site-specific project-related effects on all National Register-eligible cultural resources and implement measures to protect such sites.
- Reconvene a committee similar to the Hanford Reach National Monument Federal Planning Advisory Committee to address shoreline-related effects on archeological sites in the Hanford Reach.

Recreation and Land Use

- Finalize its draft Recreation Plan that defines the management of existing and future recreation resources associated with the project, including O&M costs; recreation monitoring; interpretation and education (includes interpretive displays/kiosks); integration of recreation resources with other resource management plans; and review. The plan would be guided by an adaptive management strategy.
- Conduct recreational use monitoring on project lands, including BLM lands, every 6 years rather than every 12 years as proposed by Grant PUD.
- Provide additional signage at identified recreation sites.
- In a final Recreation Plan, include a provision (*e.g.*, signs) at Quilomene Dune and Bay to address boat wake.
- Dredge and lengthen the Kittitas County boat launch at Vantage.
- Concentrate new recreation development in suitable areas that is compatible with a final Shoreline Management Plan.
- Finalize its draft Shoreline Management Plan and manage lands accordingly; protect the scenic quality of the mid-Columbia River and its surrounding landscape.
- As part of a final Shoreline Management Plan, manage Crescent Bar Island under the land classifications proposed as planned development and conservation, but no further development should occur beyond the existing disturbed footprint (except as noted below for the proposed trail); delineate a shoreline buffer zone on the island.

5.1.2 Discussion of Staff Recommended Measures

A complete summary and analysis of the measures proposed by Grant PUD and others can be found in the applicable resource sections of section 3.0. The following summarizes the basis for the additional or modified environmental protection, mitigation and enhancement measures recommended by the staff.

Detailed Fishery Operations Plan

CRITFC recommends that Grant PUD develop a detailed fishery operations plan. The plan would address turbine operations, spillgate inspections, bypass system operations and inspections, and fishway operations, inspections, and modifications. Development of such a plan would ensure that protocols are developed for all fishery operations. It would also consolidate all operational protocols and inspection procedures into a single document which would simplify future reviews and updating. Currently, fisheries operations of different project features are described in separate plans. We estimate that compiling these plans into a single plan and including protocols for the operation of any new project features such as the future unit 11 bypass would cost approximately $7,500. We conclude that compiling all fisheries operations into a single document would help to ensure that project facilities are operated in a manner to minimize project effects on fisheries resources and would be worth the cost.

Study of Wanapum Gate Seals

As indicated by NMFS, the spillways at Wanapum dam are the most lethal route for downstream passage. As part of its preliminary section 18 prescriptions, NMFS suggested that the poor survival associated with spillway passage at Wanapum dam could be related to the spillway gate seals. Under the staff recommended alternative, spill at Wanapum dam would continue to be used to pass juvenile salmonids and involuntary spills would occur on occasion when juveniles may be present. Because the gate seals may play a role in the poor survival rates observed at Wanapum dam, it would be useful to study the effect of the gate seals and pursue a remedy, if possible. We estimate that the cost of a gate seal study would be approximately $50,000. Because this study could ultimately lead to reducing a documented adverse project effect on juvenile fish passage, we conclude it would be worth the cost and we recommend including a requirement for this study in any license that is issued for the project. Additionally, we recommend that if the gate seals are shown to reduce downstream passage survival, cost-effective modifications or remedies should be considered for implementation.

Gatewell Exclusion Screen Study

In the license application, Grant PUD proposed to install gatewell exclusion screens (at a cost of $500,000) and discontinue its ongoing program of dipping the gatewells for juvenile salmonids. Installation of gatewell exclusion screens may increase juvenile salmonid survival at each dam since it is likely that turbine passage survival is higher than for fish that are netted from the gatewell and released in the tailrace. However, the specific effects of the screens on juvenile salmonids and lamprey passing through the turbines is unknown. Therefore, we recommend that Grant PUD experimentally install a set of gatewell exclusion screens and measure the potential effects on juvenile salmonid survival and monitor for lamprey impingement. We estimate this study would cost $100,000. We conclude that this study would be worth the cost and we recommend that any license issued for the project include a gatewell exclusion screen study. If the study demonstrates that gatewell exclusion screens would not reduce juvenile salmonid survival and would not result in significant impingement of juvenile lamprey, we recommend that Grant PUD develop and implement a plan for installing exclusion screens in each gatewell. After the exclusion screens are installed, Grant PUD could discontinue the gatewell dipping program.

Bull Trout Monitoring Plan

Available information suggests that bull trout occur only incidentally within the project area and they are rarely observed or captured in the project area. However, during the license term, ongoing bull trout recovery efforts may increase bull trout numbers throughout the mid-Columbia River region and the occurrence of bull trout within the project area may become more frequent. To track the occurrence of bull trout within the project area and help identify any potential project effects on bull trout that may occur if their numbers increase, we recommend that Grant PUD develop a bull trout monitoring plan for reporting all occurrences of bull trout within the project area. The plan would address monitoring and reporting bull trout occurrences during video fish counting at the fishways, juvenile bypass activities, gatewell dipping, turbine maintenance activities, fish ladder maintenance activities, hatchery activities, northern pikeminnow control program activities, or other related activities. As suggested by Grant PUD, reporting could be incorporated into the annual scientific collection report process. To address possible changes in the abundance of bull trout within the project area during the license term, we recommend that Grant PUD update the plan every 10 years after license issuance. The plan should be revised to describe any apparent trends in bull trout abundance or frequency of occurrence in the project area and should address technological or methodological advances that may allow evaluation of project effects on bull trout. We estimate that the cost of this plan would be $5,000. A bull trout monitoring plan would be worth the cost and we recommend including this measure in any license issued for the project.

Components of the Pacific Lamprey Plan

In this section we discuss several measures that we recommend as components of the proposed Pacific Lamprey Plan.

Grant PUD proposes to implement several measures to address project effects on lamprey including: 1) modification of the diffusion chambers in both Priest Rapids fishways to improve adult lamprey passage; 2) modification of the design of the fish count stations at Priest Rapids and Wanapum dams to improve adult lamprey passage and enumeration; 3) examination of the potential for improving upstream passage conditions for lamprey by reducing fishway flows at night; and 4) continuation of annual counts of adult lamprey passage through the project fishways. As part of the Pacific Lamprey Plan, Grant PUD should describe each of these proposed measures and provide a schedule for implementation. Grant PUD should also describe any follow-up monitoring, including radio-telemetry studies of adult passage rates that may be conducted to determine the effect of these measures.

Under section 18, Interior prescribes that Grant PUD modify the fish ladders for lamprey by improving orifices for passage, rounding sharp edges, constructing rest areas in front of submerged orifices, reducing diffuser grating spacing, and installing collection devices for adults. Grant PUD indicates that the corners of the fish ladder are already rounded; therefore, it appears that this action would be unnecessary. The other measures proposed by Interior could have some benefit to lamprey passage at the project; however, Nass et al. (2003) found no evidence of significant lamprey delays and it is not clear at this time that these measures would address the concerns within ladder entrances and submerged orifices identified by Nass et al. (2003). We estimate that the cost of these fishway modifications would be approximately $700,000. Some of these measures may improve passage conditions for adult lamprey; however, until the effectiveness of Grant PUD's proposed measures is evaluated, we do not believe implementing these measures would be worth the cost. We do, however, recommend that an evaluation of the need for these measures be included in the Pacific Lamprey Plan as potential future options for improving passage conditions for adult lamprey.

Interior prescribes under section 18 and Washington DFW recommends under section 10(j) that Grant PUD conduct radio-telemetry studies to measure the effectiveness of any measures implemented to improve upstream lamprey passage. Modifications made to the fishways or their operation, including those proposed by Grant PUD, would likely have some uncertainty associated with them. Occasionally monitoring upstream passage efficiency would be beneficial to lamprey by identifying effective, ineffective, or adverse passage measures. We estimate that radio-telemetry studies of lamprey passage would cost approximately $50,000 each time they would be conducted.

We conclude that lamprey passage studies should be conducted after the modifications proposed by Grant PUD have been implemented. Additional studies may also be appropriate in the future after any significant modifications are made to fishway structures or features. Additional modifications could occur several times during the license term, which would result in the need for additional studies and would increase study costs beyond our estimated $50,000. However, we conclude that these studies would be worth the cost and should be included as part of the proposed Pacific Lamprey Plan to ensure the enhancements are achieving the desired results. Additionally, the Pacific Lamprey Plan should establish criteria that would trigger the need to conduct additional adult lamprey passage studies.

Interior prescribed and Washington DFW recommended that Grant PUD develop a protocol for lamprey salvage during fish ladder dewatering. Developing a protocol to address possible stranding of lamprey within the fish ladders during dewatering would likely reduce any mortalities associated with these events. The cost of developing a protocol would be approximately $5,000. We would anticipate that a lamprey salvage protocol could be incorporated into the PPMP or any existing fishway operations plans that address possible salmon and steelhead salvage. We conclude that developing a lamprey salvage protocol would be worth the cost and we recommend including this measure in any license issued for the project.

As explained below, we do not recommend that Grant PUD conduct downstream passage survival studies of juvenile lamprey. This decision was based, in part, on the lack of a proven technology for measuring juvenile lamprey survival. Bleich and Moursund (2006) have developed a promising technique for PIT-tagging juvenile lamprey; however, until this methodology is tested under a variety of conditions and is more widely accepted, we are reluctant to recommend it for use at the Project. Additionally, we are not currently recommending that Grant PUD conduct juvenile lamprey passage studies because available information suggests that juvenile lamprey turbine passage survival would likely be high (i.e., greater than 90 percent) and there currently is no reliable source for juvenile lamprey to be used in testing turbine passage survival. It is possible that during the license term, information regarding juvenile lamprey turbine passage survival and the feasibility of conducting survival studies could change. Therefore, to address these potential changes during the license term, we recommend that Grant PUD revise and update the Pacific Lamprey Plan every ten years after license issuance. These revisions should summarize any new information regarding juvenile lamprey turbine passage survival and assess the need and feasibility of conducting juvenile lamprey turbine passage survival studies at the Project.

White Sturgeon Plan

Washington DFW, Interior, and CRITFC recommend that Grant PUD develop and implement a White Sturgeon Plan that would include: 1) monitoring of natural and hatchery-raised white sturgeon, 2) evaluation of recruitment rates 3) determination of year-class distributions, 4) genetic analysis, and 5) measurement of growth rates, condition factors, and sex ratios. Development and implementation of a White Sturgeon Plan would provide information to establish the benefits, or potential inadequacies, of the proposed white sturgeon hatchery program.

In suggesting goals for a White Sturgeon Plan, Washington DFW and Interior indicate that Grant PUD should be responsible for increasing sturgeon abundance to levels commensurate with available habitat. Additionally, Washington DFW and CRITFC suggest that Grant PUD should increase sturgeon abundance to levels that can support reopening a harvest-based fishing season. While these may be reasonable goals for Washington DFW, Interior, and CRITFC, they are not appropriate goals in the context of relicensing since they are not related to the magnitude of project effects. The goals proposed by the agencies suggest that the depressed status of white sturgeon is entirely attributable to effects of the Project, which does not appear to be the case based on our analysis. We recommend that Grant PUD and the agencies establish goals for the White Sturgeon Plan that are designed to identify and address project effects on the species. Development and implementation of a White Sturgeon Plan would cost approximately $50,000 per year. We conclude that developing and implementing a White Sturgeon Plan would be worth the cost and we recommend including this measure in any license issued for the project.

Final White Sturgeon Conservation Aquaculture Plan

In the license application, Grant PUD presents a conceptual White Sturgeon Conservation Aquaculture Plan that includes construction of a white sturgeon hatchery at the Priest Rapids hatchery facility. We recommend that any license issued for the Project require Grant PUD to develop and implement a final version of this plan. We estimate the cost of finalizing this plan would be $7,500 and would be worth the cost. We recommend that as part of the plan, Grant PUD include an evaluation of suitable sites, including the Priest Rapids hatchery, for developing a white sturgeon hatchery facility.

Priest Rapids Fishery Forum

Washington DFW recommends that Grant PUD establish and convene a

Priest Rapids Fishery Forum to share information, coordinate efforts, and make recommendations regarding non-salmon and steelhead management plans that would be addressed by the Priest Rapids Coordinating Committee. The forum recommended by Washington DFW would provide a means for managing the programs for bull trout, resident fish, white sturgeon, and Pacific lamprey. We estimate that the cost of conducting a Priest Rapids Fishery Forum would be approximately $5,000 per year. This fishery forum would establish a formal process for reviewing annual mitigation and monitoring efforts related to bull trout, resident fish, white sturgeon, and lamprey. It would also provide a forum for fine tuning these fishery programs and planning and adjusting future efforts. We conclude that establishment of a Priest Rapids Fishery Forum would be worth the cost and we recommend including this measure in any license issued for the Project.

Crab Creek/Burkett Lake Enhancement Plan

In the license application, Grant PUD proposed to improve fish resources and fishing opportunities in the lower 5 miles of Crab Creek. Grant PUD provided few details describing the measures that would be implemented in Crab Creek; therefore, on October 15, 2004, we issued a request for additional information describing the measures to be implemented in or around Crab Creek. On January 14, 2005, Grant PUD filed a response indicating that while some measures may be implemented in Crab Creek, the primary measures they would consider would include enhancing the stocked trout program and improving facilities at Burkett Lake.

In comments on the draft EIS, the Port of Warden indicated that establishing salmon and steelhead in Crab Creek could affect Columbia Basin irrigators and the local agricultural industry. As indicated above, Grant PUD is considering enhancement of stocking and facility improvements at Burkett Lake as part of the Crab Creek enhancement project. We would not expect these measures to affect Columbia Basin irrigators and the local agricultural industry. However, because Grant PUD's Crab Creek proposal appears to be only conceptual at this time, we do not recommend implementing the proposed stocking and facility improvements at Burkett Lake until the proposal is more fully developed. Therefore, we recommend that Grant PUD develop a Crab Creek/Burkett Lake Enhancement Plan in consultation with the federal, state, and tribal entities, including representatives of the local agricultural community. This plan would define the specific measures that Grant PUD would implement and would address potential effects on other resources, including impacts on irrigators and the agricultural industry. We estimate that the cost of developing this plan would be $20,000. This plan would be worth the cost and we recommend including it in any license issued for the Project.

Aquatic Invasive Species Plan

As a component of its draft Recreation Plan, Grant PUD proposes to manage nuisance aquatic plants at key recreation sites within the project area and monitor project waters for indicators of nuisance levels of aquatic plant growth. Further, Grant PUD proposes to continue to work cooperatively with Washington DFW and monitor for zebra mussels within the Project area at an estimated annual cost including O&M of $2,000. Washington DFW's proposal to develop and implement an AIS Plan focuses on an education and outreach program that would help change boater behavior. Such efforts could help prevent, eradicate or control introductions of invasive species, especially at project-related recreation sites. In the draft EIS we recommended one invasive species plan that would address both aquatic and terrestrial invasive species. Based on Washington DFW comments at our section 10(j) meeting and clarification from Grant PUD, we agree that a separate AIS Plan would be more efficient to administer. We are also recommending that the AIS Plan include provisions for: (1) identifying and recommending any additional measures for detecting future AIS infestations; (2) a detailed information and education program that includes identifying boat access points and distributing education material during peak boating season (May 1-October 30 each year), conducting voluntary boat inspection demonstrations to explain the AIS program and proper methods of cleaning boats, and distributing voluntary boater surveys prepared by Washington DFW; and (3) an implementation schedule. The cost of developing an AIS plan with these three additional components would be approximately $10,000. We expect that implementation could be incorporated into Grant PUD's existing aquatic macrophyte control program for little additional cost. We conclude an AIS Plan would be worth the cost and we recommend including such a plan in any license that is issued for the project.

Wildlife Habitat Management Plan

Instead of developing and implementing two separate plans (Upper Wanapum management plan and Lower Crab Creek management plan) as originally proposed, Grant PUD proposes to develop and implement a single wildlife habitat management plan for the Priest Rapids Project. The plan would identify goals and objectives, describe a process for coordination, and provide support for wildlife habitat improvement projects in lower Crab Creek and in several wildlife management areas. Elements of these programs also include providing acquiring lands, providing for fire suppression programs, controlling noxious weeds, and coordinating recreation management. Grant PUD broadly identifies the various types of actions that could be undertaken in the Project area within defined spending limits, but suggests that such details would be worked out in consultation with the resource agencies and other interested parties.

It appears that Grant PUD intends to focus on measures that would be applied to lands within or immediately adjacent to the project. This is reasonable and appropriate because such measures would be expected to benefit wildlife and botanical resources related to the project; help support biodiversity; restore and enhance native shrub-steppe and riparian habitats adversely affected by ORV and recreation use; improve riparian habitat connectivity; enhance waterfowl migration, wintering, and breeding habitat using the project lands and waters; and enhance wildlife viewing and hunting opportunities at the project. In some cases, it may be prudent to consider upland habitat improvement projects outside the project boundary, because there are limited opportunities to benefit upland species in the project boundary and to address indirect effects of some recreation activities that may extend into adjoining upland habitats. However, we recommend that Grant PUD work with Washington DFW, Interior, and others to identify and prioritize projects that rehabilitate and enhance important shrub steppe, riparian, and wetland habitats within and immediately adjacent to the project because these areas are most closely tied to project effects and resources.

Because the habitat improvement measures and management objectives are conceptual at best, additional detail is needed to ensure that the implemented measures maintain a nexus to the project. Moreover, while we have estimated costs (estimated annualized cost of $997,500) for implementing habitat restoration and management measures based on the record, the final cost would depend on the specific habitat improvement projects that are ultimately identified. We recommend that a Wildlife Habitat Management Plan be filed for Commission approval that includes an identification of the projects that would be implemented, where they would be implemented, how they would be implemented, how they would be maintained and monitored to ensure their continued success, and a schedule for their implementation. The plan should be developed in consultation Washington DFW, FWS, BLM, BOR, tribes, Washington DNR, and the IAC because of the need to coordinate the Shoreline Management Plan and the Recreation Plan.

It is likely that management actions would need to be defined and coordinated on a regular basis (at least every five years) to ensure that they address changing conditions and resource needs. Consequently, we also recommend that Grant PUD file an updated management plan every five years for Commission approval that specifically describes habitat improvement projects that would be undertaken over the next five years. We estimate that it would cost about $2,000 to update the plan; this does not include an implementation cost because that would depend on the approved measures. We find the benefits to wildlife resources from implementing the above measures would be worth the cost.

Monitoring Habitat and Coordinating Recreation Measures

To ensure that management of project lands are consistent with adjoining land use goals, Washington DFW recommends that Grant PUD develop a habitat management and monitoring plan that is coordinated with Grant PUD's draft Shoreline Management Plan. The plan, to be developed within 18 months of license issuance, would include a map of land use designations within the project vicinity, management goals and strategies for land use designations, a monitoring strategy that would identify actions inconsistent with stated land use goals, and a timeline for restoring damaged habitats. Interior also recommends a coordinated recreation and wildlife management plan.

Dispersed recreation that occurs along the project reservoir can adversely affect sensitive wildlife habitats and plants and appears to be the principal concern of the resource agencies. The project reservoir also provides a travel corridor that facilitates access to surrounding state and federal lands that is difficult to control. Grant PUD intends to coordinate implementation of the Wildlife Habitat Management Plan with its Shoreline Management and Recreation Plans to further minimize disturbance to wildlife and degradation of sensitive habitats from project-related recreation. Grant PUD's draft Shoreline Management Plan defines existing land uses within the project boundary that reflect stakeholder input for intended land use goals. However, the draft Shoreline Management Plan does not identify adjacent land uses. Such knowledge can help guide management decisions, whether that be locating recreation facilities or implementing wildlife management projects or considering signage (see Signs at Identified Recreation Sites below) and recreation access controls to sensitive lands. Therefore, we recommend that the draft Shoreline Management Plan map be revised to reflect adjacent land uses. We do not expect this to increase the cost of finalizing the Shoreline Management Plan.

We also recommend that a Wildlife Habitat Monitoring and Information & Education Program be developed in consultation with the resource agencies to monitor the indirect effects of recreation on wildlife and wildlife habitats and to educate the public about the importance of sensitive habitats (see Signs at Identified Recreation Sites below). The draft Recreation Plan includes a monitoring protocol that is based on periodic surveys and qualitative observations of bare ground, litter, and vegetation damage. We find these methods to be too subjective and do not necessarily fully consider wildlife needs. Therefore, a more detailed habitat monitoring program at dispersed recreation sites along the project reservoir needs to be developed. The monitoring plan should be coordinated with the Recreation Plan and may include a further refinement of the proposed monitoring methods to more directly consider recreation-related effects on wildlife and wildlife habitat immediately adjacent to the project

Washington DFW also recommends that the management and monitoring plan include provisions to mitigate for lost habitat and wildlife resource values that occur as a result of recreation development and dispersed recreation activities that are inconsistent with plan. Grant PUD's draft Recreation Plan identifies a number of actions that might be undertaken to curtail adverse recreation-related effects, including erecting access barriers, defining site boundaries, cleaning up the site, closing the site, hardening the site, and providing sanitation facilities. These actions would likely be adequate to stop further adverse impacts from occurring, but would not necessarily rehabilitate the sites. Because it may be difficult to discern how much adverse recreation-related affects on wildlife and wildlife habitats are attributable to the project and how much might be associated with adjoining land use and agency access policies, habitat improvement projects would need to be considered on a case-specific basis and would be legitimate candidates for habitat improvement projects developed in the context of the Wildlife Habitat Management Plan discussed above. We believe this is consistent with the objectives of Washington DFW and Interior's recommendations. We estimate it would cost about $15,000 to develop the monitoring program and to coordinate the development of the Wildlife Habitat Management Plan, Recreation Plan and Shoreline Management Plan. The cost of implementing the plan would depend on the methods employed. These efforts would continue to provide appropriate recreation access to the project lands and water, while benefiting wildlife and ensuring habitat improvement projects are consistent with management objectives. We find that these benefits would be worth the cost.

The Memorandum of Agreement between Grant PUD and the Wanapum

Under the original license for the Priest Rapids Project, Article 42 required Grant PUD to develop a MOA with the Wanapum for the protection of Indian graves in the project area, the removal of the pictographs from P'na Island, and the setting up of these pictographs as monuments. As a result of this requirement, the two parties signed a MOA on January 8, 1957. According to Grant PUD's license application (2003), the agreement was subsequently modified.

As previously discussed, Grant PUD proposes to continue its commitment with the Wanapum to protect the cultural resources. In comments on the draft EIS, Grant PUD and the Wanapum recommend that the MOA remain separate from the final HPMP, but part of a new license for the project. The Wanapum stated that the MOA reflected the need for identification, protection, and management of cultural resources, gravesites, and relics at the project, which are important to the Wanapum. As both the Wanapum and Grant PUD have expressed in their comments, we agree with the importance of Grant

PUD’s continued commitment with the Wanapum. Therefore, to protect cultural resources of significance to the Wanapum at the project, we recommend the license include an article requiring Grant PUD to file, within 6 months after license issuance, a MOA for Commission review, which may include any relevant portions of past agreements. This MOA should provide for the identification, protection, and management of cultural resources, gravesites, and relics, in the same manner that the licensee has during the current license term.

In comments on the draft EIS, the Wanapum recommended that Grant PUD develop an agreement with them providing for reasonable funding, construction, and other assistance to assure cultural artifacts are properly handled. We recommend that the filing of a MOA include provisions to ensure cultural artifacts important to the Wanapum that are located at the Priest Rapids Project are properly handled and curated. While we support an agreement between Grant PUD and the Wanapum to properly handle cultural artifacts, we maintain that funding arrangements between the two parties can be concluded privately, without being subject to Commission enforcement. We, therefore, do not recommend this provision in any license issued for the project.

Historic Properties Management Plan and Related Measures

Along with implementing the HPMP within one year after license issuance as proposed by Grant PUD, we also recommend that Grant PUD implement the following six tasks associated with the final HPMP: (1) within 3 months after license issuance, provide DAHP with the missing and incomplete information associated with submitted site record and determination of eligibility forms; (2) within six months after license issuance, develop protection/mitigation measures for the 20 archeological sites listed in Table 27 and all other archeological sites located within the Project APE known to contain human remains; (3) within one year after license issuance, implement protection/mitigation measures on the archeological sites mentioned in (2) above; (4) within 2 years after license issuance, determine National Register eligibility for the remaining inventoried archeological sites and other cultural resources located within the Project APE; (5) within 2.5 years after license issuance, identify site-specific project-related effects to National Register-eligible cultural resources; and (6) within 3 years after license issuance, develop long-term treatment plans and associated schedule for carrying out remaining site-specific protection/mitigation measures on the National Register-eligible archeological sites.

We also recommend that Grant PUD reconvene a committee similar to the Hanford Reach National Monument Federal Advisory Committee within six months after license issuance and incorporate into the HPMP, steps, procedures, and protocols involving this committee. The purpose of the committee would be to protect archeological sites being affected by project-related shoreline erosion in the Hanford Reach. In comments on the draft EIS, Grant PUD supports this concept. We also recommend that provisions be included in the final HPMP for addressing impacts from recreation use of Quilomene Dune and Bay on cultural resource sites. For further discussion see the Recreation and Land Use section.

The HPMP and associated additional Staff-recommended tasks would provide a framework for management of all identified National Register-eligible sites within the Project's APE for the term of the new license. Management actions would include site monitoring, shoreline stabilization, data recovery, curation, and Interpretation and Education programs to educate the public on historic properties. Grant PUD estimates the total estimated capital cost of its proposal is $20,000,000 with annual O&M costs estimated at $3,750,000. We believe that the costs of our additional recommendations could be incorporated in Grant PUD's total costs for the HPMP. The above measures would adequately protect the cultural resources within the Project's APE and believe the benefits to the rich cultural resources at the Project would be worth the cost.

Signs at Identified Recreation Sites

We have included in our recommended alternative two additional measures, one proposed by the Yakama and one proposed by CRITFC. The Yakama commented on project-related recreational use in the Quilomene Dune and Bay area. By allowing the number of boats in the Quilomene Dune and Bay area without any regulation for wake size, significant and on-going shoreline erosion occurs, thereby potentially affecting culturally sensitive areas of concern to the Yakama. In its filing of July 8, 2005, Grant PUD states that the impacts on the area are generally localized to the shoreline zone because visitors arrive by watercraft.

In our draft EIS, we recommended the final Recreation Plan include a provision (*e.g*., signs) at Quilomene Dune and Bay to address wake size by boaters. We received no comments on our recommendation. We still find this recommendation would likely lessen shoreline erosion of historic properties, and associated riparian habitat, caused by project-related recreation use. Overall, to minimize erosion of historic properties caused by project-related recreation use within the Project boundary, the final HPMP would take into account such impacts and those impacts would be lessened through recommended measures. We estimate the cost at $3,000.

CRITFC recommends that Grant PUD install sign(s) at identified recreation sites within the existing project boundary to improve public awareness of and the need to protect cultural resources. Although the cost of implementing this measure is unknown, we find that the measure could be developed in concert with the HPMP, which is a stipulation of the PA, but would be a component of Grant PUD's proposed Interpretation & Education Program, part of its draft Recreation Plan. We expect the cost to be nominal based on a coordinated effort among Grant PUD and the interested parties.

As previously discussed in the Recreation and Land Use section, the Project area provides an opportunity for the public to understand the Ice Age Floods and its role in creating water storage above the Project dams, as well as, its role in providing the materials used to construct the Project dams and those dams on the mid-Columbia River. We recommend, therefore, that Grant PUD develop and install at least two interpretive displays/kiosks regarding the Ice Age Floods to be located within the Project boundary. The displays/kiosks would be a component of Grant PUD's Interpretation and Education program, part of its final Recreation Plan. We estimate the cost of developing two interpretive displays/kiosks at $26,000. We conclude this measure would contribute to a beneficial effect on the recreation resource and we recommend including it in any license issued for the Project.

Recreational Use Monitoring on BLM Lands

In its draft Recreation Plan, Grant PUD proposes to conduct periodic recreation use monitoring surveys on project lands at 12 year intervals at an estimated cost of $75,000 per survey (or $225,000 for 3 surveys). We have included in our recommended alternative an additional measure proposed by Interior in its section 10(a) condition, which entails inclusion of recreation monitoring on an estimated 748.8 acres of BLM-administered land in the project boundary. The monitoring would be a component for gathering data for FERC Form 80-Recreation Report, which is required at six year intervals. Using Grant PUD's cost for recreation use monitoring, we estimate this measure would add $21,150 annually to the proposed Project cost. We find the benefit of providing coordinated planning for project-related recreation lands would help determine the adequacy of the proposed public access and recreation facilities to meet future recreation demand and would be worth the additional cost required by this measure.

Kittitas County Boat Launch at Vantage

In its draft Recreation Plan, Grant PUD proposes to improve the Kittitas County boat launch at Vantage by: (1) providing barrier-free facilities; (2) providing additional facilities, such as five picnic sites, interpretative signs, and a trail; and (3) expanding the parking area.

Based on comments on the draft EIS, we include in our recommended alternative an additional measure for Grant PUD to dredge and lengthen the Kittitas County boat launch at Vantage. As previously discussed in section 3.9.2, the Kittitas County boat launch at Vantage provides access to Wanapum reservoir and is heavily utilized primarily because of its location (near I-90) and a fee is not required. The 1999 FERC Form 80-Recreation Report estimated 31,880 persons at the boat launch. Survey results (EDAW, Inc., 2000b) support the recreational use data. Our recommendation for Grant PUD to dredge and lengthen the Kittitas County boat launch at Vantage would not only address the effects of fluctuating impoundment surface elevations on recreational boating, but also address a recreation need. Overall, the recreation opportunities at the boat launch would be enhanced and would contribute toward a cumulative beneficial effect on recreation resources within the mid-Columbia River Basin. We estimate the cost to dredge and lengthen the Kittitas County boat launch at Vantage would be $200,000 and find the benefits of this measure would be worth the cost.

Crescent Bar Island

The estimated 160-acre Crescent Bar Island is situated within Wanapum reservoir, approximately 20 miles upstream from Wanapum dam. The island is located within the Project boundary and is owned entirely in-fee by Grant PUD.

Grant PUD proposes to manage Crescent Bar Island under two land classifications: 105 acres as “planned development” and 112 acres as “conservation land” (including small islands and the mainland shore). The planned development land within or adjacent to the Priest Rapids Project boundary has experienced intensive residential, vacation home, and/or commercial development. The conservation land contains fish, wildlife, scenic, historic and/or archaeological resources that have exceptional and specific value(s) that require special protection.

As previously discussed, a series of leases (since 1962) and sub-leases issued by Grant PUD under its current Project license enabled private and public facilities to be constructed on Crescent Bar Island, primarily the northern portion of the island. The southern portion of the island has remained undeveloped. The Commission record documents “unauthorized activities”, for example clearing of wetland areas on the shoreline of Crescent Bar Island that resulted in the loss of riparian and wetland habitat. The record also documents concerns from the resource agencies and interested parties continue regarding the adverse effects of further development on the island.

In 1998, complainants (five groups representing business lessees, condominium lessees, and RV tenants on Crescent Bar Island) sought exclusion from the Project boundary of portions of Crescent Bar Island underlying their business and residences. In 1999, the Commission found Grant PUD owned the underlying lands in fee, and the lease agreements were subject to the terms and conditions of the Project license. The lease agreements reserved to Grant PUD a perpetual flowage easement over all of the lands.[120] Although the Commission determined the lands were needed for project purposes, the Commission anticipated that, during the relicensing process, the matter would be revisited.

Under Grant PUD's proposal to manage 105 acres of Crescent Bar Island for planned development, we find that private development would be allowed and could occur during the term of a new license. Such development would only occur if a master plan (developed by a representative community organization along with its proposed permit for a facility) was approved by Grant PUD that demonstrated the proposed uses were consistent with the license. We find, however, that any further development could potentially result in more habitat fragmentation and loss of riparian habitat and associated species, potential exclusion of public access to Project lands and waters, potential adverse effects on juvenile Chinook salmon that use near-shore habitat, disturbance to wintering bald eagles, and impacts on a state-sensitive plant, the shining flatsedge. Washington DFW identifies the Crescent Bar area as a Riparian Priority Habitat.

Based on these effects and that these lands are still needed for Project purposes, as discussed in this final EIS, we find that no further development on Crescent Bar Island should occur beyond the existing disturbed footprint (except as noted below for the proposed trail); the maps contained in the draft Shoreline Management Plan should be revised to reflect existing land uses within the project boundary and adjacent land uses; and, a shoreline buffer zone on Crescent Bar Island should be defined. For a buffer zone, the Commission uses 200 feet as a rule-of-thumb;[121] however, the width of a shoreline buffer and lands associated with certain recreation activities (*e.g*., boating, fishing) to ensure public access and protect the resources may vary from project to project. Therefore, Grant PUD should, at a minimum, consult with the FWS, Washington DFW, and the IAC and determine the width and acceptable uses of a buffer zone, and upon Commission approval, delineate a shoreline buffer zone for Crescent Bar Island. For further discussion, see the section entitled Monitoring Habitat and Coordinating

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[120] 88 FERC ¶ 61,012 (1999) and 89 FERC ¶ 61,177 (1999).

[121] The idea of a 200 foot buffer zone was established by Commission Order No. 313, 34 FPC 1546 (1965). *See, e.g. Northern States Power Company,* 83 FERC ¶ 62,194 (1998).

Recreation Measures above.

We recommend Grant PUD manage Crescent Bar Island under the land classifications proposed as planned development and conservation, but no further development should occur beyond the existing disturbed footprint (except as noted for the proposed trail). Grant PUD would be subject to the provisions of the Commission's standard land use article, if a new license is issued. The standard land use article contains provisions for Commission approval to authorize non-project use of project lands. This approval process would require Grant PUD to file, with the Commission, an application for non-project use of project lands, thereby initiating a process involving public input as well as agency and other interested entity input. It is a process intended to protect environmental resources, protect the scenic values of the mid-Columbia River, and to continue to allow for public access to Project lands and waters.

As discussed in section 3.9, *Recreation and Land Use*, Grant PUD proposes to improve public recreation facilities on Crescent Bar Island, which include provisions for the following: (1) a 5.5-mile-long trail; (2) dredging and lengthening the boat launch; (3) removing six existing RV campsites; (4) better publicity, information, and signage about existing public use areas; and (5) day-use facilities (*e.g.*, picnic sites, double-vault toilet). The 1999 FERC Form 80-Recreation Report estimated 32,100 persons at the boat launch.

While these actions would increase public use of Crescent Bar Island, the actions should not, except for the proposed trail, add new development outside the already disturbed footprint. The trail could be developed to minimize affects on terrestrial resources. Thus, overall, we find Grant PUD's proposed recreation improvements on the island would meet a recreation need as identified by the Washington SCORP, would be consistent with the conservation land classification objectives in Grant PUD's draft Shoreline Management Plan, and would be in the public interest.

5.1.3 Discussion of Measures Not Recommended by Staff

Staff finds that some of the measures proposed by Grant PUD or recommended by other interested parties would not contribute to the best comprehensive use of the Columbia River water resources, do not exhibit sufficient nexus to project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following discusses the basis for staff's conclusion not to recommend such measures.

Alternative Passage Standards

CRITFC recommends that Grant PUD adopt a passage standard whereby direct and indirect juvenile salmon mortality through the reservoir, dam, and tailrace would not exceed 8.5 percent by 2013. The primary differences between the CRITFC standard and the standard proposed by Grant PUD, NMFS, Interior, and Washington DFW is inclusion of tailrace mortality and increased total mortality. CRITFC provided no justification for this standard and it is not clear that it would provide any greater benefit to salmon and steelhead than the standard proposed by Grant PUD and the agencies. Lastly, it is not apparent that tailrace mortality could be accurately measured at each dam with the existing technology.

The costs of implementing measures to achieve this standard are unknown; however, because there is no apparent justification or benefit to achieving CRITFC's alternative fish passage standard in comparison to the proposed standards, we do not recommend adopting them.

Passage Efficiency Standards

CRITFC recommends that Grant PUD achieve 80 percent fish passage efficiency (i.e., non-turbine passage) by 2013 and 90 percent fish passage efficiency by 2020. This standard would be in addition to achieving survival standards. CRITFC indicates that passage efficiency standards are necessary to address delayed mortality that is not accounted for by the survival standards. Grant PUD indicates that there are no known methodologies available to partition direct and indirect mortality and they state that there are no data to support the theory that delayed effects of turbine passage are greater than other routes.

Regardless of the ability to measure delayed mortality or its significance, it is not clear that Grant PUD could implement any techniques that are not already being employed or under consideration to further increase fish passage efficiency. Spills are currently the primary non-turbine route for passage of juvenile salmonids and they are currently limited by TDG at the project. Additional spills would likely cause further increases in TDG which could reduce fish survival or result in other adverse effects.

Both the Wanapum dam future unit 11 bypass and the potential top-spill bypass design at Priest Rapids dam have the potential to increase fish passage efficiency at each dam. The Wanapum bypass is currently under construction and Grant PUD is studying top-spill bypass designs for Priest Rapids dam. We are not aware of any other practical approaches that could be employed at the dams to increase fish passage efficiencies. Because there is no evidence that the delayed effects of turbine passage are greater than other routes and there are no practical approaches for increasing fish passage efficiencies beyond what is already being considered, we do not recommend including this requirement as part of any license issued for the Project.

Adult Fishway Passage Standard

CRITFC recommends that Grant PUD be required to achieve a median upstream passage time of 24 hours for each dam. CRITFC indicates that median passage times for adult salmon moving upstream past the project range from 12 to 36 hours, while median passage times for most Columbia River mainstem dams is about 24 hours. CRITFC indicates that excessive passage times may reduce adult salmon and steelhead energy reserves and reproductive viability. CRITFC suggests that reducing upstream passage times would likely have some incremental benefit in regard to reproductive success.

Failure to achieve a fishway travel time standard would suggest a need to implement measures to reduce upstream travel times at the project dams. This is consistent with what Grant PUD is already doing and would continue to do under the staff-recommended alternative. Recently, Grant PUD addressed delay between the collection channel and the entrance to the left bank fishway at the Priest Rapids dam by closing the collection channel orifice gates and modifying the fishway entrance gate configurations. Additionally, as part of the staff-recommended alternative, Grant PUD would study methods to improve inadequate collection channel velocities which are a source of delay at both dams. After completion of the proposed fishway modifications, Grant PUD would monitor passage times to confirm that passage conditions were improved and passage times were reduced. Because we are recommending that Grant PUD improve fishway passage conditions and demonstrate improvement in passage times through subsequent monitoring, we conclude that a fishway passage time standard would be unnecessary and we do not recommend including this measure in any license issued for the Project.

Meeting Survival Standards by 2013

The Yakama and Alaska DFG indicate that Grant PUD should be required to meet the survival standards for all anadromous salmonid species by 2013. Under the SSA and NMFS' section 18 prescriptions, Grant PUD would develop and implement a plan to achieve 93 percent juvenile salmonid dam passage survival by 2010 and would measure passage survival of all species by 2013. If the survival standards are not met by 2013, Grant PUD would implement additional modifications to improve survival or implement additional mitigation or enhancements.

Alaska DFG states that because the SSA does not include a specific deadline for achieving the survival standards, Grant PUD could operate the project without meeting the survival standards for the entire license term. While this conclusion is technically correct, it is inconsistent with the spirit of the SSA. Under the terms of the agreement, Grant PUD must "make steady progress" towards achieving the survival standards including continuing to examine approaches to improve survival throughout the license term or until the standards would be met. We anticipate that Grant PUD would achieve the survival standards for each species during the license term. It is not apparent that imposing a strict deadline would provide any additional certainty of achieving the survival standards, since with or without a deadline, it would be possible that Grant PUD would fail to achieve the survival standard for an individual species. Because there does not appear to be any benefit to imposing a deadline on achievement of the survival standards, we do not recommend including this measure in any license issued for the Project.

PIT Tag Detection at Wanapum dam

CRITFC and Alaska DFG recommend that Grant PUD install PIT tag detection equipment at Wanapum dam. CRITFC indicates that installation of PIT tag detection facilities at Wanapum dam would reduce critical uncertainties regarding fallback rates and the ultimate fate of adults passing Wanapum dam and would allow calculation of smolt-to-adult returns from returning adults from juvenile survival studies. Alaska DFG indicates that installation of PIT tag detection facilities at Wanapum could serve "as a check" of information collected at Priest Rapids dam.

Installation of PIT tag detection facilities at Wanapum dam would allow tracking of individual adult fish that have passed from Priest Rapids dam to Wanapum dam. However, it would provide little additional insight regarding fallback or the ultimate fate of adults since many other factors such as natural mortality, harvest, or straying could not be accounted for by PIT tag detection alone. For these same reasons, PIT tag detection at Wanapum dam could not be used to serve "as a check" of Priest Rapids data. Smolt-to-adult survival can be measured with the existing PIT tag detectors at Priest Rapids dam and there is no additional benefit to calculating this metric with PIT tag data collected at Wanapum dam.

Based on the cost estimates for Priest Rapids dam, the cost of installing PIT tag equipment at Wanapum dam would be about $320,000; annual O&M cost would be $10,000. However, because installation of PIT tag detectors at Wanapum dam would not provide any new or valuable information regarding smolt-to-adult survival or fallback, we conclude that it would not be worth the cost and we do not recommend adopting this measure.

Measures-Based Passage Plan

CRITFC recommends that Grant PUD develop and implement a measures-based upstream passage and fallback assessment and implementation plan for the project. They indicate that the plan should include: 1) an assessment of new fishway designs to decrease energy expenditure; 2) evaluation of extending the fishway exits into the project forebays to reduce fallback; 3) creation of additional attraction flows at ladder entrances to reduce adult tailrace delay; 4) evaluation of the effects of the surface bypass superstructure at the Wanapum sluiceway on fallback adults and kelts; 5) evaluation of extended spill periods for providing fallback and kelt passage; 6) investigation of the impacts of power peaking on adult passage; 7) implementation of measures that would allow independent operation of the left and right bank fishway water supply systems; and 8) estimation of adult salmon energy expenditure during upstream passage through the fishway. These studies could identify project effects on upstream passage and could lead to improvements that would increase the efficiency of the upstream passage facilities; however, CRITFC has provided no evidence or information to indicate that any of the studies are needed.

The specific cost of the measures-based approach proposed by CRITFC is unknown; however, it is clear that the various studies and evaluations would be costly. Upstream passage at the project dams appears to be comparable to other dams within the mid-Columbia River and continued monitoring and refinement proposed by Grant PUD and the agencies should improve upstream passage conditions even further. Because there is no evidence that this approach or these studies are needed or that existing passage conditions are inadequate, we conclude that a measures-based passage plan is unnecessary and would not be worth the cost.

Effects of Peaking on Passage

CRITFC recommends that Grant PUD study the effects of peaking operations on juvenile and adult fish passage through the project dams. CRITFC speculates that decreased discharge that occurs during peaking operations increases delay in the downstream passage of juvenile salmonids and exposes them to increased predation mortality in the project forebay. CRITFC provides no details regarding the mechanism for this delay; however, it is possible that reduced flows (i.e., dam discharge) would reduce steering flows in forebay areas and cause juvenile fish to be unable to locate available passage routes.

In regard to adult passage, CRITFC suggests that increased powerhouse discharge increases adult passage delay and may increase adult mortality during upstream passage. Increases in project discharge could influence the ability of adult salmon or steelhead to locate fishway entrances by creating confusing flow conditions that conceal fishway attraction flows. However, Grant PUD has studied adult passage at both dams and found that the most significant delay problems occurred between the collection channel and the fishway entrance. The monitoring results collected by Grant PUD do not suggest that there is any significant delay of adult fish related to fluctuating flows. Grant PUD is proposing to continue monitoring adult upstream passage and implement corrective actions if problems are identified. We would expect that any significant delay problems associated with adult passage would be identified through this monitoring.

CRITFC provided no information describing the design of these peaking studies. We would expect that they would require tracking individual juvenile and adult passage times using radio telemetry under varying project operational scenarios (*i.e*., peaking vs. not-peaking). We estimate that the cost of these studies would be approximately $200,000, not including any lost power sales associated with manipulating project operations. Because we have no evidence, other than speculation, to suggest that peaking adversely affects fish passage and because other measures would be implemented that would have direct benefits towards improving fish passage, we conclude that the recommended peaking study is unnecessary and it would not be worth the cost.

Index Testing All Turbines

CRITFC recommends that Grant PUD index-test all individual project turbines to identify peak efficiency ranges. CRITFC states that fish survival is generally higher when turbines are operated within 1 percent of peak efficiency and they recommend that the project turbines be operated at near peak efficiency to maximize fish passage survival. Grant PUD indicates that any new turbines installed at Wanapum dam would be index-tested and this information would be used to operate the new turbines at near peak efficiency to maximize passage survival. For the existing turbines at both Wanapum and Priest Rapids dams, Grant PUD has developed a fish mode of operation. The fish mode of operation restricts the operating ranges of the turbines to maximize survival based on empirical passage survival data. We would expect these empirical data to be more reliable for maximizing survival than the more theoretical relationship between operating efficiency and survival that would be employed through index-testing. The cost of index-testing is unknown; however, because there would be little benefit, if any, to index-testing the existing project turbines, we are not recommending it for any license that would be issued for the Project.

Adult Fallback and Kelt Passage Studies

In comments on the draft EIS, American Rivers recommended that Grant PUD conduct adult salmon and steelhead downstream passage studies. American Rivers indicates that they support the modifications proposed by Grant PUD to provide better adult downstream passage conditions; however, they state that there is a substantial information gap regarding adult downstream mortality and there must be scientifically credible data for determining whether the spillways and sluiceways provide a safe route for adult downstream passage. American Rivers did not specify how adult downstream passage survival would be measured.

Our analysis suggests that studies of adult spillway and sluiceway survival could be conducted with hatchery fish to avoid effects on ESA listed salmon and steelhead; however, it is not clear what methodology would be best for conducting adult salmon or steelhead survival studies. Telemetry studies do not allow direct observation and assessment of fish condition, which would prevent evaluation of injuries and accurate accounting of survival (i.e., non-moving tags may not be dead fish or moving tags may not be live fish). Balloon tag recovery with adult salmon or steelhead would likely be ineffective for fish recovery or would bias fish survival. Net recovery would introduce a significant potential for recovery injuries and bias that has been shown to be difficult to account for through use of control fish. We estimate the cost of conducting these studies would range from $500,000 to $1,000,000. Because the results of these studies would likely be unreliable, we conclude that these studies would not be worth the cost and we do not recommend including a requirement for these studies in any license that is issued for the Project.

Spillflows for Adult Fallback and Kelts

In comments on the draft EIS, Umatilla stated that sluiceway passage would not be adequate to protect adult fallbacks or kelts. Umatilla stated adult mortality through turbines is very high and sluiceway flows would be only a small fraction of total streamflow. Umatilla recommend that Grant PUD provide spillflows at Priest Rapids dam and spillflows or top-spillflows at Wanapum dam for protection of adult fallbacks and kelts.

As proposed in the SSA, Grant PUD would provide spill or top-spill flows at both dams for downstream passage of juvenile fish from April through the end of July or early August depending on juvenile run timing. Our analysis indicates that these spills would provide a safe alternative to turbine passage for the entire period when kelts would be present and during most of the period when adult salmon and steelhead would be migrating upstream. Once spillway flows would be discontinued, Grant PUD would provide sluiceway flows as a fallback route. The timing of this operation would correspond to a portion of the fall Chinook salmon and steelhead migrations (from August through November 15 each year).

Sluiceway flows during the August to November 15 periods would provide a safe alternative to turbine passage. Providing additional spillway flows during this period, as recommended by Umatilla, would be costly and would reduce power generation (Umatilla did not specify a spill level; therefore, we are unable to quantify power losses and costs). Because Grant PUD's proposed sluiceway flows would provide a safe alternative to turbine passage for adult fallbacks and because providing additional spillflows from August to November 15 would reduce generation, we conclude that this proposal would not be worth the cost. We do not recommend including a requirement to provide spillflows from August to November 15 in any license that is issued for the Project.

Upgrade to State-of-the-art Hatchery Facilities

Alaska DFG and CRITFC recommend that Grant PUD initiate funding of improved state-of-the-art facilities at the Priest Rapids Hatchery. CRITFC also recommends that these state-of-the-art facilities should be employed at other hatcheries used to produce fish as mitigation for the Project.

Grant PUD acknowledges that many of the facilities at the Priest Rapids Hatchery are approaching the end of their useful life and Grant PUD is proposing to renovate the hatchery. Grant PUD's proposal includes construction of a new incubation building, a new office building, an emergency power system to provide uninterruptible water supply to the hatchery building, new early rearing raceways, an additional rearing pond, new adult trapping an holding facilities, a new weir on the return channel, predator control features, a pollution abatement settling pond, and up to three residences. These renovations would allow Grant PUD to produce the number of fall Chinook salmon needed for the proposed mitigation. Many of the measures recommended by CRITFC and Alaska DFG would be directly or partly addressed by Grant PUD's proposed renovations to the Priest Rapids Hatchery; however, it appears that not all facilities would be upgraded to "state-of-the-art" status.

Grant PUD indicates that the hatchery production goals for spring-run Chinook salmon, summer Chinook salmon, sockeye salmon, and steelhead would likely be achieved by hatcheries located in other portions of the Columbia River watershed. These hatcheries are not owned or operated by Grant PUD and hatchery production at these facilities would likely be contracted by Grant PUD to some other entity. CRITFC suggests that the facilities at these hatcheries should be improved to state-of-the-art status.

Alaska DFG and CRITFC do not provide any evidence to indicate that state-of-the-art facilities are necessary to produce adequate numbers of healthy fish for mitigation. The costs of these upgrades are unknown; however, because of the numbers of hatcheries being considered for producing fish, it is apparent that these upgrades would be fairly costly. Ultimately, if the Priest Rapids hatchery or any other hatchery that is selected is capable of producing healthy fish that meet the targeted production goals there would be no basis for additional hatchery improvements. Based on this information, we conclude that these general and non-specific upgrades and improvements are unnecessary and unwarranted.

No Net Impact Fund

NMFS and Washington DFW indicate that the Project should achieve No Net Impact (NNI) if combined adult and juvenile passage survival is 91 percent and the remaining 9 percent unavoidable loss is made up through 7 percent hatchery mitigation and 2 percent habitat mitigation. The passage survival standards are currently not being achieved for certain stocks; therefore, the project is not achieving NNI for these stocks. As part of the SSA, Grant PUD is proposing that they contribute to a NNI fund to compensate for providing passage survival at rates less than the survival standards. Based on the calculations included in the SSA, Grant PUD is proposing to annually contribute $1,112,500 to a NNI fund to compensate for failing to achieve the survival standards for summer Chinook salmon and sockeye salmon.

In comments filed on March 8, 2006, Alaska DFG indicated that survival estimates used in the NNI fund should account for differences in survival of sub-yearling and yearling summer Chinook salmon. Alaska DFG suggests that Grant PUD should conduct studies of sub-yearling Chinook salmon survival and adjust the contribution to the NNI fund accordingly. Grant PUD is proposing to study sub-yearling Chinook salmon survival rates during the license term (years 2009 to 2011). After completion of these studies, the PRCC would use the survival estimates to adjust Grant PUD’s contributions to the NNI fund for summer and fall Chinook salmon. These studies and adjustments of the NNI fund contributions would address Alaska DFG’s concerns.

NNI funds would provide the agencies with additional financial capacity to undertake measures to improve survival of stocks failing to meet the survival standards, which could include supplementation of ongoing hatchery production, providing additional habitat improvements, or implementation of other measures.

We are recommending multiple actions and measures that would substantially improve conditions for salmon and steelhead stocks inhabiting the mid-Columbia River. In general, these measures would improve upstream and downstream passage conditions and increase smolt production through hatchery supplementation and habitat improvements. Some losses would continue in spite of these substantial measures; however, because the staff-recommended measures would greatly improve conditions for salmon and steelhead and the FPA does not impose a no-net-loss requirement[122], we do not recommend including this measure in any license that is issued for the Project.

Future Populations

NMFS recommends that if a long-term hatchery program or a threshold population of naturally reproducing Coho salmon and/or Okanogan spring-run Chinook salmon is established, Grant PUD should develop, fund, and implement comprehensive protection programs for these species. The endemic stock of Coho salmon from the mid-Columbia River and the Okanogan spring-run Chinook salmon are considered extinct. Reintroduction efforts have been undertaken for both species; however, at this time both programs are considered experimental and there is no evidence that either population has established a threshold population. No long-term hatchery programs exist for either species. The cost of implementing specific protection programs for these species is unknown. Based on the information above, we conclude that requiring Grant PUD to implement protection programs for these species is premature and unwarranted at this time.

As part of their proposal included in the SSA, Grant PUD indicated that the Priest Rapids Coordinating Committee would evaluate the status of these reintroduction efforts in 2007 and determine the success of these programs and the need for mitigation. If the Priest Rapids Coordinating Committee determines that the reintroduction efforts have been successful in achieving threshold levels and project-related mitigation or enhancement would be appropriate, these efforts could be addressed through reopening the license or a request to amend the license.

Funding Regional Salmon Stock Evaluations

CRITFC recommends that Grant PUD contribute funding to regional evaluations of salmon stocks affected by the project. They suggest that these funds could be used to perform life-cycle analyses, genetic assessments, stock productivity analyses, and carrying capacity analyses. CRITFC states that these studies are needed to quantify or ground-truth the benefit of the passage survival standards proposed by Grant PUD and the agencies. They state that assessment of the survival standards is needed to determine if the standards are adequate for

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[122] See, *e.g.*, *Ohio Power*, 71 FERC ¶ 61,092 (1995) and *Indiana Michigan Power Co.,* 82 FERC ¶ 61,274 (1998).

achieving regional productivity/escapement goals for salmon and steelhead.

The ability to achieve regional salmon and steelhead production goals or escapement goals encompasses numerous factors that are unrelated to effects of the Project. As a result, failure to achieve these goals would not necessarily indicate that the effects of the Project have not been adequately mitigated. Our analysis indicates that achieving the passage survival standards, providing hatchery supplementation, and improving tributary habitat conditions would mitigate for virtually all project effects on salmon and steelhead stocks. Additionally, we are recommending multiple studies, evaluations, and monitoring that would ensure that the proposed measures would be successful. The cost of the regional studies proposed by CRITFC is unknown; however, because these studies would be unnecessary to address project effects, we conclude they would not be worth the cost and we are not recommending including them in any license for the project.

Flows to Accommodate Fall Chinook Salmon Escapement

Interior, CRITFC, and Alaska DFG recommend that Grant PUD provide flows that would maintain enough suitable spawning habitat to accommodate expected fall Chinook salmon escapement (i.e., returning spawners) in the Hanford Reach. They recommend that each year, fishery representatives from the agencies and tribes should use escapement and water availability predictions to establish a flow regime for the forthcoming spawning season.

Currently there is no reliable or verified model for predicting the amount of fall Chinook salmon spawning habitat within the Hanford Reach as it relates to flow. Anglin et al. (2006) described the relationship between flows and habitat in the Hanford Reach; however, they suggested that additional testing and development would be necessary before the model could be employed as a management tool to regulate flows during the spawning season. In addition to the lack of a reliable model for predicting spawning habitat, the ability to predict escapement and to a lesser extent, water availability is imprecise and often unreliable. Therefore, from a practical standpoint, it is not possible for fishery representatives to accurately and reliably select a flow regime that would accommodate all adult spawning fall Chinook salmon in the Hanford Reach.

From a biological standpoint, it is not clear that additional spawning habitat is needed. Interior speculated that redd superimposition during the fall Chinook salmon spawning season reduces redd survival and limits overall juvenile production. However, Interior did not provide any evidence that spawner success is related to available habitat and there is no information in our record to indicate that available habitat is limiting production or that redd superimposition is a substantial factor influencing production. Some redd superimposition would likely occur regardless of amount of habitat available since late arriving spawners are likely to select the same preferred habitat areas that early spawners selected.

Lastly, the ability of Grant PUD to reregulate inflows from the upstream projects is limited. Inflows to the Project can vary dramatically on an hourly, daily, weekly, and seasonal basis and on occasion, the useable storage within the Project would not be great enough to fully reregulate inflows from the upstream projects. To release steady state flows from Priest Rapids dam throughout the entire spawning season, modifications to the operation of some or all of the seven mainstem mid-Columbia River dams would need to be considered and these changes would affect the ability of the system to provide load following energy generation and they would likely have indirect effects on reservoir fisheries, recreation, and other resource areas.

The cost of this measure is unknown, although it would likely be high and it would result in elimination of a substantial portion of the project's operational flexibility during the spawning period. Additionally, it appears that this measure could not be implemented due to: 1) the limited ability of the project to re-regulate inflows, 2) the lack of information describing the flow versus spawning habitat relationship, 3) the unreliability of escapement predictions, and 4) the imprecision of water availability predictions. Lastly, there is no evidence that the spawning habitat availability is limiting juvenile production or fall Chinook salmon abundance. In fact, the fall Chinook salmon population is the healthiest salmon population in the northwestern United States. Based on the information above, we are not recommending that this measure be included in any license issued for the Project.

Flows to Protect Fall Chinook Salmon Eggs, Alevins, and Emerging Fry

To protect incubating eggs, alevins, and emerging fry, Interior, CRITFC, and Alaska DFG recommend that Grant PUD maintain flow releases for the successful incubation of eggs in redds from November 30 through the end of emergence. They indicate that the specific operations and flows would be determined by the agencies, tribes, and dam operators, which is similar to the approach proposed in the Hanford Reach Agreement. However, unlike the Hanford Reach Agreement, which provides specific operational requirements in response to monitoring results, Interior, CRITFC, and Alaska DFG did not provide specific information on how the appropriate flows would be selected or how often they would be modified (i.e., once annually or multiple times per spawning season). Without additional information we are unable to evaluate the specific benefits and cost of this measure. In any event, the Hanford Reach Agreement includes measures that would adequately protect incubating eggs, alevins, and emerging fry. We do not recommend including the incubation flows proposed by Interior, CRITFC, and Alaska DFG in any license issued for the Project.

Flows to Protect Rearing Fall Chinook Salmon

CRITFC and Alaska DFG recommend that Grant PUD maintain a daily flow fluctuation range of 10 kcfs in the Hanford Reach during the fall Chinook salmon rearing period. This range is lower than the fluctuation limits proposed in the Hanford Reach Agreement (*i.e*., 20 – 60 kcfs). Intuitively, smaller and fewer fluctuations should reduce fall Chinook salmon fry stranding and entrapment; therefore, it is likely that 10 kcfs fluctuation limit would result in less stranding and entrapments than operations proposed in the Hanford Reach Agreement. However, because of uncertainty associated with the Anglin et al. (2006) model, the incremental benefit of limiting fluctuations to 10 kcfs is not clear.

Fluctuations in the Hanford Reach are the result of the cumulative effects of the seven upstream dams. As a result of Grand Coulee dam's significant physical capacity to store and release flows, fluctuations in the mid-Columbia River are often greatest immediately downstream of Grand Coulee dam; however, through coordination of the seven dam system, fluctuations generally decrease as they pass downstream. Under current operations, the Project helps to reduce flow fluctuations occurring upstream before they enter the Hanford Reach. Under the Hanford Reach Agreement, Grant PUD would implement additional operational modifications that would enhance conditions in the Hanford Reach by further restricting flow fluctuations from Priest Rapids dam. The annual cost of these enhancements for protecting rearing fall Chinook salmon would be about $4.3 million.

In comparison to the Hanford Reach Agreement, the 10 kcfs fluctuation range proposed by CRITFC and Alaska DFG would potentially provide additional enhancement of conditions within the Hanford Reach and further reduce stranding and entrapment of fall Chinook salmon. However, the 10 kcfs fluctuation limit would increase fluctuations within the project reservoirs which could have adverse environmental effects on reservoir fisheries, recreation, shoreline erosion, or cultural resources. Additionally, the 10 kcfs fluctuation limit would substantially reduce the operational flexibility of the Project during the fall Chinook salmon rearing period. While baseload generation would continue to occur, the ability of the project to provide regional electrical system support and load following capability would be substantially eliminated during the rearing period. Additionally, the ability of the project to serve other purposes such as flood control, navigation, agriculture, recreation, municipal and industrial use, or cultural resources could be adversely affected. Grant PUD estimates that the annual cost of implementing the 10 kcfs fluctuation limit would be approximately $136 million based on the cost of building and operating the 1,320 MW of combustion turbine capacity that would be lost as a result of operating within the recommended constraint.

The fall Chinook salmon population inhabiting the Hanford Reach is the healthiest salmon population in the northwestern United States and there is no evidence that this population is unstable or declining. The operational restriction proposed by Grant PUD, Interior, NMFS, and Washington DFW would enhance conditions in the Hanford Reach for fall Chinook salmon. The flow restriction proposed by CRITFC and Alaska DFG would potentially provide greater enhancement than the Hanford Reach Agreement flows; however, the 10 kcfs fluctuation limit would greatly reduce the power benefits of the project and would require greater use of reservoir storage resulting in frequent and wide fluctuations in reservoir water surface levels. The resulting effects on reservoir resources would adversely reduce the ability of the Project to serve other project purposes.

Based on the above, we conclude that the flow restrictions recommended by CRITFC and Alaska DFG would not be worth the cost and we do not recommend including them in any license issued for the project.

In comments on the draft EIS, Alaska DFG suggested that Grant PUD should implement the 10 kcfs limit for several years to collect data that would be useful for defining tradeoffs between fluctuations and power generation. Experimentally implementing the 10 kcfs fluctuation limit would likely reduce stranding and entrapments below the levels of the Hanford Reach Agreement flows and it would allow for collection of stranding and entrapment data during actual 10 kcfs operation. Additionally, experimental implementation of this mode of operation would allow for quantification of Grant PUD's ability to comply with this flow restriction. However, as indicated above, experimentally implementing the 10 kcfs fluctuation limit would greatly reduce the power benefits of the project and would require greater use of reservoir storage resulting in frequent and wide fluctuations in reservoir water surface levels during the testing period. Additionally, replacing the lost power from conducting this experiment would cost approximately $136 million per year. Because the proposed Hanford Reach Agreement would improve conditions for fall Chinook salmon in the Hanford Reach and experimental implementation of the 10 kcfs fluctuation limit would result in lost power, high costs, and potential adverse affects on other Project purposes, we conclude that this measure would not be worth the cost and we do not recommend including it in any license issued for the project.

Orthophotographic Surveys of the Hanford Reach

Interior, CRITFC, and ADFG recommend that Grant PUD conduct aerial orthophotographic surveys at all known spawning areas within the Hanford Reach during the spawning season. They suggest these surveys should be conducted to help quantify the progression, extent, and geographic location of fall Chinook salmon redds within the Hanford Reach. Interior indicates that this information would provide managers with additional data regarding the physical conditions of the habitats selected by spawners and it could be used to fine-tune project operations.

As part of the Hanford Reach Agreement, Grant PUD is proposing to monitor spawning in the Hanford Reach by surveying portions of Vernita Bar and conducting aerial surveys. This information would be used to monitor the progression, extent, and location of redds and manage flows during the spawning season. Orthophotographic surveys would include the use of video or photographic equipment that is geo-referenced and provides sub-meter measurements. This information could also be used to monitor spawning locations and manage flows during the spawning season, although it is not clear why the sub-meter level locations of redds would be necessary. We estimate that the cost of conducting orthophotographic surveys would be approximately $8,060 per year. Because sub-meter, geo-referenced data would not be necessary to collect the information used to manage flows during the spawning season, we conclude that orthphotographic surveys would not be worth the cost. We do not recommend including a requirement for orthophotographic surveys in any license issued for the project.

White Bluffs Spawning Surveys

In comments on the draft EIS, Umatilla and Alaska DFG indicated that spawning surveys should focus on the White Bluffs area, since this is the primary fall Chinook salmon spawning area within the Hanford Reach. Under the Hanford Reach Agreement, three biologists would survey portions of Vernita Bar for the location and number of redds. Additionally, Grant PUD would conduct aerial surveys of the Hanford Reach to locate and count redds in other areas, including White Bluffs. The information from these two surveys would be used to select flow levels for the Hanford Reach. Umatilla and Alaska DFG recommend that White Bluffs be used in place of Vernita Bar for selecting Hanford Reach flows. We would expect that once the relationship between flows and spawning locations is worked out for the White Bluffs area, the use of this survey location in combination with aerial surveys would provide the same protection for fall Chinook salmon in the Hanford Reach as using Vernita Bar and conducting aerial surveys. There would be no additional cost to monitoring White Bluffs, other than the cost of establishing the relationship between flow releases at Priest Rapids dam and inundation of spawning locations at White Bluffs. We estimate that the cost of defining this relationship would be approximately $20,000. Because there would be no additional benefit to using the White Bluffs spawning area in place of Vernita Bar, we conclude that developing the flow versus spawning location relationship for White Bluffs would not be worth the cost. We do not recommend including this measure in any license issued for the Project.

Spawning Behavior Studies

Interior, CRITFC, and Alaska DFG recommend that Grant PUD be required to monitor and study the effects of flow fluctuations on spawning behavior, redd placement, spawning time (within-day), and the extent of deep-watering spawning. Interior indicates that this information would be used to make management decisions regarding the specific hydrograph that would provide adequate amount of spawning habitat in the Hanford Reach. While this information would be useful to fisheries managers, there is no evidence that flow fluctuations adversely affect spawning behavior or site selection. Additionally, because flow fluctuations are the cumulative result of operations of the seven dam system, it is not apparent that the existing flow fluctuations are entirely related to project effects (i.e., if Grant PUD were required to operate the Project in run-of-river mode, substantial flow fluctuations would still occur within the Hanford Reach).

In comments on the draft EIS, Umatilla stated that Grant PUD already conducted a diel spawning behavior and redd site fidelity study at Vernita Bar in 2005. They suggest that this indicates that Grant PUD is concerned with this issue; therefore, Grant PUD should be required to conduct additional studies of spawning behavior. Umatilla provides no discussion of the results of the 2005 study or reasons why additional study would be necessary. In comments on the draft EIS, Alaska DFG suggested that Grant PUD should continue studies like Anglin et al. (2005) and the diel spawning behavior and redd site fidelity study until the questions of whether or not flow fluctuations effect spawning can be answered. Alaska DFG did not provide any evidence, including data from existing studies, which would indicate that flow fluctuations adversely affect spawning behavior.

We assume that studies of the effects of flow fluctuations on spawning would require direct observations or continuous radio-telemetry tracking of spawning fish. Both of these methods would be extremely labor intensive. We estimate that these studies would cost approximately $200,000 ($16,100 per year when annualized over the license term), not including any lost generation from intentionally manipulating project releases. While these studies would provide information describing the effects of flow fluctuations on fall Chinook salmon spawning in the Hanford Reach, they do not appear to be needed since Grant PUD has already conducted a site fidelity study and there is no evidence that fluctuating flows adversely affect spawning behavior. Based on this, we conclude that these studies are not needed and would not be worth the cost. We do not recommend including a requirement for these studies in any license issued for the Project.

Primary and Secondary Production Studies

Interior and CRITFC recommend that Grant PUD monitor and evaluate the effects of project operations on primary and secondary production and resident fish in the Hanford Reach. Our analysis suggests that short-term flow fluctuations may influence productivity along the margins of the Hanford Reach. Additionally, McMichael et al. (2003) and Anglin et al. (2006) documented that resident fish can be entrapped by receding flows.

Low productivity in the Hanford Reach would influence food availability; however, there is no evidence that fall Chinook salmon fry or resident fish inhabiting the Hanford Reach are food limited, in poor condition, or exhibiting poor growth rates. Additionally, while entrapment and stranding of resident fish may result in some mortalities, there is no evidence that any of the resident fish populations inhabiting the Hanford Reach are unstable or declining. Lastly, flow fluctuations in the Hanford Reach are the cumulative result of operations of the seven dam system and not solely attributable to the operation of the Project (i.e., if Grant PUD were required to operate the Project in run-of-river mode, substantial flow fluctuations would still occur within the Hanford Reach). We estimate that the cost of three years of productivity studies and one year of resident fish stranding studies would be approximately $450,000 ($36,200 per year when annualized over the license term).

While project operations have some influence on flow fluctuations in the Hanford Reach that may influence productivity and resident fish stranding and entrapment, there is no evidence of long-term adverse impacts from these effects. Therefore, we conclude that the proposed studies are unwarranted, would not be worth the cost, and we do not recommend including them in any license issued for the project.

Annual Stranding and Entrapment Surveys

CRITFC and Alaska DFG recommend that Grant PUD conduct annual surveys to estimate fall Chinook salmon fry entrapment and stranding losses from flow fluctuations in the Hanford Reach. Grant PUD conducted stranding and entrapment surveys each year from 1997 to 2003. During 2002 and 2003, Grant PUD voluntarily complied with the flow requirements and monitoring demonstrated the benefits of the proposed flow program. Under the Hanford Reach Agreement, Grant PUD, NMFS, Interior, and Washington DFW propose to conduct follow-up monitoring using similar methods in 2011, 2012, and 2013. Either annual monitoring or the monitoring proposed in the Hanford Reach Agreement would be useful to document the benefits of the flow program and would provide information that could be used to evaluate program effectiveness and consider modifications. We estimate that monitoring would cost approximately $150,000 per year.

While it is intuitive that more frequent collection of data would allow better tracking of ongoing conditions, CRITFC and Alaska DFG provided no substantive justification for annual monitoring. In comments filed on May 27, 2005, CRITFC indicated that additional monitoring is necessary for developing additional empirical and predictive tools to assist in resolving remaining uncertainties in reducing stranding and entrapment losses. While additional monitoring would certainly provide additional information useful for developing predictive tools, CRITFC failed to indicate why additional development of predictive tools would be necessary or why the data collected under the proposed Hanford Reach Agreement could not be used for this purpose.

Over a license term, annual monitoring would cost substantially more than the follow-up monitoring proposed by the Hanford Reach Agreement signatories. Additionally, because Grant PUD already documented the benefits of the Hanford Reach Agreement flows during 2002 and 2003, it is not clear that additional monitoring is justified in the near-term. Because annual monitoring does not appear to be justified and it would be significantly more costly than infrequent follow-up monitoring, we conclude that annual surveys would not be worth the cost and we do not recommend including them in any license issued for the project.

Yakama River Habitat Mitigation

In comments on the draft EIS, Yakima County indicated that due to conditions in the Hanford Reach and the cumulative effect of upstream storage projects on flow, the ability to increase the habitat area in the Hanford Reach and downstream of Wanapum dam is limited. Yakima County suggests that the lower Yakama River is the only feasible location for mitigating project effects on fall Chinook salmon habitat caused by construction and operation of the project. Yakama River fall Chinook salmon are a component of the upper Columbia River fall Chinook salmon stock that also occurs within the Hanford Reach and Project area. We have no information to indicate that available habitat within the lower Yakama River is limiting production, although it is possible that increasing habitat for lower Yakama River fall Chinook salmon could increase juvenile production if the amount of spawning or rearing habitat is currently limiting reproductive success. However, because the SSA that we are recommending would essentially mitigate for all project effects on fall Chinook salmon[123], we do not recommend that Grant PUD implement any specific habitat improvement Projects in the Yakama River system.[124]

Measures for Bull Trout

Under section 18 of the FPA, Interior prescribes that to provide for bull trout passage, Grant PUD should operate the Project upstream and downstream fish passage facilities as prescribed for salmon and steelhead. Interior also recommends that Grant PUD develop and implement a Bull Trout Management Plan. Interior recommends that the plan include a monitoring program to assess the project affects on upstream and downstream bull trout passage, assessment of juvenile rearing in the reservoirs, implementation of modifications to correct any passage problems that are identified, assessment of off-season passage counts, PIT-tagging of incidentally collected sub-adult fish, and participation in information exchange and regional monitoring efforts.

There is evidence that bull trout may overwinter in the upstream end of Wanapum reservoir; however, there do not appear to be any adverse project effects on these fish or this habitat. Additionally, there is no evidence that bull trout are actively migrating either upstream or downstream past the project dams or that the project is adversely affecting the ability of bull trout to move through the project area. Interior prescribed that Grant PUD provide safe, timely, and effective passage for bull trout by implementing the measures prescribed for salmon and steelhead. We interpret this prescription to mean that no additional measures would be needed to provide safe and effective passage for bull trout. However, because bull trout appear to be a rare inhabitant of the project area and because bull trout passage needs are not well documented at any dam on the mid-Columbia River, it is unclear what benefit, if any, salmon and steelhead passage measures would have for bull trout.

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[123] In letters filed on May 27, 2005, both NMFS and Washington DFW indicated that the measures proposed by Grant PUD would result in the Project having no net impact on fall Chinook salmon.

[124] We are not recommending any specific habitat projects for the Yakama River; however, it is possible that the Priest Rapids Coordinating Committee could implement habitat projects in the Yakama River through implementation of the habitat fund included in the Salmon Settlement Agreement.

In regard to the Bull Trout Management Plan, many of the studies and monitoring measures that would be part of the plan are unachievable or unnecessary. For example, Interior recommends that Grant PUD monitor upstream and downstream passage effects on bull trout and assess juvenile rearing in the project reservoirs. However, because bull trout are virtually non-existent within the project area or at least extremely rare, it would be essentially impossible to conduct the recommended studies with any level of statistical validity. Additionally, the low occurrence of this species in the project area and the lack of evidence demonstrating any adverse project effects, suggests that the recommended studies are unnecessary.

There would be no cost for implementing the salmon and steelhead passage measures for bull trout since these measures would need to be implemented for salmon and steelhead anyway. However, because bull trout are uncommon within the project area, there is no evidence that the project adversely affects bull trout passage, and the benefit of the implementing salmon and steelhead passage measures for bull trout is unknown, we do not recommend including this measure in any license that is issued for the project.

We estimate that the cost of the recommended studies and monitoring proposed as part of the Bull Trout Management Plan would be approximately $575,000. Because bull trout occurrence in the project area appears to be mostly incidental and the project does not appear to adversely affect the few bull trout that are known to use the upstream end of Wanapum reservoir, we do not recommend including a Bull Trout Management Plan in any license that is issued for the project. Instead, we recommend that Grant PUD develop and implement the Bull Trout Monitoring Plan described above.

Components of the Pacific Lamprey Plan

We are not recommending several measures that Interior, Washington DFW, and CRITFC suggested as components to the Pacific Lamprey Plan. We describe each measure and our reason for not recommending it below.

Under section 18 of the FPA, Interior prescribed that Grant PUD conduct a hydraulic study of fish ladder entrance conditions, diffusion areas, and submerged orifices. Interior indicates that the study results would be used to identify problem areas and implement modifications to the fish ladders to improve upstream passage conditions. In comments on the draft EIS, Grant PUD indicated that they are already proposing to modify the ladders for adult lamprey and monitor adult lamprey passage using radio-telemetry. Grant PUD states that tracking actual adult lamprey migration and behavior within the fishways would be more beneficial than conducting the hydraulic evaluation prescribed by Interior. Both evaluations would attempt to identify problem areas for adult lamprey within the fishways. Radio-telemetry tracking would provide direct observation of adult lamprey passage through the fishways while a hydraulic study would require linking hydraulic measurements with theoretical information regarding lamprey passage abilities. We would expect direct observation from radio-tracking to provide more reliable information for identifying problem areas than a hydraulic study. We estimate that the cost of a hydraulic study would be $100,000. Because we are recommending that Grant PUD monitor adult lamprey passage using radio-telemetry, which would provide a more direct and effective means for identifying lamprey passage problems, we conclude that a hydraulic study would be redundant and not worth the cost. We do not recommend including this measure in any license issued for the Project.

CRITFC recommends that Grant PUD use radio-telemetry to track adult lamprey movements through the reservoir and into tributaries. Washington DFW recommends that Grant PUD use long-lived radio tags to track adult lamprey movements within the project boundary. Nass et al. (2003) demonstrated that lamprey moved freely through the project reservoirs with migration speeds ranging from 1.9 to 6.6 miles per day. Washington DFW states that adult lamprey travel times through the project reservoirs is slower than at other Columbia River projects and they believe this may be an indication of a project effect. However, neither CRITFC nor Washington DFW provided any information to suggest a possible project-related mechanism that would influence migration rates or how the tracking data could be used to identify any potential project effects or develop measures to mitigate for any potential project effects. We estimate that the cost of this study would be approximately $150,000 (part of Pacific lamprey studies of $1.2M). Because there is no evidence that the recommended study is needed, we conclude it would not be worth the cost and we do not recommend including it as a component of the proposed Pacific Lamprey Plan.

Washington DFW recommends that Grant PUD evaluate lamprey downstream passage routes using PIT tags and hatchery-raised lamprey, if available. Interior also recommends that Grant PUD study passage routes, although they do not specify what techniques should be used. Currently, there is no proven technology for measuring juvenile lamprey survival at dams. Bleich and Moursund (2006) have developed a promising technique for PIT-tagging juvenile lamprey; however, until this methodology is tested under a variety of conditions and is more widely accepted, we are reluctant to recommend it for use at the Project. Additionally, aquaculture techniques for Pacific lamprey have not been developed; therefore, there is no source for hatchery-reared juvenile lamprey. Lastly, available information suggests that direct turbine passage survival of juvenile lamprey is probably high (Bleich and Moursund, 2006).

We estimate that conducting a PIT tag study using fish obtained from the wild would cost approximately $400,000 (part of Pacific lamprey studies of $1.2M). Because lamprey turbine passage survival is likely high and there is no reliable source to obtain juvenile lamprey or proven method for testing juvenile lamprey survival, we conclude that the recommended study would not be worth the cost and we do not recommend including it as part of the proposed Pacific Lamprey Plan.

Interior recommends that Grant PUD develop techniques to estimate juvenile lamprey survival through the project dams. This recommendation acknowledges that currently no reliable technology exists for tracking individual juvenile lamprey through dams. However, while development of a method for assessing juvenile lamprey survival would be useful for assessing project effects; development of the technology would be extremely costly and could be unsuccessful. Additionally, the available information suggests that juvenile lamprey passage survival through the project dams is probably high. Based on the potential high costs of technology development, we conclude that this recommendation would not be worth the cost and we do not recommend including it as part of the proposed Pacific Lamprey Plan.

Interior recommends that Grant PUD identify the timing of juvenile lamprey outmigration through the project. Washington DFW recommends that Grant PUD develop a plan to assess juvenile lamprey out-migration timing characteristics through the project area, including the reservoirs, in relation to flows. There is no evidence suggesting that the timing of lamprey out-migration is related to stream flow or project effects. Additionally, flows in the project area are the result of cumulative effects of upstream storage dams and the coordinated operation of the seven dam system (i.e., Grand Coulee, Chief Joseph, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids). The operation of the Project is only partly responsible for the magnitude and timing of flows in the project area. We estimate that this study would require several years of data collection and would cost approximately $300,000 (part of Pacific lamprey studies of $1.2M). Because there is no evidence of a relationship between flow and juvenile lamprey outmigration timing or any significant project effect on juvenile lamprey outmigration timing, we conclude that the recommended study is unwarranted and would not be worth the cost. We do not recommend including this study as part of the proposed Pacific Lamprey Plan.

Washington DFW recommends that Grant PUD conduct an assessment of the relative abundance of juvenile lamprey in the project reservoir and its tributaries. Washington DFW indicated that annual abundance information would be useful for determining the relative effect of the Priest Rapids Project operations on juvenile lamprey rearing within the Project boundary. It is unclear how a ‘relative’ project effect could be determined from tracking the annual changes in abundance of juvenile lamprey within the Project reservoirs. We would expect that year-to-year variation in reservoir abundance of juvenile lamprey would be significant and potentially unrelated to Project effects. We would expect that juvenile lamprey abundance in the mid-Columbia River would be strongly influenced by factors unrelated to the project such as adult lamprey spawning population size and climatic conditions. We estimate that the cost of this study would be approximately $100,000 (part of Pacific lamprey studies of $1.2M). This information would be useful to Washington DFW in addressing its management responsibilities towards Pacific lamprey; however, it does not appear that annual abundance surveys would be useful or necessary to identify or address project effects or project purposes. Based on this information, we conclude that a juvenile lamprey abundance survey would not be worth the cost and we do not recommend including it as part of the proposed Pacific Lamprey Plan.

Interior and Washington DFW recommend that Grant PUD identify and map the extent of suitable juvenile lamprey habitat within the project reservoirs. The agencies do not indicate how this information would be used or why it is needed. Additionally, the agencies have not provided evidence that the project affects juvenile lamprey habitat or that available habitat is limiting lamprey production. We estimate that the cost of habitat mapping would be approximately $100,000 (part of Pacific lamprey studies of $1.2M). Because there is no apparent need for this information or any clear nexus to project effects, we do not recommend including the recommended habitat survey as part of the proposed Pacific Lamprey Plan.

Interior and Washington DFW recommend that Grant PUD evaluate the effects of reservoir fluctuations on lamprey rearing areas and evaluate options for avoiding or eliminating detrimental effects. There is no specific information or evidence to indicate that the reservoir contains substantial rearing habitat or that fluctuations affect this habitat. We estimate that the cost of this study would be approximately $150,000 (part of Pacific lamprey studies of $1.2M) and would require completion of the habitat mapping study described above. Because there is no evidence that project operations adversely affect juvenile lamprey habitat within the project reservoirs, we conclude that the recommended habitat studies would not be worth the cost and we do not recommend including them as part of the proposed Pacific Lamprey Plan.

Lamprey Passage Standards

Interior recommends that Grant PUD assist in regional efforts to establish upstream passage survival standards for adult lamprey. The development of regional passage standards would be useful for fisheries managers; however, developing a passage standard does not address project effects. We estimate that this measure would involve several years of consultation with the agencies and tribes. The cost of this consultation is unknown, but could be as much as $100,000. Because development of a passage standard would not identify or mitigate project effects, we conclude there is no nexus to project effects and it would not be worth the cost. We do not recommend including this measure in any license that is issued for the project.

Washington DFW and CRITFC recommend that Grant PUD pursue actions to achieve 80 percent dam passage effectiveness for adult lamprey by 2013 and 97 percent dam passage effectiveness by 2030. Neither Washington DFW nor CRTIFC provide any justification for these passage standards. Additionally, Interior's recommendation to assist in developing a standard indicates that there is no widely accepted standard for upstream lamprey passage at this time. In general, the importance of passing a significant portion of the adult lamprey run over each dam is unknown. Unlike salmon and steelhead, lamprey do not appear to have strong homing tendencies and will stray to other locations during their migration. Therefore, fish that fail to pass the project dams may move downstream into project tributaries or other areas to successfully spawn. Near 100 percent passage efficiencies may not be necessary to maintain a viable lamprey population. Because there is no justification for the standards presented by Washington DFW and CRITFC and the potential costs of achieving the 97 percent standard are likely high, we conclude that implementing these standards is not worth the cost and not warranted. We do not recommend including these standards in any license issued for the project.

CRITFC recommends that Grant PUD be required to meet downstream passage standards that are currently being developed by regional fisheries managers. CRITFC provided no evidence to indicate that current conditions for juvenile lamprey passage are inadequate. Available evidence suggests that direct turbine survival of juvenile lamprey is probably high (Bleich and Moursund, 2006). We are unable to estimate the cost of achieving a juvenile passage standard, since no standard is currently available. Additionally, because the recommended standards are in development and there is no evidence of adverse project effects on juvenile lamprey, we are unable to quantify the potential benefit to the lamprey population of achieving a downstream passage standard. We conclude that there would be no benefit to requiring Grant PUD to comply with undetermined passage standards for juvenile lamprey and we do not recommend including this measure in any license that is issued for the project.

Alternative Lamprey Passage Methods

Under section 18, Interior prescribed that Grant PUD should evaluate the feasibility of an adult lamprey capture-and-haul program. Additionally, Interior prescribed that by year 5 of any new license, Grant PUD should complete preliminary design work and develop a plan to install the lamprey-specific upstream passage facilities at the dams. Interior prescribed that these upstream passage facilities should be constructed in year 8 of any new license. Interior indicates that these alternative passage measures would be necessary if modifications to the existing fish ladders do not provide adult lamprey passage rates similar to the "best passage rates" found at other hydroelectric projects in the Columbia River Basin. WDFW also recommended that Grant should be required to achieve the best passage rates found at other Columbia River hydroelectric projects.

"Best passage rates" found at other projects appears to be an arbitrary standard since the agencies did not provide any biological justification for this standard and they did not specify how it would be calculated. It is unclear if the standard would be based on a single year of data from a single fishway or if it would be an average of several years of data for all possible routes at a given dam. Additionally, the fact that the agencies did not provide a specific number representing the current best passage rate at other projects is an indication that currently available information is insufficient to calculate such a number. Lastly, "best passage rates" would be a moving standard that would increase as more information becomes available and improvements are made to other dams. This confirms the arbitrary nature of the standard since it would be based entirely on what can be achieved at another project rather than the biological requirements of the species.

There is no evidence that the existing Project passage facilities and ongoing level of lamprey passage success are inadequate to support mid-Columbia River lamprey population. Lamprey have an innate behavior to migrate upstream and they appear to occupy all accessible habitat; however, there is no evidence in our record to indicate that unsuccessful passage at the Project is limiting the reproductive success or population size of lamprey in the mid-Columbia River. Additionally, there is no evidence in our record that the existing habitat downstream of the project dams is either unsuitable or unavailable to support the current numbers of lamprey that fail to pass the Project's dams.

In addition to the lack of a biological justification for alternative lamprey passage measures, the prescribed measures appear to be unproven and may not provide any greater passage success than the existing facilities. At this time, we are not aware of any successful capture-and-haul programs for Pacific lamprey and there is no evidence to indicate that implementation of such a program would result in passage rates exceeding the existing facilities or achieving the "best passage rate" standard. We estimate that implementing a capture-and-haul program for adult lamprey at each dam would cost approximately $80,000 per year. Additionally, we are not aware of any lamprey-specific upstream passage facilities that have been constructed at dams comparable to the Project. Interior's prescription seems to rely on the assumption that a new, effective upstream passage facility, specific to adult lamprey will be developed within the next 3-5 years. At this time, there is no evidence that such a facility would outperform existing facilities or achieve Interior's "best passage rate" standard. We assume that a lamprey-specific fishway would be constructed from concrete and similar in design to a traditional fish ladder but with smaller dimensions and flow capacity. We estimate that the cost of constructing these facilities would exceed $1,000,000 per dam.

Based on the lack of biological information indicating a need for increased adult lamprey passage success at the Priest Rapids dams and the high costs associated with implementing the alternative passage designs, we conclude that the prescribed capture-and-haul program and lamprey-specific passage facilities would not be worth the cost. We do not recommend that these measures be included in any license issued for the project.

Regional Coordination and Funding of Lamprey Research

Washington DFW, Interior, and CRITFC recommend that Grant PUD coordinate Pacific lamprey mitigation efforts with regional experts and managers, including cost-sharing, matching funds, and integrating project efforts with regional lamprey programs. While some coordination of lamprey mitigation efforts would be inherent in the implementation of these activities, 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 Project.

Funding for a Washington DFW Lamprey Biologist

We do not recommend adopting Washington DFW's recommendation for

Grant PUD to make available $30,000 annually to fund a Washington DFW fish and wildlife biologist specializing in Pacific lamprey. While funding such a position could support informed participation related to Pacific lamprey management on the part of Washington DFW, it is Grant PUD's responsibility to ensure that environmental measures that may be specified by a new license or that are specified in a Pacific Lamprey Plan and would require Commission approval are implemented in accordance with the requirements of a new license. Therefore, requiring Grant PUD to fund agency oversight of such matters is not warranted.

Regional Coordination and Funding of White Sturgeon Research

Washington DFW, Interior, and CRITFC recommend that Grant PUD coordinate white sturgeon mitigation efforts with regional experts and managers, including cost-sharing, matching funds, and integrating project efforts with regional white sturgeon programs. While some coordination of white sturgeon efforts would be inherent in the implementation of these activities, coordination with regional experts and managers, integrating project efforts with regional white sturgeon programs, and seeking cost-sharing and matching funds would not be necessary to address or mitigate for project effects on white sturgeon. Thus staff does not recommend inclusion of such provisions as a requirement in any license issued for the Project.

Funding for a Washington DFW White Sturgeon Biologist

We do not recommend adopting Washington DFW's recommendation for Grant PUD to make available $30,000 annually to fund a Washington DFW fish and wildlife biologist specializing in white sturgeon. While funding such a position could support informed participation related to white sturgeon management on the part of Washington DFW, it is Grant PUD's responsibility to ensure that environmental measures that may be specified by a new license, including a White Sturgeon Plan that would require Commission approval, are implemented in accordance with the requirements of a new license. Therefore, requiring Grant PUD to fund agency oversight of such matters is not warranted.

Columbia Basin Hatchery

Grant PUD proposes to fund improvements to the Columbia Basin Hatchery and develop and implement a Columbia Basin Hatchery Management Plan. The Columbia Basin Hatchery is located near Moses Lake, Washington, outside the project boundary. The hatchery was constructed as mitigation for the construction of the Project. Fish reared at the hatchery were initially stocked into the project area as mitigation for the effects of project construction and operation on sport fisheries; however, initial efforts to re-create sport fisheries within the project reservoirs were unsuccessful. Subsequently, fish from the hatchery have been stocked in local lakes throughout Grant County.

Grant PUD proposes to fund $1.0 million for upgrading the Columbia Basin Hatchery and $100,000 per year for O&M. Upgrading the Columbia Basin Hatchery and developing and implementing a hatchery management plan would modernize the operation of the hatchery and increase the production of healthy fish for stocking. Fish raised at the hatchery would be stocked in waters outside the project boundary and would not serve project purposes and would have no benefit to resident fish or recreational resources in the Project area. In comments on the draft EIS, Washington DFW indicated that these resident fish would be stocked outside the project boundary because stocking in the project area could adversely affect threatened and endangered fish species. Under the staff-recommended alternative, Grant PUD would expend substantial effort and expense to benefit threatened and endangered fish species. Based on the potential conflict with efforts to recover threatened and endangered fish species and the likelihood of repeating earlier stocking failures, we conclude that stocking resident hatchery fish in the project area would be imprudent. Because the resident fish stocking proposal would not benefit resident fish or recreational resources in the project area and efforts to stock resident fish in the project area would likely be unsuccessful and conflict with ongoing fisheries management efforts, we conclude that this measure would not be worth the cost. We do not recommend including this measure in any license issued for the project.

Resident Fish Mitigation and Enhancement Plan

Washington DFW recommends that Grant PUD develop and implement a Resident Fish Mitigation and Enhancement Plan with a goal of producing 137,000 pounds of fish to support recreational fisheries. As part of their justification for the plan, Washington DFW indicates that the plan would provide resident fish enhancements that are currently provided by the Columbia Basin Hatchery for ongoing project effects on resident fish. Such a plan would provide some enhancement of recreational fishing opportunities; however, we are unable to identify the specific benefits of this measure since Washington DFW did not provide any information regarding stocking locations and size and species of fish to be stocked.

Washington DFW indicated that under the plan, fish would not be stocked within the project area since historically these efforts were unsuccessful. Additionally, Washington DFW indicated that because of potential interactions with federally-listed threatened and endangered fish species, getting approval for stocking resident fish within the project area would likely be difficult, if not impossible. This information suggests that fish raised as part of the Resident Fish Mitigation and Enhancement Plan would be stocked in lakes outside the project boundary and would not serve project purposes. The specific cost of this program is unknown, although we anticipate that the costs would be similar to the Columbia Basin Hatchery measure described above. Because the resident fish stocking proposal would not benefit resident fish or recreational resources in the project area and efforts to stock resident fish in the project area would likely be unsuccessful and conflict with ongoing fisheries management efforts, we conclude that this measure would not be worth the cost. We do not recommend including this measure in any license issued for the project.

Pikeminnow Removal Program Effects on Resident Fish

CRITFC recommends that Grant PUD conduct a population analyses of resident fish stocks in the project reservoirs and determine what impact the northern pikeminnow removal program is having on resident fish. CRITFC suggests that because pikeminnow are the major predator of white sturgeon egg predators (i.e., resident fish), their removal indirectly results in increased predation of sturgeon eggs. CRITFC does not specify which species that are considered sturgeon egg predators might benefit from pikeminnow removal and we have no specific evidence to indicate that predation is a significant source of sturgeon egg mortality.

Our analysis suggests that the pikeminnow removal program may result in increased abundance of likely pikeminnow prey species such as resident salmonids and other soft-rayed fishes (e.g., minnows and suckers). Additionally, other predator species that may compete with pikeminnow for prey species, such as smallmouth bass and walleye, may also increase in numbers due to the removal of pikeminnow. However, we have no evidence that these potential changes in abundance of resident fish would result in increased predation on sturgeon eggs.

We estimate that the cost of estimating resident fish populations in the project area would be approximately $200,000 per year. However, even if these data were available, it is not clear how useful it would be for determining the effects of the northern pikeminnow removal program. Several factors would likely confound any conclusions that could be drawn for a multi-year study comparing pikeminnow harvest rates and resident fish populations. These include annual differences in pikeminnow harvest, river hydrology, and water temperatures. As a result, there would be no way to conclusively determine that any apparent changes in resident fish abundance are attributable to pikeminnow harvest.

Washington DFW indicates that the population analysis recommended by CRITFC would not be necessary for predation evaluations and that rigorous application of bioenergetics models to localized areas of the reservoir, such as a trophic dynamics study could be performed instead. Washington DFW indicates that a trophic dynamics study would remedy the lack of knowledge concerning current status and potential effects of future actions. A bioenergetics study or trophic dynamics study could provide some information useful for assessing the effects of the pikeminnow removal program on resident fish; however, similar to the population analysis, there would be a high risk of inconclusive results from this type of study. We estimate that conducting a 3 year trophic dynamics study would cost approximately $750,000.

Because there is no evidence that the pikeminnow removal program is affecting resident fish abundance or sturgeon egg survival and both studies (i.e., population analysis or bioenergetics/trophic dynamics) would be costly, labor intensive projects with potentially inconclusive results, we conclude that neither study would be worth the cost. We do not recommend including a requirement for either study in any license issued for the project.

Washington DFW Funding for Replacement of Habitat

Washington DFW recommends that Grant PUD: (1) provide Washington DFW with $2,160,000 for replacement of the lost wildlife values at Crescent Bar, plus O&M cost of $36,000; (2) implement the following habitat improvement projects: (a) Royal Lake Excavation Project (at an estimated cost of $181,000 plus $5,000 O&M), (b) Crab Creek Water Diversion Project ($230,000 plus $5,000 O&M), and (c) Lower Crab Creek Farmground Renovation Project ($126,000 plus $5,000 O&M) as mitigation for ongoing project impacts and project-related recreation impacts; and (3) provide Washington DFW $15 per acre per year for O&M of Washington DFW lands within the project boundary, for lands conveyed by Grant PUD to Washington DFW in the original license, for Washington DFW wildlife area lands in the vicinity of the project, and for lands acquired for mitigation under the new license—this represents a total of 98,000 acres and a total annual O&M cost of about $1.49 million. In addition, Washington DFW recommends that Grant PUD provide to Washington DFW $4,500,000 for land acquisition to protect recreation and wildlife values of lands purchased as mitigation for original construction impacts and to preserve habitats from increasing recreation development pressures.

Most of Washington DFW reasons for these measures are to mitigate for original project impacts and to supplement the state's budget which has been insufficient to undertake measures to fully develop the potential of the wildlife areas. The baseline for a relicense is the existing environment, not as it existed 50 years ago. Grant PUD already satisfied its responsibilities for mitigation of environmental effects of the previous license. The lands for which Washington DFW seeks funding are not part of the project. While funding the state's O&M of these lands could result in habitat improvements, it is not Grant PUD's responsibility to supplement the state's budget. It is Grant PUD's responsibility to ensure that environmental measures that may be specified by a new license and would require Commission approval are implemented in accordance with the requirements of a new license. Therefore, requiring Grant PUD to fund agency oversight of such lands is not warranted.

Nonetheless, recognizing that project effects on wildlife resources can extend beyond a project boundary, we have considered the effects of project operation, project-related recreation, and maintenance activities on wildlife and wildlife habitats. We recommend measures that are forward-looking, including protecting remaining habitats on Crescent Bar from further development, and implementing an interpretation and education program to reduce impacts. We also recommend that Grant PUD work with resource agencies to identify specific habitat improvement projects that focus on shrub steppe, riparian and wetland habitats within and immediately adjacent to the project because these are the resources most directly connected to project effects and purposes. Therefore, we conclude that providing O&M funds for unspecified actions on state wildlife lands and for mitigating for lost habitat values at Crescent Bar is not warranted.

We also recognize that Washington DFW is also trying to address increasing pressures on its lands from recreation, some of which may be attributed to dispersed recreation from the project reservoirs and some of which might be attributed to demands created by its own public access policies. We discuss effects of recreational use on environmental resources and make recommendations to protect and enhance these resources, including species of special concern, while taking into account current and future recreation demand. We are also recommending that the Wildlife Plan, Recreation Plan, and Shoreline Management Plan be coordinated and incorporate provisions to control recreational access, monitor and identify recreation-related effects on wildlife and wildlife habitats, and identify corrective actions. These efforts would help ensure that identified management and recreation projects are consistent with designated land uses and limit potential indirect effects on adjoining lands.

The three parcels that Washington DFW identified for potential acquisition include those recommended by Grant PUD, but also include lands located many miles from the project. Parcels identified by Washington DFW would offer wildlife benefits through better coordination of their management actions on their wildlife areas. However, most are upland habitats located some distance from the project and there is no evidence that the project, project-related recreation, or maintenance activities are affecting these areas. The lands that we recommend Grant PUD acquire are contiguous with the existing project boundary and could offer multiple benefits of recreation and wildlife enhancement, and would be adequate to serve project purposes.

We find that our recommend measures would be adequate to protect and enhance wildlife resources. Therefore, we do not recommend including any of the above Washington DFW measures in any license issued for the project.

Interior Coordinated Recreation and Wildlife Management Plan

Interior recommends, pursuant to section 10(a) of the FPA, that Grant PUD develop a coordinated recreation and wildlife management plan in consultation with Washington DFW, BLM, and BOR to provide for the maximum benefit to project and non-project lands and resources. The plan would also provide administrative costs to the coordinating agencies, including BLM for implementing actions. The lands include Quincy Creek Recreation Area, portions of Crab Creek Wildlife Area, and the Colockum/Quilomene Wildlife Recreation Area in which Interior notes an MOU with Washington DFW for managing the lands is in place. Interior states that the areas include approximately 3,000 acres that may be affected by unregulated recreation use of the lands. We are recommending that Grant PUD develop a coordinated recreation and wildlife management plan in consultation with the above agencies to ensure that proposed management actions are consistent with designated land uses. However, we do not recommend that the license require Grant PUD to compensate the agencies for administrative costs. We find that providing funds in the performance of an agency’s duties is not the responsibility of the Grant PUD in the context of a Commission license and is not required to fulfill the project’s purposes.

Other Measures/Funds

Law enforcement and associated items

In its draft Recreation Plan Grant PUD proposes to provide funding for 1.0 FTE for the Washington DFW enforcement program and 1.0 FTE to be divided equally between the Grant County and Kittitas County Sheriff’s Offices. Grant PUD estimates $50,000 per year per FTE. Grant PUD currently provides a boat at Wanapum dam for use by local law enforcement officers and proposes to continue this measure during a new license.

Washington DFW recommends that Grant PUD provide funds to Washington DFW for 2.0 FTE enforcement officers, including administrative costs, and provide funds to the Kittitas County and Grant County Sheriff's Offices for 1.0 FTE, including administrative costs. In addition, Washington DFW recommends that Grant PUD provide Washington DFW $73,500 for a reservoir patrol vessel, $2,200 for a boat trailer, and replace them on a 10-year cycle. Kittitas County recommends that Grant PUD provide funds to the county for 1.0 FTE Sheriff Deputy, two staff members from May through October, and a vessel. CRITFC recommends Grant PUD contract with local law enforcement personnel to enforce laws that protect cultural resources. Yakama recommends Grant PUD provide funds for tribal recreational and cultural experts to protect the cultural and natural resource sites at undeveloped campsites.

We find that providing funds for agency personnel to perform an agency's duties is not the responsibility of Grant PUD in the context of a Commission license and is not required to fulfill the project's purposes. We, therefore, do not recommend including any of the above funds for law enforcement and associated items in any license issued for the project. Nevertheless, we do not object to Grant PUD entering into any off-license agreement with Washington DFW.

The Beverly Bridge and John Wayne Pioneer Trail

Washington DNR states that the Beverly Bridge is a link between the western and eastern part of the John Wayne Pioneer Trail; however, due to current bridge conditions and concerns for public safety, the bridge is currently closed. Washington SPRC manages the John Wayne Pioneer Trail, which is located adjacent to the existing Project boundary, while Washington DNR manages the Beverly Bridge and its components east of the Columbia River. Washington DNR, IAC, and Pat Kelleher recommend that Grant PUD fund 100 percent of the restoration and maintenance of the 0.5-mile-long Beverly Bridge (John Wayne Pioneer Trail crossing of the Columbia River). We estimate the cost of the parties' recommendation would be $890,000.

The parties did not provide any evidence, which would indicate any reason for Grant PUD to fully fund the rehabilitation efforts for the Beverly Bridge. Through stakeholder input and various project-related recreation studies conducted during the relicensing process, Grant PUD proposes to contribute an estimated $445,000 toward rehabilitating the bridge (*e.g.*, new decks, rails, and gates).

As discussed in section 3.9, *Recreation and Land Use*, we assessed the Beverly Bridge and John Wayne Pioneer Trail through our cumulative effects analysis for recreation within the mid-Columbia River Basin. We find Grant PUD's proposal toward rehabilitating the Beverly Bridge could contribute toward the parties' effort to reconnect the 300-mile-long cross-state John Wayne Pioneer Trail. However, this trail is not associated with the project. Moreover, we find that there are sufficient trails at the project required in this license to satisfy project purposes. Therefore, we do not recommend including the Beverly Bridge and associated trail in any license issued for the project. Nevertheless, we do not object to Grant PUD entering into any off-license agreement with Washington SPRC and Washington DNR to provide enhancement to the Beverly Bridge.

Enhancement fund or research grants

Washington DAHP commented that the final HPMP should contain provisions for an enhancement fund or research grants in order to encourage innovative approaches to the protection, understanding, and education about the cultural resources at the project. Washington DAHP did not provide any justification or specific details for such a measure. The provisions in the final HPMP would provide for sufficient measures to protect, understand, and educate the public about cultural resources. We, therefore, do not recommend that Grant PUD include Washington DAHP's enhancement fund or research grant provisions in a final HPMP and do not recommend them as a separate requirement in any license issued for the project. Nevertheless, we do not object to Grant PUD entering into any off-license agreement with Washington DAHP.

5.2 FISH AND WILDLIFE 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 May 27, 2005), Interior (letter filed May 26, 2005), and Washington DFW (letter filed May 26, 2005). 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 42 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 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 and the previous section.

Alaska DFG filed recommendations under section 10(j) of the FPA; however, only fish and wildlife agencies, as defined by CFR § 4.30(b)(9) can make recommendations under section 10(j) of the FPA. Alaska DFG's recommendations were considered under section 10(a) of the FPA and are addressed elsewhere in this document.

In the draft EIS, the Commission staff made a preliminary determination that three recommendations by Interior and three recommendations by Washington DFW may be inconsistent with the purpose and requirements of the FPA or other applicable law. On April 19, 2006, Commission staff conducted a meeting with Interior and Washington DFW to address these apparent inconsistencies. In a letter filed on April 17, 2006, Interior revised one recommendation and indicated that they no longer recommend the other two and instead they recommend the Salmon Settlement Agreement. In a letter filed on May 2, 2006, Washington DFW filed revised section 10(j) recommendations that included withdrawing 31 recommendations and adding five new recommendations. The modifications to Interior's and Washington DFW's recommendations resolved all of the inconsistencies.

Table 42. Fish and wildlife agency recommendations for the Priest Rapids Project (Source: Staff).

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
1. Non-passage related actions contained in NMFS' BO issued on May 3, 2004, should be included in the new license.	NMFS (P-49)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Adopted
2. Establish a PRCC, including a Hatchery Subcommittee and a Habitat Subcommittee.	NMFS (P-49) Washington DFW (P5-1)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$0	Adopted
3. Within 1 year of license issuance, Grant should produce an overall Performance Evaluation Program.	NMFS (P-51)	Yes	$50,000/yr	Adopted
4. Produce annual Progress Implementation Plans that describe the implementation activities for PME measures implemented for anadromous fish species.	NMFS (P-51)	Yes	Included in item 3.	Adopted
5. At 3-year intervals, or as otherwise provided in the approved PEP above, submit a Performance Evaluation Report to the PRCC.	NMFS (P-52)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Included in item 3.	Adopted

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
6. Coordinate the design of the PEP with the development of relevant parallel monitoring or evaluation systems by other hydropower operators in the Columbia basin and the NPPC.	NMFS (P-52)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Included in item 3.	Adopted
7. Convene a Hatchery Subcommittee of the PRCC to undertake and oversee the planning and implementation of the HGMP.	NMFS (P-53)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$0	Adopted
8. Complete a HGMP to rear up to 100,000 yearling UCR steelhead for release in the UCR basin.	NMFS (P-54)	Yes	$511,900	Adopted
9. Complete a HGMP to rear up to 600,000 yearling UCR spring-run Chinook salmon for release in the UCR basin.	NMFS (P-55)	Yes	$1,564,000	Adopted
10. Complete a HGMP and develop the facilities to produce 833,000 yearling summer Chinook salmon smolts and implement a monitoring and evaluation program to assess the effectiveness of the hatchery program.	NMFS (P-56)	Yes	$1,505,000	Adopted
11. Update the existing HGMP to produce an additional 1,000,000 fall Chinook sub-yearling smolts at the Priest Rapids Hatchery.	NMFS (P-59)	Yes	$1,828,000	Adopted

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
12. Update the existing HGMP to produce and release up to 1,000,000 fall Chinook fry annually into the project reservoirs and implement a monitoring and evaluation program to assess the effectiveness of the fall Chinook salmon hatchery program.	NMFS (P-59)	Yes	Included in item 11 above	Adopted
13. Evaluate the effect of the fall Chinook salmon hatchery program on mitigating project impacts to fall Chinook salmon.	NMFS (P-59)	Yes	Included in item 11 above	Adopted
14. Attempt to artificially propagate up to 1,143,000 sockeye salmon smolts using hatchery facilities and write a HGMP. If the artificial propagation isn't feasible, Grant PUD should attempt to improve sockeye salmon production through other means.	NMFS (P-60)	Yes	$1,195,000	Adopted
15. If coho salmon become reestablished in the mid-Columbia River, consult with the PRCC to provide hatchery compensation for project effects.	NMFS (P-61)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Not adopted
16. If Okanogan spring Chinook salmon become reestablished in the mid-Columbia River, consult with the PRCC to provide hatchery compensation for project effects.	NMFS (P-63)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Not adopted

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
17. Implement fish habitat projects to compensate for the 2 percent per development unavoidable losses of salmon and steelhead related to project operations (RPA Action 34).	NMFS (P-65)	Yes	$1,096,552	Adopted
18. Develop a habitat plan for listed and non-listed anadromous fish to identify and implement habitat projects designed to restore habitat functions in drainages affected by the project.	NMFS (P-66)	Yes	$5,000	Adopted
19. Establish, manage, and make annual contributions to a NNI fund. The baseline annual contribution is $2,562,206 (2005 dollars).	NMFS (P-69)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$2,562,206	Not adopted
20. Conduct studies to measure the progress toward meeting anadromous fish survival standards.	NMFS (P-71)	Yes	$2,000,000	Adopted
21. Implement the flow regimes and river operations specified in the April 2004 Hanford Reach Agreement.	NMFS (P-74)	Yes	$4,346,607	Adopted
22. Incorporate the Salmon Settlement Agreement, in its entirety, into the new license.	Interior[125] (P6-2) Washington DFW (P6-60)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Not adopted

[125] In making this recommendation, Interior only specifically withdrew two of its original salmon and steelhead

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
23. Control flow releases, in consultation with the PRCC, from the Project from October 15 through November 30 to provide and maintain suitable spawning habitat in the Hanford Reach sufficient to accommodate the annual expected escapement for fall Chinook salmon.	Interior (P-54)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Not adopted
24. Control flow releases for successful incubation, in consultation with the PRCC, from the Project from November 30 through the end of the fall Chinook emergence at all spawning areas in the Hanford Reach.	Interior (P-54)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Not adopted
25. Develop and implement a plan to conduct annual aerial surveys during the spawning season to help quantify the progression, extent, and location of fall Chinook salmon redds in the Hanford Reach.	Interior (P-57)	Yes	Included in 21 above	Adopted
26. Develop and implement a plan to determine the effect of fluctuating flows on spawning behavior and subsequent redd placement, the extent of day and night spawning at the major spawning areas, and the extent of deep-water spawning throughout the Hanford Reach.	Interior (P-58)	No. Study that could have been done during prefiling.	$16,100	Not adopted

recommendations. We have removed those two recommendations from this table; however, all other salmon and steelhead section 10(j) recommendations made by Interior in their letter filed on May 26, 2005, remain in this table, including measures contained in the settlement agreement and measures conflicting with the settlement agreement.

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
27. Develop and implement a plan to monitor and evaluate the effects of project operations on primary and secondary productivity and of fishes in the Hanford Reach, including the collection of water temperatures in entrapments from March 1 through October 31 and quantifying fish mortalities.	Interior (P-58)	No. Study that could have been done during prefiling.	$36,200	Not adopted
28. Develop and implement a Bull Trout Monitoring Plan to track the presence of bull trout in the Project area. Includes an annual report of monitoring results.	Interior (P6-2); Washington DFW (P-31)	Yes	$1,000	Adopted
29. Develop and implement a Pacific Lamprey Plan.	Interior (P-61); Washington DFW (p-40)	Yes	This cost should be $422,663 minus the annualized costs for the next 6 lamprey items	Adopted
30. Track adult lamprey movements within the Project boundary.	Washington DFW (P6-54)	No. Study that could have been done during prefiling.	$8,600	Not adopted

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
31. Adult lamprey passage efficiency should achieve best passage rates at other Columbia River projects.	Washington DFW (P6-55)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Not adopted
32. Develop techniques to measure juvenile lamprey survival through dams.	Interior (P5-61)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$12,090	Not adopted
33. Identify timing of juvenile lamprey outmigration	Interior (P5-61)	No. Study that could have been done during prefiling.	$24,180	Not adopted
34. Identify and map juvenile lamprey habitat in the Project reservoirs.	Interior (P5-61)	No. Study that could have been done during prefiling.	$8,060	Not adopted
35. Evaluate effects of reservoir fluctuations on lamprey rearing habitat.	Interior (P5-61)	No. Study that could have been done during prefiling.	$12,090	Not adopted
36. Develop and implement a White Sturgeon Plan.	Interior (P-63) Washington DFW (P-32)	Yes	$303,547	Adopted

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
37. Develop and implement a White Sturgeon Conservation Aquaculture Plan.	Interior (P-63)	Yes	Included in 31 above	Adopted
38. Develop and implement an Avian Predator Control Effectiveness Monitoring Plan to minimize the take of migratory birds while maximizing the effectiveness of the avian predator control program.	Interior (P-64)	Yes	$166,520	Adopted
39. Develop and implement a Northern Wormwood Conservation Plan to protect and monitor Northern wormwood populations.	Interior (P-66)	Yes	$40,000	Adopted
40. Develop and implement a plan to monitor rare, threatened, and endangered (RTE) plants.	Interior (P-67)	Yes	$35,000	Adopted
41. Develop and implement an avian protection plan to protect waterfowl and raptors against collisions with the Project's transmission lines and structures.	Interior (P-67)	Yes	$40,300	Adopted
42. Develop and implement a bald eagle perching and roosting tree protection and enhancement program.	Interior (P-68)	Yes	$17,500	Adopted

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
43. The Commission should retain by means of a specific ESA reopener, authority to ensure compliance with the requirements of the ESA.	Interior (P-68)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Not adopted.
44. Establish and convene a Fishery Forum.	Washington DFW (P6-65)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$0	Adopted
45. Provide annual funding for a sturgeon biologist to participate in the development a White Sturgeon Plan.	Washington DFW (P-39)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$30,000	Not adopted
46. Provide annual funding for a lamprey biologist to participate in the development a Pacific Lamprey Plan.	Washington DFW (P-43)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$30,000	Not adopted

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
47. Develop and implement a Resident Fish Mitigation and Enhancement Plan to support a recreational fisheries program.	Washington DFW (P6-67)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Not adopted
48. Provide to Washington DFW $15 per acre per year for O&M of Washington DFW wildlife area mitigation lands.	Washington DFW (P-53)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$1,470,000	Not adopted.
49. Provide to Washington DFW $2,160,000 for replacement of the lost wildlife values at Crescent Bar, plus annual O&M cost of $36,000.	Washington DFW (P-55)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$210,000	Not adopted.
50. Fund implementation of: a) Royal Lake Excavation Project; b) Crab Creek Water Diversion Project; and c) Lower Crab Creek Farm Ground Renovation Project	Washington DFW (P-58)	No. No nexus to project effects.	a) $15,000 b) $19,000 c) $10,000	Not adopted.

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
51. Provide to Washington DFW $4,500,000 for acquiring and protecting wildlife resource lands due to original mitigation lands and increased pressure from recreationists at the Project reservoirs.	Washington DFW (P-64)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$362,600	Not adopted.
52. Develop and fund a Project Habitat Management and Monitoring Plan	Washington DFW (P-67)	Yes	$1,000	Adopted
53. Provide to Washington DFW $120,000 annually for fire suppression services on Washington DFW lands.	Washington DFW (P-70)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	$60,000	Adopted plan to address fire suppression
54. Provide to Washington DFW funding for 2.0 full-time Washington DFW enforcement officers; and, provide to Kittitas and Grant Counties Sheriff's offices funding for 1.0 FTE.	Washington DFW (P-71)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$150,000	Not adopted
55. Provide to Washington DFW $73,500 for a reservoir patrol vessel, and $2,200 for a boat trailer, and replace on a 10-year cycle.	Washington DFW (P-71)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$10,000	Not adopted

Recommendation	Agency[a]	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation[b]
56. Convene an annual law enforcement coordination meeting to discuss protection of project resources, including fish and wildlife law enforcement.	Washington DFW (P-73)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	Unknown	Not adopted
57. Develop, fund, and implement an AIS Prevention Program.	Washington DFW (P-75)	Yes	$7,000	Adopted, except for provision below.
58. Fund an AIS Program Inspector to inspect boats at $6,000 per year, plus office space and storage area.	Washington DFW (P-76)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$6,000	Not adopted.

[a] Page numbers from the filed recommendation letter. P5 indicates letters filed by Interior and Washington DFW on May 26, 2005, and May 27, 2005, respectively. P6 indicates letters filed by Interior and Washington DFW on April 17, 2006, and May 2, 2006, respectively.

[b] 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.

In the draft EIS, we did not recommend adopting Interior's recommendation that Grant PUD maintain a daily flow fluctuation range of 10 kcfs in the Hanford Reach during the fall Chinook salmon rearing period. In a letter filed on April17, 2006, Interior indicated that it recommends the provisions included in the Salmon Settlement Agreement and they no longer recommend that Grant PUD maintain the 10 kcfs flow fluctuation limit in the Hanford Reach. This modification of Interior's recommendation resolved this issue.

In the draft EIS, we did not recommend adopting Interior's recommendation that Grant PUD conduct annual surveys to estimate fall Chinook salmon fry entrapment and stranding losses from flow fluctuations in the Hanford Reach. In a letter filed on April 17, 2006, Interior indicated that it recommends the provisions included in the Salmon Settlement Agreement and they no longer recommend that Grant PUD conduct annual stranding and entrapment surveys in the Hanford Reach. This modification of Interior's recommendation resolved this issue.

In the draft EIS, we did not recommend adopting Interior's and Washington DFW's recommendation that Grant PUD develop and implement a bull trout management plan. Based on Interior's letter filed on April 17, 2006, and Commission staff discussions with Interior and Washington DFW at the April 19, 2006, Interior and Washington DFW revised their recommendation so that they now recommend that Grant PUD develop and implement a bull trout monitoring plan. We recommend adopting this measure into any license issued for the Project, thereby resolving this issue.

In the draft EIS, we did not recommend adopting Washington DFW's recommendation that until the downstream passage standards are achieved, Grant PUD should continue the ongoing spill programs at Wanapum and Priest Rapids dams to provide downstream passage for smolts. In a letter filed on May 2, 2006, Washington DFW replaced this recommendation and approximately 27 other recommendations with a recommendation to implement the Salmon Settlement Agreement. The Salmon Settlement Agreement includes provisions for Grant PUD to continue the ongoing spill programs until a better downstream passage alternative is designed, tested, and implemented. Based on new information provided by Washington DFW and NMFS, we are recommending adoption of this part of the Salmon Settlement Agreement, thereby resolving this issue.

Washington DFW initially recommended that Grant PUD develop, fund, and implement an AIS Prevention Program, a recommendation that we adopted except for the following provisions: (1) convene meetings to facilitate the participation of Grant PUD, Chelan PUD, and Douglas PUD staff in the development of a regional Mid-Columbia AIS Prevention Plan; (2) a plan to intercept boaters at boat ramps to explain the requirements of the AIS program and inspect boats for aquatic invasive weeds and zebra mussels; and (3) an annual report due to Washington DFW by March 1. We found that the project was inconsistent with comprehensive planning standards of section 10(a) and 4(e) of the FPA. We made our determination because the scope of Washington DFW's AIS Prevention Program was unclear, since the Washington DFW did not include any specific project-related effects, identification of specific aquatic invasive plant species, or costs associated with its recommendation. In addition, the recommendation extended beyond the scope of responsibility for the project. In response to the draft EIS and the section 10(j) meeting, Washington DFW revised its recommendation to focus on an information and education program that could be implemented at the project, would help control and prevent the spread of invasive species, and could be implemented at a reasonable cost to the project. We now recommend adopting the Washington DFW's recommended measure, but note for clarity that we do not recommend that Grant PUD be responsible for inspecting boats entering or leaving the project reservoirs for invasive aquatic species. The inconsistency is now resolved.

5.3 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) of the FPA, 16 U.S.C. section 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by a project. Under section 10(a)(2)(A) of the FPA, federal and state agencies filed comprehensive plans that address various resources in Washington. Table 43 identifies those plans that address resources applicable to the Project. No inconsistencies were found.

We also reviewed the following plans that are relevant to the Project: (1) Nez Perce Tribe, Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon, The Columbia River Anadromous Fish Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes, 1995; (2) BOR, 1998, Columbia Basin Scattered tracts resource management plan; (3) BOR Potholes reservoir management plan; and (4) Port of Mattawa, Washington, 2003, Port of Mattawa comprehensive plan: A port built on hope (1958-2003).

Table 43. Comprehensive Plans considered for the Priest Rapids Hydroelectric Project (Source: Staff).

Comprehensive Plan	**Agency**
Spokane resource area management plan. August 1985.	U.S. Bureau of Land Management, Spokane, Washington

Comprehensive Plan	Agency
Fisheries USA: The recreational fisheries policy of the U.S. Fish and Wildlife Service. Undated.	U.S. Fish and Wildlife Service, Washington, DC
North American waterfowl management plan. May 1986.	U.S. Fish and Wildlife Service. Canadian Wildlife Service
An assessment of outdoor recreation in Washington State: A State Comprehensive Outdoor Recreation Planning (SCORP) Document 2002-2007. October 2002.	Washington State Interagency Committee for Outdoor Recreation, Olympia, Washington
Voices of Washington: Public opinion on outdoor recreation and habitat issues. November 1995.	Washington State Interagency Committee for Outdoor Recreation, Olympia, Washington
State of Washington outdoor recreation and habitat: Assessment and policy plan 1995-2001. November 1995.	Washington State Interagency Committee for Outdoor Recreation, Tumwater, Washington
Washington State trails plan: policy and action document. June 1991.	Washington State Interagency Committee for Outdoor Recreation, Tumwater, Washington
The fifth northwest electric power and conservation plan. Council Document 2005-07.	Northwest Power and Conservation Council, Portland, Oregon.
Columbia River Basin fish and wildlife program. Council Document 2000-19.	Northwest Power and Conservation Council, Portland, Oregon.
Mainstem amendments to the Columbia River Basin fish and wildlife program. Council Document 2003-11.	Northwest Power and Conservation Council, Portland, Oregon
Protected areas amendments and response to comments. Council Document 88-22.	Northwest Power and Conservation Council, Portland, Oregon
Statute establishing the State scenic river system, Chapter 79.72 RCW. 1977.	State of Washington, Olympia, Washington

Comprehensive Plan	Agency
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, Oregon
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, Oregon
Resource protection planning process--Paleoindian study unit. 1987.	Washington State Department of Community Development. Office of Archaeology & Historic Preservation, Olympia, Washington
Resource protection planning process--Mid-Columbia study unit. 1987	Washington State Department of Community Development. Office of Archaeology & Historic Preservation, Olympia, Washington
Resource protection planning process identification component for the Eastern Washington protohistoric study unit. 1987.	Washington State Department of Community Development. Office of Archaeology & Historic Preservation, Olympia, Washington
Water resources management program-Columbia River-John Day and McNary pools. October 1978.	Washington State Department of Ecology, Olympia, Washington
Application of shoreline management to hydroelectric developments. September1986.	Washington State Department of Ecology, Olympia, Washington
Instream resource protection program for the mainstem Columbia River in Washington State. 1982.	Washington State Department of Ecology, Olympia, Washington

Comprehensive Plan	Agency
State wetlands integration strategy. December 1994.	Washington State Department of Ecology, Olympia, Washington
Hydroelectric project assessment guidelines. 1987.	Washington State Department of Fisheries, Olympia, Washington
Strategies for Washington's wildlife: 1987-1993. May 1987.	Washington State Department of Game, Olympia, Washington
State of Washington natural heritage plan. 1987.	Washington State Department of Natural Resources, Olympia, Washington
Final habitat conservation plan. September 1997.	Washington State Department of Natural Resources, Olympia, Washington
Washington State hydropower development/resource protection plan. December 1992.	Washington State Energy Office, Olympia, Washington
Washington State scenic river assessment. September 1988.	Washington State Parks & Recreation Commission, Olympia, Washington
Scenic rivers program-report. January 1988.	Washington State Parks & Recreation Commission, Olympia, Washington

5.4 RELATIONSHIP TO LAWS AND POLICIES

5.4.1 Water Quality Certification

Section 401 of the CWA (33 U.S.C. § 1341) requires a license applicant to obtain from the state a certification that project discharges will comply with applicable effluent limitations, or waiver of certification.[126] Without a 401 certificate, the project cannot be licensed. On September 17, 2003, Grant PUD requested a section 401 water quality certificate from the Washington DOE in conjunction with its application for a new

[126] Certification is deemed waived by the state, if an application for certification is not acted upon within one year of the date of receipt of the application by the state.

license. On August 30, 2004, Grant PUD withdrew its September 17, 2003 request and reapplied for a section 401 water quality certification. On October 4, 2005, at the request of Washington DOE, Grant PUD again withdrew its previous request and renewed its request for certification based on the same information filed with its initial request. Washington DOE's decision on water quality certification is pending.

5.4.2 Coastal Zone Consistency Certification

By letter dated August 5, 2002, Washington DOE states that the proposed action is located outside of Washington's coastal zone and is not subject to the Coastal Zone Management Program (letter from Gordon White, Program Manager, to Cliff Sears, Regulatory Compliance Coordinator, Grant PUD).

5.4.3 Section 18 Fishway Prescriptions

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 Interior may prescribe. In a letter filed on May 27, 2005, NMFS provided preliminary fishway prescriptions for salmon and steelhead at the Project. In a letter filed on May 26, 2005, Interior filed preliminary fishway prescriptions for salmon, steelhead, bull trout, and Pacific lamprey at the Project. For a summary of these prescriptions, see section 2.3.1. Both agencies indicated that they would file any modifications to their preliminary prescriptions within 60 days of the close of the comment period for the draft EIS.

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 habitat of such species. By letter filed April 26, 2005, NMFS indicate that the endangered UCR spring-run Chinook salmon and UCR steelhead occur in the Project area. Critical habitat was designated for both species on September 2, 2005.

By letter filed May 3, 2005, the FWS indicates the following species and critical habitat may occur in the vicinity of the Project and could be potentially affected by the project: (a) endangered: pygmy rabbit; (b) threatened: bald eagle; bull trout; and Ute ladies'-tresses; (c) designated: critical habitat for the Columbia River dps of the bull trout; and (d) candidate: Washington ground squirrel and northern wormwood. Our assessment of effects on listed species is discussed in section 3.7, *Threatened and Endangered Species*. We discuss the Washington ground squirrel and northern wormwood in section 3.6, *Terrestrial Resources*. Our final recommendations are presented in section 5.2, *Comprehensive Development and Recommended Alternative*.

We conclude that relicensing the Project with our recommended measures: (1) would likely adversely affect UCR spring-run Chinook salmon; (2) would not adversely modify or destroy any designated critical habitat for UCR spring-run Chinook salmon; (3) would likely adversely affect UCR steelhead (4) would not adversely modify or destroy any designated critical habitat for UCR steelhead; (5) would not likely adversely affect bull trout; and (6) would not affect designated critical habitat for bull trout.

Further, we conclude that relicensing the project with our recommended measures: (7) would not affect the pygmy rabbit; (8) would not affect Ute ladies'-tresses; and, (9) would not likely adversely affect the bald eagle. The draft EIS served as our biological assessment and we sought concurrence with our determinations from NMFS and FWS.

In a letter issued on March 2, 2006, Commission staff initiated formal section 7 ESA consultation with NMFS for UCR spring-run Chinook salmon and UCR steelhead.

By letter filed October 5, 2006, the FWS indicated that it concurred with Commission staff's not likely to adversely affect determination for the bald eagle because potential impacts do not coincide with the timeframes in which bald eagles are present in the Project area. No further action pursuant to the ESA is required for this species.

In a letter filed on March 27, 2006, Interior indicated that they did not concur with the staff's determination for bull trout. In a letter issued on October 12, 2006, Commission staff requested initiation of formal section 7 ESA consultation for bull trout.

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APPENDIX A

STAFF RESPONSES TO COMMENTS ON THE DRAFT EIS

The U.S. Environmental Protection Agency's notice of availability of the draft EIS was issued for the Priest Rapids Project on March 8, 2006. Comments on the draft EIS were due on May 2, 2006. The following entities files comments pertaining to the draft EIS.

Commenting Entity	**Filing Date**
State of Washington, Department of Archaeology and Historic Preservation (DAHP)	March 16, 2006
U.S. Department of the Interior (Interior)	March 24, 2006
U.S. Environmental Protection Agency (EPA)	April 17, 2006
Confederated Tribes of the Colville Reservation (Colville)	April 20, 2006
Pat Kelleher, private individual	April 27, 2006
Bonneville Power Administration (BPA)	May 1, 2006
Tom Foster, private individual	May 1, 2006
Kittitas County, Washington	May 1, 2006
Department of Natural Resources	May 1, 2006
American Rivers	May 2, 2006
Confederated Tribes of the Umatilla Indian Reservation (Umatilla)	May 2, 2006
Wanapum Band (Wanapum)	May 2, 2006
Yakama Nation (Yakama)	May 2, 2006
Department of Energy	May 2, 1006
Terry W. Garrick, private individual	May 2, 2006
National Marine Fisheries Service (NMFS)	May 2, 2006
State of Alaska, Department of Fish and Game (Alaska DFG)	May 2, 2006
State of Washington, Department of Fish and Wildlife (Washington DFW)	May 2, 2006
Yakima County, Washington	May 2, 2006
Grant County, Washington	May 3, 2006
Port of Mattawa	May 8, 2006
Port of Warden	May 8, 2006
Public Utility District No. 2 of Grant County, Washington (Grant PUD)	June 1, 2006

APPENDIX A
STAFF RESPONSES TO COMMENTS ON THE PRIEST RAPIDS HYDROELECTRIC PROJECT DRAFT EIS

COMMENT		COMMENTING ENTITY	RESPONSE
GENERAL (G)			
G-1	The draft EIS fails to adequately assess the environmental impacts of the Priest Rapids Project.	American Rivers Umatilla Yakama	The draft EIS assesses the project impacts on the affected environment and all of the proposals for protection and enhancement of environmental resources related to each of the issues identified during project scoping. We believe the assessment adequately supports the staff recommendations made in the draft EIS.
G-2	The commenting entities recommend issuing a Supplemental draft EIS to analyze the effects of alternatives offered by way of the Energy policy Act of 2005 and the fish settlement agreement.	American Rivers Umatilla Yakama	Grant PUD's hearing request was filed on December 19, 2005. The alternatives offered by Grant PUD were, essentially, the adoption of measures it proposed in its license application or which are required by existing biological opinions and agreements. These measures are covered by the draft EIS. No new alternatives are contained in the PUD's petition. Had there been new alternatives, staff would have included them in its draft EIS.
G-3	The draft EIS staff alternative does not include some conditions recommended by agencies with mandatory conditioning authority under sections 4(e) and 18 of the FPA. Excluding such recommendations from the staff alternative renders the analysis	American Rivers	The draft EIS analyzes all agencies-recommended measures. The staff alternative includes those measures staff concludes are consistent with the FPA and required for the protection of the affected resource. At this stage of the process, most of the agency recommended mandatory conditions are preliminary and subject to change based on comments and information received by the agencies,

COMMENT		COMMENTING ENTITY	RESPONSE
	inaccurate.		including analyses made by Commission staff in the draft EIS. Any license order issued by the Commission would, however, include requirements for the licensee to implement any final mandatory conditions issued by eligible agencies.
G-4	The draft EIS "repeatedly states that the Priest Rapids Project has minimal effect on flow fluctuations in the Hanford Reach and that the greatest impact is from upstream operators" and that the draft EIS contains no information to support this statement.	American Rivers	We did not find any reference in the draft EIS that states "the Priest Rapids Project has **minimal** effect on flow fluctuations in the Hanford Reach and that the greatest impact is from upstream operators" (emphasis added). In section 3.4.2 of the final EIS, however, we added a reference to information supporting our description of the effects of project operations on flow fluctuations in the Hanford Reach.
G-5	American Rivers comments that the draft EIS fails to adequately consider cumulative impacts, using as an example, effects on aquatic resources.	American Rivers	Section 3.2 of the final EIS discusses cumulative impacts for the entire project, while individual resource sections of the EIS addresses cumulative impacts for the specific resource.
G-6	Comment I summarizes and incorporates by reference comments and recommendations made by Umatilla and other tribal representatives during the licensing process.	Umatilla	We have considered most, if not all of the previously filed comments and recommendations in the preparation of scoping documents, additional information requests and the draft EIS. We have re-considered applicable comments and recommendations in the preparation of the final EIS. Although we did not include a separate alternative consisting of agency mandated and tribal recommended terms and conditions as recommended by the tribes, many of the tribal recommendations are included in the staff alternative in the final EIS. Final

COMMENT		COMMENTING ENTITY	RESPONSE
			agency mandated conditions would, by law, be included in any license order issued by the Commission.
G-7	The draft EIS only considers three alternatives: no-action, proposed action and staff alternative, and should analyze the following additional alternatives: an alternative based on the Salmon and Steelhead Settlement Agreement (SSA), an alternative that analyzes energy conservation and other power sources as a means of replacing project power, a decommissioning alternative, and an alternative that includes all of the recommendations made by tribal, state and federal resource managers.	Umatilla	In the final EIS, the SSA is considered to be part of Grant PUD's proposed project. An alternative that analyzes conservation and other power sources to replace the project power would be part of a decommissioning alternative. We did not include a detailed analysis of project retirement, or decommissioning, for the reasons given in section 2.4.3 of the draft EIS and final EIS. While energy conservation can always help to reduce the need for generation resources, the resulting reductions would ordinarily be applied to reducing fossil-fueled generation to conserve non-renewable resources and reduce atmospheric pollution. We did not devise an alternative that includes all of the recommendations made by tribal, state and federal resource managers because those parties did not put forth a consolidated licensing proposal agreed to by all parties. Instead, we consider the individual recommendations of each of the parties, and include in the staff alternative those measures we find to be consistent with the best comprehensive use of the waterway and in the public interest.
G-8	Section 2.1.8, Existing Project Operation, of the draft EIS does not reflect the requirements of the May 3, 2004 Biological Opinion for	Umatilla	We have corrected this omission in section 2.1.8 of the final EIS.

COMMENT		COMMENTING ENTITY	RESPONSE
	Upper Columbia Spring Chinook and Steelhead and the 2004 Federal Columbia River Power System BiOP project flow requirements.		
G-9	The draft EIS fails to mention or analyze effects of project operation alternatives on the Pacific Northwest Coordination Agreement (PNCA).	Umatilla	The PNCA was mentioned in section 3.4.1 of the draft EIS. We agree that any new non-power operating constraints would need to be factored into the coordinated operating plans for parties to this agreement. The Hourly Coordination Agreement, which was discussed in the draft EIS, makes note of the fact that non-power requirements take precedence over power requirements, which are met for each of the participants from the collective generating resources. Because of the complexity of optimizing the operation of the multiple projects covered by the PNCA, we believe that a determination of exactly how specific measures would affect the power operations of the individual parties to the PNCA is beyond the scope of our EIS. The EIS analyzes the environmental effects of operational alternatives and the license order will specify which measures must be implemented by the licensee. The PNCA will then determine how best to coordinate the operation of the participating projects to meet the parties' electric power demands.
G-10	Interior withdraw its preliminary conditions filed under section 4(e) of the FPA and, instead, recommends the same measures pursuant to	Interior Grant PUD	The final EIS has been revised throughout to reflect the change in the form of Interior's recommendations.

COMMENT		COMMENTING ENTITY	RESPONSE
	section 10(a) of the FPA. Grant PUD, also, pointed out this change in the form of Interior's recommendations for (1) development of a protection, mitigation and monitoring plan for all cultural resources on BOR-administered land; (2) development of a protection and monitoring plan for all ESA-listed species and candidate species on BOR land; and (3) development of a recreation resource management plan for BOR lands within the project boundary.		
G-11	Table 1 of the draft EIS, which lists non-power requirements related to operation of the project should be updated to include four other programs and agreements that control project operations.	Grant PUD	We have added the referenced operating agreements and requirements to table 1 in the final EIS.
G-12	Grant PUD provided numerous technical corrections and edits referenced to specific page numbers of the draft EIS.	Grant PUD	In the final EIS, we made the changes recommended by Grant PUD to the pages listed in their comments. We address the other changes recommended by Grant PUD and referenced to page numbers of the draft EIS elsewhere in this appendix under the applicable resource categories.
GEOLOGY AND SOILS (GS)			
GS-1	Disagrees with the first paragraph on page 54 of the draft EIS which says	Grant PUD	In the final EIS, we revised this paragraph in section 3.3.2 to say that, while rainfall amounts of sufficient

COMMENT		COMMENTING ENTITY	RESPONSE
	that rainfall events of sufficient magnitude to cause erosion would be rare in the project area.		magnitude to result in runoff and soil erosion are rare, their occurrence is a natural condition that contributes to river bank erosion.
WATER QUALITY AND QUANTITY (WQ)			
WQ-1	American River comments that the staff recommended measure on page 38 (continue to operate in accordance with the Vernita Bar Agreement) should be replaced with the single Hanford Reach Agreement.	American Rivers	As recommended by American River, we replaced the staff recommended 'Vernita Bar Agreement" measure with "Hanford Reach Agreement" in section 2.3.2 of the final EIS.
WQ-2	American River disagrees with the draft EIS's conclusion that there is no evidence that available food supply is limiting fish growth or survival. They recommend that Grant PUD conduct the macroinvertebrate analysis in the Hanford Reach, recommended by Interior, and include its results in the final EIS.	American Rivers	Grant argues that this study request is beyond the scope of section 10(j) of the FPA and unreasonably burdens the licensee. The adequacy of the content of an EIS is determined by a rule of reason which requires only "[a] reasonably thorough discussion of the significant aspects of the probable environmental consequences.." PP&L Montana, LLP, 97 FERC ¶ 61,060 (2001) (P-2188, Missouri-Madison) citing Columbia Land Basin Protection Assn. v. Schlesinger, 643 F.2d 585, 592 (9th Cir. 1981), quoting Trout Unlimited v. Morton, 509 F.2d 1276,1283 (9th. Cir. 1974).
WQ-3	American River recommends that the final EIS not contain references to Grant PUD's intent in the TMDL process.	American Rivers	In section 3.4.1 of the final EIS, we removed references of Grant PUD's intent to work within a regional framework to ensure that large existing hydroelectric dams are included as part of the "natural condition" in the TMDL.
WQ-4	American River comments that the	American Rivers	Many of the water quality parameters in the Hanford

COMMENT		COMMENTING ENTITY	RESPONSE
	draft EIS does not contain enough information to determine the influence of the Priest Rapids Project on a range of biological water quality parameters, including flow fluctuations, in the Hanford Reach and recommends that Grant PUD conduct a MASS1 flow fluctuation analysis as recommended by Washington DOE in their letter to Grant PUD dated October 12, 2005, and attached to their comment letter as Appendix A.		Reach are cumulatively impacted by the upstream projects. The Commission commonly reserves authority to require the licensee to conduct studies or make reasonable modifications to project facilities or operation, if necessary to mitigate or avoid cumulative effects identified if the NEPA document for any subsequent license, amendment, or surrender proceedings concerning other projects identified in the license proceeding for the affected project. See, Policy Statement at 18 CFR § 2.23; Use of Reserved Authority in Hydropower Licenses to Ameliorate Cumulative Impacts, 69 FERC ¶ 61,337 (Dec. 14, 1994) (RM93-25-000). The Commission's policy is to address cumulative impacts at relicensing to the fullest extent possible consistent with the Commission's responsibility to avoid undue delay in the licensing process and to avoid undue delay in the amelioration of individual impacts at licensing.
WQ-5	The Tribe comments that the water travel times shown in table 5 of the draft EIS give the impression that water spends so little time in the mid-Columbia reservoirs that heating is inconsequential. They cite quotes from the Rocky Reach Project (P-2145) proceeding to help support their belief that the travel times in table 5 are in error.	Umatilla	By definition (footnote 21 in the draft EIS) the travel times in table 5 represent the time it takes for a change in outflow from one dam to begin to affect the forebay level in another dam, all other factors being equal. Project effects on temperature are presented on page 107 of the draft EIS, where we conclude that the project reservoirs have little or no effect on Columbia River temperatures.
WQ-6	The Tribe noted that the draft EIS	Umatilla	We added Juul (2003) to our list of literature cited in

COMMENT		COMMENTING ENTITY	RESPONSE
	did not contain the literature citing for Juul (2003). They commented that our reference to average cross-section temperature differences did not include the maximum differences observed, and noted some statistical problems with the study.		the final EIS and the Tribe's reference from Juul (2003) that reported a 4ºC lateral temperature difference during single field events at the forebay sites. Concerning their comments on the adequacy of the Juul (2003) report and the draft EIS, the content of an EIS is determined by a rule of reason which requires only "'[a] reasonably thorough discussion of the significant aspects of the probable environmental consequences.." PP&L Montana, LLP, 97 FERC ¶ 61,060 (2001) (P-2188, Missouri-Madison) citing Columbia Land Basin Protection Assn. v. Schlesinger, 643 F.2d 585, 592 (9th Cir. 1981), quoting Trout Unlimited v. Morton, 509 F.2d 1276,1283 (9th. Cir. 1974).
WQ-7	The Tribe comments that Grant PUD's proposed measure to install advanced turbines at Wanapum dam as a means of improving juvenile fish passage and reducing TDG levels is speculative and factually unsupported.	Umatilla	In addition to installing advanced turbines, Grant PUD is proposing a new downstream fish passage measure for Wanapum Dam that would replace the current spillway fish spill program with a 20 kcfs surface spill design located adjacent to the powerhouse. Grant PUD's proposal is to implement and assess anadromous fish measures using an adaptive management process that would include establishment of a Priest Rapids Coordinating Committee, various technical committees, and a dispute resolution process. Adaptive management in the context of FERC projects means: a systematic approach to learning from the outcomes of monitoring and adjusting the license requirements accordingly. We believe that adaptive management

COMMENT		COMMENTING ENTITY	RESPONSE
			is especially appropriate when the outcome of proposed measures is uncertain or not yet supported by scientific research. If the currently proposed measures do not prove adequate, the other measures recommended by the Tribe to improve TDG and juvenile fish passage would be considered through a collaborative team approach.
WQ-8	The Tribe comments that "one percent or less of all dissolved oxygen (DO) measurements being less than 8 mg/L" is an inadequate analysis, especially if the actual duration was for an extended period of time. In reference to DO studies conducted, they further state that a draft EIS should fully evaluate the magnitude of any problems detected.	Umatilla	The focus of the Normandeau (2000) water quality study was to provide a comprehensive baseline limnological assessment of the project section of the Columbia River. Numerous sources of data were evaluated and summarized. The large quantity of data was refined by selecting the most pertinent parameters. Data was then summarized by averaging all measures within a given month to create a monthly mean. In some cases, a monthly minimum and maximum was also presented to indicate a range of measure. The Juul (2003) study focused on five water quality parameters (temperature, TDG, oxygen, pH, and turbidity) within the project boundaries. Eight different historic sources were used in this assessment (7 for temperature and 6 for oxygen). The advantage of this data set was that it provided information on long-term water temperature trends. One of its stated disadvantages was that the accuracy and precision of the data were largely unknown. The first step in evaluating the data was to examine the data from a quality assurance perspective, which relied heavily on comparing data from different

COMMENT		COMMENTING ENTITY	RESPONSE
			sources. The second step involved comparisons of the data using summary statistics to provide an overview. The third step was to compare the data with the state water quality standards. As discussed in our response to WQ-6, the adequacy of the content of an EIS is determined by a rule of reason which requires only "'[a] reasonably thorough discussion of the significant aspects of the probable environmental consequences. Given the focus of the water quality studies for the project, we believe our analysis meets this standard.
WQ-9	The Tribe comments that the water temperature data presented in the draft EIS only depicts average temperatures, without providing temperature increases during periods of maximum annual temperatures.	Umatilla	See our responses to WQ-8 and WQ-10.
WQ-10	The Tribe comments that project impacts water temperature in the Hanford Reach based on Anglin et al. (2005).	Umatilla	We added information in section 3.4.1 of the final EIS from Anglin et al. (2006), indicating that water temperatures in entrapments in the Hanford Reach can reach lethal levels for juvenile Chinook salmon. One of the main focuses of the Anglin et al. (2005; 2006) study was on the effects of stream flows and stream flow variation on entrapment/stranding mortality of juvenile salmonids in the Hanford Reach. Entrapments develop adjacent to the main stream channel when stream flows are reduced, resulting in pools where juvenile fish can become stranded. These separated pools can become over-heated and

COMMENT		COMMENTING ENTITY	RESPONSE
			create lethal conditions for stranded juvenile salmonids. Water temperature in entrapments was not the focus of the Juul (2003) and Normandeau (2000) temperature studies (see response to WQ-8). Grant PUD proposes to continue to refine its project operations through the Hanford Reach Agreement to reduce the project effects on fish stranding.
WQ-11	The Tribe comments that our statement about the water behind Grand Coulee dam not stratifying was not correct, and provided references that indicted that Lake Roosevelt does stratify during the summer months.	Umatilla	The reference used in the draft EIS came from the license application. We corrected this in section 3.4.2 of the final EIS, but noted that Grand Coulee dam is not equipped with selective depth-withdrawal facilities and Grant PUD has no control over the facilities and operations at Grand Coulee dam. See also the comment filed by EPA (WQ-13).
WQ-12	EPA informed the Commission in a letter filed April 18, 2006, that they believe the draft EIS adequately sets forth the environmental impacts of the project alternatives for TDG and temperature.	EPA	Comment noted.
WQ-13	EPA recommended that, if possible, the final EIS include the section 401 Water Quality Certificate conditions, which are to be filed by Washington DOE. They commented that as the Columbia River temperature TMDL is being developed, information has been gathered to show that it's possible to modify operations at	EPA	In a letter to Washington DOE dated October 4, 2005, and filed on November 2, 2005, Grant PUD withdrew and re-filed its Request for Water Quality Certification (WQC). Washington DOE has one year from the date it received the request to act on it. If the WQC conditions are filed before we issue the final EIS, we will include them in our analysis.

COMMENT		COMMENTING ENTITY	RESPONSE
	Grand Coulee dam, in conjunction with slight temperature stratification that occurs in the late summer, to improve conditions downstream. See also the comment filed by the Tribe (WQ-11).		
WQ-14	Grant PUD comments that the draft EIS refers to their monitoring and managing of spills and TDG at the project through their participation in the Mid-Columbia Coordination Committee (MCCC). In a December 16, 2004 Order Grant PUD was required to establish the Priest Rapids Coordinating Committee (PRCC) to oversee the implementation of the anadromous fish activities at the project, and is no longer required to participate in the MCCC. Further, Grant filed an Offer of Settlement on February 10, 2006 where they propose establishing the PRCC.	Grant PUD	We added text to section 3.4.1 of the final EIS that clarifies Grant PUD's responsibility in the MCCC proceeding, their requirements pursuant to the December 16, 2004 Order, and their proposal to establish a PRCC in their Offer of Settlement.
WQ-15	Grant PUD disagreed with the statement in the draft EIS that "project spill regimes and operation and maintenance of project reservoirs have historically increased overall temperatures in the	Grant PUD	We removed this text from section 3.4.2 of the draft EIS.

COMMENT		COMMENTING ENTITY	RESPONSE
	reservoirs."		
WQ-16	Grant PUD comments that they do not intend to monitor water quality parameters at the fifth fixed monitoring site, located at the Rocky Reach tailrace, during the non-spill season as they have done in the past. This water quality information was collected as baseline data for filing with their final license application. Chelan PUD owns and operates this station during the fish spill season each year as part of its own monitoring requirements.	Grant PUD	We added text to section 3.4.2 of the FEIS clarifying that Grant PUD does not intend to collect water quality information at the fifth fixed water quality sampling station in the future.
WQ-17	Grant PUD comments that the parties to the Hanford Reach Agreement have agreed that Grant PUD will operate the project in compliance with the provisions of the Hanford Reach Agreement, which replaces the Vernita Bar Agreement (VBA).	Grant PUD	We added text in section 3.4.2 of the final EIS. See the discussion and description of the Hanford Reach Agreement in sections 2.2.3 and 3.5.2, respectively. See also response to WQ-1.
AQUATIC RESOURCES (AR)			
AR-1	The data used to describe the Fall Chinook salmon stock should be updated.	American Rivers	We have added recent adult salmon and steelhead return data to section 3.5.1 of the EIS for all species of salmon and steelhead that are enumerated at Priest Rapids dam.
AR-2	The EIS should reflect the current status of the Federal Columbia River	American Rivers	We have revised section 3.5.2, *Salmon and Steelhead – Passage Standards* to indicate the status of the

COMMENT		COMMENTING ENTITY	RESPONSE
	Power System biological opinion.		Federal Columbia River Power System biological opinion.
AR-3	FERC should require Grant PUD to conduct adult salmon and steelhead downstream passage studies.	American Rivers	We have added a discussion of adult downstream passage studies to section 3.5.2, *Salmon and Steelhead – Upstream Passage* of the EIS.
AR-4	Hatcheries are no substitute for healthy, abundant rearing and spawning habitat. The EIS should address how the proposed hatchery programs are consistent with hatchery reviews conducted by the Salmon Recovery Science Review Panel and the Independent Scientific Advisory Board.	American Rivers	An analysis of the benefits of hatchery mitigation versus habitat mitigation is beyond the scope of this EIS. Hatcheries continue to play an important role in mitigating hydroelectric project effects in the Columbia River system. However, more recently, significant habitat mitigation efforts are being employed as well. For example, both this EIS and the Rocky Reach Project (P-2145) EIS evaluate and recommend that the licensees participate in habitat mitigation efforts in the mid-Columbia region in addition to hatchery mitigation.
AR-5	The Hanford Reach Agreement would not provide adequate protection of Hanford Reach resources.	American Rivers	Our analysis of the Hanford Reach Agreement is in section 3.5.2, *Salmon and Steelhead - Hanford Reach and Project Operations*. We conclude that implementation of the Hanford Reach Agreement would strike a reasonable balance between developmental project benefits and mitigation of project effects on the Hanford Reach fall Chinook salmon population. We believe this agreement would be in the public interest and we recommend including this measure in any license issued for the project.
AR-6	The EIS should include criticisms of McMichael et al. (2003) and responses to criticisms of Anglin et	American Rivers	We have revised section 3.5.2, *Salmon and Steelhead – Downstream Passage* of the EIS to include these points.

COMMENT		COMMENTING ENTITY	RESPONSE
	al. (2005).		
AR-7	The EIS should more accurately describe the physical capability of the Priest Rapids Project.	American Rivers	We have revised the discussion of the physical capability of the Priest Rapids Project based on new information filed in response to the draft EIS.
AR-8	The EIS should more accurately describe the role of the mid-Columbia Hourly Coordination Agreement and include analysis to support the assertion that the 10 kcfs fluctuation limit would require wholesale revision of the agreement.	American Rivers	We provide a detailed description of the mid-Columbia Hourly Coordination Agreement in section 2.1.8 of the EIS. We have revised the discussion of the effects of the 10 kcfs fluctuation limit on the hourly coordination agreement in section 3.5.2, *Salmon and Steelhead - Hanford Reach and Project Operations*.
AR-9	The draft EIS fails to adequately address lamprey.	Umatilla	Our analysis of project effects on Pacific lamprey is presented in section 3.5.2, *Pacific Lamprey*. This section includes an analysis of all measures recommended for Pacific lamprey and specifically addresses upstream passage, downstream passage, lamprey monitoring, and various lamprey studies.
AR-10	The draft EIS does not sufficiently consider juvenile salmonids and monitoring activities and requirements for adult passage. Specific, measurable passage standards are needed for each passage route.	Umatilla	We address project effects on juvenile salmonid passage in section 3.5.2, *Salmon and Steelhead – Downstream Passage*. We address salmonid monitoring activities throughout section 3.5.2, including the subsection entitled Salmon and Steelhead – Studies and Monitoring. We address project effects on adult salmonid passage in section 3.5.2, *Salmon and Steelhead – Upstream Passage*. We address passage standards in section 3.5.2, *Salmon and Steelhead – Passage Standards*.
AR-11	The draft EIS fails to examine fall Chinook, particularly those below	Umatilla	We address project effects on fall Chinook salmon throughout section 3.5.2 and specifically address

COMMENT		COMMENTING ENTITY	RESPONSE
	the project, and provides no assurance of appropriate monitoring.		monitoring and effects downstream of the project in the subsection entitled Salmon and Steelhead – Hanford Reach and Project Operations.
AR-12	The draft EIS does not address delayed mortality to migrating salmonids.	Umatilla	We have revised section 3.5.2, *Salmon and Steelhead – Passage Standards* to address delayed mortality and the information provided by the tribes.
AR-13	It appears there is no requirement that the applicant would participate in the No Net Impact fund.	Umatilla	In section 5.1.3 of the EIS, Commission staff indicates that other recommended measures would greatly improve conditions for salmon and steelhead and the Federal Power Act does not impose a no-net-loss requirement; therefore, Commission staff does not recommend including the No Net Impact fund in any license issued for the project.
AR-14	The recommendations in the EIS are inconsistent with existing biological opinions and FERC license articles for other Columbia River basin hydroelectric projects (specifically lamprey requirements at Willamette Falls).	Umatilla	In general, our recommendations are consistent with other Commission proceedings and ongoing actions and practices within the Columbia River basin. However, because staff recommendations are based on the project-specific benefits of each measure, there may be some differences between staff recommendations and other actions occurring within the Columbia River basin.
AR-15	Several measures were not recommended because of a lack of evidence; however, the tribes previously requested studies that would have provided evidence. Specifically, the tribes requested a study of flow impacts on fish and primary production in the Hanford	Umatilla	Several studies, including the Hanford Reach primary production study, were requested by the tribes in response to the Commission's tendering notice and again in response to the Commission's notice of application ready for environmental analysis. In both instances, we evaluated existing information, including information filed by the tribes, and concluded that there was no evidence, to suggest a

COMMENT		COMMENTING ENTITY	RESPONSE
	Reach.		relationship to the project that would warrant conducting the recommended study. Based on this information, we do not recommend including a requirement for these studies as part of any license that is issued for the project.
AR-16	The EIS fails to describe how modification of the river channel for the construction of Wanapum dam affected predation and fish passage.	Umatilla	We have revised section 3.5.2, *Salmon and Steelhead – Predator Control* to address this comment.
AR-17	The EIS fails to indicate that the Priest Rapids hatchery was originally a spawning channel that did not work.	Umatilla	We have revised section 2.1.5 of the EIS to address this comment.
AR-18	The EIS fails to quantify "contribute significantly" with respect to hatchery production of upriver bright fall Chinook.	Umatilla	We have revised section 2.1.5 of the EIS to address this comment.
AR-19	The draft EIS rejects the tribes' and Alaska DFG's recommendations for state-of-the-art facilities at the Priest Rapids hatchery without scientific or technical justification.	Umatilla	Our analysis indicates that improving Priest Rapids hatchery facilities to state-of-the-art technologies could increase hatchery efficiency and fish condition; however, we conclude that these modifications would not be necessary to achieve production goals and, therefore, they would not be worth the cost.
AR-20	The EIS should require fish survival tests after each new turbine is installed at Wanapum dam.	Umatilla	Installation of new turbines at Wanapum dam and associated survival studies was addressed in the Commission's order "Modifying and Approving Amendment of License Application and Revising Annual Charges" issued on July 23, 2004.
AR-21	FERC staff should require studies of	Umatilla	We have revised section 3.5.2, *Salmon and Steelhead*

COMMENT		COMMENTING ENTITY	RESPONSE
	the effects of gatewell exclusion screens on lamprey impingement.		– *Downstream Passage* to address this comment.
AR-22	FERC staff should specify where spawning surveys would be conducted in the Hanford Reach. Current management and monitoring for spawning and incubating fall Chinook salmon in the Hanford Reach is at Vernita Bar; however, it should focus on White Bluffs.	Umatilla Alaska DFG	In the EIS, we recommend implementation of the Hanford Reach Agreement. As indicated in section 3.5.2, spawning surveys under the Hanford Reach Agreement would be conducted at Vernita Bar. We have revised section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations* to address spawning surveys at White Bluffs.
AR-23	The EIS fails to adequately address the geographic or temporal scope of cumulative effects. The geographic scope should address cumulative effects from Wells dam to McNary pool and the temporal scope should address the long-term effects of global warming.	Umatilla	As indicated in section 3.2.1, our geographic scope encompasses the Columbia River from the Rock Island tailrace to the lower end of the Hanford Reach, which is the upper end of the McNary pool. We conclude there is no reason to include areas upstream of the Rock Island tailrace in our cumulative effects analysis, since these areas are unaffected by the project. We have revised section 3.5.3 to include global climate change as a potential cumulative effect on salmon and steelhead.
AR-24	The EIS fails to describe the full scope of project impacts on anadromous fish, including an analysis of effects on Hanford Reach fall Chinook salmon and an evaluation of alternative operations.	Umatilla Yakima County	In section 3.5.2, we include a detailed analysis of project effects on salmon and steelhead. Subsections to this section address upstream passage, downstream passage, passage standards, project operations and the Hanford Reach, predator control, hatchery programs, habitat mitigation, and various study and monitoring proposals. In section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations*, we evaluate several alternatives to current project operations.

COMMENT		COMMENTING ENTITY	RESPONSE
AR-25	The EIS does not identify the cumulative project effects on Pacific lamprey.	Umatilla	We have revised section 3.5.3 to address cumulative effects on Pacific lamprey.
AR-26	The food base in the river has been altered in quality and quantity so that impacts on growth rates and survival are likely.	Umatilla	We have revised section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations* to address this comment.
AR-27	The EIS incorrectly states that there are no reliable or verified data for predicting the amount of available spawning habitat as it relates to stream flow.	Umatilla Alaska DFG	We have revised section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations* to address the Anglin et al. (2006) spawning habitat model as a tool for managing flows.
AR-28	The EIS incorrectly states that the ability to predict spawning escapement and water availability is imprecise and unreliable.	Umatilla Alaska DFG	We have revised the discussion of these predictive tools to address this comment.
AR-29	The EIS presents an analysis of steady-state flows for the Hanford Reach spawning season; however, this operational scenario was not proposed for implementation.	Umatilla	Our evaluation of steady-state flows in the Hanford Reach was developed to address recommendations made by the U.S. Fish and Wildlife Service. As part of their recommendation and justification for spawning and incubation flows, they suggest that steady-state flows would maximize spawning habitat and could be provided based on predictions of escapement and water supply.
AR-30	Optimizing spawning habitat and the production of fall Chinook salmon in the Hanford Reach should be a high priority.	Umatilla	While we recognize the importance of fall Chinook salmon spawning habitat in the Hanford Reach, our recommendation for project operations was based on an evaluation of both the environmental and developmental benefits of each flow proposal.

COMMENT		COMMENTING ENTITY	RESPONSE
AR-31	There is indirect evidence that flow fluctuations in the Hanford Reach affect fall Chinook salmon spawning behavior and Grant PUD should be required to conduct studies of flow fluctuations on spawning behavior.	Umatilla	We have revised section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations* to address this comment.
AR-32	The statement that redd superimposition would occur no matter how much habitat is available is incorrect. It is far more likely that an increase in high quality habitat would reduce the incidence of redd superimposition.	Umatilla	Our comment was not intended to imply that increasing spawning habitat would not affect the occurrence of redd superimposition. Rather, we were simply stating that even under ideal conditions, some redd superimposition would occur.
AR-33	The EIS incorrectly states that the Priest Rapids Project reduces or mitigates flow fluctuations. USFWS modeling indicates that without the Priest Rapids Project in place, a much flatter, protracted hydrograph would occur in the Hanford Reach.	Umatilla	We have revised and expanded the discussion of project operations in section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations*.
AR-34	FERC should require Grant PUD to provide flow modeling data requested by Washington DOE and the tribes.	Umatilla	The flow modeling data requested by Washington DOE and the tribes is not necessary for us to complete our analysis of the effects of project operations on the Hanford Reach.
AR-35	The EIS states that operational modifications to enhance conditions in the Hanford Reach by restricting flows would cost $4.3 million.	Umatilla	The $4.3 million cost represents the lost power sales revenue from operating the project to comply with the Hanford Reach Fall Chinook Protection Program. In other words, if the requirements of the Hanford Reach Fall Chinook Protection Program were

COMMENT		COMMENTING ENTITY	RESPONSE
			eliminated, the project could increase power sales by $4.3 million per year.
AR-36	Project operations that may jeopardize the health of the Hanford Reach fall Chinook salmon population are not consistent with FERC's overarching mandate.	Umatilla	Our analysis of the effects of project operations on fall Chinook salmon is presented in section 3.5.2, *Salmon and Steelhead - Hanford Reach and Project Operations*. We conclude that implementation of the Hanford Reach Agreement would provide adequate protection for Hanford Reach fall Chinook salmon and we do not believe that it would not jeopardize the health of the Hanford Reach fall Chinook salmon population.
AR-37	The EIS disregards some relevant details from the 1997—2003 stranding and entrapment surveys. Specifically, the EIS doesn't report over 2 million juvenile Chinook mortalities in 2001 and 1.3 million mortalities in 2003.	Umatilla	We have revised section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations* to address this comment.
AR-38	The EIS incorrectly states that Umatilla provided no justification for annual monitoring in the Hanford Reach, when in fact Umatilla provided justification in its May 27, 2005, filing with CRITFC and Yakama.	Umatilla	We have revised section 5.1.3 to address this comment.
AR-39	The EIS fails to recognize and employ the entrapment evaluation conducted in 2003 and presented in Anglin et al. (2005).	Umatilla	We presented and discussed the results of the 2003 entrapment evaluation conducted by Anglin et al. (2005; 2006) in section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations*.

COMMENT		COMMENTING ENTITY	RESPONSE
AR-40	The effects of increased water temperatures on sockeye salmon populations in the Columbia River were not evaluated in the EIS.	Umatilla	We have added an analysis of the effects of water temperature on sockeye salmon populations in section 3.5.2, *Salmon and Steelhead – Upstream Passage*.
AR-41	NMFS and CRITFC recommend increasing the passage survival of adult salmon and steelhead, yet the EIS agrees with Grant PUD and claims that adult passage survival is high enough already.	Umatilla	In the EIS, Commission staff recommends that Grant PUD be required to achieve a 98 percent adult salmon and steelhead upstream passage survival standard which is consistent with Grant PUD's proposal, NMFS section 18 prescription, and the HCP implemented at the upstream projects. Additionally, Commission staff recommended that Grant PUD be required to implement several measures that would improve adult upstream passage conditions.
AR-42	The EIS is incorrect in stating that the juvenile salmon survival standard recommended by CRITFC is more lenient than the standard proposed by Grant PUD and NMFS.	Umatilla	NMFS and Grant PUD proposed a 93 percent survival standard for juvenile salmon and steelhead for each development. In comments filed on May 27, 2004, CRITFC recommended that juvenile salmonid mortality through the reservoir, dam, and tailrace should not exceed 8.5 percent. This recommendation equates to a 91.5 percent survival standard for each development, which is 1.5 percent lower survival than would be required by the standard prescribed by NMFS and proposed by Grant PUD. Other differences between the two standards are described in section 3.5.2, *Salmon and Steelhead – Downstream Passage* of the EIS.
AR-43	The EIS did not address CRITFC's justification for recommending 80 percent fish passage efficiency at	Umatilla	We have revised section 3.5.2, *Salmon and Steelhead – Downstream Passage* to address the 80 percent passage efficiency standard and delayed mortality.

COMMENT		COMMENTING ENTITY	RESPONSE
	each dam or discuss the delayed mortality information provided by CRITFC.		
AR-44	Sluiceway spills alone are inadequate to protect adult fallbacks and kelts. In addition to sluiceway spills, spill should also be provided at Priest Rapids dam and top-spill should be provided at Wanapum dam	Umatilla	We have added an analysis of spill and top-spill passage flows to section 3.5.2, *Salmon and Steelhead – Upstream Passage* of the EIS.
AR-45	The EIS does not include a discussion of CRITFC's recommendation for an adult travel-time standard.	Umatilla	We have added an analysis of the recommended travel-time standard to section 3.5.2, *Salmon and Steelhead – Passage Standards* of the EIS.
AR-46	It is unclear why FERC staff did not recommend developing and implementing a measures-based upstream adult passage and fallback assessment and implementation plan. Grant PUD should be required to implement a measures-based passage plan.	Umatilla Alaska DFG	As indicated in section 5.1.3 of the EIS, we did not recommend including the measures-based upstream passage plan in any license issued for the project because: 1) upstream passage at the project dams appears to be comparable to other dams in the mid-Columbia River, 2) continued refinement and monitoring proposed by Grant PUD and the agencies should improve upstream passage conditions, 3) there is no evidence that the studies included in the measures-based plan are needed or that existing passage conditions are inadequate, and 4) the measures-based passage plan appears to be unnecessary and would not be worth the cost.
AR-47	Substantial delay of adult salmon and steelhead entering the collection channel has been documented.	Umatilla	We have revised section 3.5.2, *Salmon and Steelhead – Upstream Passage* to address peaking operations and adult delay entering the collection channel.

COMMENT		COMMENTING ENTITY	RESPONSE
	Power peaking influences fishway entrance conditions; therefore, the effects of peaking on upstream migration, as recommended by CRITFC, should be studied.		
AR-48	The ability of the proposed Wanapum dam surface bypass to attract juvenile salmon and steelhead will likely be dependent on additional spills from adjacent spillbays.	Umatilla	As indicated in section 3.5.2, *Salmon and Steelhead – Downstream Passage*, there are no spillways adjacent to the Wanapum bypass. The Wanapum bypass is being constructed in the bay for future unit 11 which is adjacent to turbine unit 10 and approximately 600 feet away from the nearest spillway. However, if the Wanapum bypass does not enable Grant PUD to achieve the passage standards, Grant PUD proposes to use an adaptive management approach, in consultation with the agencies and tribes, to implement other structural and operational modifications at Wanapum dam and improve downstream passage survival. Use of spillflows to attract fish to the Wanapum bypass may be considered as part of this adaptive management approach.
AR-49	The EIS fails to provide a detailed comparison of the hatchery improvements recommended by CRITFC and ADFG and the improvements recommended by Grant PUD.	Umatilla	In section 3.5.2, *Salmon and Steelhead – Hatchery Programs*, we indicate that several of the measures proposed by CRITFC and ADFG would be addressed by upgrades to the Priest Rapids Hatchery proposed by Grant PUD and that other operational measures would likely be addressed as part of the Hatchery and Genetic Management Plan. We also indicate that other exploratory measures, such as investigating

COMMENT		COMMENTING ENTITY	RESPONSE
			water chiller installation and ozone filtration, were not proposed by Grant PUD. We conclude that implementing all of the measures recommended by CRITFC and ADFG for upgrading Priest Rapids hatchery facilities to state-of-the-art technologies could increase hatchery efficiency and fish condition, but we do not recommend implementation of all these modifications because they would not be necessary to achieve production goals and, therefore, they would not be worth the cost.
AR-50	The EIS should present a scientific explanation for not adopting CRITFC's recommended stock assessment studies (i.e., life-cycle analyses, genetic assessments, stock productivity analysis, and carrying-capacity analyses).	Umatilla	In section 3.5.2, *Salmon and Steelhead – Studies and Monitoring*, we describe the type of stock assessment studies that CRITFC recommends and discuss the benefits of conducting these studies. However, because the recommended stock assessment studies are not related to identifying or mitigating project effects and because we are already recommending mitigating project effects through implementation of other measures, the recommended stock assessment studies are unnecessary and would not be worth the cost.
AR-51	The EIS discounts the results of McMichael et al. (2003) and Anglin et al. (2005). The EIS adopts Grant PUD's proposal for Hanford Reach flows until Anglin et al. (2005) are able to provide verified stranding predictions. Additionally, FERC denies studies that would verify	Umatilla	We present and consider the results of McMichael et al. (2003) and Anglin et al. (2005; 2006) in section 3.5.2 *Salmon and Steelhead – Hanford Reach and Project Operations*. We also conclude that reducing flow fluctuations, as proposed by Anglin et al. (2006) would likely reduce stranding and entrapment below levels that would occur under Grant PUD's proposal. However, as explained in section 5.1.3, we do not

COMMENT		COMMENTING ENTITY	RESPONSE
	Anglin et al. (2005).		recommend the flow fluctuation limits or annual stranding and entrapment surveys because they would not be worth the cost.
AR-52	Under Grant PUD's proposal, flows in the Hanford Reach could fluctuate from 36 to 76 kcfs over a 48 hour period and disrupt adult fall Chinook salmon that are building redds within the reach.	Umatilla	While it is possible for fluctuations of this magnitude to occur during the spawning season, reductions below the annual spawning maintenance flow to 36 kcfs would not occur on a daily basis and would be short in duration (less than 12 hours). We expect that fluctuations from 36 to 76 kcfs during the spawning season would be uncommon under Grant PUD's proposed operations and would occur less than they have historically.
AR-53	Without providing any technical support, the EIS states that redd exposure during flow fluctuations will probably not result in any desiccation or freezing.	Umatilla	We have revised section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations* to clarify that the shorter dewatering periods associated with the Hanford Reach Agreement should reduce, but not necessarily eliminate, egg mortality from desiccation or freezing.
AR-54	The EIS provides no independent critique of Anglin et al. (2005). Additionally, the staff does not recommend any of the studies that would validate the Anglin et al. (2005) models and proposes nothing that would correct deficiencies in the model.	Umatilla	We discuss Anglin et al. (2005; 2006) in section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations* and we have expanded the discussion of criticisms of Anglin et al. (2005) in the final EIS. Anglin et al. (2005; 2006) proposed multiple studies that could be used to test the validity of the models developed in their report. We discuss the benefits of conducting these studies in section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations* and we provide our reasons for not including these studies in any license issued for

COMMENT		COMMENTING ENTITY	RESPONSE
			the project in section 5.1.3.
AR-55	The EIS states that supplementation of 1 million fall Chinook salmon fry would be sufficient to mitigate for stranding losses of as much as 7 million fish.	Umatilla	As discussed in the EIS, we expect that the recommended operational changes would reduce stranding and entrapment losses in the Hanford Reach. While it is likely that losses would exceed 1 million fish in some years, it is also likely that losses would be less than 1 million in other years. Recognizing that the flow fluctuations that occur in the Hanford Reach are the cumulative result of operations at the Priest Rapids Project and six other upstream projects, we conclude that the proposed level of hatchery mitigation is reasonable and would fully mitigate the Priest Rapids Project's share of the impact on fry in the Hanford Reach.
AR-56	The EIS incorrectly states that there is nothing in the record regarding lamprey-specific fish passage facilities, when CRITFC had filed information describing lamprey auxiliary passage systems.	Umatilla	We have added a discussion of lamprey auxiliary passage systems to section 3.5.2, *Pacific Lamprey*.
AR-57	Staff recommendations are inconsistent because staff rejects post-modification monitoring of lamprey passage using telemetry, but adopts other post-modification monitoring in the EIS.	Umatilla	In section 5.1.2, we recommend that Grant PUD be required to monitor lamprey upstream passage efficiency after modifications are made to the fishways or their operation.
AR-58	Staff rejects requests for studies of juvenile lamprey survival and speculates that survival would be	Umatilla	In section 5.1.3, we conclude that juvenile lamprey downstream passage studies would be difficult to conduct because there is currently no good source for

COMMENT		COMMENTING ENTITY	RESPONSE
	greater than 90 percent without any supporting data.		juvenile lamprey. We also conclude that juvenile lamprey downstream passage studies would be unreliable and inconclusive since no reliable methods exist for testing juvenile lamprey passage survival. Based on this information, we concluded that the requested studies would not be worth the cost. We used the limited information available in the record to conclude that it is possible that juvenile lamprey experience high turbine passage survival rates (i.e., greater than 90 percent).
AR-59	The EIS does not quantify the cumulative effects of the project on fishery resources.	Umatilla	We have revised the cumulative effects discussion in section 3.5.3 to provide more detail regarding cumulative effects on project resources.
AR-60	The unavoidable adverse effects identified in the EIS could be largely avoided by adoption of the tribes' and agencies' recommendations.	Umatilla	We address each of the tribes' recommended measures in section 5. While some unavoidable adverse effects would continue at the project, we conclude that our recommended alternative strikes a reasonable balance between developmental project benefits and mitigation of project effects and would serve the public interest.
AR-61	Without scientific justification or cost estimates, staff rejected many of the tribal recommendations.	Umatilla	Our reasons for not recommending several of the measures recommended by the tribes are explained in section 5.1.3.
AR-62	The final EIS should include an analysis of the Priest Rapids Salmon settlement agreement.	Grant PUD Yakima County	We have added an analysis of the Priest Rapids Salmon settlement agreement to the final EIS.
AR-63	The final EIS should reflect the modifications made by the USFWS to its section 10(j) recommendations.	Grant PUD	We have revised section 5.2, *Fish and Wildlife Recommendations* to reflect modifications to USFWS section 10(j) recommendations.

COMMENT		COMMENTING ENTITY	RESPONSE
AR-64	If available, any factual determinations made by the administrative law judge as part of the Energy Policy Act hearings should be incorporated into and considered in the final EIS.	Grant PUD	We have added a brief discussion of the Energy Policy Act proceedings. No determinations by the administrative law judge were available at the time this EIS went to print.
AR-65	The final EIS should include the gravity intake gate releases for fishway attraction flows as part of the proposed action and clarify if this measure is being recommended for any new license.	Grant PUD	We have revised the EIS to address the gravity intake gate releases for fishway attraction flows.
AR-66	The final EIS should reflect that Grant PUD is conducting further modeling and research to determine which downstream passage design would be most appropriate for Priest Rapids dam.	Grant PUD	We have included this information in section 3.5.2, *Salmon and Steelhead – Downstream Passage*.
AR-67	In April 2005, the Priest Rapids Coordinating Committee, with approval from NMFS, agreed to move from a Taintor gate spillway spring fish program to a gate 12 and sluiceway only spill program at Wanapum dam. During the spring migration, Wanapum dam gate 12 is operated at night and the sluiceway is operated 24 hours per day.	Grant PUD	We have included this information in section 3.5.2, *Salmon and Steelhead – Downstream Passage*.
AR-68	In September 2005, the Priest Rapids	Grant PUD	We have included this information in section 3.5.2,

COMMENT		COMMENTING ENTITY	RESPONSE
	Coordinating Committee agreed that Grant PUD had demonstrated it achieved the survival performance standard for yearling spring-run Chinook salmon.		*Salmon and Steelhead – No Net Impact Fund*.
AR-69	Orthophotographic surveys of the Hanford Reach are not needed to determine the initiation of spawning, the location of redds, or the extent of spawning as proposed by the Hanford Reach Agreement.	Grant PUD	We have revised section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations* to describe the differences between the aerial surveys proposed in the settlement agreement and the aerial orthophotographic surveys recommended by CRITFC and ADFG.
AR-70	The USFWS reports that bull trout have been extirpated from the Hanford Reach; however, if bull trout from the Snake River occurred downstream of the Project, they could readily access upstream areas.	Grant PUD	We have included this information in section 3.5.2, *Bull Trout*.
AR-71	Grant PUD believes it would be appropriate to continue to report occurrences of bull trout in the project area to the USFWS on an annual basis as part of the annual scientific collection report process.	Grant PUD	We have included this information in section 5.1.2.
AR-72	A hydraulic study of conditions at ladder entrances, diffusion areas, and submerged orifices in relation to lamprey passage is unneeded and unwarranted. It would be more appropriate to conducted radio-	Grant PUD	We have included this information in section 3.5.2, *Pacific Lamprey* and considered this information in making our recommendations in section 5.

COMMENT		COMMENTING ENTITY	RESPONSE
	telemetry monitoring of lamprey passage after modifications have been made to the fishways.		
AR-73	Grant PUD has not used barging as an approach to provide safe and effective smolt passage; however, Grant PUD has used truck transport.	Grant PUD	We have corrected the information in section 3.5.2, *Salmon and Steelhead – Downstream Passage* to reflect this comment.
AR-74	Fish passage efficiencies included in Exhibit E-4 of the license application includes all non-turbine passage routes (spillways, sluiceways, fish ladders, and gatewell dipping).	Grant PUD	We have revised section 3.5.2, *Salmon and Steelhead – Downstream Passage* to reflect this comment.
AR-75	In 2004, 46,159 pikeminnow were removed from the project area and in 2005, 44,536 pikeminnow were removed. A total of 275,387 pikeminnow have been removed from the project area between 1995 and 2005.	Grant PUD	We have added this information to section 3.5.2, *Salmon and Steelhead – Predator Control*.
AR-76	Additional evaluations of route-specific passage of juvenile salmonids in relation to flow fluctuations are not needed, since this issue has already been thoroughly evaluated.	Grant PUD	We have expanded the discussion of this issue in section 3.5.2, *Salmon and Steelhead – Downstream Passage* and included this information.
AR-77	The EIS recommends using PIT-tags to obtain dam and project passage survival estimates. This recommendation should be expanded	NMFS	We have revised sections 2.3.2 and 5.1.1 to allow for other suitable study methods.

COMMENT		COMMENTING ENTITY	RESPONSE
	to include other suitable study methods.		
AR-78	The EIS should be revised to state that returns of adult spring-run Chinook salmon have generally fluctuated between 5,000 and 50,000 since dam counts began.	NMFS	We have revised section 3.5.1 to address this comment.
AR-79	Page 142 of the draft EIS incorrectly states that adult mortality is assumed to be 98 percent. This should be revised to say adult survival.	NMFS	We have revised the text in section 3.5.2, *Salmon and Steelhead – Passage Standards* to indicate 98 percent survival.
AR-80	NOAA Fisheries (2002) is not listed in the literature cited section.	NMFS	We have added this citation to section 6.0, *Literature Cited*.
AR-81	Mortality via spill passage is currently higher than powerhouse passage at Wanapum dam and it is appropriate for Grant PUD to determine the cause of spillway mortality.	NMFS	We have added this recommendation to section 3.5.2, *Salmon and Steelhead – Passage Standards* and *Salmon and Steelhead – Downstream Passage*. In the draft and final EIS, we have recommended that Grant PUD study the effects of the gate seals on spillway survival.
AR-82	Some of the existing survival studies conducted by Grant PUD, such as radio tags, can provide a measure of tailrace survival.	NMFS	We have added this information to section 3.5.2, *Salmon and Steelhead – Passage Standards*.
AR-83	Grant PUD has made modifications to address adult passage delays associated with fishway entrance water surface elevations; however, Grant PUD is still in the process of rectifying delay associated with	NMFS	We have added this information to section 3.5.2, *Salmon and Steelhead – Upstream Passage*.

COMMENT		COMMENTING ENTITY	RESPONSE
	inadequate collection channel velocities.		
AR-84	Improving hydraulic conditions in the collection channel would not improve the ability of fish to locate and enter the fishway, but it would reduce passage delay that occurs below the junction pool in the powerhouse collection channel.	NMFS	We have added this information to section 3.5.2, *Salmon and Steelhead – Upstream Passage*.
AR-85	Survival through the Wanapum bypass should be high, but factors that influence spillway survival, such as tailrace predation, may also affect the Wanapum bypass. Therefore, to achieve survival standards through use of the Wanapum bypass, additional mitigation measures may be necessary.	NMFS	We have added this information to section 3.5.2, *Salmon and Steelhead – Downstream Passage*.
AR-86	Because Wanapum dam spillway survival is not known for all species and the performance of the Wanapum bypass is not yet known, Grant PUD should be required to continue the spillway passage program at Wanapum dam.	NMFS Yakama	We have included this recommendation in section 3.5.2, *Salmon and Steelhead – Downstream Passage*.
AR-87	The NNI fund would augment funds for habitat improvements until passage survival standards are measured and met. The NNI fund is	NMFS Washington DWF	We have added this information to section 3.5.2, *Salmon and Steelhead – No Net Impact Fund*.

COMMENT		COMMENTING ENTITY	RESPONSE
	an important component of the settlement agreement and would provide a buffer for currently unmeasured project effects and should be included in the license.		
AR-88	Gatewell exclusion screens should not be approved until they have been tested to demonstrate they improve survival of juvenile fish passing the project.	NMFS	We have included and analyzed this recommendation in section 3.5.2, *Salmon and Steelhead – Downstream Passage*.
AR-89	The EIS incorrectly suggests that NMFS concludes the spillway gate seals are the cause for poor spillway survival. It would be more appropriate to state that NMFS believes the gate seals may be related to poor spillway survival.	NMFS	We have revised the text in section 3.5.2, *Salmon and Steelhead – Downstream Passage* to more accurately reflect the basis for your recommendation.
AR-90	Several measures not adopted under section 10(j) are components of the settlement agreement signed by Grant PUD. These measures should be included in any new license issued for the project.	NMFS	We have revised the EIS to include an analysis of the measures included in the salmon settlement agreement. Additionally, we have updated the section 10(j) discussion in section 5.2, *Fish and Wildlife Recommendations*. The measures that we recommend for inclusion in any license issued for the project are listed and described in sections 5.1.1 and 5.1.2.
AR-91	Washington DWF provides additional information that was not included in the draft EIS and addresses the proposed resident fish	Washington DFW	We have added this information to section 3.5.2, *Resident Fish*.

COMMENT		COMMENTING ENTITY	RESPONSE
	stocking measures. This information includes estimates of pre-construction fish harvest in the project area, results of early efforts to stock trout in the project area, potential complications of rearing or stocking resident fish in the project area, and the original license requirements in regard to resident fish stocking.		
AR-92	The analysis in the EIS is consistent with Washington DWF's conclusion that the project adversely affects resident fish. This analysis supports Washington DFW's recommendation that Grant PUD should be required to mitigate for adverse effects on the existing resident fish community.	Washington DFW	Our description of project effects on resident fish is presented in section 3.5.2, *Resident Fish*; however, as indicated in section 5.1.3, we do not recommend the Resident Fish Mitigation and Enhancement Plan that you recommend because: 1) the details of the plan are not specific and we are unable to assess the benefits of this measure; 2) stocking within the project area would likely be unsuccessful and may conflict with efforts to recover federally-listed threatened and endangered fish species; and, 3) stocking outside the project boundary would not benefit resident fish or recreational resources within the project area.
AR-93	Grant PUD should be required to evaluate and assess the effect of project operations and the pikeminnow removal program on resident fish.	Washington DFW	We evaluate the benefits of conducting a study to determine the effects of pikeminnow removal on resident fish in section 3.5.2, *Resident Fish* and present our recommendation in section 5.1.3.
AR-94	Washington DWF recommends that	Washington DFW	We have added an analysis of this recommendation to

COMMENT		COMMENTING ENTITY	RESPONSE
	Grant PUD be required to conduct a trophic dynamics study in the project reservoirs to remedy the lack of knowledge concerning the current status and potential effects of future actions on resident fish.		section 3.5.2, *Resident Fish* and our recommendation for this measure is presented in section 5.1.3.
AR-95	Upgrading the Columbia Basin Hatchery and enhancing recreational fishing opportunities in the vicinity of the project would be the most cost effective and efficient means to mitigate for project effects on resident fish.	Washington DFW	We have added this information to section 3.5.2, *Resident Fish*.
AR-96	Washington DWF recommends that the top-spill option at Wanapum dam be continued until the Wanapum bypass facility is completed and survival rates for juvenile sockeye salmon and sub-yearling Chinook salmon are met.	Washington DFW	We have included this recommendation in section 3.5.2, *Salmon and Steelhead – Downstream Passage*.
AR-97	The measures included in the salmon settlement agreement should be included in the license in their entirety.	Washington DFW	We have revised the EIS to include an analysis of the measures included in the salmon settlement agreement. The settlement measures that we recommend for inclusion in any license issued for the project are listed and described in sections 5.1.1 and 5.1.2. Settlement measures that we are not recommending are listed in section 5.1.3.
AR-98	Grant PUD should be required to conduct a radio-telemetry study of	Washington DFW	Our analysis of a lamprey travel time study is presented in section 3.5.2, *Pacific Lamprey*. We have

COMMENT		COMMENTING ENTITY	RESPONSE
	lamprey migration time through the project using long-lived tags.		incorporated your comments regarding the use of long-lived tags into this analysis.
AR-99	Grant PUD should be required to periodically evaluate the need and feasibility of juvenile lamprey passage route and survival studies.	Washington DFW	We have incorporated this recommendation into our discussion of the Pacific Lamprey Management Plan in section 3.5.2, *Pacific Lamprey*.
AR-100	Grant PUD should be required to periodically evaluate if it is appropriate to implement studies to assess the relative abundance of juvenile lamprey within the project boundary.	Washington DFW	We have incorporated this recommendation into our discussion of the Pacific Lamprey Management Plan in section 3.5.2, *Pacific Lamprey*.
AR-101	Grant PUD should be required to fund production of juvenile sturgeon, but not specifically designate the Priest Rapids Hatchery as the site where production would occur until after a hatchery suitability assessment is conducted.	Washington DFW	We have incorporated this recommendation into our discussion of the White Sturgeon Management Plan in section 3.5.2, *White Sturgeon*.
AR-102	Changes in white sturgeon fishing regulations in the mid 1990s resulted from catch data that suggested depressed white sturgeon abundance and inadequate recruitment.	Washington DFW	We have added this information to section 3.5.2, *White Sturgeon*.
AR-103	While the depressed status of white sturgeon is not entirely attributable to Priest Rapids Project effects, the loss of white sturgeon habitat and passage impediments are directly	Washington DFW	We have added this comment to section 3.5.2, *White Sturgeon*.

COMMENT		COMMENTING ENTITY	RESPONSE
	related to project operations.		
AR-104	Lowering reservoir elevations would increase water surface gradient, velocities, and turbulence, thereby increasing white sturgeon spawning habitat and improving survival from egg-juvenile stage by reducing predation.	Washington DFW	We discuss the effect of lowering the reservoir elevations on white sturgeon recruitment in section 3.5.2, *White Sturgeon*.
AR-105	The existing white sturgeon populations in both project reservoirs appear to be slowly dying out. White sturgeon age-composition in the project reservoirs suggests insufficient recruitment to sustain these populations.	Washington DFW	We have added this comment to section 3.5.2, *White Sturgeon*. The poor recruitment and low population levels of white sturgeon in the project area were factored into our decision to recommend that Grant PUD be required to implement a White Sturgeon Management Plan, including stocking of juvenile white sturgeon.
AR-106	The inability of white sturgeon to move upstream into the project area is a significant project effect on population viability. Because white sturgeon cannot move into the project area from downstream, reproduction is dependent on existing individuals trapped within each impoundment.	Washington DFW	We have added this comment to section 3.5.2, *White Sturgeon*.
AR-107	The Priest Rapids White Sturgeon Management Plan should be closely patterned after the Rocky Reach White Sturgeon Management Plan included in the Rocky Reach	Washington DFW	We have added this comment to section 3.5.2, *White Sturgeon*.

COMMENT		COMMENTING ENTITY	RESPONSE
	settlement agreement.		
AR-108	Coordination of the white sturgeon supplementation program among entities with hatchery programs is critical to the success of the program and needed to avoid wasting valuable, limited broodstock. The best way to achieve a successful supplementation program would be to require Grant PUD to participate in development of a regionally coordinated white sturgeon hatchery facility.	Washington DFW	We have added this recommendation and a discussion of this issue to section 3.5.2, *White Sturgeon*.
AR-109	Bull trout numbers are low in the project area; however, Priest Rapids Project waters serve as the migratory corridor between the Yakima River and upper Columbia River subpopulations.	Washington DFW	We have added this information to section 3.5.2, *Bull Trout*.
AR-110	The current numbers of bull trout in the project area preclude conducting any meaningful studies; however, as bull trout numbers increase, studies would become more appropriate and feasible. Therefore, Grant PUD should be required to develop a bull trout management plan that uses an adaptive management approach to move from monitoring and reporting	Washington DFW	We have added this recommendation and an analysis of this issue to section 3.5.2, *Bull Trout*.

COMMENT		COMMENTING ENTITY	RESPONSE
	bull trout occurrences to conducting more elaborate studies as bull trout numbers increase.		
AR-111	The bull trout management plan should be updated periodically to address changing conditions, such as increased numbers of bull trout or new technologies).	Washington DFW	We have added this recommendation and an analysis of this issue to section 3.5.2, *Bull Trout*.
AR-112	Grant PUD should be required to annually report bull trout occurrences within the project area and the results of any bull trout monitoring that may have occurred.	Washington DFW	We have added this recommendation and an analysis of this issue to section 3.5.2, *Bull Trout*.
AR-113	Grant PUD should be required to meet the survival objectives within a reasonable, yet aggressive timeframe. The objectives should be met for all anadromous species by 2013.	Yakama Alaska DFG	We have added this recommendation to section 3.5.2, *Salmon and Steelhead – Passage Standards*.
AR-114	The EIS reports that some losses of salmon and steelhead would continue but does not recommend including the no net impact fund in any license issued for the project. Apparently FERC staff does not understand that the no net impact fund is intended to provide partial mitigation for fish losses during the interim period before the staff-recommended	Yakama	As indicated by our analysis in section 3.5.2, *Salmon and Steelhead – No Net Impact*, we understand the intent and benefits of the no net impact fund. However, in section 5.1.3 we explain that because the staff-recommended alternative would greatly improve conditions for salmon and steelhead and the Federal Power Act does not impose a no-net-loss requirement, we do not recommend including this measure in any license that is issued for the project.

COMMENT		COMMENTING ENTITY	RESPONSE
	measures are implemented.		
AR-115	The EIS does not require Grant PUD to conduct investigations to better understand project effects on salmonid mortalities in the Hanford Reach. This will result in status quo project operations and excuse the project from full mitigation of treaty trust resources.	Yakama	We have evaluated the effects of the project and the recommended measures and studies on the Hanford Reach in section 3.5.2, *Salmon and Steelhead – Hanford Reach and Project Operations*. Based on our analysis, we conclude that the staff-recommended measures would not result in status-quo, but would significantly improve conditions for fall Chinook salmon within the Hanford Reach.
AR-116	The EIS incorrectly states that the project has little or no effect on juvenile lamprey and concludes that development of methods to assess juvenile lamprey survival is unnecessary.	Yakama	As indicated in section 5.1.3 of the draft EIS, we are not recommending that Grant PUD develop techniques to estimate juvenile lamprey survival because it would not be worth the costs. We based this decision on available information that suggests that direct turbine passage survival for juvenile lamprey is probably high and the conclusion that development of new methods or techniques could be unsuccessful and would involve potentially high costs.
AR-117	To efficiently mitigate for project effects on lamprey, Grant PUD should be required to participate in regional efforts to address declining lamprey population abundance.	Yakama	As we explain in section 5.1.3, we do not recommend that Grant PUD be required to participate in regional lamprey recovery efforts because this measure is not project-related.
AR-118	Appropriate mitigation for project impacts to white sturgeon includes distribution of harvest benefits to affected tribal and non-tribal publics. FERC should not foreclose this	Yakama	We address mitigation of project effects on white sturgeon in section 3.5.2, *White Sturgeon*. Harvest regulations for fish species inhabiting the project area are administered by Washington DFW, not FERC. FERC staff has not made any recommendations that

COMMENT		COMMENTING ENTITY	RESPONSE
	aspect of the White Sturgeon Management Plan before formal discussions between the joint-fishery parties and Grant PUD occurs.		would foreclose the harvest benefits to tribal or non-tribal parties.
AR-119	The EIS recognizes the lack of information about white sturgeon habitat conditions, population structure, and the abundance trend; therefore, Grant PUD should be required to collect this information and improve the baseline understanding that would allow development of a long-term strategy to improve and monitor white sturgeon population health.	Yakama	In sections 5.1.1 and 5.1.2, we recommend studies that would help to identify or mitigate project effects on white sturgeon. However, we do not recommend studies that appear to be unrelated to project effects (see section 5.1.3).
AR-120	Establishing salmon and steelhead in Crab Creek could impact Columbia Basin Irrigators and the local agricultural industry and its ability to compete in an international economy.	Port of Warden	We have added this information to section 3.5.2, *Resident Fish*.
AR-121	It is the responsibility of the Priest Rapids operators, as well as all of the Federal Columbia River Power System (FCRPS), to work with fisheries management agencies to restore and maintain sustainable and harvestable population levels of salmon and steelhead.	Alaska DFG	Multiple factors in addition to the Priest Rapids Project influence the ability to restore and maintain salmon and steelhead populations in the Columbia River. While attaining sustainable and harvestable population levels is a reasonable goal for fisheries management agencies, it is not a reasonable requirement for the license since factors beyond the licensee's control could prevent them from

COMMENT		COMMENTING ENTITY	RESPONSE
			complying with this requirement.
AR-122	Alaska DFG is not aware of any other instance where passage through older turbines is safer than through spill. Grant PUD should investigate this situation and spill should not be prevented at the project.	Alaska DFG	We continue to recommend that Grant PUD conduct studies that may reveal factors influencing spillway survival. Based on new information, we have revised our recommendation regarding elimination of spillflows for fish passage at Wanapum dam.
AR-123	It is not necessary to include a requirement for modification of spillway 22 at Priest Rapids dam as part of any license. If Grant PUD wants to pursue this option, they are free to do so.	Alaska DFG	At the time the draft EIS was issued, modification of spillway 22 was part of Grant PUD's relicensing proposal. However, they subsequently revised their proposal by filing the Salmon Settlement Agreement which did not include modification of spillway 22. Since no one is currently proposing the modification of spillway 22 as a downstream fish passage option at Priest Rapids dam, we have removed analysis of this measure from the final EIS.
AR-124	A study that investigates the effects of peaking on juvenile and adult salmon should be included in the license.	Alaska DFG	We have addressed the need for this study in section 3.5.2, *Salmon and Steelhead – Upstream Passage* and *Salmon and Steelhead – Downstream Passage*. In section 5.1.3, we indicate that we do not recommend including these studies in any license issued for the project because they would not be worth the cost.
AR-125	PIT tag detection devices should be installed at Wanapum dam as a check on the data obtained at Priest Rapids dam. Natural mortality, harvest, and straying would not be significant between Priest Rapids and Wanapum dams.	Alaska DFG	We have incorporated and addressed this information in section 3.5.2, *Salmon and Steelhead - Upstream Passage*.

COMMENT		COMMENTING ENTITY	RESPONSE
AR-126	Grant PUD should be required to implement the recommended hatchery upgrades and modifications.	Alaska DFG	We address the need for hatchery upgrades in section 3.5.2, *Salmon and Steelhead - Hatchery Programs*. We have revised section 5.1.1 to indicate which hatchery modifications and upgrades we are recommending. In section 5.1.3, we list which hatchery modifications and upgrades we are not recommending.
AR-127	The 10 kcfs flow fluctuation limit should be required so that data can be collected to provide a clear picture of the tradeoffs between fluctuations and power generation.	Alaska DFG	We address implementing the 10 kcfs fluctuation limit on an experimental basis to section 3.5.2, *Salmon and Steelhead - Hanford Reach and Project Operations*.
AR-128	Grant PUD should be required to continue studies like Anglin et al. (2005) and the spawning behavior and redd site fidelity study until the question of whether or not flow fluctuations affect spawning is answered.	Alaska DFG	We have addressed this recommendation in section 3.5.2, *Salmon and Steelhead - Hanford Reach and Project Operations*.
AR-129	Annual stranding and entrapment surveys should continue until a clear picture of how dam operations affect salmon populations is developed.	Alaska DFG	We have addressed the need for annual stranding and entrapment surveys in section 3.5.2, *Salmon and Steelhead - Hanford Reach and Project Operations*.
AR-130	The EIS should address essential fish habitat.	Alaska DFG	We address essential fish habitat in section 3.7 of the EIS.
AR-131	On March 8, 2006, Alaska DFG submitted comments on the inadequacy of the 2006 Offer of Settlement by Grant PUD. We	Alaska DFG	We have addressed your comments as part of our analysis of the proposed settlement agreement included in this EIS.

COMMENT		COMMENTING ENTITY	RESPONSE
	incorporate those comments herein.		
AR-132	FERC should reject the Salmon settlement agreement unless a comprehensive and collaborative process is created to involve other key stakeholders.	Yakima County	We have addressed this recommendation in section 3.5.2, *Administrative and Procedural Recommendations*.
AR-133	The EIS fails to identify the direct loss of fall Chinook salmon habitat from construction and continued operation of the project as an unavoidable adverse effect.	Yakima County	We have revised section 3.5.4, *Unavoidable Adverse Effects* to address this comment.
AR-134	The only feasible location where the direct effects of the project on fall Chinook salmon habitat loss can adequately be mitigated is in the lower Yakama River.	Yakima County	We have revised section 3.5.2, *Salmon and Steelhead - Hanford Reach and Project Operations* to address this recommendation.
TERRESTRIAL RESOURCES (TR)			
TR-1	Washington DWF says that the wildlife lands purchased with funds provided by Grant PUD to mitigate the impacts of original project construction must be maintained under the new license at a level that continues to provide the wildlife habitat values and benefits intended for the original mitigation lands. Washington DWF says that only through implementation of habitat improvements on these upland	Washington DFW	The Commission has established that the baseline for our environmental analysis is the project as it exists today. The lands for which Washington DFW requests funding to maintain are not part of the existing project. Nonetheless, our analysis considers effects of project operations, project-related recreation, and maintenance activities on wildlife and wildlife habitats regardless of the definitions of project boundaries. We recommend measures that are forward-looking and that will enhance sensitive and important habitats within and immediately adjacent to the project boundary where project effects

COMMENT		COMMENTING ENTITY	RESPONSE
	habitats can the carrying capacity of the wildlife lands be elevated sufficiently to mitigate for habitat lost to inundation. Such actions are necessary to maintain baseline conditions.		and purposes are clearly demonstrated.
TR-2	Washington DWF says that it provided specific examples of the types of measures the Washington DWF could carry out, including approximately where they would be implemented, to increase and maintain big game, upland bird, and waterfowl carrying capacity on mitigation lands. It also identified lands that could be acquired that would buffer and help insure the protection of the wildlife and wildlife-related recreation values associated with the original mitigation lands, preserving quality habitats and the wildlife they support in the face of increasing recreation pressure. Washington DWF submitted modified recommended terms that clarify their recommended actions and support for their performance-based measures.	Washington DWF	Section 3.6 of the final EIS has been revised to reflect the actions now recommended by Washington DWF.
TR-3	Washington DWF says that Grant	Washington DWF	Grant PUD’s monitoring program is based on the

COMMENT		COMMENTING ENTITY	RESPONSE
	PUD's proposed recreation monitoring and evaluation program in the Priest Rapids Recreation Resources Management Plan is not adequate to identify and evaluate recreation impacts on wildlife and resource lands within the project boundary because it is not robust enough to serve the technical needs of managing natural resource lands to meet management resource goals and objectives. The program should include (i) monitoring and evaluation methods consistent with professional wildlife management monitoring and evaluation standards, and (2) a strategy for managing identified impacts for continued support of land use goals and objectives.		Forest Service's framework for Limits of Acceptable Change (LAC) and will cover developed and dispersed recreation sites. The proposed standards for judging resource impacts on project lands are based on qualitative judgment that would not be measurable, and do not fully consider wildlife needs. We recommend that Grant PUD develop a monitoring plan that considers wildlife needs in consultation with the resource agencies.
TR-4	Washington DWF says a sound monitoring plan would minimize adverse effects on adjoining Washington DWF wildlife areas that is already occurring and is expected to increase as recreation use increases. Washington DWF provides several examples of impacts to conservation lands and demands.	Washington DWF	Section 3.6 of the final EIS includes examples of indirect effects that may result from recreation at the project. As noted above, we are recommending the development of monitoring plan that would define the types of actions that would help control recreation impacts where they begin at the project. This includes actions such as site hardening, potentially development of additional camping sites, and closure of sites. We are also recommending that the plan include provisions for rehabilitating disturbed sites,

COMMENT		COMMENTING ENTITY	RESPONSE
			but those measures will need to be considered on a case-specific basis.
TR-5	Big horn sheep should be added to the list of wildlife species on page 246 of the draft EIS.	Washington DWF	Big horn sheep has been added to the list of wildlife species occurring on the Colockum, Quilomene, and Whiskey Dick Wildlife Areas.
TR-6	Conversion of Crescent Bar to residential and recreation uses is in direct violation of License Article 55 and contrary to the original settlement agreement for impacts of project construction. Crescent Bar was expected to remain undeveloped and to provide valuable wildlife habitat with nesting/breeding areas for wildlife, riverine wetlands, resting areas for waterfowl, and nesting, resting, forage, and escape cover for upland species.	Washington DWF	The Commission will review and consider a licensee's compliance with the terms of its license in its licensing decision. Such compliance does not need to be reviewed here. Nonetheless, we note that there is disagreement between Washington DWF and Grant PUD as to the interpretation of the terms of the settlement. Regardless, as noted above regarding the Commission policy on baseline, we reviewed the needs of the project as it exists today, not based on pre-project conditions. Consequently, we are recommending the licensee file a revised Shoreline Management Plan that will limit further development at Crescent Bar to preserve valuable wildlife habitats.
TR-7	The $1 million dollars and $288,500 for O&M proposed by Grant PUD is totally inadequate to either replace the habitat mitigation intended at Crescent Bar as a condition of the original license or to offset the adverse affects to wildlife and wildlife habitats within the project boundary and in the vicinity of the Priest Rapids Project if Grant PUD's proposed expansion of development	Washington DWF	See Responses TR-1, 3, 4 and 6 above. We revised section 3.6 of the final EIS to clarify Washington DWF's basis for replacement losses.

COMMENT		COMMENTING ENTITY	RESPONSE
	at Crescent Bar goes forward. Because Grant PUD’s proposed measures will result in a net loss of baseline conditions and irreplaceable loss of riparian and wetland habitat at Crescent Bar, Washington DWF is recommending Grant PUD replace lost values at an estimated cost of $2.16 million, expend $36,000 annually (based on 4:1 replacement/ac value and $15/ac O$M, and development of program to monitor, identify and mitigate adverse effects to conservation lands.		
TR-8	Grant PUD agrees with staff’s recommendation to prepare a single habitat management plan for the project and continues to support development of a plan that includes fire suppression; enhancements in the lower five miles of Crab Creek, the Priest Rapids, Whiskey Dick, Colockum, and Quilomene Wildlife Areas; and specific measures to protect species of concern.	Grant PUD	Your support for the measures is already noted in the EIS.
TR-9	Remove footnote 2 of Table 23, because Eurasian water milfoil is addressed in Exhibits E3 and E7 of Grant PUD’s final license	Grant PUD	Footnote 2 has been removed.

COMMENT		COMMENTING ENTITY	RESPONSE
	application.		
TR-10	Grant PUD agrees that if lands that lie immediately adjacent to the existing project boundary are identified as necessary for project purposes, then it is appropriate to include those lands within the project boundary at the time the measures are implemented. At this time there is no need to add lands to the project boundary, since no specific non-project lands parcels have been committed to project purposes.	Grant PUD	Section 3.6 of the final EIS has been revised to clarify that if the proposed lands are acquired they would be dedicated to project purposes and brought into the project boundary at that time.
CULTURAL RESOURCES (CR)			
CR-1	DAHP states that on page 296 of the draft EIS, FERC staff implies that impacts on the main-stem of the Columbia River are comparable to natural stream bank erosion.	DAHP	In the final EIS, we clarify our statement in section 3.8.4 to emphasize that shoreline erosion affecting archeological sites could be attributed to various combinations of natural processes, project operations, agreements (*e.g.*, Hanford Reach Agreement to protect fall Chinook salmon), and wave action generated by wind or by boat wakes.
CR-2	DAHP asserts that key legal documents associated with site record forms and determination of eligibility forms is missing critical information. (DAHP lists eight items illustrating where new information is needed in these forms).	DAHP	In footnote 74 of page 295 in the draft EIS and in section 5.0 of the final EIS, we recommend Grant PUD to add in any missing information involving site record forms and determination of eligibility forms as pointed out by DAHP.

COMMENT		COMMENTING ENTITY	RESPONSE
CR-3	DAHP asserts that Grant PUD is using monitoring in lieu of active protection measures for affected cultural resources.	DAHP	In section 5.0 of the final EIS, we recommend Grant PUD specify protection measures on affected cultural resources, instead of monitoring, as appropriate. We recommend Grant PUD incorporate these measures in their final HPMP and as referenced in our final PA.
CR-4	DAHP contests that Grant PUD has not expressed any specific need to protect archeological sites where there are the presence of human remains.	DAHP	In section 5.0 of the final EIS, we recommend Grant PUD file specific protection measures involving these particular archaeological sites. These measures would be incorporated into the final HPMP and as referenced in our final PA.
CR-5	DAHP requests that Grant PUD responds with specific protection measures on all National Register-eligible sites where erosion has been documented within six months after license issuance. Specific protection measures should be carried out by Grant PUD on each site within one year after license issuance.	DAHP	In section 5.0 of the final EIS, we make recommendations consistent with DAHP that would be incorporated into our final PA and Grant PUD's final HPMP.
CR-6	DAHP requests that within two years after license issuance that Grant PUD evaluate all remaining archeological sites for National Register eligibility, and specify treatment plans for resolving adverse effects to National Register-eligible sites	DAHP	In section 5.0 of the final EIS, we recommend this evaluation, in addition to having Grant PUD incorporate this approach in their final HPMP and as referenced in our final PA.
CR-7	DAHP contends that Grant PUD is not intending to implement a public	DAHP	As they pointed out in sections 4.2.2 and 4.3 of their draft HPMP, Grant PUD does intend to implement

COMMENT		COMMENTING ENTITY	RESPONSE
	education and training program for the protection of cultural resources and that more detail is needed in carryout such programs.		such programs for public education and training. We discuss these programs in sections 3.8.2 and 3.9 of the final EIS.
CR-8	DAHP contends that the final HPMP needs to substantively address the protection of cultural resources in the area of potential effect and that the final HPMP needs to incorporate more detail involving these issues.	DAHP	We state in the draft EIS that Grant PUD needs to incorporate substantive protection measures in their final HPMP along with the necessary detail. We have re-emphasized this point in section 3.8.2 of the final EIS due to more recent DAHP's comments concerning this matter.
CR-9	DAHP restates the need for a robust schedule to be incorporated into the final HPMP to carry-out remaining National Register evaluations and the implementation of management measures for all National Register-eligible archeological sites.	DAHP	In our draft EIS, we addressed DAHP's comment for the need of a more robust schedule to be incorporated into the final HPMP. We recommend in section 5.0 of the final EIS such a schedule in a final HPMP. We also stipulated such measures in our final PA.
CR-10	DAHP recommends and reinstates 29 points and items to be incorporated into the final HPMP.	DAHP	Many of these points and items were mentioned in our draft EIS. In section 5.0 of the final EIS, we explain our reasons for not recommending DAHP's provisions for an enhancement fund or research grants; however, Grant PUD should respond to DAHP's comments during the finalization of the HPMP.
CR-11	On page 270 of the draft EIS, Colville questions whether Grant PUD has contributed substantial financial support for archeological research prior to its obligations	Colville	We note your comment and have deleted the word "substantial" from section 3.8.2 of the final EIS.

COMMENT		COMMENTING ENTITY	RESPONSE
	imposed by the relicensing process.		
CR-12	On page 273 of the draft EIS, Colville notes some confusion with the archeological sequence and associated diagnostic artifacts.	Colville	We made the appropriate corrections in section 3.8.2 of the final EIS.
CR-13	Colville contends that pages 279 through 283 of the draft EIS gives a false impression that they agree with Grant PUD's inventory report, the HPMP, and the level of protection and mitigation of affected cultural resources involved with the new license.	Colville	In the draft EIS, we addressed the issues and concerns the Colville had with Grant PUD's findings and proposals. However, we have added text to section 3.8.2 of the final EIS to clarify the Colville's issues and concerns.
CR-14	On page 287 of the draft EIS, Colville contends that there has been no consultation with them involving NAGPRA items.	Colville	Items related to NAGPRA are included as one of the specified tasks that would be addressed in the final HPMP as stipulated in the final PA. Grant PUD, however, could consult with the Colville, and any other tribe, involving NAGPRA related items, prior to license issuance.
CR-15	There is concern that all measures for the protection or mitigation measures proposed for cultural resources are scheduled to be implemented following the signing of the PA and after license issuance.	Colville, Yakama	Section 106 of the NHPA affords the process by which recommendations involving cultural resources protection stemming from our analysis would be implemented after a new license has been issued. Although Grant PUD could implement measures prior to license issuance, we cannot require such actions until after the license issuance.
CR-16	Colville questions Grant PUD's ability to carry-out the directives made from the Commission and	Colville	As a concurring party to the PA, the Colville would have the opportunity to continue to consult with Commission staff and interested parties on project-

COMMENT		COMMENTING ENTITY	RESPONSE
	requests that we include information on how Commission recommendations will be enforced.		related effects on cultural resources. The Commission's Division of Hydropower Administration and Compliance would enforce the provisions of a new license, including the final HPMP.
CR-17	On pages 294-296 of the draft EIS, Colville is troubled by reference to "erosional" effects on archeological sites being attributed to natural causes.	Colville	On page 294 in the draft EIS, we note that releases from Priest Rapids dam does contribute to down steam erosion. On page 296, we also note that streambank erosion caused by the project does affect cultural resources situated along the shoreline above and below Priest Rapids dam. We have revised section 3.8.2 of the final EIS to reflect measures needed to protect archeological sites affected by project-related erosion.
CR-18	Grant PUD is concerned about the 1957 agreement between the Wanapum and Grant PUD being put into the HPMP.	Grant PUD	We have separated the 1957 agreement from the HPMP, which we recognize in the final EIS.
CR-19	On page 270 of the draft EIS, Grant PUD is concerned about the APE definition distinguishing between historic properties and TCPs.	Grant PUD	We recognize this discrepancy and revised the APE definition accordingly in section 3.8.2 of the final EIS.
CR-20	On pages 281 and 285 of the draft EIS, Grant PUD questions the existence of Tables 27 and 29 which are nearly identical.	Grant PUD	We have removed the previous Table 27 from section 3.8.2 of the final EIS.
CR-21	On page 292 of the draft EIS, Grant PUD is unsure of what incident Staff is referring to involving inadvertent	Grant PUD	We clarify this in section 3.8.2 of the final EIS. The inadvertent discoveries refer to the finding of human remains on some of the archeological sites during the

COMMENT		COMMENTING ENTITY	RESPONSE
	discoveries of tribally-sensitive materials.		field inventory.
CR-22	On page 294 of the draft EIS, Grant PUD points out that the HRNMFP committee no longer exists, but favors our recommendations for continuing a cooperative approach between agencies in resolving shoreline-related erosion effects in the HRNM.	Grant PUD	We acknowledge this fact and have revised section 3.8.2 of the final EIS accordingly. We have addressed this recommendation in section 5.0 of the final EIS.
CR-23	Wanapum request that the Commission reconsider the staff recommendation in the draft EIS for their interests (involving the 1957 agreement between them and Grant PUD) to be addressed solely through the HPMP.	Wanapum	We have revised section 3.8.2 of the final EIS to reflect the purposes of the 1957 agreement, separate from the HPMP.
CR-24	Yakama contends that there are many more significant sites that need immediate attention beyond the 20 sites that have been designated.	Yakama	We have addressed this comment in sections 3.8.2 and 5.0 of the final EIS.
CR-25	On page 278 of the draft EIS, Yakama take issue with the fact that no traditional cultural places have been identified.	Yakama	In the draft EIS, we asserted that no specific traditional cultural place had been identified, but that Grant PUD is currently working with the tribes to identify such places. In June 2006, the Colville submitted a preliminary study identifying such traditional cultural places, and we acknowledge this in section 3.8.2 of the final EIS.
CR-26	On page 279 of the draft EIS,	Yakama	We think the Yakama misunderstood our intent to

COMMENT		COMMENTING ENTITY	RESPONSE
	Yakama take issue with FERC denying protection to cultural resources considered not eligible for the National Register of Historic Places.		have Grant PUD protect all significant cultural resources. The NHPA provides criteria for determining significant cultural resources through the section 106 process and is the best method on determining significant cultural resources. Furthermore, finalization of the TCP studies would allow the Yakama to identify additional significant cultural resources within the project APE.
CR-27	Yakama contend that there is no legal or scientific basis for tasking Grant PUD to choose 20 archeological sites for immediate attention.	Yakama	Our intent was for Grant PUD to choose the 20 most significant archeological sites that were in eminent danger of being damaged or destroyed (see page 279 in draft EIS). This particular number was based on an earlier estimate (given originally from Grant PUD) of such sites being threatened. We also believed that 20 was reasonable number of sites that could be slated for protection/mitigation within the first year after license issuance. We also discuss this recommendation in section 5.0 of the final EIS.
CR-28	Yakama contend that the draft EIS does not bring up any discussion about changing power operations to reduce erosion that in turn will reduce the affects to cultural resources.	Yakama	The draft EIS assessed the project impacts on the affected environment and all of the proposals for protection and enhancement of the resources. We believe the assessment adequately supports the staff recommendations made in the draft EIS.
CR-29	Yakama contend that beyond erosion, the draft EIS does not address other cumulative effects involving cultural resources	Yakama	See responses to G-5 and RL-43.
CR-30	Yakama points out that their issues	Yakama	We acknowledge these concerns by both the Yakama

COMMENT		COMMENTING ENTITY	RESPONSE
	made in the draft EIS involving cultural resources reflect issues made by DAHP and that issuance of the draft Programmatic Agreement was premature without addressing many of these issues.		and DAHP and have addressed such issues in both the EIS and our final PA.
CR-31	Umatilla contends that our conclusion that Grant PUD's proposed final HPMP will be consistent with tribal recommendations to reduce flows in the project in order to protect cultural resources in the HRNM is false.	Umatilla	On page 294 of the draft EIS, we noted that Grant PUD proposes to dampen the magnitude and frequency of flow fluctuations in the project that would, in turn, help to reduce the effects of streambank erosion on archeological sites. Our analysis leads us to conclude that this is consistent with measures (at least in part) Umatilla proposes for the protection of archeological sites.
RECREATION AND LAND USE (RL)			
RL-1	Grant PUD should fund all necessary rehabilitation of the Beverly Bridge, including O&M.	Washington DNR, IAC, Pat Kelleher	The draft EIS at section 3.9.2 discusses Grant PUD's proposal to contribute an estimated $445,000 for improvements at the Beverly Bridge. We make our recommendation in section 5.0 of the final EIS.
RL-2	Recreational use at the Beverly Sand Dunes ORV Park on pages 303 and 304 of the draft EIS is incomplete. Further enhancement should be reconsidered at Beverly Sand Dunes ORV Park because it provides recreation associated with the project.	Washington DNR	We revised section 3.9.1 of the final EIS to include this new information on recreational use at the park. Survey results (EDAW, Inc., 2000a) indicate that recreation use at Beverly Sand Dune ORV Park is not related to the project; therefore, no further enhancement is necessary.
RL-3	Grant PUD should: (1) construct the Huntzinger Road boat launch and (2)	Terry W. Garrick	Grant PUD proposes and we recommend developing the Huntzinger Road boat launch and the Huntzinger

COMMENT		COMMENTING ENTITY	RESPONSE
	construct the fishing pier at Huntzinger Road to bring relief to anglers who find launching a boat no longer practical. The draft EIS, at p. 336, refers to "replacement" of the Vernita Bridge boat launch, which is incorrect because the area is composed of rocks in the river. A boat launch to access the Priest Rapids Project tailrace should be inside the project boundary.		Road Fishing Access Site (see sections 3.9.2 and 5.0 of the draft EIS). We changed "replacement" to "relocation". We acknowledge, in section 3.9.2 of the draft EIS, that Grant PUD proposes to provide cost-sharing funds to Washington DWF/FWS for capital facility upgrades or relocation of the Vernita Bridge boat launch. In the draft EIS we find this boat launch, located approximately 8 miles below the existing Priest Rapids Project boundary, is not needed for project purposes. The draft EIS at section 3.9 discusses the Priest Rapids Project tailrace area for recreational use and we make our recommendation in section 5.0.
RL-4	Grant PUD should: (1) upgrade the Kittitas County boat launch at Vantage (Vantage boat launch) and expand the project boundary to include the county-owned parking area; (2) dredge & lengthen the Vantage boat launch; (3) construct an additional boat launch; (4) increase O&M funds; and (5) provide one FTE sheriff deputy, 2 staff from May-October, and a vessel.	Kittitas County	Grant PUD proposes and we recommend improving the Vantage boat launch. See section 5.0 of the final EIS for our discussion on (1) expanding the project boundary and (2) dredging and lengthening the boat launch; (3) Because of the draft RRMP intent to address recreation resources comprehensively, we find construction of an additional boat launch would not fulfill a project purpose; (4) As discussed in section 3.9.2 of the draft EIS, our recommendation for Grant PUD to assess a "carry-in/carry-out" policy for trash, in addition to Grant PUD's proposal for O&M funds to Kittitas County, should help the county with costs for removing trash; (5) As discussed in section 5.0 of the draft EIS, providing funds for agency personnel to perform an agency's duties is not the responsibility of a licensee.

COMMENT		COMMENTING ENTITY	RESPONSE
RL-5	The draft EIS is essentially devoid of any discussion of applicable local land use plans, policies, and regulations.	Yakima County	The draft EIS, at sections 3.6 and 3.9, discusses various federal, state, and local land use plans, policies, and regulations. No change to the text is required.
RL-6	Section 5.3 (Consistency with Comprehensive Plans) of the draft EIS fails to address compliance with the Shoreline Management Act of 1971 and Yakima County's adopted Shoreline Master Program.	Yakima County	We considered and addressed in the draft EIS the extent to which the Priest Rapids Project is consistent with applicable comprehensive plans. The Shoreline Management Act of 1971 and Yakima County's adopted Shoreline Master Program are not comprehensive plans, pursuant to section 10(a)(2)(A) of the FPA. No change to the text is required.
RL-7	The draft EIS fails to adequately analyze and mitigate recreational impacts caused by project operations. Grant PUD proposes no measures for the lack of recreational opportunities available to Yakima County residents.	Yakima County	The draft EIS assesses project impacts on recreation resources and all of the proposals for enhancement and mitigation of the resource. We believe the assessment adequately supports the staff recommendations made in the draft EIS.
RL-8	Grant PUD should develop a monitoring and evaluation program within a habitat management plan that would be integrated with the project's RRMP and Shoreline Management Plan. The program would identify and evaluate recreation impacts on wildlife and habitat within and adjacent to the project boundary.	Washington DWF	We agree that a monitoring and evaluation program within a habitat management plan for the project could also identify and evaluate project-related recreational effects on terrestrial resources. As a result, proposed recreation facilities within the project boundary could be adjusted accordingly to protect the environmental resource from direct effects, as well as potential indirect effects adjacent to the project boundary.
RL-9	Quilomene Bay and Crescent Bar,	Washington DWF	The draft EIS analyzes direct and indirect effects on

COMMENT		COMMENTING ENTITY	RESPONSE
	originally designated by Grant PUD as Conservation Lands, continue to be adversely affected by residential and/or recreation uses. The new license should not include activities proposed by Grant PUD related to further development at Crescent Bar or that would further reduce the mitigation values provided by Crescent Bar.		Quilomene Dune and Bay, Crescent Bar, and analyzes all of the proposals for protection and enhancement of the resources at these sites. We revised sections 3.9.2 and 5.0 of the final EIS to reflect our additional analyses and recommendations for these sites.
RL-10	Commission staff lists 18 developed recreation facilities in the draft EIS (at page 304), but these facilities do not have Commission approval.	Pat Kelleher	In the draft EIS, we recommend that Grant PUD develop and upon Commission approval, implement a final RRMP. The final RRMP would address the 18 developed recreation facilities.
RL-11	There are 10 recreation sites at the Priest Rapids Project that need improvements.	Pat Kelleher	Both the draft EIS and final EIS at sections 3.9.2 and 5.0 address these 10 recreation sites and we make recommendations regarding the sites.
RL-12	Information identifies the recreation facilities, including the 10 sites in RL-11, and associated data.	Pat Kelleher	Although the draft EIS identified the sites and certain associated data, we appreciate the new information and incorporated it into section 3.9.2 of the final EIS.
RL-13	Cost summary of other hydroelectric project parks; Letter to Grant PUD, dated February 2006, from Commission DHAC staff regarding the cattle feedlot and determination that the feedlot is not unduly limiting public access.	Pat Kelleher	No response is necessary.
RL-14	Information identifies and offers recommendations for Apricot	Pat Kelleher	Although the draft EIS analyzed direct and indirect effects on these sites and all of the proposals for

COMMENT		COMMENTING ENTITY	RESPONSE
	Orchard, Crescent Bar, Sunland, Quilomene Bay and Dune, and Airstrip sites. Letter to Port of Quincy, dated July 2003, from Grant PUD regarding violation of lease and default of the 1979 Lease Agreement.		protection and enhancement of the resources at these sites, we appreciate the new information. Based on the information, we revised sections 3.9.2 and 5.0 of the final EIS to reflect our additional analyses and recommendations for these sites. Regarding the violation of lease and default of the 1979 Lease Agreement, Grant PUD is ultimately responsible for ensuring that any activity under a lease agreement is consistent with its license.
RL-15	Information on traffic growth along Interstate 90, taken from Washington State DOT "2004 Annual Traffic Report".	Pat Kelleher	No response is necessary.
RL-16	Information identifies and offers recommendations for Vantage boat launch.	Pat Kelleher	See our response in RL-4.
RL-17	Permit and associated fees for public use at Vantage Riverstone Resort.	Pat Kelleher	No response is necessary.
RL-18	Information identifies and offers recommendations for Sand Hollow-South, Wanapum State Park, and Black Sand Beach. Sand Hollow-South is an outstanding recreational asset to the project.	Pat Kelleher	Although the draft EIS analyzed direct and indirect effects on these sites and all of the proposals for protection and enhancement of the resources at the sites, we appreciate the new information and we revised section 3.9.2 accordingly.
RL-19	Newspaper article on the State's proposal to terminate leases for 13 parks.	Pat Kelleher	No response is necessary.
RL-20	Letter to the Commission, filed March 21, 2005, from Pat Kelleher	Pat Kelleher	The draft EIS at p. 335 references the recreation facility as Wanapum Recreation Area, which Grant

COMMENT		COMMENTING ENTITY	RESPONSE
	regarding unauthorized modification by Grant PUD to a project recreation facility at RM 418. Information identifies and offers recommendations for Huntzinger Road and Beverly Bridge sites.		PUD partnered with WSPRC and lengthened the boat launch. This facility would be a component of a final RRMP. We revised section 3.9.2 of the final EIS to incorporate the new information.
RL-21	Newspaper article on Grant PUD and Town of Schawana agreement to partner in developing a park.	Pat Kelleher	No response is necessary.
RL-22	Newspaper article and information on the John Wayne Trail and Milwaukee Road Corridor.	Pat Kelleher	No response is necessary.
RL-23	Letter to Washington Department of Wildlife, dated July 27, 1988, from Grant PUD regarding the Crab Creek Habitat Management Area and mitigation for original project construction.	Pat Kelleher	No response is necessary.
RL-24	Encroachment by adjacent property owners onto Grant PUD-owned land is an on-going concern. Recreational areas need to be signed for public access.	Pat Kelleher	Grant PUD is ultimately responsible for ensuring that any activity under its license is consistent with the license. Installation and/or improvement of signs for public access would be a component of a final RRMP.
RL-25	Article 7 and Article 18 of the Priest Rapids Project license on allowing public access. Letter to Pat Kelleher, dated November 1, 2005, from Grant PUD on deferring permit	Pat Kelleher	No response is necessary.

COMMENT		COMMENTING ENTITY	RESPONSE
	issuances pending project relicensing.		
RL-26	News release on Tim Douglas, former Director of the Department of Community, Trade and Economic Development. This news release notes temporary migrant housing in Mattawa.	Pat Kelleher	Sections 3.9.2 and 3.10 of the draft EIS discuss the cooperate effort between the Port of Mattawa and Grant PUD to improve the Mattawa RV/Farm Worker Campground, and as a result, a local need within a community would be addressed.
RL-27	Memorandum to the U.S. Army, Yakima Training Center, dated April 15, 2005, from Pat Kelleher on the Float Bridge and amphibious river training. Buckshot Ranch is isolated and should be managed for wildlife. A recreational need exists for a Priest Rapids tailrace boat launch.	Pat Kelleher	No response is necessary. The draft EIS at section 3.9.2 discusses Buckshot Ranch. We agree with your assessment that Buckshot Ranch should be managed for wildlife, which is its current objective, rather than for overnight camping. We revised section 5.0 of the EIS accordingly. We address the Priest Rapids tailrace boat launch in RL-3.
RL-28	Copy of Environmental and Public Use Inspection Report, filed September 17, 1998, for the Priest Rapids Project.	Pat Kelleher	No response is necessary.
RL-29	Letter to the Commission, filed December 2, 2003, from Terry Garrick regarding the need for access and a boat ramp in the Priest	Pat Kelleher	No response is necessary.

COMMENT		COMMENTING ENTITY	RESPONSE
	Rapids Dam tailrace. Letter to NW Steelhead & Salmon Council, dated February 19, 1987, from Grant PUD on the State's proposal to construct a boat launch in the vicinity of Vernita Bar.		No response is necessary.
RL-30	Recreational history of the mid-Columbia River.	Pat Kelleher	We revised section 3.9 of the final EIS to incorporate this new information.
RL-31	The Priest Rapids Project lands offer numerous interpretive opportunities for the Ice Age Floods. A brief description of enhancements is identified. Interpretive media within the project should be reviewed at least annually. The need for this review is noted by a photograph of a display at the Wanapum Day Use Area that shows a missing board.	Tom Foster	We agree. We revised sections 3.9 and 5.0 of the final EIS to incorporate the information and to reflect our recommendations, respectively.
RL-32	The draft EIS at p. 249 notes that lands dedicated to project purposes must be included in the project boundary. There is no need to add lands to the project boundary.	Grant PUD	No response is necessary.
RL-33	The draft EIS at p. 301 should clarify the Hanford Site and Monument lands that lie within the project boundary.	Grant PUD	We revised section 3.9.1 of the final EIS to clarify that a portion of the Hanford Site located within the project boundary is associated with the project transmission lines.
RL-34	The draft EIS at p. 304 and p.305	Grant PUD	We revised section 3.9.1 of the final EIS to clarify the

COMMENT		COMMENTING ENTITY	RESPONSE
	should clarify the recreation facilities at the Wanapum development and Priest Rapids development, respectively.		project-related recreation facilities.
RL-35	In footnote 79, the draft EIS at p. 310, Grant PUD clarifies that the 4,490 acres cited is a reference to the acres in Grant PUD's fee title ownership.	Grant PUD	In the final EIS, we revised footnote 79 to reflect the clarification of acres.
RL-36	The draft EIS at p. 312 should clarify that an estimated 75 percent of recreation users at the project are from the greater Puget Sound area.	Grant PUD	We revised section 3.9.2 of the final EIS to clarify recreational use.
RL-37	The draft EIS at p. 333 should remove the reference to "no-fee" use of the Mattawa RV/Farm Worker Campground.	Grant PUD	In section 3.9.2 of the final EIS, we removed the reference to "no-fee".
RL-38	The draft EIS at p. 341 requests Grant PUD clarify the difference in what appears to be two proposed license articles. Grant PUD requests the Commission order includes a "recreation article" that commits Grant PUD to finalizing and implementing its draft RRMP.	Grant PUD	We modified the text in section 3.9.2 of the final EIS to reflect other individuals' comments on the identified recreation sites (Airstrip Site, Getty's Cove Group Site, Wanapum Recreation Area, and the John Wayne Pioneer Trail). As listed in section 5.0 of the final EIS, we recommend Grant PUD develop and implement a final RRMP.
RL-39	The draft EIS at p. 345 should clarify that Sentinel Gap is owned and managed by Grant PUD.	Grant PUD	We revised the description of Sentinel Gap in section 3.9.2 of the final EIS.
RL-40	Information on land ownership	Grant PUD	No response is necessary.

COMMENT		COMMENTING ENTITY	RESPONSE
	relative to the Kittitas County boat launch at Vantage.		
RL-41	In response to comments by WDNR, Grant PUD's proposal for the Beverly Dunes ORV Park would eliminate impacts of ORV use on the resources.	Grant PUD	The draft EIS, at p. 314, discusses the Beverly Dunes ORV Park and Grant PUD's proposal. No change in the text is necessary.
RL-42	In response to comments by Washington DWF, Grant PUD provides information on Crescent Bar. No further development is proposed at Crescent Bar.	Grant PUD	We appreciate the new information, which we incorporated into section 3.9.2 of the final EIS.
RL-43	The draft EIS fails to discuss boat wake erosion, particularly at Quilomene Dune. The draft EIS fails to discuss restricting access by recreational users to culturally sensitive areas.	Yakama	The draft EIS at sections 3.3.2, 3.9.2 and 5.0, addresses tribal concerns related to the potential for shoreline erosion and recreational use, particularly at Quilomene Dune and Bay. Further, we adopted two additional measures by the Yakama and CRITFC, at p. 403 of the draft EIS, that would ensure protection of cultural resource sites.
RL-44	Grant PUD should provide funds for tribal recreational and cultural experts to assist in identifying and preparing plans to immediately protect and restore cultural sites from undeveloped campsites. The draft EIS fails to discuss or analyze an alternative-restrict access to the cultural sites.	Yakama	As discussed in section 5.0 of the draft EIS, providing funds for agency personnel to perform an agency's duties is not the responsibility of a licensee. The draft EIS at pp. 321, 322, and 329 discusses and in section 5.0 recommends such alternatives. See also our response to RL-43.
SOCIOECONOMIC RESOURCES (S)			

COMMENT		COMMENTING ENTITY	RESPONSE
S-1	The draft EIS fails to adequately analyze and mitigate economic impacts of the project. Grant PUD has not allocated a meaningful share of project benefits to Yakima County or the other counties surrounding the project boundaries.	Yakima County	NEPA requires and we believe the EIS adequately addresses the socioeconomic impacts of the project. The fact that the project may result in lower electric rates for Grant County than for some other surrounding counties does not mean the project has a negative socioeconomic impact on those counties, which must somehow be mitigated. Although the project may give Grant County a competitive edge for attracting an industry with respect to electricity rates, amenities such as topography, transportation, recreation opportunity, etc. available in other jurisdictions may give them the edge in attracting the residential and commercial development needed to support the industry's workforce. In this way the positive socioeconomic effect of the project in attracting industry to the region is shared by neighboring jurisdictions.
DEVELOPMENTAL ANALYSIS (DA)			
DA-1	Table 43 of the draft EIS provides costs for complying with a 10,000-cfs maximum flow fluctuation limit for the Hanford Reach but does not explain how this cost was determined.	American Rivers	Footnote 1 of table 43 in the draft EIS explains the basis for the estimated cost of complying with the recommended maximum flow fluctuation. We agree with Grant PUD that the constraint imposed by this recommendation would eliminate the load following capability of the project during the period this operation would be required. In section 4.0 of the final EIS we modified footnote 4 to include a reference to Grant PUD's July 8, 2005 letter describing the basis for the effect of the measure on the power benefits of the project.

COMMENT		COMMENTING ENTITY	RESPONSE
DA-2	BPA recommends specific revisions to descriptions of project operations, the influence of upstream project operations on flows in the Hanford Reach, and the Hourly Coordination Agreement given on pages 25, 69, 121 and 190 of the draft EIS.	BPA	In the final EIS, we revised the referenced text per BPA's suggestions with some slight modifications.
DA-3	BPA notes its concurrence with staff's analysis and recommendations regarding Hanford Reach flows as summarized on pages 411-414 of the draft EIS.	BPA	We appreciate BPA's statement of support for staff's analysis.
DA-4	Section 1.1 of the draft EIS says that FERC must give equal consideration to the purpose of energy conservation, but there are no draft EIS alternatives that examine how energy conservation might replace or supplement the need for project power.	Umatilla	Giving equal consideration does not require the Commission to devise alternatives that include specific conservation measures to replace all or a portion of project capacity. "Equal consideration" is not the same as "equal treatment." CLF et al. v. FERC et al., 216 F.3d 41 (D. C. Cir., 2000), citing California v. FERC, 966 F.2d 1541, 1550 (9th Cir. 1992). In making its licensing decision the Commission considers a utility or municipal licensee's program for conservation.
DA-5	FERC discusses the elimination of load following capability that would be associated with a plan to reduce flow fluctuations, but the details of such a plan or alternative are not provided in the draft EIS. FERC uses Grant PUD's estimate of $136	Umatilla	Requiring the Priest Rapids Project to re-regulate inflows to limit flow fluctuations to 10,000 cfs would preclude the use of project storage for load following. Replacing that load following capacity with capacity from other mid-Columbia projects would, in turn, eliminate the availability of that capacity for load following elsewhere in the region. Ultimately, new

COMMENT		COMMENTING ENTITY	RESPONSE
	million to replace lost load following capacity. Recommends this capability be provided by other mid-Columbia projects for “revenue-neutral” alternative for meeting the tribal recommended flow fluctuation limits.		capacity would be required somewhere in the region and the most likely source for new load following capacity is combustion turbines. Therefore, we agree with Grant PUD that the cost of this proposed measure can be equated to the cost of combustion turbine capacity. We agree with Grant PUD’s estimated cost for an equivalent amount of combustion turbine capacity.
DA-6	FERC should balance non-power constraints with the need to hold down power costs for the benefit of economic development in Grant County.	Grant County	We believe that the staff alternative satisfies the FPA requirement to adopt a project that is best adapted to serve the public interest and is best adapted to a comprehensive plan for development of the waterway for beneficial public uses.
DA-7	Table 41 on page 374 of the draft EIS contains cost estimates for staff recommended additions and modifications to Grant PUD’s proposed project. The true cost cannot be accurately estimated without further understanding of the effort required to implement these measures.	Grant PUD	We acknowledge that staff’s cost estimates are preliminary and subject to change as more detailed work plans are developed. Where specific cost information was filed by Grant PUD or others on the draft EIS, staff has revised its cost estimates to reflect such information.
DA-8	Table 43 on page 384 of the draft EIS incorrectly refers to the No Net Impact (NNI) fund as a “no net income fund”. The amount of this fund ($2,562,206) will vary annually as Project survival estimates are met.	NMFS	We made the noted correction in section 4.0 of the final EIS.
DA-9	Project economic analysis should not	Alaska DFG	Section 10(a)(1) of the FPA requires the Commission

COMMENT		COMMENTING ENTITY	RESPONSE
	be included in the final EIS. The document is supposed to be about programs that benefit fish.		to consider all public interest factors, including power, and environmental effects and to adopt the project that, in its judgment, will be best adapted to a comprehensive plan for improving or developing a waterway. We include project economic information in our NEPA documents to inform the Commission on the effects of alternative licensing conditions on power development benefits, which are an important public interest consideration in the licensing of hydropower projects.