United States Department of the Interior

FISH AND WILDLIFE SERVICE
California/Nevada Operations Office
2800 Cottage Way, Room W-2610
Sacramento, California 95825-1846

IN REPLY REFER TO:

March 27, 2006

Ms. Magalie R. Salas
Secretary
Federal Energy Regulatory Commission
888 First St, NE – Room 1A
Washington, DC 20426

Subject: Klamath Hydroelectric Project, No. 2082. Department of the Interior's Filing of Comments, Preliminary Terms, Conditions, Prescriptions, and Recommendations.

Dear Ms. Salas:

In response to the Federal Energy Regulatory Commission's (Commission) December 28, 2005, Notice of Application Ready for Environmental Analysis, the Department of the Interior (Department) herewith files its preliminary terms, conditions, prescriptions, and recommendations for the Klamath Hydroelectric Project. The Department's filing includes introductory comments, and the following sections:

Section A: Preliminary conditions for the protection and utilization of the Bureau of Land Management reservations pursuant to Section 4(e) of the Federal Power Act.

Section B: Preliminary conditions for the protection and utilization of federal lands and facilities of the Bureau of Reclamation pursuant to Section 4(e) of the Federal Power Act.

Section C: Preliminary fishway prescriptions of the Fish and Wildlife Service and National Marine Fisheries Service pursuant to Section 18 of the Federal Power Act.

Section D: Fish and Wildlife Service recommendations to protect, mitigate damages to, and enhance fish and wildlife pursuant to Section 10(j) of the Federal Power Act.

Section E: Recommendations submitted pursuant to Section 10(a) of the Federal Power Act.

The Department's preliminary terms, conditions, prescriptions, and recommendations are submitted for inclusion in the Commission's forthcoming analysis conducted under the National Environmental Policy Act (NEPA). The Department may modify these preliminary submissions in response to the Commission's NEPA process and appropriate proceedings arising from the Energy Policy Act of 2005.

If Commission staff believe that any of the fish and wildlife recommendations in Section D should not be included in a new license, then Mr. Phil Detrich, Field Supervisor, Yreka Fish and Wildlife Office should be contacted to resolve such issues prior to issuance of the license.

The Department recommends that the Commission initiate informal consultation discussions with the Department directly to jointly determine information needs to comply with section 7 of the ESA on this licensing action.

Specific questions or requests for clarification regarding any the comments contained herein may be directed to:

- Bureau of Indian Affairs:
  - Tom Dang, Regional Irrigation, Power, Safety of Dams, and FERC Program Manager, Pacific Regional Office, 2800 Cottage Way Sacramento, California 95825, (916) 978-6164.
- Bureau of Land Management:
  - Jon Raby, Klamath Falls Area Office, 2795 Anderson Avenue, Bldg #25, Klamath Falls, OR, 97603, jraby@or.blm.gov, (541) 883-6916.
- Bureau of Reclamation:
  - Cecil Lesley, Klamath Basin Area Office, 6600 Washburn Way, Klamath Falls, OR 97603, clesley@mp.usbr.gov, (541) 883-6935.
- Fish and Wildlife Service:
  - Phil Detrich, Yreka Fish and Wildlife Office, 1829 South Oregon Street, Yreka, CA, 96097, Phillip_Detrich@fws.gov, (530) 842-5763.
- National Park Service:
  - Susan Rosebrough, 909 First Ave, Fifth Floor, Seattle, WA 98104, susan_rosebrough@nps.gov, (206) 220-4121.

We appreciate the opportunity to provide these comments, recommendations, conditions, and prescriptions. Thank you for your assistance in filing these documents.

Sincerely,

Steve Thompson

Steve Thompson
Manager, California/Nevada Operations Office
For the Department of the Interior
Pursuant to Delegation Memorandum of August 3, 2005

UNITED STATES DEPARTMENT OF THE INTERIOR
COMMENTS, PRELIMINARY RECOMMENDATIONS, TERMS AND CONDITIONS, AND PRESCRIPTIONS FOR FISHWAYS
FILED PURSUANT TO SECTIONS
4(e), 10(a), 10(j), AND 18 OF THE FEDERAL POWER ACT
WITH THE FEDERAL ENERGY REGULATORY COMMISSION
FOR THE KLAMATH RIVER HYDROELECTRIC PROJECT
PROJECT NO. 2082
KLAMATH RIVER, SISKIYOU COUNTY, CALIFORNIA; AND KLAMATH COUNTY, OREGON

March 27, 2006

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INTRODUCTION

The Department of the Interior (Department) has reviewed the notice of application Ready for Environmental Analysis and Soliciting Comments, Recommendations, Terms and Conditions, and Prescriptions (REA Notice) for the Klamath Hydroelectric Project (FERC No. 2082) (Project), located primarily on the Klamath River in Klamath County, Oregon, and Siskiyou County, California, between Klamath Falls, Oregon, and Yreka, California. The December 28, 2005 REA Notice requested submission of comments, recommendations, terms, conditions, and prescriptions by February 27, 2006. On February 16, 2006 staff of the Federal Energy Regulatory Commission (Commission or FERC) approved an extension of the response deadline to March 29, 2006.

PacifiCorp (Applicant) is seeking a new license for the continued operation of the 161 megawatt (MW) Project. The existing license expired on March 1, 2006, and the Commission issued an annual license on March 9, 2006. The Department and its bureaus (the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Bureau of Reclamation (Reclamation), National Park Service (NPS), and Fish and Wildlife Service (Service or FWS)) have provided technical assistance and participated on technical subgroups with the Applicant since 2001. The Department also provided the Applicant with comments and recommendations on its Draft License Application (DLA) on September 24, 2003, the Final License Application (FLA) on April 26, 2004, and in many other letters filed with the Commission and hereby incorporated by reference. The Department formally intervened in the proceeding on September 29, 2004.

The preliminary comments, recommendations, terms and conditions, and prescriptions herein are provided in accordance with the provisions of the Federal Power Act (FPA), (16 U.S.C. § 791 *et seq.*), the Fish and Wildlife Coordination Act (FWCA), (16 U.S.C. §661 *et seq.*), the Endangered Species Act (ESA), (16 U.S.C. §1531 *et seq.*), the Federal Land Management and Policy Act (FLPMA), (43 U.S.C. § 1701 *et seq.*), the Klamath River Basin Fishery Resources Restoration Act (Public Law 99-552), the Reclamation Act of 1902 as amended and supplemented (32 Stat. 388), the Outdoor Recreation Act of 1963 (16 U.S.C. 4601-1), the NPS Organic Act (39 Stat. 535), the Wild and Scenic Rivers (WSR) Act (Pub. Law 90-542), the National Trails System Act (16 U.S.C. 1246(a)), the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 *et seq.*), and federal trust responsibilities to Indian Tribes. In this document, the Department identifies and explains these comments, recommendations, terms and conditions, and prescriptions as well as their legal and evidentiary basis:

- **Section A** contains preliminary conditions pursuant to Section 4(e) for the protection and utilization of the BLM reservations.
- **Section B** contains preliminary conditions pursuant to Section 4(e) for the protection and utilization of lands and facilities managed by Reclamation.
- **Section C** contains preliminary prescriptions for the construction, operation, and maintenance of upstream and downstream fishways pursuant to Section 18. These

prescriptions on behalf of the FWS are issued jointly with the National Marine Fisheries Service (NMFS).

- **Section D** contains recommendations to protect, mitigate impacts to, and enhance fish and wildlife resources pursuant to Section 10(j).
- **Section E** contains recommendations to protect fish and wildlife, recreation, cultural, and reservation resources pursuant to Section 10(a).

In addition, the Department is submitting for the record two technical memoranda:

- Ongoing and Future Improvement of Aquatic Habitat in the Klamath River Watershed, FWS, February 27, 2006.
- Replacement Power Values, Office of Policy Analysis, Department of the Interior, March 27, 2006.

The Department notes that the proceeding is behind schedule. PacifiCorp filed its license application on February 25, 2004 without having completed key studies. The Commission issued a Notice of Tendering of Application on February 26, 2004, and in response to that notice, the Department filed additional information requests with the Commission on April 26, 2004. The Commission did not accept the license application until August 16, 2004, and did not issue additional study requests until February 17, 2005. This order called for receipt of all additional information by August 2005. Several of the Applicant's requests for extension were granted, and final studies were not filed on key areas of water quality and fish passage until December 16, 2005. Much of this material is still incomplete, or in a form that is difficult to review and assess. The Department has filed numerous letters with the Commission on the adequacy of the Applicant's studies and information, and hereby incorporates them by reference.

Provided that our comments, recommendations, terms and conditions, and prescriptions are incorporated into the new license, the Department does not intend to object to the issuance of a new license for the Klamath Hydroelectric Project (Project). The conditions and recommendations contained herein are designed to mitigate the impacts of the Project to the fullest extent achievable under the authorities available to the Department bureaus in the traditional relicensing process, and include fish passage measures and controlled operations at the Project dams. The Department recommends that these measures be included in the Commission's NEPA analysis in order to assess their effectiveness in addressing the Project's impacts. However, the full suite of Project impacts may not be addressed through the prescription of fishways and the recommendation of other modifications to Project operations. We are hopeful that more comprehensive solutions can be attained through the ongoing settlement process, in which the Applicant is a participant. In the meantime, we continue to urge the Commission to evaluate a full range of Project alternatives during the environmental review process, including dam decommissioning and removal.

Because a Draft Environmental Impact Statement (DEIS) or Draft Environmental Assessment (DEA) has not yet been issued by the Commission, this response contains preliminary comments, recommendations, terms and conditions, and prescriptions only. The Department reserves the right to amend these preliminary comments, recommendations, terms and

conditions, and prescriptions, if warranted, based on the results of new information and conclusions developed during the Department's processes conducted pursuant to the Energy Policy Act of 2005 (EP Act) and the Commission's environmental analysis.

GENERAL COMMENTS

The Klamath River Basin in southern Oregon and northern California has sustained farming communities, provided habitat for the majority of waterfowl that migrate over the Pacific flyway, and was once the third largest salmon-producing watershed on the west coast, supporting large anadromous fish runs including Chinook salmon, coho salmon, steelhead, sturgeon, and lamprey, which supported significant commercial, recreational, and tribal harvests. Declines in populations for several species of fish have led to the restriction of fishing and tribal harvest, as well as recent reductions in deliveries of water for agricultural use.

The Commission's relicensing process provides an opportunity for government agencies, Indian Tribes, stakeholders, and the public to comprehensively address the effects of the Project on the human environment, bring the Project up to current environmental standards, strike a balance between the various competing uses of public resources, and assist the Commission in making a licensing decision that is in the public interest and based on substantial information. The Department believes that actions taken as a result of this relicensing must contribute to long-term basinwide solutions, particularly to address the Project-caused extirpation of the threatened coho salmon and other trust species such as Chinook salmon from all reaches and tributaries upstream of Iron Gate Dam.

On March 1, 2002, the President established the Klamath River Basin Federal Working Group to advise the President on immediate steps and long-term solutions to enhance water quality and quantity and to address other complex issues in the Klamath River Basin. Since the establishment of the Working Group, which is chaired by the Secretary of the Interior, five of the Department's bureaus, the Office of the Solicitor, and the Office of the Secretary have been heavily involved in activities and issues of concern to Klamath River basin communities, including Indian tribes.

The Governors of the States of California and Oregon, the President's Klamath River Working Group, and the U.S. Environmental Protection Agency signed the Klamath River Watershed Coordination Agreement in October 2004. The agreement is intended to focus science-based attention to identify and address the environmental, economic, agricultural, and Tribal trust needs of the Klamath Basin and its communities. It places a priority on the signatories' Klamath Basin activities and on their coordination and communications with one another and with tribal governments, local governments, private groups and individuals, to resolve water quantity, water quality and fish and wildlife resource problems in the basin.

Long-term solutions in the Basin are a priority for the Department, which has committed significant resources to the effort:

- The Department is committed to finding a long-term resolution to the conflict in the Klamath River basin that will provide water to farmers and Tribes while protecting and enhancing the health of fish populations. Recent budgets reflect commitment to funding habitat restoration, removal of fish migration barriers, land acquisition, and the use of water banking.
- The Department will dramatically increase habitat access for endangered sucker species by removing Chiloquin Dam, which impedes their passage to tributary habitat above Upper Klamath Lake. Removing Chiloquin Dam will improve access to more than 70 miles of the Sprague River, providing endangered suckers and other fish substantially more spawning and feeding areas.
- Reclamation has completed fish screening for the A-Canal, the largest water diversion point for the Klamath Irrigation Project, at a cost of $15 million. The fish screens bypass juvenile fish back to Upper Klamath Lake where physical injury and acute mortality for fish passing through the A-Canal pump bypass appears to be nearly negligible.
- Reclamation has also completed construction of a new fish ladder at Link River Dam at the outlet of Upper Klamath Lake to facilitate upstream passage of endangered suckers. Work will continue on screening other canals and laterals to reduce entrainment of endangered suckers.
- At the request of the Secretaries of the Interior and Commerce, the National Academy of Sciences' National Research Council (NRC) issued a final report in October 2003 that identified potential actions for the recovery of the coho salmon and the Lost River and shortnose suckers (National Research Council 2003). This report evaluated the scientific basis of the 2001 biological assessments and biological opinions on the three listed species, and identified potential actions for their recovery (National Research Council 2003). The NRC report is a timely and useful summary of what is known and what remains to be learned regarding the causes of decline and recovery strategies for the three listed species. The NRC report recommends a systematic and coordinated basinwide approach to ecological restoration and management, and urges that new information be collected and used to improve management decisions, including a serious evaluation of the benefits to coho salmon from elimination of Iron Gate Dam.
- Reclamation, in partnership with the Service, BIA, NMFS, the Natural Resource Conservation Service (NRCS), the States of Oregon and California, Klamath basin tribes, and other stakeholders in the basin, is leading an effort to develop a Klamath River Basin Conservation Implementation Program (CIP). The goals of the CIP are: 1) to largely restore the Klamath River ecosystem to achieve recovery of the Lost River and shortnose suckers, and to substantially contribute to the recovery of threatened coho salmon; 2) to contribute to the fulfillment of the Federal government's trust responsibilities to Indian tribes; and 3) to allow continued sustainable operation of existing water management facilities and future water resource improvements for human use in the Klamath Basin. The CIP was modeled after similar programs successfully being used in other river basins, such as the Upper Colorado River basin.

In addition, the Department is engaged on the question of mainstem Klamath River flows in two other forums. First, Reclamation must maintain certain lake elevations and river flows through

Biological Opinions issued by the U.S. Fish and Wildlife Service with respect to elevations in Upper Klamath Lake for ESA listed sucker fish and by the National Marine Fisheries Service with respect to Klamath River flows below Iron Gate Dam for coho salmon. Consistent with these Biological Opinions, Reclamation must also operate the Klamath Reclamation Project--including the water available in Upper Klamath Lake and the release of flows from Link River Dam into the Klamath River—consistent with its tribal trust obligations, contracts for the delivery of water for irrigation within the Reclamation project, and water supply to the Lower Klamath and Tule Lake National Wildlife Refuges.

Second, the State of Oregon is now conducting a water rights adjudication to determine the relative rights to the surface waters of the Klamath Basin in Oregon. The United States has filed claims to protect its interests as part of this adjudication, including specific instream flow claims for the Klamath River from Link River Dam to the Oregon-California border (thus including portions of the Project area at issue in this FERC proceeding) on behalf of the Klamath Tribes and other federal interests. Once the State of Oregon issues a binding decree in the adjudication, all parties with water rights in the Klamath River Basin in Oregon will exercise those rights consistent with that decree.

FERC does not have a role in either process described above. Moreover, the Department's comments, recommendations, terms and conditions, and prescriptions do not ask FERC to take any action or otherwise engage in either of these processes. This FERC proceeding, however, will result in certain conditions being imposed on the licensee in the operation of the FERC-licensed hydroelectric project. The Department is including reservations of its FPA sections 4(e) and 18 authorities to accommodate any necessary license changes resulting from Reclamation's future operational requirements or the adjudication process that will ultimately determine various water rights within the Project area.

The Department looks forward to working with the Applicant and the Commission to ensure that the Project, if relicensed, can contribute to long-term basinwide solutions.

ENERGY POLICY ACT REVIEW PROCESS

The Energy Policy Act of 2005 (EP Act) provides parties to this licensing proceeding the opportunity to request trial-type hearings regarding issues of material fact that support the conditions and prescriptions developed under FPA sections 4(e) (Federal reservations) and 18 (fishway prescriptions). Through this filing, the Department is submitting preliminary mandatory conditions and prescriptions, along with the administrative records for these conditions and prescriptions. The Act also allows parties to propose alternatives to preliminary prescriptions and conditions. Procedures for requesting a trial-type hearing on a factual issue or for proposing alternatives are set forth at 43 C.F.R. Part 45 of the Department's regulations. The Department will file modified conditions and/or prescriptions with the Commission following the completion of any EPAct processes required within 60 days of the close of the comment period on the Commission's draft NEPA document.

TRIBAL TRUST

A unique relationship exists between the Federal government and Indian tribes. The Department acts to ensure the proper discharge of the Federal trust responsibilities to Indian tribes, a responsibility shared by all Federal agencies including the Commission. With respect to interests potentially affected by the FERC-licensed Project, five federally-recognized tribes (Tribes) reside in the Klamath Basin in the geographic area affected by Project operations: the Klamath Tribes of Oregon, the Hoopa Valley Tribe, the Yurok Tribe, the Karuk Tribe of California, and the Resighini Rancheria of California. These Tribes have recognized property interests in the basin, which the United States holds in trust or otherwise tries to enhance for their benefit and which varies with the individual tribe and its associated ethnological and legal history. Among other interests, the Klamath Tribes have treaty-protected fishing, hunting, trapping, and gathering rights, and the Hoopa Valley and Yurok Tribes have federally reserved fishing rights in the Klamath Basin recognized by various court decisions and other Department memoranda. The Tribes' fishing rights entitle them to harvest for subsistence, ceremonial, and commercial purposes.

Restoration of anadromous fish to the Klamath River in and above the Project will help meet not only various statutory requirements but also the Federal Trust Responsibilities to the Basin's Indian Tribes. Basin Tribes hold Federal Reserved fishing rights to take both resident and anadromous fish within their reservation in order to support ceremonial, subsistence, and commercial needs. See, e.g., United States v. Adair, 723 F.2d 1394, 1408-15 (9th Cir. 1984), cert. denied, 467 U.S. 1252; Parravano v. Babbitt, 70 F.3d 539 (9th Cir. 1984), cert. denied 518 U.S. 1016 (1996); Memorandum from John D. Leshy, Solicitor of the Department of the Interior to the Secretary of the Interior (October 4, 1993).

Restoration of anadromous runs in the currently unutilized habitat above the dams would help restore and enhance fish harvests throughout the Basin to the benefit of the Tribes. Restoration and enhancement of fish runs would also benefit commercial, recreational, and subsistence fisheries throughout the Klamath River and off the coasts of Oregon and California.

The Department has strived to meet its Tribal trust responsibilities in all our Project relicensing activities. This includes the responsibilities described in the Department's June 5, 1997, Secretarial Order Regarding American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the ESA (U. S. Department of the Interior 1997). That document defined Tribal trust resources as those natural resources, either on or off Indian lands, retained by, or reserved by or for Indian tribes through treaties, statutes, judicial decisions, and executive orders, which are protected by a fiduciary obligation on the part of the United States. In providing these conditions and recommendations, the Department acts in accordance with its trust responsibilities on behalf of Indian tribes and individuals when Indian trust and treaty resources are involved, as they are here. In particular, on the Klamath River, the Department is committed to improving the access of Tribes to anadromous and resident fish.

COMPREHENSIVE PLANS FOR THE BASIN

The Department reviews hydropower projects in accordance with the goals and objectives of applicable national and regional resource management plans. Restoration of anadromous and resident fish habitat in the Klamath Basin is included in the plans of many agencies and organizations.

Basinwide Plans

1. Klamath River Basin Fishery Resources Restoration Act

In 1986 Congress adopted the Klamath River Basin Fishery Resources Restoration Act (Public Law 99-552, codified as amended at 16 U.S.C. § 460ss *et seq*.) (Klamath Act). This law established a federal-state cooperative called the 'Klamath River Basin Conservation Area Restoration Program' for the rebuilding of the river's fish resources. The Klamath Act also established the Klamath River Basin Fisheries Task Force (Task Force), and directed the Task Force to assist the Secretary of the Interior in the creation and implementation of *"…a 20 year program to restore anadromous fish populations of the [Klamath River Basin] Area to optimum levels and maintain such levels."* The Klamath Act also created the Klamath Fishery Management Council, and directed the Council to make recommendations to federal, state and tribal agencies for the management of ocean and in-river harvesting that affects Klamath and Trinity anadromous fisheries.

2. Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program

A Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program (LRP) and Environmental Impact Statement (EIS) for the river below Iron Gate Dam were completed by the Task Force in 1991 (USDI Klamath River Basin Fisheries Task Force 1991). The LRP generally directs that fishery restoration is to be achieved through fish habitat protection and restoration, from a total watershed perspective, not simply an instream perspective. The LRP was accepted by FERC as a "comprehensive plan" under the Federal Power Act on January 15, 2004. The goals of the LRP are:

"Restore, by the year 2006, the biological productivity of the Klamath River Basin in order to provide viable commercial and recreational ocean fisheries and in-River tribal (subsistence, ceremonial and commercial) and recreational fisheries.

I. Ensure that the Klamath Fishery Management Council devises harvest regulation recommendations that will provide for viable commercial, recreational, and tribal fisheries.
II. Recommend to the Congress, state legislatures, and local governments the actions each must take to protect the fish and fish habitats of the Klamath River Basin.
III. Inform the public about the value of anadromous fish to the Klamath River region and gain their support for the Restoration Program.

IV. Promote cooperative relationships between the lawful users of the Basin's land and water resources and those who are primarily concerned with the implementation of the Restoration Plan and Program."

Specifically, the plan calls for protection of salmon and steelhead habitat from harmful effects of water and power projects in the Klamath Basin in Objective 2.E. Sub-Objectives that pertain to this relicensing include:

- 2.E.1.A Reevaluate the currently available spawning and rearing habitat located above Iron Gate Dam, where needed.
- 2.E.1.B Monitor water quality, including water temperatures, above, within, and below the Copco and Iron Gate reservoirs... to determine the effects of water storage and power plant operations on downstream habitat conditions.
- 2.E.1.C Evaluate the instream flow needs... of each salmon and steelhead run and life stage affected by flows released from Iron Gate Dam.
- 2.E.2 A-C Identify and implement methods to rectify habitat problems identified in #1 above, including the following:
    a. Access above Iron Gate and Copco Dams to the upper Klamath Basin;
    b. Water quality above and below Iron Gate Dam;
    c. Instream flow and habitat below Iron Gate Dam.
- 2.E.3 Promote adequate fish protection requirements in the relicensing conditions for the Iron Gate Hydroelectric Project and other power projects by the FERC.
- 2.E.4 Advocate inclusion and enforcement of effective conditions for salmonid habitat protection on small and large hydroelectric projects and other water storage projects.
- 2.E.7 Require water flows adequate to achieve optimal productivity of the basin.

In a letter dated March 21, 2001, the Task Force stated its goal that the relicensing of the Klamath Hydroelectric Project will "result in the successful restoration of anadromous salmonids to their historical range as well as improvements to habitat of the Klamath River below the Project" (USDI Klamath River Basin Fisheries Task Force 2001).

<u>ESA Recovery Plans</u>

1. Federally Listed Suckers

The Recovery Plan for Lost River and shortnose suckers (USFWS 1993) calls for the improvement of habitat conditions through rehabilitating riparian areas and improving land management practices in the Klamath River watershed, developing and achieving water quality and quantity goals, and improving fish passage, spawning habitat, and other habitat conditions.

2. Bull Trout

The draft Bull Trout Recovery Plan, Klamath River Recovery Unit Chapter (USDI Fish and Wildlife Service 2002) calls for upward trends in quality to be achieved through landscape-level adjustments in land management strategies designed to maintain and/or enhance structural and functional attributes of upslope, riparian, and fluvial systems. Portions of the upper Klamath drainage, including Agency Lake and Sun Creek; portions of Coyote Creek, Long Creek, and Sycan Marsh; and portions of Boulder Creek, Brownsworth Creek, Deming Creek, Dixon Creek,

Leonard Creek, Sheepy Creek, and the North Fork of the Sprague River have been designated as Critical Habitat for Bull Trout (USDI Fish and Wildlife Service 2004a). The designated critical habitat is all above Upper Klamath Lake, and does not intersect with the Project area.

3. Coho Salmon

NOAA Fisheries initiated development of a recovery plan for Southern Oregon Northern California Coast (SONCC) coho in 2001 by convening the SONCC Technical Recovery Team (TRT). The TRT is comprised of scientists from federal, state, tribal, academic, and local agencies/groups. During Phase I of recovery planning, the TRT is focusing on development of delisting goals for the SONCC coho, identifying factors for the decline and factors limiting recovery of the species, identifying early actions that can be taken by co-managers to reduce impacts to the species and habitat, and identifying, monitoring and evaluation needs for the species and habitat conditions. During Phase II of the recovery planning process, NOAA Fisheries and stakeholders will evaluate and build on existing coho conservation programs to develop a plan that will create a "blueprint" to achieve the SONCC coho recovery goals identified by the TRT.

<u>Regional Plans</u>

1. Northwest Forest Plan

The Northwest Forest Plan's Aquatic Conservation Strategy (ACS) provides a framework for restoration and recovery of wild anadromous fish stocks on federal lands in the Pacific Northwest. Central to the ACS is the restoration of habitat and ecosystem health by maintaining and restoring aquatic habitat, restoring habitat connectivity, and maintaining flows sufficient to sustain component elements of aquatic systems. Much of the Klamath River watershed is in BLM or Forest Service ownership. Land management by these agencies adheres to this Plan.

2. Bureau of Land Management Resource Management Plans

    a. Klamath Falls Resource Area, Medford District, and Redding Field Office

The Resource Management Plans for the Klamath Falls Resource Area, Medford District, and Redding Field Office were developed as part of the Northwest Forest Plan and respond to the need for healthy forest ecosystems and habitat to support native species, including protection of riparian areas and waters, as well as the need for a sustainable supply of timber and other forest products necessary to maintain local and regional economies. The Klamath River occurs in the Northwest Forest Plan area and is administered as a riparian reserve. Riparian reserves are designed to maintain and restore aquatic ecosystem functions and together with the Aquatic Conservation Strategy (ACS) of the Northwest Forest Plan provide substantial watershed protection.

Approximately 11 miles of the Upper Klamath River is located within the Klamath Falls Resource Area in Klamath County, Oregon. According to the Klamath Falls Resource Area RMP the riparian reserve for the Klamath River includes "the stream and the area on each side of the stream extending from the edges of the active stream channel to the outer edges of the 100 year floodplain or 320 feet on each side of the river, whichever is greater." As a general rule, management of riparian reserves prohibits or regulates activities that retard or prevent attainment of objectives of the ACS.

b. Cascade Siskiyou National Monument

The Cascade Siskiyou National Monument is located within the Medford District and was established on June 9, 2000. The Monument encompasses portions of the Scotch Creek, Camp Creek, Jenny Creek, and Fall Creek watersheds which flow into Iron Gate Reservoir. The Proposed BLM Resource Management Plan and Final EIS for the Monument includes the following Primary Management Objectives for Riparian Areas:

- Protect and enhance hydrologic function, aquatic connectivity, and water quality;
- Maintain and improve wetland and riparian plant communities and structure; and
- Protect and enhance riparian areas as habitat for terrestrial and aquatic organisms.

Streams with the highest priority for aquatic habitat restoration and protection are located in the Jenny Creek watershed (USDI Bureau of Land Management 2005).

<u>National Plans</u>

1. Fisheries USA

On February 4, 1993, the Commission accepted the Service's recreational fisheries policy entitled "Fisheries USA" as a comprehensive plan pursuant to section 10(a) of the FPA. The policy identifies the Service's commitment to protect the quality and quantity of the Nation's recreational fisheries and to optimize opportunities for people to enjoy these recreational fisheries (Service 1989). The Nation's recreational fisheries are socially and economically significant, and the demand for recreational fishing opportunities is projected to increase. Actions that can be taken to meet this increasing demand include ensuring full consideration of recreational fisheries in water resource projects, restoring or enhancing depleted or declining fisheries, and optimizing productivity of existing fisheries through habitat and water quality improvements.

2. Action Plan for Fisheries Resources and Aquatic Ecosystems

The Action Plan (USDI Fish and Wildlife Service 1994) presents a comprehensive ecosystem- and watershed-based conservation, restoration, and enhancement program focusing on nationally significant fishery resources through scientific management of aquatic communities and wild populations. Interjurisdictional waters and those with National Wildlife Refuges, such as the Klamath River watershed, are covered by the plan. Among the highest priorities to be addressed through the implementation of this Action Plan are the conservation of self-sustaining native fish

populations for the maintenance of productive fisheries in healthy aquatic habitats, developing partnerships, and assuring long term ecosystem health. Among the several components of the Action Plan is the restoration and protection of the quantity and quality of water available for fishery resources and aquatic ecosystem integrity. High priority actions intended to accomplish this component include the establishment, maintenance, and protection of instream flows in important fishery habitats and the recommendation of effective approaches for fish passage for hydroelectric and other water development projects.

3. Conserving America's Fisheries - The Fisheries Program Vision for the Future

This National Strategic Plan (Plan) was developed by the Service in December 2002, in collaboration with the Sport Fishing and Boating Partnership Council, which represents a wide range of fishing and aquatic conservation organizations across the country. The Plan presents a comprehensive ecosystem- and watershed-based conservation, restoration, and enhancement program for fisheries management focusing on the management of aquatic communities, recreationally important fisheries, and native fish populations. The Plan has been "stepped down" to the Pacific Region of the U.S. Fish and Wildlife Service in the form of a "Pacific Region: Fisheries Program Strategic Plan." Both the national and regional strategic plans are implemented through cooperative partnerships with State, regional, local, and Tribal governments, non-governmental organizations, watershed councils, and a variety of businesses and private interests. The Regional Strategic Plan priorities include conserving self-sustaining native fish populations for the maintenance of productive fisheries in healthy aquatic habitats, and maintaining healthy native fish populations through genetic diversity, harvest management, habitat improvements, and judicious use of hatchery stocks. High priority actions intended to restore and protect the quantity and quality of water available for fishery resources and aquatic ecosystem integrity include the establishment, maintenance, and protection of instream flows in important fishery habitats, and the recommendation of effective approaches for fish passage for hydroelectric and other water development projects.

HISTORY AND DESCRIPTION OF THE KLAMATH HYDROELECTRIC PROJECT

1. Location

The Klamath River watershed is located in northern California and southwestern Oregon. It covers approximately 12,000 square miles and extends more than 350 river miles from its headwaters to the Pacific Ocean (National Research Council 2003). More than half the watershed is mountainous, with extensive lowlands found only in southern Oregon in the upper part of the Basin. In California, lowlands occur irregularly, primarily in major tributary streams (U. S. Department of the Interior 1985). The Wood, Williamson, Sprague, and Sycan Rivers are the significant headwater tributaries that flow into Upper Klamath Lake. Water flows from Upper Klamath Lake into Link River, a short river (about 1.2 miles long), and then into Lake Ewauna near Klamath Falls, Oregon. The Klamath River officially begins at the downstream end of Lake Ewauna. Iron Gate Dam, at 190 river miles from the Pacific Ocean, is a commonly recognized dividing point between what is referred to as the upper and lower river basins.

Significant tributaries do not enter the lower Klamath River until the Shasta River joins the Klamath River in California, downstream from Iron Gate Dam. The Scott, Salmon, and Trinity Rivers and a number of creeks enter the Klamath River as it flows through California. The Klamath River enters the Pacific Ocean about 15 miles south of Crescent City, California.

Today, the watershed includes about 96,000 acres of tribal trust lands, four million acres of private lands, and six million acres of public lands. The Klamath basin includes six National Wildlife Refuges (Bear Valley, Clear Lake, Klamath Marsh, Lower Klamath, Tule Lake, and Upper Klamath), a National Park (Crater Lake), five National Forests (Fremont-Winema, Klamath, Shasta-Trinity, Modoc, and Six Rivers), two National Monuments (Lava Beds and Cascade Siskiyou), three Wild and Scenic River designations (Klamath River from J.C. Boyle Powerhouse to the California-Oregon border, North Fork Sprague River, and the Sycan River), and other public lands.

2. Klamath Reclamation Project

The Klamath Reclamation Project (Reclamation Project, or Irrigation Project) is located in the Upper Klamath River and the Lost River Basins in southern Oregon and northern California. The Reclamation Project provides irrigation water to agricultural lands within the Project and delivers water to two National Wildlife Refuges that are wholly located within the Project (Lower Klamath and Tule Lake National Wildlife Refuges). The Klamath Reclamation Project was authorized pursuant to the Reclamation Act of 1902 and construction began in 1905. As part of the Reclamation Project development, certain lakes were drained and opened for homesteads, diversion structures, canals and drains were constructed, and project storage was provided. In 1908, the first National Wildlife Refuge was established in the area and was overlaid on the Reclamation Project. Other refuges were established within and adjacent to the Reclamation Project in 1911 (Clear Lake) and in 1928 (Tule Lake and Upper Klamath Lake).

Link River Dam, operated by the Applicant under contract with Reclamation, regulates flow from Upper Klamath Lake (UKL) into Link River and thus into the Klamath River. Water diverted from UKL provides the majority of the irrigation supplies for the Klamath Irrigation Project lands. Mean net inflow into the lake is 1.2 million acre-feet per year. The lake has a total storage capacity of about 612,000 acre-feet but a maximum operational capacity of about 486,000 acre-feet from elevations 4143.3 feet to 4137.1 feet (USDI Bureau of Reclamation 2000). Reclamation currently operates the irrigation project pursuant to two Biological Opinions issued under the Endangered Species Act (ESA). The Biological Opinions require Reclamation to release water in a way that maintains minimum levels in Upper Klamath Lake and specified flows in the Klamath River below Iron Gate Dam. Reclamation issues annual operations plans based on a forecast of available supply, generally as of April 1st of each year. The plan includes a description of the Biological Opinion Requirements for Upper Klamath Lake and the Klamath River and estimated supplies of water for agriculture and refuges within the Reclamation Project. These values are modified as necessary based on the actual hydrology for that year.

3. Klamath Hydroelectric Project

The Klamath Hydroelectric Project is located on the Klamath River in Klamath County, Oregon; and Siskiyou County, California (Figure 1). The Project consists of five mainstem dams (four of which supply powerhouses), two powerhouses at the federal Link River Dam, and one tributary facility. The dams are small to medium size, ranging in height from 25 to 173 feet in height, and impound small to medium sized, narrow reservoirs. The segment of the Klamath River between Link River Dam and Iron Gate Dam consists of about 24 miles of river reaches and about 36 miles of reservoirs, as follows:

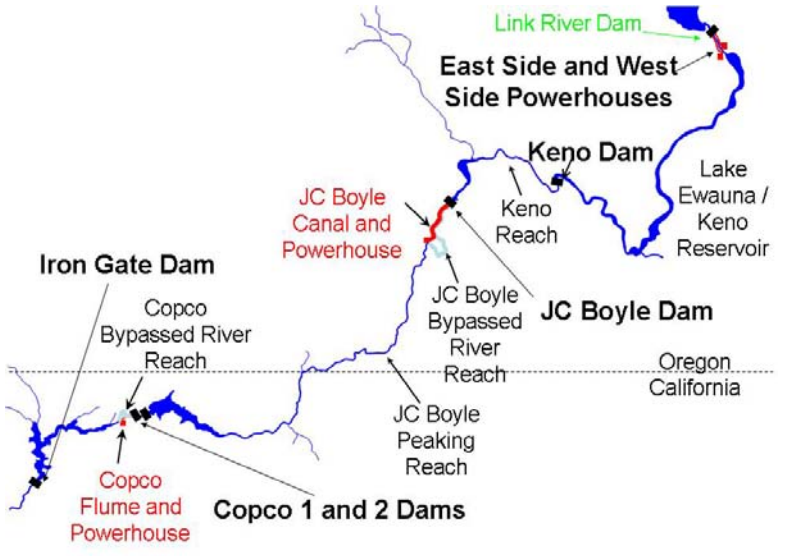


Figure 1. Project Location

- At Reclamation's Link River Dam, at the lower end of Upper Klamath Lake, the Eastside and Westside Powerhouses receive water diverted into canals on each side of the river. The Link River flows into Lake Ewauna, which is the upper end of an impounded reach of the Klamath River that is also known as Keno Reservoir, controlled by Keno Dam.
- Keno Dam is at River Mile (RM) 233, approximately 20 miles downstream from Link River Dam. Below Keno Dam, the 4.7-mile long Keno Reach flows into J.C. Boyle Reservoir (also known as Topsy Reservoir), created by J.C. Boyle Dam.
- J.C. Boyle Dam is at RM 224.7. Here most of the flow is diverted out of the river through a canal around the four-mile J.C. Boyle Bypassed River Reach. The canal extends to the J.C. Boyle Powerhouse at RM 220.4. Below the powerhouse, the 17-mile J.C. Boyle Peaking Reach of the Klamath River receives a daily peaking regime.
- Near RM 209, the river crosses into California, and enters Copco Reservoir near RM 204. Copco Reservoir is impounded by Copco 1 Dam at RM 198.7, where flow is diverted into the adjacent Copco 1 Powerhouse. About one-half mile below this powerhouse, Copco 2 Dam diverts almost the entire flow from Copco 2 Reservoir into a penstock around the 1.4-mile Copco Bypassed River Reach to Copco 2 Powerhouse at RM 196.8.
- Below Copco 2 Powerhouse, the river flows into Iron Gate Reservoir, impounded by Iron Gate Dam at RM 190. This is the furthest downstream of the Project facilities. Here the flow passes through the Iron Gate Powerhouse, and then the Klamath River continues for 190 miles to the Pacific Ocean.
- The Fall Creek development is the smallest in terms of generation, the oldest, and the only development not on the mainstem Klamath River. Flow from Spring Creek (in the Jenny Creek watershed) is diverted into Fall Creek in Oregon, and these waters flow

through the Fall Creek Powerhouse about one mile above Fall Creek's juncture with the upper end of Iron Gate Reservoir.

4. Proposed Klamath Hydroelectric Project Boundary

The proposed Project boundary included in the FLA would reduce the Project footprint and decrease the amount of United States-owned land within the Project boundary. The proposed boundary would affect resources administered by BLM and Reclamation. For BLM the reduction would be from approximately 219 acres in the current license to 156 acres in the proposed license. The types of facilities that would be removed from the Project include a mainstem dam, roads, trails, campgrounds, boat launch and take out sites, dispersed camping sites and day-use areas. The Department has many concerns about the proposed boundary changes including the exclusion of:

a) Keno Dam;
b) Project roads and facilities operations and maintenance;
c) the JC Boyle Bypassed River Reach and the J.C. Boyle emergency spillway; and
d) Topsy campground.

a) Keno Dam

PacifiCorp has proposed to exclude Keno Dam from the boundary of the Project. The Department opposes this proposed exclusion, as PacifiCorp's Keno development is part of a complete unit of hydroelectric development that benefits from the release of water from Reclamation's Link River Dam and return flow from the Reclamation Project, and it is integral to flows necessary for power generation below Keno Dam. Keno regulates water for power production at JC Boyle Powerplant, and moderates the impacts of peaking at the East Side Powerplant, as seen in the graphs from 2005 water deliveries and power production below (Fig. 2, 3, and 4). The changes in flows at Keno Dam depicted here are strictly for power production, not to meet the needs of Reclamation downstream. Therefore, the Commission should continue to include Keno Dam in the Project boundary.

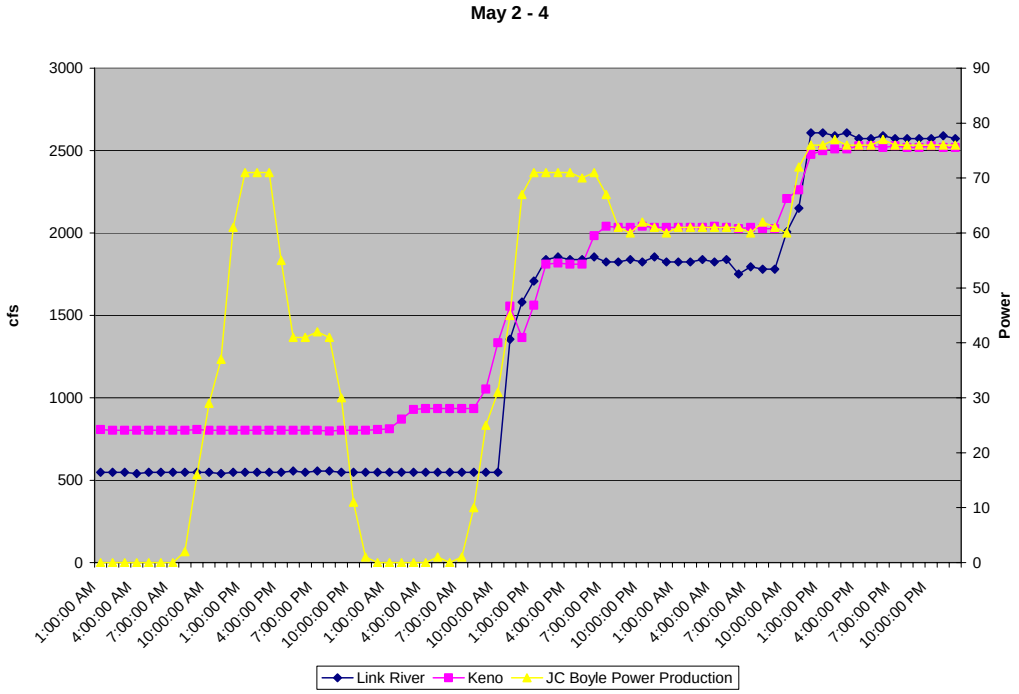


Figure 2: Keno Operations to Benefit Hydropower, May 2-4, 2005

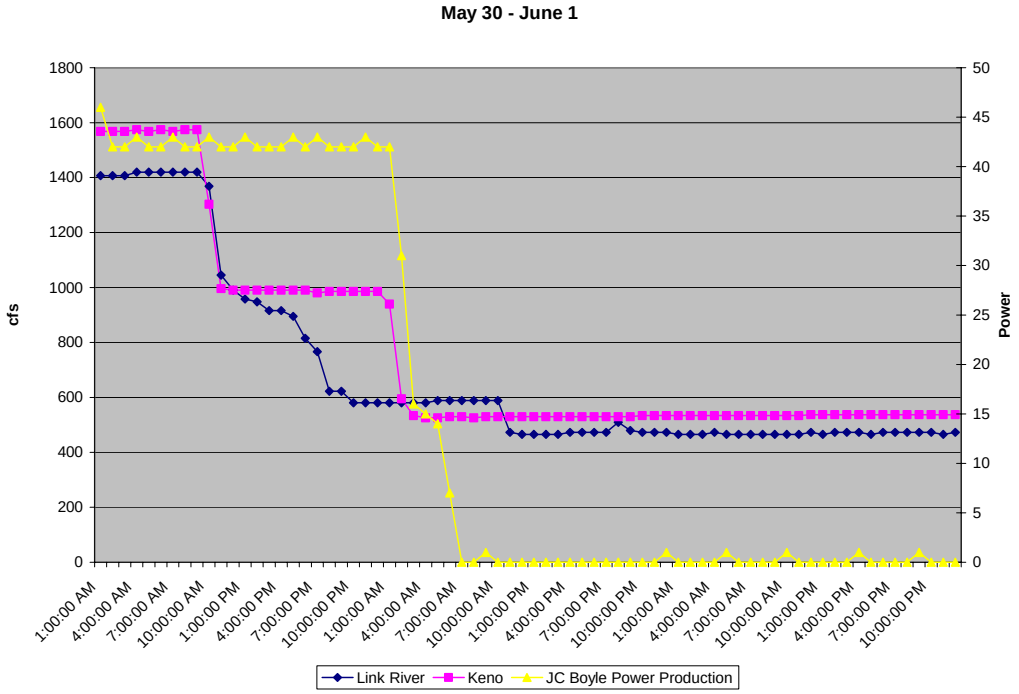


Figure 3: Keno Operations to Benefit Hydropower, May 30-June 1, 2005

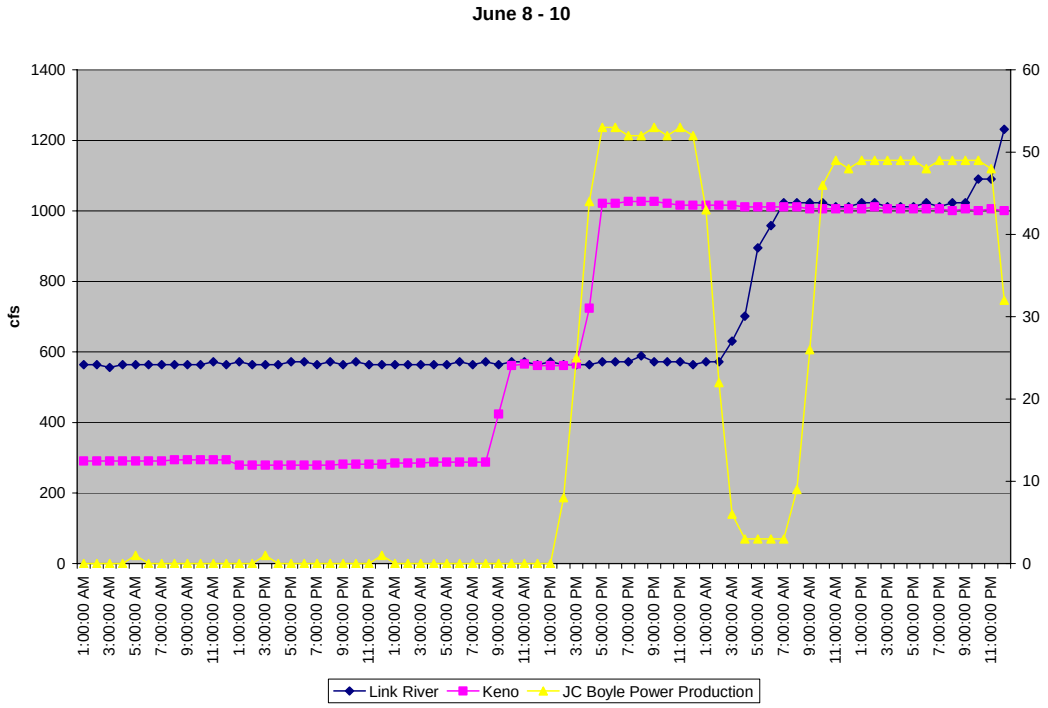


Figure 4: Keno Operations to Benefit Hydropower, June 8-9, 2005

Should the Commission decide not to allow decommissioning of the East Side and West Side Powerhouses, there would be still more evidence that Keno Dam services Project purposes. A representative of PacifiCorp testified in the Oregon PUC hearing that there were times when PacifiCorp used its flexibility to manage Link River Dam.[1] Large daily fluctuations can be directly attributed to the operation of the East Side Powerplant downstream of Link River Dam for peaking operations. A representative peaking operation is evident in gage data from August 3-5, 2005.

The Federal Power Commission found the original Keno Dam to be jurisdictional in 1960. The existing Keno Dam was licensed to be constructed with no generating facilities in 1965. The existing Keno Dam was constructed partially on federal lands subject to the Commission's express provision that the licensee enter into a formal agreement with Reclamation for the purpose of regulating the level of Lake Ewauna between Keno Dam and Link River.[2]

[1] Transcript of Oregon Public Utilities Commission hearing for Rate Case UE 170, dated February 16, 2006

[2] Contract between the United States of America and Pacific Power & Light Company, Contract No. 14-06-200-3579A, dated January 4, 1968.

The Department's position that Keno Dam should remain a part of any new license issued for the Project and that the use of Link River Dam is critical to the Project is supported by the FPA.[3] Section 3(11) of the FPA defines "project" to include ditches, dams, reservoirs, lands or interest in lands the use and occupancy of which are necessary or appropriate in the maintenance and operation of the proposed power development. PacifiCorp admits in the FLA that the operation of Keno Dam serves Project purposes: "In operating Keno Dam, PacifiCorp can more effectively schedule and plan load following operations at the J.C. Boyle powerhouse." (FLA, Exhibit B, Page 8-2). Moreover, PacifiCorp recognizes that Keno operates as a re-regulation facility (Comments of PacifiCorp Regarding Proposed Readjustment of Annual Charges, Feb 21, 2006 at 4, 13.)

Keno Dam is used by the Applicant as an upstream regulating reservoir to provide inflow to its downstream power production facilities. Reclamation currently has an agreement with PacifiCorp that PacifiCorp operate Keno Dam to hold Lake Ewauna / Keno Reservoir within a variance of only 0.5 foot. Because of its large surface area, approximately 5,900 acre feet of water storage are provided by the 0.5 foot variance in reservoir elevation, which equates to approximately 30 days of a flow of 100 cfs. The practice of using reservoir storage to follow short-term peaks in power demand – known as load following – results in rapid and significant changes in river flow and reservoir elevation. The larger storage behind Keno Dam (which is more than at J.C. Boyle Reservoir), with a 0.5 foot daily reservoir fluctuation, has given PacifiCorp more options to maximize peaking at the downstream J.C. Boyle and Copco peaking facilities. PacifiCorp's Keno Reservoir storage is being utilized to provide flow fluctuations in support of hydroelectric peaking operations at J.C. Boyle Dam, downstream.

PacifiCorp states that flows below Keno Dam, in the Keno Reach, are dependent entirely on what is delivered to the Link River to Keno reach by Reclamation and other irrigation operations and that PacifiCorp has no discretion or control over flows in the Keno Reach. However, there is great discretion on when those accumulated flows are delivered to the reach below Keno Dam, as can be seen in the previous graphs. This claimed lack of control is also contradicted by the fact that 80 percent of the inflow to Lake Ewauna is from Link River while approximately 20 percent is from agricultural returns with a very small amount from municipal and industrial inputs (PacifiCorp 2004, FLA WTR). PacifiCorp can and does alter flows in the Link River and Keno Reach for hydroelectric Project purposes, including maintenance actions, and to maximize peaking at downstream Project peaking facilities.

[3] As to Keno Dam, PacifiCorp is still under contract to Reclamation as part of Project No. 2082 to operate Keno Dam. See Article 55 of PacifiCorp's FERC license issued in Order dated 11/29/1965, 34 F.P.C. 1387 (requiring "formal agreement" or the Commission will prescribe terms for regulation of Lake Ewauna). The 1968 contract between PacifiCorp and Reclamation for Keno Dam references the FPC order, Article 55. See also Order dated 6/20/1969, 41 F.P.C. 824. Even if PacifiCorp "excludes" Keno Dam from its Project, PacifiCorp is still required to operate Keno Dam under its contract with Reclamation. Thus, PacifiCorp is contractually required to operate and maintain Keno Dam as long as PacifiCorp operates the Project. Thus, Keno Dam must remain a part of the Project.

The relationship of Link River and Keno Dams to the Project confirms that Keno Dam is necessary to the operation of the Project. The Link River Dam is a Reclamation facility currently operated by PacifiCorp under contract with Reclamation. Water released from Upper Klamath Lake via Link River Dam, continues downstream through the power project. This water is essential for the operation of the Project. In addition to the water released from Link River Dam that is delivered through the power project, Keno Dam captures and re-regulates additional surplus water from the Klamath Reclamation Project that is delivered to the river through pumping at three large federal pumping plants. This pumped surplus water is accrued through recirculation of drainage water that is pumped into the system by private and water district pumps, in addition to the federal pumping. In the period 1997 through 2004, a period significantly drier than the period 1956 through 1996 (an average of 291,180 acre-feet less annual inflow into Upper Klamath Lake), deliveries of that available water actually increased by 5.5% of the average annual inflow, providing relatively more water for generation by PacifiCorp that was provided in the previous period, as shown in the Table 1.

Table 1. Klamath River Flow Measured at Keno Oregon (All quantities are in thousands of acre-feet)

Wtr Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	UKL Inflow	% of UKL Inflow Past Keno
Avg 56-96	90.8	113.4	143.2	145.4	138.9	191.2	148.2	100.1	46.7	32.0	46.3	65.3	1261.6	1421.2	88.8%
Avg 97-04	61.8	67.7	90.5	149.8	141.8	163.7	139.1	117.9	71.3	38.6	39.2	44.4	1065.8	1130.0	94.3%
Avg Diff	29.0	45.6	52.7	-4.5	-2.9	27.5	9.2	-17.8	-24.6	-6.6	7.1	20.9	195.8	291.2	

If FERC concludes that Keno is not part of the Project, it must commence a decommissioning proceeding, subject to FERC regulations and its Decommissioning Policy.[4] The manner in which the Keno dam is to be operated must be described, and the effects of those operations must be analyzed, including the contractual obligations PacifiCorp has to Reclamation to operate Keno Dam.

[4] 69 FERC ¶ 61,336 (1994): "In those instances where it has been determined that a project will no longer be licensed, because the licensee either decides not to seek a new license, rejects the license issued, or is denied a new license, the project must be decommissioned."… "The Commission is of the opinion that implicit in the section 6 surrender provision is the view that a licensee ought not to be able simply to walk away from a Commission-licensed project without any Commission consideration of the various public interests that might be implicated by that step. Rather, the Commission should be able to take appropriate steps that will satisfactorily protect the public interests involved."…"Absent specific authority by the Federal agency involved for continued use of Federal lands at the termination of Commission licensing, it is eminently reasonable that the licensee must restore the lands to that agency's satisfaction, at the licensee's expense." See 18 CFR Sec 6.2 (on surrender a licensee is required to restore lands of the United States to a condition satisfactory to the Department administering those lands).

b) Roads and Facilities

Impacts to BLM-administered resources from construction and operation of facilities include erosion, impacts to hydrologic function, the spread of noxious weeds, fragmentation of wildlife habitat, and increased mortality of wildlife. Per 18CFR § 4.41(h)(2):

"The boundary must enclose only those lands necessary for operation and maintenance of the project and for other project purposes, such as recreation, shoreline control, or protection of the environmental resources."

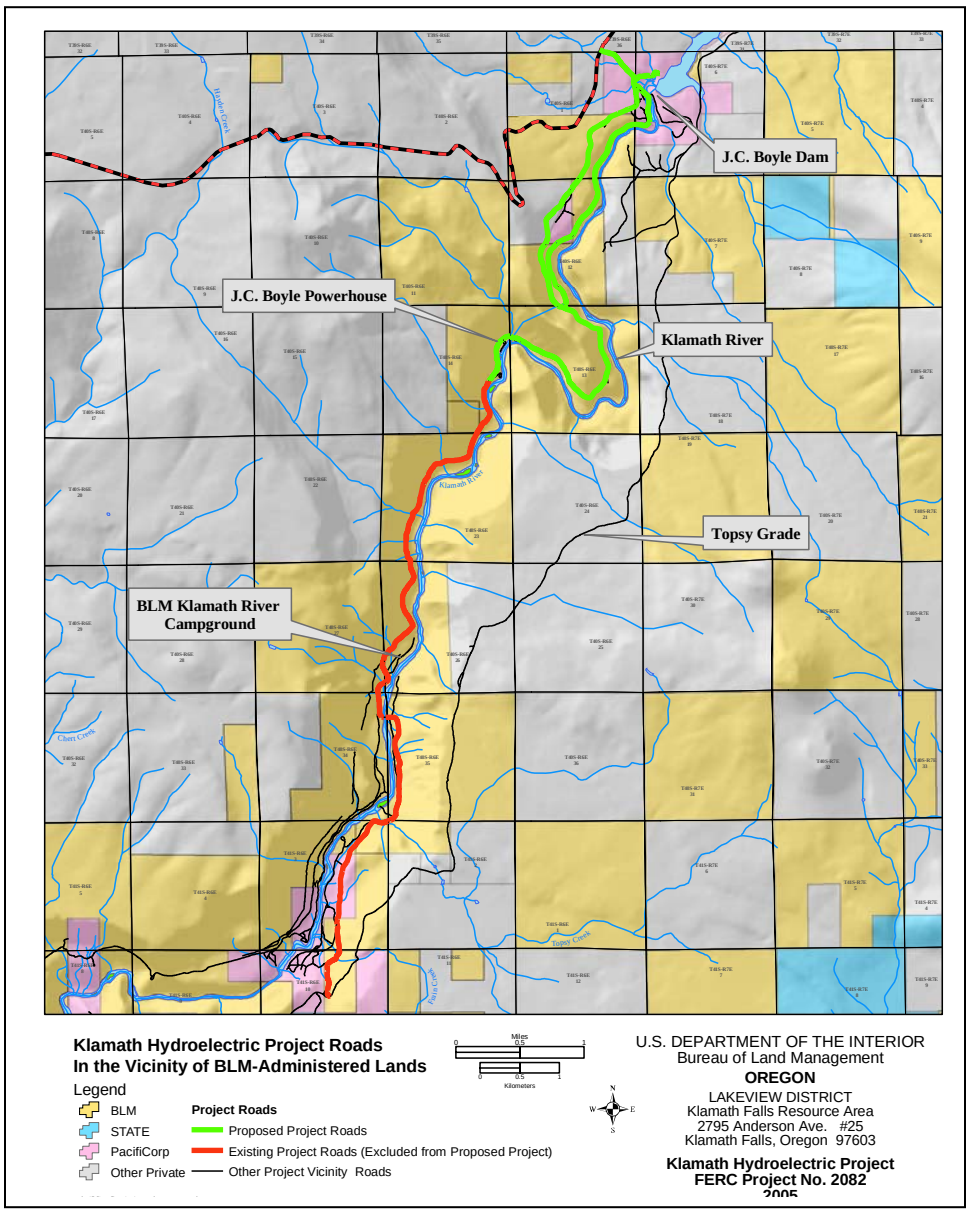
The proposed boundary adjustment excludes roads that were constructed and are currently utilized by PacifiCorp for Project operation and maintenance. Some of these roads have subsequently been used to access recreation facilities maintained by BLM for recreation uses that were enhanced as a function of the Project. Per 18 CFR § 4.41 (h) (2) (ii):

"The boundary around linear (*continuous*) project features such as access roads, transmission lines, and conduits may be described by specified distances from center lines or offset lines of survey. The width of such corridors must not exceed 200 feet unless good cause is shown for a greater width."

The proposed Project boundary excludes 5.6 miles of the Powerhouse Road (Figure 5, Klamath Hydroelectric Project Roads Map). The southern portion of the Powerhouse road between the Spring Island boat launch and the junction with Topsy Grade should be included in the new license for the following reasons:

- This Powerhouse road is adjacent to the Klamath River. The entire length of this road was withdrawn in 1959 for FERC Power Project #2082, Klamath Hydroelectric Project.
- This road continues to provide needed access for the operation and maintenance of PacifiCorp's transmission lines covered by 1970 and 1980 Rights-of-Ways.
- Regular maintenance of this road is required to prevent resource degradation and provide access to recreation sites associated with the Project.

Figure 5. Klamath Hydroelectric Project Roads



c) J.C. Boyle Bypassed River Reach

The J.C. Boyle Bypassed River Reach of the Klamath River (Bypassed Reach) is necessary for the operation of the Project. Per 18CFR § 4.41(h)(2):

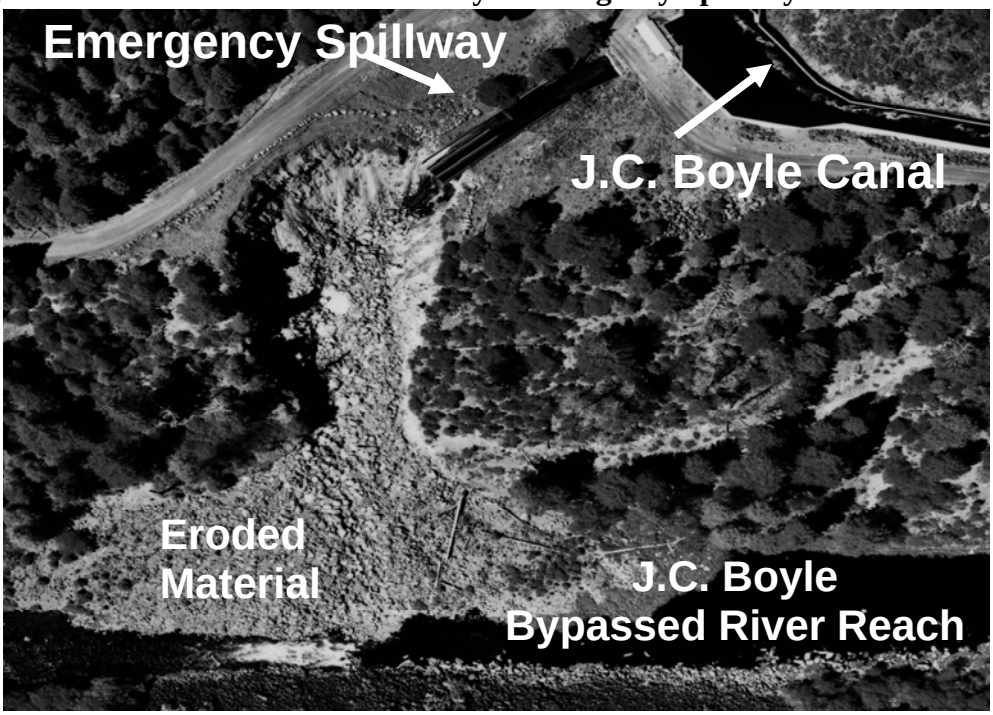
"The boundary must enclose only those lands necessary for operation and maintenance of the project and for other project purposes, such as recreation, shoreline control, or protection of the environmental resources."

The J.C. Boyle Bypass Canal (Canal) has direct impacts on the Bypassed River Reach through at least two mechanisms: the J.C. Boyle Canal Emergency Spillway (Emergency Spillway) and breach of the Canal. These impacts make it necessary for PacifiCorp to manage the Bypassed River Reach for bank and floodplain stability and to reduce channel constriction. Both the Canal and Emergency Spillway have eroded hillslope material into the Bypassed Reach during the course of the current license.

Emergency Spillway: The proposed boundary excludes the area below the Emergency Spillway located near the downstream end of the Canal. Project operations have caused overflow from the spillway to surge onto steep, unprotected slopes and created hillslope erosion which has entered the J.C. Boyle Bypassed River Reach. The attached aerial photograph shows the extent of hillslope erosion as of August 6, 2001 (Figure 6). BLM estimates that over 80,000 cubic yards of material has been eroded from the hillside and a substantial portion of that material has entered the Bypassed River Reach. This equates to an average of nearly 2,000 cubic yards per year. Although modifications have been proposed to prevent recurring overflow of the J.C. Boyle Canal, the existing resource degradation is a direct result of PacifiCorp's operation of the facility.

The deposition of the eroded hillslope material below and downstream of the Emergency Spillway has diverted the direction of the water flow toward the opposite bank causing bank erosion. The hillslope erosion has also added large amounts of sediment that have been deposited in the middle of the channel. Consequently, use of the Emergency Spillway during the course of Project operations has had direct effects on aquatic and riparian habitat.

Figure 6. Erosion from use of J. C. Boyle Emergency Spillway



J.C. Boyle Bypass Canal Failure: In December of 2005,a rockslide damaged the J. C. Boyle Bypass Canal (Canal). The rockslide originated above the Canal and was likely the result of heavy precipitation and freeze-and-thaw conditions. Debris and a large rock traveled downslope creating a hole in the Canal. Water flowed from the hole and eroded the lower Canal road fill and adjacent hillslope depositing the material on the floodplain and in the Bypassed River Reach. Consequently, the Canal had direct impacts on the J.C. Boyle Bypassed River Reach when this breach in the Canal caused water to surge onto steep, unprotected slopes and created hillslope erosion contributing substantial amounts of sediment (approximately 75,000 to 100,000 cubic yards) to the Bypassed Reach (Figure 7).

In response to this event, PacifiCorp proposed and implemented emergency repair and mitigation in consideration of the BLM resources. The BLM and PacifiCorp evaluation of this site determined that the rock slide, subsequent canal leakage and hillslope erosion required remedial action to mitigate and prevent further damage to BLM administered resources. Mitigation included excavation of eroded material on the alluvial fan, surface stabilization measures (seeding, mulching) and removal of eroded material on floodplain. PacifiCorp plans to begin follow-up actions at the site in the spring of 2006 (PacifiCorp letter to BLM Field Manager, Klamath Falls Resource Area, dated February 28, 2006).

The potential for Canal failure due to a breach caused by a rockslide will continue to be present due to the steepness of the hillslope and natural climate driven processes such as heavy precipitation and freeze-and-thaw of the hillslope materials.

Figure 7: Erosion from December 2005 J.C. Boyle Canal Breach

The J.C. Boyle Bypassed River Reach should be included as part of the Project boundary. The Bypassed Reach will continue to be necessary for operation and maintenance of the Project under the new license. The J.C. Boyle power canal and the Emergency Spillway are both located upslope from the Bypassed River Reach. Project related operations occur in the Bypassed River Reach whenever there is a canal failure, when the emergency spillway is used or when spill occurs. The Bypassed River Reach lies between two of PacifiCorp's facilities and is affected by the diversion of water essential for Project operations. The Project, as proposed in the FLA, includes enhancement flows and ramping rates for the reach to mitigate impacts on fisheries. In addition, under the BLM's preliminary conditions, the Licensee will perform a number or ongoing activities in the Bypassed River Reach, including gravel augmentation and evaluation and monitoring activities. Therefore, the J.C. Boyle Bypassed River Reach should be included in the Project boundary since it is used during Project operations of the J.C. Boyle Canal and the Emergency Spillway; and is necessary for the protection of the environmental resources.

d. Topsy Campground

The Topsy Campground is located on J.C. Boyle Reservoir within Powersite Withdrawal #258 authorized by Executive Order #6910, and is included in the license for Project No. 2082 (Commission letter to BLM State Director, Oregon, dated March 1, 1963). The proposed boundary change would exclude the Topsy Campground. The Topsy Campground is the only developed and staffed camping facility on the J.C. Boyle Reservoir. Demand for camping at Topsy Campground is high on most weekends during summer months; however, the number of campsites (16), group sites, and improved day-use sites are limited.

The Topsy Campground was established due to the creation of the J.C. Boyle Reservoir, and should be included in the Project boundary as part of Project-related public recreation. Per 18 CFR § 4.41 (h) (2) (iii) (B):

"The boundary must enclose only those lands that are necessary for safe and efficient operation and maintenance of the project or for other specified project purposes, such as public recreation or protection of environmental resources."

RESOURCES AFFECTED BY THE PROJECT

This section summarizes information on the presence and status of several high priority fish and wildlife species within and near the Project area. More detail on these and other species is found in the discussion of impacts within the section 18 prescriptions and the section 10 recommendations.

AQUATIC RESOURCES

A. Threatened and Endangered Species

1. Lost River and Shortnose Suckers

The Lost River sucker and shortnose sucker are large, long-lived suckers endemic to the upper Klamath Basin of Oregon and California upstream of Keno. Both species are typically lake-dwelling for most of the year, but migrate to tributaries or shoreline springs to spawn during spring months (Scoppettone and Vinyard 1991). Once extremely abundant and important for subsistence by the Klamath Tribes, both species have experienced severe population declines in the upper basin and were federally listed as endangered in 1988 (USDI Fish and Wildlife Service 1988). Historically, Lost River and shortnose suckers passing downstream past the current site of Keno Dam were probably lost to the population, because suitable habitat did not exist downstream and they are not capable of swimming upstream in high gradient currents.

The creation of reservoirs at the four lower Klamath River hydroelectric facilities (J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate) provided a minor expansion of the range of these two sucker species (Buettner and Scoppettone 1991; Moyle 2002). Apparently suckers pass downstream from UKL through Link River and Keno Reservoir, and those that survive passage through the hydro dams may be retained in the Project reservoirs (National Research Council 2003). The reservoirs do not provide habitat for sucker spawning, and spawning has not been documented in the flowing reaches immediately upstream of Keno, J.C. Boyle, and Iron Gate reservoirs (Desjardins and Markle 2000; USDI Fish and Wildlife Service 2001a). Some shortnose sucker spawning occurs in the Klamath River above Copco Reservoir, but larval and juvenile survival appears low (Beak Consultants Inc. 1988). Several age classes exist in J.C. Boyle Reservoir, but it is believed that all of these fish arrived from upstream.

Upstream sucker passage is blocked at Iron Gate, Copco 1, and Copco 2 dams. Upstream passage facilities at J.C. Boyle and Keno dams are ineffective or do not comply with criteria for sucker passage (USDI Fish and Wildlife Service 2005). Reclamation completed a new fish ladder on Link River Dam in December 2004 designed for sucker passage.

Sucker populations in the Project reservoirs generally do not have a high potential for contribution to recovery because they are not part of the original habitat complex of the suckers, and the reservoirs probably are unsuitable for completion of life cycles by the suckers (National Research Council 2003). However, maintenance of adults in these locations does provide some insurance against loss of other subpopulations. As such, Service conditions and recommendations are generally limited to minimization of take in the facilities in the upper portion of the Project, and the provision of capacity to capture suckers below Keno Dam for possible use in recovery actions elsewhere.

2. Bull Trout

Bull trout once ranged widely in the Upper Klamath Basin, with stream-resident fish and juveniles in the headwaters, and large fluvial fish in the rivers and adfluvial fish in Upper Klamath Lake (Light et al. 1996). Klamath River bull trout were listed under the ESA as a distinct population segment in 1998 (USDI Fish and Wildlife Service 1998) because they are physically isolated from other bull trout by the Pacific Ocean and several small mountain ranges in central Oregon. Currently, bull trout are found in three core areas and nine currently identified local populations in the small headwater streams above Upper Klamath Lake well above the Project area. Water temperatures above 15°C are believed to limit their distribution (Rieman and McIntyre 1995). Because of this limitation, bull trout are unlikely to occur in the Klamath River below Upper Klamath Lake and are not directly affected by the Project. However, return of anadromous fish to streams occupied by bull trout would provide greatly increased forage resources for this species.

3. Coho Salmon

The historic distribution of coho salmon in North America included coastal streams from Alaska to central California (Moyle 2002; Weitkamp et al. 1995). Historically, coho occurred in the Klamath River as far up as Spencer Creek, but there is no evidence of occurrence above Keno (Hamilton et al. 2005) Presently, coho are known to spawn in several tributaries below Iron Gate Dam, including Bogus Creek and the Shasta and Scott Rivers. Limited information exists regarding coho numbers, because counts are typically only made incidentally to determining fall Chinook salmon escapement. Also, most counting weirs are removed prior to high winter flows and therefore counting efforts may not include a portion of the coho salmon migration.

The SONCC coho salmon Evolutionarily Significant Unit (ESU) was originally listed as threatened under the ESA on May 6, 1997 (National Marine Fisheries Service 1997). In June, 2005, the species was again listed following a review. Coho salmon in California were officially added to the State's threatened and endangered species list effective March 30, 2005.

In contrast to the life history patterns of other anadromous salmonids, coho salmon in California generally exhibit a relatively simple 3-year life cycle. Coho begin the freshwater migration from the ocean to their natal streams after heavy late-fall or winter rains breach the sand bars at the mouths of coastal streams ((Sandercock 1991) in (Groot and Margolis 1991)). Migration continues to March, generally peaking in December and January, with spawning occurring shortly after returning to the spawning ground (Shapovalov and Taft 1954). Water temperatures for good survival and growth of juvenile coho salmon range from 10-15°C (Bell 1986). (Shapovalov and Taft 1954). Coho require clear, well-oxygenated water and low temperatures. Preferred temperatures are 12-14°C, although juveniles can under some conditions live at 18-29°C for short periods (McCullough 1999 and Boyle 2002 in (National Research Council 2003)).

If suitable habitat is available, coho juveniles spend their first summer in natal streams. Outmigration of yearlings occurs in the second spring, but first-year coho fry are observed along with coho yearlings in the mainstem Klamath River during trapping of outmigrant Chinook salmon during spring and summer months (Shaw et al. 1997).

B. Resident Species

1. Redband Trout

Redband trout are a unique resident rainbow trout whose ancestors entered the upper Klamath Basin when it was connected to the Columbia Basin via the Snake River (Behnke 1992). Coastal rainbow trout (steelhead) later entered the Upper Basin, but the redband trout derived from the Columbia Basin maintained its identity and is recognizable by its morphology and color. Redband trout can survive at higher temperatures than most other western trout. Native stocks of redband trout in the Klamath watershed have also evolved resistance to an endemic protozoa disease, *Ceratomyxa shasta*, which is highly lethal to nonnative trout (Oregon Department of Fish and Wildlife 1997). The Oregon Basin redband trout, which includes the Klamath Basin populations, is listed as a state sensitive species (Oregon Department of Fish and Wildlife 1997).

Redband trout that rear in Upper Klamath Lake and the Klamath River migrate to tributaries to spawn in good quality flowing water, with appropriate depth and velocity, over a gravel substrate in which fish dig redds and deposit their eggs. The primary spawning streams within the Project are Spencer Creek and Shovel Creek.

Adult redband trout in Upper Klamath Lake and the Klamath River can reach 18-28 inches in fork length, and are a prized game species. Restrictive fishing regulations are in place in both Oregon and California. The whole river is restricted to the use of barbless flies and lures only.

Prior to construction of J.C. Boyle Dam in the late 1950s, the Klamath River wild trout population was noted for its abundance and large fish. Trout migrated freely through all reaches and many spawned in Spencer Creek, a principal tributary to the Klamath River. Redband also migrated upstream to the Williamson-Sprague River systems above Upper Klamath Lake (Fortune et al. 1966). A fish ladder constructed at J.C. Boyle Dam was intended to provide for this passage. However, from 1961 to 1991, the number of fish using the ladder declined by 94 percent, and the average size ascending the ladder diminished from twelve to 7 inches (Hanel and Gerlach 1964; Hemmingsen 1997).

The Project directly impacts redband trout survival through entrainment and stranding during down-ramping and indirectly affects their habitat through changes in hydrology, geomorphology, water quality, and riparian resources. Many of these impacts are discussed in the following sections on the J.C. Boyle peaking reach, bypassed river reach, and dam.

C. Anadromous Fish Species

1. Chinook Salmon

Chinook salmon support a wide variety of valuable commercial, recreational, and Tribal fisheries in California, Oregon, Washington, and Alaska. Currently they spawn in suitable rivers from the Sacramento-San Joaquin river system northward through British Columbia and Alaska, as well in northeast Asia. The National Research Council (National Research Council 1996) reported that Pacific salmon have disappeared from about 40 percent of their historical breeding ranges in Washington, Oregon, Idaho, and California, and that many of the remaining populations are severely depressed.

Historical records indicate that Chinook salmon were distributed throughout the Klamath River Basin, including above the current site of Iron Gate Dam (Hamilton et al. 2005). Chinook salmon historically spawned in the Williamson and Sprague Rivers above Upper Klamath Lake (Fortune et al. 1966; Lane and Lane Associates 1981), but quantitative assessments of anadromous fish distribution are lacking. Major Tribal harvest stations were located well upstream in the Sprague River, and salmon spawning was reported in the North and South Forks of the Sprague River.

Chinook salmon exhibit many life-history strategies, including variation in age at seaward migration, variation in length of freshwater and estuary residence, variation in ocean distribution and migration patterns, and variation in age and season of spawning migration (Healey 1991 in Groot and Margolis 1991). Snyder (1931) reported that spawning Chinook salmon appeared to enter the Klamath River at all seasons, with peak abundances occurring in the spring and the mid-summer to early fall periods. Both spring and fall run Chinook spawned in areas above the current location of the Project, but were cut off from perhaps 40 percent of the available habitat by completion of Copco I Dam in 1918.

The spring and fall runs are the two primary runs known in the Klamath system. Although spring-run Chinook were the dominant run historically (Gatschet 1890; Spier 1930), this run has now been reduced to remnant status, with only a few hundred fish spawning in the wild. The only substantial spring run remaining in the Klamath watershed spawns at Lewiston Hatchery on the Trinity River. In the wild, adult spring run fish hold in deep cool pools during the summer before spawning, and juveniles may also over-summer in riverine habitat. This habitat type has been substantially reduced by human activity in the 19th and 20th centuries (National Research Council 2003).

Fall-run Chinook are now the predominant Chinook run in the basin. This run is confined to the Klamath River and tributaries downstream of Iron Gate Dam, and to the Trinity River and tributaries downstream of Lewiston Dam. Fall run Chinook enter the river in late August, September, and early October. They spawn in the main rivers, in numerous tributaries, and at Iron Gate and Lewiston Hatcheries. Juveniles depart the river in late spring and summer at less than one year of age. Spawning fish return at age 3 and 4. Numbers of fall Chinook salmon

returning to the river in 1978-2003 averaged approximately 125,600 fish per year, and ranged from 34,000 fish in 1991 to 239,000 fish in 1986 (CDFG unpublished data). The coast wide salmon Fishery Management plan (FMP) developed by the Pacific Fishery Management Council includes a conservation goal for Klamath river fall Chinook (measured as fish spawning naturally in streams) of 33-34 percent of potential spawners in each brood while providing a minimum of 35,000 adult spawners to natural spawning areas each year (Myers et al. 1998; Pacific Fishery Management Council 2003).

Providing Chinook salmon access to their historical habitat range could substantially increase Klamath Basin populations, but we cannot determine with certainty how much overall Basin productivity would increase. Developing estimates of the historical anadromous fish production from above Upper Klamath Lake prior to habitat degradation is also difficult. However, the dams block access to more than 340 miles of river (not including areas currently inundated by project reservoirs) which probably produced large numbers of Chinook salmon. Despite the uncertainties associated with estimating potential current or historical production, it is reasonable to expect that substantial runs of anadromous fish can be restored to the areas above Iron Gate Dam.

2. Steelhead

Steelhead are the anadromous form of coastal rainbow trout. Historically, steelhead trout occurred in coastal river systems ranging from Alaska, British Columbia, Washington, Oregon and California, to the Tijuana River in northern Mexico (National Research Council 1996). The current southern limit of steelhead distribution is Malibu Creek in southern California (Busby et al. 1996), but occasional spawning may occur in a few streams farther south. In the Klamath system, steelhead formerly occurred far up into tributaries of Upper Klamath Lake, and were important to the Klamath Tribes.

Unlike other salmon species, steelhead do not typically die after spawning and may spawn several times during their lifespan. Steelhead may migrate into the Klamath River at any time of the year, but peak spawning runs occur in the fall, winter, and summer periods (Barnhart 1994; Busby et al. 1996; USDI 1985; Shaw et al. 1997). In general, summer steelhead migrate into the river from March through June. Fall steelhead typically migrate in August through November, and winter-run steelhead migrate in December through March. Winter-run fish enter the river sexually mature, while summer-run fish enter the river in a sexually immature condition and require several months to mature and spawn. They migrate far up into small streams and use habitats inaccessible to larger salmon species. Fry hatch in March through June and the juvenile fish spend one or two years in the stream prior to moving out into the mainstem river (Shaw et al. 1997).

CDFG (2001) reported that the Klamath River system supported the largest population of steelhead in the state. From 1977-1983 steelhead populations ranged from 87,000-181,410 adults annually, including the Trinity River; however, steelhead have declined dramatically in

the Klamath River, most likely due to high summer water temperatures in the mainstem river (CDFG 2001). Even so, a substantial recreational steelhead fishery remains on the river.

Developing estimates of the historical steelhead production from above UKL prior to habitat degradation is difficult. Currently, abundant populations of redband trout occupy the areas presently considered suitable for anadromous steelhead. Providing access to their historical habitat range could substantially increase Klamath Basin steelhead populations. The dams block access to more than 300 miles of stream habitat which could once again produce substantial numbers of steelhead (Huntington 2006).

3. Pacific Lamprey

Pacific lampreys are the most widely distributed lamprey species on the west coast of the United States. Their distribution includes major river systems such as the Fraser, Columbia, Klamath-Trinity, Eel, and Sacramento-San Joaquin Rivers. Pacific lamprey distribution patterns are similar to anadromous salmonids (Close et al. 1995; Close et al. 2002; Simpson and Wallace 1978). Adult Pacific lampreys parasitize a wide variety of ocean fishes, including Pacific salmon.

Pacific lamprey is an important traditional food source for members of the lower river Tribes. Harvest techniques include hand, dip nets, and, most commonly, hooking. Lampreys do not provide sport or commercial fisheries in the Klamath River.

After spending 1 to 3 years in the marine environment, Pacific lampreys return to freshwater between February and June (Kostow 2002; Moyle 2002). They are thought to overwinter and remain in freshwater habitat for approximately 1 year before spawning. Prior to construction, anadromous Pacific Lamprey were distributed above the site of Iron Gate Dam (Coots 1957; Kroeber and Barrett 1960) and are now blocked from a considerable portion of their historical habitat.

Information on the historical and current distribution and abundance of Pacific lamprey in the Klamath River basin is limited. Anecdotal evidence from early historical accounts and Tribal interviews suggest that Pacific lampreys have undergone substantial declines in the lower Klamath River in recent decades. Preliminary analysis of rotary trap data from the Klamath and Trinity Rivers suggests a declining trend from 1997 to 2004 for all life stages, with a notable decline in adult captures for the Klamath River system (USDI Fish and Wildlife Service 2004b). Limitations of these data for evaluating trends include uncertainty about consistency in reporting lampreys, and a lack of standardized counts at dams over time designed to document lamprey (Close et al. 1995). In addition, data based on ammocoete counts can include the similar-appearing western brook and river lampreys.

In January 2003, the Service received a petition to list the Pacific lamprey and three other lamprey species in Oregon, Washington, Idaho, and California. The Service found that that the petition and additional information in our files did not present substantial scientific or

commercial information indicating that listing these species may be warranted (USDI Fish and Wildlife Service 2004b).

TERRESTRIAL RESOURCES

Threatened and Endangered Species

1. Bald Eagle

In recent decades, bald eagle populations in the continental U.S. have rebounded from low levels of the 1970s. The Service recently reopened the public comment period for a proposal to remove the species from the list of Threatened and Endangered Species (71 Federal Register 8238). Recovery goals for the Pacific Recovery Region, which includes Oregon and California, have been met. Protection will continue under the Bald and Golden Eagle Protection Act, potentially including newly proposed regulations regarding disturbance (71 Federal Register 8265) and new National Bald Eagle Management Guidelines (71 Federal Register 8309). The species remains under the protection of the laws of Oregon and California, as well.

About ten bald eagle nesting areas are known within the Project area. Waters of the Project probably provide the primary fish prey source for this population. It is anticipated that provision of passage for anadromous fish will provide increased forage sources for bald eagles in the region above the Project. Primary management concerns include avoidance of disturbance from recreational activities, and long term maintenance of nesting habitat. Management recommendations provided herein pursuant to Section 10(j) include measures in accordance with per the draft National Bald Eagle Management Guidelines. To the extent that state laws are more restrictive, those authorities will apply.

2. Northern Spotted Owl

The northern spotted owl was listed as threatened in 1990 (55 Federal Register 26114) and a status review was completed in 2005. Ordinary Project operations are not expected to affect this species. Activities related to potential construction of fish passage facilities will be subject to section 7 consultation under ESA; the necessity of protection measures will be evaluated at that time. No further measures are proposed herein.

3. Applegate's Milkvetch

Applegate's Milkvetch is a plant listed as endangered under the ESA in 1993 (58 Federal Register 40547). According to the species' Recovery Plan, this species occurs in alkaline flood basin grassland near Klamath Falls, Oregon. Project operations are not expected to affect this species, and no measures for the species are proposed herein.

KLAMATH HYDROELECTRIC PROJECT IMPACTS

Relicensing of the Klamath Hydroelectric Project would continue the impacts that have affected the Klamath River over the past 90 years. These include the loss and fragmentation of large amounts of habitat for resident and anadromous fish, including important thermal refugial habitats, loss of ecosystem functioning through returning anadromous fish to the Project area and upstream, alteration of the natural hydrologic regime of the Klamath River, the effects of water impoundment by five dams, and the effects of hydroelectric peaking at two dams.

A. Habitat Fragmentation and Loss

The Applicant proposes to continue to inundate a total of 14.1 miles of riverine channel with Project reservoirs over the next license term. Much of this was low gradient river channel which would have supported resident and anadromous fish populations better than habitat in reservoirs. Project reservoirs created lacustrine habitat which contributed to fish community shifts that favor mostly non-native species and impairs native species (Moyle 2002). The non-native species displace native species, compete for forage with native species, prey on native species, and subsequently limit the productive potential of native fish populations in reservoir-affected reaches.

1. *Resident Fish:* Within the project area, resident redband/rainbow trout inhabit the J.C. Boyle peaking, J.C. Boyle bypassed, Keno, and all other Project reaches of the Klamath River. Spawning occurs in the lower portion of the J.C. Boyle Bypassed River Reach and in Spencer and Shovel creeks. The lower 2.7 miles of Shovel Creek continue to provide good salmonid habitat and the reach of the Klamath River between the Oregon/California State line and Copco 1 Reservoir has been designated Wild Trout water and is currently managed under the Wild Trout Program by the California Department of Fish and Game (CDFG 2005). Fish passage among these habitat areas is strongly impaired by the Klamath Hydropower facilities.

2. *Anadromous Fish:* Lack of fish passage at the Klamath Project facilities has blocked access to much of the Klamath River Basin. Within the Project area, 58 miles of habitat are blocked, including six important tributaries and 12 minor tributaries that offer productive areas, cooler waters, and diverse habitats. These include Fall, Jenny, Scotch, and Camp creeks flowing into Iron Gate Reservoir, Shovel Creek flowing into the J.C. Boyle Peaking Reach, and Spencer Creek flowing into J.C. Boyle Reservoir. More than 300 miles of migration, spawning, and rearing habitat for salmon, steelhead, and Pacific lamprey is no longer accessible in the Upper Basin. Much of this historic habitat continues to provide a productive environment for redband trout and, at some locations bull trout, brown trout *(Salmo trutta)*, and brook trout *(Salvelinus fontinalis).* This habitat above the current location of Project dams is still capable of supporting salmon, steelhead, and lamprey.

B. Loss of Ecosystem Function

When anadromous fish are present, they are an important source of energy and nutrients for subsequent generations of salmon and to maintain proper ecological function (Stockner 2003). In the Klamath River above Iron Gate Dam, anadromous fish previously provided nutrient input from the marine environment that is no longer available due to this Project.

C. Alteration of the Natural Hydrologic Regime

The Klamath Hydroelectric Project has significantly altered the natural hydrologic pattern and functioning of the Klamath River within the project reaches and downstream. The ecological structure and functioning of aquatic, wetland, and riparian ecosystems depend largely on the hydrologic regime, or pattern and quantity of water flowing through the system (Gorman and Karr 1978; Junk et al. 1989; Mitsch and Gosselink 1993; National Research Council 1992; Poff et al. 1997; Poff and Ward 1990; Sparks 1992). Intra-annual variation in hydrologic conditions plays an essential role in the dynamics among species within such communities through influences on reproductive success, natural disturbance, and biotic interactions (Poff and Ward 1989). Modifications of hydrologic regimes can indirectly alter the composition, structure, and functioning of aquatic, riparian, and wetland ecosystems (Bain et al. 1988; Dynesius and Nilsson 1994; Lillehammer and Saltveit 1984; Stanford and Ward 1979; Ward and Stanford 1983; Ward and Stanford 1989)). Project alterations to the hydrologic regime include the impacts associated with impounding waters at five dam sites, use of storage to change the timing of flows through hydroelectric dams and river reaches to maximize revenues, diverting the majority of flows from bypassed reaches of the Klamath River to maximize power production, and ramping river water surface elevation rapidly.

D. Impoundment Impacts

1. *Water Temperature:* Project impoundments have caused water temperatures to be warmer in fall and cooler in spring than under without Project conditions.
2. *Dissolved Oxygen:* Project impoundments cause dissolved oxygen (DO) concentrations in water to fall below levels that are needed by fish.
3. *Nutrient Loads*: Project impoundments impair the assimilation of excess nutrients, exacerbating already high biological oxygen demands and low DO concentrations in Klamath River water.
4. *Disease:* Project effects such as the maintenance of high nutrient levels and lack of peak flushing flows may be contributing to increased densities of anadromous fish parasites.
5. *Toxic Algae Blooms:* Toxic algae blooms (*Microsystis* sp.) in Project reservoirs may be impacting fish condition in reservoirs and downstream.
6. *Gravel Depletion:* Project reservoirs block the natural migration of sediments, including gravels used by trout and salmon for spawning.

E. Effects of Hydroelectric Peaking Operations

Hydroelectric peaking operations are used to maximize hydroelectric revenues by maximizing power generation when demand is greatest. Storage at J.C. Boyle and the Copco Reservoirs is used to manipulate flows through the powerhouses to a constant, elevated level during the afternoon and early evening and to minimum levels at night and in the morning. Such operations at the J.C. Boyle Powerhouse result in large, artificial, daily fluctuations in flows in the J.C. Boyle peaking reach, but flows exiting the Copco Powerhouse enter Iron Gate Reservoir directly, avoiding river reach flow fluctuations. Such large flow fluctuations result in high mortalities of many aquatic populations from physiological stress, wash-out during high flows, and stranding during rapid dewatering (Cushman 1985; Petts 1984). Frequent dewatering can result in massive mortality of bottom-dwelling organisms and subsequent severe reductions in biological productivity (Weisberg et al. 1990). Frequent flow fluctuations severely impair the rearing and refuge functions of shallow shoreline or backwater areas for small fish species or young life stages of larger fish (Bain et al. 1988; Stanford 1994).

1. *Reduced Flows in Bypassed River Reaches:* Most of the water that would enter the J.C. Boyle and Copco 2 Bypassed Reaches of the Klamath River is diverted for power generation. Only 100 cfs normally is released in the J.C. Boyle bypassed reach and only 5 cfs normally is released in the Copco 2 bypassed reach. The quantity and quality of aquatic habitats have been severely reduced in these reaches due to this great amount of dewatering.
2. *Trout Growth:* Resident Redband/rainbow trout growth is impaired by the adverse effects of artificial flow fluctuations in the Peaking Reach.
3. *Abundance of Macroinvertebrates:* Hydroelectric peaking greatly decreases the abundance of macroinvertebrate prey for redband/rainbow trout in the Peaking Reach.
4. *Fish Movement:* Increased energetic costs of movement due to artificial flow fluctuations in the peaking reach impact the existing resident fish and would impact reintroduced anadromous fish in the Peaking Reach.
5. *Water Quality:* Hydroelectric peaking causes severe fluctuations in temperature that adversely affects fish.
6. *Stranding:* Hydroelectric peaking increases stranding probabilities through increased flow fluctuations.

ENDANGERED SPECIES ACT

Section 7 of the ESA, and its implementing regulations at 50 CFR 402.14, require Federal agencies to review their actions at the earliest possible time to determine whether any action may affect listed species or critical habitat. If such a determination is made, consultation with the Service is required. In the case of the Project, listed species of concern to the Department are present in the Project Area. They include the bald eagle (*Haliaeetus leucocephalus*), northern spotted owl (*Strix occidentalis caurina),* Lost River sucker, and shortnose sucker. Consequently, consultation with the Service under section 7 will be required to comply with the Act. The Department's fish and wildlife recommendations include provisions for incorporating ESA

reopener language in the new license. The Department also seeks to reduce Project impacts to listed species through our section 18 fish passage prescriptions, the FWCA, and section 10(j) recommendations.

The Department recommends that the Commission enter into consultation with the Service to cover adverse effects to listed species associated with the Project relicensing. In addition, as indicated in our comment letter to the Draft License Application dated September 24, 2003, the Department is concerned that take of listed species associated with current operations is not authorized under the ESA. The Department recommends that the Commission request a current list of ESA species in the Project area from the Service. The Commission should prepare a Biological Assessment (BA) to evaluate the potential effects of the Project on listed and proposed species, and determine whether any such species may be adversely affected by the action. Due to the complexity of this project, the BA should be separate from the draft EIS. Pursuant to the Act's implementing regulations at 50 CFR 402.08, the Commission has designated the Licensee as its non-Federal representative to conduct informal consultation or prepare a biological assessment. In order to ensure that the ESA process moves forward in coordination with the Commission's relicensing proceeding, informal consultation should begin soon. If the BA is prepared by the designated non-Federal representative, the Commission must furnish guidance and supervision, and must independently review and evaluate the scope and contents of the BA. The ultimate responsibility for compliance with section 7 remains with the Commission.

CONTINUING IMPACTS OF THE PROPOSED PROJECT

Many of the Department's recommendations, conditions, and prescriptions include requirements to address Project impacts that are occurring in the present and have been ongoing since the original license was issued over 50 years ago. To help assess these impacts and the mitigation needed to address them, the Commission's upcoming NEPA analysis should include information regarding the ongoing impacts of the Project. Inclusion of ongoing impacts in the Commission's NEPA analysis would allow for complete consideration of the Project's impacts, and provide a basis on which to assess the adequacy of proposed mitigation measures.

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Section A: U.S. Department of the Interior Preliminary 4(e) Conditions – BLM Reservation

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Section A: Preliminary Conditions for the Protection and Utilization of the Bureau of Land Management Reservations Pursuant to Section 4(e) of the Federal Power Act

INTRODUCTION

The Department of the Interior (Department) through the Bureau of Land Management (BLM) has developed conditions pursuant to Section 4(e) of the *Federal Power Act* (FPA) for the protection and utilization of BLM-administered reservation affected by the Klamath Hydroelectric project, FERC No. 2082 (Project). Section 4(e) of the FPA provides that "…licenses issued within any reservation…shall be subject to and contain such conditions as the Secretary of the department under whose supervision such reservation falls shall deem necessary for the adequate protection and utilization of such reservation." The FPA definition of reservation includes lands and interest in lands owned by the United State, and withdrawn, reserved, or withheld from private appropriation and disposal under the public land laws.

The BLM manages federal lands (BLM lands) within and near the Project boundaries that are "reservations" as defined by the FPA. Specifically, the BLM lands are located adjacent to J.C. Boyle Reservoir and along the J.C. Boyle Bypass and Peaking reaches of the Klamath River. The J.C. Boyle Development primarily resides on BLM lands, including the J.C. Boyle Powerhouse, J.C. Boyle Canal, J.C. Boyle Bypass and Peaking reaches and Project roads. (See BLM Map 1 below.)

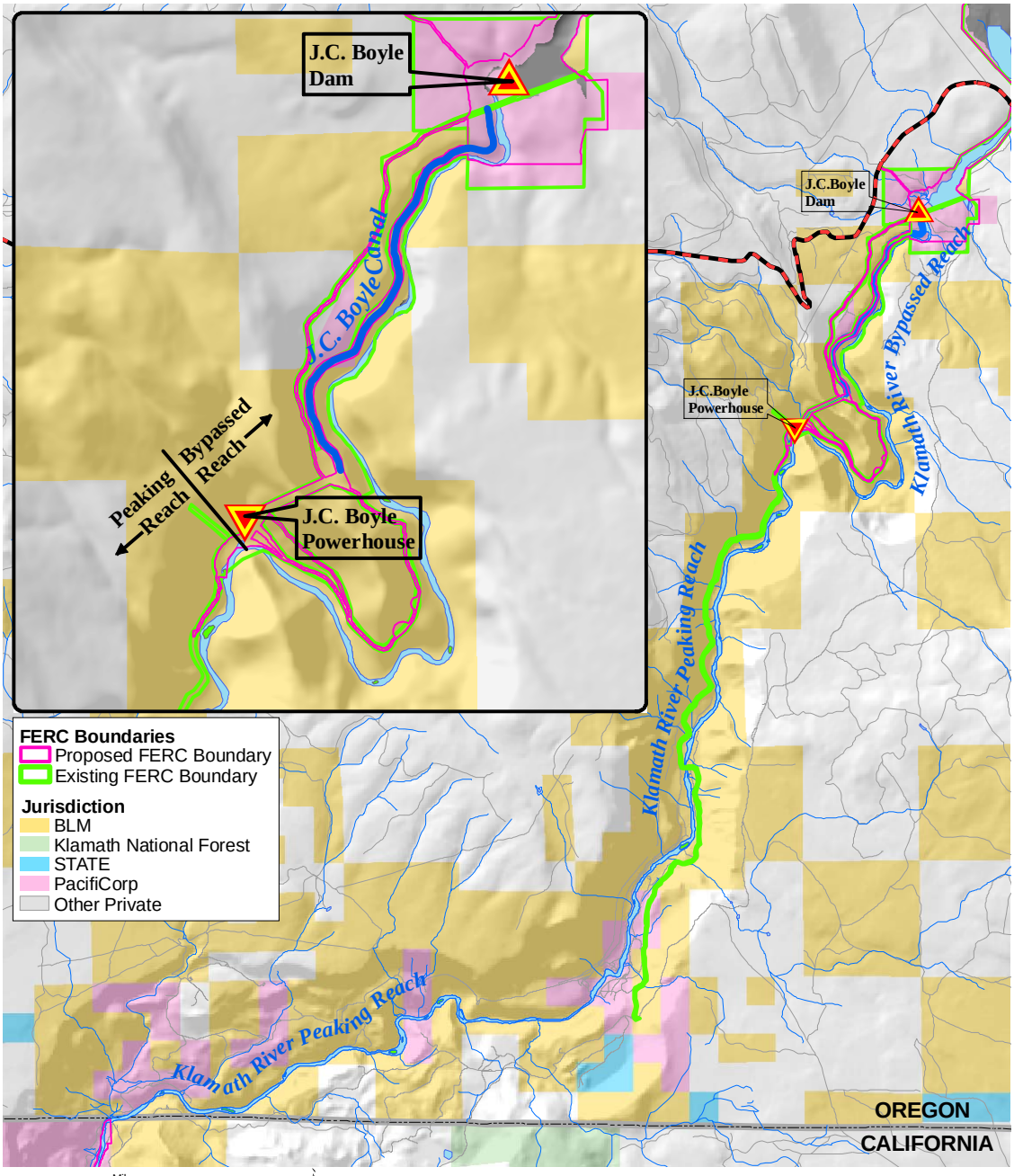
Currently, the BLM lands are withdrawn by either the *Revested Oregon and California Railroad Grant Lands Act* (O&C Act) or Power Site Reserve No. 258 (See BLM Map 2 below):

- The O&C Act (50 Stat 874) provided that these BLM lands were to be "conserved and perpetuated" rather than divested by the United States and be managed as timberlands and power site lands that shall be managed for purposes[1] provided for in BLM resource management plans developed for these areas.
- The Power Site Reserve No. 258 was approved by Executive Order dated April 13, 1912 and reserved BLM lands withdrawing them from "settlement, location, sale, or entry, and reserved for water-power site". These BLM lands were originally reserved under the *Pickett Act of 1910*[2] but subsequently withdrawn by Power Site Reserve No. 258.

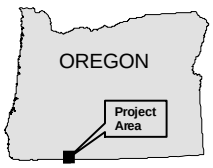
[1] In addition to providing for a permanent source of timber supply according to the principle of sustained yield, the O&C Act requires the Secretary to protect watersheds, regulate stream flow, provide recreation, and contribute to economic stability.

[2] The Pickett Act of 1910 authorized the Executive Department to "temporarily withdraw from settlement, location, sale, or entry any public lands of the United States…and reserve the same for water-power sites, irrigation, classification of lands, or other public purposes to be specific in the orders of withdrawals: "[S]uch withdrawals or reservations shall remain in force until revoked…" "…and therefore in law and in practice Pickett Act withdrawals can continue indefinitely." Opinion of the Solicitor, M-37005 (January19, 2001).

BLM Map 1: **J.C. Boyle Development and Lands under BLM Jurisdiction**



Klamath Hydroelectric Project
J.C.Boyle Development
FERC No. 2082
2006



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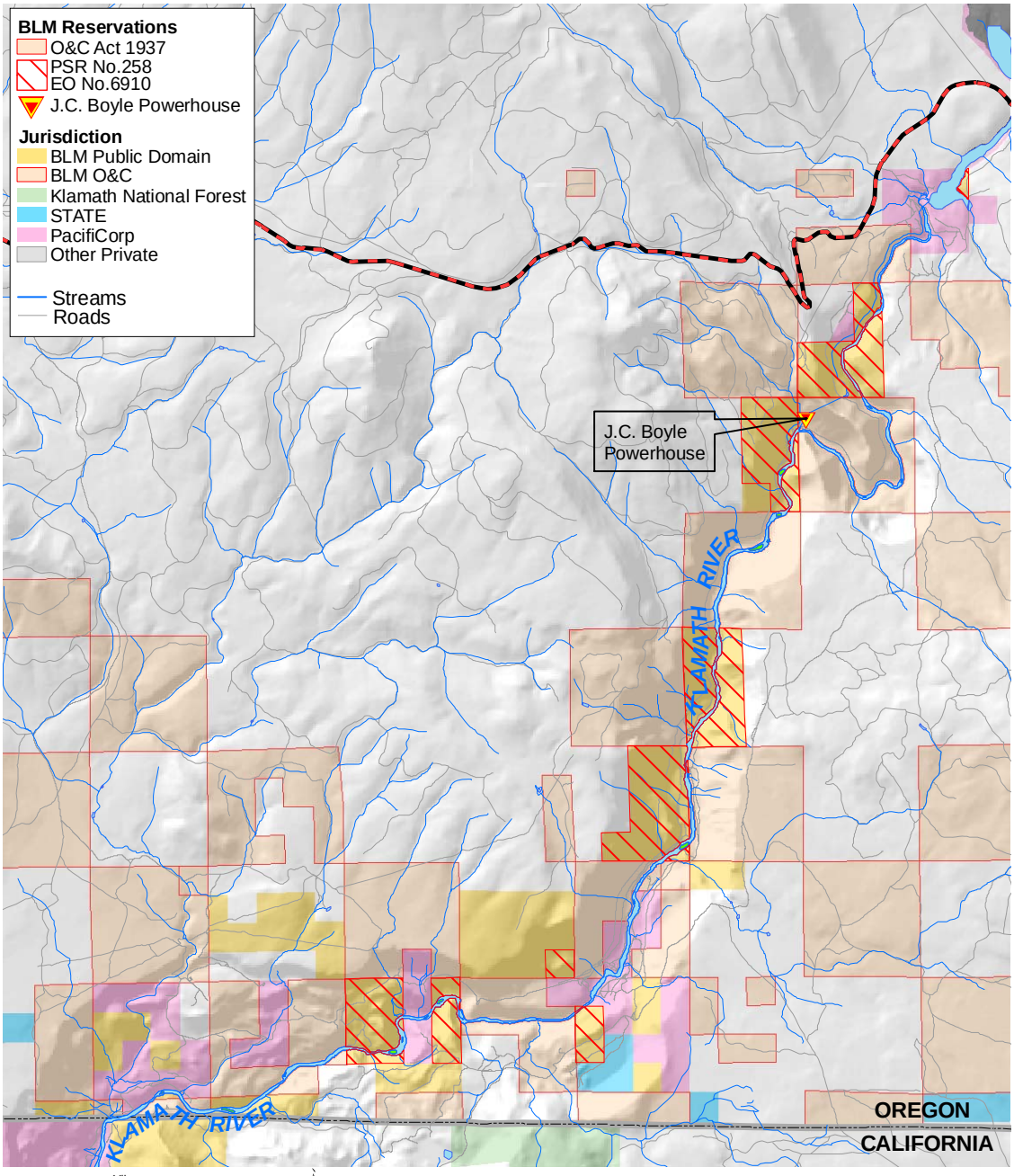
Bureau of Land Management
Klamath Falls Resource Area
Lakeview District
2795 Anderson Ave. #25
Klamath Falls, Oregon 97603

BLM Map 2: BLM Reservation Lands Map



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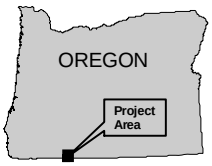
Klamath Hydroelectric Project
FERC No. 2082
2006



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RESOURCE MANAGEMENT PLAN GOALS AND OBJECTIVES

The continued protection and utilization of the BLM reservation requires management on the basis of multiple use and sustained yield according to provisions of the *Federal Land Policy Management Act* (FLPMA). This act directs BLM to develop and maintain management plans, by specific areas, for public use and requires an interdisciplinary approach to achieve an integrated consideration of the physical, biological, economic and other sciences (FLPMA, 1976).

FPLMA also defines the term multiple use to mean:

> "…the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; the use of some land for less then all of the resources; a combination of balanced and diverse resource use that takes into account the long-term needs of future generations for renewable and non-renewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output."

The Klamath Falls Resource Area Resource Management Plan (RMP), Rangeland Program Summary, and Record of Decision (ROD) (USDI BLM 1995a); the Medford District RMP and ROD (USDI BLM 1995b); and the Redding Field Office RMP and ROD (USDI BLM 1993) were developed in accordance with FLPMA. The Klamath Falls Resource Area and Medford District RODs and RMPs are also consistent with and incorporate provisions of the 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan).

The Klamath Falls Resource Area RMP responds to the need for healthy forest ecosystems and habitat to support native species, including protection of riparian areas and waters as well as the need for a sustainable supply of timber and other forest products necessary to maintain local and regional economies (USDI BLM 1995a). The Klamath Falls Resource Area encompasses 212,000 acres including 19,450 acres of "Riparian Reserves" in Klamath County, Oregon. The Klamath River occurs in the Northwest Forest Plan area and is administered as a riparian reserve.[3] According to the Klamath Falls Resource Area RMP the riparian reserve for the Klamath River includes "the stream and the area on each side of the stream extending from the edges of the active stream channel to the outer edges of the 100 year floodplain or 320 feet on each side of the river, whichever is greater" (USDI BLM 1995a). As a general rule, management of riparian reserves prohibits or regulates activities that retard or prevent attainment of objectives of the Aquatic Conservation Strategy (ACS).

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[3] Riparian reserves are designed to restore and maintain aquatic ecosystem functions and together with the Aquatic Conservation Strategy (ACS) provide substantial watershed protection benefits including attaining and maintaining water quality standards and moderating peak stream flows.

The ACS seeks to prevent degradation and restore habitat and ecosystem health by maintaining and restoring aquatic habitat, restoring habitat connectivity, and maintaining flows sufficient to sustain component elements of aquatic systems.[4] Among specific provisions of the ACS are provisions for managing roads, energy production, recreation, lands, riparian areas, fish and wildlife, and watershed and habitat restoration. Specific provisions for land management as it relates to hydroelectric projects under the jurisdiction of the Federal Energy Regulatory Commission (Commission) are provisions requiring BLM input on the maintenance of instream flows and habitat conditions and maintenance/restoration of riparian resources and stream channel integrity necessary to ensure that ACS objectives are met (USDI BLM 1995a).

The BLM reservation is located within the Project boundaries and therefore subject to conditions that the Secretary of the Interior, acting through the BLM, deems "… necessary for the adequate protection and utilization of [these] reservation[s]." (FPA). As explained in greater detail below, the Project affects water resources, recreation, wild and scenic river values, travel and access management, cultural resources, terrestrial and riparian resources, special status species and fish and wildlife resources within these BLM lands. The BLM has developed conditions for the license that are designed to provide for the adequate protection and utilization of the BLM reservation based on multiple use objectives. Where project impacts affect BLM resources that lie outside of these reservations, the BLM has included measures as recommendations pursuant to FPA § 10(a).

The following conditions are necessary for the adequate protection and utilization of these reservations and the multiple use resource values for which the reservations are managed. These conditions are based on resources identified for management pursuant to FLPMA and approved RMPs for the Lakeview District, Klamath Falls Resource Area; Medford District and Redding Field Office. Therefore, the following conditions covering specific requirements for protection and utilization of the public lands shall also be included in any license issued for the Project.

BLM PRELIMINARY 4(e) CONDITIONS

Condition No. 1 - Activities On or Affecting Bureau of Land Management-Administered Lands

A. The Licensee shall consult with the Bureau of Land Management (BLM) to identify and resolve potential conflicts with BLM policy and direction prior to initiating activities on BLM-administered lands, which are beyond the scope of the license or for which the Licensee has not obtained BLM approval.

[4] The ACS Standards and Guidelines specific to hydropower relicensing require the BLM to "identify instream flows necessary to maintain and restore riparian resources, fish passage, and channel integrity" (USDA; USDI 1994). Lands allocated as Riparian Reserves require further evaluation to assess whether occupancy and use is acceptable and will not detract from or can be mitigated so that ACS objectives can continue to be met (USDA; USDI 1994).

B. The Licensee shall cooperate with the BLM to obtain the appropriate authorizations for use or access to BLM-administered lands prior to engaging in any activity that has the potential to affect other federally authorized rights-of-way (ROW) on those lands.

C. The Licensee shall obtain written approval from BLM prior to changing the location of any Project feature or facility on BLM-administered lands. The Licensee shall also obtain written approval for any actions that are inconsistent with authorizations for use or occupancy of BLM-administered lands according the new license. Following BLM approval and at least 90 days prior to any change in location or departure from an authorized activity, the Licensee shall file a report with the Federal Energy Regulatory Commission (Commission) and with the BLM, describing the change, the reasons for the change, and documenting BLM approval of the change.

D. The Licensee shall prepare site-specific plans for approval by the BLM for activities required by the license that have the potential to impact BLM-administered lands or resources. Prior to implementing any action that is not analyzed on a site-specific basis, the Licensee shall work with the BLM to evaluate whether the action could impact BLM-administered lands or resources. The analysis shall be sufficient to meet requirements of the National Environmental Policy Act (NEPA). The site-specific details shall include:

1. a map depicting the location of the proposed activity;
2. the land use allocation and management designation including standards and guidelines for the area of the proposed activity;
3. alternative locations, designs, mitigations, and implementation and effectiveness monitoring necessary to meet standards and guidelines; and
4. data from surveys, biological evaluations, or consultation required by regulation and as applicable to activities on BLM-administered lands.
   (a) When surveys indicate that activities may affect an Endangered Species Act (ESA) listed or proposed listed species or their habitat, the Licensee shall evaluate the impacts of the action on the species or habitat and submit this evaluation to the BLM.
   (b) When surveys indicate an activity may affect a BLM sensitive species or their habitat, based on the list of BLM sensitive species that BLM will provide to the Licensee annually, the Licensee shall evaluate the potential impact of the action and submit conclusions to the BLM for review and approval. BLM reserves the authority to require mitigation for the protection of these species.

E. Upon BLM approval, the Licensee shall conduct necessary environmental analysis according to NEPA standards and sufficient for formal consultation for federally administered resources subject to regulation pursuant to the National Historic Preservation Act (NHPA), the Archaeological Resources Protection Act (ARPA), the Native American Grave Protection Act (NAGPRA), the Clean Air Act, the Clean Water Act, and the Endangered Species Act (ESA). The environmental analysis documentation shall be sufficient to comply with BLM direction in the National Environmental Policy Act Handbook 1790-1 (USDI BLM 1988), or as amended.

F. The Licensee shall file a Safety During Construction Plan with the Commission 60 days prior to initiating any ground-disturbing activity on BLM-administered lands. This plan will identify potential hazard areas and measures necessary to protect public safety. Areas to

consider include construction activities near public roads, trails, recreation areas, and facilities.

G. The Licensee shall perform daily (or on a schedule otherwise agreed to by the BLM) inspections of Licensee's construction operations on BLM-administered lands and adjoining fee title property while construction is in progress. The Licensee shall document these inspections and deliver this documentation to BLM. Inspections must evaluate fire plan compliance, public safety, and environmental protection. The Licensee shall act immediately to address any necessary corrections.

H. The Licensee shall consult with BLM to prepare a Spoils Disposal Plan prior to initiating any ground disturbing activity on BLM-administered lands. Upon BLM approval, the plan shall be filed with the Commission. The plan shall address disposal and/or storage of waste soil and/or rock materials (spoils) generated by road maintenance, slope failures, and construction projects. The plan shall include provisions for:

1. identifying and characterizing the nature of the spoils in accordance with applicable BLM regulations;
2. identifying sites for the disposal and/or storage of spoils that prevent contamination of water by leachate and surface water runoff; and
3. developing and implementing stabilization, slope reconfiguration, erosion control, reclamation, and rehabilitation measures.

I. The Licensee shall file a Hazardous Substances Plan for oil and hazardous substance storage, spill prevention, and clean up with the Commission prior to planning, construction, or maintenance that may affect BLM-administered lands. At least 90 days prior to submission, the Licensee shall provide a copy of the plan to the BLM for its review and approval. At a minimum, the plan shall:

1. outline procedures for reporting and responding to releases of hazardous substances, including names and phone numbers of all emergency response personnel and their responsibilities; and
2. maintain emergency response and HAZMAT cleanup equipment sufficient to contain any spill from the Project.

J. On a semi-annual basis, the Licensee shall provide the BLM information on the location of spill cleanup equipment on BLM-administered lands and the location, type, and quantity of oil and hazardous substances stored in the Project area. The Licensee shall inform BLM immediately as to the nature, time, date, location, and action taken for any spill affecting BLM-administered lands.

K. The Licensee shall avoid disturbance to all public land survey monuments, private property corners, and BLM boundary markers. In the event that any markers or monuments are destroyed by an act or omission of the Licensee, in connection with the use and/or occupancy authorized by the license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of the BLM. The Licensee shall ensure that any such official survey records affected are amended as provided for by law.

L. The Licensee shall maintain Project-related improvements and facilities located on BLM-administered lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the agency. The Licensee shall comply with all applicable Federal, State, and local laws, regulations, including but not limited to, the Federal Water Pollution Control Act, 33 U.S.C. § 1251 et seq., the Resources Conservation and Recovery Act (RCRA), 42 U.S.C. § 6901 et seq., the Comprehensive Environmental Response, Control, and Liability Act (CERCLA), 42 U.S.C. § 9601 et seq., and other relevant environmental laws, as well as public health and safety laws and other laws relating to the siting, construction, operation, and maintenance of any facility, improvement, or equipment.

M. The Licensee shall restore BLM-administered lands to a condition satisfactory to BLM prior to any surrender of the Project license or abandonment of Project facilities. At least one year in advance of license surrender, facility abandonment, or Project boundary change, the Licensee shall file with the Commission a restoration or maintenance plan approved by the BLM. The plan shall identify any capital improvements that will be removed, restoration measures; maintenance of facilities abandoned but not removed, time frames, and costs. In addition, the Licensee shall commission an audit to assist the BLM in determining whether the Licensee has the financial ability to fund the decommissioning and restoration work specified in the plan.

1. As a condition of any transfer of the license or sale of the project, the Licensee shall guarantee or assure, in a manner satisfactory to the BLM, that the Licensee or transferee will provide for the costs of surrender and restoration.
2. Any license amendment that authorizes use of BLM-administered lands shall be subject to such conditions the BLM deems necessary to protect and utilize affected BLM reservations.

N. The Licensee shall indemnify, defend, and hold the United States harmless for any costs, damages, claims, liabilities, and judgments arising from past, present, and future acts or omissions of the Licensee in connection with the use and/or occupancy authorized by the license. This indemnification and hold harmless provision applies to any acts and omissions of the Licensee or the Licensee's heirs, assigns, agents, employees, affiliates, subsidiaries, fiduciaries, contractors, or lessees in connection with the use and/or occupancy authorized by this license which result in: (1) violations of any laws and regulations which are now or which may in the future become applicable, and including but not limited to environmental laws such as the CERCLA, RCRA, Oil Pollution Act, Clean Water Act, Clean Air Act; (2) judgments, claims, demands, penalties, or fees assessed against the United States; (3) costs, expenses, and damages incurred by the United States; or (4) the release or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment.

O. The Licensee shall, within one year of the license issuance, develop a standard operating procedures plan for emergencies to address procedures, environmental permits, and subsequent mitigation measures for any Project-related impacts to BLM lands including, but not limited to, the emergency spillway and canal and slope failures. This plan shall be developed with consultation and approval by BLM. The plan shall include implementation strategies for agency coordination, restoration actions, monitoring and evaluation, and potential mitigation measures.

P. The Licensee shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this license, including any buildings, bridges, roads, trails, lands or other property of the United States; and shall restore, reconstruct or compensate the United States for any damage resulting from negligence or from the violation of the terms of this license or any law or regulation applicable to the BLM by the Licensee, or by any agents or employees of the Licensee acting with in the scope of their agency or employment. Arrangements to restore, reconstruct, or compensate for damages shall be made with the BLM.

Rationale

BLM administers approximately 197 acres within the current Project boundary (PacifiCorp 2003a, Exhibit A, page 2-17) for recreation use, fish and wildlife habitat, terrestrial and riparian resources, cultural resource protection, and road and facilities maintenance. Project operation and/or mitigation for impacts of the Project on BLM-administered resources must insure actions are in compliance with laws, regulations, policies and land use plan decisions which the BLM is bound or is responsible for upholding or implementing. This will necessitate consultation with the BLM prior to implementation of any action on federal lands to ensure the continued protection and utilization of BLM-administered resources and for consistency with BLM management objectives for these lands.

BLM has the authority to address planning issues through direction within the *Federal Land Policy and Management Act* (FLPMA). Specifically, according to:

- Sec. 103(c) (7) "…the public lands [shall] be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use. . . ."
- Sec. 302(b) "In managing the public lands, the Secretary shall, subject to this Act and other applicable law and under such terms and conditions as are consistent with such law, regulate, through easement, permits, leases, licenses, published rules, or other instruments as the Secretary deems appropriate, the use, occupancy, and development of the public lands, including, but not limited to, long-term leases to permit individuals to utilize public lands for habitation. . . ."
- Sec. 302(d) (2) "Use of public lands pursuant to a general authorization under this subsection shall be limited to areas where such use would not be inconsistent with the plans prepared pursuant to section 202. Each such use shall be subject to a requirement that the using department shall be responsible for any necessary cleanup and decontamination of the lands used. . . ."
- Sec. 302(d) (2) (A) "…minimize adverse impacts on the natural environment, scientific, cultural, and other resources and values (including fish and wildlife habitat) of the public lands involved."
- Sec. 302(d) (5) "To the extent that public safety may require closure to public use of any portion of the public lands covered by an authorization issued pursuant to this subsection, . . . [the Secretary] shall take appropriate steps to notify the pubic concerning such closure and to provide appropriate warnings of risks to public safety."

The BLM RMPs provide direction for issuing, renewing, or granting authorizations to occupy, use or traverse BLM-administered lands for power generation, transmission, and distribution. If such actions have the potential to affect BLM-administered resources, they must be evaluated for consistency with BLM RMPs developed pursuant to FLPMA and according to the NEPA that addresses whether any irretrievable or irreversible commitment of Federal resources will result as a consequence of actions implemented on federal lands or reliant on federal funding.

Condition No. 2 – Consultation with the Bureau of Land Management

A. The Licensee shall consult with the Bureau of Land Management (BLM) between September 1 and November 31 each year and prepare a report on the status implementing conditions of the license that could affect BLM-administered resources. The report shall include:

1. Results of any monitoring preformed over the previous year for reporting effectiveness of mitigations included as license articles;
2. Review of any non-routine maintenance;
3. Discussion of any foreseeable changes to Project facilities or operations;
4. Discussion of any necessary revisions or modification to plans approved as part of this license; and
5. Discussion of elements of current year maintenance plans, e.g. road maintenance.

B. A copy of the records, plan reports, monitoring reports, and other pertinent records shall be provided to the BLM at least 10 days prior to the annual meeting, unless otherwise agreed.

C. Copies of other reports related to Project safety and non-compliance shall be submitted to the BLM concurrently with submittal to the Commission. These include, but are not limited to, any non-compliance report filed by the Licensee for facilities or operations on or affecting BLM-administered lands.

D. Within 60-days of issuance of the report to BLM, the Licensee shall file the record of consultation and any BLM comments and recommendations with the Commission. The BLM reserves the right, after notice, comment, and administrative review, to require changes to Project operation through revision of 4(e) conditions.

Rationale

The *Federal Land Policy Management Act* (FLPMA) requires the BLM to consult with other entities regarding the management of public resources. The Licensee's obligation to operate the Project in accordance with license conditions intended to mitigate for impacts to BLM determines necessary for the continued protection and utilization of federally administered resources, necessitates this consultation requirement for the Klamath Hydroelectric Project operation and would require federal action and notice and comment to rectify or mitigate.

Section 307(a) of FLPMA requires the Secretary of Interior (Secretary) through the Interior Bureaus "… to conduct investigations, studies, and experiments, [based] on [the Secretary's]

initiative or in cooperation with others, involving the management, protection, development, acquisition, and conveying of the public lands."

Condition No. 3 - Roads Inventory Analysis and Roads Management

A. Within six months of license issuance, the Licensee shall file with the Federal Energy Regulatory Commission (Commission) for approval a Project Roads Inventory Analysis and Roads Management Plan (Roads Plan) for Project-related roads that cross Bureau of Land Management (BLM)-administered lands (BLM roads). The purpose of the Roads Plan is to facilitate coordination of transportation maintenance and management; continue to provide for public safety; minimize potential damage to big game winter range; manage transportation access consistent with BLM management objectives; coordinate off-highway vehicle (OHV) management; minimize the potential for spread of noxious and invasive plants; restore hydrologic function in areas that have been impacted by use of BLM roads for Project purposes: and continue to protect cultural resources.

1. At a minimum, the Roads Plan shall include the items specified in the Final License Application (PacifiCorp 2004a, Executive Summary, page 8-5; Land Use, Visual, and Aesthetic Resources Final Technical Report, page 3-7; and Appendix 3C) and shall:
   - (a) Specify the Licensee's goals and objectives for transportation management so the BLM can determine whether these are consistent BLM transportation management goals;
   - (b) Identify BLM roads necessary to operate and maintain the Project;
   - (c) Monitor use of roads for recreation access;
   - (d) Identify responsible parties for management and maintenance of BLM roads affected by the Project;
   - (e) Identify BLM roads previously used but which are no longer necessary to operate and maintain the Project;
   - (f) Identify levels of use and projected future use of BLM roads;
   - (g) Identify impacts associated with all Project-related BLM road use;
   - (h) Develop mitigation measures for Project-related impacts to BLM roads;
     - (1) Mitigate for soil erosion;
     - (2) Identify and implement road closures; and
     - (3) Identify and implement BMPs for maintaining and protecting cultural resources; controlling the spread of noxious weeds; protecting sensitive plants and threatened and endangered species; minimizing soil erosion; and protecting aquatic resources.
   - (i) Identify instruments (agreements) necessary to implement the Roads Plan.

2. The Roads Plan shall accommodate unrestricted access by the BLM necessary to manage and administer BLM lands and resources that are affected by Project operations. The plan shall include provisions for the maintenance of crossings and rights-of-way (ROW) required by and consistent with permit requirements for powerlines, penstocks, ditches, and pipelines.

B. The Licensee shall consult with the BLM prior to erecting any signs on BLM-administered lands that are necessary for operation or maintenance of Project operations or facilities. The Licensee must obtain approval from the BLM specific to the location, design, size, color, and

content of signs. The Licensee shall be responsible for maintaining all Licensee-erected signs to neat and presentable standards.

C. The Licensee shall prepare a draft Roads Plan after consultation with the BLM. The Licensee shall allow a minimum of 30 days for the BLM to comment and to make recommendations on the draft plan before finalizing the plan and filing it with the Commission. The Licensee shall include with the plan: documentation of consultation, BLM comments and recommendations, and a description of how recommendations are accommodated by the plan. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information. At the time it files the plan with the Commission, the Licensee shall serve a copy of the filed documents upon the BLM.

D. The BLM reserves the right to require changes to the plan by filing modifications to the plan within 30 days of service. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the BLM.

Rationale

Section 302(b) of the Federal Land Policy Management Act (FLPMA) requires BLM to address road maintenance and management, and specifically authorizes the Secretary of Interior (Secretary) to "regulate, through easement, permits, leases, licenses, published rules, or other instruments as the Secretary deems appropriate, the use, occupancy, and development of the public lands, including, but not limited to, long-term leases to permit individuals to utilize public lands for habitation, …".

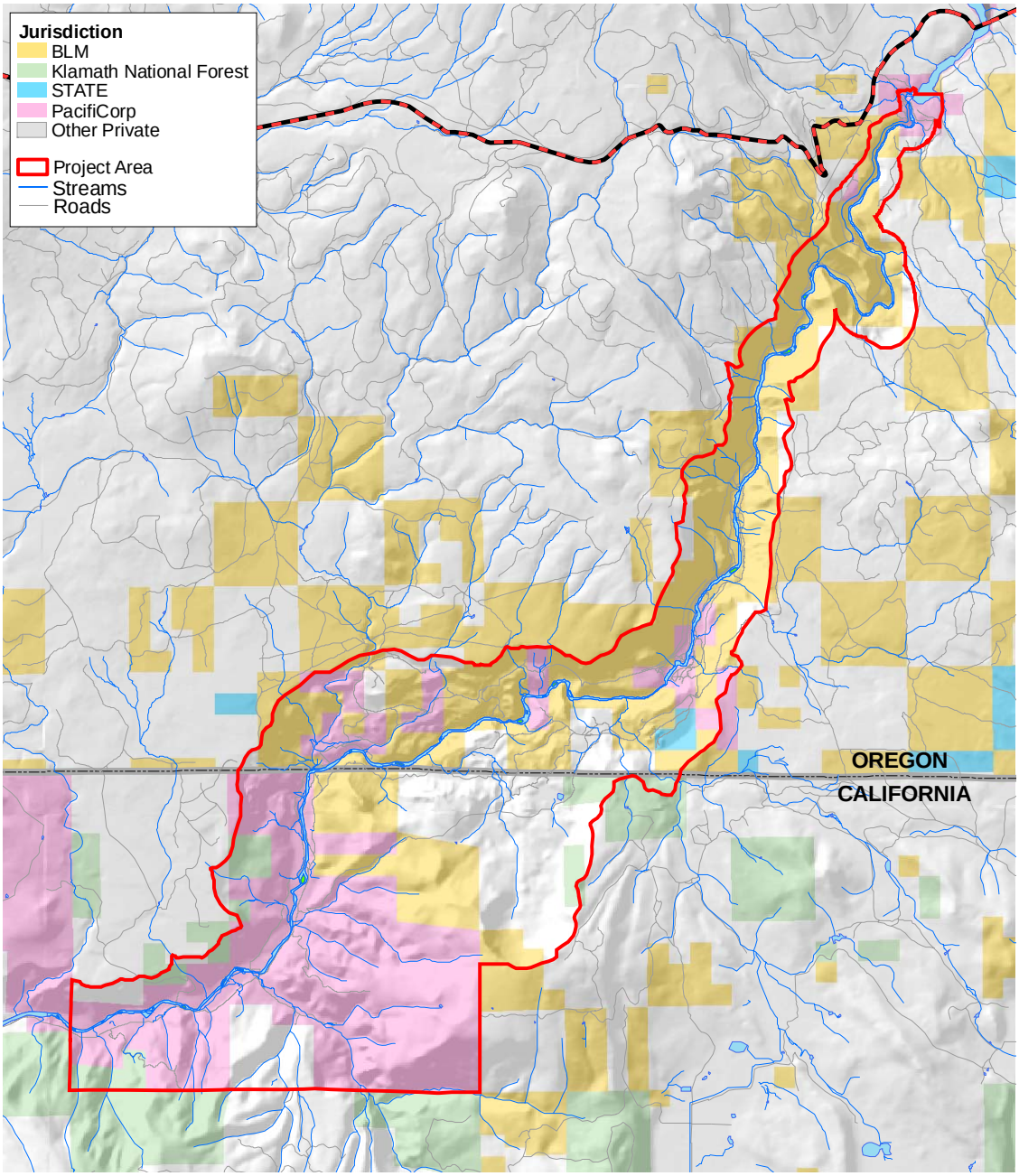
The BLM manages travel and access on roads through a road management plan (USDI BLM 1995a, page 71). Although BLM participated with the Licensee in an analysis of road conditions for roads on BLM-administered lands and PacifiCorp lands (PacifiCorp 2004h), no inventory results and analysis have been provided to BLM. In order to accurately develop travel management objectives, the Licensee needs to provide the analysis and develop a plan for management of roads in the Project area of influence. (See BLM Figure 3-1: Road Inventory Map.) PacifiCorp stated in the Land Use, Visual, and Aesthetic Resources Final Technical Report (PacifiCorp 2004h) "When completed as a post-Final License Application submittal, the inventory and analysis is intended to meet the objectives of FERC, PacifiCorp, and BLM for the management and cost-sharing responsibilities of Project-related transportation facilities."

PacifiCorp stated in the FTR (PacifiCorp 2004h) that "the data are currently being reviewed and analyzed. The analysis and management components of this study will be completed as a post-Final License Application submittal during the first half of 2004." Further, Exhibit E Land Management and Aesthetics (PacifiCorp 2004i) stated that "Project-related road management activities will be defined, including road and bridge management activities, monitoring activities, and cost-sharing responsibilities for Project related transportation facilities", and that "The results of the roadway inventory analysis and proposed roadway management actions and responsibilities will be reviewed in consultation with BLM." To date the BLM has not been consulted on the proposed management actions.

The BLM analyzed agency data compiled for the cooperative road study. Project-specific data including analysis of the Licensee's road inventory is necessary to develop a comprehensive Roads Plan and maintenance schedule. Road damage can be related to number and type of vehicles and/or frequency of trips. Data specific to PacifiCorp use of BLM roads are not available.

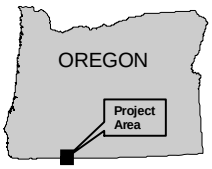
Project construction, maintenance, and operation necessitated the development of roads within and adjacent to the Klamath River canyon. Of these historic roads, approximately 14 miles adjacent to the J.C. Boyle Bypass and Peaking Reaches remain necessary for the operation and maintenance of the Project (PacifiCorp 2004h, Road Inventory Figure 3.7-1, 6 of 9 and 7 of 9). About 3.4 miles of these roads traverse PacifiCorp land and the remaining 10.6 miles are BLM roads. Because the Road Inventory Analysis and Road Management Plan are not complete, the level of Project use of BLM roads is not well defined. Compounding the difficulty in analyzing the affect of the Project on BLM roads is the Licensee's proposed Project boundary revision (PacifiCorp 2004a, Executive Summary, Figure ES1.1-1) that excludes numerous miles of road that the Licensee was previously required to manage and maintain. (See BLM Figure 3-2: Klamath Hydroelectric Project Roads Map.) The Roads Plan must include recommendations on how those roads should be managed including options for maintenance, improvement or closure if necessary. The BLM condition is intended to more precisely define the miles, levels of use, and projected future use of roads necessary to operate and maintain the Project in order to develop a cooperative Roads Plan. A Plan is necessary to meet the direction in the KFRA RMP, to manage travel and access on roads through a road management plan, (USDI BLM 1995a, page 71) and Section 302(b) of the Federal Land Policy Management Act (FLPMA) requiring road maintenance and management be addressed and necessary to mitigate for impacts to roads that are resultant of the Project.

BLM Figure 3-1: Road Inventory Map



Miles

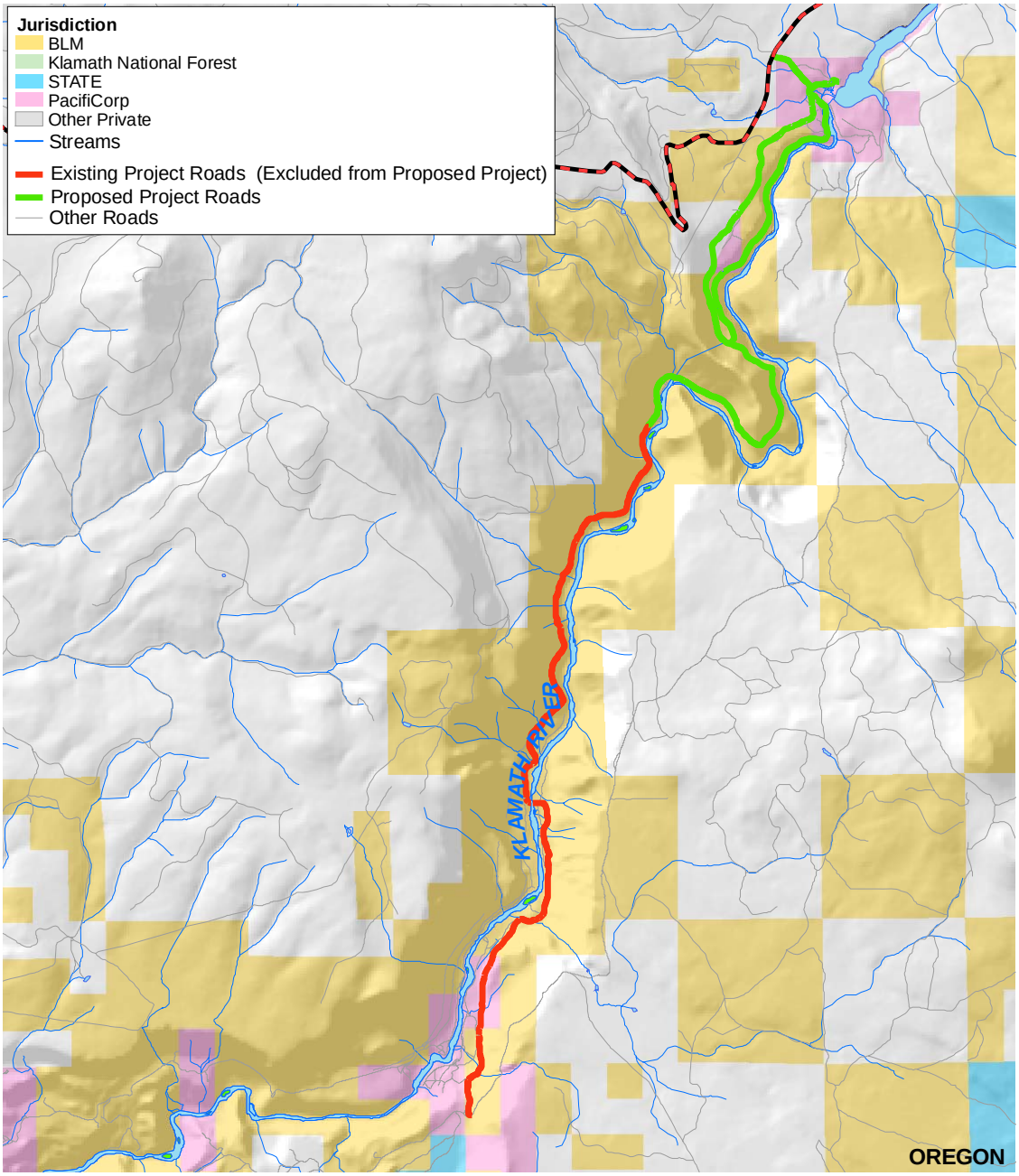
2001 Road Inventory Project Area
Klamath Hydroelectric Project
FERC No. 2082
2006



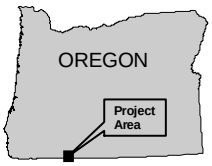
U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Klamath Falls Resource Area
Lakeview District
2795 Anderson Ave. #25
Klamath Falls, Oregon 97603

Produced by MLimb 2/27/06 P:\gis\fercimaps\060227_figure3-1.mxd

BLM Figure 3-2: Klamath Hydroelectric Project Roads



Project Roads / BLM Lands
Klamath Hydroelectric Project
FERC No. 2082
2006



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Condition No. 4 – River Corridor Management

A. J.C. Boyle Bypassed River Reach

1. Required Minimum Streamflow – The Licensee shall, within one year after license issuance, maintain minimum streamflows as specified:

(a) Proportional flow requirement: Provide no less than 40% of the inflow to J.C. Boyle Reservoir to the J.C. Boyle Bypassed River Reach, measured below the J.C. Boyle Dam at RM 225. [See Condition 4 – C.1.(a)(2)].

(1) The required proportional instream flows are the average of the previous three days of the combined daily flow, as measured from the Keno gage (#11509500) and Spencer Creek gage (#11510000) combined.

(b) Minimum base flow requirement: When 40% of the inflow is less than 470 cubic feet per second (cfs), no less than 470 cfs shall be provided to the J.C. Boyle Bypassed River Reach, except when the combined flow measured from the Keno gage (#11509500) and Spencer Creek gage (#11510000) is less than 470 cfs, then flow shall be provided to the J.C. Boyle Bypassed River Reach in an amount equal to the average of the previous three days of combined flow, as measured from the Keno gage (#11509500) and Spencer Creek gage (#11510000) combined.

(c) Seasonal High Flow: At a minimum, once annually between February 1st and April 15th diversion to the J.C. Boyle Power Canal shall be suspended when inflow to J.C. Boyle Reservoir first exceeds 3,300 cfs during this time period.

(1) Suspension of diversion shall be maintained for a minimum of seven full days.

(2) The streamflow shall be measured from the Keno gage (#11509500) and Spencer Creek gage (#11510000) combined.

2. Ramping During Controlled Events – The Licensee shall, within one year after license issuance:

(a) Not exceed an up ramp rate or down ramp rate of two inches per hour when conducting controlled flow events (e.g., scheduled maintenance and changes in minimum flow requirements), except during implementation of the seasonal high flow [See Condition 4 - A.1.(c)], measured below the J.C. Boyle Dam at RM 225. [See Condition 4 – C.1.(a)].

B. J.C. Boyle Peaking Reach

1. Streamflow Requirements – The Licensee shall, within one year after license issuance:

(a) From May 1st to October 31st, operate the J.C. Boyle development to provide a streamflow of 1,500 cfs to 3,000 cfs a maximum of once a week, with a priority set for Saturday, Sunday, then Friday.

(b) Proportional and minimum base flows as prescribed in the J.C. Boyle Bypassed River Reach will provide the inflows for the J.C. Boyle Peaking Reach. [See Condition 4 – A.1.].

2. Ramping During Controlled Events – The Licensee shall, within one year after license issuance:

(a) Not exceed an up ramp rate or down ramp rate of two inches per hour when conducting controlled flow events (e.g. scheduled maintenance, power generation, changes in minimum flow requirements), except during implementation of the seasonal high flow [See Condition 4 - A.1.(c)], measured at the gage below the J.C. Boyle Powerhouse at RM 220.5 (USGS #11510700).

C. Streamflow Measurement and Reporting: J.C. Boyle Bypassed River and Peaking Reaches

1. Instream Flow Measurement – The Licensee shall, within one year after license issuance:

(a) Continuously measure the stage of water at a minimum of four gage sites. Three sites are currently gaged. The Licensee shall establish one additional site, using the most current USGS protocol for gage station installation, maintenance, and data collection (USGS 1982 - Measurement and Computation of Streamflow: Volumes 1 and 2, Geological Survey Water-Supply Paper 2175).

(2) Existing gage stations shall include the Klamath River below Keno Dam (#11509500), Spencer Creek above the confluence with the J.C. Boyle Reservoir (#11510000), and Klamath River below the J.C. Boyle Powerhouse (#11510700). The Licensee shall operate and maintain the gages at these sites if the gages are no longer served by the current operators.

(3) The Licensee shall install a new gage on the Klamath River J.C. Boyle Bypassed River Reach below all outlets from the J.C. Boyle Dam and above the springs at RM 225. The location for the gage shall be approved by the BLM prior to installation.

2. Instream Flow Reporting - The Licensee shall, within one year after license issuance:

(a) Provide instantaneous 30-minute real time streamflow data in cfs via remote access that is readily available and accessible to the public.

(b) Design and maintain a database, similar to the most current version of the USGS National Water Information System (NWIS) for reporting on surface water. The database shall store gage network data and streamflow tracking procedures. BLM shall review and approve the database.

(c) The Licensee shall, within two years after license issuance, submit a report for each water year (i.e. October 1st through September 30th) of streamflow data reported in cfs to the BLM. The report shall be filed with the BLM within six months of the end of each water year.

D. River Gravel Management Plan

The Licensee shall, within one year after License issuance, file to the Federal Energy Regulatory Commission (Commission) a River Gravel Management Plan (RGMP), for the J.C. Boyle Bypassed River and Peaking Reaches as specified.

The Licensee shall prepare a draft RGMP after consultation with the BLM. The Licensee shall allow a minimum of 30 days for the BLM to comment and to make recommendations on the draft RGMP before finalizing the RGMP and filing it with the Commission. The Licensee shall include with the RGMP documentation of consultation with the BLM and copies of comments and recommendations that are accommodated by the RGMP. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information. At the time the Licensee files the RGMP with the Commission, the Licensee shall submit a copy of the filed documents to the BLM.

The BLM reserves the right to require changes to the RGMP by filing modifications to the RGMP within 30 days of receipt. Upon Commission approval, the Licensee shall implement the RGMP, including any changes required by the BLM.

1. River Gravel Management Plan (RGMP) - Implementation, Monitoring, and Adaptation.

(a) At a minimum the RGMP shall include a river gravel management program to increase channel complexity and availability of spawning habitat for resident and anadromous fish. The river gravel management program will continue for the life of the License. The RGMP shall include the following components as specified:

(1) A description of how channel complexity will be provided, such that variation in channel depth, velocity, substrate, cover, and temperature at all flows is restored.

(2) Quantity of gravel to be added, such that the minimum amount to be added is 1,226 tons/year (20% of the maximum) and the maximum amount to be added is equivalent to the estimated average annual deficit of 6,134 tons/year. Quantity of gravel shall be based on estimates of ongoing reductions in sediment supply due to J.C. Boyle Dam and on the improvements in channel complexity and spawning habitat over time.

(3) Timing of gravel to be added, based on estimates of ongoing reductions in sediment supply due to J.C. Boyle Dam and on the improvements in channel complexity and spawning habitat over time.

(4) Method(s) of gravel augmentation, including, but not limited to, the following approaches:

a. Passive gravel augmentation at a logistically convenient location, allowing high flows to distribute over time;

b. Placement of discrete quantities of gravels in locations, usually riffles, where they are expected to be of most benefit, based on hydrologic and biologic considerations; and

c. Modeling of reach characteristics to determine gravel augmentation.

(5) Objectives describing how the RGMP will satisfy Klamath Falls Resource Area Resource Management Plan direction (USDI BLM 1995a), such as "Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport." (USDI BLM 1995a, pages 7-9).

(6) Evaluation procedures, such as performance measures, that describe how monitoring results will be used for adaptation of the RGMP over the term of the License.

(b) The RGMP shall be accomplished in three phases (implementation, monitoring, and adaptation.)

(1) Implementation (Years 1 though 3): Implement the RGMP immediately upon approval by the Commission and the BLM, including any changes required by the Commission. Employ the gravel management program in accordance with permit approvals and biologically appropriate timing. In the RGMP the Licensee shall:

a. Identify specific goals of the RGMP, based on review of available habitat unit mapping and geomorphic and hydraulic studies to determine where specific riffles, glides, side channels, point bars, and floodplains will benefit from gravel augmentation. Identify numeric goals for quantifying success of: diversity in alluvial features, area of spawning and rearing habitat for different species, length of side channels, and area of potentially improved floodplain.

b. Identify the flows needed to move the size of material supplied at different sites, based on review hydraulic and geomorphic information, including slope, width, and depth of the channel.

c. Identify potential access points. Existing road access points are: 1) below the dam; 2) near the powerhouse; and 3) at the Klamath River Campground. Additional access points may be constructed or available, subject to approval by BLM.

d. Describe the location and timing of gravel augmentation, considering logistical and access constraints and legal requirements necessary to maintain water quality and aquatic and riparian habitats.

e. Identify methods for surveying for the surface area and volume of material added after gravel augmentation.

f. Develop a system for maintaining survey data including, but not limited to, timing and location of treatments.

(2) Monitoring and Evaluation (Years 1 though 7): Initiate monitoring at the time of gravel placement and continue through the life of the RGMP. Conduct monitoring to determine the effectiveness of implementation in meeting objectives of gravel augmentation, and to provide information to adapt the program. Monitoring shall include full reach monitoring and intensive site monitoring as specified:

a. Full Reach Monitoring (BLM-administered lands in the J.C. Boyle Bypassed River and Peaking Reaches):

- In the 7th year of implementation, after all gravel is placed, but before the Comprehensive Report is compiled: (1) map all locations where materials up to 250 mm are the dominant or subdominant substrate; and (2) re-map habitat unit types at similar flows, and with criteria similar to that used in preparation of the Final License Application (PacifiCorp 2004a).
- Before implementation, and in the 7th year of implementation, after all gravel is placed but before the Comprehensive Report is compiled, map point bars, side channels and floodplains, up to the estimated 100-year flood flow level.
- Annually measure and record spawning use identified within each habitat unit. Measure physical extent of spawning habitat areas used annually and any suitably sized gravel patches which are not used for spawning. Use the same methods in all years.

b. Intensive Site Monitoring (BLM-administered lands in the J.C. Boyle Bypassed River and Peaking Reaches): Select and monitor at least 20% of the length of riffle and run units. These units should be areas which are known to, or may be influenced by, gravel augmentation.

- Monitor these sites every three years or if flows exceed the five-year return frequency.
- Survey to record changes in topography and channel features based on ground surveys.
- Conduct Wolman Pebble counts, and bulk sediment sampling at each sampling period to adequately characterize the habitat unit.
- Sample invertebrate populations to identify changes in production.

(3) Adaptation (Years 7 through 9): During the seventh year of implementation, evaluate monitoring data and adapt the RGMP for the next 10-year gravel management cycle. In cooperation with the BLM, determine the effectiveness of the RGMP and determine the need for future augmentation and additional monitoring and evaluation over the following 10 years. Continue implementation, monitoring, and revision on 10-year cycles throughout the term of the license.

(c) RGMP Reporting - The Licensee shall:

(1) Submit to the BLM and the Commission, within six months after the end of each implementation and monitoring year, an annual report on the activities of the gravel management program during the previous year. The report shall include a description of the quantities of gravel added, methods used, and any monitoring data.

a. The BLM and the Commission shall have 60 days to comment on the adequacy of the RGMP, following submission of the report to the BLM and the Commission. The Licensee shall consult with the BLM on any necessary changes to the implementation and monitoring. Upon Commission approval, the Licensee shall implement the revisions.

(2) Submit to the BLM and the Commission, in the 7th year, a Comprehensive Monitoring Report of the gravel monitoring data from the previous six years.

a. The BLM shall have 90 days to comment on the adequacy of the Comprehensive Monitoring Report, following submission of the report to BLM and the Commission. The Licensee shall consult with the BLM on any necessary changes to the RGMP, as described in the adaptation phase of the RGMP. Upon Commission approval, the Licensee shall implement modifications to the RGMP from comments on the results in the report and consultation with the BLM.

E. Adaptive Management Plan (AMP)

The Licensee shall, within one year after License issuance, file to the Commission, an Adaptive Management Plan (AMP) for the J.C. Boyle Bypassed River and Peaking Reaches as specified.

The Licensee shall prepare a draft AMP after consultation with the BLM. The Licensee shall allow a minimum of 30 days for the BLM to comment and to make recommendations on the draft AMP before finalizing the AMP and filing it with the Commission. The Licensee shall include with the AMP documentation of consultation with the BLM and explanation of how BLM comments and recommendations are accommodated by the AMP. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information. At the time the Licensee files the AMP with the Commission, the Licensee shall submit a copy of the filed documents to the BLM.

The BLM reserves the right to require changes to the AMP by filing modifications to the AMP within 30 days of receipt. Upon Commission approval, the Licensee shall implement the AMP, including any changes required by the BLM.

1. The AMP shall be designed to monitor how implementation of the River Corridor Management Condition is effective in improving fish habitat quantity and quality for resident, migratory, and anadromous fish.

2. The Licensee shall report the monitoring results, and an evaluation of these results, annually to the BLM. The Licensee shall coordinate with the BLM, and the monitoring shall be consistent with other monitoring efforts (e.g., the RGMP.)

(a) The evaluation reports shall include at a minimum all relevant data collected and the Licensee's conclusions regarding the state of aquatic habitat (spawning, holding, feeding, juvenile rearing, riparian, and migratory).
(b) The report shall review the adequacy of flows for providing migration, rearing, and spawning habitat for native aquatic species; flow necessary to move spawning gravel; flow necessary achieve riparian habitat management objectives; flow to support power generation; and flows necessary to provide opportunities for recreation.

3. Within 60 days of issuance of the reports to BLM, the Licensee shall file the record of consultation and any BLM comments and recommendations with the Commission. The BLM reserves the right, after notice, comment, and administrative review, to require changes to Project operation through revision of 4(e) conditions.

Rationale

Introduction

In the J.C. Boyle Bypassed River Reach (4.3 miles from J.C. Boyle Dam to the J.C. Boyle Powerhouse), the Klamath Hydroelectric Project (Project) operations have altered the hydrologic regime. The Project has reduced flows, truncated flood flows, and reduced the seasonal flow variability. These changes have reduced scour and deposition, modified channel shape, and reduced the quality and quantity of riparian and aquatic habitat. The minimum base flow of 6 % of the mean annual flow (1560 cfs) has facilitated the encroachment of undesirable riparian vegetation species (e.g., reed canary grass), reduced recreation opportunities (e.g., whitewater boating), and transformed a major river into a small stream. The 100 cfs minimum base flow occurs about 89% of the time. Conversely, in the J.C Boyle Peaking Reach (16 miles from the J.C. Boyle Powerhouse to the slackwater of Copco I Reservoir) flows are currently hyper-variable, and change daily just below the J.C. Boyle Powerhouse from a low flow of approximately 320 cfs to either a high flow of 1,500 cfs (one turbine) or about 3,000 cfs (two turbines.) These current Project operations manage the Klamath River primarily for power production, while creating a summer whitewater boating industry. Current Project operations have also altered the Klamath River corridor including riparian and aquatic habitat.

The sections below, describe BLM management direction, the current and proposed operations, and the impacts of those operations on natural resources, recreation, and power production. There is also a description the development of the Condition and an assessment of the effects of the Condition on natural resources, recreation, and power production.

Purposes of the Reservation

The River Corridor Management Condition (Condition) addresses impacts of the Project operations on stream channel integrity, riparian habitat, and fish habitat to ensure adequate protection of natural resource values and utilization for recreation and power production. The Condition reflects multiple use and sustained yield management objectives of the BLM for the J.C. Boyle Bypassed River and Peaking Reaches on the Klamath River. The objective of the Condition is based on the Klamath Falls Resource Area Resource Management Plan (KFRA RMP) and the *Federal Lands Policy Management Act* (FLPMA 1976). According to policy

direction in FLPMA (1976), the BLM manages BLM-administered lands for multiple use and sustained yield. FLPMA states:

> "…management be on the basis of multiple use and sustained yield…"
>
> "The term "multiple use" means the management of public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; …a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and non-renewable resources, …and harmonious and coordinated management of the various resources without permanent impairment of the land and the quality of the environment with consideration being given to the relative value of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output."
>
> "The term "sustained yield" means the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the public lands consistent with multiple use."

1. Natural Resources

The BLM reservations within the KFRA are administered according to the KFRA RMP Record of Decision (ROD). The KRFA RMP provides direction for the BLM to engage in the relicensing process: "For proposed hydroelectric projects under the jurisdiction of the Federal Energy Regulatory Commission, provide timely, written comments regarding maintenance of instream flows and habitat conditions and maintenance/restoration of riparian resources and stream channel integrity" (USDI BLM 1995a, page 16). Further direction specific to hydroelectric projects in the KFRA RMP states that a priority emphasis should be provided for: "…maintenance of instream flows and habitat conditions and maintenance/restoration of riparian resources and stream channel integrity..." (USDI BLM 1995a, page 67).

The KFRA RMP includes provisions of the 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl that is commonly referred to as the Northwest Forest Plan. Central to the Northwest Forest Plan is the Aquatic Conservation Strategy (ACS), which seeks to restore habitat and ecosystem health by maintaining and restoring aquatic habitat, restoring habitat connectivity, and maintaining flows sufficient to sustain elements of aquatic systems. The KFRA RMP states that existing hydroelectric project support facilities in Riparian Reserves should be operated "with an emphasis to eliminate adverse effects that retard or prevent attainment of ACS objectives" (USDI BLM 1995a, page 67).

According to the KFRA RMP, the BLM-administered lands along, and including, the Klamath River are a riparian reserve for fish-bearing streams. The riparian reserve for the Klamath River is "…the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of the riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of stream channel), whichever is greatest." (USDI BLM 1995a, page 13)

Table 4-1: Aquatic Resource Objectives from the KFRA RMP

Resource	KFRA RMP (USDI BLM 1995a)
1. Stream Channel Integrity	▪ "Maintain and restore the distribution, diversity and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted." (Pages 7-9) ▪ "Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species." (Pages 7-9) ▪ "Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations." (Pages 7-9) ▪ "Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical and chemical integrity of the system and benefits survival, growth, reproduction and migration of individuals composing aquatic and riparian communities." (Pages 7-9) ▪ "Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport." (Pages 7-9) ▪ "Identify instream flows needed to maintain riparian resources, channel conditions, and fish passage." (Page 35)
2. Riparian Habitat	▪ "Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration and spatial distribution of peak, high and low flows must be protected." (Pages 7-9) ▪ "Maintain and restore the timing, variability and duration of floodplain inundation and water table elevation in meadows and wetlands." (Pages 7-9) ▪ "Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability." (Pages 7-9) ▪ "Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species." (Pages 7-9) ▪ "Protect floodplains and wetlands in accordance with Executive Orders 11988 and 11990" (Page 29) ▪ "Manage riparian-wetland areas to protect, maintain, or improve riparian habitat for wildlife and native plant diversity." (Page 29) ▪ "Achieve riparian-wetland area improvement and maintenance objectives through the management of existing uses, wherever feasible." (Page 29) ▪ "Prescribe management of riparian-wetland values based on site-specific characteristics and settings." (Page 29) ▪ "Include corrective measures, such as construction of erosion control structures…and control or mitigation of activities that may contribute to soil erosion and degradation of watershed condition." (Page 30)
3. Fish Habitat	▪ "Maintain and restore fisheries potential; promote the rehabilitation and protection of at-risk fish stocks and their habitat; and maintain instream flows to support riparian resources, and channel conditions." (Page 35) ▪ "Maintain or enhance the fisheries potential of streams and other waters…" (Page 35).

2. Recreation

In addition to the KFRA RMP direction for natural resources, the RMP includes provisions for managing the Upper Klamath River as a Scenic River in the National Wild and Scenic Rivers system. This 11-mile segment (RM 209.3 to 220.3) of the Klamath River below J.C. Boyle

Powerhouse has special management requirements. The designation of the Wild and Scenic River (WSR) reach of the Klamath River leads the BLM to protect "…their outstandingly remarkable values (ORV)…", to "…maintain and enhance the natural integrity of river-related values in designated and suitable river areas.", and to "…protect the free-flowing values and identified outstandingly remarkable values (recreation, scenic, fish, wildlife, prehistoric, and historic, and it's value as a Native American traditional use area)" (USDI BLM 1995a, page 45).

For the Klamath River Complex Special Recreation Management Area, which includes the WSR segment of the upper Klamath River direction is provided to "emphasize whitewater boating, fishing, and camping along the upper Klamath River" (USDI BLM 1995a, page 50).

Rationale - (A) and (B) J.C. Boyle Bypassed River Reach and Peaking Reach

A. Current and Proposed Project Operations

Current Project operations and Project operations proposed in the FLA (PacifiCorp 2004a, Executive Summary) are similar. The description and analysis below are based on the hydrologic record.

1. J.C. Boyle Bypassed River Reach Current and Proposed Project Operations

Base Flow: Current Project operations deliver approximately 100 cfs to the J.C. Boyle Bypassed River Reach (RM 220.4 TO 224.7) year-round. Large springs a short distance below the dam supply an estimated additional 220 cfs of accretion flow, such that the total streamflow in the lower portion of the bypassed reach is approximately 320 cfs for most of the year (PacifiCorp 2004d, pages 5-38 to 5-39).

Project operations divert the majority of inflow available from the Klamath River above J.C. Boyle Reservoir. The magnitude of diversion from the J.C. Boyle Reservoir ranges from 300 cfs to 2,850 cfs (PacifiCorp 2004d, 5-42). Analysis of published daily USGS flow data, using the basis that flows are 100 cfs unless there is a spill, illustrates a reduction in flow to the J.C. Boyle Bypassed River Reach (USGS gage station #11510700). Flow into the bypassed reach is at or near 100 cfs 89% of the time. In the upstream portion of the J.C. Boyle Bypassed River Reach, when water is diverted for power, current operations provide about 81% of the outflow from J.C. Boyle Reservoir to the J.C. Boyle Canal. That leaves 19% of flow to the J.C. Boyle Bypassed River Reach. By diverting the majority of inflow, the current operations of the Project manage flows primarily for power generation and reduce flows available for sediment transport and hydrologic processes that support riparian, fisheries, and aquatic species habitat in the 4.3 mile long J.C. Boyle Bypassed River Reach.

Spill: The exception to the base flow occurs during infrequent spill events when river flows exceed 2,950 cfs and J.C. Boyle Reservoir is full (PacifiCorp 2004a, Exhibit E 3.1.5.3). Changes to the base flow also occur during emergency shutdowns and emergency spillway releases (PacifiCorp 2004a, Exhibit E 3.1.5.3). As a result of current operation, flows that mimic seasonal high flows occur only when there is a spill. According to analysis of published USGS gage data from the Klamath River below the J.C. Boyle Powerhouse (#11510700) from 1990-2000, a spill occurs two to three times per year in average to wet water years.

Ramping: Ramping typically only occurs during spill events and Project maintenance or during emergency shutdowns and emergency spillway releases. There is no stream gage or flow records available to determine what existing ramp rates are in the J.C. Boyle Bypassed River Reach during spill events. There is no current License requirement for ramp rates in the J.C. Boyle Bypassed River Reach.

Flow Magnitude, Duration, and Frequency: The Klamath River below the J.C. Boyle Powerhouse USGS gage data (#11510700) from the period of record (45 years from 1959 to 2000) was used to estimate the frequency and magnitude of seasonal high flows in the J.C. Boyle Bypassed Reach. Seasonal high flows for the J.C. Boyle Bypassed River Reach are estimated by subtracting the hydraulic capacity of the J.C. Boyle Powerhouse (2,850 cfs) and spring accretions (220 cfs) from the daily streamflow values for the gage location. Flood frequency analysis (Gordon et al 1992) for this gage site reveals that due to Project diversions, the magnitude of the 1.5-year flood event has been reduced by 80%, the two-year flood event has been reduced by 51%, and the five-year flood event had been reduced by 33%. PacifiCorp analysis also shows that Project operations **reduce the magnitude of flood events** (PacifiCorp 2004d, page 5-46).

The frequency of flows at or near the base flow of 100 cfs is 89% for the period of record (45 years from 1959 to 2000). According to USGS gage records, spill events occur approximately two to three times per year in wet and average water year types and not at all in dry years. Spill events were determined by counting the number of times flows exceeded 3,200 cfs. They occur abruptly, are short in duration, and do not reflect a flow regime with seasonal variability. Thus, the **frequency of high flows** (greater than the base flow of 100 cfs) in the J.C. Boyle Bypassed River Reach would be reduced as a consequence of proposed Project operations. This conclusion is supported by the IHA analysis by Huntington, which demonstrates that the high flows of the greatest magnitude have been eliminated when compared to the without Project scenario (Huntington 2004).

The BLM review of PacifiCorp modeling results illustrate that flows in the J.C. Boyle Bypassed River Reach were only elevated above base flow (i.e. 100 cfs) for one month during an average water year (2000). When flows were increased above 100 cfs they did not exceed 2,000 cfs, even when available flows from the Klamath River above J.C. Boyle Reservoir were greater than 3,000 cfs for approximately two months (PacifiCorp 2004a, Exhibit E 3.1.5.3 and Exhibit 3-24). According to data in the Water Resources Final Technical Report (seven years between 1991-2001), the duration of annual spill periods at the J.C. Boyle Dam was greater than three months in wet and above average water years, while during below average and dry water years the duration was less than one month or did not occur at all (PacifiCorp 2004d, page 5-37). Therefore, the **duration of flood events** has been reduced by the Project operations.

Analysis of USGS gage data was used to compare the flows in the peaking reach to those in the bypassed reach to determine the reduction in **magnitude of high flows** in the bypassed reach. Compared to the J.C. Boyle Peaking Reach, the duration of high flows (greater than the average annual flow) is diminished through the diversion of available inflow to the J.C. Boyle Powerhouse. Analysis of USGS gage data for an average water year type (2000) shows that in the peaking reach, the duration of flows greater than the average annual flow was approximately five months, whereas the duration in the bypassed reach was only three months (USGS gage #11510700). In a below average water year (2001), flows were greater than the average annual

flow in the peaking reach for approximately four months, whereas in the bypassed reach flows did not exceed the base flow condition of 100 cfs at all.

2. J.C. Boyle Peaking Reach Current and Proposed Project Operations

Base Flow: The base flow to the J.C. Boyle Peaking Reach (RM 204 to RM 220.4) is approximately 320 cfs, comprised of approximately 100 cfs released from J.C. Boyle Dam plus spring accretions (PacifiCorp 2004d, pages 5-38 to 5-39). Changes to this base flow occur during peaking operations, spill events, or during emergency shutdowns and emergency spillway releases (PacifiCorp 2004a, Exhibit E 3.1.5.3).

Peaking: The Project controls a daily peaking flow pattern throughout most of the year when river inflows to J.C. Boyle Reservoir are less than the maximum hydraulic capacity (2,850 cfs) of the J.C. Boyle Powerhouse (PacifiCorp 2004d, pages 5-37). During peaking operations, this reach can have up to a ten-fold diurnal variation in flow, as discharge ranges from 320 cfs to about 3,000 cfs. More specifically, during peaking operations, river flows vary between 320 cfs and 1,500 cfs when the J.C. Boyle Powerhouse is running one turbine and about 3,000 cfs when two turbines are used (PacifiCorp 2004d, page 5-42).

When river flows are greater than about 3,000 cfs, constant generation (i.e. “run of the river”) and spill occurs. The project is managed as “run of the river” for limited periods, usually during the spring (PacifiCorp 2004d, page 5-35).

Ramping: Project ramping occurs when operations require an increase or decrease in flow through the turbines for power generation. Ramping also occurs when outflow is reduced to facilitate reservoir refill or when maintenance activities require lowering Project reservoirs to access structures. In addition, there are unplanned outages which are an uncontrollable cause of Project ramping. Project start-up after planned and unplanned outages also involves ramping. Under current operations, ramp rates are restricted at the top of the J.C. Boyle Peaking Reach to nine inches per hour. Ramping occurs at this rate during peaking operations and when spill occurs at the J.C. Boyle Dam (PacifiCorp 2004d, Section 4). According to BLM review of USGS gage data, peaking operations can raise or lower the river stage downstream of the J.C. Boyle Powerhouse by 2.2 feet (river stage change from 30-minute discharge data) in a period of several hours (#11510700), resulting in rapid flow fluctuations in the J.C. Boyle Peaking Reach. Huntington (2004) documented numerous compliance violations with some ramp rates exceeding 1.2 feet per hour for up ramping and 1.3 feet per hour for down ramping.

The Project is managed as a peaking operation with daily flow fluctuations ranging from 1,000 to 2,600 cfs for nine to ten months of the year (PacifiCorp 2004d, page 5-35). Run-of-river operations occur during limited periods in late winter and spring when inflow exceeds the capacity of the two turbines in the J.C. Boyle Powerhouse. Data presented in the Water Resources FTR (PacifiCorp 2004d, 5-37) regarding the length of annual spill periods at J.C. Boyle Dam indicate that run-of-river operations, with a duration greater than three months, occur only in wet and above average water years. During below average and dry years spill is very short or does not occur. Analysis of USGS flow records downstream from J.C Boyle Powerhouse indicates that flows exceeded turbine capacity in 35 out of 45 (77%) of the water years between 1959 and 2003. The average duration of flows in excess of turbine capacity between water years 1993 and 2003 was 48 days (estimated from hydrographs derived from 30-minute streamflow data).

Huntington's IHA analysis determined the Project caused dramatic increases in median daily flow ranges (more than 1000%) and in the frequency and rates of flow change below the J.C. Boyle Powerhouse. Median hourly rates of rise and fall in flow were each increased more than 500%. Maximum rates of rise and fall in flow were increased by more than 300% (Huntington 2004).

B. Impacts of Current and Proposed Project Operations

Interactions among the biotic (e.g., vegetation and fish), hydrologic, and geomorphic components of ecosystems combine to shape the structure and function of riparian and stream systems (Kauffman et al 1997). Further, the ecological structure and function of aquatic and riparian ecosystems depends on the hydrologic regime, or pattern and quantity of water flowing through a river system (Gorman and Karr 1978, Junk et al. 1989, Poff and Ward 1990; Sparks 1992, Poff et al. 1997). Intra- and inter-annual variation in the hydrologic regime affects the dynamics among aquatic and riparian species through influences on habitat, natural disturbance, and biotic interactions (Poff and Ward 1989). Thus, modifications to the hydrologic regime can indirectly alter aquatic and riparian habitat (Ward and Stanford 1983, 1989; Bain et al. 1988).

1. Steam Channel Integrity

Bypassed Reach: According to PacifiCorp analysis of Project impacts, "…significant changes to geomorphology were observed in the J.C. Boyle bypass reach…" (PacifiCorp 2004a, Exhibit E, page 5-25). Reductions in the supply of sediment from lack of gravel recruitment due to J.C. Boyle Dam and low flows have caused changes in the stream channel. If hydrologic patterns, sediment availability, or streamside vegetation are altered, then channel morphology would subsequently adjust to these new conditions (Kauffman et al 1997). The PacifiCorp (2005) fish habitat versus flow relationships [weighted usable area (WUA) curves] indicate a change in stream structure. The WUA relationships show that geomorphic changes caused by current Project operations may have reduced the extent and quality of aquatic habitat and are impairing riparian ecological processes. These WUA curves reflect the loss of gravel point bars, benches, and spawning areas due to the loss of sediment supply; confinement due to side-cast material; more uniform bedforms; and reduced riparian width; and vegetation encroachment on the channel due to largely static flow conditions.

J.C. Boyle Dam has limited the input of sediment into the bypassed reach causing changes in channel morphology and fluvial processes, such as **coarsening of bed material** (PacifiCorp 2004d, page 6-111) and reducing the extent of active alluvial features. These changes have resulted in detrimental effects on aquatic and riparian habitats, including channel narrowing, increased bank erosion, and reduced channel migration. The J.C. Boyle Dam has blocked recruitment of sediment inputs such as gravel and small cobble. As a result, the **river bed has coarsened** as smaller gravels are transported downstream and not replaced, and larger gravels and cobbles dominate the streambed substrate. In general, below dams, with lack of sediment from flushing flows, the bedload composition becomes "armored" with material too coarse to be moved by the river, until in some cases bedrock is exposed (Collier et al 1996). The larger sized substrate that dominates these reaches is unsuitable for use by spawning fish (Kondolf and Wolman 1993).

Reductions in the magnitude and frequency of seasonal high flows have contributed to increasing the recurrence interval of flows necessary to mobilize the streambed material. Under Project operations, 1,450 cfs flows are currently needed to mobilize the streambed in the upper portion of the J.C. Boyle Bypassed River Reach. The recurrence interval of flows greater than 1,450 cfs has increased from less than one year, without the Project, to almost two years with the Project due to water diversion (PacifiCorp 2004d, page 6-134). In the lower portion of the reach, the recurrence interval of bed mobilizing flows has increased from approximately 1.5 years without the Project, to 2.5 years with the Project.

High flows that mobilize the streambed are necessary for **flushing out fine sediments**, redistributing gravel to maintain quality spawning beds (Wilcock et al 1996), providing water and nutrients to riparian areas (Stromberg 2001), and increasing the amount of rearing habitat by inundating the vegetated riparian zone.

Operation of the J.C. Boyle Canal **overflow emergency spillway** has resulted in the release of fines, sands, coarse cobble, and large boulders into the Klamath River. The J.C. Boyle overflow spillway is located approximately half way down the power canal, and has caused impacts to aquatic habitat from this segment to the reach downstream (PacifiCorp 2004a, Exhibit E, pages 5-25 to 5-26). Surveys of the area impacted by use of the emergency spill indicate that approximately 1,856,000 cubic feet of material has eroded into the bypassed reach (PacifiCorp 2004d, page 6-117). In addition, **sidecast material** from the construction of the Project canal and roads has entered the bypassed reach, causing adverse impacts, including channel narrowing (PacifiCorp 2004d, page 6-117). At one site approximately 4,800 feet upstream of the emergency spillway, road sidecast encroached into the bypassed channel, causing an undercut for nearly 400 feet on the opposite bank. This undercut has produced an estimated 276,000 cubic feet of sediment (PacifiCorp 2004d, page 6-117).

Peaking Reach: The J.C. Boyle Reservoir and Dam have reduced the **sediment supply** into the Klamath River downstream, while peaking operations from the Powerhouse have increased the substrate size of the limited sediment present in the J.C. Boyle Bypassed River and Peaking Reaches (PacifiCorp 2004d, page 6-134). Under current operations, the flow required to **mobilize the bed** has increased, while the recurrence interval of these flows has decreased (compared to the Without-Project scenario). For example, currently near the BLM campground in the J.C. Boyle Peaking Reach (RM 217.5), estimated flows of greater than 40,000 cfs would be necessary to mobilize bed materials. The reduced sediment supply coupled with frequent peaking operations has increased the average substrate size (coarsened the streambed), requiring a magnitude of higher flows greater than the largest peak flow recorded in this reach. Without the Project, approximately 5,000 cfs flows would mobilize the streambed about every two years (PacifiCorp 2004d, page 6-135). Loss of bedform features and alteration of sediment transport processes reduces the amount of productive diverse aquatic habitat (Milhous 1998).

Increased flows and reduction in the frequency of flows necessary to mobilize the streambed have reduced **channel structure and complexity** in the J.C. Boyle Peaking Reach. The channel lacks active alluvial features and is dominated by "featureless bedforms" (PacifiCorp 2004d, 6-115). This, in effect, reduces the distinction between channel features, and thus decreases fish habitat diversity (Hill et al 1991). In addition, the limited sediment supply to this reach contributes to reducing the dynamic channel structure. If hydrologic patterns, sediment availability, or streamside vegetation are altered, then channel morphology would subsequently

adjust to these new conditions (Kauffman et al 1997). This is often expressed by a simplification in stream structure (i.e. loss of pools, decreased channel sinuosity, and loss of channel diversity (Kauffman et al 1997).

2. Riparian Habitat

Bypassed Reach: Reduced flows create conditions suitable for the establishment and survival of undesirable riparian vegetation, and species such as **reed canary grass** have encroached on the stream channel (PacifiCorp 2004a, Exhibit E, page 5-149). Reed canary grass is well-suited to survive in excessively coarse substrate (areas that lack gravel and smaller sized material) and gains a competitive advantage over other native riparian species that do not establish in these conditions. Reduced base and seasonal high flows from Project operations have adversely affected the location and type of riparian vegetation in the J.C. Boyle Bypassed River Reach.

Periodic flooding of riparian vegetation is important for maintaining riparian plant species (Hill et al 1991; Marston et al 1995). Inundation from **riparian maintenance flows** provides the nutrients and substrate necessary for establishment and survival of riparian species (Kauffman et al 1997). Since current Project operations reduce the magnitude and frequency of flood flows in the bypassed reach, the upper elevation of the riparian area is reduced. This produces a narrow riparian area that is mostly defined by the 100 cfs base flow provided by the Project. Although PacifiCorp analysis only reviewed "riparian vegetation maintenance flows" for the J.C. Boyle Peaking Reach, the same analysis is appropriate to apply to the J.C. Boyle Bypassed River Reach. The relationships between seasonal high flows and riparian vegetation are similar because the general physiographic and climatic conditions between the peaking reach and the bypassed reach are comparable. According to PacifiCorp analysis, 3,300 to 5,800 cfs "riparian maintenance flows" are required in the J.C. Boyle Peaking Reach to inundate riparian all riparian vegetation (PacifiCorp 2004c, pages 3-105 to 3-106). The year-round base flow of 100 cfs (except for spills) currently provided by the Project does not produce the "riparian maintenance flows," thus reducing the width of the riparian habitat in the J.C. Boyle Bypassed River Reach (PacifiCorp 2004a, Exhibit E, pages 5-25 and 5-26).

In the upper portion of the J.C. Boyle Bypassed River Reach, the river is constrained by **sidecast material** present in the margins of the active stream channel. This material was generated during the construction of the J.C. Boyle Canal and road and continues to impact 1.5 miles of the channel. The sidecast material has constricted the channel and altered the riparian vegetation along most of the reach (PacifiCorp 2004a, Exhibit E, page 5-25). Alteration of instream flows and changes in sediment regimes can result in decreased bank stability (Rosgen 1996) and loss of riparian vegetation (Hill et al 1991). Desirable riparian vegetation (e.g., willow) does not establish and survive in the conditions created by the boulder-sized rocks comprising the sidecast. Further, in some areas this material has entered the active channel and is causing accelerated bank erosion on the opposite bank (PacifiCorp 2004d, page 6-117).

Peaking Reach: Sediment transport measurements indicate that current Project peaking operations generate flows capable of moving suspended sediment and fine-grained bedload (i.e. sand) (PacifiCorp 2004d, page 6-117). During 3,000 cfs peaking events, the bedload transport rate is approximately one ton per day, while the suspended sediment transport rate is approximately 250 tons per day. Peaking operations continue to **deplete fine sediment** from the J.C. Boyle Peaking Reach which already has a reduced supply of sand and fine sediment due to the effects of the J.C. Boyle Reservoir and Dam (PacifiCorp 2004d, page 6-44). These increased

sediment transport rates are likely to impact sediment deposition in riparian areas and aquatic habitat. Further, flow fluctuations contribute to **erosion of gravels and fine sediment** below dams by scouring the channel margins in the poorly vegetated varial zone (Brandt 2000) which further exacerbates stream bed armoring (Marcus et al 1990). This reduces the amount and distribution of riparian vegetation that would otherwise be available for aquatic life. Rearing fish, including sucker larvae and trout fry rely on low velocity channel margins. Lack of riparian vegetation in these areas limits the productivity and cover value for fish. The varial zone in the J.C. Boyle Peaking Reach is the elevation range within the active channel that is affected by daily fluctuation cycles resulting from operation of the Project facilities (PacifiCorp 2004d, page 3-101).

Flow fluctuations in the J.C. Boyle Peaking Reach have enhanced conditions conducive to the establishment and survival of undesirable riparian species, such as **reed canary grass**, and reduced the potential for establishment of other native riparian species (e.g., coyote willow.) Of the limited riparian vegetation in the varial zone, most of it is reed canary grass (PacifiCorp 2004a, Exhibit E, page 5-150). This invasive plant thrives in nutrient-rich conditions subject to frequent inundation (PacifiCorp 2004b, pages 3-112 and 3-114) and is capable of out-competing more desirable riparian species under these conditions (PacifiCorp 2004b, page 3-28). The life history of reed canary grass is conducive to disturbed conditions, such as hourly and daily flow fluctuations. The seeds respond well to mechanical disturbance (e.g., scour) (PacifiCorp 2004b, page 3-108) and the species is adapted to survive in frequently inundated coarse substrates (PacifiCorp 2004b, page 3-22).

Frequent inundation and exposure within the **varial zone** create conditions that allow reed canary grass a competitive advantage over other native riparian species. The distribution and extent of other riparian vegetation within the varial zone is limited and reed canary grass dominates the vegetation species mix (PacifiCorp 2004a, Exhibit E, page 5-150). In addition, peaking operations cause the distribution of this species to extend over a broad horizontal distance as frequent large fluctuations between high and low flows inundate and expose the varial zone (PacifiCorp 2004b, page 3-102). The current average varial zone width is approximately 48.0 feet, as interpolated from average wetted widths (PacifiCorp 2004b, Table 6.7-1) for flow fluctuations from 3,000 cfs to 325 cfs in the J.C. Boyle Peaking Reach (PacifiCorp 2004b, page 6-32). The effect of peaking operations on the varial zone differs throughout the peaking reach, depending on whether the channel is broad and "U"-shaped with terraces and point bars or confined and "V"-shaped. In narrow portions of the channel water level fluctuations would result in a greater change in stage. However, in broad lower gradient segments of the channel that have lower bank slopes, inundation or dewatering occurs over a wider horizontal area of the streambed.

<u>Bypassed Reach and Peaking Reach</u>: Changes in the flow and sediment regimes due to Project operations and facilities impact the potential establishment of desirable riparian vegetation. PacifiCorp analysis indicates that the J.C. Boyle Reservoir traps "…sediment which alters the amount of **fine substrate available** for establishment of riparian vegetation for some distance downstream…" (PacifiCorp 2004a, Exhibit E, page 5-148). J.C. Boyle Dam reduces the input of gravel, sand, and silt to this reach (PacifiCorp 2004a, Exhibit E, page 5-148). In addition, flow diversions and changes in the flow regime reduce the **potential for scouring and sediment deposition** of the limited material that is transported downstream of the dam (PacifiCorp 2004c, page 6-135). Since the streamflows, sediment supply, and bed mobility are reduced, the extent

of substrate appropriate for establishment of willows and other native riparian plants is decreased. Thus, the Project contributes to a **lack of willow** production (PacifiCorp 2004a, Exhibit E, page 5-102). Riparian hardwoods typically germinate and establish on "…freshly deposited alluvium in channel positions low enough to provide adequate moisture but high enough to escape scour…" (Scott et al 1993). The Project, however, maintains frequent scour conditions that do not provide alluvium over a large portion of the area where willows have the potential to establish. The inability of species like willow to compete successfully with reed canary grass under current Project conditions reflects the ability of reed canary grass to thrive under altered hydrologic regimes.

Project-related impacts on the distribution and type of riparian vegetation present in the riparian area affect the movement and migration of **wildlife species** that utilize this habitat. According to PacifiCorp, the "…patchy distribution of riparian habitats and unnatural distribution of riparian plant species may decrease the linear movement of several avian, reptile, amphibian, and mammalian species." (PacifiCorp 2004c, page 6-54) These species include a number of riparian focal species that potentially occur in the Project area (PacifiCorp 2004c, page 6-54), some of which are currently BLM sensitive species (Oregon and Washington BLM special status species list as of March, 2006). (See Table 4-2 below.) Riparian focal species use riparian habitats more often than upland habitat (PacifiCorp 2004c, page 6-54). For example, the long-term monitoring performed by the Klamath Bird Observatory indicates that riparian areas are important for breeding and during fall migration (PacifiCorp 2004c, page 6-56). Thus, the distribution of riparian habitat may have an adverse impact on the distribution of riparian-dependent bird species. Further, in the Project area there are special status herptile (e.g., Western pond turtle) and mammal (e.g., Townsend's big eared bat) species that rely on wetland and riparian habitat during some stage of their life cycle (PacifiCorp 2004c, page 5-84).

Table 4-2: Riparian Focal and BLM Sensitive Species Potentially Occurring in the Project Area.

Common Name	**Scientific Name**
Yellow warbler	*(Dendroica petechia)*
Purple martin	*(Progne subis)*
Black crowned night heron	*(Nycticorax nytcticorax)*
Western yellow-billed cuckoo	*(Coccyzus americanus)**
Song sparrow	*(Melospiza melodia)*
Oregon spotted frog	*(Rana pretiosa)* *
Willow flycatcher	*(Empidonax traillii)**
Western toad	*(Bufo boreas)* *
Yellow breasted chat	*(Icteria virens)*
Foothill yellow-legged frog	*(Rana boylii)* *
Source: Terrestrial Resources Final Technical Report, page 6-54 (PacifiCorp 2004c) * Indicates sensitive species.	

3. Fish Habitat Impacts

J.C. Boyle Bypassed River and Peaking Reaches:

Fisheries studies conducted in the Keno, J.C. Boyle Bypassed, and J.C. Boyle Peaking Reaches provide an indication of the impacts of reduced fish migration, low base flows, and the large flow fluctuations caused by the Project operations. Creel census data from Toman (1983) illustrates that numbers of trout in the J.C. Boyle Bypassed and J.C. Boyle Peaking Reaches were less than in the Keno Reach, and the size of fish was significantly larger in the Keno Reach.

This pattern was also revealed in PacifiCorp 2005a Section 3.9.3, (Addley et al 2005) which showed that trout are significantly larger and have higher growth rates in the Keno Reach than in the J.C. Boyle Peaking or Bypassed River Reaches. Oregon Department of Fish and Wildlife research from 1988-1991 (Buchanan et al 1991; Hemmingsen et al 1992; Buchanan et al 1994) and the Final Environmental Impact Statement (EIS) for the proposed Salt Caves Project (Federal Energy Regulatory Commission 1990) also noted low adult trout densities in the upper end of the peaking reach. The FERC EIS reported that trout in the upper peaking reach had relatively low growth rates and that large trout were under represented in the population age structure. The FERC EIS cited five years of investigation compiled by the City of Klamath Falls.

J.C. Boyle Bypassed River Reach:
Evidence provided in PacifiCorp studies supports the conclusion that Project operations have negative impacts on fish habitat in the bypassed reach. Specifically, the **redband trout fishery and habitat**, including food availability, fish production, and overall fish size (Addley et al 2005) are impacted by Project operations. Macroinvertebrate drift data show lower drift density in the bypassed reach compared to the Keno Reach above J.C. Boyle Dam. In the Keno Reach, drift density was 11 times higher in July and 2.4 times higher in September than drift density in the bypassed reach (Addley et al 2005, page 5). This difference in density does not include the much lower total productivity that results from less habitat area available due to lower base flow (approximately six times less flow in the bypassed reach than in the Keno Reach in June, July, and August.) The largely static flows in the bypassed reach coupled with the high proportion of low nutrient spring water may be contributing factors to low drift density and may help explain the lower fish growth and survival observed relative to the Keno Reach. The studies show that fish growth, fish survival of older age classes and fish size-at-age in the bypassed reach are less than observed in the Keno Reach (PacifiCorp 2004b). The foraging model over-predicted observed growth in the J.C. Boyle Bypassed River Reach. It would be necessary to decrease the temperature and/or observed drift density inputs to the model to match the slow growth observed in the J.C. Boyle Bypassed River Reach (Addley et al 2005). This suggests that static flows or some other habitat limitation may be affecting fish growth and survival. Similar patterns in fish population structure were reported by Beak Consulting Inc. (City of Klamath Falls 1986). Trout age distributions (few trout over three years of age and of smaller size at age) and macroinvertebrate drift data suggest that existing flow conditions limit both habitat availability and forage productivity, thus affecting redband trout growth and productivity. The evidence from recent redband trout studies (Addley et al 2005; ODFW 2003) and other previous studies (e.g. Toman 1982) suggests that the minimum inflow of 100 cfs in the J.C. Boyle Bypassed River Reach does not provide for a productive fish community in this reach.

PacifiCorp analysis illustrates that project-related flow reductions affect **fish movement and migration** (PacifiCorp 2004b, page 5-36 and 37). Historically, migrations of redband trout were documented throughout the Klamath River basin (Fortune et al 1966). Redband trout in the J.C. Boyle and Keno areas of the river exhibit a spring time migration from the Frain Ranch area (RM 217) to Upper Klamath Lake (RM 251), with a smaller migration during the fall (Fortune et al 1966, page 112). Recent passage at J.C. Boyle Dam continues to be less than 10% of that reported one year after project construction of J.C. Boyle Dam (Buchanan et al 1991). In addition, average size of redband trout passing over the ladder showed a decline in fish size over the 30 years since the dam was constructed (Hemmingsen 1997).

The fish passage and movement study conducted by PacifiCorp shows that in ten instances, downstream migrating fish pass quickly by the J.C. Boyle Powerhouse (PacifiCorp 2004b). However, information on five upstream-moving fish shows that the two longest delays observed (213 and 24 hours) occurred near the powerhouse. These fish moved into the vicinity of the powerhouse during an extended period of power generation and remained in this vicinity for up to 213 hours. This fish data represents 20% of the observations of upstream passage past the J.C. Boyle Powerhouse. These observations indicate that **flow alterations, including low minimum flow in the bypassed reach, may be affecting fish movement and migration**. During power generation, approximately 80% to 90% of the total flow is coming from the powerhouse, potentially causing a stronger attraction than the J.C. Boyle Bypassed River Reach, because of higher flows or a more concentrated homing scent, which could result in migration delay or cessation (PacifiCorp 2004b, page 5-1).

No field evaluations were conducted by PacifiCorp to evaluate **fish stranding or displacement** in the J.C. Boyle Bypassed River Reach. Although a study was requested below all dams and powerhouses (USDI 2004), no analysis of the effects from ramping due to the Project was performed above J.C. Boyle Powerhouse. However, down ramping during cessation of spill events can cause displacement, stranding, and mortality of fish and invertebrates (Cushman 1985; Hunter 1992; ODFW 2006). Evidence that stranding has been a problem due to Project operations is apparent from review of ODFW file reports, which provide accounts of numerous fish strandings and die-off events below Link River, Keno, and JC. Boyle Dams (ODFW 2006). In the bypassed reach, a fish mortality and stranding event was reported by ODFW on April 11, 1989 when inflows were reduced to the base flow of 100 cfs after an extended duration of spill. The fish stranding and die-off reported by the public and an ODFW research crew included dead and salvaged suckers, redband trout, dace, and sculpins. The event followed a 450 cfs and 520 cfs successive decrease in mean daily flow measured at Keno Dam during the previous two days. The flow in the bypassed reach was reduced by approximately 2,500 cfs or about 96% during the previous five days. Were it not for the diversion to the powerhouse, the reduction in flow volume would have been approximately 55% over the same period. Thus, the impacts of flood events are magnified in the bypassed reach because the rapid decrease from flow volume during flood events to the 100 cfs base flow causes a large relative change. Since redband spawning occurs in the bypassed reach and juvenile redband trout migrate into this reach from Spencer Creek, there is the potential for stranding after spill events, particularly in the spring when fry are present during the recession of flood flows. Additionally, high ramp rates could interfere with spawning success in this reach.

<u>J.C. Boyle Peaking Reach</u>:
Downstream **dewatering and desiccation of spawning habitat** were documented in studies of the J.C. Boyle Peaking Reach (City of Klamath Falls 1987). The Final EIS for the proposed Salt Caves Project (FERC 1990) noted low adult trout densities in the upper end of the peaking reach. The EIS reported that trout in the upper peaking reach had relatively low growth rates and that large trout were under-represented. The FERC EIS concluded that flow fluctuations below the J.C. Boyle Powerhouse caused chronic stress on trout and stranding of eggs, fry, and juveniles. Stress occurred from daily flow fluctuations and related changes in water temperature and water quality. These flow fluctuations caused trout to continue to seek new feeding and resting habitat while water temperature changed metabolism and feeding rates. Stage changes during hydroelectric peaking cycles may inhibit spawning (Hunter 1992; Anglin et al 2004), and can

dewater redds if spawning takes place during the high flows of the peaking cycle (Anglin et al 2004).

When peaking occurs during the middle of the summer, daily water temperature fluctuations of up to 12° Celsius occur in the J.C. Boyle Peaking Reach (City of Klamath Falls 1986; BLM 2003). In September of 2002, daily water temperature fluctuations in the peaking reach were only 2° Celsius after peaking operations were stopped temporarily, compared to fluctuations of 8° Celsius shortly before (PacifiCorp 2004). During off-peak periods of operation, the spring inflow dominates the flow volume, therefore, decreasing water temperature. However, during peaking reservoir water dominates the flow volume, therefore increasing water temperature. BLM's (2003) analysis of water temperature data during this same time period and in June 2003 demonstrates the relationship between water temperatures that occur during peaking to the water temperature resulting from the prevalence of cool spring waters from the bypassed reach. PacifiCorp water quality modeling results show that a steady flow would provide slightly lower daily maximum water temperatures and higher minimum water temperatures. In addition, water quality modeling of without-Project flow would provide even lower daily maximum temperatures and similar minimum temperatures in comparison to the existing condition (PacifiCorp 2005a, page 27; Addley 2005).

Research has shown that large daily fluctuations in temperature compromise growth and survival rates of rainbow trout (Hokanson et al 1977). The thermal effects of peaking likely compound the effects of high water temperature that are near or above the thermal tolerances for salmonids (US EPA 2003) in the peaking reach. Therefore, increases in diurnal fluctuations likely incur additional stress and energetic cost to redband trout.

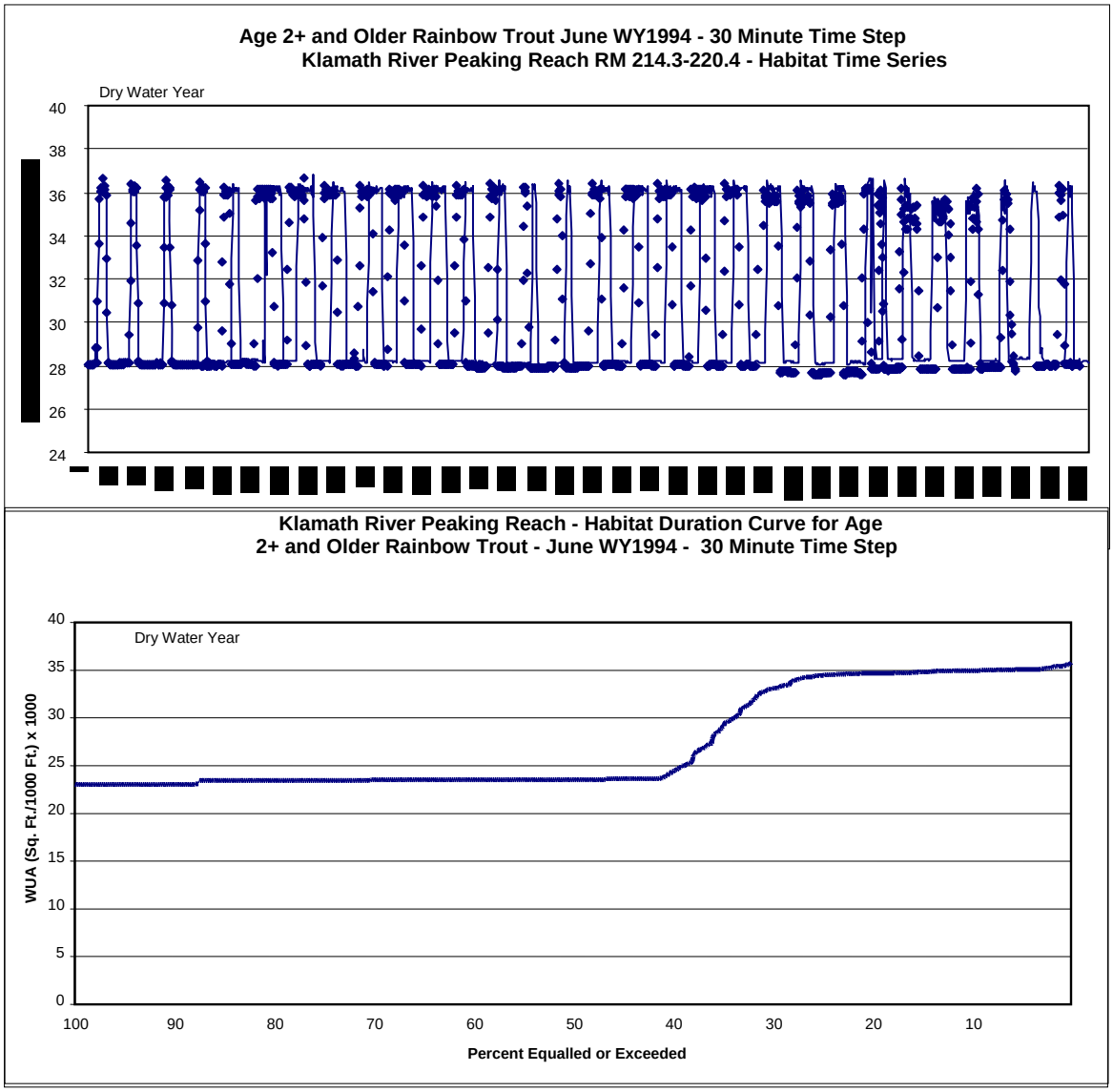
Flow fluctuations can dewater spawning beds, interfere with **spawning** at both low (when storage occurs) and peaked flows, and can result in mortality of incubating and rearing juveniles (Marcus et al 1990). Dewatering, desiccation of sucker spawning habitat, and larval stranding have been documented in the J.C. Boyle Peaking Reach (City of Klamath Falls 1986). Thus, the Project has direct effects on stranding and mortality in the peaking reach.

The effects of the Project peaking operations reduce the **amount and distribution of riparian vegetation** that would otherwise be available for aquatic life. Juvenile fish rearing habitat is generally located within ten feet of near shore areas in the varial zone. Rearing fish, including sucker larvae and trout fry rely on low velocity channel margins for escape cover and feeding. Lack of riparian vegetation limits productivity and cover values for fish (Bowen et al 2003).

The effect of peaking operations on the varial zone differs throughout the peaking reach, depending on whether the channel is broad and "U"-shaped with terraces and point bars or confined and "V"-shaped. In narrow portions of the channel water level fluctuations would result in a greater change in stage. However, in broad lower gradient segments of the channel that have lower bank slopes, inundation or dewatering occurs over a wider horizontal area of the streambed. Since a larger area across the channel and streambanks are affected by the Project, in broad portions of the reach, these areas would tend to have higher rates of fish stranding (Hunter 1992). Aadland (1993) concluded that riffle, raceway, and shallow-pool habitats were the most sensitive to flow fluctuations.

Redband trout and other native fish populations are impacted by peaking operations because these flows limit habitat area as a function of frequent low flow periods. This impact is illustrated in the time series analyses shown in Figure 4-1 (adapted from USDI BLM 2002). This data demonstrates that daily peaking operations **reduce suitable habitat** area to base flow area (approximately 320 cfs) for approximately 60% of the month of June in 1994. The 30-minute time step graph (adapted from USDI BLM 2002) illustrates the frequency and magnitude of the change to which fish and other aquatic animals must adjust on a daily basis. These graphs illustrate the change in available habitat area and the rate at which fish and invertebrates must adjust to rapidly changing conditions twice daily (USDI BLM 2002). PacifiCorp did not investigate the potential energetic cost of these flow fluctuations on trout growth and survival (Addley et al 2005).

Figure 4-1: Time Series Analysis from BLM Instream Flow Study (USDI BLM 2002).



Habitat availability information can be used to assess impacts to fish due to Project peaking operations. As Hunter (1992) points out, instream flow analysis using Instream Flow Incremental Methodology (IFIM) can be used to estimate habitat effects from flow fluctuations,

but IFIM "…is a complex and engrossing methodology that often distracts from other biological effects of hydropower development." Some of the other effects including displacement, food availability, stranding, and geomorphic impacts are discussed below.

The effects of a daily change in flow magnitude due to peaking operations are known to affect overall reach productivity and cause direct **fish mortality due to stranding** (Cushman 1985; Hunter 1992). Changes in surface water elevation cause **fish stranding** and dewatering of spawning areas during down ramping events (Cushman 1985; Hunter 1992). Studies of ramping below dams show that stranding rates increase as a function of increasing magnitude of stage change, and increasing rates of change (Bradford et al 1995). In the Bradford study, daytime stranding rates (2% bar slope) for coho juveniles in a controlled lab experiment ranged from 20% at a 2.4 inches per hour down ramp rate to 65% at an 11 inches per hour down ramp rate. Standing rates for juvenile rainbow trout were proportionally lower but exhibited similar patterns. Rapid flow increases in regulated reaches can wash out redds (Anglin et al 2005), displace fry (Hunter 1992), displace macroinvertebrates (Gislason 1985), and can incur energetic costs to fish due to frequently changing locations of available fish habitat (Anglin et al 2005). This is relevant for rearing of suckers and trout in the Klamath River because most of the habitat for rearing fish is in near-shore areas, subject to dewatering from Project peaking operations (PacifiCorp 2004b).

Physical Habitat Simulation (PHABSIM) is a method of assessing the habitat values that channels currently provide at different flows to assist with setting flow standards (Annear et al. 2004). The results of the Physical Habitat Simulation (PHABSIM) relationships provided by PacifiCorp (PacifiCorp 2005 - Flow Addendum) reflect the result of over 50 years of sediment transport impairment and regular peaking fluctuations. These changes include simplification of channel bedforms, loss of habitat diversity, loss of gravel point bars, gravel benches, and spawning areas; coarsening of the streambed; and reduced riparian productivity due to the impacts of peaking operations on the varial zone. The WUA relationships show that geomorphic changes caused by current Project operations may have reduced the extent and quality of aquatic habitat and are impairing riparian ecological processes. One explanation for why the WUA relationships do not change with changes in flow in the peaking reach is that habitat availability may be shifting with the shoreline as flow increases within the varial zone.

4. Recreation

J.C. Boyle Bypassed River Reach: According to the PacifiCorp Recreation FTR, "Project-related effects on boating in this reach have been substantial" (PacifiCorp 2004k, page 2-64). In addition "…pre-Project flows in the J.C. Boyle bypass were likely to provide flows between 1,000 and 3,000 cfs for several months each year (probably from late spring to mid summer, and then again in late fall to early winter)." Thus, the proposed operation of the Project (i.e. 100 cfs) impacts boating in this reach.

J.C. Boyle Peaking Reach: The BLM administers 21 permittees to provide commercial whitewater boating trips on the J.C. Boyle Peaking Reach of the Klamath River. The whitewater reach downstream of the J.C. Boyle Dam and Powerhouse includes 74 rapids (28 Class I, 25 Class II, 16 Class III, 3 Class IV, and 2 Class V rapids) that create a quality whitewater boating experience (PacifiCorp 2004k, Exhibit E, Page 7-29; USDI BLM 1990a, page 2-19). In the summer of 2004, a total of 4,141 visitors rafted the peaking reach. From May through October rafting visits ranged from 152 in October to 1,441 in July. The rafting use increases from May

through July and decreases from August through October, with the highest number of rafting visits in July and August (See Table 4-3).

Table 4-3: 2004 Upper Klamath Commercial Rafting Visits by Day of the Week and Month

2004 Upper Klamath Commercial Rafting Visits by Day of the Week and Month*							
	May	**June**	**July**	**August**	**September**	**October**	**Total**
Monday	11	72	157	105	28	6	379
Tuesday	38	109	110	142	0	7	406
Wednesday	7	31	32	48	0	72	190
Thursday	0	97	212	105	54	0	468
Friday	18	86	224	255	62	0	645
Saturday	72	182	517	371	161	64	1,367
Sunday	34	119	189	245	96	3	686
Total	180	696	1,441	1,271	401	152	4,141
* Data compiled January 2006.							

C. River Corridor Management Condition – Procedure for Development

As described above, Project operations do not protect stream channel integrity, riparian habitat, or fish habitat in the J.C. Boyle Bypassed River Reach or J.C. Boyle Peaking Reach. To develop the Condition, BLM utilized a multiple use resource management approach to arrive at a flow regime that would maintain and restore these resources, while also protecting recreation and providing for power production. Minimum base flows, coupled with a flow regime that includes inter-annual and intra-annual variation, are appropriate for maintaining fish habitat and riparian processes. Research also indicates that beyond prescribing a minimum flow, an appropriate flow regime based on season and water year type should be determined (Richter et al 1997; Stanford et al 1996).

To determine the flow regime to protect stream channel integrity, riparian habitat, and fish habitat, BLM used available site specific information and peer reviewed literature. The resulting flow alternatives were then analyzed with respect to impacts to recreation and power. This is achieved by implementing the direction in the KFRA RMP including the ACS objectives.

To assist in this analysis, BLM developed a Flow Management Scenario (FMS) model to assess and visualize alternatives for river flow allocation (USDI BLM 2006b). Model development was preceded by evaluating the scope and character of flow-dependent resources and the suitability of various flow regimes for specific resources. BLM used the model to run a wide range of scenarios to determine a flow regime that integrates across the BLM multiple use objectives by meeting the BLM needs for aquatic and riparian resources, while providing recreation and power generation opportunities.

The following section describes the development of four components of the Condition:

- a proportional allocation of flow to the bypassed reach and a minimum flow;
- a seasonal high flow;
- a weekly peaking opportunity; and
- ramp rate limitations.

1. Proportional Flow and Minimum Flow

The BLM began development of the proportional and minimum flow by considering the need to provide for the adequate protection and utilization of the BLM reservation, including maintenance and restoration of natural resource values and utilization for whitewater boating and power generation.

The Instream Flow Council (IFC), a nonprofit organization comprised of state and provincial fishery and wildlife agencies, recommends developing instream flow prescriptions that address five riverine components: 1) hydrology; 2) habitat; 3) geomorphology; 4) water quality; and 5) connectivity (Annear et al 2004). The IFC also notes that utilizing a percentage of unimpaired hydrology can serve as a robust and reasonable starting point in preparing a flow recommendation where site specific data is problematic (Annear et al 2004). This utilization of a percentage of unimpaired hydrology approach requires validation with site specific assessments of how biological and geomorphic processes respond to flow. This validation provides the rationale for the adaptive management component of the Condition.

The BLM coordinated with an interagency group to develop a methodology for instream flow recommendations, including fish and wildlife agencies responsible for submitting recommendations pursuant to Section 10(j) of the FPA (U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game, and Oregon Department of Fish and Wildlife). The interagency group used the best available information to determine the flows recommended for instream habitat for fish in the Project reaches. BLM then analyzed and modified these flow recommendations to accomplish BLM multiple resource management direction.

Interagency Group

The interagency group analysis used the Tennant (1976) and Tessman (1980) method as supported by site specific information from the PHABSIM results; wetted perimeter analysis; water temperature modeling information; inundation of side channels; and an unimpaired hydrology approach. To determine the minimum base flow, the interagency group used a modification of the Tennant (1976) methodology. Instead of using the 30% of undepleted average annual flow, as recommended by Tennant (1976) for good survival conditions for most aquatic life forms and general recreation, the group used 40% of average annual flow (624 cfs). This increase in the percentage of average annual flow to 40% was made to compensate for using impaired average annual flow verses undepleted average annual flow.

To determine the proportional flow, the interagency group used a modification of the Tessman methodology (1980). Instead of using the mean monthly or mean annual flow, as recommended

by Tessman (1980), the group used 40% of the three-day average inflow. This change was made to account for local hydrologic conditions and variations in flow within the month and year.

Site specific information was also used by the interagency group to arrive at a minimum base flow recommendation. The interagency group considered using a PHABSIM analysis; however, the results were not informative for making flow recommendations because the changes in fish habitat are not responsive to changes in flow. However, the WUA curves for the J.C. Boyle Bypassed River and Peaking Reaches demonstrated that as flow is increased, habitat increases for fry, particularly as flows reach edge habitat provided by shoreline riparian vegetation.

In addition, the wetted perimeter analysis demonstrates the flows in the peaking reach should be between 700 cfs to 800 cfs to avoid the most extreme habitat dewatering and associated impacts. Further, the water temperature analysis demonstrates that the inflow to the J.C. Boyle Bypassed River Reach of 600 cfs to 800 cfs would not adversely affect thermal conditions for redband trout and anadromous fish. As a result of the analyses considered, the interagency group recommends a minimum base flow of 40% of the average annual flow (624 cfs) and 40% of the three-day average inflow, whichever is greater, to provide for fish habitat.

BLM

To achieve its objectives, the BLM minimum flow requirement differs from the interagency group, and is 30% of average annual flow (470 cfs), while the 40% proportional flow element is the same. The development of the BLM minimum and proportional flow is described in further detail below.

Minimum Base Flow: The Tennant method (Tennant 1976) is one of the first and best known percentage-of-hydrology methods. The purpose of the Tennant method is to obtain seasonally adjusted instream flow recommendations with some "…hydrological relevance for maintaining natural habitat, geomorphological, and recreational attributes of streams and rivers…" (Annear et al 2004). In his study of 11 streams in Montana, Nebraska, and Wyoming, Tennant (1976) found empirical support for his method, which recommends base flows that provide good survival conditions for most aquatic species.

The Tennant method states that 30% of unimpaired average annual flow is recommended for sustaining good survival conditions for most aquatic resources and general recreation, while 60% of average annual flow provides flows for excellent to outstanding habitat for aquatic resources and the majority of recreational uses. Tennant states that since it was derived from such a large varied dataset it can be applied successfully to streams throughout the United States (Tennant 1976). The IFC supports this claim by stating that the percentages established by Tennant were determined from data collected at a wide range of streams and do not usually require adjustment (Annear et al 2004).

According to the IFC (Annear et al 2004), the Tennant method is robust and a reasonable beginning for quantifying instream flow needs to which refinements can be made as necessary. Based on review of Tennant by the IFC (Annear et al 2004), this "…method should be associated with biological habitat needs…" at different times of year "…to be most useful in a specific region."

To determine the minimum base flow, BLM used the Tennant method and published daily flow data for the period of record (USGS Klamath River below the J.C. Boyle Powerhouse gage, #11050700, 1961-2004) to derive average annual inflow of 1780 cfs. The BLM used daily flow data for the period of record, and not unimpaired hydrology, because this represents the current condition. Inflow from springs between J.C. Boyle Dam and the gage was accounted for by subtracting 220 cfs (PacifiCorp 2004d page 5-39) from the average daily flow values, because there are no significant tributaries in this reach (PacifiCorp 2004d page 5-38 and 5-39). The average annual flow for inflow to J.C. boyle Reservoir is 1560 cfs (1780 cfs minus 220 cfs) and 30% of the average annual flow is 470 cfs.

The BLM examined the effects of a minimum flow of 30% of the average annual flow on aquatic, riparian using the current hydrology for the period of record, as well as other site specific information:

- The minimum flow was analyzed in the context of the PHABSIM results and the effects on available fry habitat;
- The wetted perimeter data was evaluated to determine the flows necessary to avoid the most extreme habitat dewatering and associated impacts;
- The minimum base flow was evaluated for the effects on side channel inundation for fish habitat.

See Section D (Effects of the River Corridor Management Condition) for a detailed discussion of the effects of the minimum base flow on natural resources.

In addition to analysis of impacts to natural resource values, BLM considered the impacts on recreation and power production in developing the minimum flow requirement. The development of the Condition included an analysis of the impacts of the flow Condition on the quality and quantity of recreational opportunities provided with the required flow regime. The development of the minimum streamflow requirement also compared the number of boating days resulting from implementation of the FLA proposed requirements, the interagency recommended flows, and the BLM minimum streamflow requirement. The number of available boating days in the peaking reach was calculated using the BLM Flow Management Scenario Model (USDI BLM 2006b) and compared to actual use data to determine a flow regime that balances the need to provide recreation opportunities with other resource values such as fisheries. The effects of the minimum base flow on rafting opportunities are analyzed in detail in Section D (Effects of the River Corridor Management Condition).

The minimum base flow of 470 cfs for the J.C. Boyle Bypassed River Reach would allow for power production except during the required seasonal high flow. When the inflow is greater than 470 cfs water would be available for power production. When inflow is between 470 cfs and 1175 cfs, all inflow above 470 cfs would be available for storage and power generation. When inflow is greater than 1175 cfs, a proportion of inflow (up to 60% of inflow) would be available for storage and power generation as describe below. The effects of the minimum base flow, including maximum ramp rates, minimum bypass reach flows, and proportional flow allocation are analyzed for their effects on power generation in Section D (Effects of the River Corridor Management Condition).

<u>Proportional Flow</u>: According to the IFC review (Annear et al 2004) of the Tennant method, average annual flow does not often reflect seasonal patterns in hydrology. Further, this review states that the intention of this method was to use different flows at different times of year to

follow the natural hydrograph to the extent possible. Hence, the Tennant method is appropriate for determining the minimum base flow requirement (for example see Armstrong and Parker 2003) while the Tessman (1980) approach is effective in addressing seasonal high flows through a proportional flow allocation (e.g., Maunder and Hindly 2005; Estes and Osborne 1986).

Tessman modified Tennant's approach to be more responsive to systems with a large amount of natural variation by calibrating for local hydrologic and biologic parameters, including monthly variability. By combining annual flow statistics with monthly variability, the Tessman approach provides inter-annual variation. The Tessman approach uses a 40% proportional flow in relation to mean annual flow and mean monthly flow. The 40% of flow is needed to account for large fluctuations in flow during different months of the year (Tessman 1980). The Condition utilizes this percentage and applies it to the inflow to J.C. Boyle Reservoir. To account for local hydrologic conditions, variations in flow within the months and year, and the storage capacity of J.C. Boyle Reservoir, the Condition refines the Tessman approach to require 40% of the inflow, as determined from the average flow of the previous three days. When inflow exceeds 1,175 cfs (1,175 cfs * 40% = 470 cfs), 40% of the inflow would be provided and flow would increase above the minimum base flow requirement. Thus by applying the Tessman approach, flows are increased above the minimum base flow and reflect the seasonal variability. Inter-annual variation is needed for establishing and maintaining riparian vegetation, including disturbance regimes from high and low water year extremes (Richter 1986).

The modification from the average annual or average monthly flow to the average flow of the previous three days represents a change from the traditional "flatline" Tennant flow requirement and provides intra-annual variability. The Condition uses a smaller time step than Tessman (three days instead of monthly or annually) to provide for more frequent variations, facilitate Project operations, and accommodate the relatively small storage capacity of the J.C. Boyle Reservoir. By providing 40% of flows averaged from the previous three days, seasonal patterns based on water availability and appropriate amounts of inter-annual variation are incorporated.

2. Seasonal High Flow

In addition to the minimum base flow and proportional flow, providing a seasonal high flow to the bypassed reach sufficient to mobilize and distribute sediment is needed to support riparian and geomorphic processes. An annual flushing flow is often required to clean and redeposit gravel to provide quality spawning habitat (Wilcock et al 1996). To achieve desired ecological effects, the seasonal flow should be of adequate duration and frequency to mobilize and redistribute sediments, flush fine sediments from spawning beds (Wilcock et al 1996), deposit riparian plant seeds and fine sediment (Tessman 1980), wet the riparian area at the beginning of the growing season (Junk and Wantzen 2004), and provide a disturbance regime for germination of riparian plants (PacifiCorp 2004c, page 3-107; Hill et al 1991; Hansen et al 1998).

The Condition requirement for the timing, magnitude, and duration of the seasonal high flow was determined based on needs of riparian vegetation on BLM-administered lands in the bypassed and peaking reaches. The timing of the flushing flow (once 3,300 cfs is available between February 1st and April 15th) coincides with the early part of the growing season and germination of riparian species. The seasonal high flow duration of one week was derived from analysis of seasonal high flows at the USGS gage below Keno Dam (#110050500). One week was the minimum duration of seasonal high flows over 3,300 cfs (analysis of USGS gage records from

1990 to 2004). Flows over 3,300 cfs after February 1st, occurred in six of the last 15 years. The duration of continuous flows over 3,300 cfs averaged 28 days with a maximum 78 days and a minimum of seven days. The gage data suggests that the seasonal high flow would only occur in relatively wet years.

According to PacifiCorp analysis, in the peaking reach, 3,300 cfs to 5,800 cfs "riparian vegetation maintenance flows" are required to inundate riparian vegetation (PacifiCorp 2004c, page 3-105 to 3-106). A flow of 3,300 cfs corresponds to a return interval of about 1.5 years at the Klamath River below the J.C. Boyle Powerhouse gage (BLM analysis of USGS #11510700). Flows with a return interval of 1-2 years are often the flows necessary to support channel maintenance processes such as sediment transport and streamside vegetation (Gorden 1992). This return interval flow frequently corresponds to the "bankful dishcharge" which is the flow that fills the stream to its banks and is often assumed to control the form of alluvial channels (Gorden et al 1992; Rosgen 1996)". The 3,300 cfs seasonal high flow derived from the peaking reach data is also applicable to the bypassed reach. Flows above 3,300 in the bypassed reach would increase the frequency and magnitude of sediment bed mobility in the bypassed reach (PacifiCorp 2004d, page 6-134). Bed mobilization is needed to maintain the quality and quantity of spawning habitat (Wilcock et al 1996).

3. Weekly Peak

The Condition requires the Licensee to minimize peaking to no more than once per week targeted on weekend days during the summer months (May 1st to October 31st). The Condition reduces the impacts on aquatic and riparian resources, while providing for whitewater boating and power generation. By reducing the frequency of daily peaking events, impacts to fish habitat are expected to decrease. The peaking operations flow regime in the Condition integrates requirements for recreation, power generation, and aquatic resources, such that a quality whitewater boating opportunity is possible and power can be produced, while the effects of peaking on fish are reduced.

To accomplish objectives to provide for whitewater boating, the Condition allows peaking operations from 1,500 to 3,000 cfs a maximum of once per week with a priority set for Saturday, Sunday, then Friday from May 1st to October 31st. According to the PacifiCorp Recreation Flow Analysis for the J.C. Boyle Bypassed River Reach and the Hells Corner segment of the Klamath River, 1,500 cfs would be near the optimal level of flow for whitewater boating. Fifteen hundred cfs would allow for commercial whitewater rafting trips through both of these reaches. The analysis also indicated that 3,000 cfs would be the maximum flow to allow for a quality whitewater boating opportunity (PacifiCorp 2004k).

The season of use and priority days for peaking operations necessary for whitewater boating are based on commercial rafting use reports compiled from 1985 to 2005 (USDI BLM 1985-2005). The reports illustrate that the highest use days are Saturday, Sunday, and Friday, and that the rafting season extends from the beginning of May to the end of October. For example, during the summer of 2004, 66% of rafting visits were on Friday, Saturday, or Sunday. In addition, from May through October rafting visits ranged from 152 in October to 1,441 in July. The rafting use increases from May through July and decreases from August through October, with the highest number of rafting visits in July and August. (Refer to Table 4-3 above.)

4. Ramping Rates During Controlled Events

The Condition requirement for ramp rate limits was determined by evaluating relevant literature, site specific studies by PacifiCorp, and relevant site specific reports, and information provided by Oregon Department of Fish and Wildlife and others. Additionally, a comparison of existing ramp rates was evaluated against a relatively unaltered hydrograph in a major tributary to the Upper Klamath River to better understand the flow variability conditions under which native species likely evolved. (See Huntington 2004 and discussion of his findings below.)

The Condition requirement for ramping rates limits up or down ramping to two inches per hour for the bypassed and peaking reaches except during uncontrolled events and implementation of the seasonal high flow. This rate is considered adequate to limit stranding mortality for fisheries and other aquatic organisms as a function of rapid changes in vertical stage and rapid dewatering of the channel bed when fry are not present (Hunter 1992). Hunter (1992) noted that stranding of salmonid fry can occur at ramping rates as low as one inch per hour. He recommends no artificial ramping when Chinook fry are present because they are more vulnerable to ramping than other salmonids.

PacifiCorp evaluated stranding potential downstream of the bypassed reach however, results provided little insight to potential stranding or displacement effects because fish density was very low under current Project operations (PacifiCorp 2005). Findings from the PacifiCorp study evaluating potential fish stranding and entrapment in the peaking reach (PacifiCorp 2005) are consistent with the findings of other stranding and entrapment studies that report difficulty in detecting stranded fish due to predation and burrowing (Hunter 1992). PacifiCorp surveys indicated low numbers of stranded fish and low numbers of fish present in the study area. Thus, it is expected that stranding observations would be commensurate with fish density (Hunter 1992). In addition, there were no reliable fish population estimates and no application of a lower ramp rate to assess the effectiveness of a lower ramp rate in preventing fish stranding. Although the PacifiCorp study did not have the data needed to analyze an adequate ramp rate, fry and juvenile stranding rates are substantially reduced when ramping rates are equal to or less than two inches per hour (Hunter 1992). The results of the PacifiCorp study show that ramp rates attenuate in a downstream direction. A ramp rate below the powerhouse (RM 219.7) of about nine inches per hour attenuated to about five inches per hour at Frain Ranch (RM 214.3) and an eight inch ramp rate at the powerhouse attenuated to about a three inch per hour ramp rate near Shovel Creek (RM 206.3). If attenuation at lower ramp rates is proportional to attenuation at higher ramp rates, then a two inch ramp rate would be attenuated to about 1.1 inches at Frain Ranch and about 0.75 inches per hour at Shovel Creek.

Laboratory (Bradford et al 1995) and field studies (e.g., Anglin et al 2005) show that ramp rates over two inches per hour can cause harm to aquatic species, including rainbow trout fry, salmonid eggs, and spawning success. Studies of ramping below dams show that stranding rates increase as a function of increasing magnitude of stage change, and increasing rates of change (Bradford et al 1995). In the Bradford study, daytime stranding rates (2% bar slope) for coho juveniles in a controlled lab experiment ranged from 20% at a 2.4 inches per hour down ramp rate to 65% at an 11 inches per hour down ramp rate. Stranding rates for juvenile rainbow trout were proportionally lower but exhibited similar patterns.

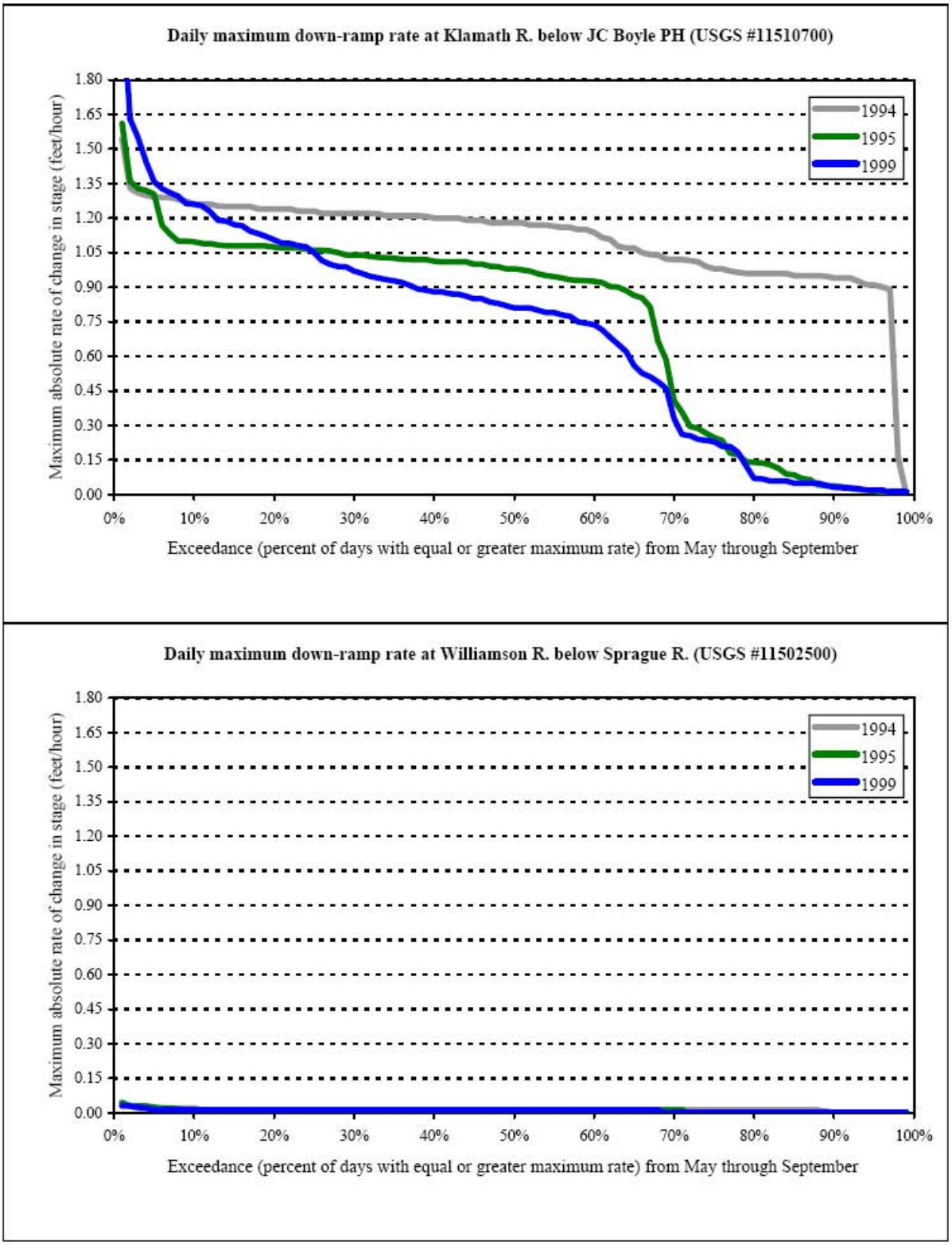
In addition to an analysis of existing studies, the ramp rate limit for the Condition was determined through evaluation of the Huntington analysis, comparing the J.C. Boyle Peaking Reach (2004) to the Williamson River. This analysis was used to determine what the appropriate ramp rate would be for a similar river system with no peaking operations. Huntington (2004) compared stage change rates on the Williamson River to stage change rates at the J.C. Boyle Peaking Reach below the Powerhouse gage (USGS #11510700), using the period from May to September. The Williamson River hydrograph is comparable to the Klamath River because of the presence of upstream springs, upstream irrigation diversions, and it is located in the same subbasin. The Williamson gage is likely the best-available source of information on the approximate levels of up ramp and down ramp rates that might be seen at the gage site below the J.C. Boyle Powerhouse (USGS #11510700) if no water was diverted for Project operations. The data from the Williamson gage likely represents the rate of stage change under which the Klamath basin aquatic species evolved.

Results of stage-change analysis for the Williamson River gage site below Sprague River are provided in Figure 4-2 (Huntington 2004). Daily maximum rates of increase or decrease in stage at the Williamson River site are approximately two inches during May to September 1994, 1995, and 1999, as compared to approximately 2.2 feet at the gage below J.C. Boyle Powerhouse (USGS #11510700) during the same years. This was a period after peak runoff had occurred at both sites and also a period during which small juvenile fish in the river system would have been relatively vulnerable to stranding or trapping by rapid flow reductions (PacifiCorp 2004b, page 6-3).

In determining a ramp rate for the Bypassed and Peaking reaches, the PacifiCorp findings and relevant literature was used to determine a rate that balanced aquatic species concerns but still provides for recreation and power generation. Ramp rates were modeled using the Flow Management Scenario Model (USDI BLM 2003) to better understand the relative difference between the ramp rates proposed by the Licensee and those more protective of aquatic resources.

The ramp rate limits provided in the Condition, based on recommendations in Hunter (1992), are designed to reduce but not eliminate stranding and displacement of trout and other aquatic organisms. Reducing the rate of water level change would provide additional time for fish to adjust to spatial changes in habitat availability potentially reducing energetic costs and vulnerability to predation.

Figure 4-2: Exceedance values for daily maximum rates of decline (down ramp) below the J.C. Boyle Powerhouse (USGS Gage # 1150700) and on Williamson River (USGS Gage # 11502500) during 1994, 1995, and 1999 (Huntington 2004, Figure 6, page 16).



D. Effects of the River Corridor Management Condition

The Condition would alter the current Project flow regime from a low static base flow (except for spills) in the J.C. Boyle Bypassed River and Peaking Reaches to a proportional flow with a higher overall minimum base flow. The Condition increases the base flow in the J.C. Boyle Bypassed River Reach from 100 cfs to no less than 470 cfs when the inflow to the J.C. Boyle Reservoir is at least 470 cfs. The Condition requires the Licensee to provide 40% of the inflow at the upstream portion of the J.C. Boyle Bypassed River Reach, with a required minimum base flow of 470 cfs. When 470 cfs is not available, then an amount no less than the inflow from the Klamath River above J.C. Boyle Reservoir is required to be released to the bypassed reach. This provision of the Condition addresses water availability, especially for dry years, and variability in the annual flow regime. Thus, the Condition requires an overall increased base flow from the current condition and flows that are more reflective of seasonal events, including high and low flows (Tessman 1980; Annear et al 2004).

The modeled flow regime provided to the bypassed reach is illustrated for the year 1994 (dry), 2000 (average) and 1998 (wet) (water year types are based on BLM 2002) in Figure 4-3 (Parts A, B, and C). These figures illustrate the intent and approximate outcome of the flow requirements, including the one week diversion suspension for seasonal high flow.

For the dry year (1994), a higher proportion (66%) of the available water supply is bypassed because the 470 cfs minimum flow requirement would provide between 40% and 100% of the total inflow for much of the year. In 1994 (Figure 4-4, Part A), inflow never exceeds 3,300 cfs, and therefore, no seasonal high flow requiring suspension of diversion is provided. However, inflow drops below 470 cfs in the summer and therefore no diversion is provided during that period.

In total, 46% of the annual flow is provided to the bypassed reach in the year (2000). When the Condition was modeled with FMS using data from 2000, flows to the bypassed reach were maintained above the minimum flow (i.e. 470 cfs) for all months. Further, when the water availability increased from January through May, flows through the bypassed reach reflected this change (See Figure 4-4, Part B). During the year 2000, an inflow event of greater than 3,300 cfs occurs between February 1 and April 15, and therefore a seasonal high flow occurs.

In 1998 (wet year), the BLM flow condition provides 47% of the annual flow to the bypassed reach. In this year the seasonal high flow is illustrated because inflows over 3,000 cfs occur (Figure 4-4, Part C).

Figure 4-3 (Parts A, B, and C) illustrates that minimum base flows are provided except during the summer of very dry years. Flows in the bypassed reach are generally proportional, as Tessman (1980) recommends, and reflective of inflow to J.C. Boyle Reservoir.

The effects of the flow requirements on a weekly peaking cycle were also modeled using the BLM Flow Management Scenario Model (USDI BLM 2006b). Examples of the flow allocations hydrographs are provided in Figure 4-4 for a dry year (1994), an average year (2000), and a wet year (1998). A weekly peaking cycle provides rafting opportunities and flows for power generation except in July and most of August in the dry year (1994). Like all models, FMS

makes some simplifying assumptions; see the model documentation submitted on the CD along with this filing for details (USDI BLM 2006b).

Figure 4-3A: FMS Modeled Flow Regimes for the J.C. Boyle Bypassed River Reach for a Dry Water Year (1994)

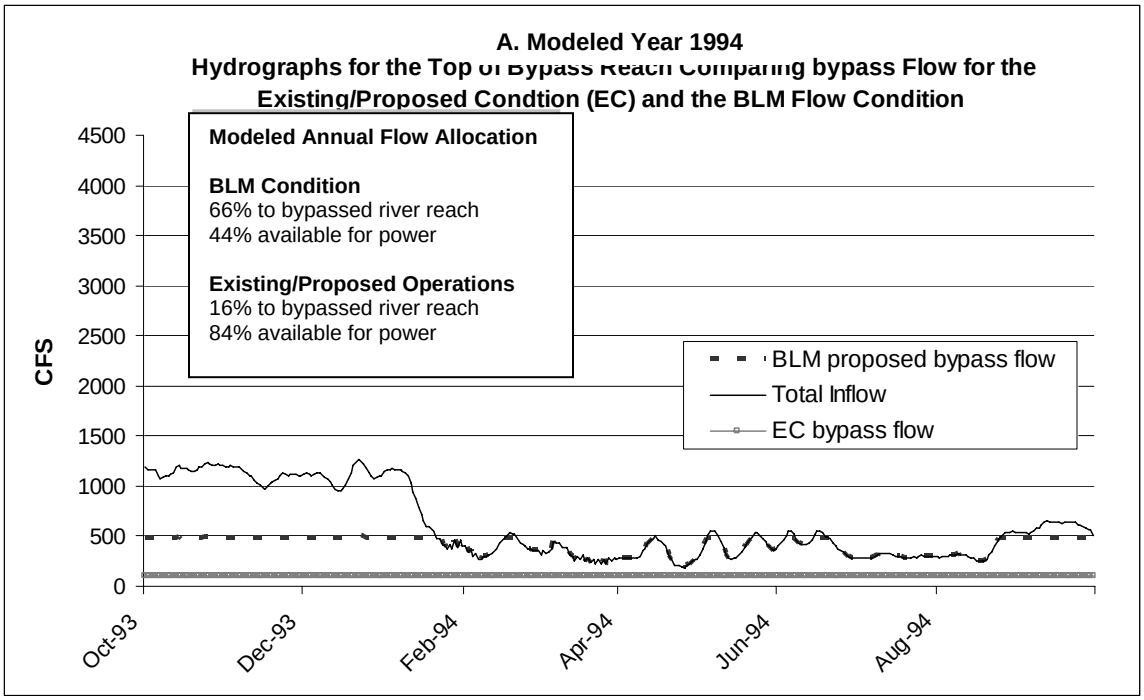


Figure 4-3B: FMS Modeled Flow Regimes for the J.C. Boyle Bypassed River Reach for an Average Water Year (2000)

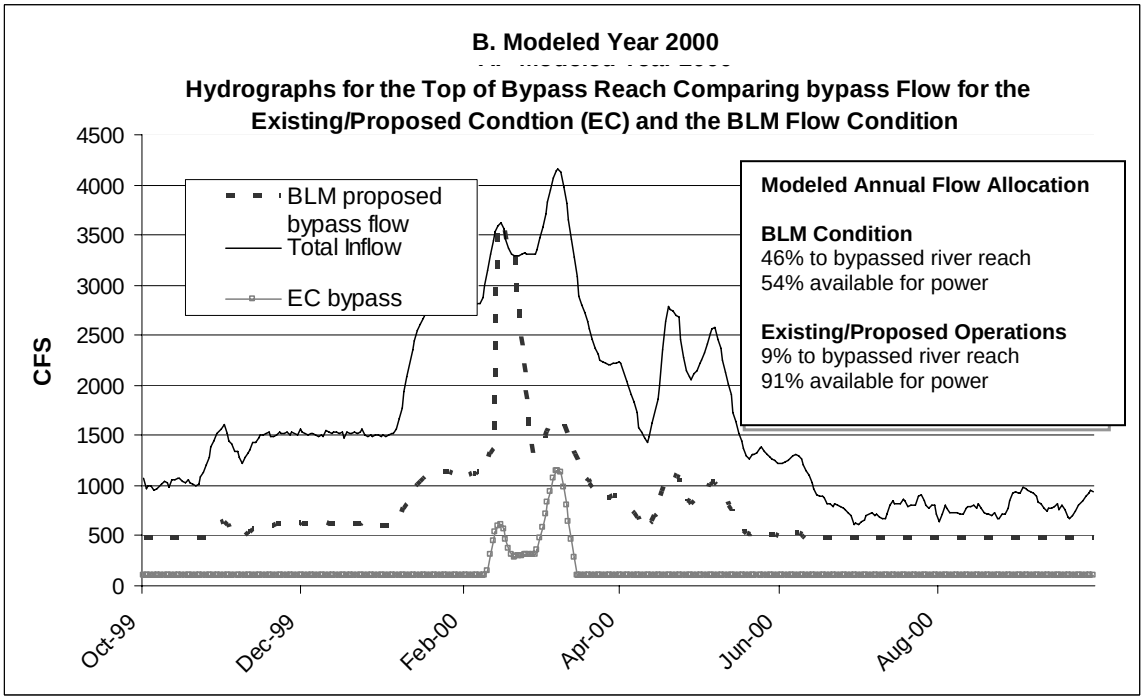
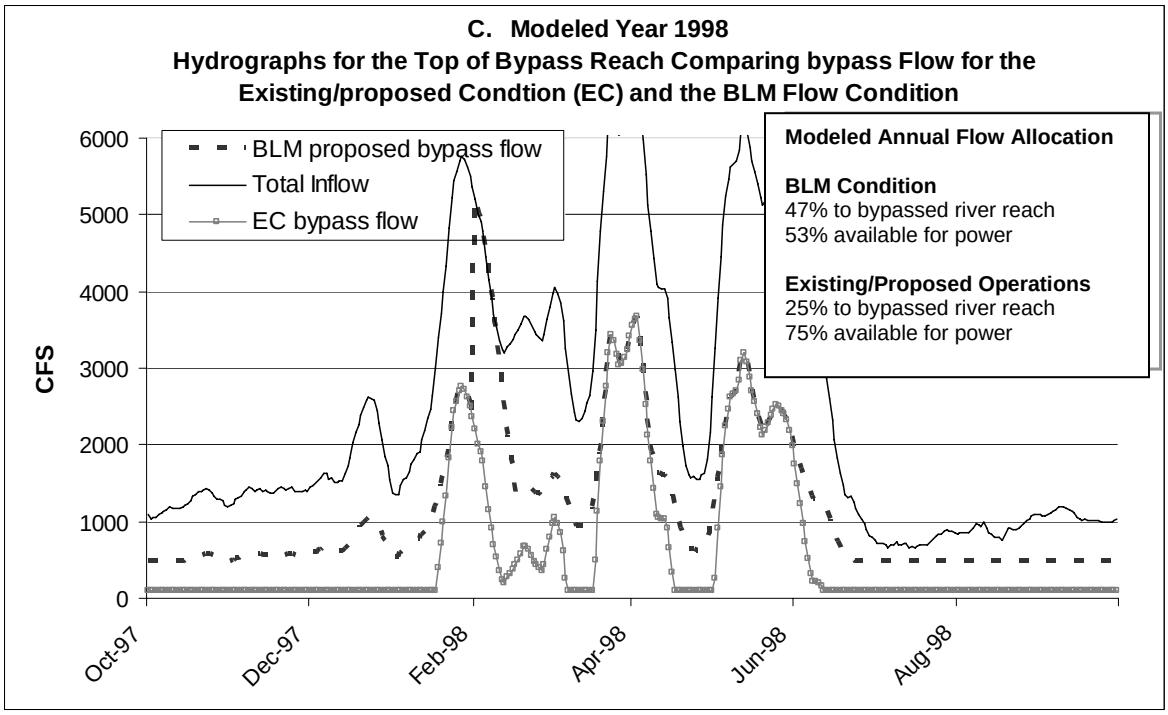
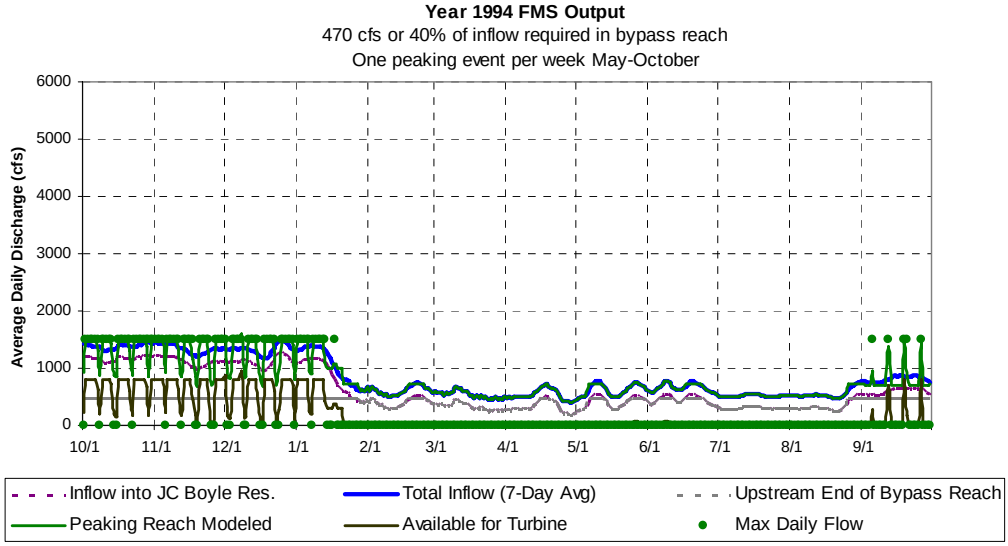


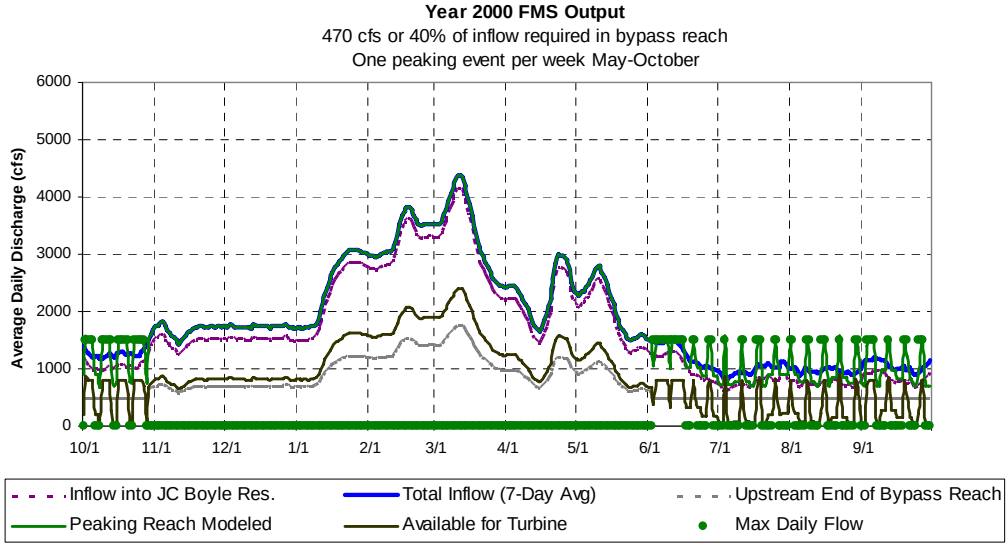
Figure 4-3C: FMS Modeled Flow Regimes for the J.C. Boyle Bypassed River Reach for a Wet Water Year (1998)

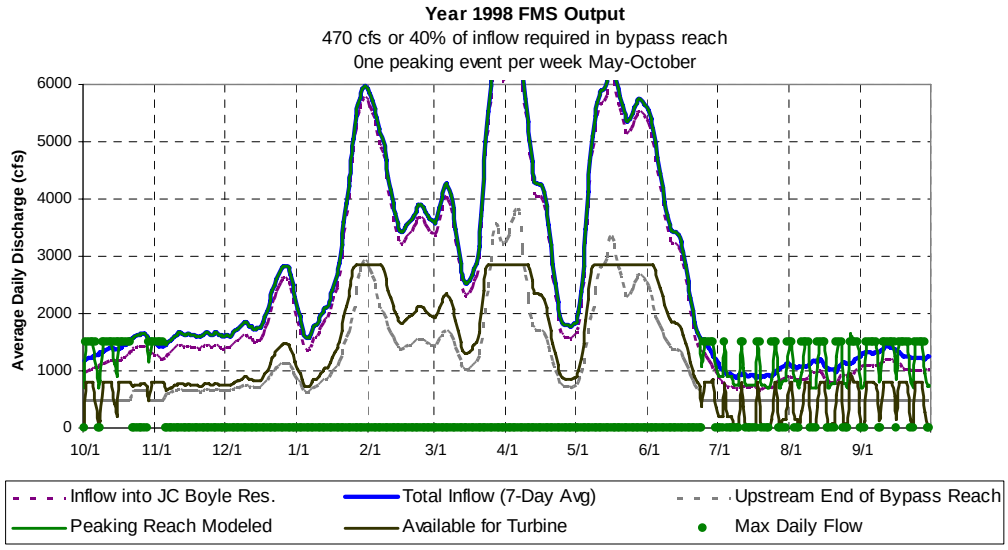


[Figures 4-3A, 4-3B, and 4-3C above illustrate modeled J.C. Boyle Bypassed River Reach Hydrographs showing Minimum Streamflow Condition bypass flows for Existing Condition (EC) compared to the BLM Condition flow requirement (470 cfs minimum or 40% of inflow) and seasonal high flow for the year 1994 (A), 2000 (B) and 1998 (C), a dry, average, and wet year respectively. Hydrographs are derived from the Klamath River below the J.C. Boyle Powerhouse gage data (#11510700) minus 220 cfs to account for spring inflow and smoothed to 7-day running average for visual presentation. Data from USDI BLM 2002.]

Figure 4-4: Flow allocations hydrographs (dry year-1994, average year-2000, wet year-1998).







1. Stream Channel Integrity

Impacts of the Condition in the Bypassed and Peaking Reaches:
In addition to the minimum base flow and proportional flow, an un-diverted seasonal high flow for one week to the bypassed reach is expected to mobilize sediment in the stream bed and distribute this sediment in a manner beneficial to riparian and geomorphic processes. An annual seasonal high flow would support high quality spawning habitat by redistributing gravels and flushing fine and embedded sediments (Wilcock et al 1996). A seasonal high flow of at least one week in duration would increase stream channel complexity and desirable bedform characteristics. Seasonal high flows are needed to maintain stream channel and riparian processes that provide fish habitat (Hill et al 1991).

2. Riparian Habitat

Impacts of the Condition in the Bypassed Reach:
The proportional flow requirement provides for the receding flows during the growing season necessary for establishing riparian vegetation on terraces on BLM-administered land. Flows needed to restore frequent inundation of the riparian vegetation and nutrient cycling processes rely on gradually receding flows during the growing season (Hill et al 1991; Stromberg 2001). The requirement of a 40% proportional flow with a 470 cfs minimum base flow would provide a more frequently inundated riparian area, thus increasing the amount of aquatic habitat provided by submerged and inundated riparian vegetation. The width of the riparian area would be expected to increase as sediments are deposited in the active channel. The Condition would improve the riparian and fish habitats by providing flows more similar to those in which desirable riparian vegetation and aquatic species are adapted. Flows occurring in the bypassed reach that are below 470 cfs would allow for some establishment of desirable riparian vegetation below the base flow waterline. This riparian habitat would provide cover and feeding areas for early life stages of rearing fish.

Due to the lack of data provided by PacifiCorp for the J.C. Boyle Bypassed River Reach as previously requested (USDI 2004), BLM evaluated other relevant studies (e.g., Hill et al 1991 and Stromberg 2001) to assess the effects of the Condition on riparian habitat. This literature shows that there would be an increase in riparian habitat based on an increase in frequency and magnitude of the seasonal high flow. The Condition would provide the increased base flow, proportional flows, and seasonal high flows needed for protection of the BLM reservation and so provides for the attainment of the KFRA RMP ACS objectives.

Impacts of the Condition in the Peaking Reach:
The Condition would provide the increased base flow and seasonal high flows during the growing season necessary for establishing riparian vegetation on terraces on BLM-administered land. The requirement of a 40% proportional flow, with a 690 cfs minimum base flow (470 cfs minimum flow and 220 cfs spring accretions), would inundate more of the riparian area, thus increasing the amount of aquatic habitat provided by submerged and inundated riparian vegetation. The width of the riparian area would be expected to increase as sediments are deposited in the active channel. The Condition would improve the riparian and fish habitats by providing flows more similar to those in which desirable riparian vegetation and aquatic species are adapted.

The Condition requires a reduction in the frequency of peaking events to once per week in the summer months (May 1st-October 31st). Reduced frequency or timing of inundation in the upper varial zone (PacifiCorp 2004d, page 3-101) is expected to reduce reed canary grass in these areas (PacifiCorp 2004a, Exhibit E 5-150). Since reed canary grass is adapted to survive in disturbed conditions subject to frequent inundation (e.g., hourly and daily flow fluctuations), reducing the frequency of peaking events is expected to reduce reed canary grass in the upper varial zone.

Impact of the Condition in the Bypassed River and Peaking Reaches:
A seasonal high flow of at least one week in duration would increase stream channel complexity and desirable bedform characteristics. Seasonal high flows are needed to maintain stream channel and riparian processes that provide fish habitat (Hill et al 1991). By requiring that the seasonal high flow be provided after the last day of February, this flow is likely to occur during the early part of the growing season.

3. Fish Habitat Quantity and Quality

Impacts of the Condition in the Bypassed Reach:
The Condition would increase fish habitat quantity and improve habitat quality as riparian and geomorphic processes are improved. A flow that reflects seasonal variability, including flood events, would restore ecological functions necessary for the protection of the BLM reservation and provides for the attainment of KFRA RMP fish habitat objectives and ACS Objectives. The results of PacifiCorp studies focusing on fish production (Addley et al 2005; PacifiCorp 2004b) demonstrate that restoring base flows and seasonal high flows to the bypassed reach would be necessary to maintain and improve fish habitat.

The Licensee conducted a PHABSIM analysis for the bypassed reach but the results appear to be unresponsive to changes in flow. The PHABSIM analysis conducted by the Licensee in the Klamath River reflects the results of a highly modified flow alteration and impacts on channel shape in the J.C. Boyle Bypassed River Reach. The Weighted Usable Area (WUA) relationships for rainbow trout presented by PacifiCorp in their April 2005 addendum to the instream flow study are remarkably flat, indicating that microhabitat is unresponsive to changes in flow. Therefore, the current PHABSIM relationships are not informative and have limited utility in determining flow needs for most life stages of trout and sucker.

The WUA do curves show that there is minimal habitat for trout fry and sucker larvae (low percent of total area for the entire range of flows), and therefore may be a limiting factor for cohort recruitment in the bypassed reach. The WUA estimates for the bypassed reach suggest that trout fry and sucker larvae habitat availability increase with increasing flows up to about 800 cfs, because more edge habitat is available at higher flows (PacifiCorp 2005 - Instream Flow Addendum Report). Since more riparian vegetation is inundated at higher flows, more trout fry and sucker larvae habitat would be available under the flow proportional flow regime required by the Condition. Figure 4-4 (above) shows that 800 cfs is available to the bypassed reach during May and June of the average and wet years when these life stages would likely be present and a proportion of the inflow would be added to the base flow.

The Condition provides for “riparian vegetation maintenance flows” which would inundate all riparian vegetation (PacifiCorp 2004c, pages 3-105 to 3-106) and seasonal high flows which

would redistribute gravel and fine sediment to edge habitat along the channel margins. Cumulatively, with the addition of gravel (See Section D – RGMP of the Condition), these processes would lead to an increased extent and improved quality of riparian vegetation, thus increasing habitat availability for critical life stages (trout fry and sucker larvae) of native fish.

Increasing the minimum base flow above the existing condition (100 cfs) results in more suitable habitat availability for trout fry. According to the PacifiCorp WUA curves for redband trout, a 470 cfs minimum base flow allows for a 32% increase in fry suitable area, over the existing minimum flow (See Table 4-4).

Table 4-4: J.C. Boyle Bypassed River Reach Percent of Optimal Fry Habitat Availability for Existing Instream Flow Requirement and the BLM 4(e) Base Flow Requirement.

J C Boyle Bypassed River Reach			
	Flow (cfs)	**% of Area**	**% of Maximum**
PacifiCorp Existing Condition	100	6.1%	65.8%
BLM 4(e) Minimum Flow	470	6.4%	86.8%
Flow values are the releases at J.C. Boyle Dam and do not include spring accretions which were weighted for flow accretions at each habitat simulation transect (PacifiCorp 2005 - Instream Flow Studies Addendum Report)			

Side channels are often characterized by slower velocities and provide for high quality microhabitat for rearing and spawning fish (Bowen et al 2003). PacifiCorp (2004b) identified nine side channels below the J.C. Boyle Powerhouse, but did not identify any in the J.C. Boyle Bypassed River Reach. BLM identified six side channels in the bypassed reach using aerial photographs. It is expected that base flow increases approaching 700 cfs would result in water flowing in most of the bypassed reach side channels, and that the proportional flow allocation would further inundate side channels during critical spawning and rearing periods.

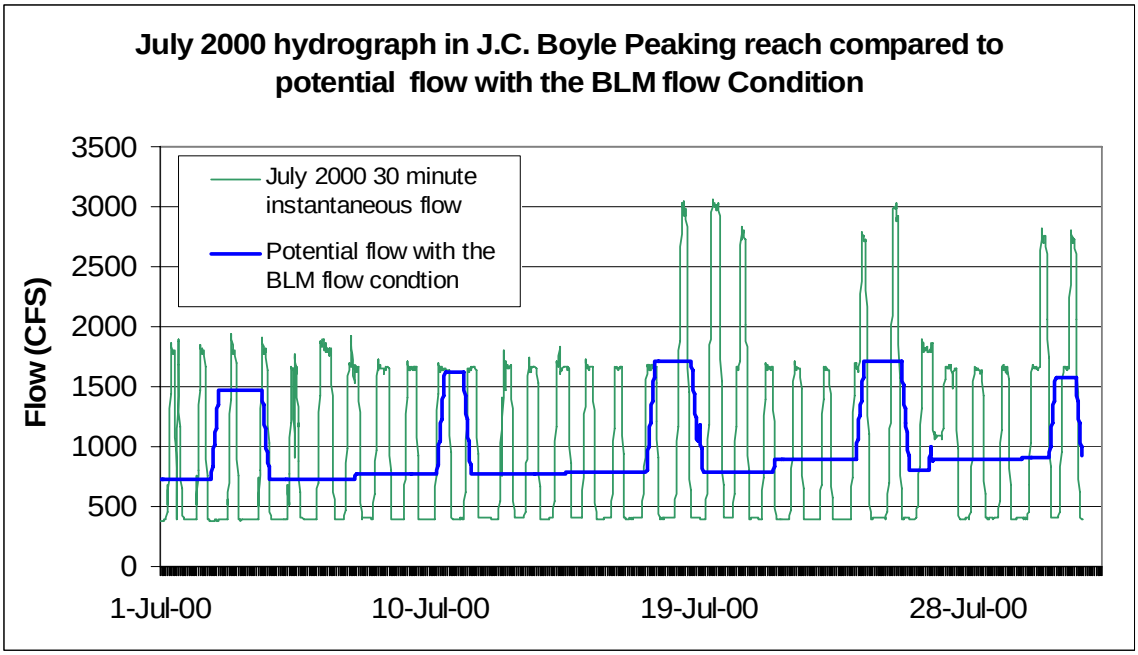
Impacts of the Condition in the Peaking Reach:
The amount of wetted perimeter change occurring between 350 cfs and 700 cfs is approximately 3.8 feet per 100 cfs versus 1.9 feet per 100 cfs between 700 cfs and 1,500 cfs (PacifiCorp 2005 - Peaking Impacts Report). This data indicates that the smallest degree of change to the wetted perimeter occurs at higher flows, and that flows that do not drop below 700 cfs would avoid the most extreme dewatering and associated impacts. The minimum base flow condition requiring a discharge that would result in 690 cfs downstream of the J.C. Boyle Powerhouse would avoid extreme changes in the wetted perimeter in the varial zone. As a result, the Condition would prevent dewatering of many of the low gradient (less than 2% to 4%) bank slopes that are susceptible to conditions that cause fish stranding.

Reducing flow fluctuations at least six months of the year to once per week would alter the varial zone, such that an increase in aquatic and riparian habitat would be expected. Reducing the amount of peaking would decrease the frequency of scour in the varial zone. Less scouring and more stable flows would support the establishment and survival of desirable riparian vegetation. It is anticipated that the decreased frequency of scouring would allow substrate to persist, such that the material needed for establishment of desirable species (e.g., willows) would be present in the varial zone. Further, providing a higher, more stable base flow would allow riparian vegetation to recolonize the varial zone. This larger riparian area would become aquatic habitat available for fish, macroinvertebrates and other aquatic life. In comparison to current frequent

flow fluctuations that favor the undesirable reed canary grass riparian community, the Condition requirement for reduced ramp rates combined with a more constant and higher base flow would aid in re-establishment of desirable riparian communities.

The Condition requires the Licensee to provide the same minimum flows on the weekdays in the J.C. Boyle Peaking Reach that result from the implementation of the J.C. Boyle Bypassed River Reach flow requirements. In addition, the weekly peaking cycle during the summer months (May 1st to October 31st) would decrease the number of peaking events from daily during most summers to four or five times a month (Figure 4-5). This would decrease impacts from summer daily peaking to the fisheries and riparian resources, while providing for power generation and whitewater boating opportunities. Reducing the magnitude of flow fluctuations and increasing base flow can improve fish productivity (McKinney et al 2001).

Figure 4-5: Instantaneous 30 minute flow measured below J.C. Boyle Powerhouse during July, 2000 compared to a potential peaking cycle under the BLM streamflow condition.



The Licensee conducted a PHABSIM analysis for the peaking reach, but the results appear to be unresponsive to changes in flow. The PHABSIM analysis conducted by the Licensee in the Klamath River likely reflects impacts on channel shape, channel complexity, substrate composition, and riparian vegetation from the highly modified flow in J.C. Boyle Peaking Reach. The Weighted Usable Area (WUA) relationships for rainbow trout presented by PacifiCorp in their April 2005 addendum to the instream flow study are remarkably flat for adults and juvenile habitat, changing only slightly over the range of flow available to the Klamath River. Therefore, the current PHABSIM relationships have limited utility in determining flow needs for most life stages of trout and sucker.

Although the results of the adult and juvenile habitat analysis for the peaking reach are difficult to interpret because of their unresponsiveness to changes in flow, the result for fry habitat availability indicate substantial increases in fry habitat with an increase in minimum base flow. The WUA estimates for the peaking reach suggest that trout fry and sucker larvae habitat

availability increase with increasing flows. More habitat is apparently available at higher flows because more edge habitat becomes available (PacifiCorp Instream Flow Addendum Report 2005). In addition, these higher flows come into contact with existing riparian vegetation (PacifiCorp Instream Flow Addendum Report 2005). More fry and sucker larvae habitat would be available under the minimum base flow requirement in the Condition (see Figure 4-4 above). The WUA curves show very low amounts of habitat are available for trout fry and sucker larvae at any flow (low percent of area), and therefore may be a limiting factor for cohort recruitment in this reach. Fry may be the most critical life stage limiting trout populations in the peaking reach due to low habitat availability.

The BLM instream flow analysis (USDI BLM 2002) indicates that substantial increases in fry habitat availability and moderate increases in juvenile and adult habitat availability would be gained with an increase in minimum base flow conditions. Additionally, the proportional flows would result in increased flows in April, May, and June when trout fry and sucker larvae are present, providing even greater habitat gains, particularly for early life stages (Table 4-5).

Table 4-5: Percent of total area and percent of optimal habitat availability interpreted from PacifiCorp instream flow analysis (PacifiCorp 2005).

J C Boyle Peaking Reach			
	Flow (cfs)	**% of Area**	**% of Maximum**
PacifiCorp Existing Condition	~325	3.8%	57.4%
BLM 4(e) Minimum Flow	~690	3.9%	65.8%
Values calculated from PacifiCorp (2005) WUA curves.			

The proportional flows would likely result in increased flows in April, May, and June during the runoff season when trout fry and sucker larvae are present (PacifiCorp 2004b), providing habitat gains, particularly for early life stages. However, PacifiCorp did not provide time series analyses using the available periodicity information for the modeled species and life stages. This is a recommended procedure in Instream Flow Incremental Methodology (IFIM) for determining potential habitat bottlenecks in species life histories when evaluating flow needs for regulated rivers (Bovee et al 1998).

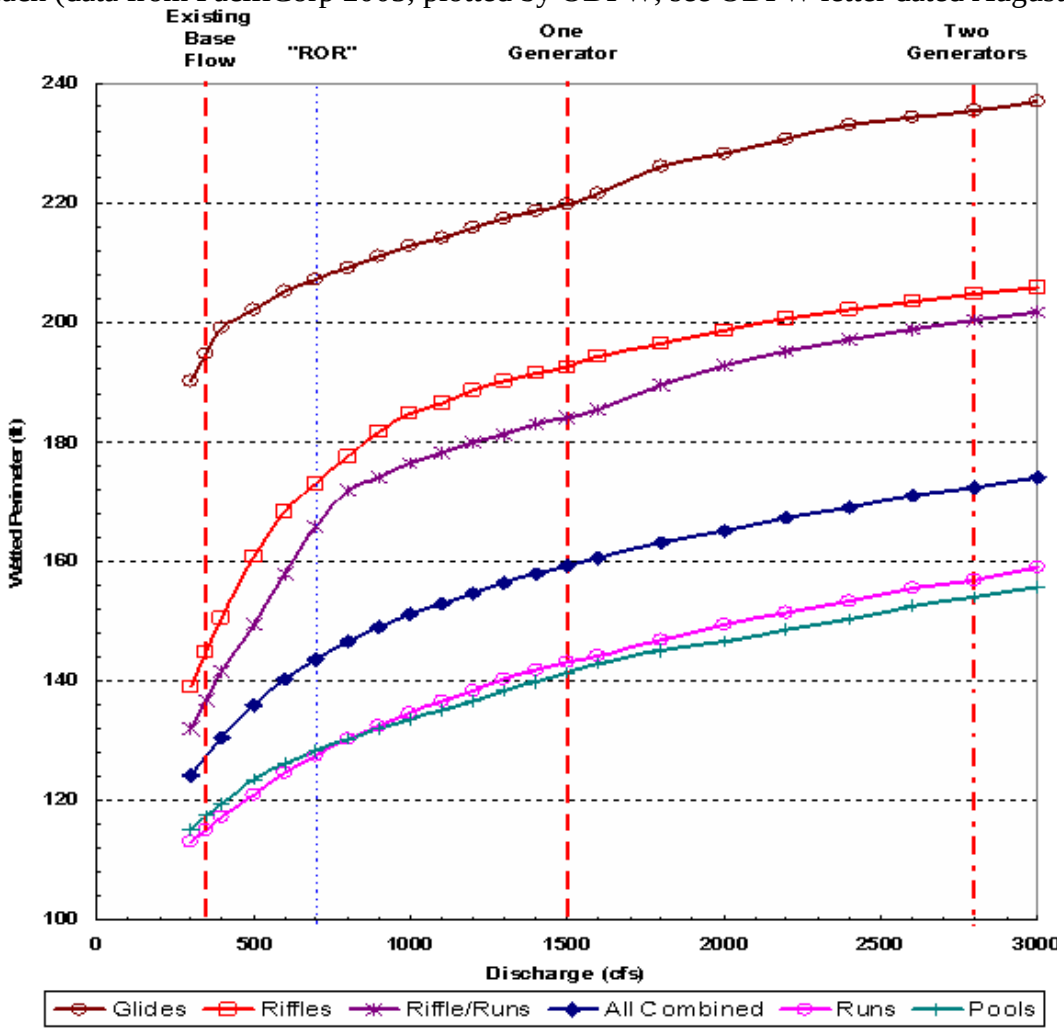
The conclusion that the BLM flow requirement would provide increased habitat availability is also supported by the BLM flow study (USDI BLM 2002, Figure 24, page 62) which derived habitat relationships for the upper peaking reach. The WUA versus stream discharge relationships for both BLM and PacifiCorp studies, when viewed in light of their limitations due to channel impacts and inclusive of other biological and physical data (e.g. macroinvertebrate drift, sediment transport and riparian vegetation) suggest that the increased base flows would benefit aquatic and riparian resources.

PacifiCorp conducted a wetted perimeter analysis in the peaking reach (PacifiCorp 2005), however the analysis was limited to a comparison of the peaking cycle base flow (lowest flow reached during a peaking cycle) against a single, assumed continuous flow under the undefined "Run of River" (ROR) flow regime (Figure 4-6). The full range of peaking impacts occurs over the lowest to highest flows during peaking cycles, including both single- and two-turbine operations, with a range of approximately 350 cfs to 1,500 cfs and 350 cfs to 3,000 cfs respectively. The wetted perimeter analysis in the peaking reach indicated that the percent of

wetted perimeter change for a single turbine peaking operation is 32% for all types of habitat and 47% in riffle habitats. Over the range of two-turbine peaking operations, the change in wetted perimeter is 48% for all types of habitat and 61% in riffle habitats. These changes represent the extent of dewatering in the channel which commonly occurs daily from peaking.

Inflection points on the wetted-perimeter analysis indicate areas of rapid changes, especially in sensitive habitat and/or microhabitats and features. Representation of an overall average curve (as in PacifiCorp 2005) obscures these changes, as they are combined with all the non-sensitive areas. The greatest amount of wetted perimeter change occurs over the range of 350 cfs to 800 cfs, indicating the highest degree of impact in this range. Figure 4-6 suggests that the flow in the peaking reach should generally range above 700 cfs to 800 cfs in order to avoid the most extreme dewatering and associated impacts (the approximate range of the inflection point in average wetted perimeter). Providing the required minimum bypassed reach flow combined with spring accretions results in approximately 700 cfs in the peaking reach during off-peak operation periods. This avoids the high dewatering impacts associated with flows lower than the inflection points (Figures 4-5 and 4-6).

Figure 4-6: Wetted perimeter versus discharge for all habitat types in the J.C. Boyle peaking reach (data from PacifiCorp 2005, plotted by ODFW, see ODFW letter dated August 12, 2005).



The BLM flow condition would result in less frequent peaking events from May through October (weekly versus daily) as illustrated in Figure 4-5 which compares a potential outcome of the flow requirements in the Peaking Reach in July, 2000 to the existing flow conditions. Peaking events would be lower in magnitude relative to base flow and occur less abruptly due to ramping rate restrictions. It is expected that lowering the frequency and magnitude of peaking events would reduce the energetic costs associated with peaking induced fish movements and reduce the likelihood of fish stranding and associated predation and mortality.

Further support for meaningful increases in habitat quality and quantity is provided by PacifiCorp in the analysis of side channel inundation flows (PacifiCorp 2004b, Table 4.7-7). Side channels often have slower velocities and provide high quality microhabitat for rearing and spawning fish (Bowen et al 2003). The Licensee identified nine side channels in the J.C. Boyle Peaking Reach and estimated the streamflow at which inundation of the side channels would occur. Six of these side channels receive flows when streamflows are greater than the current minimum flow (approximately 330 cfs per PacifiCorp 2004b). Of these, four would begin to receive flow at streamflows of approximately 700 cfs. According to this analysis, seven of these side channels could be potentially dewatered following peaking flows that recede to a base flow of 330 cfs. In contrast to the nine side channels identified by PacifiCorp, BLM identified 36 side channels in the J.C. Boyle Peaking Reach using aerial photographs. This indicates that there is even more potential for increased habitat with the Condition than indicated by the PaciCorp analysis.

Impacts of the Condition in the Bypassed and Peaking Reaches:
The Condition provides **habitat connectivity** for resident and migratory fish, and potentially anadromous fish. The flows required in the Condition provide spawning and rearing habitat in the J.C Boyle Bypassed River and Peaking Reaches. Instead of 10% to 25% of the flow in the Klamath River at the J.C. Boyle Powerhouse, the minimum and proportional flow would result in at least 25% to 63% at the J.C. Boyle Powerhouse. Thus, delays in migration would be less likely and depth and cover for migration would be increased.

PacifiCorp evaluated stranding potential downstream of the bypassed reach (PacifiCorp 2004a, Peaking Effects Study). However, the results provide little insight to potential stranding or displacement effects because fish density was very low during the study. Furthermore, no studies were conducted in the bypassed reach where most of the spawning activity in the Klamath mainstem occurs (PacifiCorp 2004b). Since a proportion of inflow would be required as instream flow in the bypassed reach, water levels would need to be managed such that impacts from water level adjustments are not causing excessive fish mortality or impairing spawning success. A ramp rate of two inches per hour would provide for protection for aquatic organisms to adjust to changing water levels without excessive mortality due to poor spawning success, entrapment, or stranding (Hunter 1992).

4. Recreation

Impacts of the Condition in Bypassed Reach:

According to PacifiCorp analysis, (PacifiCorp 2004k, page 2-61, 62, 2-90, 91), for the bypassed reach, kayakers identified a flow of around 500 cfs as a minimum to use the river for transportation, and rafters 1,000 cfs as a starting point for acceptable quality. Kayakers

"recognized that quality "technical trips" are not provided until flows are above 800 cfs. An optimal range for "technical kayaking trips" is from about 900 to 1,200 cfs." For rafters an optimal range for technical boating was 1,000 to 1,300 cfs. Standard opportunities for both craft appear acceptable at about 1,300 cfs, and they are optimal from that flow to about 1,600 or 1,700 cfs."

The proportional flow requirement in the Condition would provide opportunities for recreational boating. Depending on the water year, acceptable to optimal flows for kayaking and rafting would be provided in the range of 800-1200 cfs during the spring runoff for some years. Flows in this range are provided in May for year 2000 and through June in the year 1998. The benefits to providing flows for boating on the J.C. Boyle Bypassed River Reach include expanding opportunities for multi-day trips on the Hell's Corner Reach and providing challenging, short distance trips down to the Spring Island launch site for single day use.

Impacts of the Condition in the Peaking Reach:

According to PacifiCorp analysis (PacifiCorp 2004k, page 2-61, 2-62, 2-90, and 2-91) for the peaking reach, kayakers identified a flow of around 500 cfs as a minimum to use the river for transportation, and quality "technical trips" are not provided until flows are above 700 cfs. An optimal range for "technical kayaking trips" is from about 800 to 1,200 cfs. For the peaking reach, boaters required a minimum of 700 cfs to use the river for transportation. "An optimal range for technical rafting is about 900 to 1,300 cfs." "Boaters recognize the difference between technical and standard trips. The transition between these trips is about 1,200 to 1,300 cfs for kayaks, and about 1,400 to 1,600 cfs for rafts." "Standard opportunities for rafting become optimal at about 1,450 cfs. Standard opportunities for kayaking are acceptable at 1,300 cfs, but they require 1,450 cfs to be optimal." The development of the minimum streamflow requirement also compared the number of boating days resulting from implementation of the FLA proposed requirements, the interagency recommended flows, and the BLM Condition.

The impacts of the Condition were evaluated using the BLM Flow Management Scenerio (FMS) model, and compared the number of days of actual rafting use to the number of days available for rafting with the BLM Condition, and the interagency group fish flow recommendation. A limitation of this comparison is that the actual use does not reflect the number of days available as shown in the FMS Modeled Flows. It is expected that implementation of a weekly peaking cycle would result in a shift of use, from weekdays to the weekends. It is also expected that some boating opportunities would be lost due to the unavailability of adequate rafting flows during weekdays. The FMS Model results shows that the interagency group fish flow recommendation provides less total and weekend rafting days than the BLM Condition (Table 4-6).

Table 4-6: Projected Rafting Use Resulting from the BLM Condition

Year	Rafting Use Reports		FMS Modeled Flows			
	Actual Use		BLM Condition		Fish Flow	
	Total Days of Use	Weekend Days of Use	Total Days Available	Weekend Days Available	Total Days Available	Weekend Days Available
1994 (dry)	110	53	12	12	0	0
2000 (avg)	114	54	108	69	93	59
1998 (wet)	103	47	127	72	115	64

5. Power

In accordance with the BLM's multiple use objectives, the Condition provides for power operation. Since a 40% proportional flow is required, up to 60% of the inflow to J.C. Boyle Reservoir is available for diversion to the J.C. Boyle Canal and the turbines, as long as the base flow requirements are met. A base monthly model has been developed using CALSIM, a general purpose river and reservoir systems planning model developed by the State of California Department of Water Resources (personal communication, Nancy Parker, US Bureau of Reclamation, March 2006). The BLM Condition was modeled to determine power generation using the period of record (1959 to 2000). These results show the modeled power production available during five water year types (Table 4-7). A discussion of various approaches to valuing replacement power can be found in the technical memo: Replacement Power Values, DOI Office of Policy Analysis, March 27, 2006.

Table 4-7: Modeled J.C. Boyle Power Production Using BLM Condition—470 cfs minimum flow or 40% of inflow whichever is greater and a 2 inch per hour ramp rate below JC. Boyle Powerhouse.

Klamath River Power Production in MWH – J.C. Boyle					
	Dry	**BA**	**Avg**	**AA**	**Wet**
Oct	12,680	15,391	16,145	12,835	11,644
Nov	16,105	18,864	19,065	16,324	19,587
Dec	16,469	19,803	25,772	25,522	27,807
Jan	13,284	19,588	28,731	28,143	27,397
Feb	5,798	18,205	21,617	26,513	28,219
Mar	4,413	21,325	27,200	39,954	50,641
Apr	1,555	11,054	23,464	39,841	55,458
May	1,144	4,749	14,040	27,854	34,049
June	36	725	4,206	5,865	23,039
July	0	188	1,070	1,959	3,607
Aug	0	2,692	3,290	3,235	5,116
Sept	1,444	5,420	10,723	11,430	12,847
Total	72,928	138,004	195,324	239,474	299,410

The Condition integrates flows needed for maintenance and improvement of aquatic and riparian resources, while also allowing for power production.

Rationale - (C) Streamflow Measurement and Reporting: J.C. Boyle Bypassed River and Peaking Reaches

1. Current Project Measurement and Reporting

The Project currently maintains two stream gages in cooperation with USGS on the Klamath River in Oregon. These gage stations include the Klamath River near Keno (below Keno Dam, #11509500) and Klamath River below the J.C. Boyle Powerhouse (#11510700). The Spencer Creek near Keno stream gage (above the confluence with the J.C. Boyle Reservoir, #11510000) was operated intermittently through September, 2003 by Oregon Department of Water Resources. Instream flow data from the USGS gage sites is made available to the public through the USGS National Water Information System (NWIS) for surface water, and a report of the flow record is provided to the Commission annually. In addition to an annual report, PacifiCorp notifies the Commission when Project operations are out of compliance with the existing license requirements.

2. Current Project Measurement and Reporting Impacts

There is a lack of discharge data for the J.C. Boyle Bypassed River Reach since the Project currently maintains stream gages upstream of the J.C. Boyle Dam and below the J.C. Boyle Powerhouse. As a consequence, information that could be used to determine Project impacts to aquatic and riparian resources is not available. Further, since there is no stream gage in the bypassed reach, the analysis of effects from spring accretions is limited.

Responding to impacts to riparian and aquatic habitat from non-compliance due to Project operations is delayed as a result of the current measurement and reporting system. For example, the Project has had regular non-compliance issues, including ramp rates in the J.C. Boyle Peaking Reach (Huntington 2004). According to Huntington, the nine inch per hour ramp rate required by the license was exceeded in 1994, 1995, and 1999. Ramp rates up to 14.4 inches per hour were documented all of these years. Although a record of non-compliance events is submitted to the Commission, the BLM is not notified. Thus, evaluation of potential effects to resources by the BLM is delayed or absent.

3. Development of the Streamflow Measurement and Reporting Requirement

Data that is accurate and current is needed to monitor streamflow and ramping rate requirements for implementation of the Condition. The Condition is requiring instream flow monitoring from four stream gages and an annual report. Flow data from the required sites is needed to determine locations where Project operations are out of compliance and could impact riparian and aquatic habitats in the bypassed and peaking reaches. The additional streamflow data required from sites where discharge is not currently measured would be used to improve analysis of potential resource effects in the bypassed reach.

The Licensee shall provide real-time flow information and projections for both the J.C. Boyle Bypassed River and Hells Corner Reaches to allow boaters to take advantage of regularly scheduled boating releases and natural spill events. Commercial rafting outfitters and private

boaters would benefit from flow forecasts. In addition, providing up-to-date flow information in an easy and accessible way would also benefit anglers.

4. Effects of the Streamflow Measurement and Reporting Requirement

The annual reporting process provides a means of identifying potential natural resource impacts due to Project operations and provides a process to implement adaptive management during the term of the new license. Continuous discharge data from the required sites allows for timely determinations of where and when natural resource impacts may be occurring. Providing flow information allows the public to take advantage of flows that would be suitable for kayaking, rafting, and fishing and other recreational activities. Implementation of annual monitoring and reporting would provide a means for the BLM to inform the Licensee and the Commission when impacts to resources arise during the term of the new license. By reporting this data, there is a record of information that may be used to develop strategies to prevent similar Project impacts in the future. The discharge data and annual report would be used to ensure the flow regime, including ramping rates, required in the Condition has been implemented.

Rationale - (D) River Gravel Management Plan (RGMP)

Gravel augmentation would restore spawning gravel to portions of the Klamath River channel that have been deprived of sediment inputs due to the Project. Larger gravels and cobbles that are unsuitable for use by spawning fish dominate (Kondolf and Matthews 1993; PacifiCorp 2004d). PacifiCorp states that "pebble count results indicate potential bed coarsening immediately downstream of Project dams and in the J.C. Boyle peaking and bypass reaches" (PacifiCorp 2004d). As a result, the channel has limited gravel-sized material necessary for the spawning life history stage of salmonids and other native fishes. Maintaining an annual supply of gravel and cobble sized material aids in accomplishing ACS objectives. Mitigation of Project effects to channel complexity (side channels, point bars, riffles, and floodplains) would lead to attainment of BLM management objectives for restoring and maintaining geomorphic processes and aquatic and riparian habitats in the J.C. Boyle Bypassed River and Peaking Reaches. The addition of adequate quantities and sizes of gravel and cobble material is needed to provide spawning substrate for both resident and anadromous fish and other aquatic life.

1. Impacts

Current Project impoundments, including J.C. Boyle Reservoir and Dam, trap and block sediment movement downstream through the J.C. Boyle Bypassed River and Peaking Reaches (PacifiCorp 2004a, Exhibit E, page 5-148 and PacifiCorp 2004d, page 6-111). According to the FLA, the primary project impact on geomorphology and sediment transport is the capture of bed load material delivered from tributaries by Project reservoirs (PacifiCorp 2004a, Exhibit E, page 3-184). This, coupled with limited gravel recruitment from the presence of J.C. Boyle Dam (City of Klamath Falls 1986) (PacifiCorp 2004a, Exhibit E, page 4-9), causes gravel to be scarce in the J.C. Boyle Bypassed River Reach. Based on the PacifiCorp Sediment Budget Analysis, the average annual input of sediment from the tributaries between Keno Dam and J.C. Boyle Dam was 6,134 tons per year (PacifiCorp 2005 - Master Sediment Budget). Thus, between the

J.C. Boyle Reservoir and Dam, approximately 6,134 tons per year of suspended sediment and bedload are blocked from moving down the J.C. Boyle Bypassed River and Peaking Reaches.

Oregon Department of Fish and Wildlife surveys conducted in 1998 found substrate composition was 64% boulder and 28% cobbles in the J.C. Boyle Bypassed River Reach (ODFW 1998). Gravels are generally lacking except for an area below the canal spillway where deposition has occurred from hillslope erosion (PacifiCorp 2004d, page 6-86). The characteristics of substrate in the bypassed reach are consistent with impacts associated with stream habitat below a bedload-capturing dam; presence of bedrock, cobble and boulder, and few patches of spawning gravels.

Most trout were observed spawning in marginally suited "patch gravels" behind boulders and in the area below the emergency spillway that contains gravel because of recruitment from hillside erosion below the emergency spillway. Thus, according to PacifiCorp analysis, the limitation of gravel in this reach is limiting trout spawning (PacifiCorp 2004a, Associated Fisheries Benefits). Since substrate in the J.C. Boyle Peaking Reach is heavily armored with boulders and large cobbles and contains only a few small pockets of tightly embedded gravel behind boulders, (PacifiCorp 2004a, Exhibit E, page 4-11), there is no or little spawning habitat for trout (City of Klamath Falls 1986; USDI BLM 2002). Gravel accumulation in this reach is limited, because J.C. Boyle Dam blocks gravel recruitment and there are few tributary streams to contribute gravel. PacifiCorp identified that the lack of redband trout spawning habitat as a potential limiting factor for fish in this reach (PacifiCorp 2004a, Exhibit E, page 4-13).

Changes in the flow and sediment regimes due to Project operations and facilities impact the potential establishment of desirable riparian vegetation. J.C. Boyle Dam reduces the input of gravel, sand, and silt to this reach (PacifiCorp 2004b, Exhibit E 5-148). In addition, flow diversions and changes in the flow regime reduce the potential for scouring and sediment deposition of the limited material that is transported downstream of the dam (PacifiCorp 2004c, pp. 6-135). Further, since the streamflows, sediment supply, and bed mobility are reduced, the extent of substrate appropriate for establishment of willows and other native riparian plants is decreased.

According to PacifiCorp analysis, the Project contributes to the lack of willows in streamside areas (PacifiCorp 2004b, Exhibit E 5-102). Riparian hardwoods typically germinate and establish on freshly deposited alluvium in channel positions low enough to provide adequate moisture but high enough to escape scour (Scott et al. 1993). The Project, however, maintains static hydrologic and geomorphic conditions that do not provide alluvium over a large portion of the area where willows have the best potential to establish.

In the upper portion of the J.C. Boyle Bypassed River Reach the river is constrained by sidecast material present in the margins of the active stream channel. This material was generated during the construction of the J.C. Boyle Canal and road and continues to impact 1.5 miles of the channel. The sidecast material has constricted the channel and altered the riparian vegetation along most of the reach (PacifiCorp 2004b Exhibit E, 5-25, 2004). Alteration of instream flows and changes in sediment regimes result in decreased bank stability and loss of riparian vegetation (Hill 1991; Rosgen 1996). Desirable riparian vegetation (e.g., willow) does not establish and survive in the conditions created by the boulder-sized rocks comprising the sidecast. Further, in

some areas this material has entered the active channel and is causing accelerated bank erosion on the opposite bank (PacifiCorp 2004d).

2. Development of the condition

The amount of gravel supplied to the bypassed and peaking reaches was derived from the average annual input from tributaries between Keno Dam and J.C. Boyle Dam. The average annual input to the reach above the J.C. Boyle Dam was determined to be 6,134 tons per year (PacifiCorp 2004d, AIR WQ-5, Master Sediment Budget 051105k.xls). Thus, the Condition requires the gravel augmentation to range from 1,227 tons per year (20% of 6,134 tons per year) to 6,134 tons per year or 100% of the average annual input (See Table 4-8).

Table 4-8: Gravel Augmentation

	Average Annual Input from Tributaries above J.C. Boyle Dam	PacifiCorp Proposal for First year*	BLM Proposal Annually for 5 years*
J.C. Boyle Bypassed River Reach	6,134 tons per year	100 to 200 cubic yards (2% - 3% of amount blocked.) Also states "10% to 20% of tributary amount.	1,227 tons per year (20% of amount blocked) into bypassed and peaking reach.
* Augmentation in future years based on evaluation.			

According to the Final License Application (FLA), gravel augmentation is proposed as an enhancement measure by PacifiCorp, in part because of the effects on geomorphology and sediment transport from the capture of bed load by Project reservoirs (PacifiCorp 2004a, Exhibit E, page 3-184). PacifiCorp proposed the following gravel augmentation enhancement measures:

> "The volume of the initial augmentation in selected reaches is calculated as 10 to 20% of the average annual volume of tributary and hillslope inputs trapped in the upstream Project reservoir(s). The range of 10 to 20% adjusts the results of the sediment budget to reflect the fact that only a fraction (probably less than 10 percent) of the total tributary sediment yield in each reach is composed of spawnable material. Given the long-term reduction in gravel supply below Project dams, gravel augmentation could begin with a larger volume to fill in-channel storage sites." (PacifiCorp 2004a, Exhibit E, page 4-169)

PacifiCorp found the median size of material that was sampled in the reservoirs deltas where tributary inputs are deposited to be 34.16 mm (PacifiCorp 2004d, page 6-128). Kondolf and Wolman (1993) compiled an extensive data set of salmonid spawning gravels which showed that the median gravel size used for spawning was 25 mm and the geometric mean gravel size was 16mm. Their analysis also found that salmonids can use a wide range of gravel sizes.

Timing and location of gravel augmentation is required as part of the RGMP because of the potential adverse impacts to resident and anadromous fish. Timing of gravel placement must be considered, as protection of habitat during spawning periods is necessary. Further, the location of gravel placement is essential to the success of providing additional fish habitat since the augmentation of gravel should occur where smaller substrate is lacking and where fish could use this material for different life stages.

3. Condition Impacts
The RGMP would provide a strategy (implementation, monitoring, and adaptation) for satisfying KFRA RMP management direction, including maintenance and improvement of aquatic and riparian resources.

Sediment augmentation is needed on a recurring basis at multiple sites established throughout the bypassed and peaking reaches to mitigate for Project impacts that occur downstream from J.C. Boyle Dam and to meet management direction for aquatic and riparian habitat. Initial large volumes of gravel delivered to multiple sites would replenish in-channel storage sites that have been deprived of sediment. In addition, by providing sediment in subsequent augmentation events, substrate would be distributed by alluvial processes.

Adding river material with a median gravel size appropriate for spawning salmonids would create a dynamic and complex river channel. This substrate size is deposited, re-mobilized, and transported more frequently than larger sized material. The augmentation of appropriately sized gravel would create substrate with clean interstitial spaces; provide gradually sloped channel margins (optimal for channel margin rearing habitat); would minimize encroaching vegetation on point bars; and would create a fine substrate replacement on floodplain terraces.

Addition of ample quantity, and appropriately sized gravel and cobble material are needed to increase channel complexity and availability of spawning habitat for resident, migratory, and anadromous fish. Implementation of the RGMP would provide for the geomorphic and ecological processes needed to adequately protect aquatic and riparian resources, and provide for the attainment of KFRA RMP and ACS objectives, in the J.C. Boyle Bypassed and Peaking Reaches.

Rationale - (E) Adaptive Management Plan

The Adaptive Management Plan (AMP) includes provisions and processes for applying adaptive management principles. Adaptive management strategies would provide the necessary link between the Conditions and the KFRA RMP management direction. The AMP includes an adaptive management strategy that incorporates implementation, monitoring, and evaluation of results to allow the Licensee to determine effectiveness of the Condition. Effective monitoring plans developed in coordination with the resource agencies would provide the best opportunity for achieving aquatic resource objectives in the Project area over the term of the License (Castleberry 1996).

The components of the River Corridor Management Condition are expected to produce changes in channel morphology that would mitigate for the continuing impacts under the new License. As additional minimum, seasonal high, and variable flows are returned to the J.C. Boyle Bypassed River and Peaking Reaches, there would be alterations in the amount and quality of available fish habitat due to changing channel configurations. Consequently, continuous monitoring is required to assess changes in channel morphology and to provide for the appropriate instream flows to protect the BLM reservation. This information would be used as the basis for providing scientifically based alterations in instream flows to mitigate the impacts of Project operations.

Habitat condition, habitat production, spawning habitat, and habitat connectivity monitoring data would provide the basis for determining whether the Condition is providing for the needs of fish habitat. Fish-habitat relationships generated for the bypassed and peaking reaches reveal that Project operations have impacted substrate suitability and near shore vegetation cover. After implementation of the Condition, it is predicted that habitat would change. The habitat monitoring is necessary to evaluate if those changes meet the KFRA RMP objectives. Fish passage provisions required under Section 18 prescriptions may result in additional species interactions, changes in fish community structure. Fish habitat monitoring is needed to determine effects of Project operations and implementation of the Conditions on the resident, migratory, and anadromous fish species.

Condition No. 5 – Cultural Resources Inventory and Management

A. Conduct Cultural Resources Inventory

Within one year of issuance of the License, the Licensee shall complete cultural resources inventory of Bureau of Land Management (BLM) land within the Area of Potential Effect (APE).

1. In consultation with the BLM and affected tribes, the Licensee shall conduct a cultural resources inventory of approximately 77.2 acres of BLM-administered land within the APE that have not been inventoried (Figures 5-1 through 5-5).
2. The Licensee shall employ survey standards consistent with BLM Class III survey protocols for cultural resources (USDI BLM 1998).
3. In consultation with the BLM and affected tribes, the Licensee shall document newly identified sites according to BLM and State Historic Preservation Office (SHPO) standards and assess the sites for eligibility on the National Register of Historic Places (NRHP). Newly discovered sites shall be incorporated in an amended HPMP that includes measures for the continued protection and management of cultural resources.
4. The Licensee shall submit a draft report to the BLM documenting the results of the survey within 60 days of survey completion. The report shall follow SHPO report guidelines. The Licensee shall allow a minimum of 30 days for the BLM to review and make recommendations on the draft before finalizing the report and filing it with the Commission. A copy of the final report shall be submitted to the BLM, affected tribes, and the SHPO.
5. In consultation with the BLM and affected tribes, the Licensee shall develop a protocol for conducting cultural resources surveys on BLM land prior to future Project activities proposed within the APE. If a project is proposed within an area where cultural resource surveys are older than 15 years, the Licensee shall conduct a new survey.
6. In consultation with the BLM and affected tribes, the Licensee shall develop procedures for handling, cataloging, interring, or repatriating cultural resources on BLM land exposed by unanticipated Project related effects.

B. Amend Historic Properties Management Plan

Within 18 months of issuance of the License, the Licensee shall amend the Historic Properties Management Plan (HPMP) to address the management of sites on BLM-administered lands within the APE.

1. The Licensee shall amend the HPMP with measures to monitor, stabilize, protect, restore, and/or mitigate for known damages to sites within the APE on BLM land including sites: 35KL18, 35KL21/786, 35KL22, 35KL24, 35KL550, 35KL558, 35KL567, 35KL576, 35KL577, 35KL629, 35KL630, 35KL632, 35KL633, 35KL635, 35KL785, 35KL791, 35KL1083, and JC03-29. Sites discovered during the completion of surveys on BLM land within the APE shall also be included in the amended HPMP.
2. The Licensee shall submit a draft of the amended HPMP to the BLM for review. The Licensee shall allow a minimum of 30 days for the BLM to review and make recommendations on the draft before finalizing the report and filing it with the Commission. A copy of the final amended HPMP shall be submitted to the BLM, affected tribes, and the SHPO.
3. Monitoring (per the amended HPMP) of BLM cultural sites within the APE shall be completed by a qualified professional archaeologist (as defined in the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation).

Monitoring shall involve, at a minimum, visiting 20% of the eligible sites each year to assess impacts, the effect of mitigations in preventing degradation of the resource, whether eligible properties are being affected by Project operations, and whether non-eligible historic properties should be re-evaluated for consideration of eligibility. Monitoring shall be initiated within 180 days of Commission approval.

4. The Licensee shall prepare an annual report documenting mitigations, new findings and assessment of the effectiveness of mitigations in preventing degradation of cultural properties on BLM land. This report shall be submitted to the Commission, the BLM, and affected tribes for use by the BLM into its' Annual Program Summary and Monitoring Report.
5. In consultation with the BLM and affected tribes, the Licensee shall develop a schedule for implementing the amended HPMP. The schedule for implementation for BLM sites within the APE shall address first, those sites which are at greatest risk of continued Project degradation.
6. In consultation with the BLM and affected tribes, the Licensee shall review and/or revise the HPMP every five years to incorporate new information regarding the condition or effects to historic properties on BLM lands (based on the results of effectiveness monitoring); or changes in site eligibility as a function of policy, law, regulation, or advances in scientific technology.

Rationale

Cultural resources on the BLM reservation are managed pursuant to the *Antiquities Act of 1906*, the *Archaeological Resources Protection Act* (ARPA) *of 1979*, the *Historic Sites Act of 1935*, the *Historic and Archaeological Data Preservation Act of 1974*, the *National Historic Preservation Act* (NHPA) of 1966 (as amended), the *National Environmental Policy Act* (NEPA) *of 1969*, the *American Indian Religious Freedom Act* (AIRFA) *of 1992*, the *Native American Graves Protection Act* (NAGPRA) *of 1990*, the *Federal Land Policy and Management Act* (FLPMA) *of 1976*, Executive Order 11593 issued in 1972, and 36 CFR part 800. In addition, the Klamath Falls Resource Area Management Plan (USDI BLM, 1995a) directs the BLM to identify, manage and protect cultural resources as well as to consult and coordinate with affected Native American tribes. Specifically the RMP directs BLM:

- To identify cultural resource localities and manage them for public, scientific, and cultural heritage purposes.
- To conserve and protect designated cultural resources for future generations.
- To continue to fulfill government-to-government and trust responsibilities to appropriate American Indian tribes regarding heritage and religious concerns.

The Project affects cultural resources as a function of flow management, roads, facilities operation, and recreation use. Eighteen NRHP-eligible cultural sites on BLM-administered land exist within the currently defined APE. The Licensee has acknowledged impacts to cultural sites within the Project boundary resultant of public access and recreation (e.g., "Some of these sites appear to be affected by Project operations and/or Project-related activities such as public access and recreation" PacifiCorp 2004e, page 3-1). Additional impacts identified by the Licensee include looting, vandalism, erosion, road and utilities development, livestock grazing, and camping (PacifiCorp 2004e, Tables 3.6-1 and 3.6-2).

Recreation in the Project area is expected to increase over the period of the next license (PacifiCorp 2004k, page 3-54). The Licensee notes that visitors to the Project area mainly are concerned with resting/relaxing, fishing, camping and boating opportunities (PacifiCorp 2004k, pages 3-59 through 3-60). Within the APE on BLM land, these opportunities tend to occur on the river terraces and immediately adjacent to the river. These terraces contain the remains of numerous historical and prehistoric sites which are at risk of continued disturbance. Increased recreation use results in increased disturbance associated with casual collection of artifacts and inadvertent disturbance. This will continue over the period of the new license and over time will contribute to the loss of cultural resources or at a minimum, reduce site integrity.

Of particular concern is the use of all-terrain vehicles (ATVs), including motorcycles, within the canyon. Disturbance to archaeological sites on BLM lands by ATV use has been documented (Canaday 2003) and is expected to continue. At several sites within the canyon, especially at Frain Ranch, ATVs are using prehistoric house pit depressions as jumps/ramps and obstacle courses (PacifiCorp 2004e). This severely disturbs the artifacts as well as the integrity of the structures. Disturbance of archaeological sites from ATV use is expected to continue as long as access to these areas is unrestricted.

BLM consults and coordinates with the Klamath Tribes (a federally recognized tribe consisting of the Klamath, Modoc and Yahooskin band of Paiute) on a bi-monthly basis complying with the above referenced federal laws and regulations. All federal actions that have a potential to affect cultural resources within traditional Klamath tribal territory are identified at these meetings. The intent of the condition is to assemble the appropriate information necessary consult and coordinate with affected tribes in the way BLM is required by law. The Shasta Nation and Shasta Tribe (non-federally recognized) are also kept apprised of major federal undertakings within their traditional tribal territory.

The BLM cultural resource condition is intended to provide for the continued protection of cultural properties on BLM-administered lands.

Complete Cultural Resources Inventory

BLM lands within the APE have not been fully inspected for cultural resources. Therefore, the full extent of Project effects on the BLM reservation is unclear. All BLM lands within the APE require cultural resources surveys to fulfill the intent of the NHPA as well as to meet Tribal trust responsibilities. The BLM routinely conducts cultural resource surveys for its' own ground disturbing activities and requires outside entities wishing to conduct undertakings on federal land to comply with cultural resource laws and regulations.

The Licensee did not identify a cultural resources APE prior to the initiation of cultural resources surveys. Instead, the Licensee proposed a Field Inventory Corridor (FIC) that would encompass the APE when one was designated. Cultural resource surveys were conducted within portions of the FIC during the 2002/2003 field seasons. A proposed APE was submitted to the California and Oregon SHPO and the Yurok Tribal Heritage Preservation Officer on February 2, 2004. A copy of the proposed APE was also provided to the Cultural Resources Work Group (CRWG) at this time. The surveys conducted within the FIC do not adequately cover the entire APE. The Licensee stated in a letter to the Oregon SHPO dated August 2, 2004 (PacifiCorp 2004g), that all land within the APE was adequately inspected for cultural resources. The Licensee maintains that areas within the APE located on BLM land should be surveyed by the BLM. The BLM has

noted (USDI 2004; Raby 2004a; and Raby 2004b) that under Section 106 of the NHPA, the Licensee is obligated to ensure that surveys within the APE are conducted. Further, the BLM notes that portions of the APE on BLM lands have been inspected by BLM to meet management objectives unrelated to the Project re-licensing activity. However, when one compares past surveys with those conducted by the Licensee within the currently defined APE, it is clear that several hundred acres have yet to be inspected. Included in this total are approximately 77.2 acres of BLM land that have not been surveyed. Additional BLM land within the APE has also not been inspected, but it is too steep or marshy for effective survey. The 77.2 acres identified here are areas of relatively gentle topography (BLM Figures 5-1 through 5-5).

Changes in vegetation cover, surface visibility, erosional forces, and survey techniques can affect the reliability of past surveys. BLM routinely re-surveys areas prior to undertakings if the original survey is older than approximately 15 years and often sooner if a proposed undertaking is planned within areas considered to be high probability for containing cultural resources (river terraces, adjacent to water, etc.). The condition requires the Licensee to re-inspect past surveyed areas on BLM land if new ground disturbing projects are proposed for areas that have past survey clearance older than about 15 years.

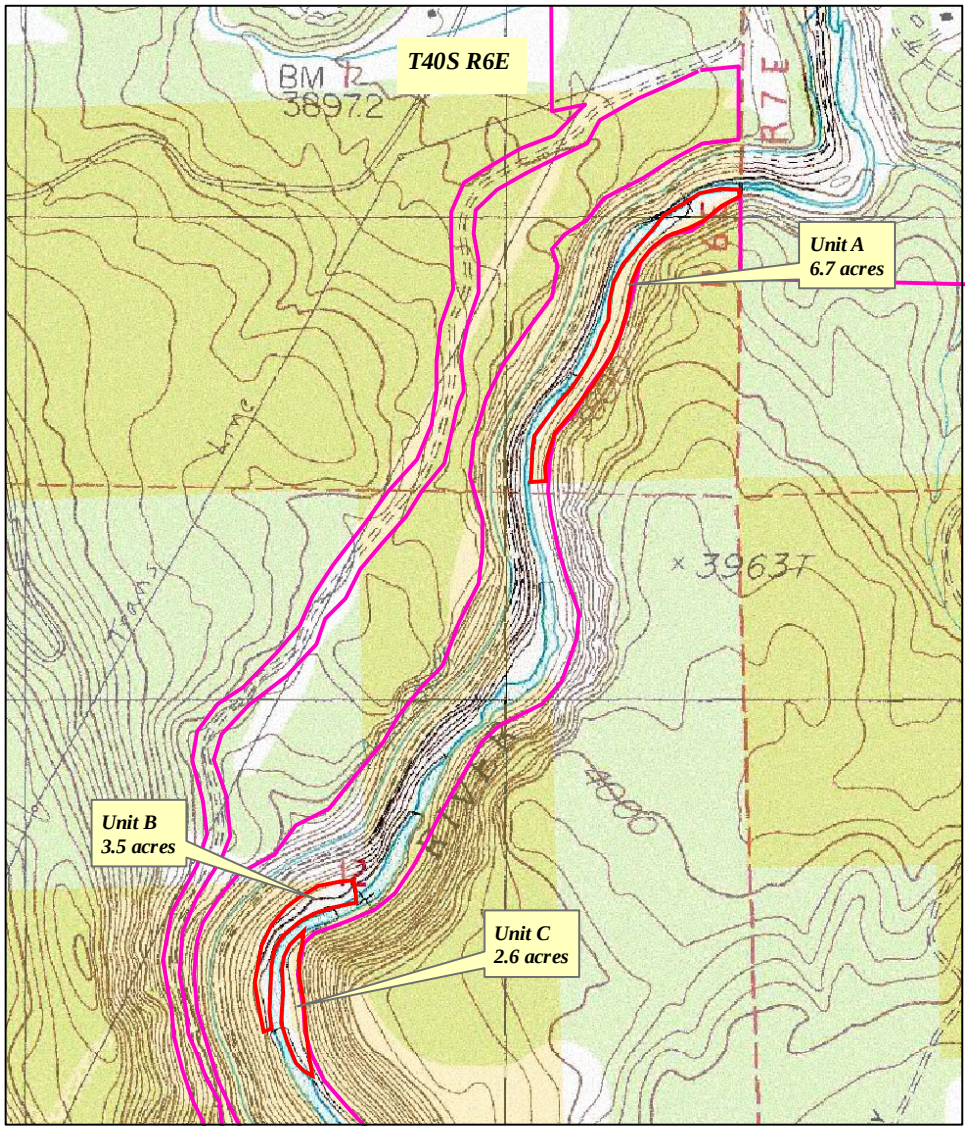
Amend Historic Properties Management Plan

Cultural resources on BLM lands have and will continue to be affected by the Project. The Licensee did not adequately address the survey, protection, monitoring, and mitigation of cultural resources located on BLM lands. The HPMP does not include NRHP eligible sites located on BLM-administered land within the J.C. Boyle Peaking Reach. These sites are within the APE included in the FLA, are impacted by Project operations, and must be included in the HPMP. The Licensee notes, "The FERC has regulations that require that a Historic Properties Management Plan be prepared to mitigate and manage Project effects on cultural resources that are eligible for the National Register of Historic Places (NRHP)." (PacifiCorp 2004j, page 1-1). In the Final Technical Report, the Licensee evaluates NRHP eligibility for 20 sites on BLM land within the APE (PacifiCorp 2004e, Table 3.6-1 and 3.6-2). Two sites (35KL634 and 35KL1419) are not eligible for inclusion in the NRHP. One site (35KL785) was not evaluated because it was not within the FIC inspected by the Licensee. The Licensee's proposed APE now encompasses this site that the BLM considers eligible for the NRHP. The 17 remaining sites were evaluated by the Licensee as being eligible for inclusion in the NRHP. At the time, the Licensee noted the effect of Project operations on these sites (PacifiCorp 2004e, Table 3.6-1 and Table 3.6-2). However, none of the sites are included in the HPMP. This condition requires the Licensee to include these sites in the HPMP.

The 18 sites on BLM-administered land within the APE immediately adjacent to the Klamath River in the J.C. Boyle Peaking Reach are impacted by flow fluctuations eroding the river bank. At least one prehistoric site (35KL22) containing human remains has been impacted (PacifiCorp 2004e, Table 3.6-1). Emergency stabilization efforts currently protect a portion of this site. Additional cultural deposits, both upstream and downstream of the stabilized area remain at risk from erosion through periodic wetting and drying of fragile archaeological deposits. Continued ramping, changes in discharge during summer months, and the short duration of peaking will continue to affect the stability of sites adjacent to the river.

The BLM monitors at least 20% of its' cultural resources as directed in the RMP (USDI BLM 1995a). The intent of the condition is to incorporate monitoring of cultural resources on BLM-administered land within the APE consistent with BLM's current management direction.

BLM Figure 5-1: Cultural resource survey requirements within the PacifiCorp defined APE. These areas within BLM land were not inspected by PacifiCorp during their surveys.



Cultural Resource Survey Requirements

1 inch equals 1,000 feet

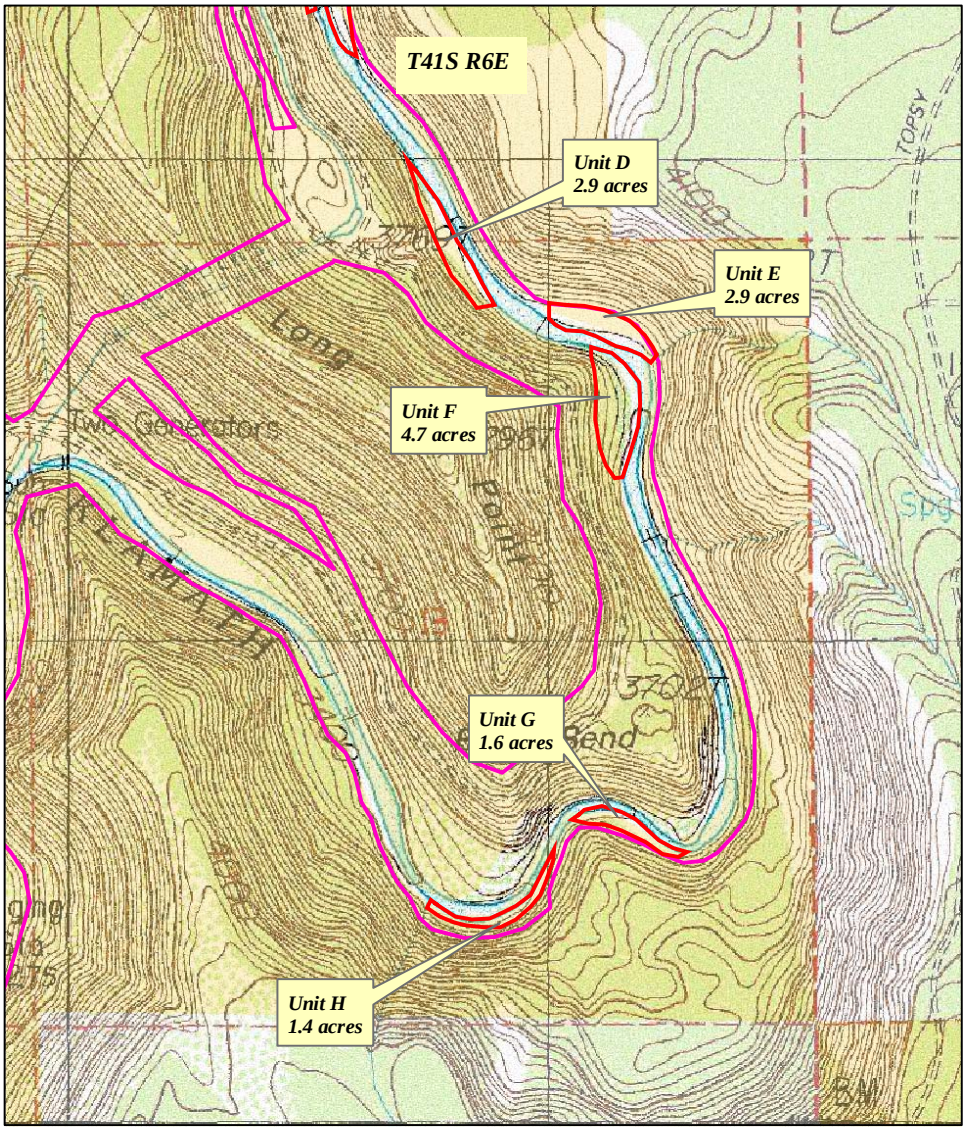
N
W
E
S

cultural_survey_needed
PacifiCorp_APE_(approximate)

Miles
0 0.1 0.2 0.3 0.4 0.5

Prepared by: tcanaday
Creation Date: 8/11/2005 11:08:24 AM

BLM Figure 5-2: Cultural resource survey requirements within the PacifiCorp defined APE. These areas within BLM land were not inspected by PacifiCorp during their surveys.



Cultural Resource Survey Requirements

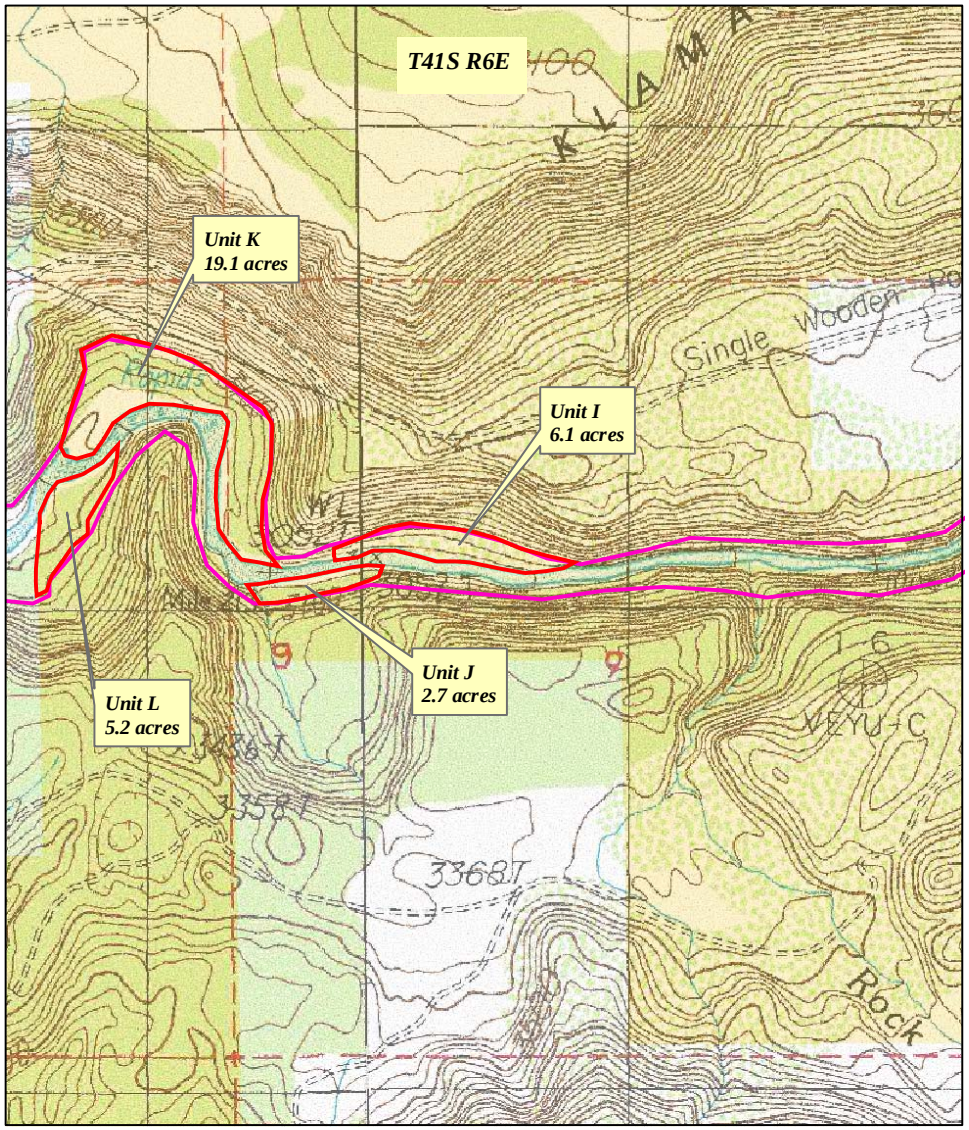
1 inch equals 1,000 feet

Miles
0 0.06 0.12 0.18 0.24 0.3

cultural_survey_needed
PacifiCorp_APE_(approximate)

Prepared by: tcanaday
Creation Date: 8/11/2005 11:08:24 AM

BLM Figure 5-3: Cultural resource survey requirements within the PacifiCorp defined APE. These areas within BLM land were not inspected by PacifiCorp during their surveys.



Cultural Resource Survey Requirements

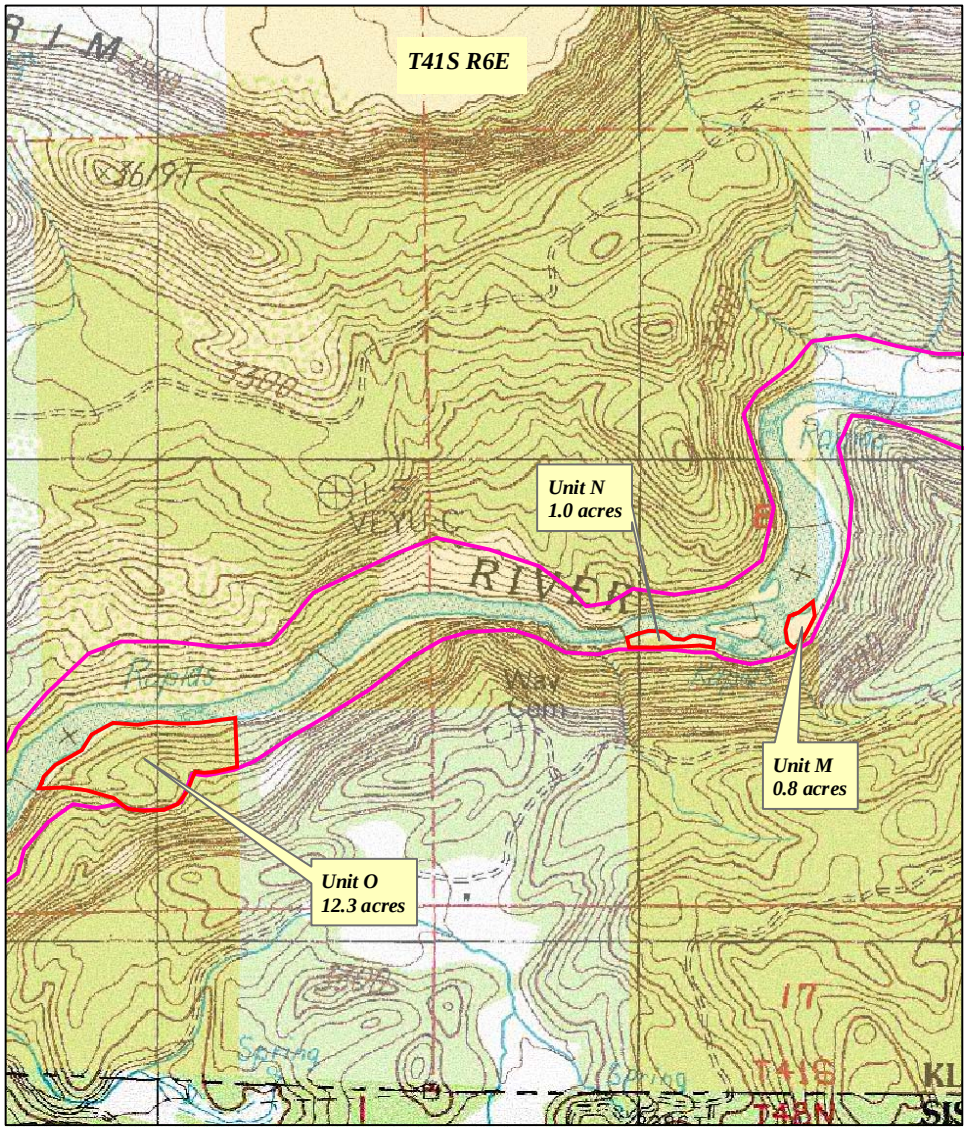
1 inch equals 1,000 feet

Miles
0 0.06 0.12 0.18 0.24 0.3

cultural_survey_needed
PacifiCorp_APE_(approximate)

Prepared by: tcanaday
Creation Date: 8/11/2005 11:08:24 AM

BLM Figure 5-4: Cultural resource survey requirements within the PacifiCorp defined APE. These areas within BLM land were not inspected by PacifiCorp during their surveys.



Cultural Resource Survey Requirements

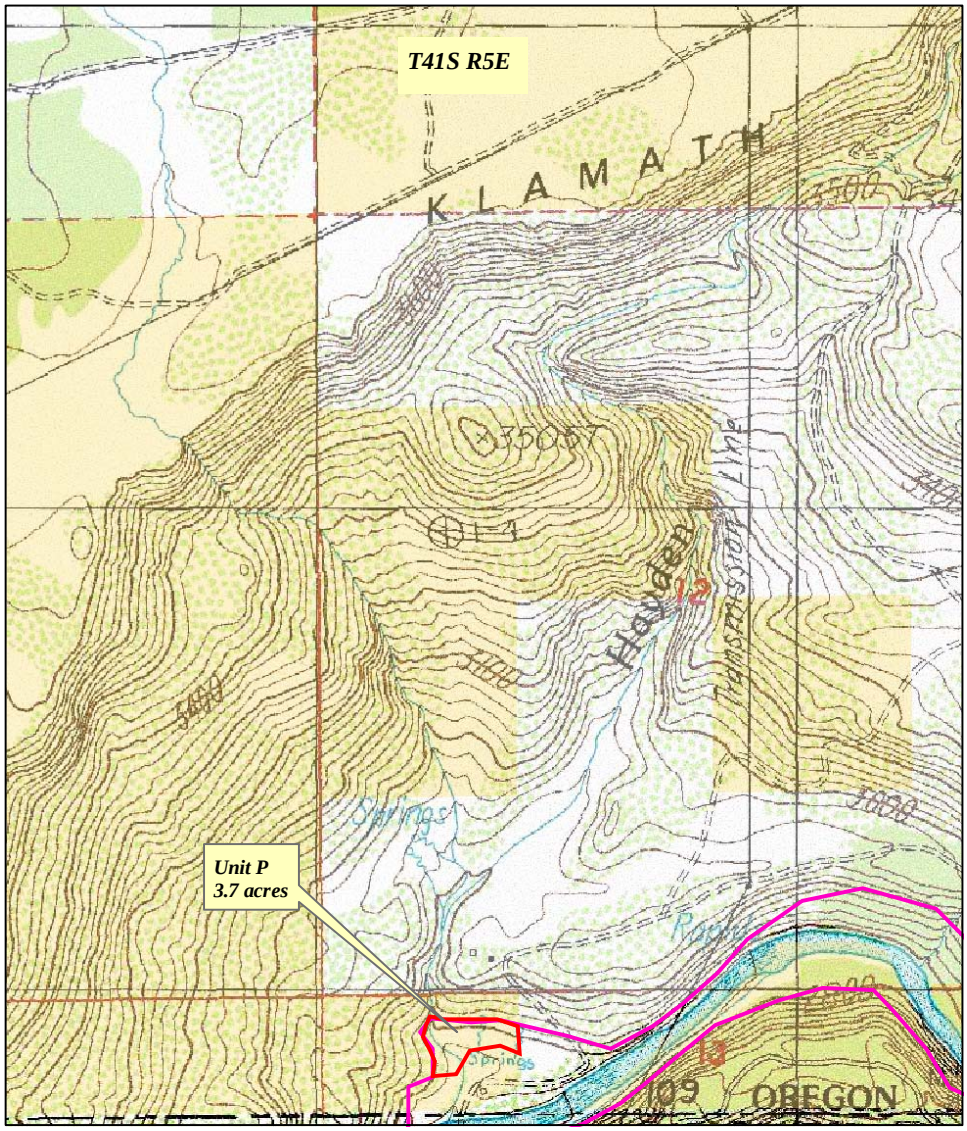
1 inch equals 1,000 feet

Miles
0 0.06 0.12 0.18 0.24 0.3

cultural_survey_needed
PacifiCorp_APE_(approximate)

Prepared by: tcanaday
Creation Date: 8/11/2005 11:08:24 AM

BLM Figure 5-5: Cultural resource survey requirements within the PacifiCorp defined APE. These areas within BLM land were not inspected by PacifiCorp during their surveys.



Cultural Resource Survey Requirements

1 inch equals 1,000 feet

Miles
0 0.1 0.2 0.3 0.4 0.5

cultural_survey_needed
PacifiCorp_APE_(approximate)

Prepared by: tcanaday
Creation Date: 8/11/2005 11:08:24 AM

Condition No. 6 – Recreation and Aesthetic Resources Management

A. Within one year of issuance of the license, The Licensee shall develop and file with the Commission a Recreation Resources Management Plan (RRMP). At a minimum the RRMP shall:

1. Include descriptions of existing and potential recreation sites and trails on Bureau of Land Management (BLM) administered lands affected by the project, including Topsy Campground, Spring Island Boaters Access, Klamath River Campground, dispersed day-use sites and Stateline Takeout.
2. Include a schedule for implementation, maintenance, capital improvements, and monitoring for those BLM recreation facilities affected by the Project.
3. Include a schedule of costs. The Licensee shall identify responsibility for the costs of operating, maintaining and monitoring Topsy Campground, Spring Island Boaters access, the Stateline Takeout, the Klamath River Campground and dispersed day-use sites. The Licensee shall work with the BLM to identify the appropriate instrument for shared administration of these sites.
   (a) Include maintenance and development provisions for recreation sites, day-use areas, and non-motorized and motorized trails located on BLM-administered lands affected by the Project. These sites include: Topsy Campground; J.C. Boyle Bypass Reach boating and fishing access sites and associated access trails; Spring Island Boaters Access; Klamath River Campground; and dispersed day-use sites used by whitewater boaters along the Klamath River; scouting trails at major rapids; and the Stateline Takeout.
4. Include provisions for working with the BLM to define standards for facilities operation and maintenance; facility replacement, modification, or upgrade; and monitoring for those BLM recreation facilities affected by the Project.
5. Include provisions to bring facilities up to BLM standards for handicap accessibility, public health and cleanliness, safety, and security.
6. Include provisions for monitoring visitor use of BLM-administered lands that are affected by the Project at an interval no greater than five years. To assess when new facilities or management are needed, a framework for monitoring shall incorporate a feedback loop and necessary trigger points for action for adaptive management.
7. Include provisions for a visitor-use report to the BLM. The BLM shall be given the opportunity to review the report and discuss the findings with the Licensee. The report shall be filed with the Commission no later than 30 days after the BLM has submitted comments to the Licensee and the report is final.
8. Include a provision for annual review and modification of the RRMP.
9. Include a Visual Resource Management (VRM) Plan that includes provisions and guidelines for managing visual (e.g., aesthetic) resources on BLM-administered lands from the headwaters of J.C. Boyle Reservoir to Iron Gate Reservoir. The VRM plan should describe how the design, maintenance, and construction of Project facilities will maintain or preserve visual resource values. The VRM plan shall be consistent with BLM VRM objectives and guidelines (USDI BLM 1995a, pages 43-44 and Map 2-5; USDI BLM 1993, page 33). The VRM Plan shall include provisions for aesthetics at the bypass canal and other concrete structures, switch yards, power houses, buildings, penstocks, powerlines (metal structures); and Project recreation facilities including campgrounds and day-use sites. The following are examples of the types of mitigation measures that may be used to meet VRM objectives for the Project:
   (a) For bypass canal and other concrete structures: mitigate color and form contrasts by application of acid/stain agent (e.g., Permeon) to reduce contrasts in existing structures;

by addition of earthtone coloring agents in concrete mix for new structures; and in concert with vegetative screening or landscaping. Vegetative screening or landscaping may require systematic watering, fertilizing or other measures to ensure its survivability and effectiveness over the term of the license.

(b) For switch yards, power houses, buildings, penstocks, powerlines (metal structures): mitigate color and form contrasts by application of paint/stain earthtone colors selected from the surrounding natural appearing landscape colors to reduce contrasts; and in concert with vegetative screening or landscaping. Replace conductors with non-reflective materials at such time as reflectors would otherwise be replaced.

(c) For Project recreation facilities including campgrounds and day-use sites: mitigate color and form contrasts by vegetative or structural screening for all existing and newly constructed recreation facilities. Mitigate impacted areas with vegetation plantings to reduce erosion, improve aesthetics and screening.

(d) For J.C. Boyle Powerhouse and Canal access roads, Project roads, and other landform alterations: mitigate color and form contrasts by establishing vegetation. Application of soil tackifiers and bio-stimulants may be necessary to facilitate revegetation. Talus slopes and cutbanks; mitigate color and form contrasts by establishing vegetation. Application of soil tackifiers and bio-stimulants may be necessary to facilitate revegetation.

B. The Licensee shall prepare a draft RRMP after consultation with the BLM. The Licensee shall allow a minimum of 30 days for the BLM to comment and make recommendations on the draft RRMP before finalizing the plan and filing it with the Commission. The Licensee shall include with the Plan documentation of consultation, copies of comments and recommendations and include descriptions of how the recommendations, and a description of how the comments and recommendations are accommodated by the RRMP. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information. At the time it files the Plan with the Commission, the Licensee shall serve a copy of the filed documents upon the BLM.

C. The BLM reserves the right to require changes to the Plan by filing modifications to the RRMP within 30 days of service. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the BLM.

Rationale

Recreation Resource Management Plan

Summary Statement

The purpose of the condition is to foster a cooperative working relationship between the BLM and the Licensee to ensure: maintenance and improvement of recreation opportunities at BLM facilities which support a recreation demand that was created as a result of the Project operations (i.e., summer whitewater boating and fishing); continued provision of "a wide range of recreation opportunities that contribute to meeting projected demand within the planning area" (USDI BLM 1995a, page 47) for both public and commercial interests; the equity in assumption of costs incurred for Project-related recreation at BLM recreation facilities; and maintenance and preservation of the visual (scenic) resources on BLM-administered lands.

Recreation Opportunities and Demand

Summer whitewater rafting, base flow fishing, and reservoir-based boating, camping, and fishing are resultant of the Project. Peaking operations for power generation accommodate whitewater boating that otherwise would be absent during summer months. Predictable flows that accommodate whitewater boating have sustained a commercial whitewater boating industry on the Klamath River. In the absence of the Project, the Upper Klamath River would likely afford only technical whitewater or low-flow boating (e.g. kayaking) opportunities after midsummer. The Project has also created and sustained a demand for reservoir based recreation. In response to demand for Project-related recreation and the need for access, BLM has developed and continues to maintain recreation infrastructure within the Project boundary. BLM incurs the cost associated with construction and maintenance of this infrastructure as well as for the costs associated with staffing, planning, maintenance, and monitoring use and condition of these facilities.

Recreation use and demand for developed, staffed and maintained facilities will continue to grow as the population of the Klamath Basin expands over the next 30 to 50 years (PacifiCorp 2004k, pages 5-46-49). Increased recreation use of the Project presents a challenge to Federal land management that requires balancing resource protection with increased demand for diverse recreation opportunities. Increased recreation use of public lands without a corresponding increase in capital improvements necessary to maintain infrastructure will ultimately result in negative impacts to other resource values, the quality of the recreation experience, and to human health and safety. To date, the cost associated with developing or maintaining recreation infrastructure has mainly been borne by the BLM

BLM management direction for the Klamath River canyon calls for the operation and maintenance of the Topsy Campground, Spring Island Boaters Access, the Klamath River Campground, the Stateline Takeout, and dispersed day-use sites (USDI BLM 1995a, page 49). However, the recreation demand which BLM accommodates has increased as a function of Project operations and facilities that serve this recreation interest. To date, the BLM has had to incur all costs associated with management and maintenance of recreation facilities.

The Commission acknowledges recreation demand resultant of Project operations and requires the details of recreation management be developed through a comprehensive recreation management plan (Code of Federal Regulations - 18 CFR Ch. 1, 4-1-96 Ed.). The Commission requires that the comprehensive recreation management plan be prepared in consultation with federal agencies with managerial responsibilities for Project lands including agency recommendations for creating, preserving or enhancing recreation opportunities at the Project and in the Project vicinity.

The Licensee developed a Draft Technical Report for Recreation Resources (PacifiCorp 2003c) and the Recreation Needs Summary (PacifiCorp 2003d) that identified existing and proposed recreation facilities and opportunities for the BLM-administered lands including: Topsy Campground, Spring Island Boaters Access, Klamath River Campground, Stateline Takeout, and dispersed day-use sites. Although these needs were omitted from subsequent filings to the Commission regarding recreation needs and opportunities in the Final License Application (PacifiCorp 2004a) the recreation needs remain and should be addressed. In the absence of provisions to improve, develop, or maintain these facilities the Licensee would fail to meet existing or projected demand for recreation resources (PacifiCorp 2004k, pages 5-46 through 5-

49). The BLM condition is intended to accommodate the recreation demand that both the BLM and the Licensee have perpetuated and supported.

Topsy Campground [A.4.(a)]

The Topsy Campground has been shown to receive recreation use that is a direct result of the Project reservoir and would not have been constructed if the Project had not created a demand for this type of recreation facility. Existing recreation demand for developed camping at the J. C. Boyle Reservoir is met entirely by the Topsy Campground. The Topsy Campground is located within Powersite Withdrawal #258 authorized by Executive Order #6910, on J.C. Boyle Reservoir (BLM Map 1) and is included in the license for Project No. 2082 (Federal Power Commission 1963 - letter to BLM State Director, Oregon). The Topsy Campground is the only developed and staffed camping facility on the J.C. Boyle Reservoir. Demand for camping at Topsy Campground is high on most weekends during summer months and the number of campsites (16), group sites, and improved day-use sites are limited. In fact, the BLM has had to close the entrance to Topsy Campground on weekends when site capacity is filled.

Availability of a potable water supply at Topsy Campground has become problematic. Two wells at the site have failed due to poor water quality and currently BLM transports potable water to the site. A reliable potable water supply is a necessity for public safety and health. The Licensee recognized the need for water system improvements, stating, "BLM's water system needs refurbishment and/or a new potable well source created." (PacifiCorp 2004k, page 5-20)

The Topsy Campground access road is potholed, washboarded, and as a result is difficult to maintain. The BLM receives frequent complaints from the public regarding the condition of the road and associated dust. This situation, and other similar situations, should be evaluated in the plan to address these concerns and reduce road hazards and dust from vehicles.

The BLM and the Licensee, in the Draft Technical Report for Recreation Resources (PacifiCorp 2003c) and the Recreation Needs Summary (PacifiCorp 2003d), identified the need for a group site on J.C. Boyle Reservoir to handle large weekend gatherings, and additional day-use picnic and camping sites for Topsy Campground. Day-use and camping sites at the Topsy campground are not designed to accommodate the increased number of day-users, campers, or groups that access the area. Off-site developments at the Boyle Bluffs area are preferred as additional space for expansion at Topsy Campground is not available. The Licensee has recognized this need in the Final License Application: "Approximately 10 new RV/tent campsites will likely be needed as the BLM's Topsy Campground reaches capacity. Infill or expansion is not feasible at this location. A new day use and campground facility at Boyle Bluffs may be considered." (PacifiCorp 2004a, Exhibit E, page 7-99)

J.C. Boyle Bypass Reach [A.4.(b)]

The BLM administers lands along the J.C. Boyle Bypass Reach for fishing, hiking, sightseeing, and other dispersed recreation. The J.C. Boyle Bypass boating and fishing access sites have not been improved with signage, barriers, or designated parking spaces. Historically, the Licensee allowed angler and boater access to the reach. Additional graveled and delineated boating and fishing access sites on BLM-administered lands are needed to meet existing demand, provide safe parking and trail access to the Bypass reach. These sites were identified by the Licensee for potential development: "*J.C. Boyle Bypass Reach/Powerhouse Area Fishing Access Trails.*" There are a number of opportunities to formalize user-defined trails and/or create new hardened

fishing access trails in the J.C. Boyle bypass reach/powerhouse area. Formalized fishing access trails could be developed below J.C. Boyle dam and near the J.C. Boyle powerhouse. One or more pull-offs along the Canal Access Road could be used for parking. A second location for a formalized trail would start at the gravel parking area adjacent to the J.C. Boyle Powerhouse 'shed' and follow the river upstream. This short fishing access trail probably would require some new trail construction." (PacifiCorp 2004k, pages 5-100 and 5-101)

Spring Island Boater Access [A.4.(c)]

The Spring Island site was developed in the early 1980s by the BLM in response to public demand for a public whitewater boat launch below the J.C. Boyle Powerhouse. The BLM considered the request in consultation with PacifiCorp and whitewater outfitters. Prior to this request, the Licensee prohibited whitewater boat launches at a site immediately above the Powerhouse. PacifiCorp erected signs at the launch site to deter boater access. Since 1982, the BLM has monitored use of this site and has incurred 100% of the cost of maintenance of this facility. Monitoring and maintenance consists of regular site visits (typically twice weekly in summer months for Spring Island and Klamath River Campground) to assist boaters and collect trip reports, collect trash, maintain restroom facilities, and monitor permitted outfitters and other recreation use. BLM estimates recreation use at Spring Island at 5,000 visits per year (USDI BLM 2004a).

The access road leading to the Spring Island Boater's access is often washboarded, dusty, and difficult to maintain. Additional maintenance and re-surfacing is necessary to reduce hazards and for dust control. Additional educational and interpretation materials are needed to better inform the public about whitewater hazards and other safety concerns. These items have been identified as a recreation need in the Recreation Resources Final Technical Report (PacifiCorp 2004k, page 5-143). In addition, the BLM and National Park Service have identified the need for enhanced and up-to-date flow information for the boating public.

If the BLM were to close Spring Island Boater there would be an unmet demand for improved day-use boat launch facility below the J.C. Boyle Powerhouse. No other facility exists or is proposed by the Licensee to meet this demand.

Because this facility has been shown to receive approximately 5,000 annual recreation user visits as a direct result of the Project (flow related whitewater boating), including a substantial commercial whitewater boating industry, and would not have been constructed if the Project had not created a demand for this type of recreation facility, the Licensee shall assume some responsibility for the operations, maintenance and improvement through a negotiated agreement with the BLM.

Klamath River Campground [A.4.(d)]

The BLM's Klamath River Campground is accessed by an extremely rough road that requires maintenance including grading, rock fall protection, and rock removal. The campground would not be accessible by road if this road had not been constructed for the Project. In addition to campers, whitewater boaters and fishermen frequently use the site's facilities. The Licensee recognized the need for road improvements in its Recreation Resources Draft Technical Report (PacifiCorp 2003c, page 5-144): "Consider some improvement to the primitive access road to this site, while not attracting large crowds to this site."

BLM estimates that annual use of the site accounted for approximately 1,000 visits (USDI BLM 2004a). Approximately 70 percent of annual recreation use at this site occurs during the peak season, summer (PacifiCorp 2004k, page 5-72). The majority of visitors in the upper Klamath River participated in whitewater boating (PacifiCorp 2004k, page 3-16). The Klamath River Campground is administered by the BLM that incurs 100% of the costs associated with management, maintenance, and operation of this facility.

The campground is in need of improvement. The access road is rutted and should be improved. The Licensee recognized the need for site improvements in its Recreation Resources Draft Technical Report: "In general, these may include site improvements and/or site relocation." (PacifiCorp 2003c, page 5-144).

Overall, use of this site is considered to be approaching its recreation capacity (PacifiCorp 2004k, pages 5-72 and 5-73) Additional sites are needed to meet demand. If the BLM were to close Klamath River Campground, there would be an unmet demand for improved camping facilities below the J.C. Boyle Powerhouse. There are no other existing or proposed developed facilities for camping on this segment of the Klamath River. As this facility has been shown to receive recreation use that is a direct result of the Project roads and Project operations and would not have been constructed in the absence of the Project, the BLM believes the Licensee has some responsibility for maintaining and operating this facility.

Stateline Takeout [A.4.(e)]

The Stateline Takeout Recreation Site and access road which the BLM and PacifiCorp share responsibility for managing, receives heavy use during peak summer months. Primary recreation users include commercial whitewater rafting companies and the general public. The BLM portion of the Stateline recreation site is impacted as a function of recreation demand and lack of developed camping and day use facilities. The Stateline Recreation Site would not exist in the absence of the Project operations.

Historically, there was no public boating take-out and visitors were charged a fee to use the Copco Store as a take out. Boaters began using Stateline Takeout that is located on public land. Boaters also tried to use the Licensee's fishing access sites as take-outs. Eventually, the Licensee allowed Fishing Access 1 as a take-out, where boaters were dragging boats from the shoreline to the access road. Currently, Fishing Access 1 and Stateline provide the only public boater access. BLM has improved road access to the BLM-administered portion of the Stateline Takeout site. BLM has also provided permanent vault and rented portable toilets at both the BLM and the PacifiCorp portions of Stateline. PacifiCorp's FLA excludes the BLM portion of the Stateline Takeout site; however, the PacifiCorp portion of Stateline Takeout can only be accessed through BLM-administered lands.

The Licensee has identified several resource protection measures and recreation enhancements for the BLM-administered portion of Stateline Recreation site in the draft technical reports and needs summaries. Overall, use of this site is considered to be approaching its recreation capacity (PacifiCorp 2004k, page 5-145). Road improvements are needed to reduce erosion, rutting and impacts from uncontrolled recreation use. Designated camping areas are needed to reduce loss of vegetation and conflicts with cultural sites. These items are necessary to meet an existing recreation demand and reduce conflicts with other resources.

The BLM portion of Stateline Recreation site is the only designated camping area between Copco Reservoir and Stateline. The BLM has incurred 100% of the cost of construction, operation, maintenance, monitoring at the Stateline Takeout since the mid-1980s. The BLM will continue to incur these costs over the period of the License. Due to declining Federal budgets, it is unlikely that the BLM will be able to continue to operate this facility at the same standards for visitor health and safety while meeting an increasing public demand. If the BLM were to close Stateline Takeout due to declining Federal budgets, there would be an unmet demand for improved camping and day-use facilities between Copco Reservoir and Stateline.

As the BLM portion of the Stateline site has been shown to receive whitewater boating use that is a direct result of the Project (PacifiCorp 2004k, pages 5-145 and 5-146) and would not have been constructed in the absence of the Project, the BLM believes the Licensee has some fiscal obligation for maintenance and operation of these facilities.

Dispersed Day-use Sites [A.4.(f)]

Several dispersed and undeveloped campsites and day-use areas on BLM-administered lands receive camping, fishing and boating use. Recreationists gain access to these sites via Project roads or the Klamath River. Several sites have fire grates and picnic tables and serve as "designated" dispersed camps when summer fire restrictions are in effect. BLM administers and incurs 100% of the costs associated with management, maintenance, and operation of these dispersed day-use facilities. These day-use sites are needed to meet an existing recreation demand as identified by the Licensee (PacifiCorp 2004k, pages 5-148 through 5-150). As these day-use sites have been shown to receive recreation use as a result of the Project, the BLM believes the Licensee has some fiscal obligation for maintenance and operation of these facilities and shall negotiate an agreement with the BLM.

Monitoring and Coordination

BLM-administered lands are affected by recreation use that 1) is facilitated by Project roads, facilities, or operations; or 2) has increased as a consequence of user demands. Monitoring visitor use will aid the BLM in developing the agency's Annual Program Summary and Monitoring Report and as well aid in developing projects within the context of a five or 10-year planning horizon. BLM currently conducts yearly monitoring and collects visitor information for Topsy Campground, Spring Island Boat Access, and Klamath River Campground; and monitors whitewater boating and other recreation activities in the upper Klamath River. The Licensee recognized the need to review recreation use as well as facility maintenance and development in its draft RRMP. BLM-administered recreation facilities and roads are managed in conjunction with Project recreation facilities and roads; thus necessitating coordination to continue to meet regional recreation demands. A framework for monitoring that incorporates a feedback loop and necessary trigger points for action for adaptive management is necessary to insure that BLM facilities are adequate to meet recreation demand.

Visual Resource Management (VRM) Plan

The Commission requires discussion of scenic values and protection of this resource in coordination with Federal or state agencies with land management responsibility (18 CFR Ch. 1, 4-1-96 Ed.). The consultation must indicate the nature, extent, and results of the consultation. The report must include a description of the measures proposed by the applicant to ensure that any proposed project works, rights-of-way, access roads and other topographic alterations blend, to the extent possible with the surrounding environment. Powerlines, concrete structures, canals,

roads and other Project facilities detract from the scenic quality of the BLM-administered lands along the lower portion of J.C. Boyle Reservoir and the Upper Klamath River to Irongate Reservoir.

Strong visual contrasts are apparent in the Bypass Reach where large continuous concrete structures dominate much of the view of visitors as they descend into the canyon. (Refer to BLM Figure 6-1.) These Project facilities continue to impact aesthetic resources and do not meet BLM Visual Resource Management class III objectives for the area (USDI BLM 1995a, Map 2-5). VRM Class III objectives allow for moderate levels of change to the characteristic landscape. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements of form, line, color, texture and scale found in the predominant natural features of the characteristic landscape.

The Klamath Falls Resource Area RMP/ROD (USDI BLM 1995a, pages 43-44) and Redding Resource Management Plan (USDI BLM 1993, page 33) requires the BLM to protect the scenic values of the Upper Klamath River, by providing for Visual Resource Management Class II management in the corridor. VRM Class II management is also to be provided within one-quarter mile of the Topsy Recreation site. VRM class II objectives allow for low levels of change to the character of the landscape. Management activities should be seen but should not attract the attention of the casual observer. Changes should repeat the basic elements of form, line, color, texture and scale found in the predominant natural features of the characteristic landscape.

BLM Figure 6-1: Photo of canal from powerhouse access road

The Licensee has indicated that BLM's VRM guidelines and standards would be used to improve some of the existing facilities which are visible from public viewing points on BLM-administered lands (PacifiCorp 2004L, pages 64-66). The BLM has consulted with the Licensee and indicated that additional facilities need to be included in the aesthetics and visual resource enhancement program as they do not meet the VRM objectives for the area. The Project facilities on BLM-administered lands impacting scenic resources include the J.C. Boyle Bypass Canal and other concrete structures, switch yards, power houses, buildings, penstocks, powerlines (metal structures); and Project recreation facilities including campgrounds and day-

use sites. Project structures require screening or concealment using methods as described in this condition in order to meet BLM VRM objectives. The VRM plan shall provide for managing landscape character in such a way as to accommodate existing and new Project facilities. Revegetation and site rehabilitation is necessary to help meet VRM plan guidelines for the Topsy Recreation site. The Licensee has identified in its Draft RRMP that the mitigation measures such as recoating or repainting facilities to reduce contrasts can be accomplished during regular Project maintenance. BLM has requested these items be accomplished within 10 years of License issuance.

The Klamath Falls Resource Area RMP/ROD also requires the BLM to "…manage designated and suitable segments of the National Wild and Scenic Rivers System to protect their outstandingly remarkable values and to maintain and enhance the natural integrity of river-related values in designated and suitable river areas." (USDI BLM 1995a) In 1994, the Upper Klamath River was designated by the Secretary of the Interior as a Scenic River and is included in the National Wild and Scenic Rivers System. Based on this, the BLM must secure interim protections specifically from the J.C. Boyle Powerhouse to the Oregon-California state line on the upper Klamath River until a river management plan has been completed (USDI BLM 1995a, page 45). Among the protections are the provisions for Visual Resource Management Class A management in the river corridor and protection of the free-flowing river values (e.g., outstandingly remarkable values) of recreation, scenic, fish, wildlife, prehistoric, and historic resources, as well as Native American traditional uses.

Condition No. 7 – Vegetation Resources Management Plan

A. Within one year of the issuance of the license, the Licensee shall prepare and file with the Commission a Vegetation Resources Management Plan which includes provisions for managing noxious and invasive plants and threatened, endangered, and sensitive (TES) plants on BLM-administered lands that are affected by the Project. The plan shall:

1. include provisions for surveying, documenting, and protecting TES plants, including a review of BLM special status species, Oregon Natural Heritage Information Center (ORNHIC), California Natural Diversity Database, and California Native Plant Society records; and
2. specifically address the maintenance of the J.C. Boyle Powerhouse, maintenance of transmission line and road rights-of-way (ROW), and use of Project roads.

B. The Licensee shall prepare a draft plan in consultation with the BLM. The Licensee shall allow a minimum of 30 days for the BLM to comment and to make recommendations on the draft plan before finalizing the plan and filing it with the Commission. The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations, and a description of how the comments and recommendations are accommodated by the Plan. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information. At the time it files the plan with the Commission, the Licensee shall submit a copy of the filed documents to the BLM.

C. The BLM reserves the right of require changes to the Plan by filing modifications to the Plan within 30 days of receipt. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the BLM.

D. The section of the Vegetation Resources Management Plan which addresses noxious and invasive plants shall include:

1. Protocol for conducting weed surveys, including a review of federal, state and local noxious weed lists, and the list of Exotic Pest Plants of Greatest Ecological Concern in California from the California Invasive Plant Council.
2. Timeline for a systematic survey of land affected by the project, including BLM-administered lands with in the Project area.
3. Protocol for producing a geospatial map (e.g., GIS map) and digital database to store information on species occurrence; distribution; status according to the Oregon Department of Agriculture (ODA) system of ranking species for control; and timing of last survey. The Licensee shall make this data base available to the BLM.
4. Proposed treatments, mitigations, and best management practices for managing weeds on BLM-administered lands that are impacted by Project maintenance, operation, and use.

E. The section of the Vegetation Resources Management Plan which addresses threatened, endangered, and sensitive (TES) plants shall include:

1. Protocol for surveying BLM-administered lands affected by the Project according to accepted protocols to determine or verify the distribution of TES species.
2. Protocol for documenting, protecting and mitigating for impacts to TES species, including a review of BLM special status species, ORNHIC, California Natural Diversity Database, and California Native Plant Society records.
3. Protocol for surveying adjacent to Project roads which cross seasonally wet meadows for occurrence of TES plant species.

Rationale

Noxious Weeds

Maintenance of the J.C. Boyle Powerhouse and Project road and transmission line ROWs as well as use of Project roads impacts vegetation resources administered by the BLM. The Licensee proposed to develop a Vegetation Resources Management Plan (PacifiCorp 2004a, Exhibit E, page 5-122) to guide vegetation and weed management and monitoring near Project facilities and roads, recreation sites, and transmission lines. In the absence of specific details about this plan, BLM has proposed a vegetation management condition that at a minimum will limit the introduction and potential spread of noxious weed species.

Vegetation maps for the Project include 165 acres adjacent to the Klamath River, Jenny Creek, and Spencer Creek and approximately 75 acres adjacent to the J.C. Boyle and Keno Reservoirs that were surveyed for botanical resources. The botanical survey is inadequate for determining the full extent of Project impacts on vegetation resources.

Noxious and invasive weeds are effective at colonizing disturbed areas. Once established these species have the capacity to invade undisturbed, adjacent sites. An integrated vegetation management strategy necessitates understanding the distribution of noxious and invasive as well as other species across the broader landscape. The limited spatial scope of the existing vegetation survey limits the ability to analyze or mitigate for effects to vegetation from Project operations.

The Final License Application (FLA) presents information on the abundance and distribution of noxious weeds and invasive non-native plants. Surveys from 2002 revealed 60 infestations and the presence of 17 target weed species. Infestations include populations of St. Johns' wort, hoary cress, Canada thistle, Dyer's woad, and Mediterranean sage (PacifiCorp 2004c, page 8-5). BLM previously mapped 52 of the 60 infestations. Previous surveys also recorded the presence of common toadflax, Himalayan blackberry, poison hemlock, and salt cedar. Also, six "widespread species" (cheatgrass, Dalmatian toadflax, medusahead, yellow starthistle, and bull thistle) were not mapped, and only their general distribution was described based on plot data. Even with the omission of this information in the FLA, the account of noxious weeds affirms the widespread distribution and abundance of noxious weeds in the Project area.

Information for noxious weeds and invasive non-native plants does not reflect the widespread distribution of various species. Because listed noxious weed species have been targeted for control by the Oregon State Weed Board, the distributions of these species should have been mapped. For example, the distribution and relative abundance of yellow starthistle, a species targeted for prevention and control by the Oregon State Weed Board, should be surveyed and mapped so appropriate treatments to control the species can be developed and implemented. Likewise, Dalmatian toadflax could be managed more effectively if the extent of the species distribution was documented and understood, since a biological invasion is most effectively controlled by treating "outlier" populations (Moody and Mack 1988). This is true for all noxious weed species; and in order to develop an effective, integrated weed management plan, the distribution of all species targeted for control is necessary.

Powerhouse maintenance, transmission line and road ROW maintenance, and use of Project roads contribute to the spread of noxious weeds and invasive non-native plant species, placing other native plant communities at risk. For example, although yellow starthistle infestations that occur along the J.C. Boyle Peaking and Bypass Reaches, the J.C. Boyle Powerhouse, and in association with Project transmission line and road ROWs may be considered outliers to larger concentrations in California, they serve as sources for further dispersal of the species across the entire Project area.

BLM management direction for the control of noxious weeds requires surveys across BLM-administered lands for noxious weed infestations, reporting to the ODA, and coordination with the ODA to reduce infestations (ODA 2005). The BLM is further required to use an integrated pest management approach to reduce or control infestations. To accomplish this, the BLM maintains a cooperative agreement with the Oregon State Weed Board. Through the Oregon State Weed Board, the BLM participates in established WMAs which include all stakeholders in order to coordinate across multiple land ownerships. Both Siskiyou and Klamath counties have established WMAs.

Threatened, Endangered, and Sensitive Species

Project impacts to TES plant species are discussed only as they relate to flow and water level manipulations. Thus, one might conclude that the Project does not affect TES plants which may occur in association with other Project features or are affected by other Project operations. Project facilities and operations directly and indirectly affect TES species and their habitat. Indirect effects include disturbance from Project operations, Project roads, and Project-related recreation.

Information regarding the abundance and distribution of TES species is based on field surveys, review of BLM, ORNHIC, California Natural Diversity Database, and California Native Plant Society records. The Licensee claims that the "intuitive controlled" survey method (Whiteaker et al. 1998; PacifiCorp 2004c, page 5-3) was used, which traverses the entire study area thoroughly enough to see a representative cross section of all the major habitats and topographic features, and then conducts a complete survey for target TES species in areas with a high potential to support these species. However, the Licensee failed to confirm information about known TES plant locations within the survey area "because of their remote location within the study area" (PacifiCorp 2004c, page 5-20). The survey focused on sites "most likely to be directly affected by Project activities," and was limited to ¼ mile (0.40 km) from Project facilities and associated recreation sites, as opposed to areas supporting potential habitat for suspected species. Thus, the location of several known populations of TES plant species that have been recorded from other sources could not be corroborated based on PacifiCorp's results. Confirmation of species presence/absence and distribution is necessary to determine the magnitude of impacts of Project operations on TES species.

Since it is unlikely that the "intuitive controlled" survey method was applied as described in the cited reference, it is unlikely that all TES plant populations within the Project area have been located. Therefore, conclusions regarding direct and indirect impacts from Project operations are incomplete. For example, bristly sedge, a BLM sensitive species believed to be extinct in Oregon, was identified along the J.C. Boyle Reservoir and the Topsy Campground subsequent to the 2002 survey. Several TES species were found in the seasonally wet, alkaline flood plains adjacent to Keno reservoir, and may be impacted by changes in reservoir management. These species are Applegate's milkvetch (federally listed as endangered), short-podded thelypodium, pendulus bulrush, Columbia yellow cress, and salt heliotrope. However, the project area has been redefined to exclude this portion of the study area.

Several other TES plant species are found in seasonally wet meadows not influenced directly by flow manipulations. However, Project roads and roads established from Project roads often cross these meadows and disrupt the natural hydrology to which these species are adapted. These species include red root yampah, Howell's yampah, and Bellinger's meadow foam.

Impacts have been described as "uncertain" and related solely to Project maintenance or flow regulation. Like the evaluation of the affect of Project operations on individual species, assessing changes in habitat as a function of Project operations is described as "difficult." Because impacts to TES plant species are inadequately described, discussion of potential future impacts is likewise inadequate. As a consequence the proposed Vegetation Resources Management Plan lacks detail describing "protections" for plant species and habitats (PacifiCorp 2004a, Exhibit E, page 5-126). Based on this inadequacy, a failure to adequately survey the Project area for TES species, and inappropriate application of the survey methodology, it is unlikely that all TES plant populations within the Project area have been located or that impacts of Project operations have been adequately described. Thus, the provisions of a Vegetation Resources Management Plan, including provisions for TES plant protection are inadequate.

Condition No. 8 – Mitigation for Impacts to Wildlife and Wildlife Habitat

A. Within two years of issuance of the license, the Licensee shall prepare and file with the Commission a Wildlife Habitat Management Plan (WHMP) for Bureau of Land Management (BLM) administered lands affected by Project operations and maintenance PacifiCorp

B. The Licensee shall prepare a draft plan after consultation with the BLM. The Licensee shall allow a minimum of 30 days for the BLM to comment and to make recommendations on the draft before finalizing the plan and filing it with the Federal Energy Regulatory Commission (Commission). The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations, and a description of how the comments and recommendations are accommodated by the Plan. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons based on project-specific information. The Licensee shall provide the BLM copies of all documents filed with the Commission.

C. The BLM reserves the right to require changes to the WHMP and will provide comments and recommendations within 30 days of receipt of the document. Upon Commission approval, the Licensee shall implement the WHMP, including any changes required by the BLM.

D. The WHMP shall include measures for:

- Wildlife Crossings and Escape Ramps for the J.C. Boyle Canal and Effectiveness Monitoring
- Western Pond Turtle Habitat and Effectiveness Monitoring
- Threatened, Endangered, Sensitive, Special Status Species Survey and Monitoring including:

(a) survey protocols for long-term survey and monitoring of TES and SS species and their habitat for BLM-administered lands within the Project to assess impacts and develop necessary mitigations. This information shall supplement the previous study completed by PacifiCorp (PacifiCorp 2004c - Threatened, Endangered, Sensitive and Special Status Species Assessment).

(b) Identify restoration, protection, and/or enhancement measures.

(c) seasonal restrictions for active nest sites on BLM-administered lands for bald eagles, golden eagles, ospreys, peregrine falcons and other raptors that are affected by Project operations.

Rationale – Wildlife Crossings and Escape Ramps for the J.C. Boyle Canal

The J.C. Boyle Canal blocks movement by individual terrestrial mammals and reptiles. The direct impact is limited to the individual animal, but there would be benefits to local populations by enhancing crossing opportunities along the canal.

The Klamath River is the only waterway that crosses the southern part of the Cascade Mountain range and is thus one of the most important big game migration and movement corridors in Oregon. The mixture of vegetation types and landforms supports a diversity of habitats and wildlife species which are designated as an Outstandingly Remarkable Value (ORV) of the

Upper Klamath Wild and Scenic River. Outstanding remarkable characteristics for wildlife include a high degree of species diversity and high wildlife habitat diversity – both of which are present in the Upper Klamath River Canyon (USDI BLM 1990a, page 3-5)

The J.C. Boyle Canal is nearly 11,000 feet (3,352 m) long and is a combination of vertical concrete walls, bedrock, and gunite-lined earthbanks (PacifiCorp 2004c, Table 6.7-8). The entire eastern or downslope wall is concrete and is 16 feet (4.9 m) tall. The west side or inner canal wall varies greatly in height above ground and accessibility. Inside the canal, the height of the freeboard (vertical distance between water and top of inside canal wall) varies depending on the amount of water in the canal, but generally exceeds several feet, so that once animals are in the water they cannot exit except at the two existing escape points. There is no way to cross the J.C. Boyle Canal (PacifiCorp 2004c). For detailed J.C. Boyle Canal wall specifications, see Figure 6.7-2 in PacifiCorp Terrestrial Resources Final Technical Report (PacifiCorp 2004c).

Habitat upslope of the J.C. Boyle Canal is a mixture of mixed conifer, ponderosa pine, and grassland habitats. Along the Bypass Reach of the Klamath River downslope of the canal, narrow patches of riparian grass and riparian shrub (primarily dogwood, willow, and ash) habitat occur intermixed with the large boulders (PacifiCorp 2004c, page 2-97). Many of the wildlife species in this area use these upslope and downslope habitats during some stage of their life cycle (PacifiCorp 2004c, 5-83). The BLM Wild and Scenic River criteria require contiguous habitat conditions to support the biological needs of the wildlife species. (USDI BLM 1990a, page 3-7). The placement and configuration of the J.C. Boyle Canal interferes with BLM's ability to meet contiguous habitat conditions of the wild and scenic river criteria.

Big game species that occur within the Project area include deer, elk, black bear and cougar. Although uncommon in the Project area, black bear and cougar either pass through or reside in the canyon. A migratory herd of 3,100 deer (ODFW estimate, 1988-1989), known as the Pokegama Herd, utilizes the area surrounding the canyon. The majority of this herd winters in and around the Project area (USDI BLM 1990a, page 2-28). The lower portion of the J.C. Boyle Bypass Reach and all of the Peaking Reach including the uplands surrounding the river lies within a larger area designated by BLM and the Oregon Department of Fish and Wildlife (ODFW) as critical deer winter range. The J.C. Boyle Canal area of the Project is in or near this critical deer winter range habitat as described in BLM's Final Eligibility Report Upper Klamath Wild and Scenic River Study. This designation is primarily due to the low elevation that gives rise to light to snow-free conditions during severe winters, providing accessible forage, easier movement, good thermal cover and early spring greenup that furnishes critically needed forage for deer coming off of winter. A small portion of this herd occurs as year-round residents of the Project area (USDI BLM 1990a, page 2-28). Deer trails parallel the right (west or uphill) side of the canal along several sections of the J.C. Boyle Canal (PacifiCorp 2004c, Figure 6.7-2). Deer tracks were observed at one of the vehicle ramps/deer escapes indicating that animals at least occasionally access the canal (likely to drink water) at those protected backwater areas (PacifiCorp 2004c).

PacifiCorp conducted a terrestrial habitat connectivity study of their North Umpqua project that involved a field assessment of wildlife movements affected by the waterways of this project. The study concluded that Project waterways may alter movement patterns or corridors, which, in turn, may make animals more susceptible to predation or hunting mortality (PacifiCorp 2004c, page 6-23). The study also suggested several management options for terrestrial habitat

connectivity focusing on project waterways. Among these recommendations was the installation of wildlife crossings.

PacifiCorp's North Umpqua study also found that populations of small mammals or amphibians are probably affected by Project waterways (PacifiCorp 2004c, page 6-23). There are at least 21 wildlife species (5 Special Status Species) that are potentially affected by the J.C. Boyle Canal that were confirmed as occurring in the study area; at least 55 other species (6 Special Status Species) potentially occur in the study area (PacifiCorp 2004c, Table 6.7-4). Many of these are small mammals and herptiles. During small mammal sampling along the J.C. Boyle Canal in 2003 there were 199 individuals (including recaptures) of at least four species documented. (PacifiCorp 2004c, Table 6.7-5). During BLM's 2000-2001 Herpetological Inventory of the Upper Klamath River Canyon, 1,087 individual herptiles representing 18 species were detected in the Project area (USDI BLM 2001b).

Small and medium-size mammals and reptiles may use the rocky habitat in the middle portions of the J.C. Boyle Bypass Reach. During small mammal trapping, several species of snakes as well as fence lizards, bobcat, raccoon and striped skunk were found immediately adjacent to the northwestern canal wall. Under current operations there is no opportunity for these species to safely cross the Canal to access riparian habitat along the Klamath River. This habitat is thought to represent important summer habitat for reptiles. In addition, even though small mammals have small home ranges, juveniles of many species disperse greater distances and may be affected by the canal (PacifiCorp 2004c).

PacifiCorp's reporting system at J.C. Boyle Canal was designed mainly to record big game mortalities, but wildlife of medium size also are noted (PacifiCorp 2004c, 6-24). Database records have been maintained since 1988. According to the data, monitoring of wildlife entrainment in the J.C. Boyle Canal appears to have been incidental (PacifiCorp 2004c, Table 6.7-2). No entrainment data was recorded between 1959 and 1988. Data collected immediately after the canal was constructed would have indicated the true affect on wildlife and surrounding habitat connectivity. Since 1988, Project personnel have documented six wildlife mortalities at the J.C. Boyle Canal/Forebay. This included five deer and one skunk collected from the J.C. Boyle Forebay trash rack. Entrainment of small animals (herptiles and small mammals) in this canal has not been assessed because the trash rack grates are too widely separated (2 inches [5 cm] gaps) to stop small animals (PacifiCorp 2004c, page 6-25).

Construction and Installation of Wildlife Crossings

Wildlife movement patterns and wildlife dispersal across the Project area is affected by the presence of the J.C. Boyle Canal. (PacifiCorp 2004c, 6.8.2, page 6-57). The canal creates a barrier to wildlife movement and poses a risk of mortality. Overall long-term effects to species may include decreased ability to locate mates, decreased parental investment/involvement with young, decreased ability to disperse, decrease in fitness and increased predation risk (Frid and Dill 2002; Sutherland et. al. 2000). The J.C. Boyle Canal presents a barrier to wildlife movement (PacifiCorp 2004a, Executive Summary, page 5-5) because the canal blocks movement of herptiles and small- to medium-sized mammals (PacifiCorp 2004c, page 4-86) and is an impassible barrier to herptiles. Building wildlife crossings that connect suitable habitat would eliminate a need for animals to enter the canal and ultimately enhance connectivity.

Pacific Gas and Electric (PG&E) assessed canal crossings to determine their effectiveness in the Upper North Fork Feather River Project (PacifiCorp 2003b, page 6-23). The survey revealed that 90% of canal crossings were successful. The study also showed that knowing where to locate escape mechanisms in canals is extremely important because animals cross at specific established locations.

During the 1970s and 1980s, several studies were conducted to document losses of big game in canals located in arid habitats of the California Central Valley and Arizona (PacifiCorp 2004c, page 6-24). The studies demonstrated that deer bridges and escapes are effective at reducing mortality. A recent study in Arizona demonstrated the importance of habitat corridors to allow deer to successful cross a large fenced canal system (PacifiCorp 2004c, page 6-24).

Construction and Installation of Wildlife Escape Ramps
USDI – BLM Instruction Memorandum No. 2004-156 (USDI BLM 2004b) requires that Water developments on public lands be designed to meet the needs of livestock, wild horses, and wildlife. To reduce the risk of wildlife fatalities, the BLM requires escape ramps in water developments. BLM policy direction, as per BLM Manual Handbook H-1741-2 (Water Developments), has been to "Install escape ramps in open water troughs and tanks to protect water quality and to reduce wildlife loss." (USDI BLM 1990b, Section II-3b)

While it may be impossible to prevent all wildlife fatalities associated with water developments, the BLM shall make a reasonable effort to ensure that these projects are as wildlife safe as reasonably possible (USDI BLM 2004b). This includes all existing and future water developments on public lands regardless of who constructed them, when they were constructed, or how construction was authorized (USDI BLM 2004b).

Effectiveness Monitoring of Wildlife Crossings and Escape Ramps
The Klamath Falls Resource Area RMP requires monitoring as part of the BLM's adaptive management strategy. The direction and guidance set forth in the RMP states that "Monitoring is an essential component of natural resource management because it provides information on the relative success of management. Monitoring results will provide managers with the information to determine whether an objective has been met and whether to continue or modify the management direction." (USDI BLM 1995a, page 85) Effectiveness monitoring is to ensure that actions meet the desired objectives (USDI BLM 1995a, page 85)

Rationale – Western Pond Turtle Habitat

Western Pond Turtle Suitable Habitat Surveys
The western pond turtle is a BLM Sensitive species in Oregon. The Project is located near the edge of the turtle's geographic range and at its upper elevational limit within this range. In Oregon, western pond turtle populations are in decline (St. John 2002; Brown et. al. 1995). The lifespan of this long-lived turtle sometimes exceeds 50 years (St. John 2002).

Western pond turtles occur throughout the Project area, although use appears to be concentrated around basking structures (exposed rocks and occasionally logs) and near areas of slower moving water. They require basking sites, such as logs, rocks, etc. (Csuti et al 1997). Basking sites for thermoregulation are an important component of western pond turtle's habitat (St. John 2002). Pond turtles are ectothermic (cold-blooded), which means that their body temperatures

are largely determined by sources of heat outside of their body (Brown et al 1995). Attaining body temperature levels suitable for activity is an important requirement of reptilian ectothermic life. "Elevated temperatures, often of narrow range and at a level characteristic for a species or group, are necessary for the vital life processes of foraging, digestion, reproduction and escape from predators." (Bury 1972) During atmospheric basking, turtles elevate and maintain body temperatures near 32 degrees Celsius through a number of thermoregulatory behaviors including: exposing shell to direct sun (heating), dunking the head, feet or body in water (cooling), changing exposure to heating and cooling sources, rotating the body axis, and extending or retracting the limbs and head (Bury and Holland 1993). Changes in water level can affect the availability of suitable basking sites along the reservoir and river shorelines. Logs that are partially submerged and available for turtles at one flow or pool level could become entirely exposed at lower flows. This would most likely occur in the J.C. Boyle Peaking Reach where daily peaking results in stage changes of several feet in some locations. Because Bury (1995) reported that basking logs are limited in this reach (PacifiCorp 2004c) dewatering of basking structures is important. In the J.C. Boyle Peaking Reach, turtles seem to be restricted to relatively few areas that still have suitable basking habitat especially under varying water levels due to peaking operations (Roninger, personal communication, 2005). It is very likely that western pond turtle populations are lower than historic levels. The survey is needed to define population habitat needs and Project impacts.

For Bureau sensitive species where lands administered or actions authorized by BLM have a significant effect on their status, BLM policy directs that Districts will protect, manage and conserve those species and their habitats such that any Bureau action will not contribute to the need to list any of these species (USDI BLM 2001a). Policy for candidate species applies to Bureau sensitive species: "For those species where lands administered by BLM or actions have a significant effect on their status, manage the habitat to conserve the species." (USDI BLM 2001a - Special Status Species Management) This includes not only inventory at the appropriate time of year in advance of BLM actions (clearances) but also general inventory where needed to determine species distribution and status and monitoring to determine the species' requirements and trends. Bureau sensitive species and their habitat will be considered priority species for inventory, planning, monitoring and management. In addition, "Management plans will be prepared when necessary and active management implemented where needed to prevent listing or to conserve the species. Progress toward meeting species management objectives will be monitored periodically." (USDI BLM 2001a)

Manual 6840 (USDI BLM 2001a) requires management plans for Bureau sensitive (BS) species where BLM lands or actions have a significant effect on their status. Districts are encouraged to review the habitats, biology, status and threats of all special status species and to develop management plans for Federal Candidate, Bureau Sensitive, and State Listed species as needed to conserve the species and habitats. They should also provide adequate information to assist in determining the location and extent of protection; acceptable mitigation (where known); monitoring plan; studies and management actions needed. General guidance may be provided in interim plans, which succinctly describe differences in species management and protection requirements.

Construction and Installation of Western Pond Turtle Basking Structure

The Topsy/Pokegama Landscape Analysis was prepared by the Klamath Falls Resource Area and the USFWS to meet requirements set forth by the Northwest Forest Plan's Aquatic

Conservation Strategy. In this plan, the BLM has been directed to "Place large logs in slow water areas known to be important western pond turtle aquatic habitat." (Bury 1995). Logs could be anchored to shore where they would be partially submerged to provide basking and escape cover…Because of the upstream dams and past harvest activity; these areas may have less instream logs than were present historically."(USDI BLM 1996)

Certain segments of the Project, like the J.C. Boyle Peaking Reach lack suitable basking sites for western pond turtles. This is among the limiting factors to pond turtle habitation of the Project area. Peaking operations for power production are another condition which has likely affected habitat suitability for the species. Peaking operations could have the effect of dislodging basking logs and dislodging logs which are not anchored to the bank or bottom. Daily water level fluctuations also increase the rate of decomposition and may make the logs unsuitable (e.g., either inaccessible due to flooding or exposure) for basking.

Peaking operations may affect pond turtles by periodically widening the distance between the water's edge and shoreline habitat, thus reducing availability of basking sites. Currently, there are few basking structures downstream of the Project facilities. The existing structures receive a high degree of use and should be protected from further degradation. Additional structures located in suitable areas of the J.C. Boyle Peaking Reach should accommodate more turtle basking at different surface water elevations (PacifiCorp 2004a). The number and distribution of these structures would be determined based on known turtle concentrations, location of recreational activity, and suitability of adjacent uplands for nesting and over wintering.

Effectiveness Monitoring of Installed Western Pond Turtle Basking Structure
The Klamath Falls Resource Area RMP requires monitoring as part of the BLM's adaptive management strategy. The direction and guidance set forth in the RMP states that "Monitoring is an essential component of natural resource management because it provides information on the relative success of management. Monitoring results will provide managers with the information to determine whether an objective has been met and whether to continue or modify the management direction." (USDI BLM 1995a, p 85) Effectiveness monitoring is to ensure that actions meet the desired objectives (USDI BLM 1995a, p 85) For Bureau Sensitive species, monitoring is required on lands administered by the BLM or actions have a significant effect on their status (USDI BLM 2001a). BLM policy further requires that monitoring be conducted to determine if protection and mitigation implemented in the field achieved management objectives.

Rationale – Threatened, Endangered, Sensitive, Special Status Species

Surveys, Habitat Protection and Improvement for SS Species on BLM-Administered Lands
The largest number of TES plant and animal species were documented in the J.C. Boyle Peaking Reach; most of the TES avian species were found in association with riparian, wetland or open water habitats. All TES herptile species, western pond turtles and TES mammals (including bats) rely on wetland and riparian habitat during some stage of their life cycle. The extent and suitability of riparian habitat would be adversely affected by proposed Project operations (PacifiCorp 2004c, 5-83 through 5-85).

The species that are likely to be affected by the increased inter-riparian shoreline distances and patchy riparian plant distribution include species that are closely tied to riparian habitat during all or part of their life history. Several amphibian species as well as small mammals, aquatic

furbearers, and some reptiles use riparian habitats for breeding, foraging or cover. Several TES and riparian focal species (RFS) including the yellow warbler (*Dendroica petechia*), song sparrow (*Melospiza melodia*), willow flycatcher (*Empidonax traillii*), black crowned night heron (*Nycticorax nytcticorax*), yellow rail (*Coturnicops noveboracensis*),western yellow-billed cuckoo (*Coccyzus americanus*), purple martin (*Progne subis*), yellow breasted chat (*Icteria virens*), foothill yellow-legged frog (*Rana boylii*), Oregon spotted frog (*Rana pretiosa*), and western toad (*Bufo boreas*), also use riparian habitats substantially more often than upland habitats. Continued water fluctuations in reservoir and riverine habitat will negatively affect amphibians (PacifiCorp 2004c, 4-84). Floodplain woodlands support higher densities of breeding birds than upland woodland or herbaceous habitats (Stauffer and Best 1980). Although birds are highly mobile, there has been some documentation that riparian connectivity plays an important role especially during dispersal. Juvenile birds are often more dependent on continuous riparian habitat for dispersal than are adults of the same species (Machtans et al 1996). The distribution of riparian habitat may have a major impact on the distribution and abundance of riparian dependent bird species. The Klamath Bird Observatory's long-term monitoring has indicated that the riparian areas are important not only for breeding, but also during fall migration (PacifiCorp 2004c, 6.8.1.3, page 6-56). Therefore, the greatest effect of the Project on passerine birds is the effect on the distribution and connectivity of riparian and wetland habitat.

Preservation of Klamath River aquatic systems and associated peripheral wetland and riparian habitat will be critical to the maintenance of wildlife populations currently existing in and around the study area. If unprotected, wetland and riparian habitat along shorelines is likely to decline in the future. Depending on which combination of water level management, wave action, and adjacent land uses (e.g., grazing and agriculture) continues to occur, habitat along Project reservoirs likely will continue to be relatively thin and botanically non-diverse without management actions specifically targeting enhancement of these areas (PacifiCorp 2004c, 7.8.2, page 7-43). Without active management, it is unlikely that riparian habitat conditions will substantially improve in the Project area even with the proposed changes in the J.C. Boyle minimum flow releases and powerhouse ramp rates. Recreation use and reservoir fluctuation regimes are Project related effects (PacifiCorp 2004a, Exhibit E, page 5-128)

The BLM special status species management requires each Field Office to: to conduct and maintain current inventories for SS species on public lands, provide for the conservation of SS species, and ensure all actions are evaluated to determine if special status species objectives are being met (USDI BLM 2001a, pages 5-6).

For all TES and SS species and their habitats it is necessary to conduct protocol surveys through the life of the new license for habitat disturbing activities on BLM-administered lands in order to evaluate the continuing impacts and maintain current inventories. Surveying initially would supplement the baseline data and subsequent surveys would allow PacifiCorp and the BLM to evaluate the impacts to TES and SS species over time. This would meet the BLM SS species policy to maintain current inventories for SS species and their habitats.

Surveys would be used to identify SS species habitat that would need protection, restoration or mitigation from Project impacts. This is consistent with current RMP direction that states that the BLM should "study, maintain or restore community structure, species composition and ecological processes of special status plant and animal habitat." and consistent with the BLM

Special Status Species Policy (USDI BLM 2001a) which states monitor and evaluate ongoing management activities to ensure conservation objectives for listed species are being met.

The Klamath Falls RMP objectives for Special Status species are to "…manage for the conservation of Federal Candidates and Bureaus Sensitive Species and their habitats so as far as not to contribute the need to list and to recover the species." (USDI BLM 1995a, page 36) The RMP also states that the BLM should "…study, maintain or restore community structure, species composition and ecological processes of special status plant and animal habitat." (USDI BLM 1995a, page 36) In order to fully evaluate the impacts from the Project an appropriate survey effort of Special Status species and their habitat is needed over the long-term to address those impacts that are on-going as a result of the Project. The surveys conducted, in preparation of the License application, in some cases did not meet BLM protocols, RMP direction, Northwest Forest Plan requirements or the policies in the BLM Special Status Species Manual. Survey protocols for most species are conducted over multiple years to increase the chances of detection.

Surveys for Survey and Manage (S&M) Aquatic and Terrestrial Mollusks are required for habitat disturbing actions under the Northwest Forest Plan (USDA USDI 1994) and subsequent 2001 Record of Decision (USDA USDI 2001). The Project has and will continue to impact suitable habitat for terrestrial and aquatic mollusks listed under the S&M species list for the Klamath Falls Resource Area. These surveys should be conducted for those species and according the S&M survey protocol. The current S&M mollusk surveys (PacifiCorp 2004c) were not conducted to Northwest Forest Plan standards (USDA USDI 2001) as stated in the FLA (PacifiCorp 2004a, Exhibit E, page 5-117).

Seasonal Restrictions for TES and SS Species

The Klamath Falls Resource Area RMP/ROD (USDI BLM 1995a, pages 34 and 38-39) provides seasonal restrictions (time of year and/or distance from sensitive area) for management activities on or adjacent to BLM-administered lands that may disturb species during critical periods of their reproduction. Those species include bald and golden eagles, peregrine falcons, Townsend's big-eared bat, northern goshawk, northern spotted owl, and osprey. The BLM condition is proposed to ensure that sensitive avian species continue to be managed consistent with BLM management objectives for these species. In the absence of BLM policy, State and Federal laws and/or regulations include provisions for such protections.

Condition No. 9 – Reservation of Section 4(e) Authorities

Authority is reserved to the Commission to require the Licensee to implement such conditions for the protection and utilization of BLM reservations as may be provided by the Secretary of the Interior, pursuant to Section 4(e) of the Federal Power Act, 16 U.S.C. § 797(e).

Rationale

This general reservation of authority allows the Secretary to consider additional data as it becomes available, to respond to changed circumstances, and modify the existing section 4(e) conditions as may be necessary. The Secretary's reservation of mandatory authorities under the FPA has been accepted by the Commission and judicially affirmed. *Wisconsin Public Services Corp.*, 62 FERC ¶ 61,905 (1993), *aff'd*, *Wisconsin Public Serv. Corp. v. FERC*, 32 F.3d 1165 (7th Cir. 1994).

The Klamath Tribes of Oregon hold treaty-protected property rights, including fishing and water rights, in the upper Klamath Basin. The United States and the Klamath Tribes have jointly filed claims in the State of Oregon's water rights adjudication for the surface waters of the Klamath Basin in Oregon, including instream flow claims within the Project area (from Link River Dam to the Oregon-California border), to protect the Tribes' fishing and water rights reserved to them pursuant to their 1864 Treaty with the United States. In addition, the Hoopa Valley and Yurok Tribes have confirmed reserved fishing rights in the lower Klamath Basin, and the water necessary to protect those rights may likewise be determined in a subsequent proceeding.

Any condition or prescription required for this Project's license, including those to protect federal interests, must be consistent with these reserved rights. Additional data or other information, including a binding decree resulting from the State of Oregon's water rights adjudication, may require modification to the license conditions. Thus, the Department is submitting these reservations of authority. The Department's other recommendations do not ask FERC to take any action or otherwise engage in the issues being addressed in the water rights adjudication.

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Acts

Antiquities Act of 1906 [Also known as the *National Monument Act (Preservation of Antiquities)*]. June 8, 1906. Ch. 3060, 34 Stat. 225 (16 U.S.C. § 431 et seq.)

Pickett Act. June 25, 1910. Ch. 421, 36 Stat. 847 (43 U.S.C. §141 et seq.)

Federal Power Act. June 10, 1920. as amended, Ch. 285, 41 Stat. 1063 (16 U.S.C. §791a et seq.)

Historic Sites Act of 1935 (Also known as the *Historic Sites, Buildings and Antiquities Act*). Aug. 21, 1935, Ch. 593, 49 Stat. 666 (16 U.S.C. § 461 et seq.)

Oregon and California Railroad Grant Lands Act. August 28, 1937. (43 U.S.C. §1181a, et seq.)

Federal Water Pollution Control Act (Clean Water Act), June 30, 1948, Ch. 758 (33 U.S.C. § 1251-1376) as amended: July 20, 1961, 75 Stat. 204, Pub. L. 87-88 (43 U.S.C. §390b note) and Oct. 18, 1972, 86 Stat. 816, Pub. L. 92-500 (33 U.S.C. §1251 et seq.)

Clean Air Act. July 14, 1955. Ch. 360, 69 Stat. 322 (42 U.S.C. § 7401 et seq.) as amended: Oct. 15, 1966. Pub.L. 89-675, 80 Stat. 954 (42 U.S.C. § 7401 note); Dec. 31, 1970. Pub.L. 91-604, 84 Stat.1676 (42 U.S.C. § 7401 note); Aug. 7, 1977. Pub. L. 95-95, 91 Stat. 685 (42 U.S.C. § 7401 note); and Nov. 15, 1990. Pub. L. 101-549, 104 Stat. 2399 (42 U.S.C. § 7401 note)

National Historic Preservation Act. Oct. 15, 1966. Pub.L. 89-665, 80 Stat. 915 (16 U.S.C. § 470 et seq.) as amended: Dec. 12, 1980. Pub. L. 96-515, 94 Stat. 2987 (16 U.S.C. §470 note); Oct. 30, 1992. Pub.L. 102-575, title XL, 106 Stat. 4753 (16 U.S.C. §470 note); and May 26, 2000. Pub.L. 106-208, 114 Stat. 318 (16 U.S.C. 470 note).

Wild and Scenic Rivers Act. Oct. 2, 1968. Pub.L. No.90-542, 82 Stat. 907 (16 U.S.C. §1271 et seq.)

The National Environment Policy Act. Jan. 1, 1970. Pub.L. 91-190, 83 Stat. 852 (43 U.S.C. § 4321 et seq.)

The Endangered Species Act of 1973. Dec. 28, 1973. Pub. L. 93-205, 87 Stat. 884 (16 U.S.C. §1531 et seq.) as amended: Nov. 10, 1978. Pub.L. 95-632, 92 Stat. 3751 (16 U.S.C. §1531 note); and Oct. 13, 1982. Pub. L. 97-304, 96 Stat. 1411 (16 U.S.C. §1531 note)

Historic and Archaeological Data Preservation Act of 1974. May 24, 1974. Ch. 1A, 88 Stat. 174, Pub.L. 86–523, § 3, as added Pub. L. 93–291, § 1(3)

The Federal Land Policy and Management Act. Oct. 21, 1976. Pub.L. 94-579, Title VII, Sec. 101, 90 Stat. 2744 (43 U.S.C. §1701).

Resources Conservation and Recovery Act. Oct. 21, 1976. Pub. L. 94-580, 90 Stat. 2795 (42 U.S.C. 6901 et seq.)

American Indian Religious Freedom Act (AIRFA). Aug. 11, 1978. Pub. L. 95-341, 92 Stat. 469 (42 U.S.C. 1996, 1996a). *American Indian Religious Freedom Act Amendments*. Oct. 6, 1994. Pub. L. 103-344, 108 Stat. 3125.

Archaeological Resources Protection Act. October 31, 1979. Pub.L. 96-95, 93 Stat. 721 (16 U.S.C. § 47Oaa et seq.) as amended (P.L. 100-555; P.L. 100-588) Archaeological Resources

Comprehensive Environmental Response, Control, and Liability Act. Dec. 11, 1980. Pub.L. 96-510, 94 Stat. 2767 (42 U.S.C. 9601 et seq.)

Omnibus Oregon Wild and Scenic Rivers Act. Oct. 28, 1988. Pub.L. 100-557, Title I, 102 Stat. 2782 (16 U.S.C. § 1271-1288)

Americans with Disabilities Act. July 26, 1990. Pub. L. 101-336, 104 Stat. 327 (42 U.S.C. §12101 et seq.)

Oil Pollution Act. Aug. 18, 1990. Pub. L. 101-380, 104 Stat. 484 (33 U.S.C. § 2701 et seq.)

The Native American Graves Protection and Repatriation Act. Nov. 16, 1990. Pub.L. 101-601, 104 Stat.3048 (25 U.S.C. § 3001 et seq.)

Code of Federal Regulation (CFR)

(18 CFR) Title 18--Conservation of Power and Water Resources, Chapter I--Federal Energy Regulatory Commission, Department Of Energy, Part 8--Recreational Opportunities and Development at Licensed Projects

(36 CFR) Title 36--Parks, Forests, and Public Property, Chapter VIII--Advisory Council On Historic Preservation, Part 800--Protection Of Historic Properties

Section B: U.S. Department of Interior Preliminary 4(e) Conditions – Reclamation Reservation

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Section B: U.S. Department of Interior Preliminary 4(e) Conditions – Reclamation Reservation

Bureau of Reclamation's Reservations

The U.S. Department of the Interior, through the Bureau of Reclamation (Reclamation) has developed conditions pursuant to Section 4 (e) of the Federal Power Act for the protection and utilization of Reclamation-administered reservations. These conditions are in support of the Klamath Reclamation Project (Reclamation Project) that uses water from the Klamath River, as well as the Lost River, to irrigate over 200,000 acres of agricultural land and provide water to two National Wildlife Refuges located wholly within the Reclamation Project's boundaries. The Reclamation-administered lands include those lands that support the diversion and drainage facilities that allow the Reclamation Project to deliver water to those agricultural lands and Refuge lands, provide for flood control and return waters previously diverted to the Klamath River. These Reclamation-administered lands are within and near the project boundaries of the Klamath Hydroelectric Project that are "reservations" as defined by the Federal Power Act.

Section 4(e) of the Federal Power Act (FPA) gives the Secretary of the Interior (Secretary) authority to impose conditions on licenses issued by the Commission for hydropower projects located on "reservations" under the Secretary's supervision. *See* 16 U.S.C. §§796(2), 797(e); *see also Escondido Mut. Water v. La Jolla Band of Mission Indians*, 466 U.S. 765 (1984). Specifically, Section 4 (e) provides:

> That licenses shall be issued within any reservation only after a finding by the Commission that the license will not interfere or be inconsistent with the purpose for which such reservation was created or acquired, and shall be subject to and contain such conditions as the Secretary of the department under whose supervision such reservation falls shall deem necessary for the adequate protection and utilization of such reservations.

The Federal Power Act (FPA), 16 U.S.C. § 796(2) defines reservations as follows:

> … "reservations" means national forest, tribal lands embraced within Indian reservations, military reservations, and other lands and interests in lands owned by the United States, and withdrawn, reserved, or withheld from private appropriation and disposal under the public land laws; also lands and interests in the lands acquired and held for any public purposes; but shall not include national monuments or national parks; . . .

The Reclamation Project lands within the Klamath Reclamation Project are located within the existing project boundary of the Klamath Hydroelectric Project (Project No. 2082) are shown on the enclosed map. Keno Dam and both of the power plants at Link River Dam are currently within Project No. 2082 and are within Reclamation supervised lands. PacifiCorp owns Keno Dam and both power plants located at Link River Dam. The United States owns Link River Dam, which is the primary storage and control

feature of the Klamath Reclamation Project. PacifiCorp operates Link River Dam under contract with the United States to the benefit of Project No. 2082. PacifiCorp's operation of Keno Dam, both power plants at Link River Dam and Link River Dam itself affect the operation of the Klamath Reclamation Project. PacifiCorp proposes to exclude Keno Dam and both Link River Dam power plants from its proposed new license. The Department addresses these proposed boundary changes elsewhere in this filing, and has shown that the Commission must keep Keno Dam within the project boundary of any new license.

Thus, because Keno Dam is part of Project No. 2082 and is located on Reclamation supervised lands any license for the continued operation of Project No. 2082 will therefore "be issued within [these] reservation[s]," the license will be subject to conditions that the Secretary of the Interior, acting through Reclamation "shall deem necessary for the adequate protection and utilization of [these] reservation[s]." 16 U.S.C. §797(e).

As explained in greater detail below, Project No. 2082 affects resources within these Reclamation-managed "reservations." These resources include water developed under pre-1909 water rights for Klamath Reclamation Project purposes and the ability to deliver that water to meet the Project's operational needs and legal obligations. Reclamation has developed conditions for the license that are necessary for the adequate protection and continued utilization of these reservations and the resource values for which those reservations are managed. Therefore, the conditions listed below, covering specific requirements for protection and utilization of these federal lands, shall be included in any license issued for the Klamath Hydroelectric Project.

Background

The Klamath Reclamation Project lies within two primary watersheds, the Upper Klamath Basin and the Lost River Basin. Third Annual Report of the Reclamation Service, 1903-04, 58th Congress, 3rd Session, Document No. 28, pp. 202-03. Prior to the development of the Klamath Reclamation Project, the two major watersheds were linked by a flood channel that allowed water from the Klamath River to enter the Lost River and flow to Tule Lake during high run-off conditions.[1] The two watersheds are still linked but in a manner that facilitates the use of water by the Klamath Project for domestic, irrigation, and Refuge beneficial uses,[2] and provides for significant quantities of return flow water to be added to the Klamath River for the generation of power and other uses downstream of Keno Dam. The Lost River is recognized as a tributary to the Klamath River as a result of Project development. Consent to Negotiate Klamath River Compact, Act of August 9, 1955, 69 Stat. 613.[3] The Project is operated so that flows of the Lost River and Klamath River are completely controlled except in some flood periods. Water

[1] Klamath Project History, 1903-1912; p. 111
[2] Klamath Project History, 1903-1912; pp. 1-2
[3] Direct Testimony of Cecil Lesley, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00010015, pp. 12-25, February 23, 2004

is reused several times before it returns to the Klamath River. The Project was designed based on this reuse of water.[4]

Major Project features of the Klamath Reclamation Project include: Link River Dam on Link River at the head of the Klamath River which regulates the flow from Upper Klamath Lake; Lost River Diversion Dam on the Lost River in Oregon that diverts excess water to the Klamath River through the Lost River Diversion Channel; Tule Lake tunnel that conveys return flow water from Tule Lake to the Lower Klamath Lake; Clear Lake Dam and Reservoir located on the Lost River in California; and Gerber Dam and Reservoir located on Miller Creek, a tributary of the Lost River in Oregon; and Malone Diversion Dam on Lost River downstream from Clear Lake Dam.[5] All of the facilities and works described in this section were constructed by the United States and are currently owned by the United States, except where noted otherwise.[6]

In 1902, Congress enacted 1902 Reclamation Act. Act of June 17, 1902, Ch. 1093, 32 Stat. 388. The Klamath Project was authorized under the provisions of this act in May 1905.[7] Preliminary reconnaissance for the Klamath Project area was made by John T. Whistler in October 1903. [8] In his report, Whistler identified some of the features that would later comprise the Klamath Project, including storage of water in Upper Klamath Lake and reclaiming Lower Klamath Lake and Tule Lake. In the following year, Whistler established gaging stations on the major streams in the Klamath Project area. Also in October 1903, H.E. Green conducted a reconnaissance study of the Klamath Project area. His report remarked on many of the same features as Whistler as well as the use of Horsefly Reservoir site and Clear Lake in the Lost River drainage for project storage.[9]

As a result of these reconnaissance studies, it was determined that further investigation was warranted. T.H. Humphreys and J.B. Lippincott conducted a number of surveys of the area to examine the feasibility of lowering or draining certain lakes and to determine whether any of the existing canals in the area could be utilized in the development of a major Reclamation project.[10] It was found that Upper Klamath Lake could be used for irrigation of a large area of land of approximately 300,000 acres lying almost equally in Oregon and California.[11]

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[4] Direct Testimony of Cecil Lesley, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00010015, p. 13, February 23, 2004
[5] Direct Testimony of Cecil Lesley, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00010015, pp. 12-25, February 23, 2004; Klamath Project Map.
[6] Direct Testimony of Cecil Lesley, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00010015, pp. 9, 62-64, February 23, 2004
[7] Letter from E.A. Hitchcock, Secretary of the Interior, to Director of Geological Survey, Dated May 15, 1905 (pp. 00009-00011)
[8] Klamath Project History, 1903-1912; p. 5
[9] Klamath Project History, 1903-1912; p. 6
[10] Klamath Project History, 1903-1912; p. 8
[11] House Report no. 3764,January 20, 1905

Shortly thereafter, in January and February 1905, the States of Oregon and California, respectively, passed legislation ceding to the United States, to aid in the operations of irrigation and Reclamation, title to lands that would be uncovered by draining certain lakes in the Project area.[12] Under the Oregon Act, the United States was given control of Upper Klamath Lake for storage of water in aid of reclamation. Congress then authorized the Secretary of the Interior to control the levels of the various lakes and dispose of any land uncovered in the process of reclamation under the terms of the federal Reclamation Act. Act of February 9, 1905, 33 Stat. 714.

Based on the recommendations of the Board of Consulting Engineers, the Secretary formally authorized the Klamath Project on May 15, 1905.[13] The Klamath Project was authorized by the Secretary on May 15, 1905, in accordance with the Reclamation Act of 1902 (43 U.S.C. section 372 et seq, Act of June 17, 1902, 32 Stat. 388).[14] The 1902 Reclamation Act authorized the Secretary of the Interior to examine, survey, locate, and construct irrigation works for the storage, diversion, and development of waters. 1902 Reclamation Act, section 2. The projects to be authorized would be built on federal land with the actual construction and operation in the hands of the Secretary. California v. United States, 438 U.S. 645, 664, 98 S. Ct. 2985, 2995, 57 L.Ed.2d 1018 (1978).

Pursuant to this authorization and that the Secretary's determination that Reclamation Projects would benefit the basin, in 1905 Reclamation filed claims to cover all of the water not previously claimed on the upper Klamath River.[15] At that time Reclamation initiated a program of acquisition of senior water rights claims and previously developed irrigation projects. Reclamation developed plans and, with the support of the Secretary of the Interior, began development of the Klamath Reclamation Project. To facilitate the appropriation of water for the Klamath Reclamation Project, in 1905 the Oregon legislature enacted that a statute that authorized the Secretary to appropriate all unappropriated water for reclamation projects under the term so the act. Act of February 22, 1905, Ch. 5, title 43, L. O. L., Section 2 (section 6588, L. O. L.) See Ex. 10008, Fourth Annual Report of the Reclamation Service, 1906, pp.306-308. That Act states in pertinent part:

> Whenever the proper officers of the United States, authorized by law to construct works for the utilization of water within this State, shall file in the office of the State Engineer a written notice that the United States intends to utilize certain specified waters, the waters described in such notice and unappropriated at the time of the filing thereof shall not be subject to further appropriation under the laws of this State, but shall be deemed to have been appropriated by the United States.

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[12] Klamath Project History, 1903-1912; p. 22

[13] Letter from E.A. Hitchcock, Secretary of the Interior, to Director of Geological Survey, Dated May 15, 1905 (pp. 00009-00011)

[14] As a formality, the Klamath Project authorization was approved by the President on January 5, 1911, in accordance with the Act of June 25, 1910, 36 Stat. 835.

[15] Filings by T. H. Humpherys with the Oregon State Engineer, Dated May 17, 1905

The Oregon Supreme Court affirmed the right of the United States to so appropriate waters in the state in developing reclamation projects under the national Reclamation program. In Re Umatilla River, 88 Ore. 376, 168 P. 922 (1917). The United States followed the procedure under the 1905 Oregon Act and became vested with title to all of the then un-appropriated water of the Klamath River with a priority dating from the date of the notice filed in accordance with the Act.

The irrigable area of the lower project was to be 188,045 acres based on preliminary surveys in the Klamath and lower Poe Valleys. The lower project would also include about 15,000 acres of land that would be served by pumping water. Third Annual Report of the Reclamation Service, 1903-04, 58th Congress, 3rd Session, Document No. 28, pp. 204-05; Fourth Annual Report of the Reclamation Service, 1904-05, 59th Congress, 1st session, Document No. 86, p. 82. These lands extend from the upper end of the Klamath Valley, at Klamath Falls, to Keno, Oregon, and include lands on either side of the Klamath River.[16] Also included are lands within Lower Klamath and Tule Lake that extend into California. The water supply for these lower lands is Upper Klamath Lake.

The water supply for the lower project was projected to be diverted from Upper Klamath Lake at the head of the Link River with a main canal being carried down either side of the valley. Various branches from the main canal would carry water to the lands in the lower project, including those in Tule Lake. Third Annual Report of the Reclamation Service, 1903-04, 58th Congress, 3rd Session, Document No. 28, pp. 207-08, and the accompanying map showing the proposed canal system.[17] Other than relatively minor adjustments, the development of the Klamath Project occurred in accordance with this original design and intent.[18] In general, for private lands using water for irrigation or domestic uses, the United States entered into perpetual contracts with landowners, districts or companies, or both landowners and districts, which provide for delivery of water through Klamath Project and related facilities.[19]

The United States also acquired the Keno Canal belonging to the Moore Brothers.[20] The United States purchased two small canals constructed to divert water from the west side of Link River for power and irrigation purposes.[21] The purchase of these facilities and associated riparian and vested rights was in consideration of 205 cfs to be retained by the Moore Brothers and delivered from the Keno Canal. This 205 cfs right is now owned by PacifiCorp for power generation on Link River.

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[16] Klamath Project History, 1903-1912; p. 22
[17] General Map of Proposed Klamath Project, 1905
[18] Direct Testimony of Cecil Lesley, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00010015, p. 32, February 23, 2004
[19] Contracts with Water users and Districts, pp. 00443-003137
[20] Direct Testimony of Stephen R. Wee, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00040049, pp. 26-28, and Direct Testimony of Rand F. Herbert, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00040048, pp. 20-21
[21] Klamath Project History, 1903-1912; p. 31; Direct Testimony of Stephen R. Wee, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00040049, pp. 10-13

Reclamation saw the benefit that could accrue to the project with the addition of hydroelectric power, and a number of filings were made to claim the right to produce power[22] in addition to the use of the water for irrigation purposes, with the waters of the Klamath River. Before Reclamation could exercise its claim for power, Copco, now PacifiCorp, proposed to develop hydroelectric power in the canyon below Keno, Oregon. For certain considerations, Reclamation relinquished its claim on the falling water, and allowed Copco to develop the now existent power infrastructure in the Klamath Basin.

To benefit both parties, Copco proposed development of Link River Dam as a feature of the Klamath Reclamation Project. Reclamation agreed to the project, and in 1917 the parties entered into a contract for Copco to build the dam and transfer it to Reclamation. In addition to transfer of the dam, Copco was to provide electric power to Reclamation and its Project water users at a fixed rate for the term of the contract.[23] This agreement benefited both parties in providing additional firm water supply for irrigation purposes with electric power for drainage pumping, and additional water at all times for power generation, both at Link River and at the Copco 1 and 2 facilities, with a firm electric customer base to pay for development of necessary infrastructure.[24] In 1919, a temporary dam was constructed on Link River at the outlet of Upper Klamath Lake by Copco. In 1920, Copco initially began construction of the permanent Link River Dam at the outlet of Upper Klamath Lake. In 1921, Link River Dam was completed.[25]

In 1951, Copco proposed development of additional facilities downstream of Keno (Big Bend No. 2, the original Project No. 2082). Reclamation through the Department of the Interior intervened in the Federal Power Commission proceedings with the current 1956 contract between PacifiCorp and Reclamation the outcome of the settlement between the parties.[26] This contract allows PacifiCorp to continue operation and maintenance of Link River Dam, and provides for power rates for Reclamation and its water users at rates similar to those in the 1917 contract.[27] The development proposed in the Big Bend No. 2 project would provide additional power for the customers in the Klamath Basin.[28] This contract had to be ratified by both the Oregon and California Public Utility Commissions to become effective.[29] The current contract, if not extended, expires April 16, 2006. The Klamath River Compact confirmed the rights of the Klamath Reclamation Project to use the water of the Klamath River, while encouraging power production and other uses of those resources. Additionally, it provided that the power produced from these resources should provide the "lowest power rates which may be reasonable for irrigation and

[22] Filings by J. B. Lippincott with the Oregon State Engineer, Filed January 5, 1905 (p. 000003)
[23] Bureau of Reclamation Contract No. I1r-406, Dated February 24, 1917
[24] Letter from Herbert D. Newell to Klamath Chamber of Commerce, Dated November 16, 1920; Evening Herald Article, Dated January 9, 1919; Copco letter to Chamber of Commerce, Dated November 15, 1920.
[25] Klamath Project History, 1921; p. 42
[26] Letter from Secretary of Interior, Oscar L. Chapman, Dated October 10, 1951; Copco letter October 26, 1951.
[27] Bureau of Reclamation Contract No. 14-06-200-5075, Dated January 31, 1956
[28] Copco letter May 18, 1953.
[29]Protest of Klamath Irrigation District to Hydroelectric commission.

drainage pumping, including pumping from wells," for those power users in the Klamath Reclamation Project.[30]

Unlike most Reclamation Projects, the Klamath Project is essentially a drainage project, not a large water storage project. Lands were developed for irrigation by draining Lower Klamath Lake and Tulelake.[31] To accommodate this, Reclamation developed Clearlake and the Lost River Diversion Channel to reduce flows to Tulelake to allow evaporation of the lake and development of the lakebed as irrigated agricultural lands.

In 1910, Clear Lake Dam was completed. Also in 1910, contracts were let for construction of Lost River Diversion Channel and Lost River Diversion Dam (also known as Horseshoe Dam and Wilson Dam).[32]

In 1911, construction began on the Lost River Diversion Channel and Lost River Diversion Dam. In 1912, the Lost River Diversion Dam and the Lost River Diversion Channel were completed.[33] The Lost River Dam was constructed upstream of Tule Lake to divert Lost River water to the Klamath River and prevent as much water as possible from entering the Lake.[34] The Lost River Diversion Channel was constructed along the same course as the Lost River Slough to control the flows of the Klamath River into Tule Lake and the flow of Lost River into either Tule Lake or the Klamath River.[35] Also in 1912, the Klamath Straits between Klamath River and the Lower Klamath area was closed.[36] In 1914, gates were installed in the Klamath Straits at Ady.[37]

In 1938, a report was released by Reclamation on the development of the Modoc Unit, identifying facilities affecting Tule Lake Sump and lands within the Tule Lake and Lower Klamath National Wildlife Refuges.[38] The plan identified, among other things, construction of a pump (Pumping Plant D) on the west side of the sump and a tunnel (Tule Lake tunnel) through Sheepy Ridge, with water pumped from the Sump through the tunnel to P-Canal and the Lower Klamath area. These facilities would provide improved flood control at the Sump and assist in maintenance of water levels in the Sump. In addition, the pumped water would provide a source to users on the P-Canal, ameliorate dust problems that existed on areas of the current Lower Klamath Refuge, and provide waterfowl benefits on that area. The Modoc Unit, which later came to be included in the Tule Lake Division, was then undertaken. Id.

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[30]Letter from Secretary of Interior Douglas McKay to Klamath River compact commission, dated October 26, 1953; Letter from Klamath River Compact Commission to Secretary of the Interior, Dated December 17, 1954.
[31] Cessions Act, 33 Stat. 174, Dated February 9, 1905
[32]Klamath Project History, 1903-1912.
[33] Klamath Project History, 1903-1912, p.172.
[34] Direct Testimony of Dr. Timothy D. Mayer, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00015001, p. 19
[35]Klamath Project History, 1903-1912, p. 97.
[36] Klamath Project History, 1903-1912; p. 166
[37] Klamath Project History, 1914; p. 3
[38]Supplemental Estimates-Department of the Interior, 76 Congr., 3d Sess., Document No. 169, March 21, 1940.

In 1940, construction was begun on Pumping Plant D and the Tule Lake tunnel. Also, in 1940, Reclamation and the Service (Biological Survey at the time) entered an agreement concerning the Modoc Unit and management of the Refuges.[39]

In 1942, Reclamation and the Service entered an agreement concerning wildlife operations within the Klamath Project pursuant to the Modoc Unit development.[40] In 1940 and 1943, the Secretary, on behalf of the Service, and Klamath Drainage District (KDD) entered agreements for, among other things, enlargement of the Ady Canal and service by KDD to California Lower Klamath lands within the Refuge.[41] In 1941, Tule Lake tunnel was completed. Also, the P-Canal was completed.[42] In 1942, Pumping Plant D was completed and placed into operation.[43]

Clearlake was developed as an evaporation sump to reduce annual flows in the Lost River to Tulelake, and the Lost River Diversion Channel was developed to divert flood flows and excess irrigation flood flows from the Lost River to the Klamath River to reduce flooding in Tulelake.[44]

The construction of the Straits Drain allowed development in the Lower Klamath Lake area. When the railroad laid their track into Klamath Falls, they had to build a berm over the marsh lands between Lower Klamath Lake and the Klamath River.[45] To allow water to exit the area, the Klamath Straits was developed into a drain with two pumping stations to lift the water from the lower portions of Lower Klamath Lake to the level of the Klamath River as it flows through Lake Euwana. The Straits Drain delivers accumulated agricultural drainage and flood waters to the Klamath River, allowing irrigated agriculture in the Lower Klamath Lake area, as well as maintaining operational levels in the Lower Klamath Lake National Wildlife Refuge.

Another feature provides additional water to the Klamath River from the Project. The D Pumping Plant pumps the water accumulated in the Tulelake sumps through Sheepy Ridge to the P Canal system where it is carried to and through the Lower Klamath National Wildlife Refuge to the Straits Drain, and eventually back to the Klamath River. The water that accumulates in the sumps is the side flow from the Lost River basin below the Lost River Diversion Dam in the winter, and drainage return flows from the Klamath Reclamation Project in the irrigation season.

These drainage features developed by the Klamath Reclamation Project have increased the water available to the Hydroelectric Project by a substantial quantity. Coupled with the additional storage provided by Link River, Gerber and Clearlake dams, control and

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[39] Agreement between Bureau of Reclamation and Bureau of Biological Survey, dated January 14, 1940
[40] Agreement between Bureau of Reclamation and Fish and Wildlife Service, dated January 8, 1942
[41] Contracts between Bureau of Reclamation and Klamath Drainage District, dated May 25, 1940 and April 28, 1943
[42] Direct Testimony of Cecil Lesley, Klamath Water Rights Adjudication, EXHIBIT NO. 003E00010015, p. 53-62, February 23, 2004
[43] Klamath Project History, 1942; pp. 15-16
[44] Letter from D. C. Henry to Oregon State Engineer, Dated May 1, 1908
[45] Agreement between United States and railroads, dated October 24, 1907

firm water supply are provided to the Hydroelectric Project that would not be available without the Reclamation Project.

Integral to the operation of Project facilities and the delivery of water to Project lands is the use of return flows.[46] Both the Klamath Irrigation District (KID) and Tulelake Irrigation District (TID) systems rely on these return flows in their operation and delivery of water.[47] Most of the water that is in Tule Lake during the irrigation season is return flow (estimated as over 90%).[48] In addition, to ensure that this water remains available to all lands within the Project, the United States retains control of this return flow through contract.[49]

Water from the Klamath River in the reach between Link River and Keno Dam is diverted for direct use on the irrigated lands.[50] These diversions include Modoc Lumber Co, Pioneer District Improvement Company, Ady District Improvement Company, Reames Golf & Country Club, Inc., Don Johnson & Son, Plevna District Improvement Company, Collins Products, LLC, and other Project water users.

Klamath River Basin Compact

The Klamath River Basin Compact (Compact) was negotiated and entered into between the states of California and Oregon and consented to by an act of Congress. Negotiation of the Compact between states of Oregon and California was granted by Congress by the Act of August 9, 1955, 69 Stat. 613. Congress consented to the Compact itself by the Act of August 30, 1957, Public Law 85-222, 71 Stat. 497. The consent of congress to negotiate the Compact was given as follows:

> The consent of the Congress is hereby given to the States of Oregon and California to negotiate and enter into a compact, providing for an equitable apportionment between the said States of the waters of the Klamath River and its tributaries, including Lost River which is not naturally tributary to the Klamath River but which is an interstate stream. within the Klamath Basin constructed by the Bureau of Reclamation, United States Department of the Interior, and for matters incidental thereto, upon the condition that one qualified person, not a resident of either Oregon or California, who shall be appointed by the President of the Unites States, and shall participate in said negotiations as a representative of the United States and shall make a report to the President and the Congress of the proceedings and of any compact so negotiated. Said compact shall not be binding or obligatory upon any of the parties thereto unless and until the same shall have been ratified by the legislature of each of the States aforesaid and consented to by the Congress of the United States.

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[46] Oregon PUC, UE-170, TP pp.163-199 (cross examination of Cecil Lesley, April 7th, A.M.)
[47] Oregon PUC, UE-170, TP 2047, 2061-2062 (Danosky April 20th P.M.), 2531-2533 (cross examination of David Solem, April 22 A.M.).
[48] Oregon PUC, UE-170, TP, pp.1690-1691, 1710 (cross examination of Dr. Timothy D. Mayer, April 19th, A.M.)
[49] Oregon PUC, UE-170, TP pp.190, 199 (cross examination of Cecil Lesley, April 7th, A.M.)
[50] Points of Diversion Tables.

Act of August 9, 1955, ch. 676, 69 Stat. 613.[51]

As provided in Article III A, the Compact recognizes and protects the water rights of the entire Klamath Project. Article III A states in full as follows:

> There are hereby recognized vested rights to the use of waters originating in the Upper Klamath River Basin validly established and subsisting as of the effective date of this Compact under the laws of the State in which the use or diversion is made, including rights to the use of waters for domestic and irrigation uses within the Klamath Project. There are also hereby recognized rights to the use of all waters reasonably required for domestic and irrigation uses which may hereafter be made within the Klamath Project.

Klamath River Basin Compact, Article III, A, Pub. L. 85-222, 71 Stat. 497, Section 1 (1957).

The area covered by the Compact includes the "Upper Klamath River Basin" which includes the drainage area of the Klamath River as well as the closed basin of the Lost River Valley. Compact Article II B. The Compact also recognizes that water diverted for use within the Project is derived from sources within both Oregon and California and that waters originating in both states are used to irrigate lands in both states. Compact Article III. The Compact also defines the Klamath Project consistent with the place of use claimed by the United States in Claim nos. 293-299 and 312 and 317. Compact Article II D. The Compact is binding on Oregon and California by virtue of their ratification of the Compact and the consent of the Compact by the Congress. El Paso County Water Improvement District No. 1 v. City of El Paso, 133 F.Supp. 894, 907 (1955) (citing Hinderlider v. La Plata River & Cherry Creek Ditch Co., 304 U.S. 92, 58 S.Ct. 803, 82 L.Ed. 1202 (1937)).[52] A compact is a contract that must be construed and applied in accordance with its terms.[53] West Virginia ex rel. Dyer v. Sims, 341 U.S. 22, 28 (1958).

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[51] The Compact was approved by the Klamath River Commissions of the States of Oregon and California on November 17, 1956, at Klamath Falls, Oregon and ratified by the state of Oregon by chapter 142, section 1 (ORS 542.610), 1957 and by the state of California by ch. 113, 1957.

[52] Once congressional consent is given, a compact is transferred into a law of the United States and the courts have no power to alter the apportionment chosen by Congress. Texas v. New Mexico, 462 U.S. 554, 564 (1983); Compact Clause of the Constitution, Art. III $ 2 cl.2. The bearing of the Compact on any water rights considered by the Compact is a federal question. See City of El Paso, supra at 910.

[53] The Compact in Article XII - General Provisions provides that:

> Nothing in this Compact shall be construed to limit or prevent either State from instituting or maintaining any action or proceeding, legal or equitable, in any court of competent jurisdiction for the protection of any right under this Compact or the enforcement of any of its provisions.

Article IV of the Klamath River Basin Compact (Compact) directs Oregon (and California) to "provide for the … lowest power rates which may be reasonable for irrigation and drainage pumping, including pumping from wells" from the use of water from the Klamath River Basin. Act of August 30, 1957, Pub. Law 85-222, 71 Stat. 497; ORS 542.620, Article IV- Hydroelectric Power. This directive sets apart the Klamath Basin irrigators from other irrigators in the Klamath Basin or elsewhere in PacifiCorp's service area.

Article IV provides in full as follows:

> It shall be the objective of each State, in the formulation and the execution and the granting of authority for the formulation and execution of plans for the distribution and use of the water of the Klamath River Basin, to provide for the most efficient use of the available power head and its economic integration with the distribution of water for other beneficial uses in order to secure the most economical distribution and use of water and the lowest power rates which may be reasonable for irrigation and drainage pumping, including pumping from wells.

In reviewing Article IV of the Compact, it is clear that the Compact identifies that power is to be made available for irrigation and drainage pumping at the cost of that service to the Klamath Project. The Compact speaks directly to the use of Klamath River water for the generation of power to provide the "lowest power rates which may be reasonable" through the use of the "available power head" from the waters of Klamath River.

This issue of the appropriate use of water in the Klamath Basin for the generation of power was discussed in 1954 by the Klamath Compact Commission in formulating the Compact. The Compact Commission viewed the use of water for irrigation and for power to be part of a comprehensive plan for development in the basin.[54] The Compact Commission noted that the decision regarding the development of hydroelectric power on the Klamath River between Keno and Copco Lake was a key consideration in formulating the Compact. Id. The Compact Commission requested the Secretary of the Interior to withhold approval of any contract with the power company until it could be "formulated as an integral part of the draft of an interstate compact." Id.

The Bureau of Reclamation began the development of the Klamath Reclamation Project in 1905, at which time it made filings to secure all of the unappropriated water in the Upper Klamath River Basin for use within the Project for irrigation, power and other uses.[55] Reclamation was also given control of Upper Klamath Lake by the State of Oregon for use in developing the reclamation project. Id.; General Laws of Oregon, January 20, 1905. PacifiCorp's predecessor, Copco, required the use of this water, including the water stored in Upper Klamath Lake, for its power development

[54] Letter from Klamath River Compact Commission to Secretary of the Interior, December 17, 1954.
[55] Notice, May 17, 1905; Water Right Filing, January 5, 1905; Letter from Herbert Newell to Klamath County Chamber of Commer, November 16, 1920.

projects.[56, 57] It is this integration of the use of water for power and irrigation that was critical in the formation of Article IV of the Compact. This integration was critical because the development of power in the Basin was dependent on the established irrigation practices in the Upper Klamath Basin, including those within the Klamath Reclamation Project.

Water from the Upper Klamath River Basin, including the Klamath Reclamation Project, is necessary for PacifiCorp's power development downstream and the use of low rate power is necessary to the irrigation and drainage of those lands that use the irrigation water that provides the benefits to PacifiCorp's power development.[58] The language of the Compact provides a reasonable basis for establishing Klamath Project cost based power rates for irrigation and pumping associated with the Klamath Reclamation Project.

Reclamation's Management Direction for "reserved" lands

Reclamation manages its federal lands in accordance with a variety of statutory mandates which include but are not limited to: the Reclamation Act; Endangered Species Act; Fish and Wildlife Coordination Act; National Environmental Policy Act; Flood Control Act; Federal Land Policy and Management Act; National Historic Preservation Act; Native American Graves Protection and Repatriation Act; Federal Water Project Recreation Act; and the Minerals Management Act. A more comprehensive list of statutory control of Reclamation land can be found in the attached policy documents.

Reclamation implements its statutory mandates through a variety of planning and policy guidance documents, including but not limited to: Floodplain Management Policy, Hazardous Waste and Materials Management Policy, Pest Management Policy, National Environmental Policy Act Policy, Reclamation Consultation Under the Endangered Species Act Policy, Emergency Management Policy, Decisions Related to Dam Safety Issues Policy, Hydroelectric Power Policy, Cultural Resources Management Policy, Wetlands Mitigation and Enhancement Policy, Recreation Management Policy,

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[56] Letter from Copco to Klamath County Chamber of Commerce, November 15, 1920; Opinion and Order, Public Utilities Commission of the State of California, March 27, 1956; See Supplemental Opinion and Order Amending Order Issuing License, In the Matter of the California Oregon Power Company, Project No. 2082, 15 FPC 14, February 28, 1956.

[57] In the Federal Power Act license proceeding for PacifiCorp's hydroelectric project, the Federal Power Commission (now FERC) also found that the construction and operation of Project No. 2082 was not economically feasible without the use of the water stored behind Link Dam and the regulation of the dam as provided in the Link Dam agreement (1956 contract). The Commission confirmed these findings in a later order stating that "[t]he evidence in this case shows that the Big Bend development [now J.C. Boyle] and all of the existing and proposed developments rely for their operations on water releases from Link River Dam, a Government dam located upstream from all the developments. Such water releases are made pursuant to an agreement between the United States and Copco for a fifty-year term terminating in the year 2006 which corresponds with the term of the license for Project No. 2082." Order Adopting Initial Decision of Presiding Examiner, The California Oregon Power Company, Project No. 2082, 23 FPC 59, 4-5 (January 13, 1960).

[58] See 23 FPC 59 (presiding examiners decision for Project No. 2082, January 13, 1960); Letter from Copco to Reclamation, May 18, 1953; Letter from Copco to Klamath County Chamber of Commerce, November 15, 1920; Federal Power Commission, Decision of Presiding Examiner, Project No. 2082, October 2, 1953, p.14-17.

Occupational Safety and Health Program Policy, and Use of Excess Capacity in Reclamation Projects for the Impoundment, Storage and Carriage of Non-Project Water Policy. A comprehensive list of Reclamation Policies as well as Directives and Standards for implementation of those policies can be found at: HTTP://www.usbr.gov/recman/.

Reclamation's Preliminary 4(e) Conditions:

1. The Licensee shall enter into new or amended contract with Reclamation for the operation and maintenance of Link River and Keno Dams under terms and conditions satisfactory to the Secretary of the Interior. Such terms shall be substantially similar to the terms of the current contract and shall specifically include the following terms necessary for the protection of Klamath Reclamation Project operations:

   A. The Licensee shall continue to operate and maintain Link River Dam. Such operation shall be consistent with the Klamath Reclamation Project Annual Project Operations Plans.

Justification:

PacifiCorp has operated and maintained Link River Dam under contract with the United States since 1917. During that time, the operation and management of Link River Dam has been critical to PacifiCorp's power generation for Project No. 2082. According to Reclamation's calculations this has not changed. Project No. 2082 continues to rely and will continue to rely during any new license period on the use and control of storage in Upper Klamath Lake. Such storage is vital to the purposes of the Klamath Reclamation Project as well as to Project No. 2082. Since PacifiCorp has in place the necessary infrastructure and expertise to continue to operate and maintain Link River Dam and because such operation is essential to its power generation, PacifiCorp shall continue to operate and maintain Link River Dam under contract with the United States during any new license period.

Additionally, because Reclamation is mandated to meets its obligations under the Endangered Species Act and Tribal Trust, in addition to delivering Klamath Project water under contract, PacifiCorp shall operate Link River Dam consistent with the Klamath Project Annual Operations Plans. This is necessary to allow Reclamation to adequately protect its resources as required by the statutes and policies listed above, and fulfill its responsibilities under the ESA and within its contractual obligations. Reclamation must work closely with PacifiCorp to manage Link River Dam in conjunction with the facilities in Project 2082. This is necessary to provide an appropriate water level in Upper Klamath Lake to protect the endangered suckers, and allow for full water deliveries at A Canal; control necessary to maintain Lake Ewauna at an elevation appropriate to provide the necessary head to make deliveries in the Lost River Diversion Channel and North

and Ady Canals; and to provide the required flows at Iron Gate Dam to meet Reclamation's responsibilities under its Biological Opinion from NOAA Fisheries.

B. For the period of the contract the Licensee would agree to furnish electric power for the purposes of pumping Klamath Water for use on Project Land and for drainage of Project Land at rates no higher than the cost of service from Project 2082.

Justification:

It is also necessary for the adequate protection and utilization of the Klamath Reclamation Project to maintain Klamath Project cost-based rates in the basin to provide pumping of return water from the irrigation project to the Klamath River for downstream uses and power generation by PacifiCorp. These cost-based rates allow Reclamation to return a substantial quantity of water to the Klamath River for use by PacifiCorp for power production below Keno (see attached spreadsheets on Reclamation return flows from Lost River Diversion Channel, D Plant, and Pumping Plants F and FF). Reclamation provides an average of over 200,000 acre-feet annually in returns to the Klamath River from Project facilities.

The Reclamation Project provides a positive effect for the Hydroelectric Project. Storage in Reclamation facilities allow for increased flows in the river during the late summer months when there would otherwise be limited ability to produce electricity (the river sometimes went dry below the current Link River Dam before the project.) Klamath Reclamation Project storage also provides flood control which reduces power outages due to high flow conditions in the winter months. Both of these periods of positive effect from storage are prime periods for power sales, due to high demand in the winter for heating and in the summer for air conditioning.

At least as important is the increased water availability from the Reclamation Project Drainage facilities. The Lost River Diversion Channel provides an average of 165,200 acre-feet annually to the Klamath River to augment power production, the Straits Drain provides an average of 106,630 acre-feet annually. An average annual increase of water available to the Hydroelectric Project of over 270,000 acre-feet, almost 23 percent of the flow that passes Keno; See attached Tables 1, 2, and 3 (KSD @ Pump F and FF; D Plant; Total Flow-Lost River Diversion Channel).

The additional water made available from the Reclamation Project, especially from the Straits Drain, depends on pumping to provide the ultimate benefit to the Hydroelectric Project. The pumps that develop this benefit are those large federally owned pumping plants that ultimately push the accumulated water from the sumps through the Straits Drain to the Klamath River, drainage pumps that are federally owned and operated by irrigation districts under contract, drainage

pumps that area owned and operated by irrigation districts, and drainage pumps owned and operated by individual irrigators. Without this integrated system, there would be a substantial reduction in water available for power production.

C. The Licensee shall, at its own expense, maintain the approach channel to the "A" Canal of the Klamath Reclamation Project to the satisfaction of Reclamation so far an may be necessary to carry a flow of not less than 1200 cfs into the "A" Canal with the water of Upper Klamath Lake at an elevation of 4137 (USBR datum).

Justification:

As part of PacifiCorp's operation and maintenance of Link River Dam as described in 1. A. above, PacifiCorp must ensure that the primary diversion facility for the Klamath Reclamation Project is not affected by PacifiCorp's operation for power generation. The intake for the 'A" Canal is just upstream from Link River Dam and the operations of Link River Dam can affect diversions to the "A" Canal if not properly monitored and maintained. Any adverse affect to the "A" Canal approach channel will likewise adversely affect the ability of Reclamation to deliver water to the lands within the Reclamation Project.

D. The Licensee shall assume any and all liability for damages resulting from operation of the Link River Dam by the Licensee or resulting from its regulation and control of the water levels of Upper Klamath Lake. The Licensee would undertake to hold the United States harmless from any and all liability for damage arising out of the operation by the Licensee of Link River Dam and the regulation and control by the Licensee of Upper Klamath Lake provided for in the contract.

Justification:

PacifiCorp would be operating and maintaining Link River Dam primarily for the benefit of power generation so should assume all liability related to that operation.

E. Nothing in the contract shall curtail or in anywise be construed as curtailing the rights of the United States to Klamath Water or to the lands along or under the margin of Upper Klamath Lake. No Klamath water shall be used by PacifiCorp when it may be needed or required by the United States or any irrigation or drainage district, person, or association obtaining water from the United States for use for domestic, municipal, and irrigation purposes on Project Land.

Justification:

Reclamation holds water rights for the Klamath Reclamation Project that are senior to the water rights for PacifiCorp's Project No. 2082 except for a 205 cfs

water right of PacifiCorp's for power generation from Link River. Further, as explained above, Reclamation has by statute the right to store water in Upper Klamath Lake for Reclamation Project purposes and any operation by PacifiCorp shall not interfere with that right to the extent that right is exercised for the benefit of the Klamath Project.

F. PacifiCorp shall operate Keno Dam so that the upstream water level will not be below the minimum normal objective operating height of elevation 4085.0 (USBR Datum), at or near the location of the present Highway No. 66 bridge at Keno, Oregon.

Justification:

This specific control is necessary to maintain Lake Ewauna at an elevation appropriate to provide the necessary head to make deliveries in the Lost River Diversion Channel and North and Ady Canals which are essential to the proper operation of the Klamath Project for both agricultural lands and lands within the National Wildlife Refuges.

G. PacifiCorp shall operate Keno Dam to accommodate the discharge of three thousand (3,000) cubic feet per second from the Lost River Diversion Channel, and six hundred (600) cubic feet per second from the Klamath Straits Drain.

Justification:

This requirement is to facilitate the flood control operation of the Klamath Project which is essential to the proper operation and management of the Project to meets its obligations.

2. The Licensee, in consultation with Reclamation, shall develop operating criteria that provides for coordination with the operations of Link River Dam and Iron Gate Dam, or the most downstream dam within Project No. 2082 to allow Reclamation to meet its responsibilities.

Justification:

Reclamation's responsibilities under the ESA as well as its responsibilities for Tribal Trust require that measured flows be provided into the Lower Klamath River (currently below Iron Gate), while specific water levels are maintained in Upper Klamath Lake. To adequately protect its resources, Reclamation must work in coordination with PacifiCorp to meet these requirements on a sustained basis. Coordinated operations should also minimize and mitigate impacts to salmonids and suckers from low flows and flow fluctuations caused by Project operations at Eastside and Westside facilities. Without coordinated operations, flow variations could have a deleterious effect on threatened species, or other resources valuable to downstream and upstream tribes. Ramping rates and flow

variations that are currently under the control of PacifiCorp could cause stranding, or crowding of fish that could lead to disease, or death if these facilities are not operated in a coordinated manner to fulfill the responsibilities and needs of all parties. Further, if these operations are not coordinated for the purposes stated above, the operations of the Klamath Reclamation Project would be adversely affected. This could result in curtailment of irrigation deliveries or deliveries of water to the National Wildlife Refuges. This is so, because operational adjustments that Reclamation must make in Klamath Reclamation Project operations independent of PacifiCorp operations to meet ESA or tribal trust resource obligations that it would not otherwise have to make if the Reclamation Project operations were properly coordinated with the Project's operations could result in additional water releases to the Klamath River or water remaining in Upper Klamath Lake that otherwise would be diverted for Reclamation Project purposes.

3. The Licensee, in consultation with Reclamation, shall develop operating criteria that provides for coordination with the operations of Keno Dam and Iron Gate Dam, or the most downstream dam within Project No. 2082, as in Attachment 2.

Justification:

In addition to the justification in 2 above, management of operations at Keno is critical to delivery of water to Project lands along Link River to Keno reach, in the Lower Klamath Lake area and to the Lower Klamath Lake Wildlife Refuge. Approximately 41 percent of the lands irrigated by the Klamath Irrigation Project and the Lower Klamath Lake National Wildlife Refuge receive their water directly or indirectly by gravity flow from the Link River to Keno reach. Coordination of these operations to meet the criteria listed in the attachment are necessary to meet minimum elevations for charging North and Ady Canals to meet demands throughout the year, as these facilities are operated year round. In addition, coordinated operations should minimize impacts to salmonids and suckers from low flows and fluctuations by Project operations at Keno Dam.

4. The Licensee shall provide Reclamation with area capacity curves for all facilities within Project No. 2082, and will provide Reclamation with real time access to reservoir elevations and releases for facilities within Project No. 2082.

Justification:

This information is necessary to allow Reclamation to adequately protect and utilize its facilities in light of the FERC-licensed operations of PacifiCorp's Project No. 2082. Without the area capacity curves and real time operational data, Reclamation would have no usable information to plan for releases from the Lost River Diversion or from the Straits Drain to coordinate efforts and manage the limited resources of the basin in the best manner possible. It is impossible at this time to determine the source of water that PacifiCorp uses to refill its facilities when it has made deliveries downstream that may be required under re-licensing or reduced storage for maintenance of facilities requiring refill. With

this information, Reclamation will be able to determine if the water used for refill and generation is indeed PacifiCorp's water or Reclamation's Project water.

5. Any operations or modifications to Project No. 2082 that could affect the federal Klamath Reclamation Project are prohibited unless approved by Reclamation.

Justification:

Changes in operations or modifications to Project No. 2082 could impact Reclamations ability to meet its contractual responsibilities within the Reclamation Project, as well as its ESA and Tribal Trust responsibilities downstream.

6. The licensee shall have no claim against the United States arising from the effect of any changes in releases from, operations of, or elevation changes in Upper Klamath Lake or Lake Ewauna related to the federal Klamath Project operations or use of water for the Upper Klamath, Lower Klamath or Tule Lake National Wildlife Refuges.

Justification:

PacifiCorp's Project No. 2082 has limited water rights, and is a subsequent user of surplus water from the Klamath Reclamation Project. Reclamation has no responsibility for delivery of water to Project No. 2082 beyond those limited water rights that are senior to Reclamation's water rights. Any operation of the Klamath Project is senior to operations of Project No. 2082, and has precedence over its operations.

7. Authority is reserved to the Commission to require the Licensee to implement such conditions for the protection and utilization of Reclamation reservations as may be provided by the Secretary of the Interior, pursuant to Section 4(e) of the Federal Power Act, 16 U.S.C. § 797(e).

Justification:

This general reservation of authority allows the Secretary to consider additional data as it becomes available, to respond to changed circumstances, and modify the existing section 4(e) conditions as may be necessary. The Secretary's reservation of mandatory authorities under the FPA has been accepted by the Commission and judicially affirmed. *Wisconsin Public Services Corp.*, 62 FERC ¶ 61,905 (1993), *aff'd*, *Wisconsin Public Serv. Corp. v. FERC*, 32 F.3d 1165 (7th Cir. 1994).

The Klamath Tribes of Oregon hold treaty-protected property rights, including fishing and water rights, in the upper Klamath Basin. The United States and the Klamath Tribes have jointly filed claims in the State of Oregon's water rights adjudication for the surface waters of the Klamath Basin in Oregon, including instream flow claims within the Project area (from Link River Dam to the Oregon-California border), to protect the Tribes' fishing and water rights reserved

to them pursuant to their 1864 Treaty with the United States. In addition, the Hoopa Valley and Yurok Tribes have confirmed reserved fishing rights in the lower Klamath Basin, and the water necessary to protect those rights may likewise be determined in a subsequent proceeding.

Any condition or prescription required for this Project's license, including those to protect federal interests, must be consistent with these reserved rights. Additional data or other information, including a binding decree resulting from the State of Oregon's water rights adjudication, may require modification to the license conditions. Thus, the Department is submitting these reservations of authority. The Department's other recommendations do not ask FERC to take any action or otherwise engage in the issues being addressed in the water rights adjudication.

Table 1. KSD @ Pump F and FF (TAF/Mo)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
1961	7.78	12.62	13.82	8.24	16.48	14.73	7.69	17.8	6.73	2.59	2.52	1.49	112.49
1962	3.84	14.01	15	1.67	7.96	18.26	12.45	4.09	2.77	3.5	4.37	1.94	89.86
1963	10.99	18.41	18.97	12.44	14.15	18.82	9.28	6.95	1.59	1.5	2.32	1.36	116.78
1964	7.03	17.56	7.24	8.06	13.99	18.39	6.42	4.55	10.59	4.21	3.88	3.33	105.25
1965	0.91	12.64	8.39	17.34	16.23	18.8	18.77	17.3	10.14	13.6	15.31	8.1	157.53
1966	6.12	14.68	13.82	2	11.7	16.85	5.54	3.15	4.21	6.83	5.64	5.36	95.9
1967	1.45	8.14	15.65	15.22	12.01	17.39	7.28	17.96	4.34	2.89	4.5	6.55	113.38
1968	7.2	8.8	6.13	9.1	13.08	45.35	3.34	2.7	4.42	4.85	7.73	9.45	122.15
1969	3.79	15.11	11.14	9.14	16.71	18.61	12.34	13.13	7.38	13	10.37	10.17	140.89
1970	15.19	11.03	11.69	18.84	17.09	18.63	10.3	17.18	10.58	13.88	4.73	9.01	158.15
1971	10.75	17.83	18.21	8.88	13.89	13.59	4.11	15.72	8.19	6.06	5.74	8.19	131.16
1972	11.94	17.71	15.44	10.44	17.17	18.66	9	11.28	4.18	5.49	7.61	10.97	139.89
1973	1.53	14.84	16.98	14.68	12.6	10.44	2.58	8.97	5.24	5.8	10.64	10.79	115.09
1974	4.6	2.92	18.94	18.26	15.13	17.71	7.64	8.95	5.18	7.42	10.66	7.89	125.3
1975	6.25	12.05	7.57	11.84	16.62	18.58	16.98	13.58	6.25	5.55	8.17	12.72	136.16
1976	7.79	8.45	13.92	17.19	11.29	12.26	2.97	3.88	6.71	6.3	14.61	14.75	120.12
1977	12.94	15.87	6.31	5.66	8.05	17.28	8.45	13.5	17.7	5.25	8.81	3.31	123.13
1978	4.22	3	8.12	12.09	13.31	12.66	12.08	4.89	3.54	6.11	7.28	0	87.3
1979	5.88	3.4	12.21	15.09	10.1	17.07	3.44	5.68	3.64	5.8	7.86	9.5	99.67
1980	4.37	11.24	16.27	13.78	16.81	22.65	6.34	6.15	6.9	7.5	4.83	10	126.84
1981	4.88	8.9	5.89	10.02	10.77	10.15	4.31	6.58	4.59	4.99	3.58	3.7	78.36
1982	4.07	9.75	15.76	20.09	23.61	27.76	7.4	3.91	6.66	11.91	7.11	7.72	145.75
1983	4.87	10.32	6.29	7.45	24.68	25.95	9.26	7.58	7.24	8.94	9.87	9.99	132.44
1984	6.3	11.49	20.47	23.49	30.03	23.43	6.91	5.9	8.86	5.73	4.74	12.98	160.33
1985	6.66	15.76	12.82	3.71	4.57	20.67	7	6.22	8.41	4.51	11.02	8.51	109.86
1986	5.03	6.04	6.87	10.88	18.4	27.96	9.57	11.85	7.13	5.92	9	7.44	126.09
1987	3.15	9.29	4.55	8.93	11.93	15.75	6.76	5.52	7.52	8.22	11.81	7.39	100.82
1988	2.72	2.94	8.55	6.19	11.78	18.65	12.01	9.6	9.39	4.95	8.03	5.39	100.2
1989	2.48	4.06	6.43	4.77	6.46	26.9	16.65	15.01	7.13	4.87	7.7	9.75	112.21
1990	4.48	7.81	3.74	7.27	6.12	19.41	10.7	8.9	11.81	6.4	7.92	8.23	102.79
1991	3.49	7.11	4.6	4.4	6.18	17.59	8.59	10.22	7.59	5.39	3.07	5.86	84.09
1992	0.28	0.35	0.69	0	0.32	2.41	0.74	1.2	0.13	0	0	0	6.12
1993	0.63	0.59	0.64	1.67	2.84	24.36	23.57	11.5	11	5.95	5.04	3.58	91.37
1994	1.81	1.36	2.04	4.68	10.17	8.28	8.29	10.42	5.98	5.3	3.37	1.38	63.08
1995	0.73	0.66	1	1.13	6.98	24.68	12.79	11.26	8.02	5.4	3.65	3.05	79.35
1996	1.17	1.69	4.52	20.46	27.39	23.06	10.49	13.56	8.61	6.02	5.08	3.14	125.19
1997	1.55	3.92	9.16	20.07	22.63	7.7	5.51	8.33	7.56	5.4	3.63	3.28	98.74
1998	2.5	5.44	7.63	11.29	17.88	11.91	18.66	18.18	13.14	5.16	4.73	3.47	119.99
1999	3.91	8.15	12.06	9.28	18.75	22	15.03	10.92	5.94	6.6	11.87	4.63	129.13
2000	2.26	1.52	3.22	4.67	10.14	11.52	6.75	14.45	8.38	7.6	4.91	5.09	80.52
2001	1	1.44	1.61	2.27	2.43	6.93	2.09	0.21	0	0	2.37	0.72	21.09
2002	0.1	0.34	0.98	4.27	9.13	13.13	7.09	8.15	6.96	6.19	12.2	6.6	75.15
2003	1.68	1.48	2.97	3.68	8.21	12.57	7.86	8.97	7.87	3.83	3.37	3.18	65.66
2004	1.89	1.5	1.67	2.05	12.6	13.68	6.44	6.11	8.49	4.04	3.91	4.15	66.53
Avg	4.6	8.23	9.09	9.61	13.14	17.8	8.9	9.36	7.02	5.94	6.72	6.23	106.63
Min	0.1	0.34	0.64	0	0.32	2.41	0.74	0.21	0	0	0	0	6.12
Max	15.19	18.41	20.47	23.49	30.03	45.35	23.57	18.18	17.7	13.88	15.31	14.75	160.33

Table 2. D Plant (TAF/Mo)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
1962	7.99	15.37	16.04	0.31	7.99	5.88	0	6.82	1.03	2.42	6.08	0.54	70.47
1963	13.89	18.21	18.41	2.93	4.91	0	1.4	9.32	0.08	4.56	5.48	3.23	82.42
1964	9.55	15.4	11.52	1.63	0	3.36	0	5.84	11.67	2.09	6.82	3.9	71.78
1965	5.94	15.94	15.56	18.53	17.13	15.49	10.64	8.48	6.78	13.4	13.19	4.18	145.26
1966	8.22	14.76	12.78	0.94	4.3	0	0	5.16	3.69	7.07	7.76	6.83	71.51
1967	7.99	16.7	18.73	11.79	0	1.43	5.18	17.28	5.24	1.27	8.33	6.19	100.13
1968	12.97	13.06	10.66	3.05	0	3.61	3.18	7.29	6.16	3.49	12.08	11.12	86.67
1969	8.8	16.39	15.1	9.95	13.23	2.99	1.71	8.77	5.28	9.16	7.8	9.91	109.09
1970	16.14	15.97	15.11	11.54	11.15	6.8	0	15.14	6.86	13.38	5.29	7.7	125.08
1971	11.98	16.36	16.42	2.69	0.42	6.13	2.09	15.6	11.88	6.05	4.49	8.51	102.62
1972	13.6	15.86	10.6	4.84	9.41	11	0.73	11.1	1.63	2.1	8.25	11.72	100.84
1973	13.35	16.58	7.69	0	0.42	1.23	2.71	9.11	2.13	2.91	7.59	11.23	74.95
1974	8.92	13.62	17.08	7.19	1.08	0	2.06	10.58	2.08	5.57	10.3	6.75	85.23
1975	8.76	14.85	11.94	0	5.4	8.2	2.71	8.34	2.91	7.91	6.86	14.1	91.98
1976	10.87	15.23	9.73	1.04	0.8	0	0	2.84	7.14	2.55	17.34	16.77	84.31
1977	16.54	16.08	4.02	0	1.25	0.29	1.82	14.99	6.72	1.27	5.86	7.62	76.46
1978	12.66	4.47	11.49	15.86	5.11	0	8.05	5.13	3.44	3.68	7.7	12.15	89.74
1979	7.24	13.24	9.99	0	0.63	0	4.88	5.86	7.71	7.92	7.26	12.45	77.18
1980	10.69	15.83	17	12.73	8.32	4.62	0	8.26	7.17	5.02	4.97	10.31	104.92
1981	13.76	15.04	5.71	0	0	0	1.01	7.92	6.77	4.18	5.02	8.72	68.13
1982	12.48	14.79	15	15.12	10.64	7.76	0	4.82	6.92	12.25	8.22	12.11	120.11
1983	11.35	14.92	10.22	2	13.02	10.98	0	7.72	7.02	11.64	11.86	10.79	111.52
1984	11.47	13.12	16.47	16.82	9.11	3.33	0	7.05	11.18	7.98	8.19	15.64	120.36
1985	13.63	16.3	12.7	3.73	1.89	1.59	1	8.13	10.56	3.81	13.28	16.66	103.28
1986	12.97	16.84	6.69	0	5.84	10.24	0.62	13.1	6.56	7.89	9.66	14.14	104.55
1987	13.1	16.6	5.99	0	0	0	1.52	9.5	8.01	10.3	17.79	14.08	96.89
1988	9.71	16.26	10.86	0	1.98	1.6	3.81	12.41	11.01	5.91	9.47	10.78	93.8
1989	11.96	16.49	8.47	0	0	11.63	4.09	12.13	5.56	4.28	9.85	15.46	99.92
1990	12.96	17.01	6.51	0.07	0.96	3.68	2.03	10.14	11.54	6.24	11.43	14.28	96.85
1991	13.46	16.13	6.06	0	0	0	0	11.02	5.47	4.9	6.3	11.56	74.9
1992	8.65	15.77	8.85	0	0	0	0	0	0	0.25	0	8.1	41.62
1993	5.79	8.58	5.37	4.36	2.77	14.75	6.68	8.11	10.36	5.27	7.59	9.15	88.78
1994	13.55	9.34	4.03	0.04	0	0	0.49	13.26	4.26	0.66	0.99	2.83	49.45
1995	2.1	12.5	0	7.95	3.66	14.38	7.47	10.63	9.4	4.35	4.36	9.33	86.13
1996	8.23	11.99	5.14	12.08	17.03	12.51	7.88	15.67	4.51	6.56	4.68	9.08	115.35
1997	9.22	13	3.96	15.17	10.03	0	2.42	7.02	7.89	5.73	4.91	10.52	89.87
1998	10.4	11	4.76	6.03	6.94	0.43	10.38	16.28	12.36	5.19	4.84	8.53	97.14
1999	12.95	12.83	11.62	2.87	7.94	9.36	5.07	11.11	7.98	4.46	11.18	12.23	109.58
2000	9.57	12.24	1.93	6.48	1.65	1.43	5.63	12.23	5.84	7.65	5.41	9.22	79.27
2001	11.02	7.17	0.58	0	0	0	0	0	0	0	0	5.07	23.84
2002	9.72	7.19	6.76	7.73	3.72	2.98	1.18	9.76	4.6	3.68	9.31	10.66	77.29
2003	7.84	3.76	2.56	3.5	3.91	1.93	11.48	10.32	1.49	0.13	8.06	6.49	61.47
2004	4.93	4.05	3.28	4.03	5.34	1.98	1.24	9.26	1.97	3.57	2.62	9.04	51.33
2005	11.81	9.75	4.02	4.7	1.33	0	1.61	13.62	3.65	0.37	4.96	9.27	65.09
Average	10.76	13.88	9.76	4.98	4.59	4.28	2.86	9.39	6.16	5.36	7.76	9.78	89.54
Minimum	2.1	3.76	0	0	0	0	0	0	0	0	0	0.54	23.84
Maximum	16.54	18.21	18.73	18.53	17.13	15.49	11.48	17.28	12.36	13.4	17.79	16.77	145.26

Table 3. Total Flow -- Lost River Diversion Channel (TAF/Mo)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
1961	9.35	7.69	11.88	8.3	12.72	11.13	7.09	11.02	10.24	10.16	10.82	11.13	121.53
1962	9.94	8.17	12.32	8.45	22.11	16.45	10.3	12.12	3.8	8.33	11.69	10.07	133.75
1963	40.03	10.35	15.97	8.13	20.94	7.86	13.95	11.23	9.04	9.69	10.24	13.21	170.64
1964	10.95	9.47	8.04	10.05	8.08	20.67	16.11	10.66	13.82	7.29	15.44	12.58	143.16
1965	11.83	8.42	50.94	69.97	45.17	14.67	11.12	14.28	17.22	13.27	16.48	13.97	287.34
1966	11.89	8.25	8.52	12.43	8.43	17.03	7.53	9.96	12.37	12.78	14.52	13.58	137.29
1967	10.66	8.37	17	14.8	14.02	20.6	15.18	12.47	10.14	9.19	13.75	13.44	159.62
1968	12.92	6.69	7.19	9.68	13.56	7.99	5.27	12.88	9.48	13.27	18.01	13.27	130.21
1969	12.7	7.92	10.36	22.85	20.45	34.83	26.6	15.2	17.91	12.81	16.07	15.66	213.36
1970	14.91	8.51	21.17	59.6	30.63	23.76	13.31	16.88	15.4	11.17	13.47	16.21	245.02
1971	14.1	12.5	18.5	25.94	12.17	47.15	55.3	22.33	17.42	19.18	34.15	46.09	324.83
1972	20.28	9.8	11.2	31.03	28.62	82.29	14.84	16.76	18.32	20.02	22.07	23.5	298.73
1973	14.67	9.41	12.4	12.4	13.05	11.28	7.28	13.39	14.25	11.95	15.4	17.69	153.17
1974	12.67	14.24	19.64	19.25	10.87	29.37	41.54	19.03	10.78	14.81	15.7	16.83	224.73
1975	15.37	8.39	8.97	8.83	16.85	28.14	16.92	15.28	13.83	17.01	20.08	20.09	189.76
1976	16.5	10.22	10.15	9.92	9.9	13.84	7.15	13.8	15.51	13.39	19.46	17.88	157.72
1977	14.45	7.15	7.43	7.02	7.17	5.96	6.77	10.97	11.33	9.03	11.12	13.47	111.87
1978	10.49	8.27	21.47	23.23	12.11	19	21.46	12.44	12.74	13.17	14.98	16.9	186.26
1979	12.65	7.94	8.35	10.83	6.79	11.66	5.56	6.73	5.36	5.91	8.88	6.62	97.28
1980	9.55	10.08	10.7	24.89	20.38	11.34	6.3	7.1	8.71	5.06	8.27	11.15	133.53
1981	8.85	4.89	6.58	5.72	9.24	9.1	5.53	5.88	3.51	4.63	4.53	7.3	75.76
1982	8.9	16.09	33.19	10.15	53.43	19.05	53.85	9.23	10.76	11.21	11.62	15.11	252.59
1983	9.75	8.15	13.68	19.91	53.8	66.88	35.26	23.13	13.83	10.32	14.94	13.23	282.88
1984	14.57	10.25	53.77	37.88	17.73	27.82	30.4	17.34	15.3	9.09	18.34	29.46	281.95
1985	32.65	17.09	11.66	7.88	12.65	14.32	17.19	10.54	9.27	8.01	11.73	13.25	166.24
1986	9.71	6.03	6.72	10.7	37.44	41.9	9.45	11.34	7.19	8.17	11.44	15.16	175.25
1987	7.27	5.18	5.65	6.69	9.47	8.74	3.98	9.57	8.19	9.79	5.98	10.41	90.92
1988	8.01	4.48	5.55	8.41	13.08	8.81	5.8	6.58	6.36	3.06	5.43	8.98	84.55
1989	7.36	7.27	6.15	5.24	13.53	34.81	11.85	7.53	6.34	5.59	8.81	14.01	128.49
1990	9.46	4.9	5.11	11.91	7.22	13.59	5.17	8.81	5.76	4.4	8.22	8.25	92.8
1991	8.36	4.77	3.71	5.33	4.34	5.94	1.69	3.74	1.85	1.71	0.94	1.28	43.66
1992	4.75	2.88	2.89	2.99	2.74	2.41	0.5	0.83	0.75	0.68	0.5	0.87	22.79
1993	0.95	1.09	1.23	2.4	7.41	61.17	12	4.45	5.4	1.85	5.64	7.15	110.74
1994	7.72	3.82	5.22	4.76	4.03	4.18	0.97	2.8	2	0.72	0.61	0.99	37.82
1995	2.56	2.05	3.65	20.66	11.19	38.34	15.25	17.27	6.1	3.28	3.82	7.5	131.67
1996	8.79	3.96	12.3	14.06	81.71	38.94	17.95	14.36	4.7	2.58	3.81	9.58	212.76
1997	7.86	6.05	17.34	57.26	39	11.45	7.65	5.96	6.67	4.98	6.6	10.19	181.02
1998	8.6	5.98	6.38	27.44	19.91	45.57	67.38	79.84	31.83	6.87	6.81	13	319.61
1999	12.06	12.12	17.85	15.75	37.14	113.35	64.38	14.51	12.17	8.09	14.76	18.97	341.13
2000	15.38	7.86	8.36	20.21	18.06	20.94	11.07	12.33	9.4	9.29	9.17	42.08	184.14
2001	13.99	7.25	8.62	7.51	7.04	8.9	3.27	0	0	0	0	0.9	57.48
2002	0	0	8.27	23.12	11.44	9.16	5.91	9.78	6.97	5.93	8.91	11.8	101.28
2003	9.76	4.7	6.59	14.47	8.62	7	11.82	11.39	7.51	5.1	7.78	13.58	108.31
Average	11.7	7.64	12.62	17.16	18.94	24.36	16.46	12.83	9.99	8.44	11.19	13.87	165.2
Minimum	0	0	1.23	2.4	2.74	2.41	0.5	0	0	0	0	0.87	22.79
Maximum	40.03	17.09	53.77	69.97	81.71	113.35	67.38	79.84	31.83	20.02	34.15	46.09	341.13

Section C: U.S. Department of the Interior Preliminary Section 18 Prescriptions, Klamath Hydroelectric Project - FERC No. 2082

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Section C: U.S. Department of the Interior Preliminary Section 18 Prescriptions

I. INTRODUCTION, BACKGROUND, AND PROCEDURAL CONSIDERATIONS

The U.S. Fish and Wildlife Service and the NMFS hereby submit a joint prescription for the construction, operation, and maintenance of upstream and downstream fishways pursuant to section 18 of the Federal Power Act (FPA). For the sake of grammatical simplicity, a naming convention is adopted in this document. Where language pertains independently to the U.S. Fish and Wildlife Service, the word "Service" (singular) is used. Where language pertains independently to the National Marine Fisheries Service, the acronym "NMFS" is used. Where language reflects the joint position of the Service and NMFS, the term "Services" (plural) is used.

PacifiCorp (Applicant) is seeking a new license from the Federal Energy Regulatory Commission (FERC or Commission) for the continued operation of the Klamath Hydroelectric Project (Project), which consists of five mainstem dams, two developments on the Federal Link River Dam, and one tributary development. The Services and other stakeholders have worked directly with the Applicant throughout the relicensing process. The Services regularly offered technical assistance and participated on technical subgroups. Furthermore, they provided comments and recommendations on the Applicant's Initial Consultation Document, Draft License Application (DLA), the Final License Application (FLA), and on numerous studies filed with the Commission. Nevertheless, the Applicant's proposed Project in the FLA (PacifiCorp 2004a) does not include modifications of existing facilities that would provide passage for anadromous fish (including salmon, steelhead, or Pacific lamprey), or provide a consistent, comprehensive strategy for resident fish passage through Project facilities.

The purpose of these Preliminary Fishway Prescriptions is to identify the engineered facilities, and the operations and maintenance of such facilities, which are necessary to achieve safe, timely, and effective fish passage conditions in all streams of the Klamath watershed impacted by the Project. As the Services describe in greater detail throughout this document, the Project is heavily impacting Klamath River fish populations, including fish listed under the Endangered Species Act (ESA).

At this juncture, the Services' joint prescriptions for fishways are preliminary. The Services developed these prescriptions using the best data and information available. We include specific prescriptive conditions which allow amendments through adaptive management in order to develop final design plans or to correct observed deficiencies. Our preliminary prescriptions require that the Licensee shall develop elements of the prescriptions in consultation with the appropriate fishery agencies and Tribes to ensure safe, timely, and effective fish passage. As the Services describe in greater detail throughout the document, these preliminary prescriptions are

consistent with the life histories and historical distributions of the target species of fish.

The Services anticipate the Commission will find this new license proposal to be a major, Federal action significantly affecting the quality of the human environment. Thus, the Commission will prepare an Environmental Impact Statement (EIS) pursuant to the requirements of the National Environmental Policy Act (NEPA)[1], and in accordance with the Council on Environmental Quality's implementing regulations.[2] The Services recommend the EIS reflect the full range of issues and alternatives identified in the NEPA scoping process, as well as all reasonable comments submitted in response to the Commission's Ready for Environmental Analysis Notice, plus any future Notice soliciting comments on any subsequent Offer of Settlement. Further, the Services support the Commission's intention to examine other fish passage alternatives, including the retirement of additional developments (besides the Eastside and Westside developments) without dams in place. Finally, and most importantly, both Services respectfully request that the Commission, in its draft EIS, identify a preferred alternative that fully incorporates our joint preliminary fishway prescriptions in their entirety as set forth herein.[3]

II. GOALS AND OBJECTIVES

The Commission's Licensing Regulations direct resource agencies to list the resource management goals and objectives that are the basis for recommended protection, mitigation, and enhancement measures (PM&E) to be incorporated into the new License.[4] These resource management goals and objectives also apply to the preliminary prescription of fishways in this document.

In 1986 Congress adopted the Klamath River Basin Fishery Resources Restoration Act (Klamath Act) (Public Law 99-552; codified as needed at 16 U.S.C.§ 460ss et seq.). This law established a Federal-State cooperative called the 'Klamath River Basin Conservation Area Restoration Program' for the rebuilding of the river's fish resources. The Klamath Act also established the Klamath River Basin Fisheries Task Force, and directed the Task Force to assist the Secretary of the Interior in the creation and implementation of "*…a 20 year program to restore anadromous fish populations of the [Klamath River Basin] Area to optimum levels and maintain such levels*." The Klamath Act also created the Klamath Fishery Management Council, and directed the Council to make recommendations to Federal, State, and Tribal agencies for the management of ocean and in-river harvesting that affects Klamath and Trinity anadromous fisheries.

The Klamath Act and the 1988 California Anadromous Fisheries Program Act recognize as the underlying reason for the decline of the anadromous fish resources the loss of habitat due to: 1) the construction and operation of dams; 2) stream diversions; and 3) adverse land use practices (USDI Klamath River Basin Fisheries Task Force 1991). Access of anadromous fish to habitat

[1] 42 U.S.C. §§ 4321 et seq.
[2] 40 C.F.R. Part 1500
[3] Interagency Task Force Report on NEPA Procedures in FERC Hydroelectric Licensing, May 22, 2000.
[4] 18 CFR4.34(e)(2)

in the Klamath River Basin upstream from Iron Gate Dam will assist in reversing the losses due to the construction and operation of dams.

In a letter to PacifiCorp dated March 21, 2001, the Task Force stated its goal that the relicensing of the Klamath Hydroelectric Project will "*result in the successful restoration of anadromous salmonids to their historical range as well as improvements to habitat of the Klamath River below the Project*" (USDI Klamath River Basin Fisheries Task Force 2001). The Services support these goals, with an added emphasis on restoring wild salmonid populations into the Upper Klamath River Basin.

Restoration of anadromous fish to the Klamath River in and above the Project will help meet not only various statutory requirements but also the Federal Trust Responsibilities to the Basin's Indian Tribes. These Tribes hold Federal Reserved fishing rights to take both resident and anadromous fish within their reservations in order to support ceremonial, subsistence, and commercial needs. See, e.g., United States v. Adair, 723 F.2d 1394, 1408-15 (9th Cir. 1984), cert. denied, 467 U.S. 1252; Parravano v. Babbitt, 70 F.3d 539 (9th Cir. 1984), cert. denied, 518 U.S. 1016 (1996); Memorandum from John D. Leshy, Solicitor of the Department of the Interior to the Secretary of the Interior (U. S. Department of the Interior 1993). The loss of fish productivity of the Klamath Basin has led to a substantial diminishment of the harvestable numbers available to these Tribes, and the resulting fish populations have been insufficient for the Tribes to harvest fish in quantities needed that would allow them a moderate standard of living.

NMFS Resource Goals and Objectives

One important NMFS goal is to ensure that the process of negotiation, public consultation, and environmental review results in decisions that provide for full and adequate protection, mitigation, and enhancement of anadromous fish and other resources affected by the Project, in accordance with NMFS statutory obligations under the FPA, the ESA, and other relevant jurisdictional authorities (see: NMFS' 2004 Motion to Intervene). NMFS is also committed to the goals and objectives developed by the Klamath River Basin Fisheries Task Force for restoration of habitat and anadromous fish populations in the Klamath River Watershed.[5]

Resource Goals

1. Protect, conserve, enhance and recover native anadromous salmonids and their habitats by providing access to historical habitats, and by restoring fully functioning habitat conditions.

2. Protect, mitigate or minimize direct, indirect, and cumulative impacts to native anadromous salmonid resources, and to enhance related spawning, rearing, and migration habitats and adjoining riparian habitats.

[5] USDI Klamath River Basin Fisheries Task Force 1991 and USDI Klamath River Basin Fisheries Task Force 2001

Resource Objectives

1. ***Flows -*** Implement scheduled flows in the Klamath River and regulated tributaries to the benefit of native anadromous salmonids and their habitats.
This includes establishing a criteria, range, and schedule of flows to consistently provide:

- optimal habitat structure and function;
- hydraulic stability during spawning and incubation of in-gravel life stages;
- safe, timely, and effective migration of all life stages of fish- including adults, juveniles, and anadromous smolts;
- viable redd selection, placement, and continuous submergence; and
- channel forming processes, riparian habitat protection, and movement of forage communities.

This also includes mitigating impacts of other Project structures or operations that:

- act to displace individuals from their forage or shelter;
- destabilize, scour, or undermine the physical habitat; or
- degrade the chemical or biological quality of habitat.

2. ***Water Quality -*** Modify Project structures or operations as necessary to mitigate direct, indirect, or cumulative water temperature and water quality impacts. Enhance water temperature and quality conditions in salmonid habitat where impaired by the Project.

3. ***Water Availability -*** Coordinate operations with other related projects, programs or initiatives. Use water transfers, water exchanges, water purchases, or other forms of agreements to maximize potential benefits to anadromous salmonids from limited water supplies.

4. ***Fish Passage -*** Provide access to historical spawning, rearing and migration habitats necessary for salmonids to complete their life cycles. Utilize seasonal habitats necessary to contribute to the recovery of coho, steelhead, and Chinook populations (and other species of concern). This includes modifications to Project developments and operations necessary to ensure the safe, timely, and effective passage for:

- upstream migration of adults;
- downstream emigration of juveniles;
- seasonal movement of rearing juveniles to feeding and sheltering habitats; and
- dispersion of adults and juveniles.

5. ***Channel Maintenance -*** Implement flow regimes and non-flow related measures necessary to mitigate and minimize the negative impacts of Project operations native fish populations and the riverine environment that supports them. Reduce or eliminate the direct, indirect and cumulative effects of dam operations on:

- alteration of the natural hydrograph;
- sediment movement and deposition;
- river geometry and channel characteristics;

- stream competence and capacity;
- flood plain conductivity and bank stability;
- extent, duration, and repetition of high flow events; and
- habitat diversity and complexity.

6. ***Hatchery Operations* -** Minimize and mitigate the impact of hatchery developments and operations on native, wild anadromous salmonids. This includes the direct, indirect and cumulative impacts of all hatchery production, and operations on anadromous salmonids and their habitats.

7. ***Predation* -** Minimize and mitigate the impact of Project structures or operations that create suitable habitat for predators, harbor predators, or are conducive to the predation of native anadromous salmonids.

8. ***Riparian Habitat* -** Protect and restore riparian habitat upon which the biological productivity of the riverine environment depends. Enhance riparian habitat and habitat functions as mitigation for the direct, indirect and cumulative impacts of Project developments and operations.

9. ***Flow Ramping* -** Modify Project structures or operations necessary to minimize adverse physical and biological impacts of flow fluctuations, associated with increases or decreases in Project discharges.

10. ***Coordination* -** Include a full range of alternatives for modifying Project and non-Project structures and operations to the benefit of anadromous salmonids and their habitats, while minimizing conflicts with operational requirements and other beneficial uses. This includes developing alternatives for greater coordination with other stakeholders and water development projects to ensure that, at a minimum, Project structures and operations are consistent with on-going and future restoration efforts and potentially enhance these efforts.

A primary goal of NMFS is to establish and maintain self-sustaining anadromous fish runs in the Upper Klamath River Basin to fully utilize the available habitat and production capability. In addition, NMFS' preliminary prescriptions and recommended terms and conditions are intended to serve the public interest and meet our environmental trust responsibilities pursuant to our statutory obligations under the resource laws that we administer, as fully described in our October 5, 2004 Motion to Intervene.

NMFS further intends, through implementation of these prescriptions and recommendations, to help achieve related planning goals and objectives established by the following State and Federal watershed plans: The Klamath River Basin Fisheries Task Force's Long Range Plan; The Long Term Plan for Management of Harvest of Anadromous Fish Population of the Klamath River (The Klamath Fishery Management Council); The Northwest Forest Plan; The Klamath National Forest Land and Resource Management Plan; The Six Rivers National Forest Land Management Plan; Klamath National Forest Wild and Scenic River Responsibilities; The Recovery Plan for Lost River and shortnose suckers (USDI Fish &Wildlife Service 1993);

California Water Quality Control Plan for the North Coast Region; BLM and Klamath National Forest Wild and Scenic River Responsibilities; several Oregon Department of Fish and Wildlife (ODFW) plans to manage fish resources in the Klamath River[6]; Recovery Strategy for California Coho Salmon (California Department of Fish and Game 2004); and the Joint Iron Gate Hatchery Review Committee Report (California Department of Fish and Game and National Marine Fisheries Service 2001). These plans contain provisions which pertain to the protection, mitigation, and enhancement of fish and wildlife resources in the Klamath River Basin, and the Project area.

Service's Resource Goals and Objectives

The Service has active programs in the Basin for the protection and restoration of the aquatic habitat upon which endangered fish, Tribal treaty and federally reserved fishing rights fisheries, and commercial and sports fisheries depend. The Service's goals (USDI Fish and Wildlife Service 2003) regarding relicensing of the Klamath River Project are:

1) Restore native fish populations within the Klamath Basin to provide fishery resources necessary to meet Tribal Trust responsibilities for commercial, subsistence, and ceremonial purposes; and to enhance ocean commercial harvest, recreational fishing, and the economic health of local communities.

2) Restore volitional passage for all life history phases of anadromous and resident fishes throughout their historical range. Provide necessary water quantity, flow regimes, water quality, and other habitat conditions for the recovery and long-term sustainability of native fishes.

3) Recover federally-listed threatened and endangered species in the Basin by avoiding jeopardy, avoiding and minimizing take, and completing recovery actions identified and detailed in recovery plans. Protect and restore habitat for federally-listed and candidate species.

4) Protect, mitigate, and enhance habitat for waterfowl and other migratory birds, terrestrial wildlife, fish, plants, and invertebrates.

5) Enhance ecological function and watershed processes to meet the above goals.

III. REVIEW PROCEDURES

The Energy Policy Act of 2005 (Act) provides parties to this license proceeding the opportunity to request "trial-type hearings" regarding issues of material fact that support the preliminary

[6] Oregon Plan for Salmon and Watersheds (ORS 541.405), Oregon Fish and Wildlife Habitat Mitigation Policy (OAR 635-415-0000-0025), Fish and Wildlife Habitat Mitigation Policy (OAR 635-415-0000-0025), Oregon Klamath Basin Fish Management Plan (OARs 635-500-3600 thru -3860), Klamath Basin Fish Management Plan (OARs 635-500-3600 thru -3860)

prescriptions developed under FPA section 18 (fishway prescriptions) and conditions developed under FPA section 4(e) (Federal reservations). Through this document, the Services submit preliminary prescriptions along with the administrative record supporting those preliminary prescriptions. The Act also allows parties to propose alternatives to preliminary prescriptions and conditions. Procedures for requesting a trial-type hearing on an issue of material fact or for proposing alternatives are set forth at 43 C.F.R. Part 45 (Department of Interior regulations) and 50 CFR Part 221 (Department of Commerce regulations). Requests for hearing must be filed within 30 days of the deadline for submission of this document, with each prescribing agency.

IV. NEED FOR FISHWAYS

In order to help achieve success of the many fish management, restoration, and recovery directives, goals and objectives in the Klamath River Basin, safe, timely, and effective fishways must be designed and constructed for all Project facilities that suppress native fish populations. At any particular facility, prospective fishways may need to accommodate upstream and downstream passage of spring and fall-run Chinook salmon, steelhead trout, coho salmon, Lost River and shortnose suckers, rainbow/redband trout, Pacific lamprey, and any other fish to be managed, enhanced, protected, or restored to the Klamath River Basin during the term of the license. The design of all fishways must be compatible with established Federal and State engineering criteria developed for the passage of fish. Fishways must be capable of supporting the life histories (PacifiCorp 2004b) and historical distributions of the named species in the Klamath River (Hamilton et al. 2005). The life history and distribution of these affected species have been previously provided in detail (National Marine Fisheries Service 2003 DLA; National Marine Fisheries Service 2004 FLA).

A. Existing Fishways and Fishways Proposed by the Applicant

As described in greater detail below, neither the existing Project, nor the Applicant's proposed Project, provide for passage of anadromous fish, or a consistent, comprehensive strategy for resident fish passage through Project facilities.

- The lower three Project dams (Iron Gate, Copco 1 and Copco 2) are not equipped with any fish passage facilities, and the Applicant does not propose any modifications (PacifiCorp 2004a).
- The J.C. Boyle Dam has upstream and downstream fishways, but these fishways do not conform to current criteria for resident and anadromous fish (Table 1) (National Marine Fisheries Service 2003; PacifiCorp 2004b). J.C. Boyle Dam was completed in 1958 and currently has an antiquated fish ladder, fish screens, and bypass facilities. Upstream passage of redband trout has declined more than 90 percent from over 5,500 trout in 1959 (Hanel and Gerlach 1964) to 70 to 588 trout in the years 1988-91 (Hemmingsen 1997; Hemmingsen et al. 1992; Oregon Department of Fish and Wildlife 2006a; USDI Fish and Wildlife Service 2004d). The existing fish ladder entrance is difficult for fish to find during spill events (PacifiCorp 2003c). The fish ladder is in poor condition with ineffective hydraulics and does not conform to current ladder criteria (USDI Fish and Wildlife Service 2005). The J.C. Boyle development has a history of fish passage

problems, which may be related to attraction hydraulics, ladder configuration, or the approach to the ladder (USDI Fish and Wildlife Service 2004a; USDI Fish and Wildlife Service 2005). The Applicant proposes only minor modifications to the J.C. Boyle upstream fishway that are already necessary for compliance with the current license and proposes an experimental gulper to replace the existing downstream fishway at J.C. Boyle Dam (PacifiCorp 2004a) that does not meet current criteria.

- The Keno Dam currently has a fishway that conforms to slope and energy dissipation criteria for salmonids, but does not meet current criteria to accomplish lamprey passage and does not meet slope guidelines for sucker passage (Oregon Department of Fish and Wildlife 2006b; USDI Fish and Wildlife Service 2005). Downstream spillway passage at Keno needs to be improved for all species to be consistent with current criteria (see Keno fishway prescription below).
- At the lower end of Upper Klamath Lake, the Bureau of Reclamation has constructed an upstream fishway at Link River Dam to pass endangered suckers that will also allow passage for anadromous fishes. The Applicant's Eastside and Westside power houses receive water diverted at Link River Dam into canals on each side of the river, but they are not equipped with fish screens and bypass facilities. The Applicant is proposing to decommission these facilities (PacifiCorp 2004a).
- The tributary developments at Fall Creek and Spring Creek have no fishways (PacifiCorp 2004b Fish Resources FTR). The Applicant is proposing canal screens and fish ladders for tributary facilities on Fall Creek and Spring Creek.

1. Upstream Fishways

Existing J.C. Boyle Ladder: The J.C. Boyle fish ladder is obsolete and ineffectual. Problems include steep gradient, insufficient attraction flow, hydraulic barriers; in addition problems with entrances limit the passage effectiveness (USDI Fish and Wildlife Service 2005). Studies indicate redband trout are not passing the dam upstream, or if attempting passing, are delayed due to problems with the existing fish ladder. In 2003 and 2004, Oregon Department of Fish and Wildlife (ODFW) radio-tagged 72 adult redband trout in the Klamath River below J.C. Boyle Dam. None of the fish moved up the fish ladder (Bill Tinniswood, ODFW, pers. comm.). In a separate study, one out of 14 radio-tagged redband trout from the bypass reach moved above the dam in 2002, while none of the 28 tagged fish from the peaking reach moved above the dam (PacifiCorp, 2004b). For the one tagged-fish that did migrate above the dam, the data indicate a delay of 3.5 days (PacifiCorp 2004b Fish Resources FTR). Passage problems are related in part to channel degradation near the entrance of the fish ladder which occurred after dam construction. The gradient of the approach to the fishway has not been maintained over the term of the license (USDI Fish and Wildlife Service 2004a; USDI Fish and Wildlife Service 2004d). The J.C. Boyle ladder rises 67 feet through 57 pools resulting in an average rise of 1.2 feet per pool which exceeds current criteria (PacifiCorp 2003c). Typically, 1 ft of rise per pool is recommended for passage of salmon and steelhead, while the recommendation for trout passage is 6 inches of rise per pool (PacifiCorp 2004b). In addition, temperature differences can greatly influence fish selection of alternative paths of upstream movement. According to studies by the Bureau of Commercial Fisheries, adult salmonids avoid temperature changes, prefer to remain in

river water, prefer cooler water when given an alternative, and take longer to pass through the test facility in water heated or cooled compared to river water (Weaver et al. 1976). Below the J.C. Boyle Powerhouse and in the peaking reach, fish encounter either water from J.C. Boyle Reservoir (the powerhouse discharge) or water from the bypassed reach (blended spring and river water) (USDI Bureau of Land Management 2003). There are daily temperature differences of up to 12°C during the middle of the summer between these two water sources as a result of daily peaking events (City of Klamath Falls 1986; PacifiCorp 2005; USDI Bureau of Land Management 2003). Thus, after comparing the findings of the Bureau of Commercial Fisheries study to the similar conditions existing at the juncture of J.C. Boyle's bypass reach and powerhouse flows, the Services conclude that upstream migration may be delayed due to these temperature differences.

Existing Keno Fish Ladder: Keno Dam currently has an upstream fishway conforming to salmonid criteria for slope and energy dissipation, but it does not meet Federal and State slope guidelines for sucker passage (Oregon Department of Fish and Wildlife 2006b; USDI Fish and Wildlife Service 2005). The ladder has 24 pools to ascend a 19-ft rise, resulting in an average rise of over 0.8–ft per pool. The Keno Dam fishway and auxiliary water supply system also have attraction hydraulics and flow regulation problems (USDI Fish and Wildlife Service 2005). Monitoring of fish passage at Keno Dam demonstrated small numbers of fish moving upstream through the existing ladder at Keno Dam (PacifiCorp 1997). While trapping studies indicated some trout and suckers use the ladder, it does not meet current criteria for upstream sucker passage (Oregon Department of Fish and Wildlife 2001; Oregon Department of Fish and Wildlife 2006b).

Proposed Upstream Fishways: With the exception of the Link River ladder and the Keno ladder in regard to salmon and steelhead criteria, none of the existing or proposed mainstem upstream fishways meet the design criteria summarized in Table 1. These criteria form the basis for the Services' Preliminary Fishway Prescriptions in Section V below.

Table 1. Recommended Design Criteria and Guidelines for Upstream Fish Passage.

Parameter	**Criteria**	**Reference**
Upstream Fish Ladders		
Resident Trout Maximum vertical jump Slope	 0.5 foot ~10%	 ODFW 2006b
Salmon and Steelhead Maximum vertical jump Slope	 1.0 Foot ~10%	 NMFS 2003, ODFW 2006b NMFS 2003
Federally listed suckers Maximum vertical jump Slope	 No jump <4.0% (4.5%)	 ODFW 2006b ODFW 2006b (4.5% used at Link River fishway)
Lamprey	Rounded ladder steps and corners	ODFW 2006b

2. Downstream Fishways

The existing J.C. Boyle screens and bypass facilities do not meet current criteria. The proposed gulper to replace the existing screen and bypass system is considered experimental (National Marine Fisheries Service 1994) and its protection would be questionable. The Applicant has not proposed downstream fishways at any of the other facilities (PacifiCorp 2004a). As a result, the proposed Project would entrain (draw in and transport) and kill fish. The likelihood of entrainment through the Project powerhouses is acknowledged by the Applicant (PacifiCorp 2004b Fish Resources FTR). In fact, the Applicant estimates that each of its unscreened hydro developments entrains tens of thousands of fish, with about 10 to 20 percent killed as they pass through each powerhouse (PacifiCorp 2003a; PacifiCorp 2003b). However, no studies of entrainment mortality have been conducted, even though requested by the Services (National Marine Fisheries Service 2003 DLA; National Marine Fisheries Service 2004 FLA; U. S. Department of the Interior 2004; U.S. Department of the Interior 2003; USDI Fish and Wildlife Service 2001). Without site-specific studies, the Services look to studies of entrainment at other hydropower installations to estimate entrainment resulting from the Klamath Project. The Electric Power Research Institute (EPRI) reported average mortality through Francis turbines at about 24 percent for all subject species (Electric Power Research Institute 1987). Francis turbines are utilized at all Project generating stations, except Fall Creek. Projects with higher head may have even greater mortality (e.g. J.C. Boyle at 440 feet of head). For projects with Francis turbines, the EPRI study found a high correlation ($r = 0.77$) between head and fish mortality. Four generating stations greater than 335 feet of head had mortality ranging from 33 to 48 percent (Electric Power Research Institute 1987). The facilities in these studies have comparable or less hydraulic head than the J.C. Boyle development and comparable turbine types. Using the above evidence, the Services conclude that entrainment mortality at J.C. Boyle Powerhouse likely falls in this range rather than the 12 to 36 percent range estimated by the Applicant (PacifiCorp 2004a, Exhibit E 4-113).

Finally, EPRI's studies, along with those of Milo Bell (Bell 1986; Bell et al. 1967), measured entrainment for some of the same species and under similar conditions as exist in the Klamath River. This evidence supports a conclusion that significant entrainment mortality (and injury) of resident fish is occurring presently at each Project development.

Klamath Project hydro-turbines entrain suckers, which are listed under the ESA and are present in all Project reservoirs (Desjardins and Markle 2000). In addition, when upstream fishways are provided for anadromous fish above Iron Gate Dam, and throughout the upper Klamath watershed, out-migrating salmonid smolts (including coho salmon which are listed under the ESA) will be entrained along with the resident fish. Unless downstream fishways and juvenile bypass systems are constructed, a significant portion of these restored fish will be killed or injured during entrainment and turbine passage. Therefore, modern fish screening and bypass facilities, which are consistent with the criteria in Table 2, are needed to prevent entrainment mortality of resident and anadromous fish. The Applicant acknowledges that downstream fish passage facilities will need to be in place to protect/bypass out-migrating fish if anadromous fish are reintroduced above Iron Gate Dam (PacifiCorp 2003a).

Existing J.C. Boyle Downstream Fishway: The fish screening and bypass facilities at J.C. Boyle Dam are ineffective and do not conform to current State or Federal criteria (PacifiCorp 2003c, 2004b). Screen approach velocity is nearly six times the modern anadromous salmonid criteria of 0.4 feet per second (PacifiCorp 2003c). The ineffectiveness of the screen is demonstrated by the large number of unidentified suckers and trout that pass downstream- through or around the fish screens. ODFW counted numerous trout and unidentified suckers in the power canal during fish salvage operations (Oregon Department of Fish and Wildlife 2001; Oregon Department of Fish and Wildlife 2006a). PacifiCorp (1997) also reported tagging a high number of fish as a result of a salvage operation in the canal below the dam. Finally, radio-tracking results showed that one 14-inch trout passed upstream through the J.C. Boyle ladder, and the *same* fish also migrated downstream through the power canal and turbines. It was not excluded by screens (PacifiCorp 2004b Fish Resources FTR, Appendix 5C, page 14). This information indicates both small and large fish are passing through or around downstream screens at J.C. Boyle Dam, and are subject to turbine mortality and injury.

Proposed J.C. Boyle Downstream Fishway: The Applicant proposes a surface collection system (gulper) for the J.C. Boyle Reservoir (also referred to as Topsy Reservoir) to exclude fish from the power intake and to facilitate downstream fish passage (National Marine Fisheries Service 1994). The Services consider gulpers to be experimental technology (National Marine Fisheries Service 1994). They would not provide volitional passage and therefore are not consistent with Service goals (USDI Fish and Wildlife Service 2003) and National Marine Fisheries Service draft guidelines and criteria (National Marine Fisheries Service 2003). We are not aware of any instance where gulpers have been shown to work as well as positive barrier fish screens (David White, NMFS, pers comm.). Gulpers would not lend themselves well to the Klamath River system because of the physical conditions needed for their successful operation. Gulpers and guide nets would have physical problems with the huge amounts of algae and organic debris originating in Upper Klamath Lake and tributaries. Klamath River conditions are very different from other systems, such as the Baker River, where gulpers are the only viable option for downstream passage.

None of the existing or proposed mainstem downstream fishways meet the design criteria summarized in Table 2. These criteria form the basis for the Services' Preliminary Fishway Prescriptions in Section V below.

Existing Keno Dam Downstream Passage: The sluiceway intake is not screened. All other flows go under the radial gates and into shallow areas where redband trout (Oregon Department of Fish and Wildlife 1997) and other predator fish hold. The Services conclude that predation mortality is significant at this location because of these facility characteristics and the concentration of predatory fish.

Proposed Keno Dam Downstream Passage: The Applicant does not propose downstream spillway improvements for fish passage at Keno Dam.

Table 2. Recommended Design Criteria and Guidelines for Downstream Fish Passage

Parameter	**Criteria**	**Reference**
Downstream Fish Screens and Juvenile Bypass Systems		
Resident Trout Square Screen Opening Approach Velocity Sweeping Velocity	 5/32 in. diagonal 0.33 ft/s 0.66 ft/s	CDFG 2000
Salmon and Steelhead Square Screen Opening Approach Velocity Sweeping Velocity	 3/32 in. side 0.33 ft/s >0.33 ft/s	NMFS 2003, 1997
Federally listed suckers	3/32 in. side 0.33 ft/s >0.33 ft/s	(USDI Fish and Wildlife Service et al. 2005).
Lamprey		Not available

B. Benefits of the Services' Fishway Prescriptions

As the Services explain in greater detail below, provision of safe, timely, and effective upstream and downstream fish passage facilities will provide a suite of benefits for resident trout, suckers, and five of the anadromous fish runs currently present in the Klamath River below Iron Gate Dam: Spring and fall-run Chinook salmon (*Oncorhynchus tshawytscha);* coho salmon (*Oncorhynchus kisutch);* summer steelhead (*Oncorhynchus mykiss*); and Pacific lamprey (*Lampetra tridentatus*). Each of the runs uses the mainstem Klamath River and its tributary streams for spawning and rearing. Klamath River resident fish will realize significant benefits resulting from restored connectivity of populations. For anadromous fish, the Klamath River "Project Reach" (Iron Gate Dam to Link River Dam) contains more than 50 miles of suitable habitat for salmon and steelhead (Table 3). The Klamath River "Above Project Reach" (from Link River Dam to the headwaters of Upper Klamath Lake, including the Wood, Williamson, and Sprague rivers) contains more than 360 miles of suitable habitat for salmon and steelhead. These designations demonstrate the fish passage benefits and habitat characteristics in each of these reaches of the Klamath River (Figure 1).

1. Fishway Benefits by Species – Project Reach

The benefits of providing fishways to restore unimpeded migration to historical habitat within the Project Reach are substantial. The Services estimate that the Project Reach, between Iron Gate Dam and Keno Dam, contains approximately 58.9 miles of suitable habitat for anadromous

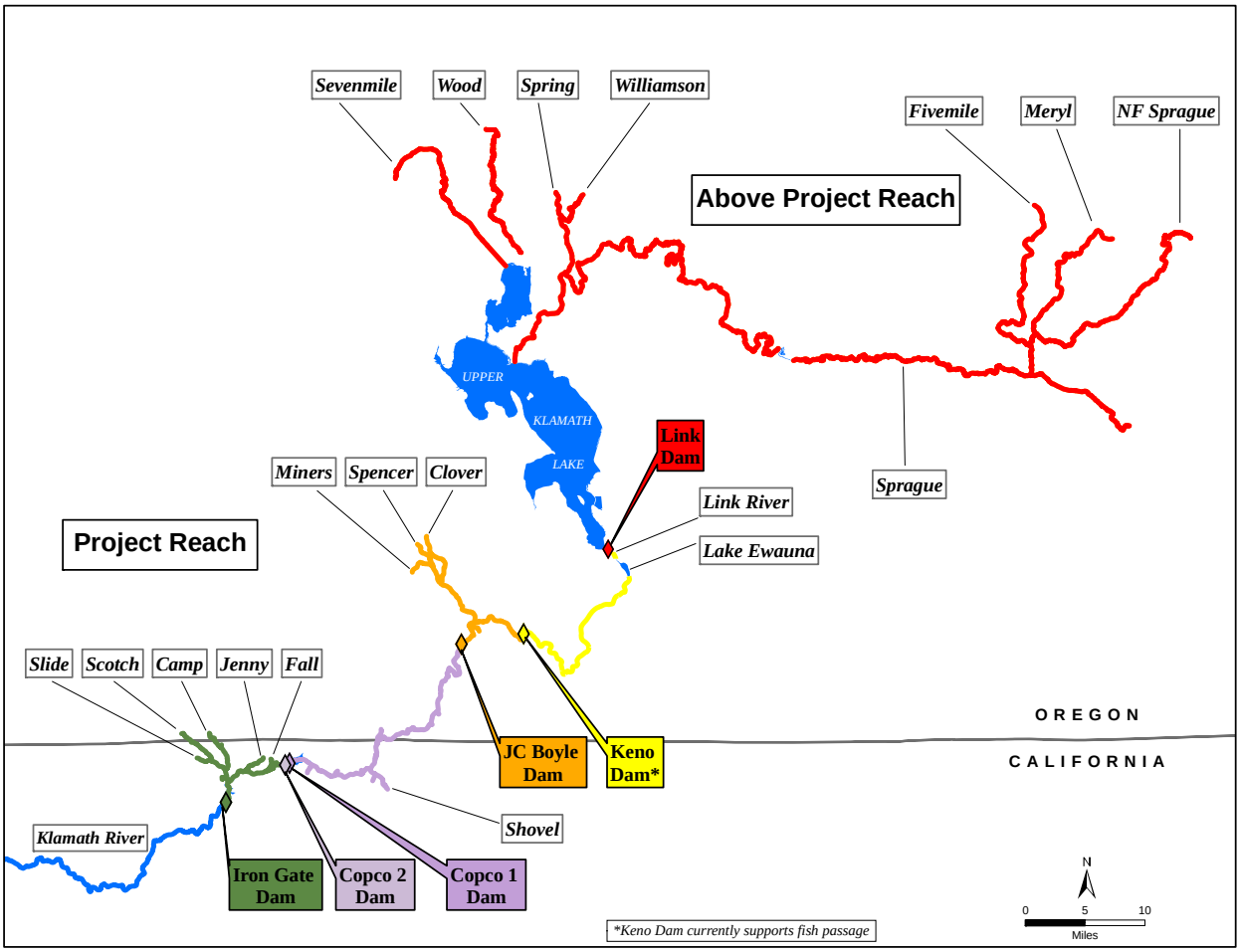

Figure 1. Project Reach and Above Project Reach (in red) designations for the Klamath River above Iron Gate Dam).

fish (Table 3), which compares closely with the estimate of 61 miles of habitat by Huntington (2006) for the Project reach. Fish passage through the Project Reach is also the stepping stone to much larger habitat gains above the Project.

A. Resident trout

For redband trout, a state of Oregon and U.S. Forest Service sensitive species, upstream fishways would restore historical seasonal migration patterns for both adults and immature fish. Upstream fishways would improve access to major spawning areas (such as Shovel and Spencer creeks) (California Department of Fish and Game 2005; Oregon Department of Fish and Wildlife 2006a). In some situations, the Project either blocks or severely impedes the movement of native redband trout. For example, one year after dam construction as many as 5,500 redband trout migrated through the ladder at J.C. Boyle Dam (Hemmingsen 1997). This event was typical of the intra-stream migrations among populations above and below the dam reach under natural conditions (e.g. Frain Ranch reach to Spencer Creek and Upper Klamath Lake) (Fortune et al. 1966). As time progressed, however, the dam's impacts on the native fish runs increased

dramatically. After decades of impacts from the Project the number of fish migrating through the ladder has been reduced by 90 percent or more (Hemmingsen 1997; Hemmingsen et al. 1992; Oregon Department of Fish and Wildlife 2006a; USDI Fish and Wildlife Service 2004d). The average size of fish using the ladder decreased significantly (Hemmingsen 1997; Oregon Department of Fish and Wildlife 2006a) since shortly after dam construction.

B. Federally-listed suckers

The fish ladder at Keno Dam does not meet criteria for sucker passage (USDI Fish and Wildlife Service 2005) and the current success of attempted upstream migration by suckers at Keno is unknown. Suckers currently held in other Project reservoirs are unable to return upstream, either because of intervening riverine reaches or lack of upstream passage facilities at dams. However, because the Project reservoirs are probably inherently unsuitable for the completion of life cycles by the suckers (National Research Council 2003) and few, if any, federally-listed suckers occur below Iron Gate Dam, the Service sees little benefit in prescribing ladders to sucker criteria at the lower five mainstem dams at this time.

Screens and bypass systems at J.C. Boyle, Copco 1 and 2, and Iron Gate Dams would have benefits in guiding federally listed sucker movements downstream. Suckers in the project reservoirs may have utility should future reintroduction efforts be necessary (National Research Council 2003). Because these four dams lack screens and bypass systems, these fish are at risk. Current screen and bypass criteria for suckers are the same as those for salmonids (Table 2). Fishways to these specifications would guide suckers downstream and reduce entrainment related mortality. Because no further measures to protect or provide for suckers are prescribed at these facilities, federally listed suckers are not referred to as a target species (Table 4) or included in the prescriptions below Link River Dam.

Tailrace barriers and spillway prescriptions for resident trout and anadromous species would benefit federally listed suckers as well and specifications would be the same. Because no further measures to protect or provide for suckers are prescribed at these facilities, federally listed suckers are not referred to as a target species (Table 4) or included in the prescriptions below Link River Dam.

C. Coho salmon

The Southern Oregon/Northern California Coast coho salmon (SONCC coho) Evolutionarily Significant Unit (ESU), which includes coho salmon in the Klamath River Basin, was listed as Threatened under the Federal ESA in 1997 (62 FR 24588, May 6, 1997; 70 FR 37160, June 28, 2005). In addition, the Klamath River Basin, excluding habitat above Iron Gate Dam, was designated as Critical Habitat for the SONCC coho (64 FR 24049, May 5, 1999). Project dams prevent coho salmon from migrating between the lower Klamath River and Spencer Creek. Coho salmon were distributed at least this far upstream historically (Hamilton et al. 2005). Coho salmon are also excluded from intermediate spawning tributaries such as Fall Creek and Shovel Creek and from historical mainstem and tributary rearing habitat. The 46.5 miles of coho habitat within the Project represents 6 percent of the total 779 miles of historical coho habitat in the Klamath Basin (Charleen Gavette, NMFS, pers. comm.).

Table 3. Project Reach Habitat for Anadromous Fish

River Reach	Habitat Miles Steelhead	Habitat Miles Chinook and Coho Salmon[2]	Source for Miles of Historical Anadromous Habitat or Potential Anadromous Fish Use
Iron Gate to Copco 2:			
Scotch Creek	5	3.9	Snedaker[1]
Slide Creek	1.4	1.1	Snedaker[1]
Camp Creek	3.7	2.9	Snedaker[1]
Jenny Creek	1.0	0.8	Coots-Wales(1952), Huntington(2006)
Copco No. 2 Bypass	1.4	1.4	PacifiCorp (2004b) Fish Resources FTR
Fall Creek	1	0.8	Wales-Coots (1954), Huntington (2006)
Salt Creek	0.2	0.2	Snedaker[1]
Total Miles:	**13.7**	**11.1**	**N/A**
Copco 1 Dam to Boyle:			
J. C. Boyle Peaking	17	17	PacifiCorp (2004b) Fish Resources FTR
Shovel Creek	2.7	2.1	CDFG (2005), Huntington (2006)
J. C. Boyle Bypass	4	4	PacifiCorp (2004b), Fish Resources FTR
Long Prairie Creek	0.4	0.3	(Coots 1965)
Deer Creek	0.4	0.3	Snedaker[1]
Edge Creek	0.3	0.2	Snedaker[1]
Frain Creek	0.1	0.1	Snedaker[1]
Negro Creek	0.6	0.5	Snedaker[1]
Tom Hayden Creek	1.1	0.9	Snedaker[1]
Topsy Creek	0.3	0.2	Snedaker[1]
Beaver Creek	0.2	0.2	(Coots 1965) and FWS estimate
Total Miles:	**27.1**	**25.8**	**N/A**
Boyle to Keno:			
Boyle Reservoir to Keno Dam	4.7	4.7	PacifiCorp (2004b), Fish Resources FTR (page 2-22)
Spencer Creek	9.2	7.1	Fortune et al (1966), Huntington 2006
Hunters Park Creek	0.8	0.6	Snedaker[1]
Miners Creek	2.4	1.9	Snedaker[1]
Clover Creek	0	0	BLM 1995
Total Miles:	**17.1**	**14.3**	**N/A**
Link River	1	1	PacifiCorp (2004b), Fish Resources FTR
Grand Total "Fish Miles" inside Project:	**58.9**	**52.2**	**N/A**

[1] (Scott Snedaker, BLM, pers. comm.)
[2] Habitat Miles for Chinook salmon = steelhead ("anadromous") fish miles x (0.774) in tributaries (Table 1 in Huntington 2004)

Upper Klamath River coho salmon support the SONCC coho ESU in two primary ways. The Upper Klamath, Scott, and Shasta river coho salmon represent three of the four functionally-independent populations of the Klamath system, excluding the Trinity system (Williams et al. 2005). Functionally independent populations are defined as having minimal demographic influence from adjacent populations and viability in isolation. The SONCC coho ESU also contains 32 smaller dependent populations. These populations do not have a high likelihood of sustaining themselves over a hundred year time period in isolation; they must have sufficient immigration from independent populations in order to persist (Weitkamp et al. 1995). Despite their dependent status, they contribute significantly to the viability of the ESU. Because each of the four functionally independent populations of the Klamath Basin is greatly diminished (Weitkamp et al. 1995), the Upper Klamath system plays an important role in preserving the SONCC coho ESU by consistently providing emigrants to dependent populations over a long-term time scale.

Upper Klamath River coho salmon also support the SONCC coho ESU during short-term droughts. Many of the functionally dependent populations exist in rivers and streams of the Coast Range that are supplied by surface run-off water (Weitkamp et al. 1995). Rivers supplied by surface water are especially vulnerable to periods of drought. Because the Upper Klamath system extends beyond the Coast Range and into the Cascade Mountains, it is a snow-melt supplied system. Larger, snow-melt watersheds have more stable hydrology than smaller, rain dependent watersheds, and are therefore comparatively less vulnerable to drought. The Upper Klamath coho population provides emigrants to the dependent populations, re-populating them after short-term catastrophic events, including droughts.

The threatened status of the SONCC coho ESU was one of the primary constraints on the West Coast 2005 mixed-stock ocean fishery. The NMFS ESA consultation standard requires that the ocean exploitation rate of SONCC coho be no more than 13 percent of the Rogue and Klamath hatchery coho stocks (Pacific Fishery Management Council 2006b). Also, there is currently no retention of coho salmon in commercial and recreational fisheries off California (Pacific Fishery Management Council 2005). In some years, these standards constrain ocean fishing for the more abundant Chinook salmon.

Weitkamp et al (1995) has identified the SONCC coho ESU as likely to become endangered in the foreseeable future if the long-term downward trend persists. The National Research Council (2003) recommended effective passage for coho at dams throughout the Klamath within three years, and that elimination of Iron Gate Dam be seriously evaluated because this structure blocks substantial amounts of coho habitat. Restoring access to the historical coho habitat above Iron Gate Dam will increase numbers of Klamath River functionally-independent coho salmon, which will support the dependent populations and appreciably contribute to the recovery of the SONCC coho ESU (Weitkamp et al. 1995). Blockage of coho migration within the Klamath Basin is inconsistent with ESA regulations on take (National Research Council 2003).

D. Fall-run Chinook salmon

The Project excludes fall-run Chinook salmon from migrating to historical spawning, incubation, and rearing habitats (Hamilton et al. 2005). Although degraded from historical conditions, most of this habitat is suitable for the life history of fall-run Chinook (USDI Bureau of Land Management et al. 1995; USDI Bureau of Land Management 2005; California Department of Fish and Game 2005; Huntington 2006). In the Project reach, there is approximately 52.2 miles of spawning, incubation, and rearing habitat for Chinook salmon (Table 3). Historically, fall-run Chinook used habitat in the Spencer Creek watershed (USDI Bureau of Land Management 2005).

E. Lamprey

The Project excludes Pacific lamprey from migrating to historical spawning habitats in the Project area (Hamilton et al. 2005). Populations have declined substantially in many Oregon rivers (Kostow 2002) and information indicates large population declines of lamprey numbers throughout the Columbia and Snake River systems (USDI Fish and Wildlife Service 2004b). Anecdotal evidence (Larson and Belchik 1998) and preliminary analysis suggest a declining trend for all life stages of Pacific lamprey in the Klamath River (USDI Fish and Wildlife Service 2004b). The upstream limits of their distribution are not well documented, but extended at least as far as Spencer Creek (Hamilton et al. 2005). Pacific lamprey are of great importance to Tribal subsistence and ceremonial fisheries (Kostow 2002; Larson and Belchik 1998; USDI Fish and Wildlife Service 2004b; Wydoski and Whitney 2003).

F. Spring-run Chinook salmon

Spring-run Chinook salmon were once the dominant run type in the Klamath-Trinity River Basin. Most spring-run spawning and rearing habitat was above the Project on the Klamath River. The Project excludes spring-run Chinook from historical spawning habitats in and above the Project area (Hamilton et al. 2005) in the Klamath River watershed. As a result of these and other factors, spring-run populations are less than 10 percent of their historic levels, and at least seven spring-run populations that once existed in the Klamath-Trinity Basin are now considered extinct (Myers et al. 1997).

Passage for spring-run Chinook into the Project Reach will restore access to cool water refugial areas such as the 220 cfs of spring water in the J.C. Boyle bypassed reach. During summer months, this area will provide key holding areas, cool water, and refugial habitat necessary for this run of fish (McCullough 1999). Juvenile spring-run salmon will rear in the cool water habitat adjacent to the springs in the J.C. Boyle bypass reach. Water temperatures in this spring-influenced area do not vary substantially from 50 to 55°F throughout the year (USDI Bureau Land Management 2003). During winter months, the reach will also provide relatively warmer water, benefiting rearing spring-run Chinook by providing optimal temperatures for juvenile growth (McCullough 1999). Spring-run Chinook will also use the main channel as an upstream migration corridor necessary to reach historical spawning areas in the Upper Klamath Basin (California Department of Fish and Game 1990).

G. Steelhead

The Project excludes steelhead trout from historical spawning, incubation, and rearing habitats in the Project area (Hamilton et al. 2005). In the Project reach, there are approximately 58.9 miles of steelhead habitat (Table 3).

2. Fishway Benefits by Species - Above Project Reach

The Above Project Reach, upstream from Link River Dam, contains approximately 49 significant tributaries comprising 360 miles of suitable, existing habitat and an additional 60 miles of recoverable[7] habitat for Chinook salmon and steelhead (Huntington 2006). While habitat has been degraded in some sections of the watershed above Link River Dam, substantial quantity and quality of habitat remains and effective habitat restoration programs could increase anadromous fish habitat to 420 miles (Huntington 2006). Ongoing habitat restoration work will continue (USDI Fish and Wildlife Service 2006). The work will expand to fully develop the capacity of the Upper Basin for anadromous fish. Efforts will include a broad range of restoration projects to restore and protect instream and riparian habitats. Chinook salmon and other anadromous fish returning to stream habitats above Upper Klamath Lake will improve the quality of spawning gravels as they construct redds. The Services expect that over a period of time, the condition of spawning sites will be improved in terms of embeddedness, particle size distribution, and compaction.

A. Resident trout

For resident redband/rainbow trout, which are present in the mainstem Klamath River, Upper Klamath Lake, and the lake's tributaries, fishways will allow reconnection of historical migration patterns. In the Upper Klamath Basin, resident redband/rainbow trout support a world class recreational fishery (Bill Tinniswood, ODFW, pers. comm.). These fish, particularly in the Williamson River, are renowned for their large size. Klamath Basin redband trout exhibit a pattern of downstream migration as fry or juveniles (Beyer 1984; Hemmingsen 1997) and return upstream as adults (Fortune et al. 1966). Historically, these populations were connected. Rainbow trout from Spring Creek and Trout Creek (above Upper Klamath Lake) are remarkably similar genetically to trout from Spencer Creek and the Klamath River (below Upper Klamath Lake) and to steelhead from Bogus Creek (below Iron Gate Dam) (Buchanan et al. 1994). This study concluded that some of these Upper Basin populations were likely once associated with runs of anadromous rainbow trout. Fishways will reconnect these now disparate populations and allow redband/rainbow trout and steelhead to be a source of adaptive variability in Klamath Basin salmonid populations.

B. Federally-listed Suckers

Benefits to suckers above the Project are provided by the ability of the fish to pass upstream at Link River Dam. A new ladder designed and constructed to current sucker criteria at Link River

[7] Huntington (2006) used this term to describe habitat that could be rehabilitated to become functional for Chinook salmon and/or steelhead trout within the next 30-50 years.

was completed in 2005. Federally-listed suckers are currently using this fishway to move from Lake Ewauna to as far upstream as the Williamson River (Bennetts 2006).

C. Fall-run Chinook salmon

The Project excludes fall-run Chinook salmon from historical spawning, incubation, and rearing habitats above the Link River Dam (Hamilton et al. 2005). Passage will provide access to approximately 49 significant tributaries comprising 360 miles of suitable, existing habitat and an additional 60 miles of recoverable habitat for Chinook salmon and steelhead (Huntington 2006).

D. Pacific Lamprey

Historically, Pacific lamprey occurred at least to Spencer Creek (Hamilton et al 2005). Lampreys occur long distances inland in the Columbia and Yakima river systems (Wydoski and Whitney 2003) and, with passage, would likely do so in the Klamath River system as well. Passage will provide access to substantial areas of habitat.

E. Spring-run Chinook salmon

The Project excludes spring-run Chinook salmon from historical habitat above the Link River Dam (Hamilton et al. 2005). Restoring spring Chinook runs will contribute to the diversity of runs in the Klamath River and eventually restore fishing opportunities for tribal and recreational users in the Upper Klamath Basin. Historically, the Klamath River spring-run Chinook salmon predominated over the fall-run (Gatschet 1890; Spier 1930), (Hume in (Snyder 1931). Large populations of these fish were found in several of the Klamath's tributaries, including both the Williamson and Sprague rivers upstream of Upper Klamath Lake (California Department of Fish and Game 1990). Historical run sizes were estimated to be at least 5,000 spring–run Chinook in both the Sprague and Williamson Rivers (California Department of Fish and Game 1990). Adequate passage is necessary at dams below Link River Dam to facilitate fish movement to these rivers.

F. Steelhead

The Project excludes steelhead from historical spawning, incubation, and rearing habitats above the Link River Dam (Hamilton et al. 2005). Adequate upstream fish passage at dams below Link River Dam would restore these runs to 360 miles of currently productive anadromous fish habitat (if anadromous fish had access to this habitat) and an additional 60 miles of recoverable habitat (Huntington 2006).

3. Additional Fishway Benefits

Restoration of populations of anadromous fish above Iron Gate Dam will provide a drought resistant genetic source (see discussion on SONCC coho above), helping to protect coastal coho and Chinook salmon stocks during extreme drought or flood events (Weitkamp et al. 1995).

Increases in the abundance of natural Klamath River Chinook stocks will not just be limited to the Klamath River and associated fisheries. There are multiplier benefits to Chinook salmon fisheries coastwide from increases in the abundance of these natural Klamath River Chinook. In many years, the abundance of Klamath River Chinook salmon can directly affect the coastal

mixed stock fisheries. When Klamath abundance is low, overall fishing effort is restricted to protect those fish. For example, in 2000, the ratio of Klamath Chinook to Chinook harvest in other fisheries was projected to be approximately 1:25 fish (Allen Grover, CDFG, pers. comm.). An increase in the abundance of Klamath River fall-run Chinook in that year would have resulted in substantial multiplier benefits to overall Chinook harvest, if other harvest restrictions (e.g. to protect federally listed coho and CA Coastal Chinook) had not been in place. In years 2003-2005, the low abundance of Klamath stocks was again a factor in the restriction of coastal Chinook fisheries south of the Columbia River and in 2005 there was also a request for disaster relief associated with the restricted fisheries due to the low abundance of Klamath stocks (Pacific Fishery Management Council 2006b). In 2006, a forecast for low abundance of Klamath stocks could require closure of most salmon fisheries from Cape Falcon, Oregon to Point Sur, California (Pacific Fishery Management Council 2006a).

There are significant ecosystem benefits associated with anadromous fish reintroduction. Restoration of anadromous runs will provide benefits to native fishes such as bull trout (*Salvelinus confluentus*) - a threatened species present in the Wood, Sycan, and Sprague rivers. This species is known to seek anadromous fry and juveniles as food sources (Wydoski and Whitney 2003). Anadromous fish runs provide nutrient input from the marine environment. They are an important source of energy and nutrients for subsequent generations of salmon; and they help to maintain proper ecological function (Stockner 2003). Over the past century, the natural contribution of marine-based nutrients to Pacific Northwest rivers declined in proportion to the decrease in salmon spawning (Gresh et al. 2000). When salmon return from the ocean to spawn, they bring vital nutrients with them to the watershed. Their decomposing carcasses provide a vital source of food and nutrients, not just for other fish species and wildlife, but for a whole host of organisms in the watershed. In addition to elemental nutrients, salmon carcasses contain minerals, amino acids, proteins, fats, carbohydrates, and other essential biochemicals for living organisms (Wipfli et al. 2003). The significance of these biochemicals and their availability to the food web may be more important than nitrogen, phosphorous, or other nutrients (Wipfli et al. 2003). Reintroduction of marine-derived nutrients from salmon carcasses will have a positive effect on the recovery of riparian ecosystems in the Klamath River Basin and provide associated benefits to other species, including federally listed suckers and terrestrial wildlife.

As a strategic approach to restoring Pacific Northwest watersheds, efforts should first focus on reconnecting isolated, high quality fish habitats made inaccessible by artificial obstructions (Roni et al. 2002). The safe, effective, and timely passage of fish around dams on the Klamath River is consistent with this strategy. The portion of the Klamath River watershed below the current upstream limit of anadromy continues to support viable (albeit diminished) runs of Pacific lamprey, steelhead, coho salmon, as well as spring-run and fall-run Chinook salmon. A run of over 30,000 hatchery and natural spring-run Chinook salmon still exists in the Trinity River and a remnant run of wild spring-run Chinook persists in the Salmon River. In the area of the Basin upstream from Iron Gate Dam, existing habitat continues to support fluvial and ad-fluvial populations of redband trout, and in some places, cold water species such as brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), and bull trout. Many of the necessary components of

the ecosystem above Iron Gate Dam appear to be present and functional, or are restorable to functional form (California Department of Fish and Game 2005; Klamath Basin Ecosystem Foundation 2005; USDI Bureau of Land Management 2005; USDI Bureau of Land Management et al. 1995; USDI Fish and Wildlife Service 2004c).

The safe, effective, and timely passage of fish around dams on the Klamath River has significant potential to assist in the recovery of depressed stocks of anadromous fish. While the entire Upper Klamath and Trinity Rivers Chinook ESU is not listed under the ESA (Myers et al. 1997), the Klamath River spring-run Chinook population is considered to be at high risk of extinction (Nehlsen et al. 1991). The Klamath Mountains Province steelhead ESU is not listed under the ESA (Busby et al. 1996), but summer steelhead in the lower Basin are in decline and are identified as being at high risk of extinction (Nehlsen et al. 1991). Access to hundreds of miles of historical anadromous habitat above dams on the Klamath River (Huntington 2006) would greatly benefit these stocks and may reduce the potential for future ESU listings under Federal and State Endangered Species Acts.

C. Summary of Benefits and Need for Fishway Prescriptions

The Upper Klamath River, above Iron Gate Dam, historically supported the spawning and rearing of large populations of both anadromous and resident fish. Due to several factors, including impacts from the Project, Klamath River anadromous fish populations are substantially diminished and, in some cases, struggling to survive. Safe, timely, and effective fishways at all hydropower and water diversion developments on the river are essential precursors to the eventual re-establishment of more robust and resilient fish populations.

Fish passage at Project developments at and above Iron Gate Dam will provide multiple benefits to society and the environment:

- Access to hundreds of miles of habitat for returning anadromous species
- Restoration of native and resident fish populations
- Restoration of historical migration patterns and access to refugial areas
- Improved species diversity and ecosystem integrity
- Resilience of commercially important Chinook stocks
- Significant contributions to coastwide and Klamath River fisheries
- Fulfillment of numerous government and stakeholder goals and objectives
- Restoration of important public trust resources
- Minimizing the loss of federally listed suckers due to entrainment by the Project

V. PRELIMINARY SECTION 18 PRESCRIPTIONS FOR FISHWAYS

Section 18 of the Federal Power Act (16 U.S.C. 811) states in part that: "the Commission shall require the construction, maintenance, and operation by a Licensee of... such fishways as may be prescribed by the Secretary of Commerce or the Secretary of Interior." Section 1701(b) of the National Energy Policy Act of 1992, P.L. 102-486, provides guidance as to what constitutes a fishway. Section 1701(b) states: "The items which may constitute a 'fishway' under section 18 for the safe and timely upstream and downstream passage of fish shall be limited to physical structures, facilities, or devices necessary to maintain all life stages of such fish, and Project operations and measures related to such structures, facilities, or devices which are necessary to ensure the effectiveness of such structures, facilities, or devices, for such fish."

These preliminary fishway prescriptions are based on the best biological and engineering information available, as described more fully in the explanatory statements that accompany each preliminary prescription. Although the maximum benefits to the fisheries are accrued with the combination of all the prescription elements in Section V, each prescription also stands on its own, and provides its own benefits. These prescriptions have been developed over a period of several years by the biological and engineering staff of the Services, in consultation with the Applicant, the U.S. Bureau of Land Management (BLM), the California Department of Fish and Game (CDFG), ODFW, affected Tribes, the Klamath Intertribal Commission, and other entities that are participating in this relicensing proceeding. Each preliminary prescription is based on substantial evidence contained in the record of this licensing proceeding before the Commission, and filed herein with the Commission. The explanatory statements below are intended only to summarize the supporting information and analysis upon which these preliminary prescriptions are based. Several documents previously submitted to the record in this proceeding contain detailed and specific information describing the Project's impacts on fish and wildlife (National Marine Fisheries Service 2003 DLA; National Marine Fisheries Service 2004 FLA; U. S. Department of the Interior 2004). These documents, including the relevant descriptions of baseline reference conditions and ongoing Project effects relative to applicable resource planning goals, provide relevant supporting information pertaining to Project impacts on anadromous fish and their habitat. All documents previously filed with the Commission by the Services are hereby incorporated by this reference.

For the Service, the preliminary prescriptions for fishways herein are issued under the authority of the Secretary of the Interior pursuant to section 18 of the Federal Power Act (see 64 Stat.1262). The Service's preliminary prescriptions are also consistent with the requirements of the Guidance for the Prescription of Fishways Pursuant to Section 18 of the FPA (USDI Fish and Wildlife Service 2002).

NMFS hereby prescribes, on a preliminary basis, the following license conditions for the construction, operation and maintenance of upstream and downstream fishways for the Klamath Hydroelectric Project pursuant to its authority under section 18 of the Federal Power Act, 16 U.S.C. § 811 as delegated to NMFS by the Secretary of Commerce.

A. RESERVATION OF AUTHORITY TO PRESCRIBE FISHWAYS

NMFS reserves the right to modify these preliminary fishway prescriptions and recommended terms and conditions in any comments filed responding to any subsequent Notice of Offer of Settlement issued by the Commission. In addition, NMFS reserves the right to modify its preliminary fishway prescriptions and its recommended terms and conditions, based on the results of new information and conclusions developed during the Commission's NEPA analysis, comments received as a result of public or agency review, or in connection with the fulfillment of other statutory consultation and review requirements, including review pursuant to regulations at 50 CFR Part 221 for implementing requirements under the Energy Policy act of 2005, or pursuant to section 7 of the ESA 16 U.S.C 1536 (implementing regulations at 50 C.F.R Part 402), or section 305(b) of the Magnuson-Stevens Act, 16 U.S.C. 1855(b), regarding essential fish habitat (implementing regulations at 50 C.F.R. Part 600, Subpart K). NMFS anticipates submitting any modified prescriptions and terms and conditions by no later than 60 days after the Commission's issuance of a Draft Environmental Impact Statement (DEIS). Finally, NMFS expressly reserves the right to revise its fishway prescriptions and recommended terms and conditions prior to a final licensing decision based upon significant new information or modifications to the Commission's proposed licensing alternative following the Commission's completion of an EIS or upon rehearing of the Commission's licensing order.

NMFS exercises its authority under section 18 and requests that the Commission include the following condition in any license it may issue for the Project:

> NMFS expressly reserves its authority under section 18 of the FPA to prescribe such additional or modified fishways at those locations and at such times as it may subsequently determine are necessary to provide for effective upstream and downstream passage of anadromous fish through the Project developments, including without limitation its authority to amend the following fishway prescriptions upon approval by NMFS of such plans, designs and implementation schedules pertaining to fishway construction, operation, maintenance and monitoring as may be submitted by the applicant (licensee) in accordance with the terms of the license articles containing such fishway prescriptions. NMFS is prescribing the design and construction standards for fishways herein. As an alternative, if necessary, authority is reserved to prescribe performance standards to ensure safe, timely, and effective movement of fish.

The Service reserves the right to modify its preliminary fishway prescriptions based on the results of new information and conclusions developed during the Commission's NEPA analysis, comments received as a result of public or agency review, or in connection with the fulfillment of other statutory consultation and review requirements, including review pursuant to 43 C.F.R Part 45 and consultation under section 7 of the ESA (16 U.S.C 1536 (implementing regulations at 50 C.F.R Part 402)). The Service anticipates submitting any modified prescriptions by no later than 60 days after the Commission's issuance of a Draft Environmental Impact Statement (DEIS). Finally, the Service expressly reserves the right to revise its fishway prescriptions prior

to a final licensing decision based upon significant new information or modifications to the Commission's proposed licensing alternative following the Commission's completion of an EIS or upon rehearing of the Commission's licensing order.

This reservation of authority allows the Service to consider additional data as it becomes available, to respond to changed circumstances, and modify the existing section 18 prescriptions as may be necessary. The reservation of mandatory authorities under the FPA has been accepted by the Commission and judicially affirmed. *Wisconsin Public Services Corp.*, 62 FERC ¶ 61,905 (1993), *aff'd, Wisconsin Public Serv. Corp. v. FERC*, 32 F.3d 1165 (7th Cir. 1994).

The Klamath Tribes of Oregon hold treaty-protected property rights, including fishing and water rights, in the upper Klamath Basin. The United States and the Klamath Tribes have jointly filed claims in the State of Oregon's water rights adjudication for the surface waters of the Klamath Basin in Oregon, including instream flow claims within the Project area (from Link River Dam to the Oregon-California border), to protect the Tribes' fishing and water rights reserved to them pursuant to their 1864 Treaty with the United States. In addition, the Hoopa Valley and Yurok Tribes have confirmed reserved fishing rights in the lower Klamath Basin, and the water necessary to protect those rights may likewise be determined in a subsequent proceeding.

Any license articles required for this Project's license, including those to protect federal interests, must be consistent with these reserved rights. Additional data or other information, including a binding decree resulting from the State of Oregon's water rights adjudication, may require modification to the license conditions. Thus, the Service is submitting this reservation of authority. The Service's other recommendations do not ask Commission to take any action or otherwise engage in the issues being addressed in the water rights adjudication.

The Service has prepared its preliminary prescriptions for fishways in response to the proposals being considered by the Commission in this proceeding. If any proposal is modified prior to licensing, as a result of licensing, or after licensing, then the Service will require adequate opportunity to reconsider each prescription and make modifications it deems appropriate and necessary for submittal to the Commission. Therefore, the Service exercises its authority under section 18 and requests that the Commission include the following condition in any license it may issue for the Project:

> Authority is reserved for the Service to prescribe the construction, operation, and maintenance of fishways at the Klamath River Hydroelectric Project, Project No. 2082, as appropriate, including measures to determine, ensure, or improve the effectiveness of such fishways, pursuant to section 18 of the FPA, as amended. This reservation includes, but is not limited to, authority to prescribe fishways for spring and fall-run Chinook salmon, coho salmon, steelhead trout, Pacific lamprey, Lost River and shortnose suckers, and any other fish to be managed, enhanced, protected, or restored to the Klamath River Basin during the term of the license. Authority is reserved to the Service to prescribe an upstream fishway to sucker criteria at Keno Dam pending the evaluation of the need for such a

fishway. The Service is prescribing the design and construction standards for fishways herein. As an alternative, if necessary, authority is reserved to prescribe performance standards to ensure safe, timely, and effective movement of fish.

The Services reserve the authority to modify these prescriptions for fishways at any time before license issuance, as well as any time during the term of the license, after review of new information.

B. PRELIMINARY PRESCRIPTIONS FOR FISHWAYS

These prescriptions for the Klamath Project include design specifications and implementation schedules, operating requirements and procedures, and specifications for post-installation implementation, evaluation, and maintenance. The Services have carefully reviewed these preliminary prescriptions, and consider them to fall fully within the scope of their section 18 authority. In general, the Licensee shall develop all elements of the prescriptions in consultation with appropriate technical specialists of the Services, along with CDFG, ODFW, and affected Tribes where appropriate.

Design, construction, evaluation, monitoring and modifications of developments shall be conducted according to NMFS guidelines (National Marine Fisheries Service 2003). The Services expect that the Licensee shall employ all measures necessary and appropriate to maximize upstream and downstream fish passage effectiveness for resident and anadromous species over the full range of river flows for which the Project maintains operational control. The Licensee shall manage Project reservoirs and forebays to ensure that all upstream and downstream fish passage facilities are fully operational at all times and at all reservoir elevations and inflows. Other general prescriptions for fishways are specified to provide for the modification, inspection, and maintenance of upstream and downstream fishways during the term of the license.

Rationale for General Preliminary Prescriptions*:*

Agency Review and Approval: Because the Services, along with other Federal, State, and Tribal partners, have considerable expertise, experience, and responsibilities in fishway system design and operations, it is standard procedure for this type of design review procedure to be instituted for any plans proposed by the Licensee or its agent(s). This is particularly true where Federal and State oversight is implied by law, either explicitly or implicitly, as is the case here. The Services possess multi-disciplinary technical review capabilities to assist the Licensee in developing effective functional fishway system designs. A Fisheries Technical Subcommittee (FTS), to be established by the Services and comprised of engineers, biologists, and other fish passage specialists, will help ensure quality and performance of complex hydraulic and biological systems.

Sequencing of Construction and Operations Rationale: As explained in greater detail below in the rationale for specific preliminary prescriptions, adult and juvenile fish may migrate into

Project facilities that may cause injury or mortality if measures are not in place to ensure their protection. For example, if adult fish are allowed to migrate upstream via a fish ladder, they may become susceptible to entrainment in hydro-turbines unless the downstream screening facilities are also in place. Large numbers of juvenile fish (downstream migrants) will be particularly susceptible to entrainment into hydro-turbines if screen and bypass systems are not in place and functioning for their protection. The Services intend to work with the Licensee to design the best sequence for the construction and operation of fishway facilities when more specific design information is known.

Design and Construction: Fish passage facilities shall be completed on a phased schedule to allow appropriate time for design and contracting construction. The Licensee shall complete downstream fishways (screens, bypasses, and spillway modifications) at each development, at or before the completion of the upstream fishway at that development, to prevent injury or mortality to fallback fish.

Access to Developments and Records Rationale: The Licensee shall grant reasonable access to developments and Project records so that Agency personnel will be able to evaluate fishway performance, inspect fishway facilities, and help to optimize facility performance based upon those evaluations and inspections.

Post-Construction Evaluation: The Licensee must complete a Post-construction Evaluation Plan for review and approval by the Services because it will be necessary to determine fishway system effectiveness and to identify and correct any fish delay, loss, injury, or hydraulic problems that may be present. Adjustments are often required to achieve optimal fish passage conditions within the fishway, in front of screens, and within bypass systems, or to achieve effective attraction flows in front of fishway entrances. After the initial adjustments have been made, wear and tear, accumulation of sediment and other debris, and various other factors can, over a period of time, alter hydraulic conditions and decrease the effectiveness of fishways (National Marine Fisheries Service 2003). Therefore, periodic evaluations of fishway effectiveness are necessary to assure continuing compliance and the safe, timely, and effective passage of fish.

Maintenance Requirement: It is essential that the Licensee observe proper maintenance practices for the correct, long term operation of each facility. Large scale fishways and fish protection systems are subject to continuous operations and harsh riverine and climatic conditions. Because vital fish migrations occur at each site on a regular basis, the Services must be notified whenever system maintenance is required that may cause excessive delay, injury, or mortality to migrating fish, or other species. An explicit element of fishway maintenance is the design of facilities that can withstand the elements and perform in continuous duty. Proper maintenance is necessary to ensure the temporal movement of fish in completing their biological requirements, including spawning, smolting, and outmigration (National Marine Fisheries Service 2003).

Maintenance, Inspection, and Operation Plan Rationale: Effective operation and performance of the fishways, including fish screens, conveyance, and bypass facilities, are also dependent on

regular inspection and maintenance to assure proper operating conditions within the fishway. Wear and tear, corrosion, accumulation of sediment and debris, and various other factors decrease the effectiveness of the fishway's physical features such as screens and seals. If left untreated, this would increase fish losses. Annual inspections of the physical features prior to each migratory period are necessary to assure that all elements of the fishways are in good condition and will operate effectively (National Marine Fisheries Service 2003). Maintenance procedures during shutdown periods need to include provisions for timing fishway maintenance to avoid peak migration periods and safely removing fish from the fishways and returning them to the river. All fishway elements need to be made available to fishery agencies (the Services, CDFG, ODFW, and the Tribes) for immediate inspection to ensure proper implementation of and compliance with fishway operation and maintenance conditions.

Fishway Evaluation and Modification Plan Rationale: It is important that the Licensee complete Fishway Evaluation and Modification (FEMPs) for the optimal operation of each fishway for the safe, effective, and timely passage of each species. These plans need to include measures to remedy problems with fish passage observed through operations and maintenance and fishway evaluations. FEMPs are necessary to achieve program goals, objectives, and strategies. To assess progress towards these goals and objectives, and minimize fish losses, the Service and NMFS-Engineering must approve these plans.

Annual Work Plan Rationale: The FEMPs will include an Annual Work Plan describing prospective actions the Licensee will take to implement and monitor fish passage. The Work Plan will ensure adequate and timely coordination between the Licensee and the Services, allowing the Services to determine whether program goals are being achieved and whether the Licensee is utilizing appropriate methodologies.

Attraction Flow Rationale: The higher percentage of total river flow used for attraction into the fishway, the more effective the facility will be in providing upstream passage. Experience with other fish facilities often shows that lack of adequate attraction flow, poor auxiliary water system design and operation, or unsatisfactory water quality can be major limiting factors in successful fish passage (National Marine Fisheries Service 2003)[8]. However, water allocated for attraction flow cannot be used for electricity generation. Therefore, the Services will allow the Licensee to scientifically test whether fish passage efficiency can be satisfactorily maintained with attraction flow rates between 5 and 10 percent. Testing will be based upon experimental testing protocols recommended by the Services to optimize the balance between attraction flow and fish passage efficiency. If statistically valid testing proves that flows less than ten percent, but not less than 5 per cent (National Marine Fisheries Service 2003), can provide equivalent passage efficiency, then the Services may authorize the Licensee to adopt a different attraction flow regime. It is recognized that attraction flows may vary depending on a variety of factors and over time. This prescription recognizes that variability and offers the Licensee the opportunity to demonstrate the viability of different attraction flow regimes and to adaptively manage Project operations during the new license term.

[8] Some large hydropower installations use pump-back systems to recover auxiliary water so that it can be used for electricity generation.

High and Low Passage Design Flow Rationale: The design streamflow range for fish passage, bracketed by the designated fish passage design high and low flows, constitutes the bounds of the fish passage facility design where fish passage facilities must operate within the specified design criteria. Within this range of streamflow, migrants must be able to pass safely and quickly. The low passage design flow is the lowest stream discharge for which migrants are expected to be present, migrating, and dependent on the proposed facility for safe passage. The high fish passage design flow rationale is the highest stream discharge for which migrants are expected to be present, migrating, and dependent on the proposed facility for safe passage. Within this range of streamflow, migrants should be able to pass in a safe and timely fashion. Outside of this flow range, fish are expected to be either not present or not be actively migrating, or shall be able to pass safely without need of a fish passage facility. Site-specific information is critical to determine the design time period and river flows for the passage facility. Local hydrology may require that these design streamflows be modified for a particular site (National Marine Fisheries Service 2003).

General Preliminary Prescriptions:

The following general prescriptions for fishways apply to each of the specific prescriptions below for the construction, operation, and maintenance of upstream and downstream fishways at the Project. These preliminary prescriptions are included to ensure the effectiveness of the fishways pursuant to section 1701(b) of the 1992 National Energy Policy Act (P.L. 102-486, Title XVII, 106 Stat. 3008).

1.1.1. *Design and Construction Plans*: For each facility, the Licensee shall develop detailed design, construction, evaluation, and monitoring plans for review and approval by the Services prior to construction. All original plans, and subsequent modifications of facilities, shall be conducted according to NMFS guidelines for the design of fish screens, fishways, and other fish passage structures (National Marine Fisheries Service 1997, 2003). The Licensee, or their authorized and qualified agent(s),[9] shall have all designs reviewed by the FTS. The Licensee and its agents must establish close consultation with Agency fisheries engineering and fish passage specialists at the outset of design and throughout the entire process. The initial design meetings shall commence at the pre-design, or conceptual-level design phase. Prior to advancing to feasibility-level of design, the Services must concur with all preferred alternatives for each independent facility, or any major feature of a facility. The Licensee will then proceed with the feasibility and final design phases providing detailed design, specification, and construction plans at the 50, 90, and 100 percent stage of completion. The Licensee shall schedule and provide a minimum of 90 days for the Services' engineering and technical specialists to review and approve

[9] "Authorized agents" will typically be qualified engineering and/or biological consulting firms who specialize in this area of work.

comprehensive plans. Shorter review periods may be possible, depending on the nature of the subject, as approved by the Services. The Licensee shall implement any design modifications as required by the Services as necessary to fulfill the objective of safe, timely, and effective passage for all species considered. The Licensee shall include in plans and obtain any critical spare parts or equipment, as needed to effect timely repairs of critical system components. The Licensee shall complete and begin operation of fish passage facilities in a phased schedule. The phased schedule will allow appropriate time and sequencing for design, contracting, and construction. Unless otherwise approved, downstream fishways (screens, bypasses, and spillway modifications) at each development must be complete prior to the completion of the upstream fishway at any given development. After approval by the Services, the Licensee shall file final designs with the Commission. The Services may specify the acquisition of any critical spare parts or equipment, as needed to effect timely repairs of critical system components. Fish passage facilities shall be completed, and brought on line, in a phased schedule. This will allow appropriate time and sequencing for design, contracting, construction, and in some cases, studies of the optimal design for tailrace barriers, or other facility enhancements not immediately apparent. Unless otherwise approved, downstream fishways (screens, bypasses, and spillway modifications) at each development must be complete prior to the completion of the upstream fishway at any given development. The designs approved by the Services shall be filed with the Commission.

1.1.2. *Access to Developments and Records*: The Licensee shall provide timely site access to Agency personnel at all Klamath River Hydroelectric Project developments, as well as pertinent Project records for the purpose of inspecting fishways to determine compliance with this fishway prescription.

1.1.3. *Maintenance Requirement:* The Licensee shall keep all fishways in proper order, and shall keep all fishway areas clear of trash, sediment, logs, debris, and other material that would hinder passage, or create a personnel safety hazard. The Licensee shall perform anticipated maintenance well in advance of any critical migratory periods so that fishways can be tested, inspected, and be operating effectively during fish migration. If any fishway system becomes seriously damaged or inoperable, the Licensee shall notify NMFS Engineering and the Service within 48 hours. The Licensee shall take remedial in a timely manner and in a manner satisfactory to NMFS-Engineering and the Service.

1.1.4. *Fishway Operation, Inspection, and Maintenance Plans*: The Licensee shall, in consultation with the Services, affected Tribes, CDFG and ODFW, develop a fishway operation, inspection, and maintenance plan describing anticipated operation, inspections, maintenance, schedules, inspections, and contingencies for each fish passage facility. The operation, inspection, and maintenance plans shall be submitted to the Service and NMFS Engineering

for final review and approval with final designs for fishway construction. To minimize fish losses, the Licensee must complete these plans and ensure adequate time for review and approval by the Service and NMFS Engineering prior to the completion of construction and operation of each upstream and downstream fish passage facility. After approval by the Services, the Licensee shall file these plans with the Commission.

1.1.5. *Post Construction Fishway Evaluation Plans:* Prior to the completion of construction of the new fishways, the Licensee shall, in consultation with the Services, ODFW, CDFG, and affected Tribes, develop post-construction monitoring and evaluation plans to assess the effectiveness of each fishway, spillway, and the tailrace barrier prescribed below. The plans shall include hydraulic, water quality, and biological evaluations using Passive Integrated Transponder (PIT) or similar technology to detect and record fish passage and assess the performance of the fishway, including measures for follow-up evaluations of effectiveness and fish survival through fishways. The Licensee shall provide a report on the monitoring and evaluation of the developments annually for the term of the new license. Specifically, the plans must include measures to estimate numbers of fish passed by species on a daily basis (including but not limited to spring-run and fall-run Chinook salmon, coho salmon, steelhead, Pacific lamprey, Lost River and shortnose suckers, and redband/rainbow trout), sampling of fish size, and the sampling of age class of fish passed at each development on a daily basis; a record of the daily observations by a qualified fisheries biologist on the physical condition of the fish using the fishways; and a continuous record of DO (dissolved oxygen) and water temperature at locations in the fishway as determined by the Services, and in front of and adjacent to the entrance(s) and exit(s) of the fishways. The evaluation plans shall be submitted to the Services for final review and approval within six months of the date when final designs for fishway construction are approved by the Services. At least 60 days shall be provided for Services to review the evaluation plans. The Licensee shall fund and implement the approved plans and any plan modifications, operational or physical changes necessary for the safe, effective, and timely passage of fish as may be required by the Services. The Agency approved designs shall be filed with the Commission.

1.1.6 *Fishway Evaluation and Modification Plans:* The Licensee shall, in consultation with the FTS, prepare a Fishway Evaluation and Modification Plan (FEMP) for each fishway, spillway, and tailrace barrier prescribed to achieve the Services' fish passage goals and objectives. The Licensee shall provide an outline of the FEMPs to the Services no later than one year after license issuance. Consultation with the agencies listed above shall begin as early as possible following license issuance. The Licensee shall document all consultation, including the agencies' responses to requests for consultation, and include this documentation in the FEMPs. The complete FEMPs shall be submitted to the Services for review and approval no later

than eighteen months from the date of license issuance. At least 60 days shall be provided for review. After receiving the Services' approval, the Licensee shall file the FEMPs with the Commission.

A. Each FEMP shall include:

1. A specifically quantified program to meet the Services' fish passage goals, objectives, and strategies;
2. The Services criteria by which to measure progress towards fisheries management goals;
3. Procedures for redirecting effort, including funding, as necessary under adaptive fishway management to achieve the Services' goals and objectives;
4. Schedule for implementation of activities to achieve the Services' goals and objectives;
5. A monitoring plan to evaluate progress towards, and achievement of the Services' goals and objectives; and
6. A format for the Annual Report and Annual Work Plan, which are described below.

B. The Services, in consultation with the States of Oregon and California as well as affected Tribes, will review the FEMPs and reserve the right to accept, reject, or modify the FEMPs, in whole or in part, to ensure the safe, timely, and effective passage of resident and anadromous fish. Any reviews or amendments to the FEMPs, over the term of the license, shall be subject to the same level of Services' review and approval as the original FEMPs. After receiving the Services' approval, the Licensee shall file with the Commission FEMPs and any amendments therein.

C. By February 1 of every year, for the term of the License and all annual licenses, the Licensee shall submit to the Services for approval an Annual Report detailing the work accomplished under the FEMPs during the previous calendar year, progress made toward program goals and objectives, plans or suggestions to redirect effort per adaptive fishway management with a detailed justification of why this is warranted, and documentation of consultation with the Services and their responses. After receiving Services' approval, the Licensee will submit each Annual Report to the Commission.

D. By December 1 of every year, for the term of the License and all annual licenses, the Licensee shall submit to the Services for approval an Annual Work Plan detailing the Licensee's proposed activities for the next calendar year as necessary to implement the FEMPs. The work plan must provide sufficient detail for the Services to determine whether the Plan

continues to provide for the safe, effective, and timely passage of resident and anadromous fish. The Annual Work Plan shall include, but not be limited to, detailed information on methods to be employed; schedule of activities; and explanations of how planned activities will help attain program goals.

1.1.7. *Upstream Fishway Attraction Flows and Range of Design Flow*: The following general prescriptions for design flow ranges and attraction flows for fishways apply to each of the specific prescriptions below for the construction, operation, and maintenance of upstream fishways at the Project. These prescriptions are included to ensure the effectiveness of the fishways consistent with NMFS guidelines and criteria (National Marine Fisheries Service 2003).

A. The Licensee shall design each upstream fish passage facility to pass migrants throughout a design streamflow range, bracketed by a designated High and Low Fish Passage Design Flow.

1. Low Fish Passage Design Flow - For each upstream fish passage facility the Low Fish Passage Design Flow shall be the mean daily average stream discharge that is exceeded 95 percent of the time during periods when migrating fish are normally (historically) present at the site, as determined by a flow-duration curve summarizing at least the previous 25 years of daily discharges or, if discharge records are not available, by an artificial streamflow duration methodology approved by the Services. This could also be an applicable minimum instream flow, as determined by state regulatory agencies, by ESA consultations with NMFS, or by an article in Project license.

2. High Fish Passage Design Flow - For each upstream fish passage facility, the High Fish Passage Design Flow shall be the mean daily average stream discharge that is exceeded 5 percent of the time during periods when migrating fish are normally (historically) present at the site, as determined by a flow-duration curve summarizing at least the previous 25 years of daily discharges or, if discharge records are not available, by an artificial streamflow duration methodology.

B. Each upstream fish passage facility shall provide physical facilities capable of producing at least 10 percent attraction flow as a percent of High Fish Passage Design Flow. Attraction flow is the total amount of flow discharged from the fishway entrance pool at any given time. For fishways in streams with mean annual streamflows exceeding 1000 cubic

feet per second (cfs), the Licensee shall determine the optimum attraction flow in consultation with the Services (National Marine Fisheries Service 2003). During facility evaluations, attraction flows may be throttled for testing purposes between the range of 5 percent and 10 percent, in order to determine whether fish passage efficiency can be maintained at a lower attraction flow.

C. The Licensee shall ensure that any reduction in attraction flow shall not result in reduction in fish passage efficiency below performance standards (established by the Services) during seasons of important fish migrations. The Licensee shall test fishway performance in accordance with experimental testing protocols recommended by the FTS. The Licensee shall report testing results to the Services, and implement adaptive management measures to alter attraction flows (to no less that 5 percent), if approved by the Services. The Licensee shall report any changes in attraction flows to the Commission. In the absence of valid experimental results, the default attraction flow is 10 percent.

Specific Fishway Prescriptions for Klamath Hydroelectric Project Fishways

All general prescriptions above shall apply to the specific prescriptions below. The preliminary prescriptions for developments in the Project are summarized in Table 4.

Table 4. Summary of Preliminary Fishway Prescriptions and Timetable for the Klamath Hydroelectric Project (Commission Project #2082)

Development	Target Species	Fish Ladder and Passage Impediment Modification (in Chronological Order)	Tailrace Barrier	Screens and Bypass	Spillway Modifica-tions	Interim, Seasonal Trap and Haul
Copco 2 Bedrock Sill	Salmonids, lamprey	2 yrs (Bypass Barrier/Impediment Modification)	Not Applicable (NA)	NA	NA	NA
JC Boyle	Salmonids, lamprey	2 yrs (Bypass Barrier/Impediment Modification)	NA	NA	NA	NA
Eastside	Salmonids, lamprey, suckers	BOR current facility	3 yrs[1]	3 yrs[2] (to sucker criteria)	NA	Seasonal downstream trapping and hauling for Chinook
Westside	Salmonids, lamprey, suckers	BOR current facility	3 yrs[1]	3 yrs[2] (to sucker criteria)	NA	Seasonal downstream trapping and hauling for Chinook
Fall Creek	Resident trout	3 yrs (0.5 ft/drop and ≤ 10%)	5 yrs[3]	3 yrs	NA	NA
Spring Creek	Resident trout	3 yrs (0.5 ft/drop and ≤ 10%)	NA	3 yrs	NA	NA
Keno	Salmonids, lamprey,	3 yrs (0.5 ft/drop and ≤ 10%)	NA	NA	3 yrs	Seasonal upstream trapping and hauling for Chinook
Iron Gate	Salmonids, lamprey	5 yrs (0.5 ft/drop and ≤ 10%)	NA	5 yrs	5 yrs	Modify existing trapping facility
Copco 2	Salmonids, lamprey	6 yrs (0.5 ft/drop and ≤ 10%)	8 yrs[3]	6 yrs	6 yrs	NA
Copco 1	Salmonids, lamprey	6 yrs (0.5 ft/drop and ≤ 10%)	8 yrs[3] (if adults in C2 pool)	6 yrs (bypass below C2)	6 yrs	NA

[1]Study of impacts to and the potential design and construction of tailrace barrier is given priority due to the presence of federally listed suckers
[2] Screen and bypass system given priority due to the presence of federally listed suckers
[3] Tailrace Barrier design and construction deferred for study to determine optimal design

1. Iron Gate Dam

Upstream Prescription Rationale: Historically coho salmon, Pacific lamprey, steelhead, and spring-run and fall-run Chinook salmon (Hamilton et al. 2005) and resident trout migrated above the site of Iron Gate Dam to reach holding, spawning, incubation, and rearing habitat. Iron Gate Dam is a barrier to this passage and thus to critical holding, spawning, incubation, and rearing habitat in tributaries (Slide, Scotch, Camp, Jenny, Salt, and Fall creeks) and the Copco 2 bypass reach. The goal of the Services and the Klamath River Basin Fisheries Task Force is to successfully restore anadromous salmonids to their historical range and habitat. A goal of the Service is to successfully restore resident fish to their historical range and habitat as well. The means of reaching these goals is restoration of safe, timely, and effective fish movement. Volitional fish passage at Iron Gate Dam would be consistent with the goals and objectives of the Services and the Klamath River Basin Fisheries Task Force for resource management. The Licensee shall provide effective facilities to meet these goals and mitigate for the impacts of the dam. A holding, sorting, and counting facility is necessary to segregate and mark fish for management purposes, including returning fish resulting from upstream restoration for transport efforts. The 5 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Benefits: Specific benefits of fishways at Iron Gate Dam include:

Resident Trout: For the resident redband trout currently present both above and below Iron Gate Dam, fishways would restore historical seasonal movement for immature fish, restore population connectivity and genetic diversity, and allow greater utilization of existing habitat and refugial areas. Fish passage at Iron Gate Dam alone would restore the connectivity of resident redband populations in the mainstem Klamath River with those in the Copco 2 bypassed channel and Slide, Scotch, Camp, Jenny, Salt, and Fall creeks. These tributaries also provide important habitat elements, such as spawning and temperature related refugial areas. In particular, Fall Creek provides a steady volume of high quality water and historically provided good habitat for resident fish, including rainbow/redband trout, Klamath small-scaled suckers (*Catastomus rimiculus*), and Klamath sculpin (*Cottus klamathensis*) (Coots 1957). With fish passage, seasonal migration of trout and access to refugial areas would be restored.

- Coho: Coho salmon are present in the Klamath River below the dam and were present historically above the dam. Iron Gate Dam blocks these fish species from reaching elements of their historical habitat. Between Iron Gate Dam and the next barrier upstream (Copco 2 Dam), coho salmon would regain access to 11.1 miles of habitat, including tributaries and the Copco 2 bypass reach (Table 3). National Research Council (2003) considered the amount of this tributary habitat between Iron Gate Dam and the next barrier upstream to be substantial. Coho are known to have spawned in Fall Creek (California Department of Water Resources 1964; Coots 1954; Coots 1957; Coots 1962). In both 1951 and 1952, at least 10 adult coho spawned in Fall Creek and greater than 29,600 young of the year and juvenile coho salmon outmigrated in 1954 (Coots 1954). No information is available for Scotch, Slide, Camp, and Jenny creeks, but the lower

reaches of these streams are relatively low gradient and appear to be suitable coho habitat. With fish passage, coho will have access to this habitat and access to refugial areas would be restored.

- Fall-run Chinook: With fish passage at Iron Gate Dam, fall-run Chinook salmon access would be restored to 11.1 miles of habitat, including Scotch, Camp, Jenny, and Fall Creeks (Table 3) between Iron Gate Dam and the next barrier upstream (Copco 2 Dam). Prior to the construction of Iron Gate Dam, escapement of Chinook salmon to Jenny and Fall Creeks averaged 215 and 1,384 adults respectively from 1950 to 1960 (Coots 1957; Coots 1962; Coots and Wales 1952; Wales and Coots 1954). With fish passage, fall-run Chinook will have access to this habitat again. Seasonal migration of fall-run Chinook and access to refugial areas would be restored.
- Spring-run Chinook: With fish passage at Iron Gate Dam, spring-run Chinook salmon would regain access to cool water refugial areas necessary for this run of fish (McCullough 1999) such as Fall Creek. Spring-run Chinook would also regain access to upstream migration corridors necessary to reach historical spawning areas in the Upper Klamath Basin (California Department of Fish and Game 1990).
- Pacific Lamprey With fish passage at Iron Gate Dam, Pacific lamprey would regain access to 13.7 miles of habitat, including tributaries and the Copco 2 bypass reach (Table 3) between Iron Gate Dam and the next barrier upstream (Copco 2 Dam). Pacific lamprey are known to have been present and spawning in Fall Creek (Coots 1954, 1957). With fish passage, lamprey will have access to this habitat again.
- Steelhead With fish passage at Iron Gate Dam, steelhead would regain access to 13.7 miles of habitat, including tributaries and the Copco 2 bypass reach (Table 3), between Iron Gate Dam and the next barrier upstream (Copco 2 Dam). Adult steelhead have been documented in Fall Creek (Coots 1957, 1962). During 1951-1952, 471 steelhead spawners were counted in Fall Creek and between January and April 1954, more than 6,500 fry and 1,200 yearling steelhead emigrated from Fall Creek (Coots 1954). Steelhead are generally tributary spawners and able to access reaches of tributaries upstream from areas where salmon spawn (Platts and Partridge 1978). Therefore, with fish passage, steelhead would have access to habitat in its entirety in tributaries above Iron Gate Dam. Steelhead would have access to 13.7 miles of habitat in Slide, Scotch, Camp, Jenny, and Fall creeks. Seasonal migration of steelhead and access to refugial areas would be restored.

Downstream Prescription Rationale: Downstream fishways and fishway modifications are prescribed for Iron Gate Dam. Redband/rainbow trout and other resident fish (including federally listed suckers) are currently present in Iron Gate Reservoir. The Services conclude that trout (in particular fry and juveniles) move downstream (Hemmingsen 1997), a significant portion move through the powerhouse, and turbine entrainment at Iron Gate Dam causes significant mortality to downstream migrating redband trout (see discussion of turbine-caused mortality later in this paragraph). In addition, with the construction of a functional adult fish ladder at Iron Gate Dam, Pacific lamprey, salmon, and steelhead would return to hold, spawn, and rear in habitat where they were present historically (Hamilton et al. 2005). However, the progeny of these fish must negotiate not only the reservoir but the dam, powerhouse, and

spillway during their outmigration. To ensure that the fish can outmigrate, downstream passage through the dam, powerhouse and spillway is necessary. Unless protected by fish screening and bypass systems, fish migrating downstream can suffer injury or death by passing through turbines at hydroelectric plants (Electric Power Research Institute 1987). Turbine caused mortality can have serious consequences for fish populations, especially among anadromous species (Cada 2001). Survival of juvenile salmonids passing dams during their seaward migration is highest through spillways and lowest through turbines (Muir et al. 2001), turbine mortality being caused by pressure changes, cavitation, shear stress, turbulence, strike, and grinding (Cada 2001). The Electric Power Research Institute (Electric Power Research Institute 1987) reported that Francis turbines, which are used at Iron Gate Dam, had average mortality to downstream moving fish of about 24 percent (see section IV.A.2 of this document for additional discussion of turbine entrainment). In light of the foregoing evidence, the Services conclude that turbine entrainment at Iron Gate Dam presently causes a degree of mortality to downstream migrating resident fish comparable to that cited in the studies above and would cause comparable losses of reintroduced anadromous fish populations in the future, absent effective fish screening systems. The Applicant has acknowledged, based on their initial review of other studies, that tens of thousands of resident fish are likely entrained annually at each of the unscreened mainstem Klamath River developments and estimated that between 7 to 21 percent of those fish are killed passing through the Iron Gate Powerhouse (PacifiCorp 2004a, Exhibit E 4-113). The Applicant has estimated that approximately 85,848 fish are entrained annually at each mainstem development and that many of these fish are nongame or warmwater fish species. Volitional fish passage would be consistent with fish movement through Klamath River system for purposes such as spawning, rearing, feeding, and seasonal use of habitat, as well as ensuring that the goals and objectives of the Klamath River Basin Fishery Task Force and the Services for resource management are met. The Licensee must provide effective facilities to meet these goals and objectives and mitigate for impacts of the dam. The 5 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Spillway Prescription Rationale: Spill survival estimates for juvenile salmonids are numerous and range from 70 percent to 100 percent, depending on species, life stage, amount or proportion of water spilled, spillway configuration, tailwater hydraulics, the methodology of estimating survival, and predator conditions (Bell and DeLacy 1981 in National Marine Fisheries 2000). Fish passing down a spillway may experience physical, chemical, and biological effects. Turbulent mixing of spilled water with receiving waters may result in gas supersaturation and resultant gas bubble disease in fish. Dissolved nitrogen concentrations of more than 130 percent of normal equilibrium levels have been measured in tailwaters (Ebel and Raymond 1976). The threshold value for significant mortality among juvenile Chinook salmon and steelhead trout occurs when nitrogen gas levels are about 115 percent of normal. Along the Columbia River, where many spillways discharge from a given dam and there are many consecutive dams along the stream course, supersaturation increases cumulatively from one dam to the next. Losses of salmon and steelhead trout in this river due to supersaturation have been severe in years of high spillage (Ebel and Raymond 1976). Fish passing over spillways can be injured by strikes or impacts with solid objects (e.g. baffles, rocks, or walls in the plunge zone), rapid pressure changes, abrasion with the rough side of the spillway, and the shearing effects of turbulent water.

Given the steepness and configuration of the Iron Gate Dam spillway, the Services conclude that spillway mortality will likely occur at levels near the high end of the range found in the studies above. Therefore, the following spillway modifications and 5 year timeline are necessary to meet resource goals and objectives as quickly as possible.

1.1 Iron Gate Dam Upstream Fishway

1.1.1 Fishway Design Features and Performance Standards: The Licensee shall construct, operate, maintain, and evaluate a volitional fishway at Iron Gate Dam to provide for the safe, timely, and effective upstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The fishway shall be operated year-round and shall consist of a fish ladder designed in accordance with NMFS criteria for anadromous fish (National Marine Fisheries Service 2003) or alternative acceptable criteria for other species as determined by the Services. The ladder shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The ladder shall have a minimum of two entrances and associated entrance pools. An auxiliary water system (AWS) shall be designed to augment ladder flow from the forebay. The AWS shall be screened and bypassed in accordance with NMFS juvenile fish screen and bypass criteria (National Marine Fisheries Service 1997) or such alternative criteria as may be determined acceptable to the Services. The AWS shall be designed to provide the correct water quality and quantity to effectively attract fish. The fish ladder and AWS together must supply at least 5-10 percent of high fish passage design flow (National Marine Fisheries Service 2003) for adequate attraction to the ladder. The ladder shall have a maximum drop between pools of 0.5 ft and the maximum slope of the fish ladder shall not exceed 10 percent (Table 1). The ladder shall include features to detect and record data for PIT-tagged (or fish identified using similar technology) upstream migrating fish. The construction shall include features to modify the existing development to hold, count, and mark fish and to sort fish by age, species, and origin for the purposes of fish population restoration and management. The upstream fishway must be constructed to current criteria for passage of Pacific lamprey. The Licensee shall complete construction and begin operation of the fishway within 5 years of the issuance of the new license.

1.1.2 Design Consultation: The ladder design shall include features to detect and record data for PIT-tagged (or fish identified using similar technology) upstream migrating anadromous fish. The Licensee shall develop design and construction plans according to the terms of 1.1.1 above within 2 years of the issuance of a new license for review and approval by the Services prior to construction. The design shall include features to modify the existing development to hold, count, and mark fish;

and to sort fish by age, species, and origin for the purposes of fish population restoration and management.

1.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

1.2 Iron Gate Dam Downstream Fishway

1.2.1 Intake Fish Screens and Bypass Facilities: The Licensee shall, to provide for the safe, timely, and effective downstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout, construct, operate, maintain, and evaluate a fish screen and bypass facility for volitional fish passage at Iron Gate Dam. The screens and bypass shall be operated year-round and shall be designed in accordance with NMFS juvenile fish screen criteria (National Marine Fisheries Service 1997) or alternative criteria as determined by the Service and NMFS Engineering. The screens and bypass shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The bypass facility shall include features to detect and record data for PIT-tagged downstream migrating fish (or fish identified using similar technology). The Licensee shall complete construction and begin operation of the fishway within 5 years of the issuance of the new license.

1.2.2 Design Consultation: The bypass facility design shall include features to detect and record data for PIT-tagged downstream migrating fish (or fish identified using similar technology). The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 2 years of the issuance of the new license for review and approval by the Service and NMFS prior to construction.

1.2.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

1.3 Iron Gate Spillway

1.3.1 Spillway Modification: The Licensee shall modify, maintain, and evaluate hydraulically-engineered spillway modifications to improve volitional downstream fish passage at Iron Gate Dam for Chinook and coho salmon, steelhead trout, and redband trout. The purpose of all spillway modifications is to improve hydraulic conditions and overall fish passage conditions on the downstream side of the dam, to prevent false attraction to non-passable areas, and to make the entrance of the fishway more accessible. The spillway modifications shall be constructed and operational within 5 years of the issuance of the new license.

1.3.2 Spillway Design Consultation: Within 2 years of the issuance of the new license, the Licensee shall develop design and construction plans according to the terms of 1.1.1 above for review and approval by the Service and NMFS Engineering.

1.3.3 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

2. Fall Creek Diversion Dam

The prescriptions for fishways at the Fall Creek Diversion Dam are made solely by the Service. The prescription for the Fall Creek Powerhouse Tailrace Barrier is made jointly by NMFS and the Service.

Upstream Prescription Rationale: There are currently no upstream fish passage facilities at the Fall Creek Diversion Dam for any species (PacifiCorp 2004b Fish Resources FTR). This dam is a seasonal or low flow barrier to the upstream movement of fish (Scott Snedaker, BLM pers. comm.). The Applicant has proposed an upstream fishway at this development. The Service's prescription is consistent with this proposal. Redband/rainbow trout are present in Fall Creek below the dam and above the dam. The fish need to be able to move between the two areas to make seasonal use of habitat. Volitional upstream passage would be consistent with the Service goal to successfully restore resident fish to their historical range. One objective of reaching this goal is the restoration of safe, timely, and effective fish movement, and to ensure the Project does not impair future restoration of fish populations in the upper Fall Creek and Klamath River systems. The Licensee must provide effective facilities to meet the volitional passage goal and mitigate for impacts of the diversion dam. The 3 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Downstream Prescription Rationale: There are currently no downstream fish passage facilities at the Fall Creek Diversion Dam for any species (PacifiCorp 2004b Fish Resources FTR, Exhibit E). The Applicant has proposed a downstream fish screen at this development. We agree with the Applicant's proposal to screen downstream migrating fish. In addition, a bypass system is needed to guide the movement of redband/rainbow trout and restore historical fish populations in Fall Creek. Redband trout are present above the diversion. The Service concludes that trout (in particular fry and juveniles) move downstream here as they do in the Klamath River system elsewhere (Hemmingsen 1997), a significant portion move through the diversion canal, and that turbine entrainment at the Fall Creek Powerhouse causes significant mortality to downstream migrating redband trout (see the discussion for the Downstream Prescription Rationale for the Iron Gate Dam development). The Licensee must provide effective facilities to protect rainbow/redband trout and mitigate for impacts of the dam. With the 5 cfs proposed for instream flows by the Licensee and the construction of a functional fish ladder at the Fall Creek Diversion Dam, biological connectivity for rainbow trout would be restored to some degree in upper Fall Creek. However, the progeny of these fish must be excluded from the power canal and turbines. Adequate passage conditions would be consistent with the Service's goal of restored fish

populations in the Fall Creek system. The 3 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Fall Creek Powerhouse Tailrace Prescription Rationale: With an upstream fishway at Iron Gate Dam, anadromous fish would migrate to Fall Creek. Water discharging from the Fall Creek Powerhouse can represent a significant portion of the total flow of Fall Creek in the vicinity of the powerhouse. Coots (1954; 1957; 1962) reported steelhead, Pacific lamprey, and both coho and Chinook salmon in Fall Creek downstream from the powerhouse. The natural tendency for fish attracted to such an area is to hold and wait for upstream passage opportunities or to attempt to move past the obstacle either by swimming or leaping. Depending on powerhouse operations, water velocities in hydropower facilities range from roughly 5 to 10 fps; these velocities easily fall within the swimming abilities of salmonids (Weaver 1963). The types of injury sustained by some fish entering draft tubes or contacting turbines vary from site to site, as do immediate and delayed mortality rates. Several studies, however, attribute injuries in migrating salmonids to powerhouse structures associated with tailrace structures (Department of Fisheries Canada 1958; International Pacific Salmon Fisheries Commission 1976; Schadt et al. 1985; Williams 1985). To prevent injury or mortality to salmonids caused by attempts to swim upstream into the tailrace, a barrier is required to prevent fish from entering this area (National Marine Fisheries Service 2003). The 5 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

2.1 Fall Creek Diversion Dam Upstream Fishway

2.1.1 Fall Creek Upstream Fishway: The Licensee shall construct, operate, maintain, and evaluate a volitional upstream fishway at the Fall Creek Diversion Dam to provide for the safe, timely, and effective upstream passage of rainbow/redband trout. The fishway shall be operated year-round and shall consist of a fish ladder designed in accordance with NOAA's National Marine Fisheries Service (NMFS) criteria (National Marine Fisheries Service 2003) or alternative criteria as determined by the Service. The ladder shall provide for the uninterrupted passage of fish over the full range of Fall Creek flows for which the Project maintains operational control. The ladder shall have a maximum drop between pools of 0.5 ft and the maximum slope of the fish ladder shall not exceed 10 percent (Table 1). The fishway shall be constructed and operational within 3 years of the issuance of the new license.

2.1.2 Design Consultation: The Licensee shall develop design and construction plans according to the terms of 1.1.1 above within 1 year of license issuance for review and approval by the Service prior to construction.

2.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

2.2 Fall Creek Diversion Dam Downstream Fishway

2.2.1 Intake Fish Screens and Bypass Facility: The Licensee shall construct, operate, maintain, and evaluate a fish screen and bypass facility at the Fall Creek Diversion Dam to provide for the safe, timely, and effective downstream passage of rainbow/redband trout. The screens and bypass facility shall be operated year-round and shall be designed in accordance with NMFS juvenile fish screen and bypass facility criteria (National Marine Fisheries Service 1997) or alternative criteria as determined by the Service. The screens and bypass facility shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The downstream fishway shall be constructed and operational within 3 years of the issuance of the new license.

2.2.2 Design Consultation: The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above, within 1 year of the issuance of the new license, for review and approval by the Service prior to construction.

2.2.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

2.3 Fall Creek Powerhouse Tailrace Barrier

2.3.1 Tailrace Barrier Construction: The Licensee shall construct a tailrace barrier and guidance system at Fall Creek Powerhouse. The tailrace barrier and guidance system shall be constructed according to approved design plans and within 5 years of the issuance of the new license.

2.3.2 Tailrace Barrier Design: The Licensee shall, within three years of the issuance of the new license develop detailed design and construction plans for Service and NMFS Engineering approval for a tailrace barrier and guidance system to protect adult fish according to the terms of 1.1.1 above.

2.3.3 Tailrace Barrier Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

3. Spring Creek Diversion Dam

The prescriptions for fishways at the Spring Creek Diversion Dam are made solely by the Service.

Upstream Prescription Rationale: There are currently no upstream fish passage facilities at the Spring Creek Diversion Dam for any species (PacifiCorp 2004b Fish Resources FTR). The

Applicant has proposed an upstream fishway at this development. We agree with this action and our prescription is consistent with the Applicant's proposal. Redband/rainbow trout are present in Spring Creek below the dam and above the dam. The fish need to be able to move between the two areas to make seasonal use of habitat. Volitional upstream passage would be consistent with the Service goal to successfully restore resident fish to their historical range. The objective in reaching these goals is the restoration of safe, timely, and effective fish movement, and to ensure the Project does not impair future restoration of fish populations in the upper Spring Creek, Jenny Creek, and Klamath River systems. The Licensee must provide effective facilities to meet the volitional passage goal and mitigate for impacts of the diversion dam. The 3 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Downstream Prescription Rationale: There are currently no downstream fish passage facilities at the Spring Creek Diversion Dam for any species (PacifiCorp 2004b Fish Resources FTR). The Applicant has proposed a downstream fish screen at this development. We agree with the Applicant's proposal to screen downstream migrating fish. In addition, a bypass system is needed to guide the movement of redband/rainbow trout and restore historical fish populations in Spring Creek. The Service concludes that trout (in particular fry and juveniles) move downstream here as they do in the Klamath River elsewhere (Hemmingsen 1997), a significant portion move through the Spring Creek diversion canal to Fall Creek, and turbine entrainment at the Fall Creek Powerhouse causes significant mortality to redband/rainbow trout that have originated in Spring Creek (see the discussion for the Downstream Prescription Rationale for the Iron Gate Dam development). Volitional fish passage to a bypass around the Spring Creek Diversion Dam is consistent with the Service goals and objectives for resource management. The Licensee must provide effective facilities to meet these goals and mitigate for impacts of the dam. With minimum flows and the construction of a functional fish ladder at the Spring Creek Diversion Dam, biological connectivity for rainbow trout would be restored to some degree in Spring Creek. However, these fish must be excluded from the power canal and turbines. Adequate passage conditions would be consistent with the Service's goal of restored fish populations in the Spring Creek system. The 3 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

3.1 Spring Creek Diversion Dam Upstream Fishway

3.1.1 Spring Creek Upstream Fishway: The Licensee shall construct, operate, maintain, and evaluate a volitional fishway at Spring Creek Diversion Dam to provide for the safe, timely, and effective upstream passage of rainbow/redband trout. The fishway shall be operated year-round and shall consist of a fish ladder designed in accordance with NMFS criteria (National Marine Fisheries Service 2003) or alternative criteria as determined by the Service. The ladder shall provide for the uninterrupted passage of fish over the full range of Spring Creek flows for which the Project maintains operational control. The ladder shall have a maximum drop between pools of 0.5 ft (Table 1) and the maximum slope of the fish ladder shall not exceed 10 percent (Table 1). The fishway shall be

constructed and operational within 3 years of the issuance of the new license.

3.1.2 Design Consultation: The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 1 year of the issuance of the new license for review and approval by the Service prior to construction.

3.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

3.2 Spring Creek Diversion Dam Downstream Fishway

3.2.1 Intake Fish Screens and Bypass Facility: The Licensee shall construct, operate, maintain, and evaluate a fish screen and bypass facility at the Spring Creek Diversion Dam to provide for the safe, timely, and effective downstream passage of rainbow/redband trout. The screen and bypass facility shall be operated year-round and shall be designed in accordance with NMFS juvenile fish screen and bypass facility criteria (National Marine Fisheries Service 1997) or alternative criteria as determined by the Service. The screens and bypass facility shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The downstream fishway shall be constructed and operational within 3 years of the issuance of the new license.

3.2.2 Design Consultation: The Licensee shall develop design and construction plans according to the terms of 1.1.1 above within 1 year of the issuance of the new license for review and approval by the Service prior to construction.

3.2.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

4. Copco 2 and Copco 1 Dams

Copco 2 and Copco 1 Upstream Prescription Rationale: Historically coho salmon, Pacific lamprey, steelhead, and spring-run and fall-run Chinook salmon (Hamilton et al. 2005) and resident trout migrated above the site of Copco 2 and Copco 1 dams to reach holding, spawning, incubation, and rearing habitat. Copco 2 and Copco 1 dams are a barrier to this passage and thus to holding, spawning, incubation, and rearing habitat in tributaries (Shovel, Long Prairie, Deer, Edge, Frain, Negro, Tom Hayden, Topsy, and Beaver creeks) and the Boyle peaking and bypass reaches (Table 3). The goal of the Services and the Klamath River Basin Fisheries Task Force is to successfully restore corresponding life history phases of anadromous salmonids to their historical range and to this habitat. The Service goal is to successfully restore resident fish to their historical range and habitat as well. The objective in reaching these goals is restoration of

safe, timely, and effective fish movement through volitional fish passage. Providing volitional fish passage at Copco 2 and Copco 1 dams is consistent with goals and objectives for resource management of the Services and the Klamath River Basin Fisheries Task Force. The Licensee shall provide effective facilities to meet these goals and mitigate for the impacts of the dam. The 6-8 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Benefits – The Copco Dams are less than one half mile apart. Specific benefits of fishways at Copco 2 and Copco 1 dams include:

- Resident Trout: For the resident redband/rainbow trout currently present both above and below Copco 2 and 1 dams, fishways would restore historical seasonal migration patterns for immature fish, restore population connectivity and genetic diversity, and allow greater utilization of existing habitat and refugial areas. For resident rainbow/redband populations, fish passage at the Copco dams alone would result in restoring the connectivity of fish populations in the mainstem Klamath River below the Copco dams with those in tributaries above the dams and the Klamath River reach designated as Wild Trout water by the CDFG (California Department of Fish and Game 2005). The lower 2.7 miles of Shovel Creek are accessible and provide important habitat elements for rainbow/redband trout, including spawning and temperature related refugial areas. With fish passage, Shovel Creek would again become accessible to resident trout from below the Copco dams and seasonal migration and habitat use would be restored.
- Coho: Coho salmon are present in the Klamath River below Iron Gate Dam and were present historically below and above Copco 2 and Copco 1 dams. Copco 2 and Copco 1 dams block these fish from reaching elements of their historical habitat. Between Copco 1 and Copco 2 dams and the next barrier upstream (J.C. Boyle Dam), coho salmon would have access to 25.8 miles of habitat, including the J.C Boyle peaking and bypass reaches of the Klamath River mainstem (Table 3). With fish passage, coho would have access to this habitat again and connectivity to refugial areas would be restored.
- Spring-run Chinook: With passage, spring-run Chinook salmon access to cool water refugial areas such as the 220 cfs of spring water in the J.C. Boyle bypassed reach would be restored. During summer months, this would provide key holding, coolwater refugial habitat necessary for this run of fish (McCullough 1999). Juvenile spring-run Chinook would be able to rear in the cool water habitat adjacent to the springs in the J.C. Boyle bypass reach. These springs also provide warmer, ice-free habitat during winter months (Hanel and Gerlach 1964). The temperature of incoming spring water does not vary substantially from 50 to 55°F throughout the year (USDI Bureau Land Management 2003) and would be optimal for juvenile Chinook growth (McCullough 1999). Spring-run Chinook adults would also have access to the main channel as an upstream migration corridor necessary to reach historical spawning areas in the Upper Klamath Basin (California Department of Fish and Game 1990).
- Fall-run Chinook: Between Copco 2 and Copco 1 dams and the next barrier upstream (J.C. Boyle Dam), passage for fall-run Chinook salmon would restore access to 25.8 miles of habitat, including the J.C Boyle peaking and bypass reaches of the Klamath

River mainstem (Table 3). Snyder (1931) reported large numbers of salmon annually passed the point where the Copco dams are now located. The lower 2.7 miles of Shovel Creek continue to provide good salmonid habitat. The reach of the Klamath River between Copco 1 Reservoir and the Oregon/California State line is designated Wild Trout water and is currently managed under the Wild Trout Program by the CDFG (California Department of Fish and Game 2005). With fish passage, this area would again become accessible to fall-run Chinook salmon.

- Pacific Lamprey Between Copco 2 and Copco 1 dams and the next barrier upstream (J.C. Boyle Dam), passage for Pacific lamprey would restore access to 27.1 miles of habitat, including the J.C Boyle peaking and bypass reaches of the Klamath River mainstem (Table 3). Pacific Lamprey were present historically above Copco 2 and Copco 1 dams (Hamilton et al. 2005). Pacific Lamprey are able to access higher gradient stream reaches and would fully use the 27.1 miles of habitat in Shovel, Long Prairie, Deer, Edge, Frain, Negro, Tom Hayden, Topsy, and Beaver creeks (Table 3). With fish passage, this habitat would again be utilized by Pacific lamprey.
- Steelhead Between Copco 2 and Copco 1 dams and the next barrier upstream (J.C. Boyle Dam), passage would allow steelhead to regain access to 27.1 miles of habitat, including the J.C Boyle peaking and bypass reaches of the Klamath River mainstem (Table 3). Steelhead occurred historically above the Copco 2 and Copco 1 dams (Hamilton et al. 2005). Steelhead are generally tributary spawners and able to access reaches of tributaries upstream from areas where salmon spawn (Platts and Partridge 1978). Therefore, with fish passage, steelhead would utilize habitat in its entirety in tributaries above the Copco dams. This means that steelhead would fully have access to the 27.1 miles of habitat in Shovel, Long Prairie, Deer, Edge, Frain, Negro, Tom Hayden, Topsy, and Beaver creeks (Table 3). Seasonal migration of steelhead and access to refugial areas would be restored.

Copco 2 and Copco 1 Downstream Prescription Rationale: Downstream fishways and fishway modifications are prescribed for Copco 2 and Copco 1 dams. Redband/rainbow trout and other resident fish are currently present in Copco reservoirs. The Services conclude that trout (in particular fry and juveniles) move downstream here as they do in the Klamath River elsewhere (Hemmingsen 1997), a significant portion move through the powerhouses, and turbine entrainment at Copco 2 and Copco 1 dams causes significant mortality to downstream migrating redband trout (see discussion of turbine-caused mortality later in this paragraph). In addition, with the construction of a functional adult fish ladder at Iron Gate Dam and the Copco dams, Pacific lamprey, salmon, and steelhead would return to hold, spawn, and rear in habitat where they were present historically (Hamilton et al. 2005). The progeny of these fish must negotiate not only the reservoirs but the dams, powerhouses, and spillways during their outmigration. To ensure these fish can safely outmigrate, downstream passage around the dams, powerhouses, and spillways is necessary. Fish migrating downstream can suffer injury or death by passing through turbines at hydroelectric plants (Electric Power Research Institute 1987). Turbine caused mortality can have serious consequences for fish populations, especially among anadromous species (Cada 2001). Survival of juvenile salmonids passing dams during their seaward migration is highest through spillways and lowest through turbines (Muir et al. 2001), turbine

mortality being caused by pressure changes, cavitation, shear stress, turbulence, strike, and grinding (Cada 2001). The Electric Power Research Institute (Electric Power Research Institute 1987) reported that Francis turbines, which are used at both Copco dams, had average mortality to downstream moving fish of about 24 percent. In light of the foregoing evidence, the Services conclude that turbine entrainment at each Copco dam presently causes levels of mortality to downstream migrating resident fish comparable to those cited in the studies above and would cause comparable losses of reintroduced anadromous fish populations in the future, absent effective fish screening systems. The Applicant has estimated that approximately 85,848 fish are entrained annually at each mainstem development and has estimated that between 7 to 20 percent of fish passing through the Copco 2 Powerhouse are killed and that between 6 to 18 percent of the fish passing through the Copco 1 Powerhouse are killed (PacifiCorp 2004a, Exhibit E 4-113). Volitional fish passage would be consistent with fish movement through the Klamath River system for purposes such as spawning, rearing, feeding, and seasonal use of habitat. Volitional fish passage is consistent with the goals and objectives for resource management of the Klamath River Basin Fishery Task Force and the Services. The Licensee must provide effective facilities to meet this goal and mitigate for impacts of the dam. The 6 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Tailrace Prescription Rationale: Water discharging from the Copco 2 and Copco 1 powerhouses can represent the major portion of the total river flow of the Klamath. Under the current license, the powerhouses each can discharge up to ~3000 cubic feet per second (cfs) and the Copco 2 bypass reach contains as little as 5-10 cfs. Even with the Applicant's proposed minimum instream flow, the disparity in flow levels can contribute to false attraction of upstream migrating fish to an area which provides no upstream passage, and delay these fish in their migration. The natural tendency for fish attracted to such an area is to hold and wait for passage conditions to improve, or to attempt to move past the obstacle either by swimming or leaping. Depending on powerhouse operations, water velocities in hydropower facilities range from roughly 5 to 10 feet per second (fps); these velocities easily fall within the swimming abilities of salmonids (Weaver 1963). The types of injury sustained by some fish entering draft tubes or contacting turbines vary from site to site, as do immediate and delayed mortality rates. Several studies, however, attribute injuries in migrating salmonids to powerhouse structures associated with tailrace structures (Department of Fisheries Canada 1958; International Pacific Salmon Fisheries Commission 1976; Schadt et al. 1985; Williams 1985).

Adult anadromous fish are attracted into oncoming flows (National Marine Fisheries Service 2003). Migration upstream may be delayed when tailrace flows from the powerhouse exceed river bypass reach flows. A migration delay, or combined delays at several facilities, may prevent fish from reaching suitable spawning habitat when they are ready to spawn or conditions are optimal for survival. Migration delays caused by tailrace effects may have a greater impact on fish populations than injury and mortality from turbine impacts (Federal Energy Regulatory Commission 1994). Migration delays may occur to a greater percentage of migrating adults than the percentage of adults impacted by turbine mortality. Migration delays are well documented for anadromous salmonids in the Pacific Northwest (Haynes and Gray 1980; Rondorf et al. 1983; Schadt et al. 1985; Vogel et al. 1990). For migratory adults, false attraction occurs when

upstream migrants are attracted to turbine discharge or spillway flows rather than to fishway flows. False attraction also occurs when upstream migrants detect the scent of their natal stream downstream of its natural outlet (Fretwell 1989). This happens when water from a natal stream is diverted through a canal or pipe to a hydroelectric project. In either instance, without proper project design or operation modifications, there may be migratory delays.

To prevent injury, delay, or mortality to salmonids, caused by attempts to swim upstream into the tailrace, a barrier is required to guide migrating fish away from this area and encourage them to continue their upstream migration (National Marine Fisheries 2003). The 8 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Spillway Prescription Rationale: Spill survival estimates for juvenile salmonids are numerous and range from 70 percent to 100 percent, depending on species, life stage, amount or proportion of water spilled, spillway configuration, tailwater hydraulics, the methodology of estimating survival, and predator conditions (Bell and DeLacy 1981 in National Marine Fisheries Service 2000). Fish passing down a spillway may experience physical, chemical, and biological effects. Turbulent mixing of spilled water with receiving waters may result in gas supersaturation and resultant gas bubble disease in fish. Dissolved nitrogen concentrations of more than 130 percent of normal equilibrium levels have been measured in tailwaters (Ebel and Raymond 1976). The threshold value for significant mortality among juvenile Chinook salmon and steelhead trout occurs when nitrogen gas levels are about 115 percent of normal. Along the Columbia River, where many spillways discharge from a given dam and there are many consecutive dams along the stream course, supersaturation increases cumulatively from one dam to the next. Losses of salmon and steelhead trout in the Columbia River due to supersaturation have been severe in years of high spillage (Ebel and Raymond 1976). Fish passing over spillways can be injured by strikes or impacts with solid objects (e.g. baffles, rocks, or walls in the plunge zone), rapid pressure changes, abrasion with the rough side of the spillway, and the shearing effects of turbulent water. After examining the height of Copco 1 Dam, the angle of the spillway, and the stair-stepped design of this spillway, the Services conclude that spill entrainment mortality at the Copco 1 development will likely occur at levels near the high end of the range found in the studies above. While Copco 2 Dam is not as high, mortality may occur here as well (National Marine Fisheries Service 2000). Therefore, spillway modifications and a 6 year timeline are necessary to meet resource goals and objectives as quickly as possible.

Transverse Bedrock Sill Fish Barrier Evaluation/Modification Rationale: A transverse bedrock sill is located about RM 197.3 or 0.5 miles above the Copco 2 Powerhouse (1 mile below Copco 2 Dam). Historical fish distribution upstream from this point (Hamilton et al. 2005) indicates this sill was not a fish barrier prior to the Project, but the sill is a depth barrier to salmonids under the current 5-10 cfs release during normal operation, except during periods of spill, and may continue to be a depth barrier under the flows specified in the new license. This impediment to fish was observed during the summer of 2005 (David K. White, NMFS, pers. comm.). The 2 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

4.1 Copco 2 Upstream Fishway

4.1.1 Copco 2 Upstream Fishway: The Licensee shall construct, operate, maintain, and evaluate a volitional fishway at Copco 2 Dam to provide for the safe, timely, and effective upstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The fishway shall be operated year-round and shall consist of a fish ladder designed in accordance with NMFS criteria (National Marine Fisheries Service 2003) or alternative criteria as determined by the Service and NMFS Engineering. The ladder shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The ladder shall have a minimum of two entrances and associated entrance pools and the auxiliary water system (AWS) shall be designed to augment ladder flow from the forebay. The AWS shall be screened in accordance with NMFS juvenile fish screen criteria (National Marine Fisheries Service 1997) or such alternative criteria as may be determined acceptable NMFS Engineering and the Service. The AWS shall be designed to provide the correct water temperature and water quality to attract fish. The fish ladder and AWS together must supply at least 5-10 percent of fish passage design high flow for adequate attraction to the ladder. The ladder shall have a maximum drop between pools of 0.5 ft and the maximum slope of the fish ladder shall not exceed 10 percent (Table 1). The ladder shall include features to detect and record data for PIT-tagged upstream migrating anadromous fish (or fish identified using similar technology). The upstream fishway must be constructed to current criteria for passage of Pacific lamprey (Table 1). The fishway shall be constructed and operational within 6 years of the issuance of the new license.

4.1.2 Design Consultation: The ladder design shall include features to detect and record data for PIT-tagged upstream migrating anadromous fish (or fish identified using similar technology). The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 3 years of the issuance of the new license for review and approval by the Service and NMFS prior to construction.

4.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

4.2 Copco 2 Downstream Fishway

4.2.1 Intake Fish Screens and Bypass Facility: The Licensee shall construct, operate, maintain, and evaluate a fish screen and bypass facility for volitional fishway at Copco 2 Dam to provide for the safe, timely, and effective downstream passage of Chinook and coho salmon, steelhead

trout, Pacific lamprey, and redband trout. The screens and bypass facility shall be operated year-round and shall be designed in accordance with NMFS juvenile fish screen and bypass facility criteria (National Marine Fisheries Service 1997) or alternative criteria as determined by the Service and NMFS Engineering. The screens and bypass facility shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The bypass facility shall include features to detect and record data for PIT-tagged downstream migrating fish (or fish identified using similar technology). The downstream fishway shall be constructed and operational within 6 years of the issuance of the new license.

4.2.2 Design Consultation: The bypass facility design shall include features to detect and record data for PIT-tagged downstream migrating fish (or fish identified using similar technology). The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 3 years of the issuance of the new license for review and approval by the Service and NMFS Engineering prior to construction.

4.2.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

4.3 Copco 2 Spillway

4.3.1 Spillway Modification Design Consultation: The Licensee shall modify, maintain, and evaluate a spillway for the volitional passage at Copco 2 Dam to provide for the safe, timely, and effective downstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The spillway modifications shall be constructed and operational within 6 years of the issuance of the new license.

4.3.2 Spillway Design: The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 3 years of the issuance of the new license for review and approval by the Service and NMFS Engineering prior to construction.

4.3.3 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

4.4 Copco 2 Tailrace Barrier

4.4.1 Tailrace Barrier Construction: The Licensee shall construct a tailrace barrier and guidance system at Copco 2 Dam. The tailrace barrier and guidance system shall be constructed according to approved design plans and within 8 years of the issuance of the new license.

4.4.2 Tailrace Barrier Design: The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 5 years of the issuance of the new license, for review and approval by the Service and NMFS Engineering prior to construction.

4.4.3 Tailrace Barrier Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

4.5 Copco 2 Bypass Channel Barrier/Impediment Modification

4.5.1 Barrier Modification: The Licensee shall modify the sill (as provided in 4.5.2 below), unless the Licensee demonstrates through an evaluation (conducted in consultation with the Services and CDFG and in a manner approved by the Services) using accepted fish barrier evaluation methodology (Powers and Orsborn 1985) that the transverse bedrock sill approximately 0.5 miles above the Copco 2 Powerhouse in the Copco 2 bypassed reach is not a barrier to fish passage under normal operating flows specified for the Copco 2 bypassed reach in the new license. The evaluation shall be completed within six months of the issuance of the new license and its conclusions must be approved by the Services.

4.5.2 Design and Construction: The Licensee shall develop design and construction plans for the barrier modification according to the terms of general article 1.1.1 above within 1 year of the issuance of the new license for review and approval by the Service and NMFS Engineering prior to construction. The barrier shall be modified in accordance with specified guidelines and criteria for fish passage (National Marine Fisheries Service 2003), including providing at least 1.0 foot of swimming depth across the sill and with adequate attraction, velocity, capacity and vertical jump characteristics.

4.5.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

5. Copco 1 Dam

5.1 Copco 1 Dam Upstream Fishway

5.1.1 Copco 1 Upstream Fishway: The Licensee shall construct, operate, maintain, and evaluate a volitional upstream fishway at Copco 1 Dam to provide for the safe, timely, and effective upstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The fishway shall be operated year-round and shall consist of a fish ladder designed in accordance with NMFS criteria (National Marine Fisheries Service 2003) or alternative criteria as determined by the Service and

NMFS Engineering. The ladder shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The ladder shall have a minimum of two entrances and associated entrance pools and the auxiliary water system (AWS) shall be designed to augment ladder flow from the forebay. The AWS shall be screened in accordance with NMFS juvenile fish screen criteria (National Marine Fisheries Service 1997) or such alternative criteria as may be determined acceptable to NMFS Engineering and the Service. The AWS shall be designed to provide the correct water temperature and water quality as to attract fish. The fish ladder and AWS together must supply at least 5-10 percent of fish passage design high flow for adequate attraction to the ladder. The ladder shall have a maximum drop between pools of 0.5 ft and the maximum slope of the fish ladder shall not exceed 10 percent (Table 1). The ladder shall include features to detect and record data for PIT-tagged upstream migrating anadromous fish (or fish identified using similar technology). The Licensee shall construct the upstream fishway according to current criteria for passage of Pacific lamprey (Table 1). The fishway shall be constructed and operational within 6 years of the issuance of the new license.

5.1.2 Design Consultation: The ladder design shall include features to detect and record data for PIT-tagged upstream migrating anadromous fish (or fish identified using similar technology). The Licensee shall develop design and construction plans according to the terms of general article1.1.1 above within 3 years of the issuance of the new license for review and approval by the Service and NMFS Engineering prior to construction.

5.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

5.2 Copco 1 Downstream Fishway

5.2.1 Intake Fish Screens and Bypass Facility: The Licensee shall construct, operate, maintain, and evaluate a fish screen and bypass facility for volitional fish passage at Copco 1 Dam to below Copco 2 Dam to provide for the safe, timely, and effective downstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The screens and bypass facility shall be operated year-round and shall be designed in accordance with NMFS juvenile fish screen and bypass facility criteria (National Marine Fisheries Service 1997) or alternative criteria as determined by the Service and NMFS Engineering. The screens and bypass facility shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The bypass facility shall include features to detect and record

data for PIT-tagged downstream migrating fish (or fish identified using similar technology). The downstream fishway shall be constructed and operational within 6 years of the issuance of the new license.

5.2.2 Design Consultation: The bypass facility design shall include features to detect and record data for PIT-tagged downstream migrating fish (or fish identified using similar technology). The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 3 years of the issuance of the new license for review and approval by the Service and NMFS prior to construction.

5.2.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

5.3 Copco 1 Spillway

5.3.1 Spillway Modification: The Licensee shall modify, maintain, and evaluate a spillway for volitional passage at Copco 1 Dam to provide for the safe, timely, and effective downstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The spillway modifications shall be constructed and operational within 6 years of the issuance of the new license.

5.3.2 Spillway Design: The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 3 years of the issuance of the new license for review and approval by the Service and NMFS prior to construction.

5.3.3 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

5.4 Copco 1 Tailrace Barrier

5.4.1 Tailrace Barrier Construction: The Licensee shall construct a tailrace barrier and guidance system at Copco 1 Dam to provide for the safe, timely, and effective downstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The tailrace barrier and guidance system shall be constructed according to approved design plans and within 8 years of the issuance of the new license.

5.4.2 Tailrace Barrier Design: The Licensee shall, within 5 years of the issuance of the new license, develop design and construction plans according to the terms of general article 1.1.1 for review and approval by the Service and NMFS Engineering prior to construction.

5.4.3 Tailrace Barrier Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

6. J.C. Boyle Dam

Upstream Prescription Rationale: Historically coho salmon, Pacific lamprey, steelhead, and spring-run and fall-run Chinook salmon (Hamilton et al. 2005) and resident trout (Hanel and Gerlach 1964) migrated above the current site of J.C. Boyle Dam to reach holding, spawning, incubation, and rearing habitat. The upstream fishway at J.C. Boyle Dam is obsolete and does not meet current design criteria. It is a partial barrier to trout passage and thus to critical holding, spawning, incubation, and rearing habitat in tributaries (Spencer, Hunters Park, and Miners creeks) and the Boyle Reservoir to Keno Dam reach (Table 3). The goal of the Services and the Klamath River Basin Fisheries Task Force is to successfully restore corresponding life history phases of anadromous salmonids to their historical range and this habitat. The Service goal is to successfully restore resident fish to their historical range and habitat as well. The objective in reaching these goals is the restoration of safe, timely, and effective fish movement. Providing fishways that meet current criteria at J.C. Boyle Dam is consistent with the goals and objectives for resource management of the Services and the Klamath River Basin Fisheries Task Force. The Licensee shall provide effective facilities to meet these goals and mitigate for the impacts of the dam. The 4 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Benefits: Specific benefits of fishways at J.C. Boyle Dam include:

- Resident Trout: Fish passage at J.C. Boyle Dam alone would restore the unimpaired connectivity of resident redband trout populations in the mainstem Klamath River with those in Spencer Creek. This tributary, in particular, provides important habitat elements, such as spawning and temperature related refugial areas for redband trout. A number of reports document the importance of Spencer Creek habitat to redband trout (Buchanan et al. 1990; Buchanan et al. 1991; Hemmingsen 1997; Hemmingsen et al. 1992; USDI Bureau of Land Management et al. 1995). The Spencer Creek population of Klamath River redband trout is migratory and has connectivity to the population in the mainstem Klamath River and nearby tributary watersheds. This Basin connectivity coupled with homing behavior (and straying of individuals) allows Spencer Creek redband/rainbow trout to be a source of adaptive variability in Klamath Basin trout populations (USDI Bureau of Land Management 1995). This connectivity has been greatly impaired by inadequate passage at J.C. Boyle Dam. The number of redband trout using the J.C. Boyle fish ladder have declined 90 percent or more since shortly after the dam was constructed (Hanel and Gerlach 1964; Hemmingsen et al. 1992; Oregon Department of Fish and Wildlife 2006a). An upstream ladder, built to current criteria and with the entrance located to avoid false attraction flows, would provide for the safe, timely and effective passage around J.C. Boyle Dam for redband trout migrating to Spencer Creek and upstream. With fish passage, habitat in Spencer Creek and habitat between J.C. Boyle Dam and Keno Dam would be fully utilized. Seasonal migration of steelhead and access to refugial areas would be restored.
- Coho: Coho salmon are present in the Klamath River below Iron Gate Dam and were present historically below and above the J.C. Boyle Dam to at least Spencer Creek. With

passage at J.C. Boyle Dam, coho salmon would regain access to 9.6 miles of habitat (Table 3). With fish passage, access to this habitat would no longer be unutilized. Seasonal migration of coho and access to refugial areas would be restored.

- Spring-run Chinook: With fish passage at J.C. Boyle Dam, spring-run Chinook salmon would regain access to seasonal cool water refugial areas necessary for this run of fish (McCullough 1999) between J.C. Boyle Dam and the next dam upstream (Keno Dam). Spring-run Chinook would also have access to the main channel as an upstream migration corridor necessary to reach historical spawning areas in the Upper Klamath Basin (California Department of Fish and Game 1990).
- Fall Chinook: With fish passage, fall-run Chinook salmon would regain access to 14.3 miles of habitat, including tributaries and the mainstem Klamath River (Table 3) between J.C. Boyle Dam and the next dam upstream (Keno Dam). With fish passage seasonal migration of fall-run Chinook and access to refugial areas would be restored.
- Pacific Lamprey: With fish passage, Pacific lamprey would regain access to at least 17.1 miles of habitat, including tributaries and the mainstem Klamath River (Table 3) between J.C. Boyle Dam and the next dam upstream (Keno Dam).
- Steelhead: With fish passage, steelhead would regain access to 17.1 miles of habitat between J.C. Boyle Dam and the next dam upstream (Keno Dam). Steelhead are generally tributary spawners and able to access reaches of tributaries upstream from areas where salmon spawn (Platts and Partridge 1978). Therefore, with fish passage, steelhead would utilize habitat in its entirety in tributaries above J.C. Boyle Dam. This means that steelhead would fully have access to the 17.1 miles of habitat in Spencer, Hunters Park, and Miners creeks as well as the mainstem Klamath River below Keno Dam (Table 3). Seasonal migration of steelhead and access to refugial areas would be restored.

Downstream Prescription Rationale: Redband/rainbow trout, federally listed suckers, and other resident fish are currently present in J.C. Boyle Reservoir (Desjardins and Markle 2000; PacifiCorp 2004b). The Services conclude that trout (in particular fry and juveniles) move downstream as they do in the Klamath River elsewhere (Hemmingsen 1997) and that the vast majority of these move through the J.C. Boyle Powerhouse because the screens are ineffective and the facility seldom spills. Dam operators at the J.C. Boyle development generally do not spill until Klamath River discharge exceeds 3,000 cfs. Over the past 25 years the Klamath River exceeded this threshold a median of 4.5 days per year and in 12 years it did not exceed 3,000 cfs (Oregon Department of Fish and Wildlife 2006a). The Services conclude that turbine entrainment at J.C. Boyle Dam causes significant mortality to downstream migrating redband trout (see discussion of turbine-caused mortality later in this paragraph). With the construction of a functional adult fish ladder at J.C. Boyle Dam, Pacific lamprey, salmon, and steelhead would return to hold, spawn, and rear in habitat where they were present historically (Hamilton et al. 2005). However, the progeny of these fish would also move downstream and must negotiate not only the reservoir but the dam, powerhouse, and spillway during their outmigration. Turbine caused mortality at dams can have serious consequences for fish populations, especially among anadromous species (Cada 2001). Survival of juvenile salmonids passing dams during their seaward migration is highest through spillways and lowest through turbines (Muir et al. 2001), turbine mortality being caused by pressure changes, cavitation, shear stress, turbulence,

strike, and grinding (Cada 2001). The Electric Power Research Institute (EPRI) (Electric Power Research Institute 1987) reported that the Francis turbines which are used at the J.C. Boyle development have an average mortality of about 24 percent for all subject species. EPRI's studies, and those of Milo Bell (Bell 1986; Bell et al. 1967) measured entrainment for some of the same species and under similar conditions as exist at J.C. Boyle Dam, and thus support the conclusion that entrainment mortality is presently occurring at significant levels for resident fish. The J.C. Boyle development, at 440 feet of head, may have even greater mortality due to turbine entrainment, as pressure gradients will be even greater. For projects with Francis turbines, the EPRI study found a high correlation (r = 0.77) between head and fish mortality. Four hydroelectric developments with Francis turbines that had greater than 335 feet of head had mortality ranging from 33 to 48 percent (Electric Power Research Institute 1987). The facilities in these studies have comparable or less hydraulic head than the J.C. Boyle development and comparable turbine types. Using the above evidence, the Services conclude that entrainment mortality at J.C. Boyle Powerhouse likely falls in this range rather than the 12 to 36 percent range estimated by the Applicant (PacifiCorp 2004a, Exhibit E 4-113). When anadromous fish are restored above J.C. Boyle Dam, out-migrating salmonid smolts, including federally listed coho, would be entrained and a significant portion killed during turbine passage absent downstream fish screens and bypass systems. Volitional fish passage would be consistent with fish movement through Klamath River system for purposes such as spawning, rearing, feeding, and seasonal use of habitat. It is also consistent with the goals and resource management objectives of the Klamath River Basin Fishery Task Force and the Services.

The development of detailed design and construction plans for review and approval by the Service and NMFS Engineering is critical to ensure that effective passage measures are incorporated into the design. The 4 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Sidecast Rock Barrier Removal Prescription Rational: Sidecast rock extends from the J.C. Boyle canal access road into and across the J.C. Boyle bypass channel, blocking or inhibiting fish passage. Presently, all flows in the bypass reach filter through the sidecast rock and there is no unimpeded route for anadromous fish passage at the typical bypass flows observed. The rock has been deposited in this channel recently and is sidecast from Project construction and operation of the J.C. Boyle canal and access road. This impediment to fish was observed during the summer of 2005 (David K. White, NMFS, pers. comm.). Historically, higher flows in the bypassed channel might have been able to disperse this material and restore fish movement. Removal is necessary to achieve the safe, timely, and effective passage through the channel past this obstruction and would be consistent the goals and objectives for resource management of the Services and the Klamath River Basin Fishery Task Force. The 2 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Tailrace Prescription Rationale: Water discharging from the J.C. Boyle Powerhouse represents a significant portion of the total river flow of the Klamath River. Under the current license the powerhouse can discharge up to 3000 cubic feet per second (cfs) and the bypass reach contains as little as 320 cfs. Even with the instream flow in the bypassed channel proposed by the

Applicant, this disparity in flows contributes to false attraction for upstream migrating fish to an area which provides no upstream passage. The natural tendency for fish attracted to such an area is to hold and wait for passage conditions to improve or to attempt to move past the obstacle either by swimming or leaping. Depending on powerhouse operations, water velocities in hydropower facilities range from roughly 5 to 10 fps; these velocities easily fall within the swimming abilities of salmonids (Weaver 1963). The types of injury sustained by some fish entering draft tubes or contacting turbines vary from site to site, as do immediate and delayed mortality rates. Several studies, however, attribute injuries in migrating salmonids to powerhouse structures associated with tailrace structures (Department of Fisheries Canada 1958; International Pacific Salmon Fisheries Commission 1976; Schadt et al. 1985; Williams 1985).

Adult anadromous fish are attracted into oncoming flows (National Marine Fisheries Services 2003). Migration upstream may be delayed when tailrace flows from the powerhouse exceed river bypass reach flows. A migration delay, or combined delays at several facilities, may prevent fish from reaching suitable spawning habitat when they are ready to spawn or conditions are optimal for survival. Migration delays caused by tailrace effects may have a greater impact on fish populations than injury and mortality from turbine impacts (Federal Energy Regulatory Commission 1994). Migration delays may occur to a greater percentage of migrating fish than the percentage of fish impacted by turbine mortality. Migration delays are well documented for anadromous salmonids in the Pacific Northwest (Haynes and Gray 1980; Rondorf et al. 1983; Schadt et al. 1985; Vogel et al 1990). For migratory fish, false attraction occurs when upstream migrants are attracted to turbine discharge or spillway flows rather than to fishway flows. False attraction also occurs when upstream migrants detect the scent of their natal stream downstream of its natural outlet (Fretwell 1989). This happens when water from a natal stream is diverted through a canal or pipe to a hydroelectric project. In either instance, without proper project design or operation modifications, there may be migratory delays.

In order to prevent injury, delay, or mortality to salmonids, caused by attempts to swim upstream into the tailrace, a barrier is required to guide migrating fish away from this area and encourage them to continue their upstream migration. The 4 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Spillway Prescription Rationale: Spill survival estimates for juvenile salmonids are numerous and range from 70 percent to 100 percent, depending on species, life stage, amount or proportion of water spilled, spillway configuration, tailwater hydraulics, the methodology of estimating survival, and predator conditions (Bell and DeLacy 1981 in National Marine Fisheries Service 2000). Fish passing down a spillway may experience physical, chemical, and biological effects. Turbulent mixing of spilled water with receiving waters may result in gas supersaturation and resultant gas bubble disease in fish. Dissolved nitrogen concentrations of more than 130 percent of normal equilibrium levels have been measured in tailwaters (Ebel and Raymond 1976). The threshold value for significant mortality among juvenile Chinook salmon and steelhead trout occurs when nitrogen gas levels are about 115 percent of normal. Along the Columbia River, where many spillways discharge from a given dam and there are many consecutive dams along the stream course, supersaturation increases cumulatively from one dam to the next. Losses of

salmon and steelhead trout in the Columbia River due to supersaturation have been severe in years of high spillage (Ebel and Raymond 1976). Fish passing over spillways can be injured by strikes or impacts with solid objects (e.g. baffles, rocks, or walls in the plunge zone), rapid pressure changes, abrasion with the rough side of the spillway, and the shearing effects of turbulent water. The configuration of the J.C. Boyle Dam spillway includes numerous rocks and many such solid objects and it is reasonable to conclude that significant mortality will occur while passing fish through the spillway. Therefore, the following spillway modifications and 4 year timeline are necessary to meet resource goals and objectives as quickly as possible.

6.1 J.C. Boyle Bypass Channel

6.1.1 Barrier Removal: The Licensee shall remove the sidecast rock barrier approximately 2.5 mile above the J.C. Boyle Powerhouse in the J.C. Boyle Bypass reach within 2 years of the issuance of the new license to provide for the safe, timely, and effective upstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout.

6.1.2 Design and Construction: The Licensee shall develop design, construction, and maintenance plans according to the terms of general article 1.1.1 above within 1 year of the issuance of the new license for review and approval by the Service and NMFS Engineering prior to construction.

6.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

6.2 J.C. Boyle Upstream Fishway

6.2.1 J.C. Boyle Upstream Fishway: The Licensee shall construct, operate, maintain, and evaluate a volitional fishway at J.C. Boyle Dam to provide for the safe, timely, and effective upstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The fishway shall be operated year-round and shall consist of a fish ladder designed in accordance with NMFS' criteria (National Marine Fisheries Service 2003) or alternative criteria acceptable to the Service and NMFS Engineering. The ladder shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The ladder shall have a minimum of two entrances and associated entrance pools and the auxiliary water system (AWS) shall be designed to augment ladder flow from the forebay. The ladder entrance shall be located downstream of the fish screen bypass outfall and existing velocity barrier below the existing ladder. The AWS shall be screened in accordance with NMFS juvenile fish screen criteria (National Marine Fisheries Service 1997), or such alternative criteria as may be determined acceptable by NMFS Engineering and the Service. The AWS shall be designed to provide the correct water temperature and water quality as to attract fish.

The fish ladder and AWS together must supply at least 5-10 percent of fish passage design high flow for adequate attraction to the ladder. The ladder shall have a maximum drop between pools of 0.5 ft and the maximum slope of the fish ladder shall not exceed 10 percent (Table 1). The ladder shall include features to detect and record data for PIT-tagged upstream migrating anadromous fish (or fish identified using similar technology). The upstream fishway must be constructed to current criteria for passage of Pacific lamprey. The fishway shall be constructed and operational within 4 years of the issuance of the new license.

6.2.2 Design Consultation: The ladder design shall include features to detect and record data for PIT-tagged upstream migrating anadromous fish (or fish identified using similar technology). The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 2 years of the issuance of the new license for review and approval by the Service and NMFS Engineering prior to construction.

6.2.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

6.3 J.C. Boyle Downstream Fishway

6.3.1 Intake Fish Screens and Bypass Facility: The Licensee shall construct, operate, maintain, and evaluate a new fish screen and a bypass facility at J.C. Boyle Dam to provide for the safe, timely, and effective downstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The screen and bypass shall be operated year-round and shall be designed in accordance with NMFS juvenile fish screen and bypass facility criteria (National Marine Fisheries Service 1997) or alternative criteria acceptable to the Service and NMFS Engineering. The screen and bypass facility shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The screen shall divert all fish to a bypass facility. The bypass facility shall include features to detect and record data for PIT-tagged downstream migrating fish (or fish identified using similar technology). The Licensee shall complete construction and begin operation within 4 years of the issuance of the new license.

6.3.2 Design Consultation: The bypass facility design shall include features to detect and record data for PIT-tagged downstream migrating fish (or fish identified using similar technology). The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 2 years of the issuance of the new license for review and approval by the Service and NMFS Engineering prior to construction.

6.3.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

6.4 J.C. Boyle Spillway

6.4.1 Spillway Modification: The Licensee shall modify, maintain, and evaluate a spillway for the volitional passage at J.C. Boyle Dam to provide for the safe, timely, and effective downstream passage of Chinook and coho salmon, steelhead trout, and redband trout. The spillway modifications shall be constructed and operational within 4 years of the issuance of the new license.

6.4.2 Spillway Design: The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 2 years of the issuance of the new license for review and approval by the Service and NMFS engineering prior to construction.

6.4.3 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

6.5 J.C. Boyle Tailrace Barrier

6.5.1 Tailrace Barrier Construction: The Licensee shall construct a tailrace barrier and guidance system at J.C. Boyle Dam. The tailrace barrier and guidance system shall be constructed according to approved design plans and within 4 years of the issuance of the new license.

6.5.2 Tailrace Barrier Design –The Licensee shall, within 2 years of the issuance of the new license, develop design and construction plans according to the terms of general article 1.1.1 for review and approval by the Service and NMFS Engineering prior to construction.

6.5.3 Tailrace Barrier Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

7. Keno Dam

Upstream Prescription Rationale: Historically steelhead, spring-run and fall-run Chinook salmon (Hamilton et al. 2005), and resident fish migrated through the current site of Keno Dam to reach holding, spawning, incubation, and rearing habitat. Keno Dam is a partial barrier to this passage and thus to holding, spawning, incubation, and rearing habitat in the Link River reach. The goal of the Services and the Klamath River Basin Fisheries Task Force is to successfully restore corresponding life history phases of anadromous salmonids to their historical range and habitat. The goal of the Service is to successfully restore resident fish to their historical range and habitat as well. The objective in reaching these goals is restoration of safe, timely, and

effective fish movement. Providing fish passage that meets current standards at Keno Dam is consistent with goals and objectives for resource management of the Services and the Klamath River Basin Fisheries Task Force. The Licensee shall provide effective facilities to meet these goals and mitigate for the impacts of the dam.

Keno Reservoir in its current state would be primarily a migration corridor for anadromous salmonids because the depth and velocity of the impoundment provide little suitable habitat. Link River is the only free flowing reach of the Klamath River between Keno Dam and Link River Dam. Link River provides habitat for Klamath largescale suckers (Catastomus snyderi) during all months of the year, and for Lost River and shortnose suckers in summer when water quality is poor in downstream Lake Ewauna (Rich Piaskowski, BOR, pers. comm.) For salmonids, Link River provides habitat most of the year other than summer months. During most years, the Lake Ewauna reach of the Klamath River (Link River Dam to Keno Dam) has dissolved oxygen concentrations greater than 6 mg/L and temperatures less than 20C from mid-November through mid-June (Jason Cameron, BOR, pers. comm.). These conditions are within the criteria for migrating adult anadromous salmonids for these months (U. S. Environmental Protection Agency 2003). However, interim, seasonal, upstream trap and haul for adult Chinook salmon around Keno Reservoir and Lake Ewauna would be necessary during summer months when DO and temperature are out of criteria for this life stage of this species (USEPA 2003) and water quality conditions may not be suitable for migration. The Services expect that the major runs of these fish would occur from March to June for spring- run adult Chinook and October through December for fall-run adults. The Services expect trap and haul to be an effective interim, seasonal fish passage method for adult Chinook salmon under these summer conditions because only this species would be transported and only for a short distance. Other species need volitional fishways to access habitat in Keno Reservoir and Link River year round. Conditions in this reach are expected to improve over time to a point when volitional passage will be effective year-round for all target species. Water quality is expected to improve over the term of a new Project license through the implementation of the Total Maximum Daily Load (TMDL) process, imposition of state water quality certification conditions, and provisions of a new license including terms and conditions added by the Commission as well as the inclusion of recommendations pursuant to FPA section 10(j). Upper Klamath Lake above Link River Dam currently provides habitat for salmonids. Water quality problems in the lake during the summer months are relatively short lived and springs in the lake provide thermal refugial areas for redband trout and other species. Redband trout are also well known for migrating upstream into the Wood and Williamson rivers when Upper Klamath Lake water quality deteriorates. Once fish pass Keno Dam, Keno Reservoir, and Lake Ewauna, the current upstream fishway at Link River Dam would pass anadromous fish species (including Pacific lamprey) on their way to currently available, good quality upstream habitat upstream (Oregon Department of Fish and Wildlife 1997; Huntington 2006). The 3 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Keno Dam may impede native suckers occupying habitat below the dam from reaching elements of their historical habitat including Lake Ewauna, Link River, and Upper Klamath Lake, the core recovery area for this species (USDI Fish and Wildlife Service 1993). The existing fishway at

Keno Dam does not meet Service and ODFW criteria for sucker passage (Table 1) because the slope is too steep (USDI Fish and Wildlife 2005). However, the potential contribution of the J.C. Boyle Reservoir population for conservation of the species may be limited. Monitoring of fish passage at Keno Dam has demonstrated small numbers of fish moving upstream through the existing ladder at Keno Dam (PacifiCorp 1997). Until additional information becomes available regarding the populations of federally listed suckers in J.C. Boyle Reservoir and the need for passage of federally listed suckers upstream, the Service will reserve the authority to prescribe an upstream fishway to sucker criteria at Keno Dam.

Benefits of fishways at Keno Dam include:

- Resident Trout: Significant recreational fisheries for redband trout currently exist in the Project area, as well as in and upstream of Upper Klamath Lake. Upstream fish passage at Keno Dam would result in restoring the connectivity of resident redband populations in the mainstem Klamath River with those in Keno Reservoir/Lake Ewauna, Link River, and Upper Klamath Lake. In 2005, Reclamation completed a new fishway at Link River Dam designed to pass endangered suckers, trout, lamprey, and other native species. Adequate upstream fish passage at Link River Dam has resulted in restoring the connectivity of resident redband populations in the Link River reach with those in Upper Klamath Lake and its tributaries. These tributaries, including the Wood, Williamson, and Sprague rivers in particular, provide important habitat elements, such as spawning and temperature related refugial areas for redband trout (Oregon Department of Fish and Wildlife 1997). With fish passage, habitat between Keno and Link River Dam would be fully utilized. Seasonal migration of trout and access to refugial areas would be improved.
- Spring-run Chinook salmon, fall-run Chinook, and steelhead: All these species occurred historically above the current site of Keno Dam and Upper Klamath Lake (Hamilton et al. 2005). With upstream fishways at downstream dams and the new ladder at Link River Dam, adequate anadromous fish passage facilities at Keno Dam would mean these runs would regain access to 49 significant tributaries in the Upper Klamath Basin, comprising 360 miles of currently productive anadromous fish habitat (if anadromous fish had access to this habitat) and an additional 60 miles of recoverable habitat (Huntington 2006). Large populations of spring-run Chinook were found in several of the tributaries to Upper Klamath Lake, including both the Williamson and Sprague rivers (California Department of Fish and Game 1990). Historical run sizes in each these two rivers were estimated to be at least 5,000 spring-run Chinook salmon (California Department of Fish and Game 1990). Substantial numbers of what were apparently fall-run Chinook were still being harvested in the Sprague River up until about 1910 (Lane and Lane Associates 1981). Steelhead are generally tributary spawners and able to access reaches upstream from areas where salmon spawn (Platts and Partridge 1978). Therefore, with fish passage, steelhead would have access to tributaries above Keno Dam. Seasonal migration of anadromous salmonids and access to refugial areas would be restored.
- Pacific lamprey: At Keno Dam the existing fishway does not meet current criteria to accomplish lamprey passage because corners and ladder steps are not rounded (USDI

Fish and Wildlife 2005). Lampreys occur long distances inland in the Columbia and Yakima river systems (Wydoski and Whitney 2003) and would likely do so in the Klamath River system as well, as habitat conditions are similar.

Spillway Prescription Rationale: Spill survival estimates for juvenile salmonids are numerous and range from 70 percent to 100 percent depending on species, life stage, amount or proportion of water spilled, spillway configuration, tailwater hydraulics, the methodology of estimating survival, and predator conditions (Bell and DeLacy 1981 in National Marine Fisheries Service 2000). Fish passing down a spillway may experience physical, chemical, and biological effects. Fish passing over spillways can be injured by strikes or impacts with solid objects (e.g. baffles, rocks, or walls in the plunge zone), rapid pressure changes, abrasion with the rough side of the spillway, and the shearing effects of turbulent water. Water exits Keno spillways via undershot gates with small openings and plunges into a wide, shallow bedrock sill that is an area known for predatory fish (Oregon Department of Fish and Wildlife 1997). It is likely that fish will be injured as water is passed through the gates under pressure and that predation will occur in the receiving waters. Therefore, the spillway modifications and 3 year timeline are necessary to meet resource goals and objectives as quickly as possible.

7.1 Upstream Fishway at Keno Dam

7.1.1 Keno Upstream Fishway: To provide for the safe, timely, and effective upstream passage of Chinook salmon, steelhead trout, Pacific lamprey, and redband trout, the Licensee shall modify, operate, and maintain the existing volitional fishway. The Licensee shall also construct, operate, and maintain a holding and sorting facility to accommodate upstream interim, seasonal trap and haul for anadromous salmonids at Keno Dam. In addition, the modification shall include features to trap, hold, and sort anadromous salmonids by age and species, as well as accomplish the transfer of these fish upstream above Link River Dam between June 15 and November 15 for the purposes of restoration and the safe, effective, and timely passage of fish. If agreed to by the Services, seasonal trap and haul shall not be employed during this time in periods when dissolved oxygen concentrations are greater than 6 mg/L and temperatures lower than 20°C, as measured at Miller Island using a method that is acceptable to the Services. The upstream fishway shall be operated year-round regardless of trap and haul operations to allow for the passage of lampreys, suckers and other species. The ladder shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The auxiliary water system (AWS) shall be designed to augment ladder flow from the forebay. The AWS shall be screened in accordance with NMFS juvenile fish screen criteria (National Marine Fisheries Service 1997) or such alternative criteria acceptable to NMFS Engineering and the Service. The AWS shall be designed to provide the correct water temperature and water quality as

to attract fish. The fish ladder and AWS together must supply at least 5-10 percent of fish passage design high flow for adequate attraction to the ladder. The ladder shall include features to detect and record data for PIT-tagged upstream migrating anadromous fish (or fish identified using similar technology). The upstream fishway shall be modified to current criteria (Table 1) for passage of Pacific lamprey. The fishway shall be modified and operational within 3 years of the issuance of the new license.

7.1.2 Design Consultation: The Licensee shall develop design and modification plans according to the terms of general article 1.1.1 above within 1 year of the issuance of the new license for review and approval by the Service and NMFS Engineering prior to construction. The design shall include features to hold and sort anadromous salmonids by age and species, as well as accomplish the transfer of these fish upstream between June 15 and November 15 for the purposes of restoration and the safe, effective, and timely passage of fish. Facilities shall be designed so that fish to be trapped and hauled above Keno are held a maximum of 8 hours before transport. The ladder design shall include features to detect and record data for PIT-tagged upstream migrating anadromous fish (or fish identified using similar technology). The upstream fishway must be modified to current criteria for passage of Pacific lamprey.

7.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

7.2 Keno Spillway

7.2.1 Spillway Modification: The Licensee shall modify, maintain, and evaluate the radial gate(s) to provide a spillway at Keno Dam to provide for the safe, timely, and effective downstream passage of Chinook and coho salmon, suckers, lamprey, steelhead trout, and redband trout. The spillway modifications shall be constructed and operational within 3 years of the issuance of the new license.

7.2.2 Spillway Design: The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 1 year of the issuance of the new license for review and approval by the Service and NMFS engineering prior to construction.

7.2.3 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

8. Eastside and Westside Developments

Eastside and Westside Downstream Prescription Rationale: PacifiCorp's Eastside and Westside developments divert water at Link River Dam to downstream powerhouses. Significant numbers of redband trout and other resident fish are presently moving downstream from Upper Klamath Lake and being entrained by PacifiCorp's Eastside and Westside developments, including tens of thousands of larvae and juveniles of federally listed suckers annually (Gutermuth et al. 2000). Unless protected by fish screens and bypasses, fish migrating downstream can suffer injury or death by passing through turbines at hydroelectric plants (Electric Power Research Institute 1987). Turbine-caused mortality can have serious consequences for fish populations, especially among anadromous species (Cada 2001). Survival of juvenile salmonids passing dams during their seaward migration is highest through spillways and lowest through turbines (Muir et al. 2001); turbine mortality being caused by pressure changes, cavitation, shear stress, turbulence, strike, and grinding (Cada 2001). The Electric Power Research Institute (Electric Power Research Institute 1987) reported that Francis turbines, which are used at PacifiCorp's Eastside and Westside developments, have an average mortality of about 24 percent. Based upon these studies, turbine similarities, and known entrainment, the Services conclude that turbine entrainment at PacifiCorp's Eastside and Westside developments causes comparable levels of mortality to downstream migrating fish as found in studies cited above. Volitional fish passage would be consistent with fish movement through the Klamath River system for purposes such as spawning, rearing, feeding, and seasonal use of habitat. Volitional fish passage would be consistent with the goals and objectives for resource management of the Klamath River Basin Fishery Task Force and the Services. Downstream fishways at PacifiCorp's Eastside and Westside developments would screen and divert both resident and anadromous fish from turbine intakes. This would guide downstream migrating fish, minimize mortality of federally listed suckers, and ensure that delay and entrainment mortality of redband trout, other resident species, and anadromous outmigrants would be minimized. With the adult fish ladder in place at BOR's Link River Dam and construction of functional adult fish ladders at dams downstream of Link River, Pacific lamprey, salmon, and steelhead will return to hold, spawn, and rear in habitat where they were present historically (Hamilton et al. 2005). However, the progeny of these fish must negotiate not only the reservoir but the dam, powerhouse, and spillway during their outmigration. To ensure that these fish can outmigrate, downstream passage facilities at the Eastside and Westside developments are necessary.

Temporary, seasonal trap and transport for downstream migrants would be necessary due to seasonal water quality problems in Lake Ewauna and Keno Reservoir. During most years, the Lake Ewauna reach of the Klamath River (Link River Dam to Keno Dam) has dissolved oxygen concentrations less than 6 mg/L and temperatures greater than 20°C from mid-June through mid-November (Jason Cameron, BOR, pers. comm.). These conditions are not within criteria (USEPA 2003) for outmigrating juvenile anadromous salmonids and may not be conducive to downstream migration during this period. Transporting outmigrant anadromous salmonids around Keno Reservoir during this period would avoid poor water quality during summer months until restoration efforts improve reservoir dissolved oxygen and water temperatures.

The Services expect that the major outmigrations of juvenile Chinook salmon would occur from March to June for spring-run Chinook and February to May for fall-run juveniles. The Services expect trap and haul to be an effective interim, seasonal fish passage method for Chinook salmon under these summer conditions because only this species would be transported and only for a short distance. Other species need volitional fishways to access habitat in Keno Reservoir\Lake Ewauna and Link River year round. Seasonal trap and haul would be performed on an interim basis. Water quality is expected to improve over the term of a new Project license through the implementation of the Total Maximum Daily Load (TMDL) process, imposition of state water quality certification conditions, and provisions of a new license (the inclusion of 10(j) recommendations).

Migrating suckers make use of habitat in Lake Ewauna as long as water quality is adequate (i.e. outside of July, August, September (Rich Piaskowski, BOR, pers. comm). Downstream migrating suckers captured during periods when water quality is inadequate in Keno Reservoir\Lake Ewauna would be returned to Upper Klamath Lake.

Eastside and Westside Tailrace Barrier Prescription Rationale: Water discharging from the Eastside and Westside powerhouses represents a significant portion of the total river flow of the Klamath River. These developments have no tailrace barriers and have never been tested for mortality to federally listed suckers, other resident fish, or anadromous salmonids. The natural tendency for fish attracted to such an area is to hold and wait for passage conditions to improve, or to attempt to move past the obstacle either by swimming or leaping. Depending on powerhouse operations, water velocities in hydropower facilities range from roughly 5 to 10 fps; these velocities easily fall within the swimming abilities of salmonids (Weaver 1963). The types of injury sustained by some fish entering draft tubes or contacting turbines vary from site to site, as do immediate and delayed mortality rates. Several studies, however, attribute injuries in migrating salmonids to powerhouse structures associated with tailrace structures (Department of Fisheries Canada 1958; International Pacific Salmon Fisheries Commission 1976; Schadt et al. 1985; Williams 1985).

Adult anadromous fish are attracted into oncoming flows (National Marine Fisheries Service 2003). Migration upstream may be delayed when tailrace flows from the powerhouse exceed river bypass reach flows. A migration delay, or combined delays at several facilities, may prevent fish from reaching suitable spawning habitat when they are ready to spawn or conditions are optimal for survival. Migration delays caused by tailrace effects may have a greater impact on fish populations than injury and mortality from turbine impacts (Federal Energy Regulatory Commission 1994). Migration delays may occur to a greater percentage of migrating fish than the percentage of fish impacted by turbine mortality.

Migration delays are well documented for anadromous salmonids in the Pacific Northwest (Haynes and Gray 1980; Rondorf et al. 1983; Schadt et al. 1985; Vogel et al 1990). For migratory fish, false attraction occurs when upstream migrants are attracted to turbine discharge or spillway flows rather than to fishway flows. False attraction also occurs when upstream

migrants detect the scent of their natal stream downstream of its natural outlet (Fretwell 1989). This happens when water from a natal stream is diverted through a canal or pipe to a hydroelectric project. In either instance, without proper Project design or operation modifications, there may be migratory delays. In order to prevent injury, delay or mortality to suckers and salmonids, caused by attempts to swim upstream into the tailraces, barriers are required to guide migrating fish away from the tailrace area to continue their upstream migration.

The 3 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

8.1 Eastside and Westside Downstream Fishways

8.1.1 Intake Fish Screens and Bypass Facilities: The Licensee shall construct, operate, maintain, and evaluate fish screens and bypass facilities for volitional fishways at both Eastside and Westside developments to provide for the safe, timely, and effective downstream passage of Chinook salmon, steelhead trout, Pacific lamprey, federally listed suckers, and redband trout,. The fish screens and bypass facilities shall be located as close as is practicable to the beginning of each diversion to minimize entrapment in the diversion canals. The fish screens and bypass facilities shall transport fish to holding, sorting, counting, and tagging facilities where fish would either be passed into a volitional fishway or into temporary, seasonal trap and haul facilities for transport downstream. The facilities shall be constructed to accomplish the transfer of these fish downstream between June 15 and November 15 for the purposes of restoration and the safe, effective, and timely passage of fish. If agreed to by the Services, seasonal trap and haul shall be not be employed during this time in periods when dissolved oxygen concentrations are greater than 6 mg/L and temperatures lower than 15°C, as measured at Miller Island using a method that is acceptable to the Services. The bypass facilities shall include features to detect and record data for PIT-tagged downstream migrating fish (or fish identified using similar technology), including features to detect and record data from fish tagged above the facilities to evaluate survival and fishway effectiveness. The downstream fishway shall be operated year-round regardless of trap and haul operations to allow for the passage of lampreys, suckers and other species. The screens and bypass facilities shall be operated year-round and shall be designed in accordance with sucker criteria (Table 2), or alternative criteria as acceptable to the Services. The screens and bypass facilities shall provide for the uninterrupted passage of fish over the full range of river flows for which the Project maintains operational control. The construction shall include features to return suckers to Upper Klamath Lake. The downstream fishways shall be constructed and operational within 3 years of the issuance of the new license.

8.1.2 Design Consultation: The Licensee shall develop design and construction plans according to the terms of general article 1.1.1 above within 1 year of the issuance of the new license for review and approval by the Service and NMFS Engineering. The design of the bypass facilities shall include features to detect and record data for PIT-tagged downstream migrating fish (or fish identified using similar technology) and to hold, sort, count, and mark downstream migrating anadromous fish by age and species. The facilities shall include features to detect and record data from fish tagged above the facilities to evaluated survival and fishway effectiveness. The design shall include features to accomplish the transfer of these fish downstream between June 15 and November 15 for the purposes of restoration and the safe, effective, and timely passage of fish. The design shall include features to return suckers to Upper Klamath Lake. Facilities shall be designed so that fish to be trapped and hauled are held a maximum of 8 hours before transport.

8.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

8.2 Tailrace Barriers at Eastside and Westside Developments

8.2.1 Tailrace Barrier Construction: The Licensee shall construct a tailrace barrier and guidance system at the Eastside and Westside powerhouses. The tailrace barriers and guidance system shall be constructed according to approved design plans and within 3 years of the issuance of the new license.

8.2.2 Tailrace Barrier Design: The Licensee shall, within 1 year of the issuance of the new license, develop design and construction plans according to the terms of general article 1.1.1 for review and approval by the Service and NMFS Engineering prior to construction.

8.2.3 Tailrace Barrier Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in General Prescriptions, above.

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Section D: U.S. Department of the Interior
Fish and Wildlife Service 10(j) Recommendations
Klamath Hydroelectric Project - FERC No. 2082

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Section D: U.S. Department of the Interior, Fish and Wildlife Service, 10(j) Recommendations
Klamath Hydroelectric Project - FERC No. 2082

Recommended License Conditions Pursuant to 10(j) of the Federal Power Act

The Federal Power Act (16 U.S.C. 791 *et seq*.) requires in section 10(j) that each license issued for a hydropower project contain conditions to adequately and equitably protect, mitigate damages to, and enhance, fish and wildlife (including related spawning grounds and habitat) affected by the development, operation, and management of the Project. 16 USC 803(j). These conditions are based upon recommendations from the United States Fish and Wildlife Service (Service), the National Marine Fisheries Service (NMFS), and state fish and wildlife agencies.

Pursuant to Section 10(j) and to carry out the purposes of the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq*) (FWCA), the Service recommends that the following terms and conditions to protect, mitigate damages to, and enhance fish and wildlife resources be included in the new license for the Klamath Hydroelectric Project, No. 2082 (Project).

These recommendations were developed by the Service to support the resource agency management goals and objectives. The Service's primary goal is to establish safe and effective fish passage, restoration, and habitat conservation for native fish at the Project's facilities consistent with the management goals detailed in the plans and policies described in Attachment C. The purpose of the Service's recommended conditions is to restore and maintain productivity of fish and wildlife populations and their habitats affected by Project development, as well as offset current and continuing impacts that result from Project operation and maintenance. The Service's goals (USDI Fish and Wildlife Service 2003c) regarding relicensing of the Klamath River Project are:

> 1) Restore native fish populations within the Klamath Basin to provide fishery resources necessary to meet Trust responsibilities for tribal, commercial, subsistence, and ceremonial purposes; and enhance ocean commercial harvest, recreational fishing, and the economic health of local communities.
>
> 2) Restore volitional passage for all life history phases of anadromous and resident fishes throughout their historical range. Provide necessary water quantity, flow regimes, water quality, and other habitat conditions for the recovery and long-term sustainability of native fishes.
>
> 3) Recover federally-listed threatened and endangered species in the Basin by avoiding jeopardy, avoiding and minimizing take, and completing recovery actions identified and

detailed in recovery plans. Protect and restore habitat for federally-listed and candidate species.

4) Protect, mitigate, and enhance habitat for waterfowl and other migratory birds, terrestrial wildlife, fish, plants, and invertebrates.

5) Enhance ecological function and watershed processes to meet the above goals.

Mitigation Policy

The Service's Mitigation Policy (USDI Fish and Wildlife Service 1981) is pertinent to our assessment of the proposed Project and the development of recommendations for fish and wildlife resources. That policy recommends avoiding impacts as the first priority; minimizing any impacts which can not be avoided; rectifying impacts by repairing, rehabilitating, or restoring affected environments; reducing or eliminating impacts over time; and finally compensating for impacts by replacing or providing substitute resources or environments. Thus, the Service's first priority is to eliminate Project impacts through modification of Project operations or facilities.

Most of the fish and wildlife resources affected by the Project are considered to be of high value and relatively scarce or becoming scarce on a national or ecoregion basis. Accordingly, the Service's mitigation goal is no net loss of in-kind habitat value.

Ecosystem Approach

The Service's Ecosystem Approach to Fish and Wildlife Conservation (USDI Fish and Wildlife Service 1994) also provides management goals and guidance for the conservation of fish and wildlife resources affected by Project development. That document states that the primary goal of a conservation approach is conserving natural biological diversity and ecosystem integrity, while supporting sustainable human use. The Ecosystem Approach also includes a planning and action framework. It recommends first identifying natural resource needs by examining ecosystem components from a historical perspective, and understanding why they have changed over time. Goals and objectives are then stated. Goals are to be broad, and defined by objectives that are more specific and quantifiable. The next step is to identify and implement action strategies to achieve objectives. The final step is to monitor and evaluate actions. The Ecosystem Approach and its goals should incorporate concepts such as:

- Perpetuation of natural communities of plants and animals;
- Maintenance of naturally-occurring structural and genetic diversity;
- Needs of rare and ecologically important species;
- Minimization of habitat fragmentation;
- Role of natural processes such as fire and floods; and,
- Maintenance of compatible, sustainable human activities.

The Service has prepared these preliminary recommended terms and conditions based on current information regarding the proposed relicensing of the Project. As more detailed plans are developed, new information becomes available, and Project operations begin under a new license, deficiencies may be observed and modifications to fish and wildlife protection, mitigation, and enhancement measures may be necessary. The Service will modify these section 10(j) recommendations as needed to be consistent with finalized design plans and with new information developed as a result of the Federal Energy Regulatory Commission's (Commission) environmental review process or to correct deficiencies or problems found during post-licensing monitoring or evaluations.

1. Downstream Fish Passage Habitat Protection, Mitigation, and Enhancement Plan

Recommendation: The Licensee shall, within one year of license issuance and after consulting with the Service, NMFS, affected Tribes, the Oregon Department of Fish and Wildlife (ODFW), California Department of Fish and Game (CDFG), and Bureau of Land Management (BLM), develop and submit for FERC approval, a Downstream Fish Passage Habitat Protection, Mitigation, and Enhancement Plan to mitigate for unavoidable and ongoing Project impacts to downstream migrating anadromous and resident fish. Reclamation should be consulted regarding fish passage at or associated with facilities owned or operated by Reclamation. The plan shall describe specific actions to be undertaken, and contain provisions to monitor the success of those actions. The schedule for completing the plan shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the Plan all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the Plan. All mitigation measures will be reviewed by the Fisheries Technical Subcommitee, established by Section 10(a) recommendation 4, prior to submission to FERC. The Plan shall be submitted to FERC for approval. The Licensee shall implement the Plan upon FERC approval. The plan shall at a minimum:

A. Assess the effectiveness of all downstream fishways for resident (including federally listed suckers) and anadromous species. Assessment will be done at each downstream fishway and will include the use of Full Duplex Passive Integrated Transponder (PIT) tagging with PIT tag detection facilities at each downstream fishway, including the downstream fishways at the East Side and the West Side developments. Full Duplex tagging and detection technology is necessary to track small fish ($\geq$60mm in fork length) of interest to agencies. Monitoring may need to be augmented with radio telemetry. This assessment will be conducted every other year for the first twelve years of the license and every three years thereafter through the license term.
    a. Juvenile trout outmigrants shall be collected from Klamath River tributaries in the Project reach (Scotch, Camp, Jenny, Fall, Shovel, and Spencer Creeks) and PIT tagged with Full Duplex marking.

    b. Juvenile anadromous fish shall be collected from the East Side and the West Side developments and from important Klamath River tributaries in the Project reach

(Scotch, Camp, Jenny, Fall, Shovel, Long Prairie, and Spencer Creeks) and/or locations upstream and PIT tagged with Full Duplex marking.

B. Evaluate the survival of downstream migrating juvenile fish as well as ongoing and unavoidable losses resulting from the Project fish passage program;
C. Identify fish habitat protection, mitigation, and enhancement measures which fully mitigate the ongoing and unavoidable losses;
D. Implement the measures above, and monitor them to ensure their effectiveness.

Justification: Other than 1) decommissioning the East Side and West Side Diversions, 2) a gulper proposed at J.C. Boyle Reservoir to replace the downstream fishways at J.C. Boyle Dam, and 3) modifications to the J.C. Boyle upstream fishway that are necessary for compliance with the current license, the Applicant has not proposed fishways at mainstem developments nor has the Applicant proposed to mitigate for unavoidable and ongoing Project impacts to downstream migrating anadromous and resident fish. Relative to a without Project scenario, Project facilities will continue to affect downstream fish movement, even with the prescribed downstream fish passage facilities. These impacts include the loss of fish from migrating through Project reservoirs; stress; disease; impacts from angling in Project reservoirs; delayed migration timing; avian and other predation; residualization; and other factors. Even when screens and downstream migrant facilities perform to criteria, some salmon, steelhead, federally listed suckers, lampreys, and resident fish smaller than 60 mm will be entrained in the system's surface and/or deep water intakes and be lost. These losses would reduce the number of outmigrating fish available for passage and diminish biological productivity and connectivity. While we are proposing other measures to address some of the Project's ongoing effects, the intent of this program is to minimize mortality to federally listed suckers and lampreys, reduce losses of resident fish species, and increase overall anadromous smolt survival above the dams to offset this continued, unavoidable loss of outmigrating fish. After initial installation, downstream fishways may require monitoring and appropriate operational modifications.

Impacts: When first installed, downstream fishways may require modification to operate in an effective manner to provide safe, timely and effective fish passage. Monitoring and appropriate operational modifications of fishways are likely to be necessary. In addition, downstream fishways may have qualitative as well as quantitative impacts on target fish populations. For example, the effects of stress have been studied at passage facilities at several projects, including the effects of passage stress in relationship to predation (Petersen et al. 1990). These authors noted that stress had sublethal effects to fish physiology, and that these effects probably increased the fish's exposure and vulnerability to predation. Another study (((Park et al. 1984) in (Wedemeyer et al. 1985)) examined the post-transport mortality of downstream migrating spring-run Chinook and steelhead and noted that spring-run Chinook are among the least resistant to stress-mediated fish diseases. This study also indicated that delayed mortality in spring-run Chinook was higher than that for steelhead, and was as high as 50 percent. Delayed mortality of salmonids in the estuary or ocean residence is also linked to earlier downstream passage through hydropower systems (Budy et al. 2002). Delayed mortality caused by sublethal

impacts to fish sensory systems associated with passage through hydropower facilities and the resulting increased vulnerability to predation has been found to comprise a significant portion of the total mortality (Ferguson et al. 2006). These studies indicate that downstream fishways on the Klamath River will need to be monitored and adjusted to minimize outmigrant mortality.

2. Upstream Fish Passage Habitat Protection, Mitigation, and Enhancement Plan

Recommendation: The Licensee shall, within one year of license issuance and after consulting with the U.S. Fish and Wildlife Service, National Marine Fisheries Service; affected Tribes; Oregon Department of Fish and Wildlife; California Department of Fish and Game; and Bureau of Land Management, develop and submit to FERC for approval an Upstream Fish Passage Habitat Protection, Mitigation, and Enhancement Plan to mitigate for unavoidable and ongoing Project impacts to upstream migrating anadromous and resident fish. The Licensee shall consult with the Bureau of Reclamation (Reclamation) regarding fish passage at or associated with facilities owned or operated by Reclamation. The plan shall describe specific actions to be undertaken, and contain provisions to monitor the success of those actions. All mitigation measures will be reviewed by the Fisheries Technical Subcommittee prior to approval (see section 10(a) recommendation for a description of the Fisheries Technical Subcommittee). The schedule for completing the plan shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the Plan all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the Plan. The Plan shall be submitted to FERC for approval. The Licensee shall implement the Plan upon FERC approval. The plan shall, at a minimum:

A. Assess the effectiveness of all upstream fishways for resident (including federally listed suckers at Keno Dam) and anadromous species. Assessment will be done at each upstream fishway and will include the use of Full Duplex PIT tagging with Full Duplex PIT tag detection facilities at each upstream fishway on Project dams, including Keno Dam. Monitoring may need to be augmented with radio telemetry. This assessment will be every other year for the first twelve years of the new license and every three years thereafter throughout the license term.

B. Evaluate the survival of upstream migrating adult fish as well as ongoing and unavoidable losses resulting from the Project fish passage program;

C. Identify fish habitat protection, mitigation, and enhancement measures which fully mitigate the ongoing and unavoidable losses;

D. Implement the measures above, and monitor them to ensure their effectiveness.

Justification: When first installed, upstream fishways may require modification to operate in an effective manner to provide safe, timely and effective fish passage. Monitoring and appropriate

operational modifications of fishways are likely to be necessary. Relative to a without Project scenario, upstream fish movement, even with the prescribed upstream fish passage facilities, will be negatively affected by continuing impacts associated with the Project. These impacts include the loss of fish migrating through Project reservoirs; stress; disease; losses from angling in Project reservoirs; delayed migration timing; avian and other predation; and other factors. Even when upstream migrant facilities perform to criteria, some salmon, steelhead, federally listed suckers, lampreys, and resident fish will be lost. These losses would reduce the number of fish available for spawning and diminish biological productivity and connectivity. The intent of this additional program is to minimize mortality to federally listed suckers and lampreys, reduce losses of resident fish species, and increase overall returns of anadromous fish above the dams.

Impacts: Upstream fishways may have qualitative impacts on target fish populations. For example, migration delays caused by tailrace effects may have a greater impact on fish populations than injury and mortality (Federal Energy Regulatory Commission 1994). Migration delays are well documented for anadromous salmonids in the Pacific Northwest (Haynes and Gray 1980; Rondorf et al. 1983; Schadt et al. 1985; Vogel et al. 1990). False attraction can occur when upstream migrants are attracted to turbine discharge or spillway flows rather than to fishway flows. False attraction also occurs when upstream migrants detect the scent of their natal stream downstream of its natural outlet (Fretwell 1989). This happens when water from a natal stream is diverted through a canal or pipe to a hydroelectric project. In either instance, without proper Project modifications there may be extensive migratory delays.

3. Fish Habitat Protection, Mitigation, and Enhancement Plan

Recommendation: Within one year of license issuance, the Licensee shall, for the conservation, and development of, and mitigation of damages to, fish and wildlife resources, develop and submit a Fish Habitat Protection, Mitigation, and Enhancement Plan (FHP) to FERC for approval. The Licensee shall develop the FHP in consultation with the Service, NMFS, CDFG, ODFW, and the affected Tribes. The goal of the FHP shall be the restoration of fish habitat above and below the Project to mitigate the continued effects of the Project on fish habitat. All mitigation measures will be reviewed by the Fisheries Technical Subcommittee prior to approval (see section 10(a) recommendation for a description of the Fisheries Technical Subcommittee). The schedule for completing the FHP shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the FHP all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the FHP. The FHP shall be submitted to FERC for approval prior to implementation.

The Licensee shall fund fish habitat restoration to mitigate affected habitat connectivity and habitat loss. Implementation of the FHP shall be completed by the fifth anniversary of the issuance of a new license.

The FHP shall include, but not be limited to, the following measures:

A. Provide compensatory mitigation for a total of five miles of bypassed river channel (four miles below J.C. Boyle Dam and one mile below Copco 2 Dam).

B. Provide compensatory mitigation for a total of 14.1 miles of riverine channel inundated by Project reservoirs (6 miles for Iron Gate reservoir, 4.4 miles for Copco reservoirs; and 3.7 miles for J.C. Boyle reservoir).

C. Develop and implement a plan for habitat mitigation and enhancement for U.S. Forest Service (USFS) and BLM lands on Jenny, Fall, Spencer, and Shovel Creeks. Some of these projects have already been identified by the USFS and BLM for Spencer Creek Pilot Watershed Analysis (USDI Bureau of Land Management et al. 1995). Habitat mitigation may include cooperative funding with the water users on these tributaries to improve adult and juvenile fish passage facilities at irrigation diversions or other constructed fish barriers in the upper basin. Habitat enhancement may also include purchase of instream water rights. The Licensee shall fund the planning and implementation of projects on Federal lands to meet associated agency requirements under the National Environmental Policy Act and the Endangered Species Act. The Licensee shall fund the maintenance of these projects and monitoring to determine their effectiveness.

D. Provide compensatory mitigation such as for any continuing effects on fish and wildlife that are not avoided in future operations. These effects may include, but are not limited to: 1) effects of hydroelectric peaking operations on: a) fish productivity in the bypassed reaches, b) fish productivity in the peaking reach, and c) fish productivity in the Link River and Keno reaches to the extent that hydroelectric operations affect flows in those reaches; 2) effects of water impoundment on: a) water quality, including temperature, within the Project area and downstream, b) the prevalence of toxic algal blooms and fish diseases within the Project area and downstream, c) gravel depletion, d) reduced flood flows, and e) ramping and stranding impacts.

Justification: The Applicant has not proposed any mitigation for the loss of fish habitat due to the continued operation of the Project. The bypassed channels have been impacted heavily and will continue to be impacted by Project operations. The habitats that were inundated by the reservoirs will continue to preclude these riverine areas from native fish habitat use. Impacts of hydroelectric peaking and impoundment of waters will continue to some extent, and to the extent that these impacts have not been avoided, it is prudent to provide compensatory mitigation, in accordance with the Mitigation Policy of the Fish and Wildlife Service (see description of the Policy in the Introduction). There are excellent opportunities to provide for fish habitat compensatory mitigation within the watersheds described in element C, above.

Impacts: The Project continues to reduce fish habitat quality through the continued loss of 14.1 miles of riverine habitat within the Project's reservoirs. Of this, much of the river channel was low gradient stream habitat and at least 2.5 miles was important spawning habitat for resident and anadromous salmonids. These river segments historically provided spawning, incubation, and rearing areas for juvenile anadromous salmonids (Fortune et al. 1966; Hamilton et al. 2005; Lane and Lane Associates 1981). Production capacity for rainbow trout, Chinook, coho, Pacific lamprey, and steelhead are reduced due to the continued occupation of the river habitat by Project's reservoirs. Spring-run Chinook spawning and rearing habitat will continue to be unavailable for use by this segment of the Chinook population. Rainbow trout and other native species will have reduced habitat quantity and quality in the Project area. In addition, there will be continued loss of upstream and downstream migrating fish caused by fishway inefficiencies, reservoir mortality due to predation, migration delays, and water quality impacts.

Effects of hydroelectric peaking are summarized in Attachment A. Effects of water impoundment are described in Recommendations 6, 7, 8, 9, 10, 11, and 12.

4. Pacific Lamprey Management Plan and Evaluation

Recommendation: For the conservation and development of, and mitigation of damages to Pacific lamprey, the Licensee shall, within two years of license issuance, in consultation with the Service, NMFS, CDFG, ODFW, and the affected Tribes, develop and submit to FERC for approval, a Pacific Lamprey Management Plan (PLMP). The PLMP will include telemetry studies to evaluate upstream and downstream passage of Pacific Lamprey through Project fishways and reservoirs. The PLMP shall use the results of these studies as well as lamprey passage information from other Klamath Basin facilities to direct operational and structural improvements in Project fishways. The completed PLMP shall include the following measures to be developed and implemented by the Licensee:

> a. Monitor and evaluate: 1) the timing of juvenile lamprey outmigration through the Project; 2) downstream passage routes and proportion of juvenile lamprey which use each route; 3) juvenile lamprey survival through the Project; and 4) the effects of reservoir fluctuations on juvenile lamprey rearing.
>
> b. Develop and implement plans to modify or replace existing Project structures and operations to achieve upstream and downstream survival and passage levels that are commensurate with the best levels achieved elsewhere in the Klamath River Basin.

The PLMP shall describe specific actions to be undertaken, and contain provisions to monitor the success of those actions. The schedule for completing the PLMP shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the PLMP all comments received during consultation with the parties identified above, and an explanation of

how all comments are accommodated in the PLMP. The PLMP shall be submitted to FERC for approval. The Licensee shall implement the PLMP upon FERC approval.

Justification: The FLA does not contain a Pacific Lamprey Management Plan or measures that identify and mitigate for the Project's effects on Pacific lamprey during the term of the new license. This recommended Plan is consistent with agency, Tribal and Klamath River Basin Fisheries Task Force goals and objectives for anadromous fish restoration.

Impacts: The Project continues to block Pacific lamprey from historical habitat above the dams (Hamilton et al. 2005). The Klamath River Basin Fishery Resources Restoration Act (Public Law 99-552) directs the Secretary of the Interior to restore and maintain fish populations in the Klamath River Basin Conservation Area to optimum levels. The lack of Project fishways has impeded the Secretary's ability to successfully comply with this directive, as well as the ability of numerous agencies, Tribes, and the Klamath River Basin Fisheries Task Force to achieve published fish restoration goals.

5. Decommissioning Plan for the East Side and West Side Developments

Recommendation:

If FERC approves the Licensee proposal to decommission the East Side and West Side Developments, within one year of license issuance, the Licensee shall, for the conservation and development of, and mitigation of damages to, fish and wildlife resources, develop and submit to FERC for approval a Decommissioning Plan for the East Side and West Side Developments. The Decommissioning Plan shall be developed in consultation with the Service, NMFS, CDFG, ODFW and the affected Tribes. The schedule for completing the plan shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the Plan all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the Plan. The Plan shall be submitted to FERC for approval prior to implementation. The Decommissioning Plan shall include, but not be limited to, identification of optimal periods of the year to avoid impacts to fish and wildlife resources due to decommissioning, and a comprehensive plan for managing resources after decommissioning.

The Plan shall describe specific actions to be undertaken, and contain provisions to monitor the success of those actions. The schedule for completing the Plan shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the Plan all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the Plan. The Plan shall be submitted to FERC for approval. The Licensee shall implement decommissioning within three years of the Commission order requiring decommissioning and results shall be monitored to determine future needs in continued consultation with the Service, NMFS, CDFG, ODFW and the affected Tribes.

Justification:

The Applicant has proposed decommissioning of the East Side and West Side Developments, but provided very little detail of how decommissioning would be implemented, and failed to identify measures to minimize impacts to fish and wildlife. A Decommissioning Plan for East Side and West Side Developments, developed in consultation with the agencies and affected Tribes, will ensure that all aspects of decommissioning are considered and timed to avoid impacts to federally listed suckers, redband trout, anadromous salmonids, and other fish and wildlife resources. The Plan will also ensure compliance with all state and federal laws, as well as best management practices.

Impacts: Dismantling water related developments and dewatering power canals often result in the loss of habitat or in mortality to fish and wildlife. Without careful consideration and planning for the needs and habitat use of federally listed suckers, redband trout, anadromous salmonids, and other fish and wildlife resources, decommissioning may negatively impact these species and fail to minimize mortality.

6. Instream Flows

Recommendation:

1. East Side and West Side Powerhouses: The Department recommends that the Commission grant the Licensee's proposal to decommission East Side and West Side powerhouses. In the event that these facilities are not decommissioned as proposed by the Licensee, ramp rates at the powerhouses shall not exceed one inch per hour any time of the day or night or shall not exceed 300 cfs in any one 24 hour period. Ramp rates shall apply to all hydroelectric flow-regulated (controlled) operations including load following, re-regulating, and Project start-up and planned Project shutdowns.

2. Keno: The Keno facility shall be managed as a modified run of the river facility and the Licensee shall discharge inflow as available, below Keno Dam. On a 24 hour basis, the Licensee shall make every reasonable effort to hold river flows below Keno Dam to within ±10 percent of the measured Project inflow. Project inflow shall be measured as the sum of the three-day running average flow from Link River and the Reclamation projects including Straits Drain, Lost River, and North/ADY Canal. Flow records shall be made available to the Tribal, Federal and State resource agencies upon request.

3. J.C. Boyle: See Attachment A, the Bureau of Land Management 4(e) condition No. 4.

4. Copco 2: Licensee shall provide a minimum flow of 730 cfs in the Copco 2 Bypassed Reach. If inflow is less than 730 cfs, the Licensee shall direct all inflows into the

bypassed reach. If 40 percent of inflow is greater than 730 cfs, the Licensee shall direct 40 percent of the inflow into the bypassed reach. Inflow shall be computed as a running average of flows during the prior three days at J.C. Boyle Powerhouse gage (#11510700) added to a new gage to be installed by the licensee at Shovel Creek. Flow records shall be made available to the Tribal, Federal and State resource agencies upon request.

Ramp rates at the Copco 2 Dam shall not exceed one inch per hour any time of the day or night or shall not exceed 300 cfs in any one 24 hour period. Ramp rates shall apply to all hydroelectric flow-regulated (controlled) operations including load following, re-regulating, and Project start-up and planned project shutdowns.

5. Fall Creek: Licensee shall provide a minimum of 40 percent of the instantaneous flow, as measured above the Fall Creek power canal diversion, into the bypassed reach. To ensure compliance, the Licensee shall install gages in Fall Creek above the power canal diversion and within the bypassed stream channel. Flow records shall be made available to the Tribal, Federal and State resource agencies upon request.

   Ramp rates at Fall Creek power canal diversion shall not exceed one inch per hour any time of the day or night or shall not exceed 300 cfs in any one 24 hour period. Ramp rates shall apply to all hydroelectric flow-regulated (controlled) operations including load following, re-regulating, and Project start-up and planned Project shutdowns.

6. Spring Creek: Licensee shall provide the following minimum flows at Spring Creek:
   - Full un-diverted flows from June 1 through September 15.
   - 50 percent of the flow above the diversion to remain instream during the remainder of the year, regardless of flow volume.

   Flow records shall be made available to the Tribal, Federal and State resource agencies upon request.

   Ramp rates at Spring Creek diversion shall not exceed one inch per hour any time of the day or night or shall not exceed 300 cfs in any one 24 hour period. Ramp rates shall apply to all hydroelectric flow-regulated (controlled) operations including load following, re-regulating, and Project start-up and planned Project shutdowns.

7. Iron Gate Dam: With the exception of biologically based pulse releases, Licensee shall operate its facilities to ensure that the Project operates as a run-of-the-river facility. In so doing the Licensee shall make releases from its Iron Gate Dam facility that are equivalent to the combined instantaneous inflow to the Project including tributary inflow, spring accretion flow, irrigation return flows and releases made by Reclamation from its Klamath Reclamation Project.

Ramp rates at Iron Gate Dam shall not exceed 125 cfs per hour and 300 cfs per 24 hours when flows are greater than 1,750 cfs, and 50 cfs per 2 hours and 150 cfs per 24 hours when flows are 1,750 cfs or less.

Justification:

Instream Flows:
The ecological structure and functioning of aquatic, wetland, and riparian ecosystems depend largely on the hydrologic regime, or pattern and quantity of water flowing through the system (Gorman and Karr 1978; Junk et al. 1989; Mitsch and Gosselink 1993; National Research Council 1992; Poff et al. 1997; Poff and Ward 1990; Sparks 1992). Intra-annual variation in hydrologic conditions plays an essential role in the dynamics among species within such communities through influences on reproductive success, natural disturbance, and biotic interactions (Poff and Ward 1989). Modifications of hydrologic regimes can indirectly alter the composition, structure, and functioning of aquatic, riparian, and wetland ecosystems (Bain et al. 1988; Lillehammer and Saltveit 1984; Stanford and Ward 1979; Ward and Stanford 1983; Ward and Stanford 1989). The literature consistently illustrates the adverse effect of inadequate flow on aquatic organisms (Annear et al. 2004). Research also indicates that beyond prescribing a minimum flow, managers should determine an appropriate flow regime based on season and water year type ((Richter et al. 1997) and (Stanford et al. 1996)). The artificial manipulation of flow without reference to a baseline hydrograph can profoundly impact habitat and fish communities (Poff and Allan 1995).

Project alterations to the hydrologic regime include the impacts associated with impounding waters at five dam sites, use of storage to change the timing of flows through hydroelectric dams and river reaches, diverting the majority of flows from bypassed reaches of the Klamath River, and ramping river water surface elevation rapidly.

The Applicant's proposal includes operations essentially equivalent to the status quo. To correct this imbalance, the Service's flow recommendations include significant increases in flows in the bypassed and regulated reaches to support aquatic life and to improve water quality. Flow restoration will sustain well-connected and functional riparian and aquatic habitats to which the native aquatic and riparian communities are adapted.

Based upon the current configuration of Project facilities, it is unlikely that the Applicant is capable of providing any appreciable flows in excess of Project inflow on a continuous basis. Project inflow is derived from a combination of tributary inflow, spring accretion flow, irrigation return flows and releases made by the U.S. Bureau of Reclamation (BOR) from its Klamath Reclamation Project. The instream flow recommendations are actions that are deemed to be within the capacity of PacifiCorp to perform.

Ramping Rates:
Project ramping occurs when operations require an increase or decrease in flow through the turbines to adjust for shifts in power demand or to adjust flows for other reasons. Ramping also occurs during Project drawdown for flood control, as well as when outflow is reduced to facilitate reservoir refill. Ramping can also occur when maintenance activities require lowering Project reservoirs to access structures. Unplanned outages are an uncontrollable cause of Project ramping. Project start-up after planned and unplanned outages also involves ramping.

Sudden flow changes in stream reaches due to Project operations can adversely impact fish and aquatic resources. Significant rapid flow reduction in bypassed, peaking, and regulated reaches affects a fish population by dewatering redds and stranding fry or juvenile fish. Rapid flow increases in bypassed, peaking, and regulated reaches can wash out existing redds, displace fry, displace macroinvertebrates, or adversely impact amphibian populations in these reaches. Downramping of only 1 inch per hour can impact fish populations. One very significant ramping event at a very unusual time can cause a significant limiting condition for one or more age classes of fish, or a section of habitat to be impacted for a long period (Hunter 1992).

Large flow fluctuations can also result in increased erosion of important small substrates such as gravel and small cobble, which can reduce available habitat for spawning fish and macroinvertebrate species. Daily and hourly flow fluctuations may increase the rate of erosion of shallow shoreline habitats, and with the cumulative effect of sediment recruitment blocked by dams, magnifying the effect on aquatic, terrestrial, riparian, botanical and recreational resources.

One of the most thorough studies of the effects of hydropower fluctuation on fish habitat was conducted in 2003 and 2004 by Federal, State, Tribal, and private researchers in the Hanford reach of the Columbia River near Richland, Washington (Anglin et al. 2005). The researchers integrated hydrodynamic modeling and Geographic Information System analyses with empirical, physical and biological data. This study confirmed that flow fluctuations from hydropower operations caused significant mortality in juvenile fall Chinook. The following excerpt documents the relative impact of peaking operations:

> We found that although rearing habitat varies with streamflow, stability is likely more important to juvenile Chinook than absolute flow level. Stable flows and habitat conditions require less movement and less energy expenditure than constantly fluctuating flows and spatially variable habitat conditions. Stable flows would also help to reduce the potential for stranding or entrapment of juveniles. (page 3).

The Hanford study on stranding and entrapment also provides insight into the stranding component of PacifiCorp's peaking analysis (PacifiCorp 2005a). The Hanford researchers noted that previous efforts to quantify the magnitude of stranding and entrapment were confounded by low fish sampling probabilities. Anglin et al. (2005) stated the following comment:

> …most important, the sampling approach had problems with detecting stranded fish. Fish stranded on substrates within the Hanford Reach are inherently difficult to find (i.e. detectability is low, even when fish are present). On larger substrates fish tend to migrate downwards as water recedes, requiring excavation of the site to locate dead fish. On finer substrates, fish are exposed to predators and are often quickly removed. Because of the problems with detection of stranded fish, the estimates of stranding and entrapment impacts are likely biased low. (page 57).

The Hanford study focused on entrapped fish to counter the sampling bias inherent in surveys for stranded fry. These entrapped fish remained visible in isolated pools or channels longer, facilitating a more accurate count. However, while these fish may not die from outright desiccation, these fish are significantly impacted by predation and thermal mortality.

The current FERC license does not include conditions that require PacifiCorp to apply specific ramping rates to operations, with the exception of the J.C. Boyle Peaking Reach, which has ramp rates of 9 inches per hour, and below Iron Gate Dam at 250 cfs or 3 inches per hour, whichever is less. Stranding of anadromous salmonids and other fish in the Klamath River has been documented at these high ramp rates (USDI Fish and Wildlife Service 1998).

The Applicant's study of impacts of ramping and stranding in the Project reach was not adequate. Field surveys were unable to detect stranded trout fry and yielded small numbers of stranded sculpin, suckers and dace, and because the Applicants's visual detection methods had little success, PacifiCorp's stranding and entrapment study results are consistent with the findings from the Hanford study. However, the Applicant's examination of isolated pools and side channels did find trapped trout fry, larval suckers and dace. Contrary to resource agency interpretation and the Anglin et al. (2005) study, PacifiCorp discounted these observations, since fish were not technically stranded and generally still alive. A different interpretation, supported by the Hanford study, is that fish populations are severely impacted by flow fluctuations since chronic stranding, desiccation, depredation, and thermal mortality occur as a result.

Ramping rates recommended by the Service are consistent with license conditions at other hydroelectric projects and are based on recommendations from Hunter (1992) and other ramp rates applied at hydro projects from the Pacific Northwest. The recommended ramping rates are feasible to apply at the Project, effective for protecting aquatic and riparian resources, and have been accepted for implementation at other hydroelectric projects by FERC.

1. Flow Recommendations for the East Side and West Side Powerhouses:

The Department supports the Applicant's proposal to decommission the East Side and West Side Powerhouses.

After numerous observations of fish strandings in the Link River, ODFW entered into an interim agreement with PacifiCorp to have minimum flows of 90 cfs at Link River Dam and 450 cfs at

the Eastside powerhouse in the early 1990s (Amy Stuart pers comm.). In 2001, the Service's Biological Opinion for endangered suckers required a minimum flow at Link Dam of 250 cfs from June to October, when needed. Since there is no gage below the dam, the only gage data that can be evaluated to assess minimum flow needs is the Link River flow data below the Eastside powerhouse, approximately one mile downstream from Link River Dam. While the "minimum flow" below the Eastside powerhouse is 450 cfs, this reach of the river frequently fluctuates between less than 450 cfs and greater than 3,000 cfs. For example, from the period May 1 to August 30, 2005, the flow ranged from 437 to 3,790 cfs, largely due to hydroelectric peaking at the Eastside powerhouse. Meanwhile, flows below Link River Dam have been observed as low as 25 cfs although the minimum flow required is 90 cfs. While there is no formal FERC ramp rate, an existing agreement with ODFW calls for 20 cfs/5 minutes for 0-300 cfs, 50 cfs/30 minutes for 300-500 cfs, and 100 cfs/30minutes for 500-1500 cfs. Fish salvages are required per the 1996 Biological Opinion below 300 cfs.

Wetted Perimeter Analysis (Link River below Eastside Powerhouse): The Licensee conducted a wetted perimeter analysis in the Link River above and below the Eastside powerhouse. The Licensee's analysis of wetted perimeter in the Link River consists of a total of 11 transects in different habitat types that evaluated change in wetted perimeter under different flow regimes, with 4 transects below the Eastside powerhouse discharge and 7 above the Eastside powerhouse discharge. The wetted perimeter analysis presented in Figure 1 shows the 4 individual wetted perimeter transects (dotted or dashed lines) located below the Eastside powerhouse and a combined summary of the four transects (solid line).

The wetted perimeter analysis in the Link River below Eastside powerhouse indicates that the percent of wetted perimeter change from 50 to 3,000 cfs is 42% for all types of habitat and 62% in riffle habitats. Even with flow changes from 450 to 3,000 cfs, the wetted perimeter change is 18% for all habitats and 31% in riffle habitats. These are very substantial changes and represent severe dewatering of the channel bed.

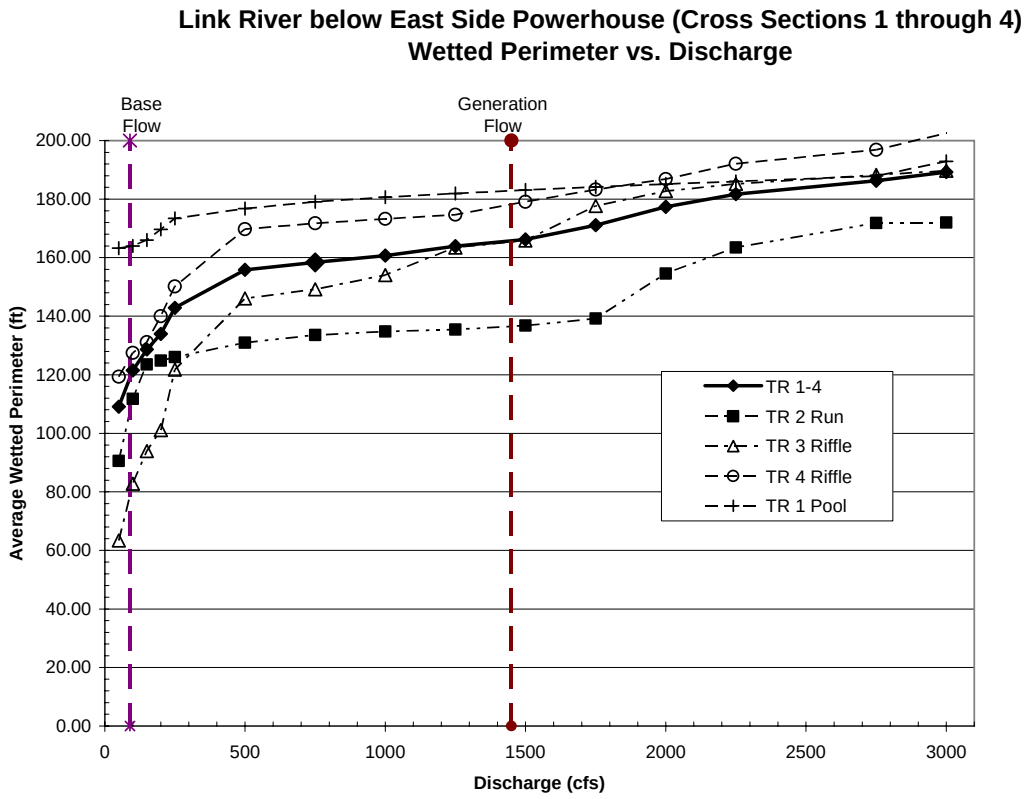

Figure 1. Wetted perimeter versus discharge for the combined and 4 individual habitat transects of Link River flows below Eastside powerhouse.

Project Impacts in Link River Reach: The minimum flow pursuant to agreement with ODFW for below Link River Dam is 90 cfs, yet during site visits in recent years, such as the PacifiCorp-led tour on September 26, 2000, barely an estimated 25-30 cfs was flowing downstream from the dam, primarily dam leakage and flow via the fish ladder. Even the current 90 cfs minimum flow is inadequate and only provides some flow for passage and little flow for rearing native fish.

Numerous fish kills have been documented in the Link River, particularly when flows drop below 300 to 500 cfs (Amy Stuart, ODFW pers comm.). One resident along the Link River documented in a letter to "Pacific Power and Light" (the Licensee) a large fish kill with numerous flow changes and the river height falling from 3-4 feet in a period of 3-4 minutes. The resident commented that only the residents that live along the river observed stranded and dead fish because "twenty minutes later the river rose in a rapid fashion, washing away the dead fish" (letter from (Wagstaff 1992) to Jerry Rope at Pacific Power and Light, April 12, 1992). The resident indicated that this was not an isolated incident and this situation had occurred repeatedly for the past 13 years. When he contacted the Licensee, the Licensee's responses ranged from "we are working on that problem" to "those aren't game fish."

2. Flow Recommendation for the Keno Reach:

The minimum flow requirement below Keno Dam, per FERC article 58 and ODFW agreement is 200 cfs. Flows generally range from as low as 200 cfs up to 1700 cfs during the summer although there is no generation at Keno Dam. PacifiCorp regulates flows at Keno Dam to maximize generating efficiency at J.C. Boyle and downstream peaking facilities and to keep the Keno pool within one foot of the high water mark to allow gravity irrigation facilities to operate. There is no FERC ramp rate requirement, but PacifiCorp indicated a self-imposed, non-regulatory ramp rate of 500 cfs or 9 inches per hour in the FLA. The number of hourly flow changes greater than 500 cfs per hour averages 28 for each year for water years 1995 to 2001.

Flows received at Keno Dam are a combination of flows from Link River and irrigation return water from canals downstream from Link River that return water to Lake Ewauna. Reclamation and PacifiCorp have an agreement that PacifiCorp operate Keno Dam to hold Keno Reservoir within a variance of only 0.5 foot (see Figure 3). The steady reservoir elevation allows Reclamation to manage its irrigation water through its diversion channels from Keno Reservoir, and enables PacifiCorp to more effectively plan downstream load following operations at the J.C. Boyle powerhouse (PacifiCorp 2004c). Approximately 5,900 acre feet of water storage is provided by the 0.5 foot variance in reservoir elevation, which equates to approximately 30 days of a flow of 100 cfs (Hicks, pers. comm.). Currently, this storage is being utilized to provide flow fluctuations in support of hydroelectric peaking operations at J.C. Boyle Dam, downstream, as shown in Figure 4. We recommend that this storage be used to dampen the unnatural flow fluctuations coming out of Keno Dam (see Figures 3 and 4) to support better fish habitat.

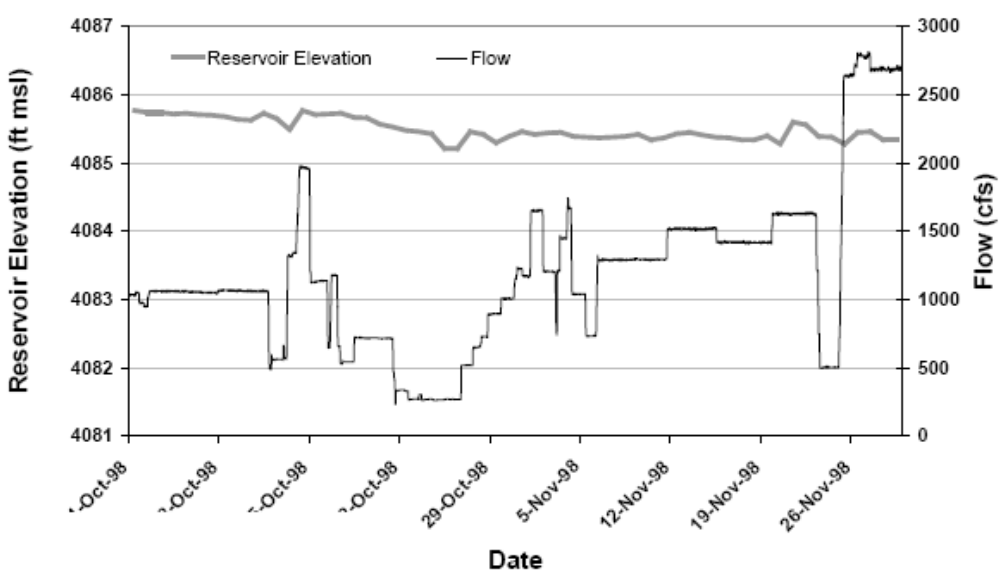

Figure 3. Keno Reservoir elevation and hourly discharge below Keno dam during October and November 1998 (PacifiCorp 2004c)

The flow recommendation for the Keno reach also allows a +/- 10% of inflow within the irrigation season to allow for adjustments due to changes in inflow and outflow from the Reclamation Project on a daily basis. The intent is to provide some "smoothing" of flows in the Keno reach to accommodate the one inch per hour ramp rate under the Licensee's control, and also accommodate flow fluctuations due to the Reclamation Project above Keno Dam.

Decreasing the amount of unnatural flow fluctuations in the Keno reach will substantially restore aquatic and riparian resources toward a more natural condition that supports redband trout and federally listed suckers. In addition, the reach will need to provide better habitat conditions than those present to promote the potential future migration of anadromous fish.

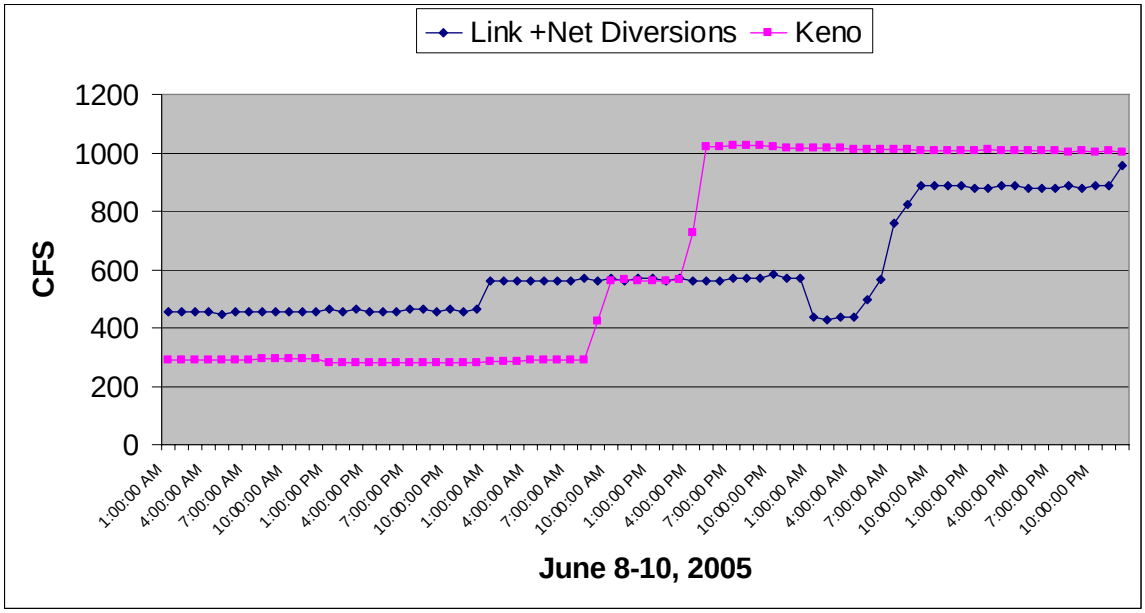

Figure 4. Comparison of flows in Link River, including net diversions from Reclamation Project facilities, and below Keno Dam, during June 8-10, 2005 (Reclamation data)

Project Impacts in Keno Reach: PacifiCorp did not conduct a flow study or a flow fluctuation study in this reach. PacifiCorp states that flows below Keno Dam, in the Keno Reach, are dependent entirely on what is delivered to Lake Ewauna / Keno Reservoir by Reclamation and other irrigation operations, and that PacifiCorp has no discretion or control over flows in the Keno Reach (PacifiCorp 2004c). This is contradicted by the fact that 80 percent of the inflow to Lake Ewauna is from Link River while approximately 20 percent is from agricultural returns with a very small amount from municipal and industrial inputs (PacifiCorp 2004c). PacifiCorp can and does alter flows in the Link River and Keno Reach for hydroelectric Project purposes,

including maintenance actions, and to maximize peaking at downstream Project peaking facilities.

While the Keno Reach is not as severely impacted as the bypassed or peaking reaches downstream, flows are ramped up and down to re-regulate flows to maximize peaking at downstream facilities and to regulate incoming flow from Reclamation irrigation (see Figures 3 and 4. For example, from the 4-month period from May 1 to August 30, 2005, the gaged flow below Keno Dam ranged from 279 to 5,490 cfs, with no apparent cause for high or low flows.

The practice of using reservoir storage to follow short-term peaks in power demand – known as load following – results in rapid and significant changes in river flow and reservoir elevation. The greater storage at Keno Dam (compared to J.C. Boyle Reservoir), with a 6 inch daily reservoir fluctuation, has given PacifiCorp more options to maximize peaking at the downstream J.C. Boyle and the Copco peaking facilities. The Applicant describes Keno Dam operation as: "The steady reservoir elevation allows Reclamation to manage its irrigation water through its diversion channels from Keno reservoir, and enables PacifiCorp to more effectively plan downstream load following operations at the J.C. Boyle powerhouse" (PacifiCorp 2004c).

Although the Keno Reach has some of the better existing conditions for native redband trout among the Project-affected reaches, the trout fishery is impacted by the low flows and frequent flow fluctuations from PacifiCorp and Reclamation flow regulation. Effects of these flow fluctuations are of the types described for the peaking reach, but of much less magnitude. Institution of a minimum flow and combination with a more restrictive ramp rate will reduce the incidence of fish kills, and increase habitat, survival and productivity of native fish.

Project impacts occur from a combination of periodic low flows in combination with a high ramp rate. Impacts are greatest during very high and cold water temperatures and often lead to fish die-offs. For example, in June 2003 flows in the Keno Reach were reduced by PacifiCorp in order to limit the amount of inflow to the J.C. Boyle Reservoir during a Project outage for maintenance at the J.C. Boyle Powerhouse. Due to both rapid declines in flow, the sustained low flow of 250 cfs and hot weather and water temperatures, a fish die-off occurred in the Keno Reach. The large fish and macroinvertebrate die off occurred due to the rapid de-watering in combination with the high water temperatures of the Klamath River which stranded fish and caused stressful conditions. An unknown amount of macroinvertebrate abundance was lost but was significant considering abundance ranges from 11,000 to 21,000 m^2 in the Keno reach of the Klamath River (Tinniswood 2006).

A second large fish-die off occurred later that summer in late July and early August and was caused by a combination of algae die-off, very warm water, and low flows (flows in the Keno Reach ranged from 413 cfs to 521 cfs during the die off), and resulting lack of DO for fish, that occurred the previous nights. The stressful conditions (low DO, warm water temperatures, and low flows) probably resulted in an epizootic of columnaris which appeared to be the immediate cause of death of most fish sampled.

As recently as December 10, 2005, ODFW district staff observed fish mortality and heavy macroinvertebrate loss when river flows below Keno Dam were reduced from 1,140 cfs on December 4, 2005 to 333 cfs on December 6, 2005 (Tinniswood 2006). This reduction of flow coincided shortly after the JC Boyle bypass canal failure on December 2, 2005. Low flows of 358 cfs continued until 14 December when mean flows were increased to 770 cfs when the increase in flow coincided with the completion of repairs on the JC Boyle bypass canal on December 15,2005. Flows were then increased again to a mean of 1170 cfs for the date. Although ODFW staff were unable to be on site in the Keno reach until December 10, four days following the drawdown for the canal repair, dead redband trout and tui chub were observed as well as thousands of blue chub and fat head minnow stranded in the shallows. The loss of macroinvertebrates was unquantifiable but significant and probably in the millions of organisms for the entire reach. In summary, the fish and macroinvertebrate stranding and die-off occurred due to a drastic decrease in river flows during very cold water temperatures of 2º-3º C.

Many fish die-offs have occurred in the Keno Reach since ODFW staff began to keep records in their monthly reports. ODFW concludes that in most cases, when fish die-offs occur in the Keno Reach, PacifiCorp, not Reclamation, alters flows in the Keno Reach for Project purposes. This alteration results in adverse impacts to fish and aquatic resources. Die-offs are more severe during episodes of very warm or cold water temperatures, in combination with low flows or cumulative down ramps that reduce the river to low flows (Bill Tinniswood, ODFW. pers comm.). For this reason, reduced flow fluctuations need to be established as part of the new license to protect fish and aquatic life from Project operational impacts.

3. J.C. Boyle:
See Attachment A, the Bureau of Land Management 4(e) condition No. 4.

4. Flow Recommendation for the Copco 2 Bypassed Reach:
At Copco 1 Dam, 100 percent of the instream flow below 3,200 cfs goes through the penstocks and powerhouse. Diversion at Copco 2 Dam is 97 percent of the instream flow below 3,200 cfs. Flow is 5 to 10 cfs below Copco 2 in the Copco 2 Bypassed Reach.

The Service participated in an inter-agency group of fisheries professionals to develop methodology for instream flow recommendations. The participating agencies were the Service, NMFS, BLM, Reclamation, CDFG, and ODFW. Explanation of the instream flow methodology developed by this group is located in this section, below, and in the BLM's section 4(e) conditions (Attachment A). The Service recommends implementing an instream flow regime based on the best available information in order to meet the objective of restoring instream habitat for fish in the Project reaches. The Instream Flow Council (IFC) recommends developing instream flow prescriptions that address five riverine components: 1) hydrology; 2) habitat; 3) geomorphology; 4) water quality; and 5) connectivity (Annear et al. 2004). The Project operations and facilities, coupled with upstream land and water use, have profoundly impacted all five of these components. As a result, data must be carefully evaluated in the

context of multiple interacting parameters. No one tool should be considered definitive, but rather employed in conjunction with other sources of information to provide perspective and guidance in developing recommendations.

The IFC also notes that utilizing a percentage of unimpaired hydrology can serve as a robust and reasonable starting point in preparing a flow recommendation where site specific data is problematic (Annear et al. 2004). The caveat to using this standard setting approach is the need to augment it with site specific assessments of how biological and geomorphic processes respond to flow. The Service and its partners considered utilizing the PHABSIM results provided by the Licensee and found that problems with the results precluded their use (for explanation, see Attachment A, condition 4). Instead, the group decided to develop minimum base flow recommendations based on hydrology and a percentage of inflow approach, where needed, to provide for inter-and intra- annual variation.

Two aspects of using a percentage of inflow approach lend themselves to the Project in particular. First, this approach translates into a simple and direct flow prescription. Requiring PacifiCorp to bypass a percentage of inflow eliminates the confounding complexities of multiple other water users and regulators in the Upper Klamath Basin. Second, this approach provides flexibility to accommodate ongoing watershed restoration. Interior and many other stakeholders are actively working towards enhancing instream flows in the Klamath River through efforts such as wetland restoration and water conservation. By avoiding a static flow requirement, this approach will allow impacted resources to benefit from future restoration initiatives both within and upstream of the Project.

Base Flows: The Service recommends a minimum base flow in the Copco 2 Bypassed Reach, that equals 40 percent of the mean annual inflow for that reach. The recommended reservation of at least 40 percent of the mean annul flow is supported by the hydrologic methods proposed by Tennant (1976), Tessman (1980), Estes and Orsborn (Estes and Orsborn 1986), and the IFC (Annear et al. 2004). Reserving at least 40 percent of the mean annual flow for aquatic resources is also supported by site specific information from the PHABSIM results, wetted perimeter analysis, an unimpaired hydrology approach, side channel analysis, and water temperature modeling information. Different site specific supporting information is available for different reaches (see discussions below, above, and in Attachment A).

In his study of 11 streams in Montana, Nebraska, and Wyoming, Tennant (1976) found empirical support for the Montana Method, which recommends base flows that provide good survival conditions for most aquatic species. The Montana Method recommends base flows of 40 percent of the mean annual flow received under unimpaired conditions to provide "outstanding" habitat from October to March and "good" habitat from April to September (Tennant 1976). Tennant (1976) empirically studied only 30 percent and 60 percent flows, and found that base flows equaling 30 percent of mean annual flow provides good aquatic habitat and 60 percent provides outstanding aquatic habitat conditions. He also recommends using "undepleted" USGS hydrology data for flow recommendations. "Otherwise, recommendations from the Montana Method may relate to depleted stream conditions and result in less than ideal flows" (Tennant 1976). We based our base flow recommendations on the best available gage information (longest period of record) for each reach, and under "depleted" conditions (i.e., diversions upstream of the reaches have reduced flows from what would be expected under natural conditions, also termed "impaired"). Based on Tennant's analysis, we found that 30 percent of these "depleted" flows would likely be "less than ideal" for fish and other aquatic life, and chose 40 percent of the "depleted" flows as likely providing good aquatic habitat. Then we endeavored to collect independent information in any and all reaches to test that assumption. We found that the independent information provides good support for the 40 percent of "depleted" flows recommendation.

Seasonal Flow Variation: Seasonal flows above the 40 percent minimums will take place in all of the mainstem Project reaches except the bypassed reaches, where most higher flows are diverted to the powerhouses. In order to promote a more natural hydrologic pattern in the bypassed reaches, we adopted the modified Montana method of Tessman (1980). Tessman (1980) modified the Montana Method by using either 40 percent of the mean annual flow or 40 percent of the mean monthly flow, whichever was greater. This modification represents an important improvement over the traditional "flatline" Tennant flow requirement and provides intra-annual variability during the wetter part of the year. We adapted the Tessman approach to the two bypassed mainstem reaches by requiring either: 1) 40 percent of mean annual flow or 2) 40 percent of the three day running average, whichever is greater below the Copco 2 Dam. Our approach uses a smaller time step than Tessman (1980), 3 days instead of monthly, to provide for more frequent variations, facilitate Project operations, and accommodate the relatively small storage capacity of the Project reservoirs.

Upstream storage and diversions have impacted flow into PacifiCorp's Project since construction. As a result, we do not have access to an "unimpaired" hydrograph. We do have access to USGS gage data over an extended period of record (i.e. the past 44 years) that includes a range of water year types as well as a variety of regulatory constraints. This record of what has actually been delivered to the Project provides the foundation for the recommended minimum base flows in the bypassed reach. By using 40 percent of the mean annual flow received by PacifiCorp over 44 years, we have recommended minimum flows that will, on average, be available to the Applicant.

We acknowledge that during drier months and drier water year types, these flows will not always be available. This is not unique to the Klamath. As Tessman notes, "There will be circumstances when the actual flow is less than the minimum flow value. The minimum flow is not intended to suggest that stream flow should be augmented when naturally occurring flows are less. Minimum flows simply serve as a constraint on withdrawal." ((Tessmann 1980), p. 7-8). In instances when the minimum release of 40 percent of the mean annual flow is not available, Tessman recommends releasing a flow equal to the mean monthly flow into bypassed reaches. Under our recommendation, whenever the three day running average drops below the required minimum releases, diversion at that facility shall cease and all inflow be directed to the respective bypassed reach.

Comparison with PHABSIM Results:
Almost 100 years of extreme flow reduction in the Copco 2 Bypassed Reach has created an artificial channel that limits the applicability of PHABSIM weighted usable area (WUA) curves for developing appropriate instream flows. The riparian encroachment of large alder trees in the riverine channel is reflected in the WUA curves. In the Copco 2 Bypassed Reach, the minimum flow release of 5-10 cfs is less than 0.5 percent of the mean annual flow and has transformed a major river into a wadable stream and boulder field. The riparian encroachment of large alder trees in the riverine channel creates fish habitat at much lower flows than would have naturally occurred in the channel. Habitat amounts increase with discharge only up to 100 or 200 cfs to any significant degree (see Figure 29, (PacifiCorp 2005e)), above which increased flows have little effect on the amount of modeled habitat in the channel. Nevertheless, the recommended minimum flows of 730 cfs in the Copco 2 Bypassed Reach are supported by the Applicant's PHABSIM results in that they would provide approximately 95 percent, 98 percent, and 87 percent of maximum WUA for fry, juvenile, and adult redband/rainbow trout, respectively, in the Copco 2 Bypassed Reach.

If the instream flow recommendation is implemented, flows in the Copco 2 Bypassed Reach will be significantly increased and the channel will change significantly. Encroached riparian vegetation will recede up the channel slope and the low flow channel will reform. These alterations will significantly change results that would be obtained from a new PHABSIM analysis.

Comparison with Unimpaired Hydrology and Tennant Approach: Another line of evidence in support of the minimum recommended flows utilizes the recently developed Natural Flows of the Upper Klamath River (USDI Bureau of Reclamation 2005). At this time, we regard this estimate of natural flows in the Klamath River to be an approximation because the National Research Council will be reviewing it by next year, and other estimates of natural flow also exist and will be reviewed. The Tennant method recommends a minimum of 30 percent of unimpaired or "undepleted" flows be used as a base flow to provide good aquatic habitat conditions. Reclamation's Natural Flows provide a 51 year hypothetical record of the flows at Keno Dam under natural, unimpaired conditions. The mean annual flow using this hypothetical record is 1,810 cfs at Keno Dam. Accretions from the Keno gage to Copco 2 Dam were estimated from

the actual 44 year gage records (Parker, pers. comm.) and added to this hypothetical mean annual flow, yielding an estimated mean annual flow at Copco 2 Dam of 2,074 cfs. Our recommended minimum flow in the Copco 2 Bypassed Reach is 35.2 percent of the mean annual unimpaired flows estimated in this way, providing good validation of the recommended minimum flows.

Ramp Rates: See general discussion of ramp rate recommendations and their impacts, above.

Project Impacts in Copco 2 Bypassed Reach: Of all river reaches impacted by the Project, the Copco 2 Bypassed Reach is the most strongly affected. Copco 2 Bypassed Reach is approximately 1.4 miles long, and extends from Copco No. 2 Dam to Copco No. 2 Powerhouse. The powerhouse discharges directly into Iron Gate Reservoir. The channel is in a deep, narrow canyon with a steep gradient, and consists of bedrock, boulders, large rocks, and occasional pool habitat. The Project's ability to divert up to 3,200 cfs, combined with decades of minimum flows in the bypassed reach of 5-10 cfs, have resulted in the almost complete de-watering of this reach. Except during spill events, between 98 and 99.5 percent of the flow into this reach is diverted. As a result, riparian vegetation has encroached on the channel and adversely altered channel characteristics. PacifiCorp's instream flow habitat curves show this riparian encroachment and narrowing of the channel. As the water level is simulated to increase above a base flow, relatively large areas become flooded, resulting in a steep initial increase followed by a flattened curve in simulated WUA for trout and suckers (PacifiCorp 2005e).

Fisheries surveys conducted by the Applicant indicate that the fisheries in the Copco 2 Bypassed Reach are in poor condition in comparison to the other Project reaches (PacifiCorp 2004d). In the Copco 2 reach, only 3 native species were captured with backpack electrofishing, whereas 7 were captured in the Keno and J.C. Boyle Bypassed Reaches, and 5 in the Peaking reach. Catch per unit effort (CPUE), an index of fish density, of redband/rainbow trout with the backpack electrofishing effort was much less successful in the Copco 2 Bypassed Reach, an average of 7.5 in comparison to combined CPUE of 46.2, 18.6, and 19.1 for the Keno, J. C. Boyle, and Peaking reaches, respectively. Sampling of the fisheries in the Project reaches using angling was largely unsuccessful in the Copco 2 Bypassed Reach, whereas the other reaches had caught large numbers (96, 262, and 187 trout in the Keno, J. C. Boyle, and Peaking reaches, respectively) and a variety of sizes of fish.

The Copco 2 bypassed channel is expected to adjust significantly to the addition of flows to the levels recommended here. Riparian vegetation and associated sediment will be removed by the additional flows and deposited into Iron Gate Reservoir. Reservoir fisheries will likely improve due to the additional habitat surface area provided by large woody debris. Fisheries in the Copco 2 Bypassed Reach are expected to improve due to the significantly increased amount of habitat area and quality.

5. Flow Recommendation for Fall Creek:

PacifiCorp's diversion on Fall Creek has a 50 cfs capacity and only 0.5 cfs bypass requirement. PacifiCorp diverts 99 percent of the streamflow except during the infrequent and brief storm events when flows exceed 50 cfs. There is no formal or informal ramp rate.

To address flow requirements in Fall Creek, the Service recommends that PacifiCorp implement an instream flow regime based on the best available information for this tributary. At this time, information for flow requirements of native aquatic species within Fall Creek comes from a USGS gauge on Fall Creek just above Iron GateReservoir (No. 11512000) and PacifiCorp's instream flow study (PacifiCorp 2005e).

Given the best available information, the Service recommends applying the Tennant method of setting flow for Fall Creek in a similar manner to that for the Copco 2 Bypassed Reach. To provide good habitat based on hydrology, Tennant recommends a minimum of 40 percent of the average annual unimpaired flow. To adapt the Tennant method to this relatively small and unstudied watershed, we recommend reserving at least 40 percent of the instantaneous flow to mimic an acceptable level of intra-annual variability and provide good aquatic habitat. Applied to the historic USGS flow data, this would range from 22 to 14 cfs. The weighted usable area curves provided in the FLA indicate this range of flows will provide roughly 50 percent of the simulated adult rainbow trout habitat and 95 percent of the simulated juvenile rainbow trout habitat.

Ramp Rates: See general discussion of ramp rate recommendations and their impacts, above.

Project Impacts in Fall Creek:
Over 20 years of streamflow data from the USGS (1933 through 1959) indicates mean monthly flows in Fall Creek above Iron Gate Reservoir range from a high of 50 cfs (in February) to a low of 33 cfs (in August). Currently, PacifiCorp's diversion on Fall Creek has a 50 cfs capacity and only 0.5 cfs bypass requirement. PacifiCorp diverts 99 percent of the streamflow except during the infrequent and brief storm events when flows exceed 50 cfs. This causes a significant impact on the hydrology and aquatic resources of Fall Creek. The PacifiCorp instream flow study presented in the FLA provides some preliminary documentation of the habitat impact. The results depict increasing habitat for redband/rainbow trout with increasing flow throughout the range of the simulation (up to 30 cfs), with no appreciable flattening of the curves (PacifiCorp 2004c).

6. Flow Recommendation for Spring Creek:

The diversion at Spring Creek is 16.5 cfs to augment flows into Fall Creek hydroelectric plant. Approximately 0.22 cfs is returned to Spring Creek. There is no formal or informal ramp rate.

The best available information documenting Project impacts on Spring and Jenny Creek water quality is provided by studies performed by the BLM. The Project's Spring Creek diversion impacts stream temperature in both Jenny and Spring Creeks, based on water temperature data collected by the BLM in 2004 and summarized in its April 25, 2005, filing with the FERC (USDI Bureau of Land Management 2005). According to BLM (2005), when PacifiCorp diverts water, temperatures in Spring Creek below the diversion increase and the number of days that the temperature exceeds the State of Oregon water quality standard also increases. This impact continues downstream, evidenced by increases in water temperature in Jenny Creek below the confluence with Spring Creek. This impact is particularly adverse during the warmer months as the native aquatic species evolved under a flow regime influenced by cool spring inflows. Implementation of our recommended flow regime in Spring Creek should mitigate this water quality impact.

Beyond impacting water temperature, PacifiCorp's Spring Creek diversion also reduces aquatic habitat. However, PacifiCorp has yet to present data that quantify this impact. When such information becomes available, the Service may modify the flow recommendation for Spring Creek.

Ramp Rates: See general discussion of ramp rate recommendations and their impacts, above.

Project Impacts in Spring Creek:
The PacifiCorp diversion impacts fisheries resources in both Spring and Jenny creeks. In 2004, BLM identified redband trout (*Oncorhynchus mykiss ssp.*) in Spring Creek. Although few individual fish were found, these trout are present in the creek as well as in the PacifiCorp diversion canal. When PacifiCorp diverts water, it dries approximately the downstream third of Spring Creek. Although small, Spring Creek provides important cool-water summer fish habitat in the Jenny Creek Watershed. PacifiCorp's diversion compromises the connectivity and amount of that habitat.

BLM's temperature data shows a moderate temperature effect in Jenny Creek from the PacifiCorp diversion (Table 3). This temperature difference could be physiologically and biologically significant to both redband trout and Jenny Creek suckers (*Catostomus rimiculus*). When water temperatures are near a fish's critical thermal maxima, small increases can negatively impact fish health or reproductive fitness, or even cause death ((Bjornn and Reiser 1991) and US EPA 2003). Summer is a critical period for recovering from spring spawning and for replenishing body fat reserves in order to grow during the summer and develop gametes through the non-feeding winter. Although BLM does not have specific data relating the cooling effect of Spring Creek water to trout and sucker health and reproduction, the water temperature data shows that the cooling effect of Spring Creek flows can be as much as 5.4°F during the summer months. The cooling effect was measured definitively one mile downstream from the mouth of Spring Creek (at BLM-14) and is projected to impact an additional two miles downstream from this site. BLM snorkeling data shows that the Jenny Creek reaches downstream of Spring Creek are important summer habitat for adult suckers and trout (USDI

1999). The water withdrawals from PacifiCorp's diversion would undoubtedly affect these adult fish during the summer months.

7. Flow Recommendation for Downstream of Iron Gate Dam:

At Iron Gate Dam, 100 percent of flows below 1,735 cfs go through penstocks and the powerhouse. Flows in excess of 1,735 cfs are spilled. The FERC ramp rate is 250 cfs or 3 inches per hour whichever is less. More recently, the NOAA Fisheries Biological Opinion for coho revised the ramp rates to 125 cfs per hour and 300 cfs per 24 hours when flows are greater than 1,750 cfs and 50 cfs per 2 hours, and 150 cfs per 24 hours when flows are 1,750 cfs or less (National Marine Fisheries Service 2002).

Project inflow is derived from a combination of natural flow, tributary inflow, spring accretion flow, irrigation return flows and releases made by Reclamation from its Klamath Reclamation Project to total the Biological Opinion obligations for coho downstream from Iron Gate Dam. To date, PacifiCorp has been unclear and not entirely responsive in providing information on Project operations. However, it is clear from flow records that PacifiCorp uses storage to "shape" releases and has the ability to provide minimum flows, on a daily, weekly, or even monthly basis that differ from the real-time inflow from Link River Dam. Based upon modeling results, water releases from Reclamation's Link River Dam would take 2-3 days to reach the IGD if the Project did not act to reduce travel time. With the Project in place and operating, that same release would take a week or more to reach IGD. In addition, the Project impounds approximately 52,000 acre feet of potential active storage.

The recommended run-of–river operations constitute a flow regime that 1) protects aquatic resources whenever PacifiCorp has operational discretion and 2) acknowledges that "fish flows" will not always be available for release by PacifiCorp.

Outside of the FERC relicensing, developing appropriate target flow recommendations for the Klamath River below Iron Gate Dam as been a prime objective of multiple Federal, State, and Tribal agencies in their efforts to pursue restoration of anadromous salmonids of the Klamath River. The Department asked Dr. Thomas Hardy of the Utah Water Research Laboratory to work with professionals from these agencies and Tribes to develop flow recommendations for Iron Gate Dam. This effort produced a Phase I document that was based on information that was available (Hardy 1999) and a Phase II document that was based on a flow model developed with site specific hydrologic, hydraulic, habitat, and fisheries information (Hardy and Addley 2001). In this document, Hardy and Addley (2001) recommend instream monthly flows at IGD for 90, 70, 50, 30 and 10 percent exceedance ranges corresponding to the Reclamation Dry, Below Average, Average, Above Average and Wet water year types as designated by the Natural Resource Conservation Service. Methodology used in developing Hardy and Addley (2001) is being published in Hardy et al. (in press). In addition, Hardy and Addley's work will be reviewed by the NRC in 2006.

Project Impacts Downstream of Iron Gate Dam:
Though Iron Gate Reservoir allows high flows to pass, their magnitude is often decreased. The reduction of flood flows has resulted in changes in the distribution of riparian vegetation due to changes in the availability of sediments. Less active bed scour, erosion, deposition, and channel migration downstream results in less fresh sediment surfaces available for colonization by seedlings of riparian plants (Johnson 1992).

7. Geomorphic and Juvenile Outmigrant Flows at Copco No. 2

Recommendation:

At a minimum, once annually between February 1st and April 15th, diversion to the Copco No. 2 Powerhouse should be suspended when inflow to Copco Reservoir first exceeds 3,300 cfs during this time period.

- Suspension of diversion shall be maintained for a minimum of seven days.
- The streamflow shall be measured from the gage below J.C. Boyle Dam at RM 225 and a new gage to be installed at Shovel Creek, combined.
- The down ramp rate shall not exceed 300 cfs per 24 hours, measured at a new gage to be stalled below the Copco No. 2 powerhouse.

Justification:

Flood flows at bankfull levels or above are needed to provide natural scour to the channel to maintain natural levels of sediment transport, shallow aquatic habitats, and riparian vegetation. All of these features are important fish habitat components. High flows naturally occur from about December through June. However, due to the potential for salmonid eggs or alevins to be disturbed by high flows in December, January, and February, the flood flows should be implemented starting in March.

Impacts: The Project has altered the natural annual hydrograph of the Copco 2 Bypassed Reach by reducing the frequency and magnitude of flood flow events (see Figure 1-17 in PacifiCorp Exhibit E, Water Use and Quality, (PacifiCorp 2004b)). Extremely reduced flows in the Copco 2 Bypassed Reach have resulted in a significant degree of riparian encroachment into the active channel, a significantly reduced channel, and reduction in aquatic habitat availability (PacifiCorp 2004c).

Klamath Project reservoirs are relatively small, and are not operated for flood control. Though reservoirs allow high flows to pass, their magnitude is often decreased and the flood flows do not pass through the bypassed reaches. The reduction of flood flows has resulted in changes in the distribution of riparian vegetation due to changes in the availability of sediments. Less active bed scour, erosion, deposition, and channel migration can result in less fresh sediment surfaces available for colonization by seedlings of riparian plants (Johnson 1992).

For spawning, salmonids are dependent on the gravel sediments that are normally maintained by flood events, and riparian vegetation is important for providing stream edge habitats for juvenile rearing. Salmonid egg incubation and fry development occurs in the winter months in the Klamath River. These life stages can be adversely affected by high flow events that could wash the eggs or fry downstream prematurely (Jensen and Johnsen 1999). However, higher flows in spring appear to increase survival of spring out-migrants (Cada and Sale 1993; Kjelson and Brandes 1989; Kope and Botsford 1990), but see (Williams and Matthews 1995)).

8. Gravel Augmentation

Recommendation:

Within one year of license issuance, the Licensee shall, for the conservation and development of, and mitigation of damages to, fish and wildlife resources, develop and submit to FERC for approval a Gravel Augmentation Plan (GAP) for the Project reaches and Klamath River below Iron Gate Dam to improve habitat resources for resident trout and anadromous salmonids. The GAP shall be completed in consultation with the Service, NMFS, CDFG, ODFW and the affected Tribes. The schedule for completing the plan shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the Plan all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the Plan. The Plan shall be submitted to FERC for approval prior to implementation. The goal of the GAP shall be the development and implementation of a comprehensive management plan to provide spawning gravel in reaches of the Klamath River that have lost spawning gravel due to impoundments. The GAP shall include, but not be limited to, the following measures:

1. Identification of priority spawning and holding reaches
2. Assessment of flows needed to transport gravels and maintain holding habitats (pools)
3. Identification of areas for removal of deposits of large debris
4. Identification of priority areas for gravel augmentation, volumes of gravel, and flows to implement deposition of gravel in target areas.

The Licensee shall file the Plan with the Commission for approval, with copies to the agencies consulted. The Licensee shall implement gravel augmentation within three years of license issuance and results shall be monitored to develop future augmentation needs with continued consultation with the Service, NMFS, CDFG, ODFW, and the affected Tribes. Gravel augmentation needs shall be reviewed at least every five years for the duration of the license.

Justification: Gravel augmentation will restore spawning gravel to portions of the Klamath River channel that have been deprived of any sediment inputs for decades. As a result, these portions of the channel now have little if any gravel necessary for the spawning life history stage of salmonids and other native fishes.

The development of a Plan will maximize the likelihood of success in restoring spawning habitat quantity and quality and at the same time minimize the potential damage to critical areas, such as the deep pools in the J.C. Boyle Bypassed Reach immediately below the input of 220 cfs of spring water. These areas were likely to have been used historically and have potential as holding areas for spring-run Chinook adults. This type of coolwater refugial habitat is necessary for this run of fish (McCullough 1999). Juvenile spring-run Chinook would rear in the cool water habitat adjacent to the springs in the J.C. Boyle Bypassed Reach. Water temperatures in this spring influenced areas do not vary substantially from 50 to 55°F throughout the year (USDI Bureau of Land Management 2003) and would also provide relatively warmer water during winter months, benefiting rearing spring-run Chinook by providing optimal temperatures for juvenile growth (McCullough 1999).

Impacts: Native species in the Klamath River evolved under the seasonal variability of an unregulated river, with a freely moving bedload. However, the Project's dams have been collecting and storing sediments for decades, while reaches below the dams have been deprived and scoured of gravel and finer sediments. PacifiCorp (PacifiCorp 2004c) reports that the Project impacts alluvial features (and therefore potential salmonid spawning material) from Iron Gate Dam to the confluence with Cottonwood Creek.

In most Project reaches, the river bed is coarsened as smaller gravels are transported downstream without being replaced, and larger gravels and cobbles that are unsuitable for use by spawning fish dominate (Kondolf and Matthews 1993; PacifiCorp 2004c). PacifiCorp's Water Resources Final Technical Report, dated February 2004, indicated that the Project causes a deficit of sediment for transport between dams and below the Project. Sediment supply is especially limited in the below J.C. Boyle Dam. Indeed, "pebble count results indicate potential bed coarsening immediately downstream of Project dams and in the J.C. Boyle peaking and bypassed reaches" (PacifiCorp 2004c). In addition, the Project may have significantly coarsened the channel bed from downstream of Iron Gate Dam to the confluence with Cottonwood Creek (PacifiCorp 2004c).

A natural river transports sediment inputs from upstream to downstream reaches through flood flow events. Reservoirs trap gravels that would otherwise be supplied from upstream. In most Project reaches, the river bed is coarsened as smaller gravels are transported downstream without being replaced, and larger gravels and cobbles that are unsuitable for use by spawning fish dominate (Kondolf and Matthews 1993; PacifiCorp 2004c). This effect is particularly critical in the J.C. Boyle Bypassed and Peaking reaches and below Iron Gate Dam.

Changes in the flow and sediment regimes due to Project operations and facilities impact the potential establishment of desirable riparian vegetation. J.C. Boyle Dam reduces the input of gravel, sand, and silt to this reach ((PacifiCorp 2004b), Exhibit E 5-148). In addition, flow diversions and changes in the flow regime reduce the potential for scouring and sediment deposition of the limited material that is transported downstream of the dam (PacifiCorp 2004c), pp. 6-135). Further, since the streamflows, sediment supply, and bed mobility are reduced, the

extent of substrate appropriate for establishment of willows and other native riparian plants is decreased.

According to PacifiCorp analysis, the Project contributes to the lack of willows in streamside areas (PacifiCorp 2004b), Exhibit E 5-102). Riparian hardwoods typically germinate and establish on freshly deposited alluvium in channel positions low enough to provide adequate moisture but high enough to escape scour (Scott et al. 1993). The Project, however, maintains static hydrologic and geomorphic conditions that do not provide alluvium over a large portion of the area where willows have the best potential to establish.

In the upper portion of the J.C. Boyle Bypassed Reach, the river is constrained by sidecast material present in the margins of the active stream channel. This material was generated during the construction of the J.C. Boyle canal and road and continues to impact 1.5 miles of the channel. The sidecast material has constricted the channel and altered the riparian vegetation along most of the reach (PacifiCorp 2004b), Exhibit E, 5-25). Alteration of instream flows and changes in sediment regimes result in decreased bank stability and loss of riparian vegetation (Hill et al. 1991). Desirable riparian vegetation (e.g., willow) does not establish and survive in the conditions created by the boulder-sized rocks comprising the sidecast. Further, in some areas this material has entered the active channel and is causing accelerated bank erosion on the opposite bank (PacifiCorp 2004c).

9. Temperature Control Device Feasibility Study

Recommendation:

The Licensee shall contract with an independent third party (to be approved by NMFS, Service, ODFW, and CDFG) to conduct a study to determine the potential effectiveness of a Temperature Control Device for Iron Gate and Copco No. 1 Dams. The study should include an uncertainty analysis to quantify model performance for all years simulated, establish a realistic target water temperature schedule, and assess impacts of temperature control options on Iron Gate Hatchery operations. The study methodology and results shall be subject to review and approval by the Service, NMFS, CDFG, and ODFW. If the study demonstrates that the established watere temperature target is attainable, the Licensee shall construct and/or operate Temperature Control Devices at Iron Gate and/or Copco No. 1 Dams.

Justification:

Water temperatures below the Project (PacifiCorp 2004c) during summer months often exceed recommended criteria to protect salmonids (USEPA 2003). The Project exacerbates the effects of high temperatures on downstream fisheries during late summer due to the thermal lag produced by the water impoundments (PacifiCorp 2005d). This effect inhibits cooling of the river during the early fall.

Deas (2003) provided a water quality model and analysis of the potential benefits of a temperature control device indicating that modest benefits could be obtained by construction of new intake structures and choosing combinations of intake outflows to provide lower temperature releases from Iron Gate Reservoir. Although it does not appear that the optimum combination of water releases was identified by the analysis, a reduction in water temperature of 1.1 to 1.8 EC for a period of 1-1/2 months in August – September was predicted. PacifiCorp's evaluation of temperature control alternatives (PacifiCorp 2005c) concluded that temperature control options were not feasible.

However, more recent assessments have led the Service to conclude that further analyses should be carried out. First, Reclamation reviewed the above results and concluded that further analysis would be appropriate (USDI Bureau of Reclamation 2005, memo dated Sept. 27,2005,from T Vermeyen, Technical Service Center; and USDI Bureau of Reclamation 2005, memo dated October 6, 2005 ,from T Vermeyen, Technical Service Center) (attached to Service letter to C. Scott, PacifiCorp dated November 17, 2005). Additionally, the USGS has begun analyses of potential temperature control alternatives for Iron Gate and Copco No. 1 dams using their Systems Impact Assessment Model (SIAM). Preliminary results indicate that mixing flows from the upper outlet with a new lower outlet at Iron Gate Dam could result in significant cooling (2 to 3EC) throughout September, while maintaining a reduced thermocline at the end of September, allowing further cooling in October (Campbell and Heasley, pers comm.).

There are indications that even this modest cooling of water temperatures during the critical fall spawning period would benefit anadromous fish production in the Klamath River below Iron Gate Dam. Salmon Production Model (SALMOD, see Bartholow et al. 2001) simulations run by USGS showed that earlier spawning by fall Chinook salmon, with at least 2°C cooling, produced more juvenile fish in the following spring than spawning at the normal time in October (Campbell, pers. comm.). Predicted emergence times averaged four weeks earlier for the early spawning scenarios than for spawning in October. SALMOD predicted larger numbers of juvenile fish spread out over longer periods of time for the early spawning scenarios. Twenty nine percent of modeled fish produced from October spawning were exposed to springtime stream temperatures greater than 10C (temperature above which disease is more prevalent), but this dropped to twelve and eight percent for progeny of adults that spawned two and three weeks earlier. The predicted number of Chinook presmolts exiting the study area was 38 percent higher for the early spawning scenarios. In addition, the average weight of migrating juveniles was predicted to be 13 percent to 22 percent greater for those fish produced from early spawning (Campbell, pers. comm.). Larger juveniles may have potentially higher survival rates when they reach the ocean as smolts.

Thus, according to these modeling results, improvement of early fall river temperatures could markedly increase production of juvenile fall Chinook. Due to the significance of potential benefits to aquatic resources, additional analysis on the practicability of temperature control devices at both Iron Gate and Copco No. 1 Dams is warranted.

Impacts:

Changes in water temperature due to reservoir impoundments are well documented (Crisp 1977; Jaske and Goebel 1967; Sylvester 1963; Wunderlich and Shiao 1984). Reservoirs reduce annual and daily fluctuations in temperature and delay the warming and cooling periods by acting as thermal sinks. The changes caused by Project reservoirs were demonstrated by Bartholow et al. (2005), who modeled the effect of hypothetical removal of the Klamath hydroelectric dams on thermal characteristics of the Klamath River. They found that dam removal would restore the timing of the river's seasonal thermal signature by shifting it approximately 18 days earlier in the year. Without dams, river temperatures would more rapidly track ambient air temperatures, and would be cooler in the late summer and fall and winter (when air temperatures are cooling) and warmer in spring (when air temperatures are warming). Both of these changes would be beneficial to salmonids, as described below.

PacifiCorp (2005, AR-2, September 2005) also modeled the expected thermal lag condition caused by reservoirs to assess temperature differences between existing conditions and hypothetical without Project conditions. Model results showed that river reaches cool and heat relatively quickly without the reservoir volumes (assuming no reservoirs). Under existing conditions, water temperatures are generally cooler in the spring and warmer in the late summer and fall than in most of the without dam alternatives. The Project dams warm water temperatures by 1 to 5 EC during the months of August through November, and cool water temperatures by 1 to 3 EC during the months of February through June (PacifiCorp 2005, Figures 1-1 through 1-5, Appendix B, AR-2).

Temperatures are critical for salmonids on the Klamath River at three times of the year. In the spring months of March through May, juvenile salmonids need temperatures above 10 to 13 EC for optimal growth (U. S. Environmental Protection Agency 2003). The Project significantly delays the onset of these temperatures in the spring (PacifiCorp 2005, Figures 1-1 through 1-5, Appendix B, AR-2), slowing salmonid juvenile growth rates. Outmigration of juvenile fall Chinook salmon normally occurs by the summer months of June and July, in part, to avoid warmer temperatures. Juvenile disease risk is elevated at 14 to 17 EC and is high at 18 to 20 EC (EPA 2003). By slowing juvenile growth rates, juvenile outmigration is likely delayed, subjecting juvenile Chinook to higher disease risk.

High water temperatures in the mainstem Klamath River during summer months are commonly cited as a cause of decline of anadromous fish runs in the Klamath River (Bartholow 1995; Campbell et al. 2001). Temperatures commonly reach levels that are lethal to salmonids, and temperatures in the mainstem Klamath River get higher with a greater frequency, and stay higher for a longer time, than waters in adjacent coastal anadromous streams (Bartholow 1995). Spring-run Chinook, steelhead, and coho over-summer in the Klamath River as juveniles, making them especially vulnerable to these higher temperatures. Salmonid juveniles have been shown to use cool water areas to survive during these warm time periods, but these areas are limited on the Klamath River (Belchik 1997; Berman and Quinn 1991; Sutton et al. 2004).

The Project dams exacerbate the effects of high water temperatures on salmonid juveniles because while they decrease maximum temperatures in June and July, they also elevate minimum temperatures at that time and slow the cooling of both daily maximum and minimum temperatures in August and September (2005, AR-2, Sept). The elevation of minimum daily temperatures in June and July is likely to impact fish by removing the effectiveness of important thermal refugial areas (National Research Council 2003). The elevation of water temperatures in August and September prolongs the exposure of juvenile salmonids to high temperatures with impaired thermal refugia, which very likely increases mortality rates. Indeed, mortality of over 240,000 juvenile Chinook salmon in the Trinity and Klamath rivers was associated with water temperatures in excess of 20 EC in June, July, and August (Williamson and Foott 1998). As stated earlier, juvenile disease risk is high at 18 to 20 EC and temperatures are lethal above 23 EC (EPA 2003).

Adult salmonids also are likely impacted by the temperature effects of Project dams. Fall-run Chinook salmon enter the river in August and September. Upstream migration appears to be delayed when temperatures equal or exceed 22 EC, at which point adult Chinook seek out and reside in thermal refuges where temperatures are much cooler (Strange 2005). Thermal tolerances for adults are similar to those for juveniles identified above (EPA 2003). Project dams contribute to elevated water temperatures in August and September. These conditions may postpone spawning migration, leading to delayed spawning and egg development. In addition, elevated water temperatures in August and September increase adult mortality by causing salmonids to hold in poor quality habitat, becoming stressed and crowded (Matthews and Berg 1997; Schreck and Li 1991). Such conditions are known to lead to outbreaks of diseases such as *Flexibacter colunmaris* (Holt et al. 1975; Wakabayashi 1991) and *Ichthyophthirius multifiliis* (Bodensteiner et al. 2000).

10. Dissolved Oxygen Enhancement Feasibility Study

Recommendation:

The Licensee's proposal to install a hypolimnetic oxygenation system at Iron Gate Reservoir shall be studied further to demonstrate downstream effectiveness and the potential for adverse effects on nutrient levels and thermal stratification. The Licensee shall also study effectiveness of a hypolimnetic oxygenation system at Copco No. 2, and J.C. Boyle Dams and the potential for adverse effects on nutrient levels and thermal stratification. These studies shall develop recommendations that will control dissolved oxygen (DO) content of reservoirs and released waters from reservoirs to meet salmonid fish requirements for the geographic extent of Project DO effect without exacerbating algal blooms or disrupting reservoir thermal stratification. As a part of these studies, the role of nutrient input and cycling shall also be studied and remedies to the problems of hypereutrophication proposed. The Licensee shall develop and submit to FERC for approval a Dissolved Oxygen Enhancement Plan (DOEP) that will plan implementation of recommendations from these studies.

These studies and DOEP shall be developed in consultation with affected Tribes, NMFS, the Service, ODFW, and CDFG. The schedule for completing the studies and DOEP shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the studies and DOEP all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the plan. The DOEP shall be submitted to FERC for approval prior to implementation. If the Licensee does not adopt agency recommendations, a rationale for why these were not included should be included in the studies and DOEP. Within three years of license issuance, the Licensee shall fully implement the DOEP.

Justification:

In the Final License Application, PacifiCorp indicated that DO levels in water releases from Iron Gate and Copco No. 2 Dams do not meet the objectives of the Water Quality Control Plan for the North Coast Region (Basin Plan) (NCRWQCB 1996) during certain periods. To mitigate for this impact, PacifiCorp is proposing to install a hypolimnetic oxygenation system that will improve dissolved oxygen levels below Iron Gate Dam (PacifiCorp 2005b; PacifiCorp 2005c). However, the effectiveness of the system and potential effects of the system were not adequately studied by PacifiCorp. The extent of the Klamath River to which benefits would occur was not analyzed. In addition, the potential for increased DO levels in the hypolimnion to alter chemistry of the lake and cause a release of nutrients require further study. Deas (2003) found that "forced reaeration slightly decreased ammonia, noticeably decreased ortho-phosphate, slightly increased algae, and significantly increased nitrate in the outflow between mid-July and Mid-October." These changes may affect other conditions including algal dynamics and impact water temperatures. The oxygenation system could also impact water temperatures in the reservoir by breaking up the stratification, which would also impact water temperatures downstream and the effectiveness of any temperature control alternatives that may be considered.

PacifiCorp decided to not install hypolimnetic oxygenation systems at Copco No. 2 and J.C. Boyle Dams. However, DO levels below these dams are impacting fish during some portions of the year. Oxygenation at Copco No. 2 should be studied and an implementation plan developed to reverse these impacts. Nutrient levels interact with other physical and chemical factors to influence DO in reservoirs, and thus should be studied and incorporated as a part of the DOEP.

Impacts:

Salmonids are adversely affected by low DO levels. Adult salmonids showed reduced swimming speeds when DO was reduced below saturation (Reiser and Bjornn 1979; Vinson and Levesque 1994), and they exhibited avoidance behavior of low DO water (Warren et al. 1973; Whitmore et al. 1960). Egg incubation and juvenile rearing is also adversely affected by DO levels that drop below 8 mg/l (Groot and Margolis 1991; Reiser and Bjornn 1979). Davis

(1975) showed that the degree of adverse effects to both adult and juvenile salmonids from reduced DO levels is a function of temperature.

The Basin Plan objective for the river below Iron Gate is a minimum of 8 mg/l DO and a 50% lower limit of 10 mg/l. During fish spawning and egg incubation periods the minimum allowable DO is 9 mg/l. Iron Gate and Copco Reservoirs are stratified in the summer with extremely low DO levels in the hypolimnion (PacifiCorp 2005, Water FTR). DO concentration of water releases from Iron Gate are well below objectives for salmon in the summer and early fall, but levels are well elevated through mixing by the time waters reach the Shasta River (PacifiCorp 2005, Water FTR). Simulated DO levels downstream of Iron Gate Dam were 2-4 mg/l less under existing conditions than under the without Project scenario (PacifiCorp 2005d). Directly downstream of Iron Gate Dam, simulated DO levels under the without Project scenario approximated the minimum level of 8 mg/l, while DO levels were significantly below 8 mg/l under the existing conditions (PacifiCorp 2005d). The next location studied downstream was the Shasta River, where impacts to DO of the Project appear to be absent. It is unknown how far DO effects of the Project extend downstream of Iron Gate Dam.

During fish spawning and egg incubation periods, the minimum allowable DO is 9 mg/l. DO levels are well below these objectives in the upper portion of the J.C. Boyle Bypassed Reach due to impairment by J.C. Boyle Reservoir (PacifiCorp 2004c) WTR). Median and minimum DO levels are particularly impacted by the Project during the summer months (see Appendix A2 of (U. S. Department of the Interior 2004), Figures 13, 14, 19, and 20). The Project reduces DO levels at the upstream end of the bypassed reach by as much as 4 to 5 mg/L during the June to August period, and occasionally causes DO levels to approach zero (PacifiCorp 2004c), 4-53). This results in an apparent violation of Oregon DO standard (described at Exhibit E 3-147).

DO is very low below Copco No. 1 and Iron Gate Dams (PacifiCorp 2005b AR-1a); therefore, fish in the Copco Bypassed Reach and within and downstream of Iron Gate Reservoir are adversely affected due to inadequate DO levels. In the FLA, PacifiCorp acknowledges that, as a consequence of normal temperature stratification of Iron Gate Reservoir, high nutrient loading, and biological processes, the hypolimnetic water is deficient in oxygen during the summer and fall. PacifiCorp is proposing to install a hypolimnetic oxygenation system that will improve DO levels below Iron Gate Dam (PacifiCorp 2005b AR-1a and (PacifiCorp 2005c AR-1b).

PacifiCorp has argued that the Project reservoirs decrease nutrient loads and algal growth in the Klamath River below Iron Gate Dam by allowing organic matter from Upper Klamath Lake to settle in the reservoirs (PacifiCorp 2005d). However, this statement is not supported by analysis. Previous studies have concluded that the reservoirs do not trap nutrients from water, and may increase water nutrient levels (Campbell 1999; U. S. Environmental Protection Agency 1978). A recent nutrient budget analysis of Copco and Iron Gate reservoirs demonstrates that both reservoirs act as a source of nitrogen and phosphorus periodically, especially during the critical period of July through September (Kann and Asarian 2005).

11. Management Plan for Keno Reservoir to Improve Water Quality

Recommendation:

Within one year of license issuance, the Licensee shall, for the conservation and development of, and mitigation of damages to, fish and wildlife resources, form and lead a regional team whose purpose shall be to study and develop a Lake Ewauna - Keno Reservoir Water Quality Plan. The Plan shall be completed in cooperation with Reclamation, the Klamath Tribes, the Service, BLM, USGS, ODFW, ODEQ, the City of Klamath Falls, and other parties who use water from this impoundment. Based on the results of this study and plan, PacifiCorp shall mitigate impacts of the Project to the extent such impacts can be determined and mitigations feasibly implemented. Possible actions to improve water quality include restoration of wetlands, treatment wetlands, mechanical aeration, and/or mechanical removal of algae.

The schedule for completing the plan shall accommodate a 30-day review period for agencies to submit comments. If the Licensee does not adopt agency recommendations a rationale for why these were not included should be included in the plan. Within two years of license issuance , the Licensee shall file the Plan with FERC for approval, with copies to the agencies consulted, and implement upon FERC approval.

Justification:

Construction and operation of PacifiCorp's Keno Dam altered the elevation, storage, and flow characteristics of Lake Euwana and the Klamath River at Keno Reef (USDI Bureau of Reclamation 2005; PacifiCorp 2004 Water FTR). The impoundment created by Keno Dam is subject to serious water quality problems, including persistent anoxia, during summer months. These conditions are hypothesized to result from large quantities of organic matter (primarily in the form of blue green algae) originating in UKL and exceeding the assimilative capacity of the Link River and Lake Ewauna / Keno Reservoir reaches, resulting in a considerable oxygen-demanding load on the system in the summer. High pH and un-ionized ammonia are also associated with the heavy transfer of blue green algae from UKL. In addition to the UKL water releases, there are municipal, industrial, and agricultural return flows to this reach. Thus, the Licensee's operations and responsibilities for impacts interact with impacts of other users, who share responsibility for water quality conditions.

Impacts:

Between October and June, water quality conditions in the Lake Ewauna/Keno Reservoir are typically within acceptable limits for native fishes, including suckers and salmonids. However, water quality in the impoundment is not within DO criteria for suckers or trout from July through September in most years (Rich Piaskowski, BOR, pers. comm). The Keno impoundment experiences widespread, persistent anoxia annually during warmer months. During most years,

the Lake Ewauna reach of the Klamath River (Link River Dam to Keno Dam) has dissolved oxygen concentrations less than 6 mg/L and temperatures greater than 20°C from mid-June through mid-November (Cameron, pers. comm.). At these levels, water quality impacts migrating suckers in Lake Ewauna/Keno Reservoir from July through September (Rich Piaskowski, BOR, pers. comm). These conditions are also not within North Coast Regional Water Quality Control Board and Environmental Protection Agency criteria for migrating anadromous salmonids (NCRWQCB 1996, USEPA 2003). These impacts extend downstream during some years. As the owner and operator of Keno Dam, the Licensee is at least partially responsible for addressing the water quality impacts at Lake Ewauna/Keno Reservoir.

12. Monitoring and Evaluation

A. <u>Fish Disease Risk Monitoring and Evaluation</u>

Juvenile Disease Risk - The Licensee shall develop a Juvenile Fish Disease Risk Monitoring and Management Plan (JDRP) with affected Tribes, NMFS, the Service, ODFW, and CDFG. All mitigation measures will be reviewed by the Fisheries Technical Subcommitee, established by Section 10(a) recommendation 4, prior to submission to FERC. The Plan will establish methods to evaluate the contribution of the Project to the disease risk for juvenile anadromous salmonids in the Klamath River, and to remediate this impact of the Project. This may require studies to determine key factors controlling disease risk and pathogen abundance and to better understand pathogen ecology. This plan will also include mitigation steps to be taken to minimize disease risk to reintroduced anadromous species above Iron Gate Dam, to resident species, and to fish production from Iron Gate Hatchery. In addition, the plan will include studies to assess the potential role of seasonal flows and managed pulse flows in controlling habitat for the intermediate host, *Manayunkia speciosa*, of the anadromous fish parasite, *Ceratomyxa shasta*. In order to assess this issue, test freshets of varying extent could be created to determine sufficient mobilization of the bed that results in scour of the algae mats and then subsequent testing of both the polychaete and myxozoan abundance. If appropriate, the Plan will include assessment of the benefits through restoration using geomorphic processes, management of flows, and water quality to minimize disease risk

Adult Disease Risk - The Licensee shall develop an Adult Fish Disease Risk Monitoring and Management Plan (ADRP) with the affected Tribes, NMFS, the Service, ODFW, and CDFG. All mitigation measures will be reviewed by the Fisheries Technical Subcommitee, established by Section 10(a) recommendation 4, prior to submission to FERC. The Plan will establish methods to evaluate the contribution of the Project to the disease risk for adult anadromous salmonids in the Klamath River, and to remediate this impact of the Project. This will include recommendations for the management of flows and water quality to minimize disease risk.

Emergency Response Pulse Flow Plan - The Licensee shall participate with the affected Tribes, NMFS, the Service, Reclamation, ODFW, and CDFG in development of a Emergency Response Plan (ERP). All mitigation measures will be reviewed by the Fisheries Technical Subcommitee,

established by Section 10(a) recommendation 4, prior to submission to FERC. This plan would provide an analysis of the conditions under which enhanced flows from Iron Gate and Copco Reservoirs might be available and effective in prevention or remediation of a juvenile or adult fish die-off, utilizing the estimated active storage of 52,000 acre feet (AF). In the event of emergency, these flows would be provided subject to request by the fisheries agencies subject the conditions of the Plan. Adaptive Management reports would be provided by the Licensee summarizing the successes and failures of such attempts and recommendations for future enhanced flow management.

Toxic Algae Bloom Risk – The Licensee shall develop a monitoring program with affected Tribes, NMFS, the Service, ODFW, and CDFG to assess the risk of toxic cyanobacteria blooms in Iron Gate and Copco Reservoirs on fish health and the environmental factors that lead to such blooms and their adverse effects on fish. A plan shall be developed and implemented to reduce the risk of cyanobacteria blooms on fish in consultation with these Tribes and agencies.

An interagency team of fisheries experts (Klamath Fish Health Assessment Team, KFHAT) has formed to provide an emergency plan and process to respond to potential fish kill events in their early stages (Klamath Fish Health Assessment Team 2005). The KFHAT should be consulted regarding the development of the JDRP, ADRP, and ERP.

The schedule for completing the above plans shall accommodate a 30-day review period for agencies to submit comments. If the Licensee does not adopt agency recommendations, a rationale for why these were not included should be included in the plans. Within two years of the development of disease risk monitoring and plans and agency approval, the Licensee shall fully implement the Plans.

Justification: Fish disease and die-offs in the lower Klamath River downstream from the Project are a serious management concern. Fish disease among anadromous fish has increased in recent years in both adults and outmigrating juveniles in the lower Klamath River (Williamson and Foott 1998; Foott et al. 1999, 2002, 2003, Nichols and Foott 2005). Conditions created by the Project apparently favor the organisms responsible for these diseases, as described below. During the September 2002 fish die-off below River Mile 36, increased flows provided from the Project helped trigger upstream migration and alleviated additional mortality due to disease (USDI Fish and Wildlife Service 2003a; McCracken 2002).

The Applicant has not proposed any measures to increase the understanding of the possible contributions of the Project to disease and die offs in the Klamath River, or to manage to minimize disease outbreaks. The development of the JDRP, ADRP, and ERP for adult and juvenile salmonids will help ensure that agencies, Tribes, and the Applicant will explore all options for minimizing future fish die-offs and meet their management goals and objectives.

Impacts:

Outmigrating juvenile Chinook (*Oncorhynchus tshawytscha)* and steelhead (*O. mykiss*) within the Lower Klamath River Basin experience significant mortality from infectious disease, with recent estimates of disease-related mortality in downstream migrants as high as 90 percent (Foott, personal communication). The primary pathogens implicated in this mortality are the myxozoan parasites *Ceratomyxa shasta* and *Parvicapsulum minibicornis* (Williamson and Foott 1998; Foott et al. 1999; Foott et al. 2002; Foott et al. 2003). Algal buildup on substrate in the Klamath River below Iron Gate is believed to contribute to increasing habitat suitable for the polychaete worm that is the alternate host for *Ceratomyxa shasta* (Stocking and Bartholomew 2004). Increase in habitat probably provides for increased production of the polychaete, and subsequently the number of infective myxozoan spores in the water column.

The Project contributes to elevated water temperatures, which increase disease risk. Temperature was the only indicator and determinant of parasite load proposed for consideration by PacifiCorp (2005 – AR-2). However, the Project also may be increasing the amount of suitable habitat for the polychaetes, because high nutrient levels emanating from the Project, and Project-related reductions in the magnitude and extent of natural peak flows, have likely contributed to increased algal buildup downstream of the Project (McKinney et al. 1999).

The September 2002 fish die-off killed at least 33,000 adult fish, mostly Chinook salmon from infection by two pathogens (*Ichthyophthirius multifiliis* and *Flavobacterium columnare*) (USDI Fish and Wildlife Service 2003b). Impacts from the Project were not implicated in this event, but the event does illustrate the potential for catastrophic disease outbreaks among adult salmonids migrating to spawning grounds in the Klamath River. Project reservoirs result in higher water temperatures in the river in the fall (Bartholow et al. 2005) that elevate the risk of disease to adult fish downstream at least to Seiad Valley.

Our estimate of active storage for these reservoirs is different from the amount reported in the Applicant's documents, which report only the active storage that is available during normal operations. The USGS has estimated actual active storage in Copco and Iron Gate Reservoirs at approximately 52,000 ac/ft. (Campbell and Heasley, pers. comm.). They used a procedure outlined in the September 27, 2005, memo attachment to the U.S. Fish and Wildlife Service November 17, 2005, letter commenting on PacifiCorp's response to information request AR-1a, dated September 2005. A volume of 52,000 AF would provide approximately 875.4 cfs per day for a 30 day month (Campbell, pers. comm.).

Blooms of *Microcystis aeruginosa*, a blue green alga (cyanobacteria), have recently been reported in Iron Gate and Copco Reservoirs (Kann 2005). *M. aeruginosa* is a microscopic organism that is found naturally at low concentrations in lakes and streams. Occasionally, it forms a harmful bloom, a dense aggregation of cells that float on the water surface. This species forms a toxin (microcystin) that is a strong hepatotoxin, causing liver disease in fish (Carmichael 1988; Andersen et al. 1993; Sahin et al. 1995; Watanabe et al. 1996).

M. aeruginosa is commonly found in water bodies that are eutrophic and hypereutrophic (Watanabe et al. 1996). Excessive nutrients, poor water flow (stagnant conditions), and alterations of lake conditions such as land clearing, agricultural development, and water management have been associated with cyanobacteria blooms (Hallegraeff 1993; Florida Fish and Wildlife Research Institute 2005). Research on the lower Neuse River of North Carolina indicated that blooms of *M. aeruginosa* were triggered by high levels of nutrients and periods of low flows and decreased turbulence (Paerl 1987). The reservoirs of the Klamath Hydroelectric Project have created large areas with ideal conditions for the development of toxic blue green algae blooms. *M. aeruginosa* may naturally exist in small concentrations along the margins of the Klamath River, but it would likely be far less abundant if the reservoirs were restored to free-flowing river reaches. PacifiCorp states that "the risk of blue-green algae blooms in the Project area is less under the without-dams scenarios" (PacifiCorp 2005d).

B. Resident and Anadromous Fish Monitoring and Evaluation

Recommendation:

1. Resident Fish – The Licensee shall develop and implement a Resident Fish Monitoring Plan (RFMP) that meets the approval of the Service and the appropriate state wildlife agency . The RFMP shall be developed in consultation with the Service, NMFS, affected Tribes, ODFW, and CDFG. All measures will be reviewed by the Fisheries Technical Subcommitee, established by Section 10(a) recommendation 4, prior to submission to FERC. The RFMP will describe the protocol for:

A. Monitoring the distribution, population structure, and abundance of resident fish populations, including federally listed suckers, in all Project reservoirs and river reaches below Keno Dam. Monitoring will be at three-year intervals for the duration of the license. The Licensee shall use the sampling protocol in (Markle et al. (2000) and (Simon et al. (1995) for monitoring larvae, juvenile, and adult sucker populations.

B. Monitoring the number, size, and sex of spawning rainbow/redband trout in important Klamath River tributaries to the Project reach (Scotch, Camp, Jenny, Fall, Shovel, Long Prairie, and Spencer Creeks). Monitoring will be at three-year intervals for the duration of the license.

2. Anadromous Fish - The Licensee shall develop and implement an Anadromous Fish Monitoring Plan (AFMP) that meets the approval of the Service and NMFS and the appropriate state wildlife agency. All measures will be reviewed by the Fisheries Technical Subcommitee, established by Section 10(a) recommendation 4, prior to submission to FERC. The AFMP shall

be developed in consultation with the Service, NMFS, affected Tribes, ODFW, and CDFG. The AFMP will describe the protocol for:

A. Annually estimating the number, size, and sex; and determining, using a combination of PIT tag technology and analysis of returning fish marked in other ways, the timing, survival, and origin of all species of anadromous fish returning to Iron Gate Hatchery, passing upstream and downstream over Iron Gate Dam, and passing upstream and downstream at the upper end of the Project.

B. Annually estimating the spawning populations of each species of anadromous fish in mainstem reaches of the Klamath River in the Project area, as well as important Klamath River tributaries in the Project area (Scotch, Camp, Jenny, Fall, Shovel, Long Prairie, and Spencer Creeks). If deemed appropriate by the agencies, numbers coho spawners may be evaluated on other temporal schedules.

C. Estimating the numbers of juvenile outmigrant salmon originating from important Klamath River tributaries in the Project reach (Scotch, Camp, Jenny, Fall, Shovel, Long Prairie, and Spencer Creeks). This estimate will be at three-year intervals for the duration of the license.

C. Implementing any measures deemed necessary by the Service, NMFS, ODFW, CDFG, and Tribes to meet project passage goals.
D.

Justification:

The Project has blocked access to historical mainstream and tributary habitat at several locations for 45 to 85 years. Even with ladders, screens, and bypasses, Project facilities, will impact survival of resident and anadromous fish migrating within and beyond the Project. The goals and objectives of the Klamath River Fisheries Task Force (USDI Klamath River Basin Fisheries Task Force 2001), agencies, and Tribes in relicensing of the Project include the successful restoration of anadromous salmonids to their historical habitats. Fish produced at Iron Gate Hatchery will need to be distinguished from reintroduced, wild spawning fish for the purposes of managing successful reintroduction. Evaluation of passage facilities provided at Project dams will require that fish be marked so they can be identified as to their natal area. Project impacts on the survival of migrating fish must be identified and corrected.

Distribution and abundance studies of resident fish populations are necessary to assess any population trends in tributaries or in reservoirs to be able to evaluate habitat or population limitations. This information will provide the basis for ongoing protection, mitigation, and enhancement of resident fish populations.

The determination of timing and the estimation of survival of outmigrating fish (in particular, juvenile Chinook) from above Iron Gate Dam (including the upper basin) in outmigrating through the Project will require juvenile collection, PIT tagging, and downstream tracking; and the assessment of their returns as adults to the Klamath River will be used to evaluate progress towards Service management goals and objectives. Full Duplex tagging and detection technology is necessary to track small fish (≥60mm in fork length) of interest to agencies. This is particularly important for the estimation of survival of outmigrant Chinook salmon.

Assessment and monitoring of anadromous and resident fish spawning is necessary to understand the contribution of important Klamath River tributaries in the Project reach (Scotch, Camp, Jenny, Fall, Shovel, Long Prairie, and Spencer Creeks). The identification of juveniles allows returning adults (in particular adult Chinook salmon) produced above Iron Gate Dam (including areas above Upper Klamath Lake) to be identified at Iron Gate Dam during passage. This capability is necessary to assess progress towards recovery goals and implement measures to achieve these goals and objectives. It gives agencies the ability to manage the return of adults to their natal areas and evaluate the rate of adaptation to the reintroduction environment.

Recording of the timing of movements anadromous fish moving upstream and downstream is necessary to understand migration and manage Project operations and flow to minimize Project related mortality to migrating fish. Survival estimates are necessary to identify reaches where passage problems may exist and diagnose potential bottlenecks to the production of anadromous fish.

Impacts:

Coho salmon - Coho salmon, a federally listed species, have a three year peak in abundance. Assessment of recovery of the entire population is often based on how well the largest cohort performs. The Project area is believed to contain a substantial amount of spawning and rearing habitat, and utilization of this habitat should be monitored and assessed.

Federally Listed Suckers –Lost River and shortnose suckers are known to reside in the Project reservoirs (Desjardins and Markle 2000). Spawning shortnosed suckers have been observed upstream from Copco Reservoir; however, no recruitment has been attributed to these fish. J.C. Boyle Reservoir contains a sucker population with a diverse age class structure. These populations are apparently not self-sustaining, and are supported by drift of suckers from UKL over Keno Dam. However, these populations have value for eventual relocation (NRC 2003), and more information is needed as to their numbers and population structure.

Redband Trout - The Klamath mainstem in the Project reach and Jenny, Fall, Shovel, and Spencer Creeks are known to provide important habitat for rainbow/redband trout (Beyer 1984; Buchanan et al. 1990; California Department of Fish and Game 2005; Coots 1957; USDI Bureau of Land Management 2005; USDI Bureau of Land Management et al. 1995).

In 1974, a six mile reach of the Klamath River from Copco Reservoir upstream to the Oregon border was designated as Wild Trout Water by the California Department of Fish and Game (CDFG). This reach is currently managed under the California Wild Trout Program. Shovel Creek is the primary spawning tributary for the population of resident rainbow/redband trout in this reach. The lower 2.7 miles of this stream are accessible to rainbow/redband trout and it supports a healthy trout population. Angling regulations are in place to protect spawners and juvenile trout.

Spencer Creek is of particular importance to redband trout. Klamath River redband trout are of a unique stock indigenous to the river and its tributaries. Historically, redband trout rearing in the Klamath River in the Project area spawned mainly in Spencer Creek (Oregon Department of Fish and Wildlife 1997). Prior to the current passage problems at J.C. Boyle Dam (USDI Fish and Wildlife Service 2004), juveniles dispersed from this stream to rear in other reaches of the Klamath River before they returned (Fortune et al. 1966; Buchanan et al. 1990).

Anadromous Fish - Chinook salmon and/or steelhead migrated to Scotch, Camp, Jenny, Fall, Shovel, and Spencer Creeks before dams blocked access (Hamilton et al. 2005). From 1950 to 1960 (prior to the construction of Iron Gate Dam) CDFG records indicate that between 344 and 2,496 Chinook salmon returned to spawn in Fall Creek. During this same period, an estimated 25 to 400 Chinook spawned in Jenny Creek (Coots 1957; Coots 1962; Coots and Wales 1952; Wales and Coots 1954). Steelhead also spawned in Shovel Creek (Coots 1965).

Coho salmon were present in Fall Creek prior to dam construction (Coots 1957; Coots 1962). Hamilton et al. (2005) concluded this species migrated to at least Spencer Creek. Pacific lampreys were present in Fall and Spencer Creeks as well (Coots 1957; USDI Bureau of Land Management et al. 1995). There is evidence that steelhead used Long Prairie Creek (Coots 1965).

These tributaries and mainstem reaches in the Project area continue to provide suitable habitat (Beyer 1984; California Department of Fish and Game 2005; Oregon Department of Fish and Wildlife 1997; USDI Bureau of Land Management 2005; USDI Bureau of Land Management et al. 1995; Weyerhaeuser Company 1994). Comprehensive plans have been approved or proposed to manage reaches of Scotch, Camp, Fall, and Jenny Creeks (Oregon Department of Fish and Wildlife 1997; USDI Bureau of Land Management 2005), Shovel Creek (California Department of Fish and Game 2005), Spencer Creek (USDI Bureau of Land Management et al. 1995; Oregon Department of Fish and Wildlife 1997), and mainstem Klamath River in Oregon (Oregon Department of Fish and Wildlife 1997) for their continued provision of fish and aquatic habitat.

13. Aquatic Habitat Monitoring Plan

Recommendation:

Within one year of license issuance, the Licensee shall, for the conservation, and development of, and mitigation of damages to, fish and wildlife resources, complete an Aquatic Habitat Monitoring Plan (AHMP). The Licensee shall develop the AHMP in consultation with the Service, NMFS, CDFG, ODFW, BLM, and the affected Tribes. The goal of the AHMP shall be to adaptively manage the license conditions designed to restore aquatic habitat within the Project area to mitigate the continued effects of the Project on fish habitat (i.e., 10(j) conditions 6, 7, 8, 9, 10, 11, and condition 4 of Attachment A). All mitigation measures will be reviewed by the Fisheries Technical Subcommittee (FTS) prior to approval (see section 10(a) recommendation for a description of the Fisheries Technical Subcommittee). The schedule for completing the plan shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the Plan all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the Plan. The Plan shall be submitted to FERC for approval and will be implemented upon approval.

Aquatic Habitat Monitoring Plan (AHMP) – The Licensee shall, within one year after License issuance, file with the Commission for approval, an AHMP.

(a) The AHMP shall be designed to monitor how implementation of the license conditions that improve aquatic habitats within the Project reaches are effective in improving fish habitat quantity and quality for resident, migratory, and anadromous fish and to apply adaptive management, as needed.

(b) The Licensee shall report the monitoring results, and an evaluation of these results, annually to the FTS (see Attachment E). The Licensee shall coordinate with the Service, NMFS, ODFW, CDFG, and BLM, and the monitoring shall be consistent with other monitoring efforts (e.g., the RGMP).

    (1) The evaluation reports shall include at a minimum all relevant data collected and the Licensee's conclusions regarding the state of aquatic habitat (spawning, holding, feeding, juvenile rearing, riparian, and migratory.)

    (2) The report shall review the adequacy of flows for providing migration, rearing, and spawning habitat for native aquatic species; flow necessary to move spawning gravel; flow necessary to achieve riparian habitat management objectives; flow to support power generation; and flows necessary to provide opportunities for recreation.

(c) The Licensee shall develop and implement the following monitoring components of the AHMP as specified:

    (1) Habitat condition: Implement fish habitat surveys using FTS-approved protocols for monitoring effectiveness in meeting physical habitat objectives as described in the license conditions designed to restore aquatic conditions, including the RHMP and RGMP. Surveys shall include the identification of potential new spawning areas, substrate composition and particle size distribution, degree of

embeddedness, changes in aerial extent of riparian vegetation, riparian vegetation species cover. Surveys shall be conducted at five year intervals.

(2) Habitat productivity: Implement a monitoring program using protocols and methods outlined in the PacifiCorp bioenergetics report for the peaking and bypassed reaches (Addley et al. 2005). Begin two years after license issuance and repeat at five year intervals.

(3) Spawning habitat: Monitor the number, size, and sex of spawning rainbow/redband trout and anadromous salmonids (*Oncorhynchus mykiss*) in all of the Project Reaches. Monitoring of redband trout will occur at three-year intervals for the duration of the License. Monitoring of anadromous salmonids will occur annually for the duration of the License.

(4) Habitat Connectivity: Monitor native fish populations for effects of flow alteration on habitat use and connectivity between the Project reaches. This monitoring will occur at three-year intervals for the duration of the License.

(d) The following elements shall be described for all the monitoring components of the AHMP as described above [Section (b)]. The Licensee shall:

(1) Provide a description of the basis for measuring the effectiveness of resource protection, mitigation and restoration measures, and procedures to modify activities to achieve resource management objectives.

(2) Describe implementation strategies, methods, and protocols for monitoring. Describe the geographic scope, species, monitoring frequencies, and duration.

(3) Develop monitoring methods that facilitate a comparative analysis of results from previously completed studies to determine if mitigations and enhancements are effective in achieving license condition objectives.

(4) Identify a mechanism for revising monitoring strategies and methods to reflect improvement in sampling procedures and/or changes in regulations or environmental conditions.

(5) Describe how results of monitoring will be evaluated to determine what operational or structural changes are necessary to meet goals and objectives of the license conditions.

(6) Identify practices for data storage, distribution, and reporting.

(7) Provide a description of the specific monitoring activities proposed for future monitoring periods, including a schedule for completing such activities.

(8) Based on the results of monitoring and newly acquired data, apply adaptive management principles to achieve license condition objectives for riparian and aquatic habitat conditions.

Justification:

The AHMP will assist the evaluation of the effectiveness of license conditions for maintenance and restoration of aquatic and riparian resources. The AHMP includes provisions and processes for applying adaptive management principles. Quantifiable data for the habitat condition, productivity, spawning habitat, and habitat connectivity are necessary to determine effectiveness

of the proposed mitigations and to demonstrate if compliance with protection of the BLM reservation occurs.

The AHMP includes provisions and processes for applying adaptive management principles. A monitoring plan that includes an adaptive management strategy incorporates implementation, monitoring, and evaluation of results to allow the Licensee and consulting fisheries resource agencies to determine effectiveness of the Project mitigations and Conditions. Effective monitoring plans developed in coordination with the resource agencies will provide the best opportunity for achieving aquatic resource objectives in the Project area over the term of the License (Castleberry 1996).

The Required Minimum Streamflow in the J.C. Boyle and Copco 2 Bypassed Reaches, and Streamflow in the J.C. Boyle Peaking Reach are expected to produce changes in channel morphology that will mitigate for the continuing impacts under the new License. As additional minimum, peak, and variable flows are returned to the reaches, there will be alterations in the amount of available fish habitat due to changing channel configurations. Consequently, continuous monitoring, including fish abundance is required to assess changes in channel morphology and to allow for the appropriate instream flows to protect the BLM reservation. This information will be used as the basis for providing scientifically based alterations in instream flows to mitigate the impacts of Project operations.

Habitat condition, habitat production, spawning habitat, and habitat connectivity monitoring data will provide the basis for determining whether Required Minimum Streamflows are providing for the needs of fish habitat and fish populations as described in each license condition. Fish-habitat relationships generated for both bypassed and the peaking reaches reveal that Project operations have impacted substrate suitability and near shore vegetation cover. After implementation of the Required Minimum Streamflows, it is predicted that habitat will change. Fish passage provisions required under Section 18 prescriptions may result in additional species interactions, changes in fish community structure, and potential pathogen introductions. Fish habitat monitoring is needed to determine effects of Project operations and implementation of the Conditions on the resident, migratory, and anadromous fish species.

Project Impacts:

See impacts described under license conditions to improve aquatic habitats (6, 7, 8, 9, 10, 11, and condition 4 of Attachment A).

14. Riparian Habitat Management Plan (RHMP)

Within one year of license issuance, the Licensee shall, for the conservation, and development of, and mitigation of damages to, fish and wildlife resources, complete a Riparian Habitat Monitoring Plan (RHMP). The Licensee shall develop the RHMP in consultation with the Service, NMFS, CDFG, ODFW, BLM, and the affected Tribes. The goal of the RHMP shall be

to adaptively manage the license conditions designed to restore riparian habitats (6, 7, 8, 11, and condition 4 of Attachment A) within the Project area to mitigate the continued effects of the Project on fish habitat. All mitigation measures will be reviewed by the Fisheries Technical Subcommittee prior to approval (see section 10(a) recommendation for a description of the Fisheries Technical Subcommittee). The schedule for completing the plan shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the Plan all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the Plan. The Plan shall be submitted to FERC for approval and will be implemented upon approval.

Riparian Habitat Management Plan (RHMP) - The Licensee shall, within one year after license issuance, file with the Commission for approval, a RHMP.

(a) At a minimum, the RHMP shall:
    (1) Identify actions to minimize the effects of Project operations on riparian habitats, and
    (2) Identify site-specific restoration measures for riparian habitat impacted by the Project.

(b) The RHMP shall include the following objectives for BLM-administered lands as specified:
    (1) Mitigate impacts from Project facilities and/or operations by restoring degraded riparian habitats within all Project Reaches.
    (2) Conduct inventory of riparian areas as needed to develop restoration goals based on riparian ecological type and potential condition.
    (3) Identify activities necessary to restore hydrologic connectivity in the varial zone and diversity of riparian species. Mitigation should specifically:
        a. Increase riparian habitat on the low terraces in the Oregon portion of the J.C. Boyle Peaking Reach.
        b. Improve riparian condition in the J.C. Boyle Peaking Reach varial zone.
        c. Improve habitat conditions for TES plant and animal species associated with riparian, wetland or open water habitats.
        d. Reduce conditions that are conducive to the establishment of reed canary grass, yellow starthistle and other noxious weeds or invasive plant species.
    (4) Coordinate riparian habitat restoration activities with other plans for aquatic habitat, streamflow, geomorphologic processes and features, wildlife habitat, and vegetation management, including treatment of noxious weeds.
    (5) Monitor implementation of the Plan to determine whether planned actions are meeting license condition objectives; conform to accepted monitoring protocols including methods, locations, and monitoring intervals; and meet reporting requirements.
    (6) Monitor effectiveness of riparian mitigation and restoration and apply adaptive management principles to ensure RHMP objectives are accomplished.

Justification:

Mitigation and restoration of the riparian areas in the Project reaches is needed to maintain and restore aquatic and riparian resources. Since reed canary grass has invaded much of the riparian areas in these reaches (see Attachment A), management of this species through mitigation and restoration is necessary for re-establishment of desirable riparian vegetation.

According to analysis by the Nature Conservancy for the Control and Management of Reed Canary Grass in the Pacific Northwest: "…even highly infested areas can be restored to more desirable vegetation." (Tu 2004). Further, this analysis states that objectives can be accomplished in two to three years and continued monitoring and follow-up treatments for the next five to 10 years will be needed to prevent re-invasion.

The RHMP is intended to identify and implement site- specific activities to minimize Project-related impacts on riparian areas. Mitigation activities applied to the Project Reaches would reduce the impacts caused by the loss of desirable riparian vegetation and habitat due to the Project.

Implementation of the RHMP will provide for the hydrologic, geomorphic, and ecological processes needed for the establishment and survival of desirable riparian vegetation. Subsequently, fish and wildlife riparian habitat would be adequately protected.

Project Impacts:

For a discussion of Project impacts to riparian vegetation, see Attachment A.

15. Iron Gate Hatchery Operations

<u>Recommendation</u>:

a. The Licensee shall continue hatchery operations at Iron Gate Hatchery to meet hatchery target goals for fall-run Chinook, spring-run Chinook, coho and steelhead. The hatchery target goals for each species will be adjustable and developed by the Service, CDFG, ODFW, NMFS, and the Tribes, and will be approved by the Service, NMFS, and CDFG. The hatchery will provide mitigation as well as facilitate implementation of fish passage measures to restore/reconnect wild runs of anadromous and resident fish above and below the Project. The hatchery target goals will be adjusted by CDFG, NMFS, and the Service in response to ongoing impacts of the Project and implementation of the passage conditions. The above measures will be reviewed by the Fisheries Technical Subcommittee prior to approval (see section 10(a) recommendation for a description of the Fisheries Technical Subcommittee).

b. Marking of all Iron Gate hatchery (IGH) Chinook salmon releases shall be 25 percent, and marking of coho salmon releases shall be 100 percent, to develop a time series of accurate estimates of hatchery contribution and distinguish returning adult salmon that are the progeny of reintroduced fish above Iron Gate Dam.

c. Development of a Hatchery and Genetics Management Plan (HGMP) for IGH operations including, but not limited to: 1) an accurate adult census of natural salmonids; 2) the rate and contribution of hatchery strays to natural spawning stocks; 3) determining the rate of competition between hatchery and natural salmonids; 4) determining genetic characteristics of natural and hatchery coho salmon and steelhead stocks; 5) determining out-migration timing of hatchery and natural stocks; 6) maintaining Tribal trust and Resource Trustee obligations to mitigate for lost habitat; 7) developing conservation hatchery techniques; and 8) minimizing any negative effects from fish husbandry or juvenile release on native, naturally occurring populations of listed salmonids. This plan will be subject to review by the appropriate resource agencies (the Service, CDFG, NMFS, ODFW, and the Tribes). The above measures will be reviewed by the Fisheries Technical Subcommittee prior to approval (see section 10(a) recommendation for a description of the Fisheries Technical Subcommittee).

d. Fund 100 percent of hatchery operations and maintenance which are necessary to provide protection, mitigation and/or enhancement to the fishery resources impacted by the Project. This would include:

- 100 percent of any improvements to existing facilities
- 100 percent of any new construction
- 100 percent of the annual operating costs
- 100 percent of the fish marking, monitoring and recovery costs
- 100 percent of any permits and/or plans required by the State and/or Federal governments to operate existing or new facilities.

Justification:

The future role of Iron Gate Hatchery will be to compensate for ongoing and continuous impacts of irretrievable productivity lost due to the inundated Klamath River and impeded passage into historical habitats. The Iron Gate Hatchery provides a harvestable fishery. Until wild populations in the upper basin can provide sufficient, harvestable, self-sustaining runs, a hatchery program will be needed to supplement natural production in the upper basin.

The Licensee needs to fully fund mitigation for Project impacts and mark fish resulting from mitigation to ensure that agencies and Tribes can assess reintroduction efforts above the dam.

The progress towards reintroduction goals cannot be adequately assessed without being able to distinguish IGH fish from fish originating above Iron Gate Dam.

Requirements for future operation of IGH and any other hatchery facilities mitigating Project impacts should include a goal of designing future hatchery activities to complement the recovery of natural stocks in the Klamath River. To achieve this goal will require comprehensive monitoring and assessment of hatchery impacts. HGMP must also be in place that ensures that the fish used to reestablish fall-run Chinook, spring-run Chinook, steelhead, and Pacific lamprey be genetically appropriate and genetically robust. If they are not, it could impact the likelihood of success of reintroduction.

An effective and responsive mitigation hatchery program will require a substantial financial commitment. The Service considers the current license condition whereby the Licensee pays for 80 percent of IGH operations and the State of California pays for the remaining 20 percent inappropriate for a mitigation hatchery. The Licensee should bear the full cost of any measures necessary to mitigate Project impacts on fish and wildlife resources. The Service recommends that the FERC address this issue by requiring that the Licensee fund 100 percent of IGH operations and maintenance which are necessary to provide protection, mitigation and/or enhancement to the fishery resources impacted by the Project.

The lack of fish passage has prevented management agencies, the Tribes, and the Klamath River Basin Fisheries Task Force from meeting their goals and objectives. To ensure that mitigation for Project impacts is consistent with the goals and objectives of management agencies, the Tribes, and the Klamath River Basin Fisheries Task Force, the above anadromous fish hatchery mitigation of Project impacts is critical. Because of its location in the watershed and production capacity, the hatchery is also key to facilitate implementation of measures to restore wild runs of anadromous fish above the Project.

16. Adaptive Management Plan for Federally Listed Suckers

Recommendation: The Licensee shall develop a plan in consultation with ODFW and the Service to evaluate the need for a ladder built to sucker criteria at Keno Dam. During the months of February through May, or as otherwise recommended by the Service, the anadromous fish trap at that location shall be operated to gather data on the possible need for such a ladder for suckers. Data collected shall include information on species, size, sex, and estimated numbers. Regular visual examinations shall also be conducted to evaluate use of the ladder. The plan will be reviewed by the Fisheries Technical Subcommittee prior to approval (see section 10(a) recommendation for a description of the Fisheries Technical Subcommittee). The schedule for completing the plan shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the Plan all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the Plan. The plan shall be submitted to FERC for approval within one year of license issuance, and will be implemented upon approval.

Justification: The National Research Council (2003) stated that the primary value of the sucker populations in Project reservoirs was for potential reintroduction elsewhere. If the species remains listed under the ESA, a new recovery plan will probably further evaluate these populations. In section 18 prescriptions for passage at Keno, the Service reserved the right to prescribe a sucker ladder in the future at this location. This study will provide further information on management decisions regarding these populations.

Impacts: PacifiCorp (1997) found that some suckers attempted to use the current ladder at Keno Dam, but the ladder is regarded as ineffective for suckers. Current knowledge does not suggest that such passage is a priority; however, this understanding could change in the future.

17. Avian Collision and Electrocution Hazards

Recommendation: The Licensee shall, within one year of license issuance and in consultation with the Service, ODFW, BLM, and the U.S. Forest Service, complete an Avian Collision and Electrocution Hazard Avoidance Plan to ensure that adverse interactions between Project transmission and distribution lines and birds are minimized. The schedule for completing the plan shall accommodate a 30-day review period for agencies to submit comments. The Licensee shall include in the Plan all comments received during consultation with the parties identified above, and an explanation of how all comments are accommodated in the Plan. The plan shall be submitted to FERC for approval, and implemented upon approval. The plan shall include monitoring strategies sufficiently repetitive to detect sites causing mortalities. Any pole or tower involved in a bird fatality and all new or rebuilt power poles shall conform to guidelines established by (Avian Power Line Interaction Committee and USDI Fish and Wildlife Service 2005). Development and implementation of this plan shall be based upon the measures of the existing Avian Protection Plan for the Klamath Basin (PacifiCorp, Revision 4, 2005) and upon any existing Memorandum of Understanding (MOU) between the Licensee, the Service, and other agencies. Development and implementation of this plan will also include a review of existing measures to ensure that they are consistent with current management direction or guidelines. If deemed necessary by the U.S. Forest Service or BLM, a MOU specific to this Project shall be developed by the Licensee in consultation with those agencies, to be filed for Commission approval within two years from license issuance.

Justification: The bald eagle, golden eagle, osprey, prairie falcon and peregrine falcon have all been documented ((Isaacs et al. 2001; PacifiCorp 2004c), pp 5-55 through 5-60) within the Project and all are susceptible to collision or electrocution from existing transmission facilities. The Final License Application acknowledged that several poles along the transmission line south of the Copco II bypass are not raptor safe ((PacifiCorp 2004a), Executive Summary 5-5) and it is likely that other poles also impact raptor populations.

The Applicant has proposed to develop a Wildlife Resource Management Plan, including the monitoring of powerlines and retrofitting poles to decrease electrocution risk. The development

of the Avian Collision and Electrocution Hazard Avoidance Plan will more specifically augment the Applicant's Wildlife Resource Management Plan and provide more specific measures to protect and minimize mortality to all raptor species, and particularly federally listed bald eagles. These goals are consistent with those of wildlife management agencies.

Impacts: Poorly designed and constructed transmission lines and distribution lines pose a risk of collision or electrocution to many raptor species. Past surveys have probably not been sufficient to describe actual impacts. Several species that are prone to collision or electrocution hazards, including bald and golden eagles and peregrine falcons, are known to inhabit the project area (Brian Woodbridge, USFWS, pers comm.)

18. Bald Eagle Protection Measures and Management Plan

Recommendation:

Within two years of license issuance, in cooperation with the Service and the appropriate state agencies and federal land management agencies, the Applicant shall develop and implement a Bald Eagle Management Plan for the Project Area. The Plan will provide for monitoring, and for protection of bald eagle nest sites, roost sites, and regular foraging areas from human disturbance. Measures of the plan will be based on the Service's Draft Bald Eagle Management Guidelines (USDI Fish and Wildlife Service 2006) or on the successor to those Draft Guidelines, and shall incorporate local knowledge as available. The Plan shall include measures for evaluation of changes in prey base relationships. The Plan shall incorporate protections from powerline collision and electrocution as described in #17 above. The Plan shall require appropriate consultations with state and federal regulatory agencies regarding actions that might affect bald eagles.

Justification: In 2002 and 2003, ten bald eagle nest territories were identified as being adjacent to Project facilities or reservoirs (PacifiCorp 2004a). Some of these nest territories are on Project lands and would be protected by the provisions and restrictions above. Provisions also need to be made to maintain and protect bald eagle perch trees and roost trees and potential nest trees. New nest trees need to be identified and given the same protection as well known nest trees.

The Applicant has proposed to develop a Wildlife Resource Management Plan, including support of aerial bald eagle surveys and the protection of bald eagle habitat. The development of the Bald Eagle Management Plan will augment the Applicant's Wildlife Resource Management Plan and provide more specific measures to protect and minimize mortality to federally listed bald eagles. These goals are consistent with those of wildlife management agencies.

If bald eagles are removed from the federal list of threatened and endangered species (71 Federal Register 8238), protections of the Bald and Golden Eagle Protection Act will still apply to the species. These protections include prohibition of disturbance of nesting locations.

Impacts: As described in detail in USDI Fish and Wildlife Service 2006, some human activities may result in varying degrees of disturbance to bald eagles at various times of year. In some cases, such disturbance may result in nest abandonment and loss of eggs or juveniles, or abandonment of traditional foraging areas.

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Section E: U.S. Department of the Interior 10(a) Recommendations

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Klamath Hydroelectric Project - FERC No. 2082

INTRODUCTION

Section 10(a)(1) of the Federal Power Act (FPA) requires the Project adopted by the Federal Energy Regulatory Commission (Commission) to be, in its judgment, the best adapted to a comprehensive plan for ... beneficial public uses, including ... purposes referred to in section 4(e) (16 U.S.C. § 803(a)(1)). Section 10(a)(2) requires that, in making this determination, the Commission consider the recommendations of Federal agencies exercising jurisdiction over resources of the State in which the Project is located (16 U.S.C. § 803(a)(2)(B)). Pursuant to this authority, the Department recommends the following recommendations be included in any license issued for the Klamath Hydroelectric Project – FERC Project No. 2082:

GENERAL

1. Emergency Operations

Within one year of license issuance the Licensee shall:

- Develop standard operating procedures for emergency situations and develop a plan that addresses procedures, environmental permits, and mitigation in the event of an emergency. The plan should specifically address the emergency spillway and canal and slope failures that could result in the event of an emergency. The plan shall be developed in consultation with the Bureau of Land Management (BLM). The plan shall include implementation strategies for agency coordination, restoration actions, monitoring and evaluation, and potential mitigation measures. The plan shall be approved by the Commission.
- Ensure that the J.C. Boyle Powerhouse has the capacity to maintain flow continuously for 48 hours in the event of a powerhouse failure. In the event of this type of emergency, flow shall be released at the powerhouse for the duration of the failure.
- Develop stabilization plans that consider structural, vegetative, and flow strategy methods to minimize erosion and restore damaged hillslopes, riparian areas and stream channels to minimize resource and visual impacts that could occur in the event of an emergency.
- Develop and submit for FERC approval a plan to restore the Klamath River from the J.C. Boyle Dam to the Copco Reservoir to mitigate impacts associated with the use of the J.C. Boyle Canal Emergency Spillway. The plan should be developed in consultation with the BLM.
- Develop monitoring protocols based on channel cross sections to determine the effectiveness of restoration actions.

Site-specific mitigation plans for the JC Boyle Canal Emergency Spillway and other canal and slope failures shall include the following:

- A map depicting the location of the proposed activity.
- Designs for site stabilization, channel restoration, location of disposal site and erosion control plan.
- Implementation and effectiveness monitoring designed to meet restoration objectives, which include but are not limited to fish passage, channel bed and bank stability, and riparian re-vegetation.
- Survey data, biological evaluations, or results from consultation for ground or habitat disturbing activities on BLM-administered lands.
- An environmental analysis of the proposed action that meets requirements of the National Environmental Policy Act (NEPA).

Rationale

Project lands within the Klamath Falls Resource Area are administered according to the Northwest Forest Plan 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl. Integral to the Northwest Forest Plan is the Aquatic Conservation Strategy (ACS), which seeks to prevent degradation and restore habitat and ecosystem health by maintaining and restoring aquatic habitat potential, restoring habitat connectivity, and maintaining flows sufficient to sustain component elements of aquatic systems. The Klamath Falls Resource Area Resource Management Plan and Record of Decision was amended to incorporate provisions of the Northwest Forest Plan to achieve ACS objectives.

Current operation of the Klamath Hydroelectric Project (Project) uses the J.C. Boyle Canal emergency spillway to evacuate the canal in the event of an emergency shut down of the J.C. Boyle Powerhouse. This practice has resulted in the erosion of approximately 80,000 cubic yards of material from the hillslope adjacent to the Klamath River, J.C. Boyle Bypassed River Reach. The deposition of the eroded material below and downstream of the spillway has altered the direction of the water flow, and increased channel width, bank erosion, and the amount of sediment that has been and is being deposited into the stream channel. Increased channel width and associated bank erosion reduces fish habitat by eliminating bank vegetation and water depth. Mid-channel deposition of sediments can cause flows to split into two streams that reduce the amount of water in each channel. This deposition can become critical in the J.C. Boyle Bypassed River Reach as low flows in this reach (approx. 320 cubic feet per second) have impaired passage of adult fish through this section of the Klamath River.

This 10(a) recommendation for the J.C. Boyle Bypassed River Reach includes provisions to maintain aquatic connectivity in the event of an emergency and to continue to use the J.C. Boyle emergency canal. This condition would contribute to long term protection and recovery of listed and non-listed species within the project reaches.

2. Cooperative Management Agreement

The Licensee shall enter into a Cooperative Management Agreement with the Bureau of Land Management (BLM) to ensure management of Klamath River lands and resources is not compromised as a result of Project operation.

In developing and implementing the agreement, the Licensee shall work with the BLM to:

- Manage riparian and aquatic habitats to maintain or improve fish, wildlife and scenic resources,
- Maintain and enhance species of special concern and their habitats,
- Maintain and enhance recreation and scenic resource values, and provide for safe recreational experiences,
- Manage deer winter range to maintain or improve habitat,
- Manage water resources to meet water quality standards as defined by the states of Oregon and California,
- Protect and interpret archaeological resources and cultural values,
- Provide on-the-ground presence to eliminate or minimize unsafe and unlawful activities.

Rationale

A Memorandum of Understanding between the BLM, PacifiCorp, State and Federal wildlife management agencies, and landowners is in effect for the Upper Klamath River (USDI BLM 1991). In 2001, the Licensee indicated an interest in pursuing a management arrangement with the BLM for lands downstream of the J.C. Boyle Powerhouse near the Oregon – California border and lands between the border and Copco Reservoir where "…the Company was willing to consider options such as…entering into a mutually beneficial land management arrangement." (PacifiCorp 2001).

Some of the lands that are currently encumbered with licensed facilities are directly or indirectly impacted by operation of the Project and were not proposed for inclusion in the Project boundary in the Final License Application (FLA). As explained thoroughly elsewhere, the Department opposes the omission from the Project of lands encumbered or impacted by Project facilities.

AQUATIC RESOURCES

3. Fisheries Technical Subcommittee (FTS)

The Licensee shall establish a Fisheries Technical Subcommittee (FTS) to advise the Licensee on the development of plans and environmental measures related to implementation of the new license. The Licensee shall fund the administrative costs of establishing the FTS.

Rationale

Development of plans and environmental measures related to implementation of the new license will necessitate the continued involvement of the FTS. This FTS will include representatives from the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and other parties to advise the Licensee as requested on implementation issues. While the Licensee is responsible for establishing the FTS, and funding its administrative costs, participants from federal and state agencies shall bear their own participation costs.

TERRESTRIAL RESOURCES

4. Fire, Fuels, Forest Health Managing Upland Vegetation

The Licensee, in consultation with BLM, shall develop and submit to FERC for approval a plan for managing upland vegetation to improve forest health and reduce potential fire hazard adjacent to Project facilities.

For the purpose of reducing the risk of high intensity, stand-replacing wildfires and/or insect infestation that would affect the condition of resources on BLM-administered lands, the plan shall include provisions for the following activities within the Project area and adjacent to Project-related facilities:

- Perform fuel reduction treatments.
- Perform thinning projects to reduce overstocking. Each potential treatment area would be examined to evaluate stand condition and develop prescriptions for thinning and treatment. In more dense stands, up to half of the basal area of trees may require removal.
- Utilize a variety of types of fuel treatments including manual and mechanical treatment and prescribed fire. Mechanical treatment may be necessary to break down or remove vegetation. Excess fuels will be utilized or piled for burning. Prescribed fire would be used to reduce fuels and alter vegetation in conifer and deciduous forests and shrub fields.
- Thin understory trees and ground vegetation to relieve stress on larger, older trees. Larger trees in such stands are typically moisture stressed as a function of dense understory vegetation.
- Remove excess fuels through salvage to reduce high fuel loads and promote long-term enhancement of scenic resources.
- Re-establish conifer forest and woodland stands following stand-replacing events. Management would include revegetation, control of competing vegetation, animal damage control, and, density control thinning of young stand.
- Implement an underburn program following initial treatment. This program would involve periodic light underburns to reduce fuel loading and density of understory vegetation.

Rationale

The Klamath Falls Resource Area RMP provides for the following uses of prescribed fire:

- as a tool for site preparation, fuel reduction, and to restore or retain natural ecological processes through site disturbance (USDI BLM 1995a, p.33)
- to reduce tree mortality and restore the degree of vigor, resiliency, and stability in forest stands which is necessary in order to achieve land use allocation objectives (USDI BLM 1995a, p.53)
- to meet resource management objectives including, but not limited to, fuels management for wildfire hazard reduction, restoration of desired vegetation conditions, management of habitat, management of fire dependent/adapted species, and silvicultural treatments (USDI BLM 1995a, p.75).

Portions of the Klamath Falls Resource Area, Redding Field Office, and the Ashland Resource Area are located within the range of the northern spotted owl and are administered according to the Northwest Forest Plan. The 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA USDI 1994) amended the Redding Field Office's RMP to include new land allocations. The Klamath Falls Resource Area and Medford District RMPs were completed after the ROD was issued, and therefore incorporate direction from the Northwest Forest Plan. The licensing process for non-Federal hydropower projects in the Northwest Forest Plan area are required to implement direction in the 1994 and 2001 RODs, as well as the Final Supplemental EIS and ROD to Clarify Provisions Relating to the Aquatic Conservation Strategy (USDA USDI 2004).

Heavy fuel loads typify forests, woodlands, and shrubfields in the Klamath River Canyon. Dense conifer stands are characterized by ladder fuels that can carry ground fires to the forest canopy. Dense overcrowded stands that are often stressed are at risk of insect (e.g., bark beetle) infestations that can kill trees and further increase fuel loading of these stands. Accumulated logs and other dead material add to fuel loads contributing to the risk of stand-replacing fires. Historically, the Klamath River canyon has had a high incidence of lightning strikes. Given the steep terrain of hillslopes surrounding the river canyon any fire could result in a stand-replacing event. Historically, lightning-caused fires and Native American burning maintained forests in the Klamath River Canyon in an open condition. Recurring fire burned as relatively light ground fires creating a mosaic of sparsely distributed perennial grasses, forbs, and occasional smaller trees clustered among widely spaced, large-diameter Ponderosa pine and Oregon white oak.

Elimination of burning by Native Americans, grazing of ground fuels, and active fire suppression reduced the effect of fire as a disturbance agent in most of these communities. Assuming an average fire-return interval of 15 years, an average of eight light ground fires has not occurred to reduce fuel loading naturally. As a consequence, in many stands, the Douglas fir and ponderosa pine understory has grown very dense.

BLM management objectives for forest health emphasize the use of prescribed fire for site preparation, fuel reduction, and to restore or retain natural ecological processes. Use of fire

accommodates restoration of stand vigor, resiliency, and stability necessary to achieve resource objectives established in BLM management plans. Use of prescribed fire includes, but is not limited to fuels management for wildfire hazard reduction, restoration of desired vegetation conditions, management of habitat, management of fire dependent/adapted species, and silvicultural treatments. The Licensee needs to recognize the value of treating vegetation through the use of fire and other treatments and implement these terms and conditions as a way to protect their facilities. Fuels treatment shall place greater emphasis on the use of prescribed fire.

RECREATIONAL RESOURCES

5. Creating and Improving trails in the Link River Reach

The licensee shall improve the Link River Trail by resurfacing the trail, managing vegetation in the trail corridor, and incorporating river access off the trail. In addition, the Licensee shall develop a trail that links Veteran's Memorial Park and the Link River Trail.

Rationale

These recreation measures should be included as part of the decommissioning plan to terminate the east and west side developments. The Veteran's Memorial Park/Boat Launch and Link River Trail were shown to be the sites with the highest use measured in recreation days from the studies that PacifiCorp's consultant EDAW conducted during the relicensing process. In addition, trail use is one of the highest recreation activities in the State of Oregon as indicated by the Oregon SCORP, a comprehensive plan filled with FERC. Mitigation needs to be a part of the decommissioning process and these two trails provide excellent opportunities for recreation improvements.

6. Developed Trails from J.C. Boyle Reservoir to Copco Reservoir

As a component of the Recreation Resources Management Plan the Licensee shall develop, and maintain a comprehensive trail network that extends from J.C. Boyle Reservoir to Copco Reservoir.

Within one year of issuance of the License, the Licensee shall:

- Improve scouting trails at the Caldera and Hell's Corner rapids. Scouting trails shall be designed for safe hiking and scouting and shall originate at locations that accommodate safe ingress and egress for rafts and visitors.

Within two years of issuance of the License, the Licensee in coordination with Bureau of Land Management (BLM) and Oregon Parks and Recreation Department (OPRD) shall:

- Develop an off-highway vehicle (OHV) management program. Additional opportunities for OHV use shall be explored to mitigate for loss of existing OHV

opportunities from necessary road/trail closures around the J.C. Boyle Reservoir and along the Upper Klamath River. OHV trails should be developed to accommodate OHV use while minimizing impacts to other resources.

Within three years of issuance of the License, the Licensee shall:

- Implement a comprehensive trail development plan for the J.C. Boyle Reservoir that links Topsy Recreation Site, Sportsman's Park, and Pioneer Park.
- Work with the Bureau of Land Management (BLM) to design trails that provide universal access to fishing, wildlife viewing, and dispersed camping at appropriate sites.
- Improve trail access to design standards for semi-primitive gradients to access fishing sites and provide river access along the J.C. Boyle Bypassed River Reach.
- Improve the hiking trail upstream of the parking area at the J.C. Boyle Powerhouse to enhance fishing and boating access and improve user safety.
- In cooperation with the BLM and Oregon Parks and Recreation Department (OPRD) design and construct a hiking trail connecting the J.C. Boyle Powerhouse to Copco, California.
- Develop several parking sites connected by a trail system along the powerhouse road. The powerhouse road may be used in lieu of new trails for short stretches where trail construction would be extremely difficult or expensive.
- Work with the BLM to design trail sections to connect with Klamath River canyon dispersed sites.
- Replace a bridge across the Klamath River in the upper Frain Ranch at the location of the old powerhouse road bridge crossing to provide pedestrian access and access for administrative vehicular traffic.
- Work with BLM, OPRD, and the National Park Service (NPS) to design and locate the bridge and trails along the east side of the Klamath River that connect dispersed camping and fishing sites to maintain the outstandingly remarkable scenic values in the Wild and Scenic River corridor.

Within five years of issuance of the License, the Licensee in partnership with OPRD shall:

- Design a non-motorized trail to connect with the new upper J.C. Boyle boat access and an existing non-motorized trail that provides fishing and hiking access to the Keno Reach of the Klamath River.

Rationale

Non-motorized recreation trails are non-existent in the Project area. Casual use trails have been established along the J.C. Boyle Reservoir, the J.C. Boyle Bypass Reach, and along the Upper Klamath Wild and Scenic River. Most of these trails afford limited access due to steep gradients or uneven terrain. Existing scouting trails are likewise user-created, are poorly located, present safety concerns, and are in poor condition.

There is a moderate level of dispersed recreation on lands surrounding J.C. Boyle Reservoir and use of the Klamath River canyon for OHVs, camping, hiking, and mountain biking, hunting, fishing, swimming, picnicking, and sightseeing. Vehicular access to the Upper Klamath Wild and Scenic River below the J.C. Boyle Powerhouse is gained via a Project road which joins the Topsy Road above Frain Ranch. A bridge spanning the Klamath River that connects the existing Project road with Topsy Road was constructed to support the Klamath Project. The bridge was destroyed many years ago and was not replaced. Public access previously provided by the bridge is lost. No other nearby bridge crossing the river is available for public use.

There is a recognized lack of developed trails for both non-motorized (hiking, horseback riding and mountain biking) and OHV recreation within the Project area. The Oregon State Comprehensive Outdoor Recreation Plan (SCORP) has identified the need for additional trails in this region. There has been increased use of both public and private lands surrounding J.C. Boyle Reservoir and river area roads by OHVs, mountain biking, hiking, camping, horseback riding and driving for pleasure. Both non-motorized and OHV use have resulted in creation of new trails and access roads. These roads and trails are steep, established on uneven grades, or are in poor condition and present a safety hazard. Many of these roads are impacting the quality of the natural environment for dispersed recreation users, are impacting cultural sites and wildlife, and create problems related to erosion and loss of vegetative cover.

Unregulated use of lands, roads, and trails around the J.C. Boyle Reservoir for OHV recreation, mountain biking, hiking, camping, horseback riding, and pleasure driving has degraded the condition of other resource values. Further, because roads and trails are established on steep or uneven grades and are not maintained, they threaten the condition of other cultural, wildlife, water quality and vegetation resources as well as present a safety hazard.

7. Interpretation and Education Program

Within three years of issuance of the License, in coordination with Bureau of Land Management (BLM) the Licensee shall develop an Interpretation and Education program for the Klamath Project (Project). The plan shall identify interpretive opportunities (including brochures) and signage needs at recreation sites, Project facilities and along Project roads. Interpretive "portal information kiosks" shall be considered for the Topsy Road, Highway 66, and other major thoroughfares. The plan shall address monitoring and maintenance of these facilities. The program shall include provisions for developing information specific to health and safety, public access, off-highway vehicle (OHV) use, illegal dumping, and use of firearms. The program shall include information regarding public service announcements and early warning systems to provide real-time flow information for the J.C. Boyle Bypass and Keno Reaches.

Rationale

Few interpretive or educational plans or programs have been developed for the Project. Although BLM has developed some informational signs that are posted at the Topsy Recreation site, Spring Island boat launch, and the Klamath River campground and PacifiCorp has placed

informational signs at the six fishing access sites above Copco Reservoir and at other Project recreation facilities, the majority of these amenities are deteriorating and/or need updating and replacement. The Oregon Department of Forestry posts seasonal fire regulation signs and the Oregon Department of Fish and Wildlife posts fishing regulations. PacifiCorp has also installed signage, primarily to warn visitors about hazards and dangers associated with Project operations. Aside from these facilities, no provisions for early warning or emergency management are provided in areas that receive a high degree of organized or dispersed use.

8. Recreation Law Enforcement Program

Within one year of issuance of the License, the Licensee shall:

- Negotiate an agreement fund the Klamath County Sheriff's Department to retain a land-based deputy for four to six months to patrol Project roads.
- Negotiate an agreement to fund the Klamath County Sheriff's Department to retain a part-time water-based deputy to patrol the J.C. Boyle and Keno Reservoirs during periods of peak recreation use (e.g., mid-May through October).
- Fund the operation of a 4-wheel drive vehicle to patrol the Project area.
- Fund a communications firm to analyze the feasibility of establishing and improving an emergency/early warning system that would be maintained over the period of the new License. This system would be available to public agencies and commercial interests for notifying law enforcement of emergencies and for the Licensee to provide early warning to the public in the event of an emergency at the J.C. Boyle Dam or Powerhouse.
- Increase on-river patrols and management presence and improving river access sites in the Middle Klamath Reach. The Licensee shall provide for on-river patrols and management in the river segment between Iron Gate and Happy Camp during the peak recreation season (mid-spring to mid-fall). In addition, the Licensee shall conduct maintenance and improve three river access sites – one below Iron Gate Dam, one near Interstate 5, and the Indian Creek access. These measures shall be developed and approved by the USFS and NPS and incorporated into the Recreation Resource Management Plan.

Rationale

Within Project: The upper Klamath River and Project reservoirs are easily accessible by a variety of recreation users which presents problems associated with unregulated or uncontrolled access to Bureau of Land Management (BLM) administered lands and resources. Resource concerns include excessive litter and dumping, vandalism, use of firearms, and uncontrolled OHV use. Much of the resource damage and vandalism and many of the law enforcement concerns could be addressed with appropriate interpretive and informational resources. High recreation use and access also contribute to personal and safety concerns. Currently, there is insufficient specialized law enforcement available to address these issues.

In addition to resource damage, uncontrolled recreation use and vandalism in the Topsy, J.C. Boyle Bluffs, Pioneer Park, and Sportsman's Park Recreation areas, and at the Frain Ranch, threaten resource conditions on Federal lands adjacent to the Project. Increased use associated with the area's popularity and increasing population in the local area will continue to threaten resource condition. The focal point for visitation to the J.C. Boyle Reservoir are the J.C. Boyle Bluffs, Pioneer Park, and recreation use by water skiers, personal watercraft, fishers, and swimmers.

Limited telephone or radio communications, especially within the Klamath River canyon below the powerhouse, result in safety concerns related to wildfires, human accidents, hydropower flow release changes and law enforcement emergencies. Improved communications are necessary to meet basic emergency management and safety needs.

Below Iron Gate Dam: The project and its operations have affected the river reach below Iron Gate Dam. Since the Iron Gate Dam became operational in the mid-1960s, project operations have greatly increased the stability and reliability of river flows downstream. This has been beneficial to summer boating activities for whitewater boating and boat-based fishing. This predictability extends as far as Seaid Valley, California, if not down to the Salmon River confluence. Regulated river flow conditions have resulted in a unique whitewater boating setting for this Klamath segment, with distinct types of attractions, boaters, and river trips. Commercial outfitters comprise 80% of both the Klamath River white water boating and fishing recreation from Iron Gate Dam to the Salmon River. This segment of the Klamath River is also a designated WSR segment and these improvements are needed to protect and enhance this segment. The Klamath National Forest (KNF) and NPS have joint WSR management responsibilities on the Lower Klamath River. The Middle Klamath River communities depend on the economic benefit that the recreation boating and fishing revenue bring to these communities. These communities qualify as economically disadvantaged populations, and have high populations of Native American representation (Karuk Tribe), which depend on the river's fisheries and recreation river use for income. Thus, these recommended mitigation measures will also help support achievement of the environmental justice goals for these economically disadvantaged communities and populations. Due to the flow regime provided by the project, recreation use has increased and is project-induced. Therefore, PacifiCorp should share in the management responsibilities. Two primary management responsibilities are needed. These include improving river access sites and increasing on-river patrols.

CULTURAL RESOURCES

9. Historic Properties Management Plan

Within one year of issuance of the License, the Licensee shall:

- In consultation with the affected Tribes, the BIA, and the State Historic Preservation Officer (SHPO), develop an Historic Properties Management Plan (HPMP) for the

identification, evaluation, assessment, and treatment of cultural resources within the Project's Area of Potential Effect (APE) for approval by FERC.

- at its own expense, arrange for processing, cataloging, accessioning, storing, inspecting, inventorying, maintaining, and conserving material remains and associated records recovered and developed as a result of cultural resource surveys or excavations on lands within the APE pursuant to 36 C.F.R. § 79.7(d). In addition, the Licensee, at its own expense, shall arrange for a suitable repository capable of meeting the requirements of 36 C.F.R. § 79.9 for the long-term curatorial services called for in this condition.
- in consultation with the affected Tribes and the SHPO develop and fund a cultural resources monitoring program. The program shall include periodic monitoring of known cultural resource sites (including historic and traditional cultural properties and archaeological sites) to assess impacts from Project activities, recreational use, vandalism, or any other impacts; periodic reconnaissance of the impoundment shorelines to assess damage to known cultural resources and to identify and avoid adverse Project effects to previously unknown cultural resources exposed by erosion; and monitoring of all ground-disturbing activities to identify and avoid adverse effects to previously unknown cultural resources.
- in consultation with the affected Tribes, the BIA, and other resources agencies, shall evaluate the monitoring program annually to ensure mitigation measures and corrective actions are effective.

Rationale

Section 106 of the National Historic Preservation Act (NHPA) requires that Federal agencies consider the effects that their projects and programs will have on historic properties. In this case the Commission can "use the services of applicants, consultants, or designees to prepare information, analyses and recommendations ..." 36 CFR § 800.2(a)(3). However, the Commission is ultimately responsible for completing the Section 106 process. Therefore, it is appropriate that any new license contain conditions requiring Pacific Corp to complete the various phases of the Section 106 process. Including these recommendations as conditions in the license assures that if Pacific Corp fails to complete its duties, it will be subject to the Commission's enforcement authority.

Operation of the Project has disturbed and otherwise affected cultural and historical sites of significance to the Tribes, requiring that such sites be investigated and, potentially, mitigated through data recovery excavation. The regulations implementing the National Historic Preservation Act and the Archaeological Protection Act of 1979 establish requirements for the protection of archaeological resources recovered from public and Indian lands, including provisions for the preservation of material remains and associated records. See 36 C.F.R. Part 79. These regulations contain requirements by which a repository for curatorial services may meet federal standards for such services. Requiring Pacific Corp to fund these curatorial services constitutes simple recognition that it is Pacific Corp's Project that has made necessary the recovery and displacement of the artifacts from their current locations, and it is Pacific Corp's responsibility to pay for curatorial services and storage for these artifacts at a suitable facility.

Archaeological sites contain ancestral artifacts of the Tribes that define their existence and sense as a people. Several known sites within the Project boundary have been subjected to erosion caused, or exacerbated by, the operation of the Project. Project operations during the future license term may continue to cause damage to these and other as yet unknown sites. Given the length of the licensing period, it is critical that the licensee, in consultation with tribal and resources agencies staff, establish a monitoring program to ensure appropriate and alternative mitigation measures are in place. More importantly, since tribal staff are most familiar with locations of culturally sensitive sites, it is sensible that the licensee invite tribal staff to be part of the monitoring team.

Direct tribal involvement and participation will not only ensure that damages to cultural resources are alleviated, but also minimized further deterioration due to possible neglect and failure to implement the HPMP.

10. Mitigate Recreational Impacts on Cultural Resource Sites

- The Licensee, within one year of license issuance and in consultation with the affected Tribes, the SHPO, and the BIA, shall develop a vandalism awareness program to educate short-term visitors and local area residents about the legal and ethical implications of activities that disturb culturally sensitive sites. The program should include methods, such as distribution of flyers, placement of signs, erection of fences, and development of interpretive centers, that will help deter such activities.
- The Licensee, within one year of license, shall develop and implement an erosion protection program to protect and stabilize cultural resource sites that have been affected by unauthorized off-road vehicle use and other unnatural causes.
- The Licensee, within one year of license issuance and in consultation with the affected Tribes and the BIA, shall develop and implement a comprehensive monitoring program that should include, but not be limited to, surveillance cameras at sensitive sites and periodic patrols by personnel, including tribal staff, with communication equipment capable of dispatching local law enforcement authorities.
- The Licensee, within six months of license issuance and in consultation with the affected Tribes, shall establish a program providing access by tribal members to traditional gathering areas. The program shall include methods for ensuring accessibility to gathering sites, particularly those that are gated, through the use of tags, vehicle window stickers, passes, and notification to Pacific Corp personnel prior to entrance. The program should also include methods for limiting access by non tribal members to gathering sites.

Rationale

People are drawn to the Project area because of the natural and recreational amenities within the Project boundary. Roads, parking lots, and facilities associated with recreational activities within and outside the Project boundary allow easy access to cultural resource sites, which

include gathering, archaeological, burial, ceremonial, and sacred sites that are of paramount importance to the Tribes. As a result of this access, cultural resources are degraded and destroyed.

To protect sensitive cultural sites from these effects, there is a need to educate the public about Native American traditional and cultural heritage. Interpretive centers, signs, and flyers can be used to achieve this purpose. In addition, we believe surveillance cameras and periodic patrols, limiting the siting of new campgrounds and day use areas in culturally-sensitive sites, and controlling access to traditional gathering areas - will reduce the negative effects of these recreational activities.

11. Native Plant and Noxious Weed Management

The Licensee, within one year of license issuance and in consultation with the affected Tribes, shall develop and implement a vegetation management plan to re-establish native vegetation and plants that are suitable to tribal members for food, medicine, basket materials, cradles, art and other cultural products. Those plants could include, but are not limited to red bud, willow, hazel shoots, pine roots, white grass, bear grass, silver leaf willow, and maidenhair fern.

Rationale

Operation of the Project and recreation activities within the Project area have contributed to loss of vegetation. It is important to re-vegetate areas that have been affected. The BIA believes it is logical to use native vegetation for this purpose. Native plants have traditionally been gathered and used by the Tribe for many cultural products. By the same token, efforts to re-establish native vegetation should coincide with efforts to reduce or eradicate noxious weeds

12. Safety of Dams – Emergency Action Plan

The Licensee, within one year of license issuance and in consultation with the Tribes and the BIA, shall invite tribal staff to participate in the annual Emergency Action Plan exercise and meeting.

Rationale

PacifiCorp must ensure representatives from all Tribes are invited to the annual emergency action plan exercise/meeting. This exercise/meeting involves major coordination and participation among various Federal, State, and local agencies, and would provide tribal staff with the opportunity to understand how their reservations might be impacted and to provide input to the emergency preparation process.

The emergency action plan exercise details site-specific information and emergency management roles, responsibilities, and procedures that the licensee, authorities, and affected parties including

the tribes might have in responding to an emergency event. Thus, it is of paramount that tribal staff are informed and involved in this process. Tribal participation and awareness could serve as an integral role in warning and evacuation process. Particularly, tribal readiness to response to an emergency affecting the dam(s) will help save lives and prevent loss of properties.

13. Tribal Participation

The Licensee, within one year of license issuance and in consultation with the Tribes and the BIA, shall allocate annual funding for tribal staff participation in cultural resource related mitigation programs.

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