SECTION C: UNITED STATES DEPARTMENT OF THE INTERIOR AND NATIONAL MARINE FISHERIES SERVICE MODIFIED PRESCRIPTIONS FOR FISHWAYS AND ALTERNATIVES ANALYSIS PURSUANT TO SECTION 18 AND SECTION 33 OF THE FEDERAL POWER ACT FOR THE KLAMATH HYDROELECTRIC PROJECT (FERC Project No. 2082)

Introduction

The U.S. Fish and Wildlife Service and National Marine Fisheries Service hereby submit joint Modified Prescriptions for the construction, operation, and maintenance of upstream and downstream fishways for the Klamath Hydroelectric Project (FERC Project No. 2082; hereafter Project) pursuant to section 18 of the Federal Power Act (FPA). For the sake of 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. The Services are submitting this document, along with the Supplemental Administrative Record,[1] to the Federal Energy Regulatory Commission (Commission).

The Services' Modified Prescriptions for Fishways are based on the best biological and engineering information available, as described more fully in the rationale that accompanies each prescription. Although the maximum benefits to the fisheries are accrued with the combination of all the prescription elements, 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), Oregon Department of Fish and Wildlife (ODFW), affected Tribes (Klamath, Karuk, Hoopa Valley, and Yurok Tribes), the Klamath Intertribal Fish and Water Commission, and other entities that are participating in this relicensing proceeding. Each Modified Prescription is based on substantial evidence contained in the record of this licensing proceeding before the Commission, and filed herein with the Commission. The rationale for each Modified Prescription is intended only to summarize the supporting information and analysis upon which these 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 and resident fish and their habitat. All documents previously filed with the Commission by the Services are hereby incorporated by reference.

The Services' Modified Prescriptions for Fishways provided in Attachment 1 herein are issued under the authority of the Secretary of the Interior pursuant to section 18 of the FPA, delegated by the Secretary of the Interior to the California/Nevada Operations

[1] The Services filed an original Administrative Record with their filing of the Preliminary Prescriptions on March 27, 2006. The original Administrative Record is incorporated by reference, and is supplemented by the materials included herein in the Supplemental Administrative Record.

Office Manager, U.S. Fish and Wildlife Service; the Director, U.S. Fish and Wildlife Service; and the Assistant Secretary for Fish, Wildlife and Parks. See 64 Stat. 1262; 209 Departmental Manual 6.1; and 242 Departmental Manual 1.1A. The NMFS hereby prescribes the license conditions as provided in Attachment 1 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 FPA, as delegated to NMFS by the Secretary of Commerce.

FERC Relicensing Proceeding

PacifiCorp (Applicant) is seeking a new license for the continued operation of the 169 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)) 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. On December 28, 2005, the Commission issued its "Notice Soliciting Comments and Final Recommendations, Terms and Conditions, and Prescriptions" (REA Notice) for the Klamath Project. The Department filed comments, recommendations, and preliminary prescriptions on March 27, 2006, that included preliminary fishway prescriptions to accommodate upstream and downstream passage, and between dam connectivity for resident trout, anadromous salmon, steelhead, and Pacific lamprey (USDI 2006). The Commission issued a draft environmental impact statement (DEIS) on September 25, 2006, and the Department filed comments in response to that document on December 1, 2006.

In a similar manner, NMFS has participated in the re-licensing process for this Project. NMFS provided comments on the Applicant's DLA and FLA, which are hereby incorporated by reference. NMFS formally intervened in the proceeding on October 5, 2004. NMFS filed comments, recommendations, and preliminary prescriptions dated March 24, 2006, that included preliminary fishway prescriptions to accommodate upstream and downstream passage, and between dam connectivity for resident trout, anadromous salmon, steelhead, and Pacific lamprey (NMFS 2006). NMFS filed comments in response to the Commission's DEIS on November 29, 2006.

Energy Policy Act Procedures

On April 25, 2006, PacifiCorp and the Hoopa Valley Tribe submitted requests for a hearing on disputed issues of material fact related to the Preliminary Prescriptions pursuant to the FPA, as amended by the Energy Policy Act of 2005 (EPAct), and pursuant to the Services' joint implementing regulations. (See 43 C.F.R. § 45.21; 50

C.F.R. § 221.21). The CDFG, ODFW, the Hoopa Valley Tribe, the Klamath Tribes, the Yurok Tribe, the Karuk Tribe, and a consortium of Conservation and Fisheries Groups timely intervened in response to the hearing request. The hearing requests were referred to the Department of Commerce's designated Administrative Law Judge (ALJ) office, and Coast Guard ALJ Parlen L. McKenna was appointed to preside over the case in accordance with implementing regulations at 50 C.F.R. Part 221. On July 6, 2007, the ALJ issued an order withdrawing the Hoopa Valley Tribe's disputed issue based on the Hoopa Valley Tribe's notice of withdrawal filed on July 5, 2006.

After an evidentiary hearing that included direct written testimony, live cross-examination, some re-direct examination, and submission of thousands of pages of scientific studies and other evidence, before ALJ McKenna on August 21–25, 2006 and briefing by the parties, the ALJ issued a decision on September 27, 2006, containing Preliminary and Ultimate Findings of Fact and Discussion. The ALJ found that, as to the eight issues of material fact that went to trial, PacifiCorp "partially proved its version of the facts" as to one issue[2] but "failed to prove its version of the facts with respect to the remaining disputed issues of material fact." ALJ Decision at 2.

In the Preliminary Prescriptions, the Services provided the rationale and scientific evidence providing the basis for the prescriptions. The Modified Prescriptions incorporate by reference the scientific evidence cited by the Services in their Preliminary Prescriptions; in addition, the Services provide additional or revised discussions that are based on relevant ALJ Findings of Fact,[3] including short form citation to the relevant Findings. Where the Modified Prescriptions reference the ALJ's Findings, the underlying citations to those Findings incorporate by reference supporting evidence developed in the hearing process. These citations offer further scientific support to the Services' prescriptions. The ALJ's Findings of Fact and the scientific information upon which they were based are included in the ALJ's decision (Administrative Law Judge 2006) and the record for that decision. The full record has been forwarded to the Commission for inclusion in the licensing record. (See 50 C.F.R. § 221.60(c)(2)). The Services' filing herein refers extensively to these Findings of Fact and supporting evidence. The ALJ's decision is referenced as follows: ALJ Decision at [page number][Finding of Fact (FOF) number]; ALJ Decision at [page number][Ultimate Findings of Fact and Conclusions of Law (UFOF)]. Testimony and exhibits submitted in the hearing are cited [Issue] [Agency] [Witness Name], [Exhibit Number], and [page number], where applicable.

[2] As to USFWS/NMFS Issue 8, the ALJ qualified his findings as is discussed more fully below, in Section 3.B.8.

[3] The purpose of the trial-type hearing is to provide a "determination on the record. . . of any disputed issues of material fact." 70 Fed. Reg. 69,804 (Nov. 17, 2005). The ALJ's findings are "final, with respect to the disputed issues of material fact" for the Departments. 43 C.F.R. § 45.60(d); 50 C.F.R. § 221.60(d). The ALJ's decision was made "following a two-day prehearing conference; the submission of thousands of pages of written direct and rebuttal testimony, exhibits, and transcripts; the filing of and ruling on numerous pretrial motions; and over forty-five hours of hearing over a five day period." ALJ Decision at 2. The ALJ made preliminary findings of fact "based upon a complete review of all evidence of record." ALJ Decision at 10.

In addition to the hearing requests, on April 25, 2006, PacifiCorp timely submitted an alternative fishway prescription, pursuant to the section 33 of the FPA (16 U.S.C. § 823d as added by the EPAct; see 43 C.F.R. § 45.71, and 50 C.F.R. § 221.71).[4] PacifiCorp's April 25, 2006, alternative is analyzed in detail in Section 3, below.

Section 33 of the FPA and the Services' joint implementing regulations require that, along with the Modified Prescriptions, the Secretaries submit into the public record of the Commission a written statement explaining the basis for the Modified Prescriptions and the reason for not accepting any Alternative Prescription submitted under this section, and a demonstration that the Secretaries gave equal consideration to the effects of the prescriptions and of the alternative on energy supply, distribution, cost, and use; flood control; navigation; water supply; air quality; and the preservation of other aspects of environmental quality based on such information as may be available to the Secretaries. 43 C.F.R. § 45.73; 50 C.F.R. § 221.73. The entirety of this document constitutes the Secretaries' written statement.

The Modified Prescriptions are provided in Attachment 1; a full analysis of PacifiCorp's Alternative, and the reasons for not accepting and prescribing it are specifically set forth in Section 3; and the basis for the Modified Prescriptions is provided throughout this document and Attachment 1.

Overview

This document builds upon the Preliminary Fishway Prescriptions filed by the Services in March 2006. The document is structured as follows:

- Section 1 provides resource goals and objectives and statutory authorities.
- Section 2 describes the changes from the preliminary to the Modified Prescriptions, and rationale and basis for the Modified Prescriptions.
- Section 3 provides the detailed analyses of fishway alternatives required by the FPA section 33 (and pursuant to 43 C.F.R. § 45.73(b), 50 C.F.R. § 221.73(b)), and the effects consideration required by the FPA section 33 (and pursuant to 43 C.F.R. § 45.73(d), 50 C.F.R. § 221.73(d)).
- Section 4 discusses other material considered, including comments filed directly with the Services and material filed with FERC that relates to the preliminary prescriptions.
- Section 5 constitutes the Services' reservation of authority.
- Section 6 provides references to literature cited.

The Modified Fishway Prescriptions for the Klamath Project are provided as Attachment 1. When the Services filed the Preliminary Prescriptions with the Commission, the

[4] The Hoopa Valley Tribe submitted to NMFS an alternative fishway prescription dated April 27, 2006. However, the Hoopa Valley Tribe withdrew that alternative by a letter dated January 8, 2007.

Services also filed the Administrative Record relied upon to support the Preliminary Prescriptions as provided in the Services' joint regulations (43 C.F.R. § 45.20 and 50 C.F.R. § 221.20). Citations to the extant record are provided herein. Additional information that has been considered and used in developing the Services' Modified Prescriptions is listed on the attached Index to the Supplemental Administrative Record, which contains the studies, data, and other factual information relied on that are not already part of the licensing proceeding record, pursuant to 43 C.F.R. § 45.73(c)(2), 50 C.F.R. § 221.73(c)(2)). The Supplemental Administrative Record is filed concurrently with this submission of the Modified Prescriptions.

Section 1. Resource Management Goals and Statutory Authority

Section 18 of the FPA (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 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."

The Services incorporate by reference the goals and objectives stated in the Preliminary Prescriptions, with the clarification that the goal to establish and maintain self-sustaining anadromous fish runs in the Upper Klamath River Basin, while a key part of the region's overall, long-term management objectives, is not the immediate objective of these Prescriptions. Consistent with the focus of Section 18 of the Federal Power Act, the Services' emphasis in this proceeding is to address the impacts of the Project and expand access to historical and currently suitable habitat above Iron Gate Dam.

In this relicensing, the Services' focus is on mitigating the Project's impacts to the passage of fish through the Klamath River. Mitigating Project impacts is separate and apart from larger fish reintroduction efforts. Fish passage at PacifiCorp facilities would provide access to habitat for resident fish and for anadromous fish already in the river below Iron Gate Dam, including the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of coho salmon which is listed as threatened under the Endangered Species Act. Reintroduction of anadromous fish to historic and suitable habitat above Upper Klamath Lake is a much broader enterprise, for which fish passage is but one necessary precursor. Reintroduction planning will require participation of Federal, State, Tribal, and local governments, as well as land owners and others, and is beyond the scope of the Commission's jurisdiction. While fish passage measures address a specific project impact, and are appropriately considered in the context of FERC relicensing, any adaptive management strategy to actively reintroduce fish in the upper Klamath basin is beyond the scope of the FERC relicensing.

Section 2. Description For Modified Fishway Prescriptions

General

The Modified Fishway Prescriptions have been revised from the Services' Preliminary Prescriptions dated March 27, 2006, as generally described below, to include revisions to the downstream fishway prescription at Copco 1, tailraces and spillways prescriptions, and bypass/attraction flow changes. The modification to the downstream fishway at Copco 1 was necessary to establish a single downstream, fishway for Copco 1 Dam that would provide the same level of guidance for downstream migrating fish. The tailraces and spillways prescriptions were modified based on an agreement with the Services during the Trial Type Hearing process to consider the results of studies in determining the need for and design of tailrace barriers and spillway modifications for anadromous and native resident fish (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number 2006-NMFS-001, Order Granting the Applicant's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). The bypass flow modifications were necessary to clarify flows for attraction for upstream fishways and the immediately downstream in bypass reaches as necessary to ensure the effectiveness of structures, facilities, or devices that constitute fishways.

Iron Gate

Iron Gate Dam Upstream Fishway Prescription: The Modified Fishway Prescription for Iron Gate Dam has been revised from the Services' Preliminary Prescription dated March 27, 2006, to include modifications for lamprey and resident trout passage to the existing ladder below the CDFG trap and holding tanks. These changes are necessary because the current approach to the CDFG trap is not designed to criteria for resident trout or lamprey.

Iron Gate Dam Downstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

Iron Gate Dam Spillway: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for spillway modifications in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

Fall Creek

Fall Creek Upstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

Fall Creek Downstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

Fall Creek Tailrace Barrier: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for tailrace barriers in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

Spring Creek

Spring Creek Upstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

Spring Creek Downstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

Copco 2

Copco 2 Dam Upstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

Copco 2 Dam Downstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

Copco 2 Dam Spillway: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for spillway modifications in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

Copco 2 Tailrace Barrier: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for tailrace barriers in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

Copco 2 Bypass Channel Barrier/Impediment Elimination: The Modified Fishway Prescription has been revised from the Services' Preliminary Prescription dated March 27, 2006, to clarify that PacifiCorp shall construct physical structures, facilities, devices or a barrier modification to eliminate the impediment, unless PacifiCorp demonstrates through an approved evaluation that there is not a barrier to fish passage

under normal operating flows specified for the Copco 2 bypassed reach in the new license.

Copco 1

Copco 1 Upstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

Copco 1 Downstream Fishway Prescription: The Modified Fishway Prescription has been revised from the Services' Preliminary Prescription dated March 27, 2006, to include one downstream bypass system from the Copco 1 forebay into the Copco 2 reservoir (immediately below the Copco 1 Dam). This revision will benefit fish and be less costly.

Copco 1 Spillway: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for spillway modifications in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

Copco 1 Tailrace Barrier: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for tailrace barriers in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

J.C. Boyle

J.C. Boyle Bypass Channel: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

J.C. Boyle Upstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

J.C. Boyle Downstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

J.C. Boyle Spillway: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for spillway modifications in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

J.C. Boyle Tailrace Barrier: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for tailrace barriers in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

Keno

Keno Upstream Fishway Prescription: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

Keno Spillway: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for spillway modifications in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

East Side and West Side Developments

East Side and West Side Downstream Fishway Prescriptions: The Modified Fishway Prescription and rationale have not changed substantively from the Services' Preliminary Prescription dated March 27, 2006.

East Side and West Side Tailrace Barriers: In accordance with a stipulation with PacifiCorp, the Services have revised the prescriptions for tailrace barriers in the Modified Prescriptions to allow PacifiCorp to conduct site-specific studies on the need for and design of spillway modifications (Administrative Law Judge 2006b).

Section 3. Alternative Condition Analyses

In accordance with the Interim Final Rule "Resource Agency Procedures for Conditions and Prescriptions in Hydropower Licenses," which the Departments of Agriculture, Commerce, and Interior jointly promulgated (70 Fed. Reg. 69804, (November 17, 2005)), any party to a license proceeding may propose an alternative to a Federal Power Act (FPA) section 4(e) condition or section 18 fishway prescription within 30 days after the deadline for the agency's preliminary condition or prescription (43 C.F.R. § 45.71; 50 C.F.R. § 221.71). The Department of the Interior and the Department of Commerce must adopt the proposed alternative prescription if the Department determines, based on substantial evidence provided by any party to the license proceeding or otherwise available to the agency, that the Alternative Prescription, as compared to the preliminary prescription:

1. Will be no less protective than the Services' Preliminary Prescription; and
2. Costs significantly less to implement or results in improved operation of the project works for electricity production.

[*see* Pub. L. No. 109-58, Title II, §241(c), 119 Stat. 674, 675-76 (2005) (adding new FPA Section 33(a) and (b)) (codified at 16 U.S.C § 823d(a) and (b)).]

In deciding whether to adopt a proposed alternative, the statute and implementing regulations (43 C.F.R. § 45.73 (Interior); 50 C.F.R. §221.73 (Commerce)) require that agencies must consider the evidence/supporting material provided by any party to the license proceeding or otherwise available to the agency, including evidence on the implementation costs or operational impacts for electricity production of the proposed alternative, comments received to the Preliminary Prescription, any comments received on the draft or final National Environmental Policy Act documents, the Proposed Alternative, and any Administrative Law Judge (ALJ) decision on disputed issues of material fact issued under 43 C.F.R. § 45.60 (Interior), and/or 50 C.F.R. §221.60 (Commerce) with respect to the preliminary prescription. In this case, this includes the ALJ decision issued by the Hon. Parlen L. McKenna, dated September 27, 2006.

When the agency files its Modified Prescriptions, it must also file with FERC:

1. Any study, data, or other factual information relied on that is not already part of the licensing proceeding record.

2. A written statement explaining:
    a. The basis for the Modified Prescription (justification); and
    b. If the agency is not adopting any alternative, its reasons for not doing so.

This written statement must also demonstrate that the agency gave equal consideration to the effects of the prescription adopted and any alternative not adopted on:

1. Energy supply, distribution, cost, and use;
2. Flood control;
3. Navigation;
4. Water supply;
5. Air quality; and
6. Preservation of other aspects of environmental quality.

In Section 3, below, the Services analyze the alternative prescriptions for protectiveness and cost, in accordance with the statutory standards set forth in Section 33 of the FPA (16 U.S.C. § 823d(b)(2)); and include the Services' consideration of effects in accordance with the factors set forth in Section 33 of the FPA (16 U.S.C. § 823d(b)(4)). The Services' Preliminary Prescriptions were included in U.S. Department of the Interior 2006 and NMFS 2006 (National Marine Fisheries Service 2006), and as modified are

included as Attachment 1. The Services' Prescriptions are compared to PacifiCorp's April 25, 2006, Alternative.[5]

In addition to the April 25, 2006, Proposed Alternative Fishway, PacifiCorp on December 1, 2006, sent to the Services an "Addendum" to the earlier filing. PacifiCorp requested that the proposal be considered under FPA Section 33 as an additional proposed alternative, or "modified prescription," to be considered "in the event that the Services prioritize anadromous fish access to habitat within the Project area" (a qualification not fully explained in the filing). *See* Addendum at 1. PacifiCorp also requested that, even if the Services did not consider the filing as setting out an alternative under Section 33, the Services nevertheless consider the Addendum as information relevant to development of the Services' modified Prescriptions. *See, e.g., id.* at 1 n.2; *id.* at 7 n.5; *id.* at 10. PacifiCorp expressly declined to withdraw the distinct April Alternative.

The joint regulations implementing the EPAct amendments to the FPA provide the definitive set of procedures to be followed by parties wishing to place a proposal before the Services for full consideration as an "alternative" under Section 33. The regulations were recently upheld as validly promulgated procedural and interpretive rules.[6] The regulations expressly require that any such alternative must be filed within 30 days after the deadline for the Services to file preliminary Prescriptions with FERC. See 50 C.F.R. § 221.71(a)(2) (DOC regulations); 43 C.F.R. § 45.21(a)(2) (DOI regulations). The deadline for filing proposed alternatives for the Services' March 2006 preliminary prescription was no later than April 28, 2006. The December 1 "Addendum" filed by PacifiCorp was thus filed more than seven months past the binding regulatory deadline.

Adherence to the regulatory deadline for submitting new proposals for full Section 33 analysis is essential to facilitate timely and thorough consideration of alternatives and the concomitant preparation of Modified Prescriptions. Consistency with the deadlines is particularly important for projects of the level of complexity of the Klamath Project, to allow full development of a record within the time available in the FERC licensing process. Thus, it would have been both inconsistent with the regulations and infeasible for the Services to accord full section 33 analysis to an alternative proposal filed so late in the process.

However, consistent with their statutory and regulatory obligations to consider relevant evidence and supporting material that is reasonably available to the Services, the Services reviewed the Addendum to determine whether it set forth "evidence and supporting material" that was relevant to consideration of the timely filed April Alternative and the development of Modified Prescriptions. See 50 C.F.R. § 221.73(a); 43 C.F.R. § 45.73(a).

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[5] The Hoopa Valley Tribe submitted to NMFS an Alternative Fishway Prescription dated April 27, 2006. However, the Hoopa Valley Tribe withdrew that Alternative by a letter dated January 8, 2007.

[6] *See* American Rivers v. United States Department of Interior, *et al.*, 2006 WL 2841929 (W.D. Wa. Oct. 3, 2006) (holding, *inter alia*, that the interim final regulations were valid procedural and interpretive regulations and, as such, were not required to be issued with prior notice and comment).

To the extent relevant and feasible in the time available, such evidence and supporting material was considered by the Services in evaluating the April alternative and developing the modified prescriptions. *See also* 16 U.S.C. §823d(b)(4) (information "provided in a timely manner" must be taken into account in preparation of the written statement explaining basis for ultimate decision to accept or reject an alternative).

The FPA provides that, where the relevant Secretary finds on the basis of substantial evidence that the statutory criteria are met, then he or she "shall accept and prescribe" the proposed alternative. FPA § 33(b)(2), 16 U.S.C. § 823d(b)(2). Thus, like the Services' Preliminary Prescriptions, each element of the Modified Prescriptions must fall within the Secretaries' authority under FPA Section 18 to prescribe "fishways."[7]

Though there is no current regulation defining "fishway," Congress has provided guidance that a "fishway 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." Energy Policy Act of 1992, Public Law 102-486, Title XVII, Section 1701(b), 106 Stat. 3008 (Oct. 24, 1992) (vacating definition at 18 C.F.R. Section 4.30(b)(9)(iii) (1992)). The Services must be guided by these parameters in developing their modified fishway prescriptions, including consideration of alternatives.[8]

In its Alternative, PacifiCorp suggests that several items (specifically, those elements requiring planning, record-keeping, and monitoring activities, the tailrace barriers, seasonal trap and haul around reservoirs, and removal of barriers in Copco and J.C. Boyle bypass channels, and prescriptions for resident fish passage) in the Services' Preliminary Prescriptions do not constitute a 'fishway." The Services disagree with this assessment, concluding that the listed elements do meet the parameters as set out in the Congressional guidance discussed above. Planning, record-keeping and monitoring activities are

[7] PacifiCorp suggested in its Alternative that the Services could accept a measure or measures set forth as part of a party's proposed alternative that do not themselves constitute a "fishway" consistent with the Congressional guidance. Alternative at 18. However, because any alternative must be ultimately "prescribe[d]" by the Secretary, language which invokes the scope of authority available to the Secretary under Section 18 (16 U.S.C. § 811), it would be unreasonable to read the statute to permit the Secretary to adopt, by way of a proposed alternative, measures that the Secretary would not otherwise have authority to prescribe. Thus, the Agencies believe the legislative guidance of the 1992 Energy Policy Act setting out the basic parameters for what constitutes a fishway that may be prescribed is equally applicable to all elements of the modified prescription, whether initially set forth by the Services or taken from a party's proposed alternative. Accordingly, the elements of PacifiCorp's Alternative that do not meet the fishway parameters are not included in the following alternatives analysis. The non-fishway elements of PacifiCorp's filing include hatchery operations and other elements not consistent with the Secretaries authority under Section 18.

[8] This guidance language is not codified in the United States Code, but rather was set out in the context of repealing the then-current FERC regulatory definition of "fishway" and directing that any future definition must be concurred in by the Secretaries of the Interior and Commerce and limited to the parameters identified above.

"measures" related to the structures, facilities, or devices necessary to maintain all life stages of such fish and which are necessary to ensure the effectiveness of the structures, facilities, or devices. As fish move upstream, tailrace barriers guide their migration so that they can successfully navigate upstream passage facilities, thus constituting structures, facilities, or devices necessary to maintain all life stages of such fish. The seasonal trap and haul prescribed at Keno Dam (upstream) and at the East- and West-Side diversions (downstream) provide safe, timely, and effective passage of fish around the dams in the context of the particular applicable conditions. Removal of barriers constitute "devices," consistent with the ordinary meaning of that term (which includes a "contrivance or an invention serving a particular purpose" as well as a "technique or means"),[9] necessary to endure that fish can pass through these bypass channels and thus achieve safe, timely, and effective passage. Finally, with respect to resident fish, based on the scientific evidence before him, the ALJ found that "migration is one of several defining life history characteristic[s] of trout. ... (citations omitted). Their ability to migrate is one of several evolutionary advantages contributing to survival of trout in the Klamath River for millions of years through dramatic environmental changes." ALJ Decision at 27; FOF 3-7. The ALJ's Ultimate Finding on this issue found that "Project operations have and continue to adversely affect the resident trout fishery by, among other things: a) confining the resident trout between the Project dams and associated reservoirs thereby impairing their utilization of the full range of life history strategies and spawning productivity; (b) unscreened flow through Project turbines result in mortality of juvenile and adult trout migrating down stream; and the inability to effectively migrate adversely affects the genetic health and long term survival of the resident species." ALJ Decision at 87, UFOF 6. Accordingly, as migration represents a life history characteristic of resident trout that is necessary to their overall health, reproduction, and survival, the prescription of passage allowing resident fish to meet these life history requirements is permissible under the fishway definition.

A. Description of Alternative Fishway Prescriptions

Description of the Services' Preliminary Prescriptions

The NMFS and FWS issued general and specific Preliminary Section 18 Prescriptions for the Klamath Hydroelectric Project on March 27, 2006. The Prescriptions address design standards, consultation, construction, monitoring, evaluation, and adaptive management requirements that would apply to all developments within the Klamath Project. The NMFS and FWS prescribe volitional passage facilities at all project dams. However, due to the prevalence of water quality problems (primarily excessive water temperatures) in the Keno reach during late spring, summer and early autumn, the agencies include an interim trap-and-haul measure to transport juvenile and adult fish past Keno Reservoir. Trap-and-haul operations would cease once conditions improved to the point that fish could survive transit through the reservoir. Specific fish passage

[9] The American Heritage College Dictionary (4th ed. 2004).

measures prescribed by the Services for upstream and downstream passage of anadromous and resident fish at each project are listed in Table 4 of the Services' Preliminary Prescriptions. These measures would be constructed over a period ranging from 3 to 8 years from license issuance.

Description of PacifiCorp's April 25, 2006 Alternative

The Pacificorp Alternative includes no passage at Keno dam and Link River Dam Eastside/Westside powerhouses. For resident fish within the Project area the PacifiCorp Alternative includes upstream and downstram passage at Fall and Spring Creek diversion dams and modifications to the existing J.C. Boyle fish ladder. PacifiCorp's Fishway Alternative for anadromous fish at Iron Gate, Fall Creek, Copco 1, Copco 2, and J. C. Boyle Dams are described in PacifiCorp (2006), and consist of minor modifications to the existing Iron Gate Dam hatchery ladder to accommodate an adult collection and transport facility, creation of adult fish release access sites above J.C. Boyle Dam, modifications to the existing J.C. Boyle fish ladder, and studies for 5 to 10 (or more) years to determine what, if any, juvenile collection and release efforts should be implemented. At some point within the study period, PacifiCorp would either construct a collection facility at J.C. Boyle Dam and commence a juvenile collection and transport program, or end fish passage activities upon completion of a "limiting factors analysis." Details regarding the final design and implementation of fish passage are not fully described in the alternative.

Upstream Passage of Adult Fish

The PacifiCorp Alternative for upstream passage anticipates modification to the existing J.C. Boyle ladder, and modifications to the existing Iron Gate Hatchery fish collection, sorting, and holding facilities as necessary to facilitate upstream collection and transport (trap and haul) of Chinook, coho, steelhead, and Pacific lamprey. The details of the construction requirements would be based on the results of 5 to 10 year Phase I studies. PacifiCorp's Alternative includes an additional lift/hopper system per NMFS criteria and would augment the existing sorting facility to enable detection and recording of PIT-tag data and other identifiers at Iron Gate Dam. The existing auxiliary water system would probably continue to be used to augment ladder flow from the forebay. Neither the existing ladder nor the spillway would be modified. PacifiCorp would develop a design and construction plan for modifications to the existing hatchery facilities for the Services' review and approval, and would complete construction and begin operating within two years of license issuance. However, the actual time frame for construction and/or implementation is unclear as up to 5 to 10 years of Phase 1 studies on juvenile survival and behavior through lakes and reservoirs; juvenile transport survival; early life-stage survival and juvenile production from important tributaries; disease effects to both juveniles and adults; adult transport and migration survival and behavior; and smolt-to-adult survival rates are proposed ((PacifiCorp 2006), Attachment A, page A-6 and A-10, Table 2). Decisions regarding full implementation of adult and juvenile transport facilities will be based on the results of these 5 to 10 year Phase I studies.

PacifiCorp proposes that some or all of the adult fish trapped at Iron Gate Dam would be transported and released at or above J.C. Boyle Reservoir. However, the proposed alternative focuses on Chinook and does not specify how other species would be accommodated. Final decisions on how each species would be handled, potential release locations, and final design criteria would be deferred until the results of the Phase 1 monitoring studies outlined in Attachment A of the PacifiCorp Alternative have been completed. Phase 1 studies are scheduled to take between 5 and 10 years to complete. PacifiCorp indicates that their program would likely not include collection and transport of steelhead trout.

At J.C. Boyle Dam, PacifiCorp proposes to modify the existing ladder. The existing bar spacing on the fishway exit pool trashrack will be increased and an additional weir will be added to the fishway entrance pool to decrease the height of the existing step.

PacifiCorp proposed no new upstream fish passage facilities for Copco 1, Copco 2, and Keno.

PacifiCorp's Alternative does not include fishways at Iron Gate Dam (other than the upstream passage proposed as part of the anadromous fish collection and transport program) or at the Copco 1 and 2 dams for resident fish. PacifiCorp's position is that all trout now arriving at the Iron Gate ladder are considered to be of a coastal-lineage stock (steelhead). However, PacifiCorp would transport any resident fish that do arrive in the Iron Gate Dam collection facility to above or below the Dam at the request of fish managers.

PacifiCorp proposes no downstream fishway at Iron Gate Dam, and no upstream or downstream fishways or spillway modifications at Copco 1 or Copco 2 Dams. PacifiCorp does not believe that resident fish require passage at J.C. Boyle Dam (Section V.B.3.a.). However, because there is an existing ladder at J.C. Boyle Dam, PacifiCorp proposes to modify the ladder, increase the existing bar spacing on the fishway exit pool trashrack, and add an additional weir to the fishway entrance pool. PacifiCorp is proposing to implement minor fixes to fill gaps among boulders and bedrock in the J.C. Boyle spillway within four years of license issuance; however, PacifiCorp is not proposing to implement hydraulically-engineered spillway modifications of the type described in the Services' Prescription because, they suggest, there is no evidence that significant modifications are necessary to protect redband trout.

PacifiCorp proposed in its license application to decommission the East Side and West Side powerhouses at Link Dam, and PacifiCorp is also prepared to apply to FERC to decommission Keno Dam. PacifiCorp's position is that there is no evidence to suggest that passing resident fish—and in the future, anadromous fish—requires any additional protections at the Keno Dam. PacifiCorp does not propose to subsample fish on a daily basis for size, species identification, age determination, and condition, as described in the

Services' Prescription. PacifiCorp's collection and transport program for anadromous fish would be used to provide fish access to habitat above Keno Reservoir.

Downstream Passage of Juvenile Fish

Under PacifiCorp's Alternative (pages 57-61, 90-91 in Attachment A), PacifiCorp proposes no downstream fish passage facilities for Iron Gate, Copco 1, Copco 2, or Fall Creek Dams.

At J.C. Boyle, PacifiCorp will continue to use existing downstream screening facilities to bypass resident fish. These facilities consist of traveling screens that cover the entire flow to the power canal. The system also includes a fish bypass system that discharges to a pool just downstream of the spillway. The screen approach velocities under maximum flows do not meet current criteria for fry; however, if a juvenile anadromous collection and transport facility is ultimately constructed at J.C. Boyle Dam, it will be constructed to meet criteria for juvenile salmon and trout.

In addition, PacifiCorp states that it *might* construct a juvenile collection and transport facility at or above J.C. Boyle Dam. PacifiCorp proposes to conduct a number of studies (up to 5 years in duration) on juvenile fish survival in transport, survival in the upper basin, and survival after downstream release. The decision to build a collection facility would be based on the results of the studies, but neither the evaluation criteria nor the decision-making process have been described in detail. As a result, the precise timing, location and type of juvenile collection facilities is not known at this time, although PacifiCorp has included an example of the type of facility that may be considered in Attachment D of their Alternative. Under PacifiCorp's proposal, these details would be based on a phased analysis of downstream migrating juvenile behavior.

PacifiCorp does not specify release facilities, but provides that juvenile migrants could be released directly into the Klamath River below Iron Gate Dam at one or more unspecified locations. PacifiCorp's Alternative does not include stress relief ponds at this time. However, presumably using available raceway space at the Iron Gate Hatchery, stress relief ponds "easily could be added if determined to be worthwhile." (PacifiCorp 2006, page 60).

Limiting Factors Analysis

The PacifiCorp Alternative for complete fish passage (upstream and downstream for both adults and juveniles of all species) will only be fully implemented if PacifiCorp and fisheries managers decide that self-sustaining runs of reintroduced anadromous fish can be established. The criteria for establishing successful establishment of self-sustaining runs were not articulated in the PacifiCorp Alternative. If, based on the results of the proposed studies, PacifiCorp and Fisheries Managers decide that sustained runs cannot be established, PacifiCorp will develop and implement a limiting factors analysis to identify obstacles to establishing such runs. PacifiCorp specifies that it would not, solely by

virtue of implementing this Adaptive Reintroduction Plan (ARP), assume any responsibility for addressing or removing an identified limiting factor. However, should Fisheries Managers or other stakeholders succeed in removing or minimizing limiting factors in a manner that is anticipated to allow the establishment of self-sustaining fish runs in the upper Klamath basin, PacifiCorp will implement necessary studies to confirm that the relevant factor is no longer limiting. If, based on such additional studies, the Fisheries Managers determine that a previously-limiting factor is no longer an obstacle to establishing self-sustaining anadromous fish runs, only then will PacifiCorp commence reintroduction efforts as directed by Fisheries Managers. Under the PacifiCorp Alternative, it is possible that complete fish passage may never be established.

B. Comparison of PacifiCorp's Alternative to the Services' Prescriptions Under Statutory Criteria

Criteria 1 – Would the Alternative, as compared to the Services' Prescriptions, be no less protective?

As described more fully below, the Services' Prescriptions are more protective than PacifiCorp's Alternative. In short, the Project's dams create barriers to migration of resident trout among reaches within the Project area, and to migration of anadromous fish into and above the Project area. The Services' Prescriptions are intended to restore migration through the Project and provide migrating fish a means through the barriers posed by project facilities. The level of protection provided by the Services' Prescriptions is much greater than the level of protection provided by PacifiCorp's Alternative for the following reasons:

1. PacifiCorp's Alternative Provides Less Access to Habitat in the Project Reach
2. PacifiCorp's Alternative Provides Less Habitat Connectivity
3. Evidence Indicates that for the Site-specific Conditions of the Project, Volitional Passage Would Be More Effective than Trap and Haul Methods at Passing Anadromous and Resident Fish Across Dams
4. Upstream Migration
    - 4a. PacifiCorp's Alternative Provides Less Effective Passage at J.C. Boyle Dam and Keno Dam
    - 4b. PacifiCorp's Alternative Would Delay Upstream Migration
    - 4c. PacifiCorp's Alternative Would Cause Greater Stress and Prespawn Mortality to Adult Fish
    - 4d. Services' Prescribed Upstream Fishways at Iron Gate and Copco 1 Dams Would Allow Fish to Express a Full Range of Migratory Behavior
    - 4e. PacifiCorp's Alternative Would Be No Less Likely to Cause Fish Losses in the Hatchery and Ladder
    - 4f. PacifiCorp's Alternative Would Increase Straying of Returning Adults
    - 4g. The Services' Prescriptions are Based on Well Documented Adult Cumulative Survival in Established and Accepted Fishways
5. Downstream Migration

5a. PacifiCorp's Alternative Would Cause Greater Stress to Juvenile Fish than the Service's Prescription
5b. PacifiCorp's Alternative Provides No Measures for Downstream Migration or Protection from Entrainment at Copco 1, Copco 2, and Iron Gate Facilities
5c. PacifiCorp's Alternative Provides Less Protection from Entrainment at J.C. Boyle Dam
5d. PacifiCorp's Alternative Would Cause Increased Mortality of Outmigrating Fish Associated with Premature Downstream Migration
5e. PacifiCorp's Alternative Does Not Minimize Spillway Mortality
5f. The Services' Prescriptions Provide for the Migratory Needs of Fish Based on Valid Modeling Comparisons of Passage Alternatives.

6. PacifiCorp's Alternative is More Likely to Exacerbate Pathogen and Fish Disease Risks to Anadromous Fish
7. PacifiCorp's Alternative Provides No Protective Measures for Fish at Keno Dam and Link River East Side/West Side Powerhouses
8. PacifiCorp's Alternative Would Bypass Habitat for Pacific Lamprey in the Project Reach
9. PacifiCorp's Alternative Would Rely on Passage Methods for Pacific Lamprey That Have Not Been Established
10. It Is Unlikely that PacifiCorp's Alternative Would Provide Migratory Cues Necessary for the Attraction of Adult Pacific Lamprey
11. PacifiCorp's Alternative Provides Lesser Population-level Benefits for the Upper Klamath Coho Population and for the Federally Listed SONCC Coho ESU
12. PacifiCorp's Alternative Does Not Protect Federally Listed Coho Salmon From Entrainment at the Copco 1, Copco 2, and Iron Gate Turbine Intakes
13. PacifiCorp's Alternative Risks Inadvertent Transport of Resident Trout and Lamprey
14. PacifiCorp's Alternative Provides Little Protection from Entrainment for Resident Trout
15. Unlike the Services' Prescriptions, PacifiCorp's Alternative Would Not Reduce the Project's Impacts on the Resident Trout Fishery
16. PacifiCorp's Alternative Does Not Protect or Bypass Federally Listed Suckers

The Services' Prescriptions provide certainty and an appropriate time frame (2-8 years) for the construction of fishways that will provide safe, timely, and effective passage for resident and anadromous fish at Project facilities. PacifiCorp's Alternative is less protective because it delays the certainty of fish passage in favor of studies that would not be completed for up to 10 years (PacifiCorp 2006, Attachment A, page A-12) and with no certainty that the eventual outcome will mitigate project effects.

The Services analyzed the Alternative in accordance with the regulations. As explained further below, the Services determined that, while likely less costly, the Alternative is less protective of the resource. Therefore, the Service are not adopting the Alternative. Below are discussions of the reasons that PacifiCorp's Alternative is less protective of fishery resources of the Klamath River than are the Services' Prescriptions. The first set

of reasons apply generally to the resident redband/rainbow trout currently inhabiting the Project reach and all of the anadromous fishes that could be reintroduced to the Project reach (i.e., fall Chinook salmon, spring Chinook salmon, coho salmon, steelhead, and Pacific lamprey). Secondly, we discuss specific reasons that apply to each of these species independently. All of the reasons, below, explain why the provision of safe, timely, and effective passage, as described in the Services Prescriptions, would be more protective than PacifiCorp's Alternative.

General

1. PacifiCorp's Alternative Provides Less Access to Habitat in the Project Reach

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions provide access to habitat suitable for anadromous fish in the Project Reach, including perennial tributaries, intermittent tributaries, mainstem habitat, and natal streams.
- PacifiCorp's Alternative is less protective because, if any fish passage is provided at all, anadromous fish would be transported around suitable habitat in the Project reach, including thermal refugia, perennial tributaries, intermittent tributaries, mainstem habitat, and natal streams.

The Service's Prescriptions provide volitional fish passage at each Project dam to allow both resident and anadromous fish to migrate freely among the habitats between the dams and in the tributaries of the mainstem between the dams and reservoirs. Resident fish need to migrate among these areas to improve their ability to meet their life history requirements over current conditions with volitional passage. Anadromous fish will be provided access to these habitats for the first time since the Project was constructed.

Significant habitat for anadromous fish currently exists in the Project Reach ((U.S. Department of the Interior 2006b; USDI Fish and Wildlife Service 2006)Tech memo). The ALJ agreed with the Services' technical finding that 58 miles is a reasonable estimate of the amount of useable habitat currently in the Project reach (ALJ Decision at 86, UFOF 8). Based on the scientific evidence presented, the ALJ found habitat in the Project reach to include: 1) the main stem (containing approximately 28 miles of suitable habit), which PacifiCorp admits is suitable for anadromous fish; 2) perennial tributaries (containing approximately 12 miles of suitable habitat) and intermittent streams (containing approximately 18 miles of suitable habitat) (ALJ Decision at 66, citing Findings of Fact 6-9 through 6-14). Of this habitat, PacifiCorp's Alternative would transport anadromous fish around the reach between Iron Gate Dam and J.C. Boyle Reservoir (pages 57-59 and page 62), bypassing approximately 40 miles of suitable anadromous fish habitat (Table 3, Agencies' Preliminary Prescription; see ALJ Decision citations above). Portions of this habitat contain spring influenced areas that would accommodate anadromous fish through periods when water quality might be unsuitable ((USDI Fish and Wildlife Service 2006) Tech memo). Such habitat includes areas cooled by springs (thermal refugia) in the J.C. Boyle bypass (ALJ Decision at 33, FOF 6-10). In

the lower river, refugial areas have been shown to accommodate over-summering anadromous fish (Benson and Holt 2006; Sutton et al. 2002; Sutton et al. 2004).

The Services' Prescriptions would provide access to the suitable anadromous fish habitat, including thermal refugia, between Iron Gate Dam and J.C. Boyle Reservoir.

2. PacifiCorp's Alternative Provides Less Habitat Connectivity

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because volitional fishways provide continuous habitat connectivity for fish so they can utilize the full range of different habitat types, such as perennial or intermittent streams or thermal refugia, at different points in their life history and fully express all life history strategies. The diversity of habitats available and the genetic intermixing of sub-populations provided with the Services' Prescriptions allow for the healthy maintenance of genetic diversity of the fish populations.
- PacifiCorp's Alternative is less protective because fish would not continually have access to the full range of different habitat types in the Project reach because anadromous fish would be trucked around the Project reach and resident fish would not be able to freely move past each of the dams. The diversity of life history strategies would not be fully expressed and the genetic diversity benefits would not be realized under PacifiCorp's Alternative.

Volitional passage, as the Services prescribed, allows fish to use ladders to move past dams in their migrations or other movements up and down rivers. As provided in PacifiCorp's Alternative, trap and haul would involve trapping and collecting fish downstream of Iron Gate Dam, and loading them in trucks to transport to the upstream side of J.C. Boyle Dam for release. This method would deprive the transported fish of access to the diversity of habitats available within the project reach. If instead, fish were trapped and hauled around each of Iron Gate and the Copco Dams in order to provide access to most of the 58 miles of habitat, the adverse effects due to stress of collecting and handling, described below (in Subsections 4c and 5a above), would be significantly increased. If it was decided to trap and haul at each dam and release at the upstream end of the reservoirs in order to avoid reservoir mortality, then the habitats in the tributaries that flow into the reservoirs, such as Spencer Creek and Jenny Creek, would not be accessible to migrating fish. Ladders, as prescribed by the Services, would operate continually, while trucks would only be available at specific times.

Connectivity is critical in the Klamath watershed to allow resident and anadromous fish to migrate seasonally to take advantage of different habitat types and thermal refugia as environmental conditions and life history needs change. Tributaries and thermal refugial areas are critically important in the Klamath watershed for juvenile (Belchik 1997; National Research Council et al. 2002; Sutton et al. 2004) and adult Chinook salmon (Hillemeier 1999; Strange 2005) and may not be adjacent or coincide with road access points for hauling trucks. Even if PacifiCorp contemplated release within the Project area, trap and haul operations would likely bypass many areas of good habitat because their

suitability is unknown or it is inconvenient to release fish in those areas. Therefore, at this particular site, and in context of this Project, it would be infeasible to devise a comprehensive Trap and Haul method as a primary approach that would be equally protective to the Services prescriptions because of site-specific conditions at this Project.

PacifiCorp (2006, pages 64-65) states that one of the clear benefits of a trap and haul operation over volitional passage for anadromous fish is the ability to bypass less viable areas in favor of higher-quality upstream habitat. In this way, PacifiCorp says, large reservoirs, unscreened diversions, and marginal water quality can be avoided. However, as discussed below, we find that fish can migrate through reservoirs and unscreened diversions, and marginal water quality could be addressed while using volitional passage. Unscreened diversions would still have to be screened (see Subsections 5b and 5c, below) and the marginal water quality in Lake Ewauna would need to be bypassed using trap and haul methods until water quality concerns are remediated (see Subsection 6, below). Many more problems exist with PacifiCorp's trap and haul Alternative, as discussed below. Attempts to sort upstream migrating fish to desired locations such as Fall Creek, Spencer Creek, or habitat below Iron Gate Dam would be difficult because identification of which natal stream the fish are from would not be possible. It would be most effective if the fish themselves were allowed to choose their natal streams through the use of fish ladders.

Migration Through Reservoirs – PacifiCorp (2006, page 49) states that the Services' Prescriptions would subject anadromous fish to stress and delay due to water temperature differences. Based on the record evidence, the ALJ found that adult coho salmon enter the river to spawn in late September and reach peak migration strength between late October and mid-November (ALJ Decision at 35, FOF 7-10) when the water temperatures above Iron Gate Dam are low. Further, juvenile coho salmon begin outmigrating to the ocean in late February and continue migration through early July (ALJ Decision at 36, FOF 7-11). For a significant amount of the outmigration period, water temperatures are low. While juvenile coho salmon rear in streams for one year and have a preference for cold water (ranging between 12 and 14^{o} C), they can tolerate higher water temperatures (exceeding 20^{o} C) where food is abundant, there are areas of thermal refugia, and other conditions are not stressful (ALJ Decision at 36, FOF 7-11). Therefore, water temperature will not preclude coho salmon from utilizing the habitat within the Project area (ALJ Decision at 36, FOF 7-12). The ALJ made similar findings for other species of anadromous fish (ALJ Decision at 17, FOF 2A-27 through FOF 2A-29 (fall-run Chinook); ALJ Decision at 18, FOF 2A-35 and FOF 2A-36 (spring-run Chinook); and ALJ Decision at 19, FOF 2A-43 and FOF 2A-44 (steelhead). With respect to anadromous species and habitat in the Project reach, the ALJ found that warm water temperatures in the summer and cold water temperatures in the winter will not preclude anadromous fish from successfully utilizing habitat above Iron Gate Dam (ALJ Decision at 14, FOF 2A-14). The ALJ found strong evidence that anadromous salmonids could migrate through Project reservoirs and facilities in the fact that anadromous fish currently complete life cycles through eight dams and reservoirs on the Columbia and Snake

Rivers, and historically completed life cycles through Upper Klamath Lake (ALJ Decision at 15, FOF 2A-20).

PacifiCorp (2006, page 92) states that "neither the resident trout populations in and above Copco 1 Dam nor the populations below Copco 1 Dam require passage in order to maintain all life stages." However, for resident trout, barriers such as dams may cause the extinction of mobile life history forms of resident trout, and if these life history forms are genetically distinct, their genetic contribution to the population will be lost (Young 1995). In addition, implementing fish passage would help improve connectivity among populations in the Project area to the extent that all life stages would be better maintained. The ALJ found that the Project contains habitat for resident trout (ALJ Decision at 26, FOF 3-1); that prior to the construction of dams, redband trout within the Project area belonged to a single, large intermixing population throughout the Klamath River Basin (ALJ Decision at 26, FOF 3-4); and that migration is one of several defining life history characteristics of trout (ALJ Decision at 27, FOF 3-7). The ALJ also found that life history strategies (such as spawning above the J.C. Boyle Dam) are denied to the resident trout population below the dam (ALJ Decision at 26, FOF 3-6); the Project restricts migration of resident fish within the mainstem and into and out of the tributaries (ALJ Decision at 27, FOF 3-8), including highly productive spawning and rearing habitat in Spencer Creek (ALJ Decision at 27, FOF 3-13); that the lack of fishways at Iron Gate, Copco I, and Copco II Dams block all upstream passage, isolating resident fish from counterparts below the dams (ALJ Decision at 27, FOF 3-8); and the Project's limitation on riverine migration may have reduced the genetic diversity of the remaining stocks within the Project reaches (ALJ Decision at 28, FOF 3-16). Improvements in the efficiency of the fishway at J.C. Boyle Dam would result in significant trout population migration above the dam over time (ALJ Decision at 27, FOF 3-12).

3. Evidence Indicates that for the Site-specific Conditions of the Project, Volitional Passage Would Be More Effective than Trap and Haul Methods at Passing Anadromous and Resident Fish Across Dams

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because volitional passage is the most effective method for re-establishing fish passage. Migrating salmonids, in particular, are capable of entering and ascending properly designed fishways, traversing reservoirs, and locating their streams of origin with little or no delay or wasted energy, thus minimizing the stress associated with migration.

- PacifiCorp's Alternative is less protective because of increased fish stress, injury, and mortality due to handling and transport, in combination with uncertainties of long term funding, maintenance, and operation.

The Services prescribe volitional passage as the most effective method for re-establishing fish passage across dams in the Project. This is primarily due to the successes achieved with volitional passage in similar river systems in comparison to the risks associated with

trap and haul, including the handling and transport of adult upstream migrants, in combination with the long term uncertainty of funding, maintenance, and operation of trap and haul programs. Volitional ladders have been accepted as effective and appropriate fishways, whereas trap and haul methods are generally considered when ladders are not technically feasible, desirable, or management goals include trapping anyway (National Marine Fisheries Service 2004b).

Volitional ladders are well understood (Steward and Associates 2007). The bioengineering principles of upstream passage systems are well established and the results, expressed as the proportion of fish arriving at the dam that are passed within an acceptable period of time, have generally been good (Steward and Associates 2007). Upstream migrating salmonids, in particular, are capable of entering and ascending properly designed fishways, traversing reservoirs, and locating their streams of origin with little or no delay or wasted energy. Importantly, energy expenditures and levels of stress associated with migration through fishways and reservoirs are comparable to those experienced in undammed systems, leaving ample reserves for sexual maturation and successful reproduction (Steward and Associates 2007).

When considering fish passage on other rivers, the river most comparable to the Klamath is the Columbia River. These are the only two west coast rivers with headwaters east of the Cascade Range. The rivers are comparable in size and both had large runs of anadromous fish historically.

Adult salmonids generally enjoy very high survival and passage success through ladders and through reservoirs on the Columbia. In a reach of the river with much larger reservoirs than the Klamath River, passage success rates of 86 to 98 percent have been estimated from tailrace to tailrace from Ice Harbor to Lower Granite Dam (3 dams and reservoirs). These survival rates include ladder entry, passage and reservoir survival (National Marine Fisheries Service 2000b) NMFS concluded that minimum per project passage rates for Columbia River facilities were 96 to 98 percent for Chinook and 97 percent for steelhead (National Marine Fisheries Service 2000a).

On the lower Columbia River, there are currently nine dams with ladders for upstream passage (Gary Fredricks, NMFS, pers. comm.). Originally, both ladders and locks (the concept is similar to trap and haul) were installed as fishways for the Columbia River at Bonneville Dam (Time Magazine 1938; U. S. Army Corps of Engineers 1958). When the first salmon to use the ladders at Bonneville returned, an average of 1,600 salmon per day used the ladders and there was no indication that fish had difficulty finding their way (Time Magazine 1938). Fish in general preferred to enter the ladders when available rather than the locks (U.S. Corps of Engineers 1958). The conventional pool-type fish ladders have been the primary means of passing fish over Bonneville Dam since they were placed in operation in 1938 (U.S. Corps of Engineers 1958).

The fish locks were later discontinued (U.S. Corps of Engineers 1958). They were not considered suitable for salmon and steelhead passage, were very time

consuming, and were labor intensive (Beamesderfer and Nigro 1992). It was difficult to attract and keep fish in a lock. Fish could be attracted to the lock chamber, but lack of directional flow within the chamber and other factors permitted fish to leave. Various types of trapping devices were tried but with only fair results. The longest period in which locks were continually used was during 1941 and 1942. (U.S. Corps of Engineers 1958).

On the Klamath River, the channel and reservoirs of the Project reach are relatively confined and narrow, making it easier for adults to find ladder entrances and navigate reservoirs. It is reasonable to expect that ladder efficiencies on the Klamath would be comparable to the facilities on the Columbia River.

Given this, even if the 95 percent adult upstream passage rate using trap and haul could be achieved as the Applicant has suggested, it be less than the best observed passage rates on the Columbia River. Further, the Alternative would be less protective of naturally spawned fish and less effective at restoration of native fish to historically occupied habitats and thus is inconsistent with the Department of the Interior and Klamath River Basin Fisheries Task Force's Long Range Plan (USDI Klamath River Basin Fisheries Task Force 1991). This alternative would also be inconsistent with Agency goals (U.S. Department of the Interior 2006b).

Trap and haul associated fish stress, injury, and/or mortality have been documented. Trap and haul relies on extensive handling and sorting of fish, as well as crowding fish in holding ponds and transport trucks, all of which cause stress to fish (Oregon Department of Fish and Wildlife 2006). For example, carbon dioxide use may contribute to physical injuries in adult salmon as they thrash in the anesthetic bath during handling. This stressful behavior can cause injuries that are not readily apparent when fish are released, but may show up as fungal infections in the following weeks (Beidler and Knapp 2005). Trap and haul operations delay fish passage by either closing off the entrance to the trap or by holding fish in entrance pools or holding ponds until a truck and driver are available for transport and release (Oregon Department of Fish and Wildlife 2006, Beidler and Knapp 2005). Fish delayed in the river below a dam often jump at the face of the dam or ladder and venture into draft tubes, all sources of potential mortality or injury. Fish that are held in pools are often over-crowded, increasing stress, risk of disease transfer, and the potential for injury or mortality (Oregon Department of Fish and Wildlife 2006). Captive fish can also become susceptible to poaching and pollution events.

System disruption during peak migration periods, due to either natural or logistical events, can result in catastrophic loss of significant segments of a fish run (Oregon Department of Fish and Wildlife 2006). For example, the traps at the Bennett Dams on the North Santiam River in Oregon cannot be operated during high flows (Firman et al. 2005; Firman et al. 2002), therefore, trapping was not possible the entirety of the winter steelhead run in 2004 (Firman et al. 2005). With a trap and haul alternative, a single malfunction of equipment or other such incident could harm a migrating portion of a

population of one of the ESA-listed species (Oregon Department of Fish and Wildlife 2006).

Further problems with the use of trap and haul for the Klamath Project is that there are species and life history issues that complicate the collection system. For example, steelhead juveniles can outmigrate after having spent one to three years in freshwater, and adults can return after one or two years in the ocean. The weir at the collection facility would need to be specially designed to prevent smaller fish such as trout, juveniles, and lamprey from exiting if these fish are designated for trap and transport. The smaller open area of the weir may be more prone to plugging by debris resulting in overflows and allowing all fish to escape ((Oregon Department of Fish and Wildlife 2006) Dec 1 comment letter).

4. Upstream Migration

4a. PacifiCorp's Alternative Provides Less Effective Passage at J.C. Boyle Dam and Keno Dam

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions would upgrade existing upstream fishways at J.C. Boyle Dam and Keno Dam.
- PacifiCorp's Alternative would be less protective because it relies on existing ladders at these facilities that fail to meet current criteria.

The Service has concluded that a new ladder constructed to current criteria is required to provide adequate passage for resident trout at J.C. Boyle Dam (USDI Fish and Wildlife Service 2005b). The existing ladder at J.C. Boyle Dam has approximately 1 foot drops across each weir (PacifiCorp 2004c). Current ODFW design criteria include a 6 inch maximum jump height between pools (Oregon Department of Fish and Wildlife 2004). In addition, the modern recommended turbulence factor for fish ladder pools for anadromous fish is less than 4.0 ft-lbs/s/ft^3 (National Marine Fisheries Service 2004a). The current turbulence factor in the J.C. Boyle fish ladder pools is approximately 6.8 ft-lbs/s/ft^3 or 1.7 times the recommended value. Improvements in the efficiency of the fishway at J.C. Boyle Dam would result in significant trout population migration above the dam over time (ALJ Decision at 27, FOF 3-12), and improved passage of anadromous fish.

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 Service 2005b). Resident lamprey ammocoetes (juveniles) already rear within tributaries within the Project (ALJ Decision at 37, FOF 8-4). Although the historical upstream distribution of Pacific lamprey is unknown, suitable habitat for spawning and juvenile rearing is available within tributaries and stream reaches in the Project area (ALJ Decision at 37, FOF 8-3). Pacific lamprey below Iron Gate Dam would migrate above the dam if access was provided through fishways (ALJ Decision at 37, FOF 8-7).

Volitional passage for lampreys has been designed and is in place in other river systems (ALJ Decision at 37, FOF 8-8). Resident and Pacific lamprey would benefit from a fishway that meets current criteria to accomplish lamprey passage.

PacifiCorp (2006, pages 93-94) describes how a fish ladder primarily for resident trout was built at J.C. Boyle Dam in 1958, and trout use of the ladder was monitored. Trout use of the ladder in the first year was quite high, but it declined quite rapidly to almost no use today. PacifiCorp (2006, pages 94-95) states that the design of the existing ladder does not explain the decline in its use over the years because use became progressively worse through the years, yet the ladder remained unchanged. PacifiCorp believes their proposed ladder modifications will benefit fish that may use the ladder, but that resident fish do not need passage at this site (PacifiCorp 2006, page 95). The Services have addressed in detail problems with the J.C. Boyle ladder that have contributed to reduced resident fish passage in recent years (USDI Fish and Wildlife Service 2004). In addition, PacifiCorp has agreed to improve the channel configuration below the fishway so that upstream migration of trout will no longer be impeded (ALJ Decision at 27, FOF 3-11). This improvement is necessary in order to be compliant with the current license. The Services disagree that resident fish do not need passage at this site. Improvements in efficiency to the fishway at J.C. Boyle Dam would result in significant trout population migration above the dam over time (ALJ Decision at 27, FOF 3-12). Migration will benefit resident trout as migration is one of several defining life history characteristic of trout (ALJ Decision at 27, FOF 3-7).

4b. PacifiCorp's Alternative Would Delay Upstream Migration

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions provide volitional, timely migration of adult fish.
- PacifiCorp's Alternative would be less protective because adult migrating fish would be delayed.

PacifiCorp (2006, page 51-52) states that requiring migration through all project reservoirs would delay arrival of fall Chinook salmon at spawning grounds. PacifiCorp (2006, page 71) also states that upstream migration timing for fall Chinook is better served with their trap and haul Alternative. PacifiCorp states that because Chinook currently arrive at Iron Gate Dam at approximately October 1 and peak spawning occurs about two weeks later, and that pre-Project peak fall Chinook arrival to the upper basin probably occurred in September (Fortune et al. 1966), that it would take too long for Chinook to make it through the Project area to reach their spawning destinations above Upper Klamath Lake.

While delay may be a factor in reestablishing runs to the upper reaches of the Sprague River (Huntington et al. 2006) , delay would be of minimal concern for fish returning to Spencer Creek and Upper Klamath Lake. The fact that anadromous fish currently complete life cycles through eight dams and reservoirs on the Columbia and Snake

Rivers, and historically completed life cycles through Upper Klamath Lake, provides strong evidence that anadromous salmonids could also migrate through the reservoirs created by Project facilities (ALJ Decision at 15, FOF 2A-20).

For adult salmonids, migration speeds through reservoirs are generally high. Bjornn and Perry (1992) (in Steward and Associates 2007) estimated reservoir passage rates as ranging from 16 km/day to 56 km/day. Similarly, Bjornn et al. (1991) (in Steward and Associates 2007) measured reservoir migration rates of 55 km/day, while the rate in free-flowing rivers was estimated as 15-31 km/day. Historically, now extirpated runs of Chinook and steelhead were clearly able to use and migrate through Upper Klamath Lake and Spencer Creek.

Under PacifiCorp's Alternative, returning adults would be delayed up to 2 days in trapping facilities (PacifiCorp 2006, page 73). Delay can result in the depletion of energy reserves critical to successful spawning.

4c. PacifiCorp's Alternative Would Cause Greater Stress and Prespawn Mortality to Adult Fish

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' volitional fish passage Prescriptions result in less stress on fish, as opposed to PacifiCorp's trap and haul alternative, which involves intensive trapping, handling, crowding, transport, and acclimation.
- PacifiCorp's trap and haul Alternative is less protective because fish would be subject to the stress of trapping, handling, crowding, transport, and acclimation. Moreover, PacifiCorp's Alternative fails to specify details of transport.

Transportation is very stressful to fish of many, if not all, species. Decreased disease resistance generally follows stress in fishes and the delayed effects of stress may include the activation of latent disease organisms (Wedemeyer 1970). Most of the transportation stress-related work on salmonids has examined juvenile fish, since these are transported by barge and truck in large numbers on the Columbia River (see subsection 5a, below). However, a substantial amount of information is available regarding the stress of transport to adult salmonids and other fish species.

Transportation stress has been evaluated for many species. While some of these studies did not include wild fish, it should be noted that in studies of juvenile salmonids, wild Chinook show a greater stress response than did hatchery Chinook (Congleton et al. 2000). The primary response to stressors in fish is the release of corticosteroid hormones from renal tissues. Secondary effects include elevated plasma glucose concentrations and plasma electrolyte dysfunction (Mazeaud et al. 1977).

In a study of largemouth bass, Carmichael et al.(Carmichael et al. 1984) (cited in Steward and Associates 2007) documented significantly elevated plasma glucose and corticosteroid levels, coupled with reduced plasma chloride and osmolality. On long

hauls (24-30 hrs), 38-92 percent of fish perished when transported in untreated water. Plasma characteristics returned to normal in 3-28 days following transport, depending on the length of the haul.

Shrimpton et al. (Shrimpton et al. 2001) (cited in Steward and Associates 2007) studied transportation stress on shad subjected to 3 hrs of acute handling and confinement. They measured levels of plasma cortisol during recovery under two different treatments: recovery in freshwater and recovery in brackish water. In the freshwater group, plasma cortisol increased nearly 13-fold within 0.5 hrs of transport, then peaked at 40-fold after 3 hrs. Twelve percent of these fish died within 8 hrs, and 14 percent within 24 hrs.

Clements et al. (Clements et al. 2002) investigated the effect of a trapping procedure on the stress response of wild, sexually mature rainbow trout, an example that is particularly relevant to both resident and anadromous salmonids in the Klamath River. Both the basal plasma cortisol concentrations and subsequent stress responses to trap confinement were much higher in females than in males. Female cortisol concentrations rose from 21.4 ng/mL to 549.1 ng/mL in females after just one hour of confinement, and resting cortisol and glucose levels were not reached even after 40 hrs of recovery. Clements et al. (2002) concluded that the trapping procedure induces a severe and prolonged stress response in wild rainbow trout.

Hauling of fish would add stress in addition to trapping. In a study of domesticated rainbow trout, Chandroo et al. (Chandroo et al. 2005) found that vigorous swimming occurred in fish during a 50 minute transport by truck, but that the fish's swimming activity returned to baseline levels within 48 hrs. However, even after a 48 hr resting period in a stationary tank, swimming was still impaired relative to non-transported fish. Moreover, oxygen consumption was also substantially elevated following transport.

In the Biological Opinion for the Elk Creek Dam Interim Trap and Haul Project on the Rogue River, NMFS found that even with proposed upgrades to the trap-and-haul facility, significant risks to adult coho salmon remain associated with this trap and haul facility including fallback injury, trap rejection, migration delay, and injury during trapping, handling and hauling, as well as spawning disruption (National Marine Fisheries Service 2004b). In the Biological Opinion, NMFS cited documentation of direct mortalities associated with the trap-and-haul program by ODFW, and documentation of delayed mortalities by the U.S. Army Corps of Engineers.

Prespawn loss from transport activities can be high. Average prespawn loss for four species that were transported from the collection facility at Three Mile Diversion Dam on the Umatilla River to off-site brood holding facilities ranged from 8.7 percent to 17.1 percent (Zimmerman 2005). Delayed adult mortality due to transportation varies substantially and is affected by water temperature. Where water is relatively warmer (as can be the case in the Klamath River), trucking adult fish around dams can be problematic both because of the stress of the warm water on them and the shock of refrigerated trucks, followed by release into warmer water (Oregon Department of Fish

and Wildlife 2006). Disease problems can be more of a problem with trucking because of crowding. The extensive handling of fish when stream temperatures are high will exacerbate the effects of stress and disease, resulting in higher pre-spawning mortality (Oregon Department of Fish and Wildlife 2006). The ODFW is evaluating the success of adult releases in the Little North Fork as part of a larger study relating to compliance with the Biological Opinion of hatchery programs in the Willamette Basin (Beilder and Knapp, 2005,Table 7; Firman et al., 2002, 2004). Researchers suspect that most spring Chinook died before spawning as few adults were recovered in spawning surveys. All tagged carcasses were generally very decomposed and found within a few miles of the release site. Based on recovery of tagged carcasses, an estimated 93 percent of the females died prior to spawning. Similarly, Beidler and Knapp (2005) found overall production from fish outplanted above Foster Reservoir was relatively low, compared with the North Santiam above Detroit Reservoir. Pathology results indicated poor condition and disease manifestations for adult Chinook, potentially leading to pre-spawning mortality (Beidler and Knapp 2005). Their data indicated poor survival to spawning of transplanted adult Chinook and that most transplants produced few offspring in most years.

In contrast, volitional ladders easily pass large numbers of fish and avoid the risks of handling, stress, and delay (see Subsection 3, above). These are the primary reasons ladders are used for upstream passage on the Columbia River instead of other options, including trapping and hauling (Gary Fredricks, NMFS, pers. comm.).

4d. Services' Prescribed Upstream Fishways at Iron Gate and Copco 1 Dams Would Allow Fish to Express a Full Range of Migratory Behavior

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because volitional passage allows more species of fish to migrate at the appropriate times and to the appropriate locations.
- PacifiCorp's trap and haul Alternative is less protective because delays occur at the trap, followed by the stress of handling and transport.

PacifiCorp (2006, pages 52-53) states that the Services' prescribed volitional upstream fishways at Iron Gate and Copco 1 Dams would be biologically ineffective because they would be long, "result in long transit times for fish, and in come cases, fish may become discouraged and stop ascending the fishway."

However, the Services' Prescriptions are consistent with ladders for upstream migration that have been successful at other dams. For example, the North Fork Dam (upstream of River Mill Dam) on the Clackamas River has a 2 mile long ladder that rises 196 feet. This fishway has been in operation since 1958 and has generally had good passage success. Virtually all anadromous salmonids that enter the ladder also exit (Doug Cramer, Portland General Electric, pers. comm.). Pacific lamprey also ascend the ladder in its entirety, but trapping limitations preclude evaluation (Doug Cramer, Portland General Electric, pers. comm.). Median travel times from entrance to exit were 22 hours (year

2001) to 1.3 days (2003) for winter steelhead; 22 hours (2000) to 1 (2003) day for coho salmon; and 1.1 day (2004) for spring Chinook (Portland General Electric 2004a) (steelhead), (Portland General Electric 2004b)(coho), and (Portland General Electric 2005) (Chinook). The ladder has a trap near its base that is used for evaluation, monitoring, and other fish management purposes. Originally, the trap introduced some problems with Chinook delay, caused by a cooler water supply (causing hold up at the trap). This problem was subsequently corrected with modifications to the trap. Some of the delay at the trap is also related to the fact that fish move in and out. If they have to wait long to be moved they tend to move out. The introduction of human scent during fish sorting may slow them down as well (Doug Cramer, Portland General Electric, pers. comm.). The Services' trapping facilities would be used for monitoring limited to certain periods of the year (i.e., peak migration) and would not be used continually. This use would not necessarily involve the same level of evaluation and, thus, delays fish experience on the Clackamas River.

The ladder transport flow at North Fork Dam is provided by reservoir surface water, the temperature of which can become elevated during the summer. This warm water causes some problems with attraction during July and August and may have caused some minor rejection, but these problems will be addressed with design modifications (Doug Cramer, Portland General Electric, pers. comm.).

4e. PacifiCorp's Alternative Would be No Less Likely to Cause Fish Losses in the Hatchery and Ladder

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because they allow for the option of using water from the -17 ft and -35 ft depths for the Iron Gate ladder, which would provide water temperatures conducive to fish migration and maintain water for the hatchery.
- PacifiCorp's trap and haul Alternative is less protective because fish would not be able to volitionally migrate when conditions are appropriate.

PacifiCorp (2006, pages 50-51) states that summer operation of a fish ladder at Iron Gate Dam would deplete cool water and cause catastrophic fish losses in the hatchery and ladder. PacifiCorp (2006, page 88) reiterates this point and adds that PacifiCorp's Alternative, in contrast, would be compatible with operation of Iron Gate Hatchery. In addition, PacifiCorp (2006, pages 49-50) states that the volitional passage system in the Services' Prescription would cause temperature shock to adult fall Chinook migrating upstream that would likely result in significant stress and migration delays.

The CDFG currently uses cold water from Iron Gate Reservoir for the partial ladder to maximize holding survival of returning adult Chinook salmon for the hatchery, not for migration. The cold water is from -70 ft depth of Iron Gate Reservoir. It would be advantageous to have the option to use this water for the fishways, but for most of the year surface water would be appropriate. However, even if water from the -70 ft depth was used in the Iron Gate ladder, it would not cause thermal shock. In September of an

average water year (1997), the difference between the temperature of surface water and -70 ft water is predicted to range from -7.5°C on September 1 to -3.6°C on September 30 (U.S. Geological Survey 2006). Thus, if -70 ft depth water were used in the ladder during the period that adult fall-run Chinook salmon now migrate, the maximum temperature difference would be less than the 10°C difference that PacifiCorp considers would cause thermal shock (PacifiCorp 2006, April Alternative).

However, the Services' Prescription would not require use of cool water from Iron Gate Reservoir because surface water would generally be appropriate for ladders for anadromous fish. Migration to Iron Gate hatchery begins the second to third week of September with peak counts in mid October (Fishpro 2000). At this time, surface water temperatures at Iron Gate Reservoir on average do not exceed 20°C after mid September (for 1997, an average water year, surface temperature at Iron Gate Reservoir on September 12 was 19.9°C and temperatures stayed at or below 20°C until July 4 (U.S. Geological Survey 2006). For Chinook salmon, adults migrate up to 20°C and migration blockage and delay do not occur until 21-22°C (U. S. Environmental Protection Agency 2003).

There is evidence that Klamath River Chinook migrate at temperature greater than 20°C (Strange 2005). In the Snake River (Columbia River tributary), Caudill et al. (Caudill et al. 2006) observed Chinook to exit ladders into reservoirs with surface water temperatures close to 26ºC. At Iron Gate and Copco Reservoirs, SIAM simulations showed that surface temperatures did not exceed 22.4°C and 22.7°C in July, the hottest time of the year (U.S. Geological Survey 2006).

Water temperatures in ladders would be minimally increased by ambient conditions. For fishways at Ice Harbor and Lower Granite Dams on the Snake River, there was little evidence that water warmed in summer (Peery and Bjornn 2002). Any temperature changes along the length of the fish ladder were found to be slight: less than 0.5°C with differential increases to 2°C only found on a few occasions (Keniry and Bjornn 1998 in National Marine Fisheries Service 2000).

Under a worst case scenario, water from either the -17 ft or -35 ft depths at Iron Gate are options that would keep temperature in ladders to within thermal limits and not jeopardize hatchery supply of cool water. The CDFG currently has the capability to take water from the -17 ft depth (slightly cooler than the surface water) for the partial ladder and hatchery. Temperatures from the -35 ft depth are generally from 1 to 3°C cooler than the surface water at Iron Gate after July 4, and were 0.5 °C to 3°C cooler than the surface water for Copco Reservoir (U.S. Geological Survey 2006). In both reservoirs, the temperature at -35 ft is not predicted to exceed 20°C during the period from September to the end of July in an average year based on a 1997 SIAM simulation (U.S. Geological Survey 2006).

If necessary, these layers of cool water could be used to maintain appropriate water temperatures. While the partial ladder below Iron Gate Dam to the CDFG fish trap also uses water at 9–12^{o}C from the -70 ft depth of Iron Gate reservoir (the same depth as water used for the hatchery), the use of water of this temperature to the CDFG trap is intended to maximize holding survival of returning adults Chinook, not for migration. Thus, the option of using water from the -17 ft and -35 ft depths for the ladders for the Iron Gate ladder would ensure that cool water necessary for the hatchery would be maintained with the Services' Prescriptions, thus avoiding any fish losses in the hatchery.

4f. PacifiCorp's Alternative Would Increase Straying of Returning Adults

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because volitional passage allows more species of fish to migrate at the appropriate times and to the appropriate locations, minimizing straying and other potentially detrimental behaviors.
- PacifiCorp's trap and haul Alternative is less protective because data on the Columbia River suggest that juvenile transport (similar to trap and haul proposed by PacifiCorp) impaired adult orientation of both hatchery and wild fish during return migration.

Recent data on adult returns to the Columbia River show increased survival for wild fish that migrated in-river, compared to those that were transported in the barge transport system. Keefer et al. (Keefer et al. 2006) examined the effects of juvenile transportation on adult fate and migration behaviors. Approximately 60 percent of the adults radio-tagged in this study were transported in barges as juveniles from Snake River dams to release sites downstream from Bonneville Dam on the Columbia River. Juveniles that were not transported migrated downstream in-river.

Adult homing was significantly lower and unaccounted loss and permanent straying into non-natal basins were higher for both spring–summer Chinook salmon and steelhead that were barged as juveniles. On average, adult fish barged as juveniles homed to Lower Granite Dam at rates about 10 percent lower than fish that had migrated in-river. Straying rates in both species were higher among groups barged as juveniles. When compared to in-river migrants, barged Chinook salmon were 1.9 times more likely and barged steelhead were 1.3 times more likely to fall back at dams as adults. Among fish that fell back, a significantly greater proportion of barged fish also experienced multiple fallback events than in-river migrants.

Decreased homing, increased fallback, and increased straying rates by transported fish were inter-related. The results were consistent between species and years, strongly suggesting that juvenile transport impaired adult orientation of both hatchery and wild fish during return migration. There were clear associations between adult behavior and transport history. Overall, the results suggest that the trap and haul methods proposed by PacifiCorp for the Klamath, which are similar to barging juvenile salmon and steelhead through the Columbia and Snake River hydrosystems, would cause negative effects on

returning adults. These effects may include a reduction in adult return rates and could foster significant changes to population genetic structure caused by increased straying and interbreeding of transported fish with natal fish. Accordingly, PacifiCorp's Alternative would be less protective than the Services' Prescriptions.

4g. The Services' Prescriptions are Based on Well Documented Adult Cumulative Survival in Established and Accepted Fishways

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because upstream survival with ladders is well documented and survival is high.
- PacifiCorp's trap and haul Alternative is less protective because adult trap and haul survival has not been well documented, and the one estimate provided by PacifiCorp is based on a significantly different project, with shorter transport distances, and does not account for key uncertainties including delayed mortality.

Adult salmonids generally demonstrate very high survival and passage success through ladders and through reservoirs. On facilities with much larger reservoirs on the Columbia River, passage success rates of 86 to 98 percent have been estimated from tailrace to tailrace from Ice Harbor to Lower Granite Dam (3 dams and reservoirs), including ladder entry, passage and reservoir survival (National Marine Fisheries Service 2000b). NMFS concluded that minimum per project passage rates for Columbia River facilities were 96 to 98 percent for Chinook and 97 percent for steelhead (National Marine Fisheries Service 2000a). Volitional passage rates of 95 percent were expected at one dam (Ferguson et al. 2002). The river channel and reservoirs of the Project are relatively confined and narrow, making it easier for adults to find ladder entrances and navigate reservoirs. It is reasonable to expect that ladder efficiencies on the Klamath would be comparable to the examples listed above.

PacifiCorp (2006, page 60 and 61) states that, based on experience elsewhere, they expect "(juvenile and) adult trucking survival rate(s) of 98 percent (State of California 2004)".

The adult trucking survival rates of 98 percent (State of California 2004) were achieved in conditions significantly different from the Klamath River. These estimates do not include delayed mortality and are based upon a short hauling duration, not the longer time fish would have to be hauled on the Klamath. This report (State of California 2004) qualifies its estimate as "assumed to be applicable for a transport period of less than one hour." Travel time was for time-in-truck alone which was just 45 minutes.

PacifiCorp's Alternative does not provide a justification for the substantial difference between the travel time referenced in the report (State of California 2004) and that associated with the Alternative. The Services estimate the transport distance in PacifiCorp's Alternative in excess of 100 miles and requiring at least 2 hours under favorable conditions. This does not include time for loading, unloading, acclimation, or delays (which could frequently occur on these rural and sometimes snowy roads). It is

reasonable to assume that survival would be lower than that referenced by the report (State of California 2004), especially when delayed mortality is taken into account.

PacifiCorp (PacifiCorp 2006, page 62) states that estimates used in KlamRAS modeling assumed an adult cumulative survival rate of 68 percent for fish volitionally traveling from J.C. Boyle Dam to tributaries to Upper Klamath Lake, and a survival rate of 79 percent for adult fish transported directly by trap and haul to the Williamson River, above Upper Klamath Lake.

Estimated adult survival is only one factor of many important to overall fish passage survival and returns. Considering in-river adult survival alone ignores gains in production that could be achieved in other habitats or during other life history phases. When the Services Prescriptions were compared to PacifiCorp's Alternative in terms of overall returns, the Services' Alternative (1A-volitional) provided greater returns of spawners on average, over years 11-50 of 50 year simulations, than PacifiCorp's Alternative of trap and haul of downstream migrants from J.C. Boyle (1C – screens-T&H JCB-below IGD) (Oosterhout 2005b).

In addition to adult returns other factors need to be considered. Bypassing historic habitat in a collection and transport scenario may decrease other measures of population viability (i.e., abundance, productivity, diversity, and spatial structure). PacifiCorp's collection and transport Alternative bypasses nearly all historical habitat for coho salmon, a federally listed species. PacifiCorp's Alternative is not feasible for lamprey and steelhead. Collection and transport may negatively impact behavioral traits of fish, such as when and where to migrate, whereas volitional passage provides fish the opportunity to move when they are ready. Finally, PacifiCorp's assessment does not take into account the uncertainties of trap and haul, such as human error, uncertainties in funding, or mechanical failure.

5. Downstream Migration

5a. PacifiCorp's Alternative Would Cause Greater Stress to Juvenile Fish than the Services' Prescription

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the stress, injury, and mortality associated with trap and haul would be minimized.
- PacifiCorp's trap and haul Alternative is less protective because increased stress to fish during transport and release makes them more vulnerable to predation or increased mortality due to injury or disease.

PacifiCorp's Alternative would transport juvenile outmigrants downstream via truck from above J.C. Boyle Dam to a release site below Iron Gate Dam on the Klamath River. Under similar circumstances on the Columbia River, transportation of juvenile Chinook and steelhead around multiple dams and the associated stress effects have been evaluated

in a number of studies. During barge transport indices of stress in wild and hatchery-origin juvenile Chinook and steelhead were higher in wild fish than in hatchery fish. Stress also increased with the density of fish in transport containers (Steward and Associates 2007).

Congleton et al. (Congleton et al. 1984) focused on the stress effects of different stages of the trap-and-haul process. Transport stress led to significant increases in plasma stress indicators. The authors found that the initial collection and routing of fish into gatewells was somewhat stressful. However, the transfer into raceways elicited an even stronger stress response, as did loading onto trucks and barges (overall mean plasma cortisol concentration after loading was 175 ng/ml). Cortisol concentrations were observed to decline during barge transport, but did not decline when the fish were transported in trucks, suggesting that truck transport is more stressful and for a more sustained period than barge transport. This study demonstrated a significant positive correlation between impaired predator avoidance and elevated stress indicators. Chinook salmon with plasma cortisol concentrations of 75-150 ng/ml or higher were captured by predators at a higher rate than control fish. This study concluded that physiological response to stressors associated with transportation probably would impair the ability of transported fish to escape predators immediately after release, but losses would depend on the numbers of predators near release sites. Exposure to acute handling stress resulted in increased avoidance response time for juvenile Chinook salmon (Sigismondi and Weber 1988) and presumably greater vulnerability to predators.

Congleton et al. (1984) found that plasma stress indicators remained elevated for 24-48 hours following truck transport. While blood plasma stress indicators can rise dramatically during or after passage through bypass systems, they generally return to pre-exposure levels within several hours (National Marine Fisheries Service 2000, page 101).

Evidence for transport-related juvenile stress extends to non-salmonids. In a study of red drum fingerlings, Tomasso and Carmichael (1988) (in Steward and Associates 2007) subjected fish to a five-hour haul by truck and documented only 1 percent mortality during transport. However, cumulative mortality over the following ten days reached 12-51 percent. They also subjected groups of transported fish to a secondary stressor of crowding, some with a recovery period following transport and others without. Those without the chance to recover had a mean mortality rate of 57 percent, whereas the groups that had recovered from transport for 2-5 days had much lower mortalities of 2-6 percent (Steward and Associates 2007).

Recent studies have found that transporting juvenile steelhead with outmigrating Chinook salmon significantly increased cortisol concentrations (stress indices) in the smaller Chinook (Congleton et al. 2000). Kelsey et al. (Kelsey et al. 2002) also found that confining steelhead and Chinook salmon together in tanks (similar to haul trucks) is stressful to Chinook salmon. When held with juvenile steelhead, Chinook were attacked up to 16 times more often and had higher cortisol concentrations. Steelhead established territories and aggressively defended them; Chinook showed little aggression toward the

steelhead. Under PacifiCorp's alternative, juvenile Chinook and steelhead would be confined together during downstream transport and juvenile Chinook would be subject to this aggression related stress in each transport downstream. Under the Services' Prescriptions, juvenile Chinook would not be subject to this stress (except during interim, seasonal trap and haul around Keno Reservoir when trap and haul is necessary to avoid water quality conditions that may be potentially fatal to fish).

There is evidence that the stress associated with trapping and hauling juvenile fish contributes to lower survival and reduced harvest. Yearling hatchery coho salmon transported prior to release had lower survival and reduced returns to the commercial fishery relative to untrucked fish (Johnson et al. 1990) and transportation of yearling hatchery coho salmon had a marked physiological stress response (Schreck et al. 1989). Budy et al. 2002 (Budy et al. 2002) found evidence linking delayed mortality of Snake River salmon to their earlier hydropower experience, including trap and barge. Capture, crowding, marking or tagging, loading, transport, and release of juvenile fish as the Applicant has proposed would result in similar exposure to handling stress and, thus, increase the risk of predation or mortality due to illness. Decreased disease resistance generally follows stress in fishes and the delayed effects of stress may include the activation of latent disease organisms (Wedemeyer 1970).

Some of the negative effects of transporting can be eliminated if the fish are allowed to acclimate for 6 weeks before release (Johnson et al. 1990). However, this would mean acclimation ponds need to be constructed and maintained and would need to be considered in an evaluation of the long term operation and maintenance costs of trap and haul operations. PacifiCorp's Alternative does not include acclimation ponds.

5b. PacifiCorp's Alternative Provides No Measures for Downstream Migration or Protection from Entrainment at Copco 1, Copco 2, and Iron Gate Facilities

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions protect downstream migrating fish from entrainment and mortality at Copco 1, Copco 2, and Iron Gate facilities.
- PacifiCorp's Alternative is less protective because no screens or bypass facilities would be provided at Copco 1, Copco 2, and Iron Gate facilities, which would likely result in entrainment, causing injury and mortality to downstream migrating fish.

Under PacifiCorp's alternative, juvenile anadromous fish will pass downstream into the Project reach below J.C. Boyle Dam where no screen and bypass system would guide migration away from entrainment and turbines.

With the construction of functional adult fish ladders at Iron Gate Dam and other Project facilities, salmon and steelhead would return to hold, spawn, and rear in habitat where they were present historically (Hamilton et al. 2005; ALJ Decision at 12, FOF 2A-3 through FOF 2A-6; ALJ Decision at 14, FOF 2A-12; ALJ Decision at 33, FOF 6-4 and FOF 6-10; ALJ Decision at 34, FOF 6-11 and FOF 6-14; ALJ Decision at 35, FOF 7-9; ALJ Decision at 36, FOF 7-15). Pacific Lamprey would migrate past Iron Gate Dam and gain access to habitat that would provide benefits to that species (ALJ Decision at 37-38, FOF 8-7 and FOF 8-9). However, the progeny of these fish must negotiate not only the reservoir but the dam, powerhouse, and spillway during their outmigration. Migration is one of several defining life history characteristics of anadromous fish, especially salmonids (ALJ Decision at 13, FOF 2A-10). 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 is 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. 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 ((PacifiCorp 2004a)a, Exhibit E 4-113). It is estimated that "several tens of thousands of resident fish" are annually entrained at "each of the Projects" facilities (ALJ Decision at 28, FOF 4-2). It is anticipated that annual entrainment of anadromous fish would be on the same order of magnitude, if not greater. Once entrained, the fish face a high risk of mortality. For juvenile fish, the risk is between 10 to 30 percent (ALJ Decision at 29, FOF 4-5).

Achieving suitably high rates of collection efficiency over the range of flows and other environmental conditions that occur as fish move downstream is perhaps the greatest challenge in designing downstream trap and haul systems. Collection efficiencies on the order of those obtained for adults (e.g., 95 percent or greater) are unlikely to be achieved using technology available today. Fish collection efficiencies at most downstream collection facilities are typically low – often too low to sustain self-perpetuating populations – and typically remain at unacceptably low levels despite efforts to improve them through mechanical and operational manipulations. For example, at the Cowlitz Falls Dam, Lewis County, Washington where managers have identified a goal of 95 percent collection efficiency for outmigrating juvenile salmonids, measured efficiencies were in the range of 19-65 percent for age-1+ steelhead, 17-45 percent for age-1+ coho, and 17-24 percent for subyearling spring chinook. In the decade since the dam was built,

attempts to improve juvenile collection efficiency at Cowlitz Falls have met with little success (Steward and Associates 2007).

Fish that are not collected successfully either pass the dam via spill or turbine passage. Passage via turbines causes high mortality, though survival differs by species and by turbine type.

Under PacifiCorp's trap and haul Alternative the collection facility would be located at or above J.C. Boyle Dam (PacifiCorp 2006 at 57, last paragraph). The facility would be able to screen only the flow being routed into the location's power canal intake. Fish that move downstream with flow that passes over the spillway would not be collected. PacifiCorp cites an estimate that 20 percent of migrants would be spilled (PacifiCorp 2006 at 60, second paragraph). Under PacifiCorp's Alternative, spilled juvenile anadromous fish would then be entrained at each facility below J.C. Boyle Dam, as these facilities would not include screens. Once entrained, these fish face a high risk of mortality (see subsection 12 below).

5c. PacifiCorp's Alternative Provides Less Protection from Entrainment at J.C. Boyle Dam

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions protect downstream migrating fish from entrainment and mortality at the J.C. Boyle facility.
- PacifiCorp's Alternative is less protective because the existing screens and bypass facility, which fail to meet current criteria to protect resident and anadromous fish, would be used at the J.C. Boyle facility.

With restored upstream anadromous fish migration at J.C. Boyle Dam, salmon, and steelhead would return to hold, spawn, and rear in habitat where they were present historically (Hamilton et al. 2005; ALJ Decision at 12, FOF 2A-3 through FOF 2A-5; ALJ Decision at 14, FOF 2A-12; ALJ Decision at 33, FOF 6-4 and FOF 6-10; ALJ Decision at 34, FOF 6-11 and FOF 6-14; ALJ Decision at 35, FOF 7-9; ALJ Decision at 36, FOF 7-15). However, the progeny of these fish must negotiate not only the reservoir but the dam, powerhouse, and spillway during their outmigration. J.C. Boyle Dam has fish screening and bypass systems in place, but they do not conform to current criteria for resident and anadromous fish (ALJ Decision at 29, FOF 4-8). The seals at the J.C. Boyle Dam have rendered the fish screens partially ineffective, allowing fish to be entrained in the turbines (ALJ Decision at 29, FOF 4-9). An Electric Power Research Institute (EPRI) report indicates that entrainment mortality at hydro Projects using Francis turbines (such as J.C. Boyle) with operational head greater than 335 feet ranged from 33 to 43 percent (ALJ Decision at 29, FOF 4-10). In light of the large percentage of river flow that is diverted into the J.C. Boyle power canal, the operation of Francis turbines, and the high operational head of 440 feet, fish mortality from entrainment at the J.C. Boyle facility is likely in the higher end of the mortality range as described in the EPRI report (ALJ Decision at 30, FOF 4-11). The J.C. Boyle reservoir contains shortnose and Lost River

suckers that are listed under the federal Endangered Species Act that are susceptible to entrainment (ALJ Decision at 30, FOF 4-16). While the vast majority of fish entrained consists of small juvenile fish, the record shows that adult fish are also susceptible to being entrained and killed (ALJ Decision at 31, FOF 4-22). PacifiCorp's Alternative would not provide for adequate protection at J.C. Boyle Dam during downstream migration.

5d. PacifiCorp's Alternative Would Cause Increased Mortality of Outmigrating Fish Associated with Premature Downstream Migration

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions would not cause increased mortality associated with premature downstream migration of juvenile fish.
- PacifiCorp's Alternative is less protective because transported juvenile fish often suffer significant levels of mortality after transport.

Outmigrating juvenile salmonids and lampreys undergo physiological changes in preparation for entering the ocean. Juveniles moving down river naturally have more time to accomplish these changes than do juveniles transported artificially. On the Columbia River the fate of transported outmigrant Chinook once they have been hauled has been carefully studied (Budy et al. 2002; Fish Passage Center and Comparative Survival Study Oversight Committee 2006; Keefer et al. 2006; Marmorek et al. 2004). Indications are that these fish smolt as they migrate (Marmorek et al. 2004). Outmigrants that were given insufficient time to complete smoltification, such as transported outmigrants, experience high energetic costs in attempting to osmoregulate in salt water, resulting in decreased resistance to pathogens and increased susceptibility to predators (Marmorek et al. 2004). Transported Chinook have been shown to suffer greater delayed mortality than outmigrants that pass through the river and hydrosystem facilities. Delayed mortality of transported wild spring and summer Chinook was substantial most years relative to that of in-river migrants. Transport provided little or no benefit to wild Chinook during most years during 1994-2004 (except during the severe drought year 2001) (Fish Passage Center and Comparative Survival Study Oversight Committee 2006). With the exception of 2001, transported smolts died at twice the rate as in-river migrants once they passed the lowermost dam (Fish Passage Center and Comparative Survival Study Oversight Committee 2006). Overall, in an average year in the Columbia River system, Chinook that outmigrate in river have better survival to adulthood than fish that are transported (Budy et al. 2002).

Accordingly, based on this evidence, transported Chinook in the Klamath would face greater risk of mortality than would volitionally passed fish.

5e. PacifiCorp's Alternative Does Not Minimize Spillway Mortality

- The Service's Prescriptions are more protective than PacifiCorp's Alternative because the Service's Prescriptions minimize injury and mortality in spillways.

- PacifiCorp's Alternative is less protective because spillways would not be modified to minimize mortality.

PacifiCorp (2006, page 57) states that downstream migrating anadromous fish would be transported to below Iron Gate Dam and would not be required to migrate through the spillway. However, PacifiCorp (2006, page 60) also states that the estimated percentage of migrants that would be spilled is 20 percent, because the Boyle facility would only be able to screen the flow being routed into the power canal intake. If this estimated percentage was based on flow alone, it is likely that more than 20 percent of migrants would be spilled. Migration events are triggered by and primarily occur during high flow events, and simply determining what percentage of water is spilled will underestimate the percentage of migrants spilled. In PacifiCorp's Alternative, flow that is passed over each spillway would not be screened. Fish would, therefore, be spilled over J.C. Boyle Dam and each successive downstream dam, depending on spill conditions, as described below.

During the winter and spring in average and above average water years, Project operations become run-of-river such that all hydroelectric facilities operate at full hydraulic capacity and excess water is spilled at each of the dams (PacifiCorp 2004a). Spill at Keno Dam is continuous. Spill occurs at J.C. Boyle Dam when incoming river flows are greater than 2,850 cfs. Downstream at Copco No. 1 and No. 2, spill occurs when flow is greater than 3,200 cfs. Flows greater than 1,750 cfs at Iron Gate Dam will spill over the spillway dependent on reservoir elevation. Spill may also occur at J.C. Boyle, Copco 1, Copco 2, and Iron Gate Dams during unscheduled turbine shutdowns (PacifiCorp 2004a).

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 over spillways may 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. This trauma may render fish more susceptible to predation or disease. Spillways may also significantly delay the upstream migration of adults by providing false attraction away from ladder entrances.

Fish passing down a spillway may also experience 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).

Under the Services' Prescriptions and PacifiCorp's Alternative, resident and anadromous fish passage through the spillway at Keno Dam will be necessary for juveniles and some adults. The Services' Prescriptions include spillway modifications at Keno Dam, but PacifiCorp's Alternative does not. All water passing Keno Dam passes through undershot spill gates except for the water supplying the existing fishway. These undershot gates may injure adult (primarily migrating steelhead) and juvenile fish as they are jetted through a narrow opening and under pressure. Mechanical injury due to impact or pressure changes may occur. The spillway receiving waters consist of a very shallow, wide bedrock area that may induce avian predation. Current spillway operations may attract fish away from the ladder entrance and cause delay. PacifiCorp's Alternative will not prevent these impacts and is therefore less protective.

The Services' Prescriptions include spillway modifications at J.C. Boyle Dam. At J.C. Boyle Dam, the spillway drop is significant and the receiving waters appear shallow and turbulent. The Services expect mechanical abrasion, trauma and increased predation as juvenile and adult fish pass over J.C. Boyle spillway. PacifiCorp's Alternative does not include spillway modifications at J.C. Boyle and is, therefore, less protective.

Copco 1 has perhaps the most considerable spillway configuration, with the most height and a series of stair steps down to the water that would appear to present multiple opportunities for injury or abrasion. Copco 2 does not have obvious spillway configuration problems, but minor operational or structural modifications to the spillway may reduce injury or delay. Iron Gate Dam has an ungated concrete spillway 730 feet long leading to a large spill canal that may cause sheet flow and extensive abrasion. The Services' Prescriptions minimize mortality by including spillway modifications at each spillway. PacifiCorp's Alternative does not include spillway modifications at any facility and is therefore less protective.

In the Preliminary Prescriptions, the Services based specific spillway prescriptions on the evidence cited above. In its request for hearing on disputed issues of material fact, PacifiCorp disputed facts supporting the spillway prescriptions. PacifiCorp subsequently withdrew its request for hearing regarding spillway prescriptions based on a stipulation with the Services (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number

2006-NMFS-0001, Order Granting PacifiCorp's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). In accordance with the stipulation, the Services have revised the spillway prescriptions in the Modified Prescriptions to allow PacifiCorp to study the need for and design of spillway modifications for anadromous and native resident fish. PacifiCorp must perform any such studies in consultation with the Services, and provide the results of any such studies to the Services for approval before design and construction of the spillway modifications in order to inform the need for and design of spillway modifications. However, unless and until such site-specific studies are done, the Services must rely on the available information in concluding that spillway modifications are necessary for safe, timely, and effective fish passage where prescribed. PacifiCorp's Alternative is less protective because it does not provide for spillway modifications to minimize anadromous and resident fish mortality at those facilities.

5f. The Services' Prescriptions Provide for the Migratory Needs of Fish Based on Valid Modeling Comparisons of Passage Alternatives.

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because they are based upon modeling with a sufficient level of documentation and transparency, and take into account valid comparisons of passage alternatives.

- PacifiCorp's alternative is less protective, as demonstrated by modeling, when existing models are appropriately applied.

Ecosystem Diagnosis and Treatment (EDT) is a habitat-based model of salmon life histories. It has been reviewed critically in the Columbia River Basin as being over-parameterized (having too many inputs), but offers a structured basis for assessing habitat restoration and protection opportunities with an eye toward improving the biological performance of fish populations [NMFS/FWS-Issue 6-Huntington-Dir.-Ex. 1 at 8]. When the EDT model inputs are reviewed by experts, when runs are appropriately checked for errors, and if predicted patterns are adequately corroborated, it can be used for relative comparisons of production across the landscape [NMFS/FWS-Issue 6-Huntington-Dir.-Ex. 1 at 1].

KlamRas is a newer, stochastic life cycle model, developed specifically to simulate the outcomes of alternative fish passage options for fall-run Chinook at the Klamath Hydroelectric Project. KlamRas in this situation relies, in part, on productivity inputs from EDT. KlamRas, where used in conjunction with EDT, is referred to KlamRas/EDT [NMFS/FWS-Issue 6-Huntington-Dir.-Ex. 1 at 8].

Neither EDT nor KlamRAS/EDT produces outputs whose absolute values are expected to be a perfect reflection of reality (Oosterhout 2005b). At best, and if properly used, the model results available at present can provide structured but rough answers to questions about interactions between fish passage measures at the Klamath Hydroelectric Project

and their potential effects on the future performance of fall-run Chinook populations above Iron Gate Dam [NMFS/FWS-Issue 6-Huntington-Dir.-Ex. 1 at 9].

The multi-species, anadromous fish modeling effort associated with the relicensing process for the Klamath Hydroelectric Project began as a collaborative effort that included a Habitat Modeling Group (HMG). However, eventually the Applicant submitted new EDT model results for three species (fall-run Chinook, spring-run Chinook, and steelhead) to FERC in December 2005. The HMG was not involved with the modeling efforts that produced these results [NMFS/FWS-Issue 6-Huntington-Reb.-Ex. 1 at 8]. The Service does not support the assumptions or the premise that this model is appropriate for any species as applied on the Klamath River by the Applicant. (USDI Fish and Wildlife Service 2005a) (October 17, 2005)

In their Alternative, PacifiCorp (2006, pages 62, 65, 68, 69 (and Table 4), 74 (and Table 5), 76, and 77 (Table 5)) refers to KlamRAS/EDT and EDT rankings and estimates of cumulative rates of survival to contend that bypassing salmon around historic habitat using collection and transport has benefits over volitional passage. This is an inappropriate use of the KlamRAS/EDT model. The KlamRAS/EDT estimates are specific to fall-run Chinook and do not apply to spring-run Chinook, coho salmon, steelhead, or Pacific lamprey.

The Service is on record (USDI Fish and Wildlife Service 2005a) (October 17, 2005) that the KlamRas/EDT modeling effort had a sufficient level of documentation and transparency for modeling fall-run Chinook for the relative evaluation of fish passage scenarios; however, the EDT model, as applied on by PacifiCorp, was not similarly documented or transparent and was thus not valid.

The Klamath Tribes raised additional substantive doubts about the Applicant's EDT modeling results during the Trial Type Hearing [NMFS/FWS-Issue 6-Huntington-Reb.-Ex. 1 at 6]. In the Discovery process for the Trial Type Hearing proceeding, the Applicant released to the Klamath Tribes previously undisclosed modeling information (analytical details of selected model runs) underlying its EDT-based approximations of the potential future performance of fall-run Chinook and steelhead above Iron Gate Dam, if fish passage were provided [NMFS/FWS-Issue 6-Huntington-Reb.-Ex. 1 at 6]. These are the same EDT-based approximations that were submitted to FERC by the Applicant. These results suggest that stocks of fall-run Chinook and steelhead trout, with characteristics similar to stocks present below Iron Gate Dam, would find suitable habitat in multiple areas above the dam(s) [NMFS/FWS-Issue 6-Huntington-Reb.-Ex. 1 at 7]. However, the Applicant did not include these results in the testimony on "unsuitable" habitat above Iron Gate Dam, nor did the Applicant include these results in their Alternative [NMFS/FWS-Issue 6-Huntington-Reb.-Ex. 1 at 7]. The Applicant's Alternative is based upon a selective presentation of a portion of the modeling results.

In particular, the misapplication of the EDT model provides problematic results with respect to steelhead. Steelhead have broad habitat tolerances and should find abundant

habitat in the river and tributaries above Iron Gate Dam. The Klamath Tribes' analysis of PacifiCorp's latest EDT model indicates that the ability of Spencer Creek, and other Klamath tributaries, to produce juvenile steelhead is under-estimated [NMFS/FWS-Issue 6-Huntington-Dir.-Ex. 1 at 7]. In fact, the model suggests zero production potential for steelhead in many areas above Iron Gate Dam [NMFS/FWS-Issue 6-Huntington-Reb.-Ex. 1 at 10].

KlamRas/EDT, when appropriately developed and reviewed, as it has been for fall-run Chinook on the Klamath River, is a more valid methodology for comparing passage alternatives. Using KlamRas/EDT, Oosterhout (Oosterhout 2005b) examined 13 scenarios for passage of fall-run Chinook for the Klamath River. She concluded that of the scenarios evaluated, those that relied on volitional passage to move juveniles and adults around dams generally ranked higher, with one exception, than options that relied on trapping and hauling them. The lowest ranked options for moving fish around the one to five lower dams in both the 'existing' and 'restored' scenarios were for trap and haul, rather than volitional passage (Oosterhout 2005b).

Among the trap and haul alternatives analyzed in the modeling, the one exception (1F-trap and haul of adults to above Upper Klamath Lake; juveniles collected at Link River) that performed fairly well assumes a high (90 percent) collection efficiency for juvenile fish at Link River Dam, No basis is provided for this unrealistic assumption. When this scenario was modeled using the same collection efficiency rates (50-78 percent) as used in the other model scenarios (Oosterhout 2005a), this option did not rank nearly as high and was about the same as volitional (Oosterhout 2005a),

The scenario that resulted in this exception is not the same as the Applicant's trap and haul Alternative from J.C. Boyle to below Iron Gate Dam. The other trap and haul model outputs did not increase passage survival enough to compensate for losing access to spawning and rearing habitat bypassed by transporting fish past it (Oosterhout 2005b). In this evaluation, for both existing and restored habitat, the Services' Prescription (1A-volitional) ranked higher, in terms of the number of spawners on average, over years 11–50 of 50 year simulations, than PacifiCorp's Alternative to trap and haul downstream migrants from J.C. Boyle (1C – screens-T&H JCB-below IGD) (Oosterhout 2005b).

While the results for restored habitat for the Applicant's Alternative were very close to the Services' Prescription, in fact, Klamath River fish would need to be hauled a greater distance than assumed in the model, and thus, trap and haul mortality would be higher than assumed. Long term trap and haul performance is less certain under Klamath River conditions. Thus, it is reasonable to conclude that the Services' Prescriptions would likely better provide for the migratory needs of fish and be more protective under restored conditions, rather than less protective.

Estimated adult survival is only one factor of many important to overall fish passage survival and returns. Bypassing historic habitat in a collection and transport scenario may decrease other measures of population viability (i.e., abundance, productivity,

diversity, and spatial structure). PacifiCorp's collection and transport Alternative bypasses nearly all historical habitat for coho salmon, a federally listed species. PacifiCorp's Alternative is not feasible for lamprey and steelhead. Collection and transport may negatively impact behavioral traits of fish, such as when and where to migrate; whereas volitional passage provides fish the opportunity to move when they are ready. Finally, PacifiCorp's assessment does not take into account the uncertainties of trap and haul, such as human error, uncertainties in funding, or mechanical failure. Therefore, the PacifiCorp Alternative is less protective than the Services' Prescriptions.

6. PacifiCorp's Alternative is More Likely to Exacerbate Pathogen and Fish Disease Risks to Anadromous Fish

- The Services' Prescriptions are more protective than PacifiCorp's Alternative. Most pathogens in the lower basin are already present in the upper basin, therefore, establishing volitional fish passage will not increase the risk of disease. Volitional ladders easily pass large numbers of fish and avoid the risks of handling, stress, and delay.
- PacifiCorp's trap and haul Alternative is less protective because stress associated with trap and haul has been shown to increase the potential for disease, injury, and mortality.

PacifiCorp contends that the Services' joint preliminary prescriptions for volitional fishways increase the potential for reintroduced fish to bring disease to the upper Klamath basin, resulting in possible catastrophic losses of native fish (PacifiCorp 2006, pages 28, 47, and 54).

The ALJ found that the weight of the evidence shows that many pathogens are already present in the upper and lower Klamath Basin (ALJ Decision at pages 60-61) and Ultimate Finding of Fact #4 (ALJ Decision at page 85, UFOF 4). Thus, establishing fish passage will not increase the risk of disease. (ALJ Decisions at page 20, FOF 2B-2; page 21, FOF 2B-10; page 22, FOF 2B-11; page 22, FOF 2B-17; and page 23, FOF 2B-22). *C. Shasta and P. minibicornis* exist throughout the Klamath River System in both the upper and lower basins, so migration of wild anadromous fish upstream from below Iron Gate Dam would not increase the risk of introducing pathogens to resident trout residing above Iron Gate Dam (ALJ Decision at page 22, FOF 2B-11; page 22, FOF 2B-17; and page 23, FOF 2B-22). This is especially true given the fact that trout are resistant to *C. Shasta* and the remaining known pathogens (except *F. columnaris* and *Ich)* do not impact non-salmonids (ALJ Decision at page 23, FOF 2B-20).

The ALJ also found that there is insufficient evidence to determine whether IHN exists in either the lower or upper basin of the Klamath River. (ALJ Decision at page 21, FOF 2B-4). The record evidence shows that there has only been a single detection of IHN documented in the lower basin in 1997, and since then there has been no further detection. (ALJ Decision at page 20, FOF 2B-3). The virus was detected in one adult Chinook salmon returning to Iron Gate Hatchery. (Id). The ALJ did not find a single

detection nearly ten years ago in a fish suspected to be a "hatchery fish" to be significant or cause for alarm given the Chinook salmon population size existing in the lower basin. Moreover, to date, there has been no work or surveys completed concerning the actual occurrence of IHN in the upper basin. (ALJ Decision at page 21, FOF 2B-4). Therefore, any suggestion that IHN exists in either the lower or upper Klamath Basin would be mere speculation.

Further, the ALJ found that there is insufficient evidence to determine whether *R. salmoniranrum* exists in the upper Klamath Basin. Like *IHN*, no research or studies have been performed to detect the occurrence of *R. salmoniranrum*. (ALJ Decision at page 21, FOF 2B-7). Consequently, PacifiCorp failed to prove that facilitating the movement of anadromous fish would present a high risk of introducing pathogens to resident fish inhabiting the basin above Iron Gate Dam.

The preliminary findings of fact and underlying evidence lead to the ALJ's ultimate finding of fact #4 "Facilitating the movement of anadromous fish via prescribed fishways presents a relatively low risk of introducing pathogens to resident fish above Iron Gate Dam. Many of the pathogens (such as C. Shasta, F. Columnaris, P. minibicornis, and Ich) present below Iron Gate Dam, are also present above the dam. The evidence is inconclusive as to whether IHN exists either above or below Iron Gate Dam. The evidence is also inconclusive as to whether R. salmoniranrum exists above Iron Gate Dam." (ALJ Decision at page 85, UFOF #4)

PacifiCorp contends that their proposed collection and transport (trap and haul) program is designed to provide the greatest possible opportunity for successful reintroduction in the upper basin and would be able to address concerns about the introduction of fish diseases to upper Klamath basin. (PacifiCorp 2006, pages 54 and 88)

However, trap and haul associated fish stress has been well documented (Carmichael et al.1984 [cited in Steward and Associates 2007]; Congleton et al, 2000; Kelsey et al. (2002);Shrimpton et al. 2001; [cited in Steward and Associates 2007]; Clements et al. 2002; Chandroo et al. 2005). Decreased disease resistance generally follows stress in fishes and the delayed effects of stress may include the activation of latent disease organisms (Wedemeyer 1970). Capture, crowding, marking or tagging, loading, transport, and release of juvenile fish as the Applicant has proposed would result in exposure to handling stress and, thus, increase the risk of disease. Trap and haul relies on extensive handling and sorting of fish, as well as crowding fish in holding ponds and transport trucks, all of which cause stress to fish (Oregon Department of Fish and Wildlife 2006). For example, carbon dioxide use may contribute to physical injuries in adult salmon as they thrash in the anesthetic bath during handling.

This stressful behavior can cause injuries that are not readily apparent when fish are released, but may show up as fungal infections in the following weeks (Beidler and Knapp 2005). Fish that are held in pools are often over-crowded, increasing stress, risk of disease transfer, and the potential for injury or mortality (Oregon Department of Fish

and Wildlife 2006). Delayed adult mortality due to transportation varies substantially and is affected by water temperature. Where water is relatively warmer (such as the Klamath River) trucking adult fish around dams can be problematic both because of the stress of the warm water on them and the shock of refrigerated trucks, followed by release into warmer water (Oregon Department of Fish and Wildlife 2006). Disease problems can be exacerbated with trucking because of crowding. The extensive handling of fish when stream temperatures are high will exacerbate the effects of stress and disease, resulting in higher pre-spawning mortality (Oregon Department of Fish and Wildlife 2006).

In contrast, volitional ladders easily pass large numbers of fish and avoid the risks of handling, stress, and delay. These are the primary reasons ladders are used for upstream passage on the Columbia River instead of other options, including trapping and hauling (Gary Fredricks, NMFS, pers. comm.).

In the DEIS, FERC Staff conclude that unless the disease issues are addressed "implementing fish passage through the project may yield little or no benefit." DEIS at 3-297. We concur that there is a need to remedy the situation. However, our comments to the DEIS ((U.S. Department of the Interior 2006a) DOI Response to DEIS, pages 23–25) demonstrate that the DEIS provides no clear indication that an increased prevalence of disease pathogens may affect salmonids other than late outmigrating fall-run Chinook and does not provide any analysis or examples from other river systems showing that a disease monitoring and management plan would be an effective remedy, especially in combination with the increased disease risks of trap and haul practices.

7. PacifiCorp's Alternative Provides No Protective Measures for Fish at Keno Dam and Link River East Side/West Side Powerhouses

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because they provide passage at the Keno Dam, and the East Side/West Side Powerhouse.
- PacifiCorp does not propose any action be implemented to provide protective measures at Keno Dam and the Link River East Side/West Side Powerhouses.

PacifiCorp does not propose any action be implemented to provide protective measures at Keno Dam and Link River East Side/West Side Powerhouses because they believe that the Commission lacks authority to re-license Keno Dam and they propose to decommission Link River East Side/West Side Powerhouses[10].

[10] PacifiCorp asserts that the Services have no authority to prescribe fishways at Keno or Link River Dams because, in its view, the East Side and West Side powerhouses and Keno Dam will not be included in the new Project license or in the FERC boundary. PacifiCorp at 105. This is not an issue that is appropriate for discussion or resolution in the Alternatives Analysis process. Rather, it is a jurisdictional question that is entrusted to the Federal Energy Regulatory Commission for determination, not to the Services. Obviously, if FERC determines that any or

The Services' Prescriptions are predicated upon the retention of the Keno facility as a licensed development within the Project. Based on this predicate, the Service's Prescriptions are more protective than PacifiCorp's Alternative because they provide protective measures for the Keno facility, and the Alternative includes no protective measures for Keno Dam.

The Service's Prescriptions are more protective than PacifiCorp's Alternative because they include improved fishways at Keno Dam and the Link River East Side and West Side Powerhouses to benefit fish resources; the Alternative includes no protective measures at these facilities.

The Service's Prescriptions are more protective than PacifiCorp's Alternative because they provide for fish screens and bypass facilities that reduce entrainment mortality of resident fish, including endangered suckers, at the Link River East Side and West Side Powerhouses; the Alternative includes no protective measures at these facilities.

The Service's Prescriptions are more protective than PacifiCorp's Alternative because they provide tailrace barriers at the East Side and West Side Powerhouses to reduce migration delays of migrating fish; the Alternative includes no protective measures at these facilities.

The Service's Prescriptions are more protective than PacifiCorp's Alternative because they include a volitional fishway at Keno Dam to restore connectivity of resident redband populations in the mainstem Klamath River with those in Keno Reservoir/Lake Ewauna, Link River, and Upper Klamath Lake and provide for the safe, timely, and effective upstream passage of anadromous fish to be reintroduced; the Alternative includes no protective measures at these facilities.

The Service's Prescriptions are more protective than PacifiCorp's Alternative because they include a spillway modification at Keno Dam to provide for the safe, timely, and effective downstream passage of resident redband trout and anadromous fish to be reintroduced; the Alternative includes no protective measures at these facilities.

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all of the noted developments are non-jurisdictional and thus not included in any new license issued for the Klamath Project, the Services' section 18 fishway prescriptions would not apply to those excluded facilities. If, on the other hand, the Commission determines that any or all of the developments are jurisdictional, the Services' prescriptions would apply to the jurisdictional facilities. Since ultimate resolution of this issue is with the Commission, PacifiCorp's arguments regarding jurisdiction are not considered herein.

PacifiCorp (2006, page 110) states that "there is nothing to suggest that passing resident fish – and in the future, anadromous fish – require any additional protections at Keno Dam", as required in the Services' Prescriptions.

However, 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 Service 2005b). 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 (USDI Fish and Wildlife Service 2005b). Downstream spillway passage at Keno needs to be improved for all species to be consistent with current criteria (U.S. Department of the Interior 2006b).

The Services' Prescriptions would require that PacifiCorp conduct trap and haul operations at Keno Dam to transport upstream migrant fish to the upper Klamath basin during times when water quality conditions in portions of Lake Ewauna would be potentially fatal to fish. PacifiCorp (2006, page 111) states that FERC lacks jurisdiction for this requirement, but PacifiCorp's Alternative trap and haul operation can provide a similar benefit by releasing trapped fish higher in the basin during periods of harmful water quality.

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 20EC 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). 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^{o}C from mid-June through mid-November (Jason Cameron, BOR, pers. comm.). 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 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. Migrating suckers and lamprey, which tolerate a greater range of water quality conditions than salmonids, 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. Other species need volitional fishways to access habitat in Keno Reservoir\Lake Ewauna and Link River year round. 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).

PacifiCorp (2006, page 110) states that PacifiCorp does not propose to subsample fish on a daily basis for size, species identification, age determination, and condition as described in the Services' Prescription because such fish handling would merely add to the already stressful conditions that these fish encounter, thereby further jeopardizing the success of the anadromous fish reintroduction effort.

The Services' prescriptions require the Licensee to 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. The auxiliary water system (AWS) shall be designed to provide the correct water temperature and water quality as to attract fish, and the ladder shall include features to detect and record data for PIT-tagged upstream migrating anadromous fish (or fish identified using similar technology). These important design features, in conjunction the requirement that the monitoring be conducted when water quality is conducive to sampling, will minimize handling stress for fish.

PacifiCorp (2006, page 112) states that their "Alternative of implementing none of the Services' Prescriptions at the East Side and West Side powerhouses is no less protective of anadromous and resident fish in the upper Klamath basin" because they intend to "cease generating and decommission the powerhouses, which will eliminate any adverse effects to fish passage."

In their Prescriptions, the Services address fish passage requirements under current conditions for all of the facilities covered by the license. If the East Side and West Side Powerhouse remain in the license, anadromous and resident fish (including Federally listed suckers) would require fish passage for the reasons outlined in this Section. PacifiCorp has provided no protective mechanisms for fish in this circumstance. Accordingly, the Services' Prescriptions are more protective for all species of fish than is the PacifiCorp alternative.

Pacific Lamprey

8. PacifiCorp's Alternative Would Bypass Habitat for Pacific Lamprey in the Project Reach

- The Services' Prescriptions are more protective because they provide access to habitat for Pacific lamprey in the Project Reach.

- PacifiCorp's Alternative is less protective for Pacific lamprey because it would bypass much of this habitat.

While the historical upstream distribution of Pacific lamprey is unclear, it is clear that suitable habitat for spawning and juvenile rearing is available within tributaries and stream reaches in the Project area (Hamilton et al. 2005, ALJ Decision at 13, FOF 2A-7; ALJ Decision at 37, FOF 8-1, FOF 8-3, FOF 8-5; ALJ Decision at 86, Ultimate Finding of Fact 10).[11] 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. Access to the additional habitat within the Project reach would benefit Pacific lamprey populations (ALJ Decision at 38, FOF 8-9), and would not be available to Pacific lamprey under PacifiCorp's Alternative. Therefore, PacifiCorp's Alternative is less protective of this species.

9. PacifiCorp's Alternative Would Rely on Passage Methods for Pacific Lamprey That Have Not Been Established

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions would rely on methods of passage for adult and juvenile Pacific lamprey that are in use elsewhere.
- PacifiCorp's Alternative is less protective because the technology for large scale trap and haul of adult or juvenile Pacific Lamprey has not been established.

Lampreys occur long distances inland in the Columbia and Yakima river systems (Wydoski and Whitney 2003) and habitat conditions above the dams on the Klamath are similar. If access was provided through fishways, Pacific Lamprey from below Iron Gate Dam would migrate above the dam (ALJ Decision at 37, FOF 8-7). However, PacifiCorp (2006, page 79) states that while they would expect few lamprey to use any fishway at the Dam, its Alternative would likely provide a greater probability of success compared to the Services' Prescription because the all-volitional ladder would be much longer than the existing partial ladder to the collection facility. This assessment is inaccurate because the Services' Prescription incorporates design elements that are in use elsewhere and PacifiCorp's alternative relies on the use of a ladder designed for adult salmonids only. For example, research on Columbia River fish ladders has found that the efficiency of existing ladders improves with simple design changes, and has resulted in the permanent

[11] The ALJ found in favor of the Services on the overall question stated for trial (whether access to habitat within the Project would benefit Pacific Lamprey), although the ALJ found that the evidence is nconclusive as to whether Pacific lamprey were historically present above Iron Gate Dam (ALJ Decision at 2, 70, and 86, Ultimate Finding of Fact 10). However, the ALJ also found the evidence shows that Pacific Lamprey occur in the Lower Klamath River, below Iron Gate Dam (ALJ Decision at 13, Finding of Fact2A-7), and Pacific Lamprey below Iron Gate Dam would migrate above the dam if access were provided through fishways (ALJ Decision at 37, Finding of Fact 8-7). Because Pacific Lamprey that are currently below Iron Gate Dam would migrate past the dam if access were provided through fishways, the Services conclude that Iron Gate Dam currently blocks passage of Pacific Lamprey, and the Services' Prescriptions related to Pacific Lamprey address this Project impact.

installation of a Lamprey Passage Structure at Bonneville Dam in 2006. This device allows adult lamprey to pass volitionally at rapid rates and with high (>90%) passage success [NMFS/FWS-Issue 8- Moser, Ex.1 at 3,4].

PacifiCorp also reports the results of recent studies which indicate that net upstream passage efficiency is about 50 percent on average for Pacific lamprey through contemporary fishways designed for anadromous salmonids (review in Stevenson et al. 2005). However, the report states that an additional 16 percent of these tagged Pacific lamprey were probably lost into the Attraction Water System at Rocky Reach Dam, which was designed to exclude adult salmonids only. The final report for this study (Golder Associates 2006) demonstrates the substantial deficiencies in existing ladders, but "Numerous opportunities exist to improve upstream passage of adult lamprey" including ramps (section 4.1.1), fishway bottom improvements (4.1.2), rounded bulkhead wall ends (4.1.3), maintenance practices (4.1.4), orifice openings (4.1.5), and powerhouse entrance/spillway gate openings (4.1.6). Juvenile passage at conventional screen systems also has been problematic (Kostow 2002), however Golder Associates (2006) also provides recommendations for these issues as well.

PacifiCorp's conclusion relies upon its assertion that "Pacific lamprey are more likely to utilize the [hatchery] ladder" because it is shorter (PacifiCorp 2006). However, Pacific lamprey are known to be able to swim through 9 ladders to the limit of anadromy on the Columbia River (Chief Joseph Dam), more than 500 miles from the Pacific Ocean (Hamilton et al. 2005). The recommendations in Golder Associates (2006) emphasize improvements to design features, not ladder length. Although the Columbia mainstem ladders need improvements, many Pacific lamprey are nonetheless able to ascend all of them and would likely swim further if given the opportunity. PacifiCorp fails to provide justification as to why its "shorter is better" argument applies.

Design features in ladders can provide partial or complete passage of one species efficiently while excluding others entirely. PacifiCorp fails to explain why the features of the existing hatchery ladder would not hinder passage to the same or greater degree that the existing Columbia River ladders do. For instance, (Stevenson et al. 2005) and Golder Associates (2006). found that 16% of the Pacific lamprey likely were lost into the auxiliary water system at Rocky Reach dam; the Alternative provides no provision to ensure that this doesn't happen at Iron Gate Dam.

Therefore, PacifiCorp's assertion that its trap-and-haul alternative will pass Pacific lamprey more efficiently than the Services' prescription is largely unsubstantiated. The Services intend to use improved designs for volitional fishways, which are more protective than the speculative design provided in the Alternative.

10. It Is Unlikely that PacifiCorp's Alternative Would Provide Migratory Cues Necessary for the Attraction of Adult Pacific Lamprey.

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions promote the establishment of continuous, healthy populations of resident and anadromous lamprey in the areas between the dams, which will, in turn, provide sufficient levels of juvenile pheromone production to attract robust numbers of adults to the trap at Iron Gate Dam.
- PacifiCorp's trap and haul Alternative is less protective because it precludes the establishment of the pheromone cues necessary for the attraction of adult Pacific lamprey.

Pacific lamprey, being ectoparasitic, often do not return to their natal stream to spawn, and their movements appear to be dependent upon the movements of their host fish. Adult attraction to a particular stream is facilitated by pheromones from lamprey juveniles (but not adults) of several species of resident and anadromous lamprey that produce and release a suite of bile acids that serve as migratory attractants to adults. The bile acids are strong attractants even at low concentrations and the pheromones are not species-specific.. Larval pheromones are not particularly stable, with a half-life estimated as approximately one day in laboratory conditions. This suggests that pheromones produced above the bypassed Project habitat will not persist until they can be passed through Iron Gate Dam (Steward and Associates 2007). It appears unlikely that current populations of resident lamprey in the lower reservoirs and their tributaries are sufficient to attract large numbers of adult Pacific lamprey to the trap at Iron Gate. Therefore, if the passage system does not promote the establishment of continuous, healthy populations of resident and anadromous lamprey in the areas between the dams, there may be an insufficient level of juvenile pheromone production to attract robust numbers of adults to the trap at Iron Gate. If, on the other hand, tributaries begin to produce higher numbers of anadromous juveniles, adults will be attracted in greater numbers, leading to a greater likelihood of reintroduction success (Steward and Associates 2007).

The role of migratory pheromones highlights the importance of a continuum of habitat utilization as a key factor for lamprey reestablishment in the Klamath River above Iron Gate Dam (Steward and Associates 2007). The presence of juvenile Pacific lamprey in the Project reach would likely be very important to providing the cues necessary for the attraction of adult Pacific lamprey. In the Project reach, the Services' Prescriptions would provide these cues coming from juvenile Pacific lamprey; PacifiCorp's Alternative would not.

Attraction flow at the ladder entrance is critically important to all upstream-migrating fishes (Federal Energy Regulatory Commission 2004). The existing ladder incorporated into the Alternative would use its existing auxiliary water supply (page 81), which provides substantially less flow than the Services' prescription. The Alternative does not claim that this lesser flow would equal the prescription's capability of attracting fish. Indeed, the Alternative's attraction water supply would clearly attract fewer Pacific

lamprey (as well as other up-migrating fishes) to the ladder. Here again, the Alternative is less protective than the Services' prescription.

Coho Salmon

11. PacifiCorp's Alternative Provides Lesser Population-level Benefits for the Upper Klamath Coho Population and for the Federally Listed SONCC Coho ESU

- The Services' Prescriptions provide greater population-level benefits.
- PacifiCorp's Alternative provides lesser population-level benefits.

Access to the historical habitat of the Upper Klamath coho salmon population, part of the federally listed SONCC (Southern Oregon/Northern California Coast) coho ESU (Evolutionarily Significant Unit), was significantly reduced when Project dams blocked access (Williams et al. 2006). In general, one assumes greater risk of extinction when less habitat is available across an ESU. Access to less habitat constrains the abilities of populations within the ESU, and the ESU as a whole, to persist (McElhany et al. 2000). The Services' Prescriptions provide access to suitable coho tributary and main stem habitat above Iron Gate Dam, including important rearing habitat in the Project tributaries and main stem, and cold water refugia below J.C. Boyle Dam. This includes Spencer, Fall, Beaver, Deer, Shovel, Scotch, and Jenny Creeks (ALJ Decision at 35, FOF 7-9). Historically, coho salmon spawned in Fall Creek (ALJ Decision at 12, FOF 2A-6). In addition, there are approximately 28 miles of suitable spawning habitat for anadromous fish in the main stem provided gravel augmentation occurs in those areas (ALJ Decision at 33, FOF 6-10). Out of the streams specifically listed above from the ALJ's Decision, PacifiCorp's Alternative provides access only to Spencer Creek.

The comparatively small amount of upstream habitat made available by Pacificorp's Alternative diminishes the likelihood that the Upper Klamath coho salmon population will be a functional component of the SONCC coho salmon ESU. In other words, when considering the various measures of viability (i.e., abundance, productivity, diversity and spatial structure) outlined in McElhany et al. 2000 (McElhany et al. 2000), the lesser amount of re-claimed habitat realized under Pacificorp's Alternative is more likely to preclude the Upper Klamath population from becoming a Functionally Independent sub-population of the larger Klamath River coho population.

The ALJ Decision provides support for this position, because the ALJ found that, over time, access to habitat above Iron Gate Dam would benefit the coho salmon population by: a) extending the range and distribution of the species thereby increasing the coho salmon's reproductive potential; b) increase genetic diversity in the coho stocks; c) reduce the species vulnerability to the impacts of degradation; and d) increase the abundance of the coho population (ALJ Decision at 36, FOF 7-16). Coho salmon below Iron Gate Dam would migrate above the dam if access was provided through fishways (ALJ Decision at 35, FOF 7-15).

PacifiCorp (2006, pages 54-56) states that access to Project-area habitat may further impede recovery of ESA-listed coho salmon because the vast majority of habitat in tributaries above Iron Gate and Copco 1 and 2 Dams is no longer suitable for juvenile rearing, and would require juveniles to move into reservoirs where they would face significant hazards, such as predation, disease, impaired water quality resulting from nutrient load in Upper Klamath Lake, and juvenile screening and bypass facilities. PacifiCorp (2006, page 71) makes the same argument again later in the document, adding that their Alternative "would allow adult coho salmon to be sorted and distributed to desired locations (e.g., Spencer Creek above J.C. Boyle Dam or habitat below Iron Gate Dam, as appropriate)."

The Services' disagree with this position. Coho salmon depend heavily on tributaries to complete their life histories and sustain their populations (National Research Council 2004). The Services' Prescriptions provide access to significantly more tributary and mainstem habitat than PacifiCorp's Alternative. Although portions of the habitat above Iron Gate Dam have been degraded, much of this habitat remains suitable and restoration projects are currently in progress or planned (ALJ Decision at 35, FOF 7-7). Further, coho salmon below Iron Gate Dam still use the habitat below the dam even though it has suffered degradation commensurate with that above the dam (ALJ Decision at 35, FOF 7-6). Although water temperature in the summer above Iron Gate Dam could be an issue, the evidence on record shows that water temperature will not preclude coho salmon from successfully utilizing the habitat within the Project area (ALJ Decision at 36, FOF 7-12). Similarly, when juvenile coho migrate through reservoirs, predation rates may increase. However, reservoir predation could be minimized through use of remedial measures (ALJ Decision at 36, FOF 7-13). Finally, juvenile screening and bypass facilities constructed to NMFS criteria, as specified in the Services' Prescriptions, function at very high efficiencies (National Marine Fisheries Service 2000b).

12. PacifiCorp's Alternative Does Not Protect Federally Listed Coho Salmon From Entrainment at the Copco 1, Copco 2, and Iron Gate Turbine Intakes

- The Services' Prescriptions are more protective because they protect federally listed coho from turbine mortality at Copco 1, Copco 2, and Iron Gate facilities.
- PacifiCorp's Alternative is less protective because juvenile coho salmon that pass downstream with spill at J.C. Boyle would not be screened from turbines at Copco 1, Copco 2, and Iron Gate Project facilities.

Under PacifiCorp's Alternative, a juvenile collection and transport facility would be located at or above J.C. Boyle Dam (PacifiCorp 2006 at 57, last paragraph). The facility would be able to screen only the flow being routed into the location's power canal intake. Flow that occasionally passes over the spillway would not be screened. PacifiCorp cites an estimate that 20 percent of migrants would be spilled (PacifiCorp 2006 at 60, second paragraph). Under PacifiCorp's Alternative, spilled coho juveniles could be entrained at each facility below J.C. Boyle Dam, as these facilities would not include screens. Once entrained, juvenile coho face a high risk of mortality. The Copco 1, Copco 2, and Iron

Gate facilities are all equipped with Francis turbines with between 123 and 158 feet gross head at the powerhouses (PacifiCorp 2004a). A 1987 report prepared by the Electric Power Research Institute (EPRI) concluded that mortality from entrainment at hydroelectric projects using Francis turbines averaged 24 percent. The EPRI report also found that entrainment mortality at hydroelectric projects using Francis turbines with operational head greater than 335 feet ranged from 33-48 percent. The ALJ found that for juvenile fish entrained in the Project, the risk of mortality is between 10-30 percent (ALJ Decision at 29, FOF 4-5).

The expected losses of federally listed juvenile coho spilled at J.C. Boyle under PacifiCorp's Alternative are significant. It is reasonable to assume that nearly all fish spilled downstream will be entrained at each of the three facilities downstream, as there is negligible spill at Copco 1, Copco 2 and Iron Gate Dams leaving no routes of egress other than through the turbines[12]. Assuming 20 percent spill and 100 percent entrainment at each of the three facilities downstream, an estimated 48 percent of all spilled fish would be lost to entrainment mortality[13]. Given PacifiCorp's estimate that 20 percent of all fish will be spilled, approximately 10 percent of all juvenile coho outmigrants will be lost to entrainment mortality.

Under the conditions specified in the Services' Prescriptions, downstream migrants would be collected and transported downstream at each dam by screens and bypasses rather than entrained into the turbines. Positive exclusion barrier screens and bypass facilities designed to NMFS fish passage criteria have consistently resulted in guidance efficiencies of over 98 percent, or less than 2 percent loss (National Marine Fisheries Service 2004a). This less than 2 percent loss is compared to the 10-30 percent entrainment mortality estimated for PacifiCorp's Alternative. The Services' Prescriptions are therefore more protective for spilled juvenile coho outmigrants. Given that the SONCC coho ESU is listed as threatened under the ESA, measures to minimize loss of

[12] Any predation, mortality or residualization of spilled fish that would occur during reservoir passage would likely be the same under PacifiCorp's Alternative and the Services' Prescriptions, and is therefore not addressed here.

[13] Assuming (for analytical purposes only) that 1000 juvenile outmigrants are present in J.C. Boyle Reservoir and 20 percent are spilled, then 0.2 (1000) or 200 juveniles will be spilled over J.C. Boyle Dam. Assuming that all 200 survive the spill (spill mortality is addressed in a separate subsection), it is reasonable to assume nearly all 200 will be entrained into the turbines at Copco 1, as there is negligible spill at Copco 1 and there is no other route of egress except through the turbines. Here they will undergo 10-30 percent entrainment mortality. Assume the midpoint of 20 percent entrainment mortality for simplicity, 20 percent of 200 is 0.2 (200) or 40 entrainment mortalities and 160 survivors at Copco 1. Assuming all 160 survivors are entrained at Copco 2 (again, there is negligible spill at Copco 2 and there is no other route of egress except through the turbines), there will again be 20 percent entrainment mortality at Copco 2. 20 percent of 160 is 0.2 (160) or 32 mortalities and 128 survivors at Copco 2. Finally, with the same assumptions of 100 percent entrainment and 20 percent entrainment mortality at Iron Gate dam, there will be 0.2 (128) or 26 mortalities and 102 survivors below Iron Gate Dam. Given the assumptions above, then 40+32+26 = 98 fish are entrainment mortalities of the original 200 fish spilled. In other words, about one half of all fish spilled over J.C. Boyle Dam will be lost to entrainment mortality while passing through the Project.

coho will be necessary in accordance with the ESA, and the comparison of entrainment mortality estimates described above is an especially important consideration.

Resident Fish

13. PacifiCorp's Alternative Risks Inadvertent Transport of Resident Trout and Lamprey

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions would not risk the inadvertent transport of resident redband trout which cannot be distinguished from outmigrating steelhead juveniles or non-anadromous lamprey species which cannot be distinguished from anadromous Pacific lamprey.
- PacifiCorp's Alternative is less protective because juvenile resident redband trout and non-anadromous lamprey would be inadvertently transported downstream.

Outmigrating juvenile anadromous steelhead and Pacific lamprey are indistinguishable from resident stocks in collection facilities. Under the Services' Prescriptions, these fish would decide when they were ready for migration, if at all, and the distance to be traveled. Under PacifiCorp's alternative, many of these fish would be inadvertently transported. These individuals may be displaced and moved greater distances than conducive to their needs and survival.

14. PacifiCorp's Alternative Provides Little Protection from Entrainment for Resident Trout

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the Services' Prescriptions include adequate fish screens at J.C. Boyle Dam, and accommodate downstream protection at Copco 1, Copco 2, and Iron Gate Dams.
- PacifiCorp's Alternative is less protective because the existing screens at J.C. Boyle have been shown to be inadequate and would not be upgraded; and no screening and bypass systems would be provided for downstream protection of resident fish at Copco 1, Copco 2, and Iron Gate Dams.

Unscreened flow through Project turbines results in mortality of juvenile and adult trout migrating downstream; and the inability to effectively migrate adversely affects the genetic health and long term survival of the resident species (ALJ Decision at 86, Ultimate Finding of Fact 6). J.C. Boyle Dam has fish screening and bypass systems in place, but they do not conform to current fish screen criteria for resident and anadromous fish (ALJ Decision at 29, FOF 4-8). The seals at the J.C. Boyle Dam have rendered fish screens partially ineffective, allowing fish to be entrained in the power canal and turbines (ALJ Decision at 29, FOF 4-9). PacifiCorp recognizes that entrainment at the J.C. Boyle Dam is a "problem that needs to be addressed" (ALJ Decision at 30, FOF 4-12). Precise

estimates of the number of fish entrained at the facilities are not available. However, extrapolating from data at other comparable FERC Facilities, PacifiCorp estimates a median annual entrainment of 75,655 fish for reservoirs the size of J.C. Boyle, and 115,979 fish for reservoirs the size of Copco and Iron Gate (ALJ Decision at 30, FOF 4-14).

PacifiCorp states approximately 20 percent of flow is spilled at J.C. Boyle Dam (PacifiCorp 2006 at 60, second paragraph). It is reasonable to assume that resident fish would be spilled with these flows. Resident fish migrate seasonally to maximize habitat, survival and growth. Under PacifiCorp's Alternative, spilled resident fish would be subject to entrainment at each facility below J.C. Boyle Dam, as these facilities would not include screens. Once entrained, resident fish face a high risk of mortality. The Copco 1, Copco 2, and Iron Gate facilities are all equipped with Francis turbines with between 123 and 158 feet gross head at the powerhouses (PacifiCorp 2004). A 1987 report prepared by the Electric Power Research Institute (EPRI) concluded that mortality from entrainment at hydroelectric projects using Francis turbines averaged 24 percent. The ALJ found that for juvenile fish entrained in the Project, the risk of mortality is between 10-30 percent (ALJ Decision at 29, 4-5). The risks of entrainment under PacifiCorp's Alternative are cumulative below J.C. Boyle Dam, as described in detail with respect to federally-listed coho salmon (see Section 12 above).

Unlike PacifiCorp's Alternative, the Services' Prescriptions include screens and bypasses at all downstream facilities, decreasing entrainment and allowing greater habitat connectivity. Resident fish would be able to migrate in order to maximize habitat, survival and growth, as they would be collected and transported downstream at each dam by screens and bypasses rather than entrained into the turbines. Under the Services' Alternative, entrainment is virtually eliminated with positive exclusion barrier screens at all facilities. The Services' Prescriptions are therefore more protective for resident fish that will be entrained under PacifiCorp's Alternative.

15. Unlike the Services' Prescriptions, PacifiCorp's Alternative Would Not Reduce the Project's Impacts on the Resident Trout Fishery

- The Services' Prescriptions would improve the resident trout fishery by re-establishing the ability of resident trout to move among habitat areas to meet their life history requirements.
- PacifiCorp's Alternative would perpetuate the impacts of the Project on resident trout by not providing passage options to fish residing in river reaches between dams and in tributaries above dams.

PacifiCorp (2006, page 3) states that resident trout populations would not benefit from habitat connectivity and increased genetic diversity that fishways would provide because the populations are currently healthy and sustaining and support a premier sport fishery in the J.C. Boyle peaking reach. PacifiCorp (2006, page 92) cites National Park Service ((U.S. National Park Service - Pacific Northwest Region 1994), pages 12 and 18)

indicating that the Klamath River below the J.C. Boyle Powerhouse to the Oregon/California border "provides an exceptional trout fishery and is reputed to be one of the better fly fishing rivers in Oregon…[and] offers an excellent fishery for wild rainbow trout with a size and catch rate among the highest in the state [with] nearly unlimited shoreline access [and a] year-round fishing season."

However, information from ODFW (Tinniswood 2006) and FERC (Federal Energy Regulatory Commission 1990) show that the trout populations within the project reaches are not healthy and sustaining and the fishery is not premier. After reviewing the available information, the ALJ found that Project operations have and continue to adversely affect the resident trout fishery by, among other things: a) confining the resident trout between the Project dams and associated reservoirs, thereby impairing their utilization of the full range of life history strategies and spawning productivity; b) unscreened flow through Project turbines result in mortality of juvenile and adult trout migrating down stream; and c) the inability to effectively migrate adversely affects the genetic health and long term survival of the resident species (ALJ Decision at 86, UFOF 6).

PacifiCorp (2006, page 96) states that their Alternative includes no fishways for resident trout at Iron Gate and the Copco Dams because there is no evidence that the few trout in the areas of Iron Gate and Copco Reservoirs require access to additional habitat, or that trout outside the reservoirs would benefit from access to habitat within the reservoirs. This view ignores the point that the trout population segments between and inside the reservoirs all would benefit from individual fish being able to disperse among these areas to select the most advantageous habitat areas under different hydrologic or other weather pattern conditions and life stages, and discounts the benefits to population genetic diversity that would result.

PacifiCorp (2006, page 96-97) suggests that providing fish passage at Iron Gate Dam may allow genetic introgression between coastal rainbow and Klamath redband trout. However, after review of the scientific evidence presented, the ALJ found that "[T]here are no scientific studies of the Klamath basin demonstrating that reintroduction of anadromous steelhead trout would detrimentally affect the genetic makeup of the resident trout fishery"(ALJ Decision at 25, FOF 2C-9). The ALJ also found that "[T]here are many examples from nearby river systems in the Pacific Northwest that show wild anadromous steelhead trout and resident rainbow/redband trout can co-exist and maintain abundant populations without adverse consequences. The Deschutes River in Oregon, the Yakima River in Washington, and the river systems in Idaho are examples" (ALJ Decision at 25, FOF 2C-11).

Shortnose and Lost River Suckers

16. PacifiCorp's Alternative Does Not Protect or Bypass Federally Listed Suckers

- The Services' Prescriptions are more protective than PacifiCorp's Alternative because the screens prescribed by the Services meet current criteria for salmonids, and also meet the same specifications as those designed to protect the life stages of federally listed suckers and other resident fish.
- PacifiCorp's trap and haul Alternative is less protective because it does not provide downstream screens or bypass facilities at the Eastside Development, Westside Development, Copco 1 Dam, Copco 2 Dam, and Iron Gate Dam for suckers or other resident fish.

PacifiCorp (2006, page 98) states that "[B]ased on the fact that listed sucker species in Iron Gate and Copco Reservoirs are either too large to enter the powerhouses or too small to be effectively and safely screened with the Services' Prescribed facilities, it is clear that PacifiCorp's Alternative of not including downstream fish facilities at Copco 1, Copco 2, and Iron Gate Dams is no less protective for suckers."

PacifiCorp's alternative does not call for downstream screens or bypass facilities at the Eastside Development, Westside Development, Copco 1 Dam, Copco 2 Dam, and Iron Gate Dam (page 97). 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 assist recovery efforts for the listed suckers in the future if reintroduction efforts become necessary (National Research Council 2003). Because these four dams lack screens and bypass systems, these fish are at risk.

Precise estimates of the number of fish entrained at [each] facility are not available. However, extrapolating from data at other comparable FERC Facilities, PacifiCorp estimates a median annual entrainment of 75,655 fish for reservoirs the size of J.C. Boyle, and 115,979 fish for reservoirs the size of Copco and Iron Gate (ALJ Decision at 30, 4-14).

At the Eastside Development and Westside Developments, significant numbers of 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).

At the J.C. Boyle facility, PacifiCorp's alternative would continue to use the existing downstream screening facilities to bypass resident fish until a decision is made regarding the details of a collection and transport system for downstream migrating salmonids (page 91). J.C. Boyle Dam has fish screening and bypass systems in place, but they do not conform to current criteria for resident and anadromous fish (ALJ Decision at 29, FOF 4-8). The seals at the J.C. Boyle Dam have rendered the fish screens partially ineffective, allowing fish to be entrained in the turbines (ALJ Decision at 29, FOF 4-9). An Electric Power Research Institute (EPRI) report indicates that entrainment mortality at hydro projects using Francis turbines (such as J.C. Boyle) with operational head

greater than 335 feet ranged from 33 to 43 percent (ALJ Decision at 29, FOF 4-10). In light of the large percentage of river flow that is diverted into the J.C. Boyle power canal, the operation of Francis turbines, and the high operational head of 440 feet, fish mortality from entrainment at the J.C. Boyle facility is likely in the higher end of the mortality range as described in the EPRI report (ALJ Decision at 30, FOF 4-11). The J.C. Boyle Reservoir contains shortnose and Lost River suckers that are listed under the federal Endangered Species Act that are susceptible to entrainment (ALJ Decision at 30, FOF 4-16). While the vast majority of fish entrained consists of small juvenile fish, the record shows that adult fish are also susceptible to being entrained and killed (ALJ Decision at 31, FOF 4-22). Records from canal salvage operations at the J.C. Boyle power canal show that resident fish, in particular resident trout and suckers, are entrained and possibly killed in the power canal each year (ALJ Decision at 31, 4-18).

The Services' Prescriptions, which include screens that meet salmonid criteria, meet the same specifications as those designed to protect the life stages of federally listed suckers in which the Service is interested. The Service has consulted with the Bureau of Reclamation regarding the installation of screens that meet salmonid criteria at the A-canal diversion, and authorized take of larval suckers subject to these screening criteria (USDI Fish and Wildlife Service 2002).

Conclusion

After fully analyzing PacifiCorp's Alternative in comparison to the Services' Prescriptions, and considering all the available evidence and information and for the reasons outlined herein, the Services conclude that PacifiCorp's Alternative would be less protective than the Services' Prescriptions.

***Criteria 2* – Would the Alternative, as compared to the Services' Prescriptions, be significantly less costly to implement or result in improved operation for electricity production?**

PacifiCorp's alternative would be significantly less costly to implement, according to engineering cost estimates provided by PacifiCorp. PacifiCorp states that the Services' Prescription ladders and screens at and between Iron Gate, Copco 1, Copco 2, and J.C. Boyle (including a tailrace barrier at Fall Creek) would cost approximately $300,792,000 (2006, page 84), plus an additional $3.1 million for fishways at Fall and Spring Creek for resident fish (2006, page 100), plus an additional $60 million should fishways be required at Keno and Link Dams (2006, page 112).

PacifiCorp states that its alternative, including initial studies pursuant to the adaptive reintroduction program, would cost approximately $49,440,000 (2006, page 84), plus $4.7 million for fishways at Fall and Spring Creeks and modifications to the existing J.C. Boyle fish ladder (2006, page 101).

The Services' do not have access to all of the documentation and assumptions underlying PacifiCorp's estimates, and have not independently verified the specific cost estimates PacifiCorp presents. However, the Services are not aware of information that would discredit the general conclusion that it would cost significantly less to implement PacifiCorp's proposed Alternative (April 2006) than to implement the Services' Preliminary Prescriptions (which are essentially adopted as the Modified Prescriptions, as discussed in prior sections). Therefore, for the limited purpose of carrying out this comparative Section 33 analysis, the Services accept the information as showing that PacifiCorp's Alternative would likely be less costly.

Conclusion

As noted above, to satisfy FPA section 33's standards for when an alternative proposal must be accepted, a proposed alternative must *both* be equally protective of species *and* either significantly less costly to implement or resulting in improved operations for electricity production. Here, as discussed above, the overwhelming substantial evidence in the record indicates that PacifiCorp's proposed alternative is significantly *less* protective of the species than the Services prescriptions. . We do not find substantial evidence that PacifiCorp's Alternative would be no less protective than the Services' prescriptions. Therefore, the Services conclude that the proposed Alternative fails to satisfy the standards of Section 33 and should not be accepted, even though we assume for purposes of the analysis that the proposed Alternative would be significantly less costly to implement.

C. Equal Consideration of Effects Demonstration

The Services have conducted the appropriate analysis of effects in accordance with the factors set forth in Section 33 of the FPA (16 U.S.C. § 823d(b)(4)) and implementing regulations (43 C.F.R § 45.73 (Interior); 50 C.F.R. § 20.73 (Commerce)) and have determined the following.

1. **Energy supply, distribution, cost, and us**e

Neither the Services' prescriptions nor the Alternative condition has a significant impact on energy supply, distribution, cost or use.

Supply: Although the fishway prescriptions will minimally reduce the generating capability of the project, the impact is insignificant when compared to the total customer requirements supplied by PacifiCorp, and *de minimis* in the context of regional energy supply. The project is a system resource, meaning that it has no function other than the provision of electric energy to the applicant's system as a whole. PacifiCorp's engineering cost estimate (2006, Attachment E) states that the prescriptions would reduce total generation by 22,000 megawatt hours (MWh) annually, amounting to 3 percent of

the 656,000 MWh average annual power generation from the project. This amount is 0.03 percent of the total MWh hours supplied by PacifiCorp in 2004, the latest year for which data were available. Moreover, PacifiCorp's transformer and line losses in 2004 were 3,741,391 MWh, which were considered acceptable, predictable and consistent with PacifiCorp's system planning criteria. Thus the prescriptions would reduce total generation by only 0.6 percent of current, planned energy losses. Particularly taking into account that PacifiCorp is only one a number of energy suppliers in the Northwest, the impact on total regional energy supply must be considered *de minimis*. Although PacifiCorp provided no information regarding the impact of its proposed alternative on regional energy supply, we note that project generation, in total, represents less than 1 percent of total system generation, and a little over one-sixth of transformer and line losses. Accordingly, the Klamath Project itself makes an insignificant contribution to PacifiCorp's energy supply, and makes a *de minimis* contribution to regional energy supply. Thus, neither the prescriptions nor the alternative would have a significant impact on energy supply, either in the region or on the applicant's system.

Distribution: PacifiCorp provided no information regarding the impact of its proposed alternative on the distribution of energy. The Services have no other information indicating any impact of PacifiCorp's alternative on energy distribution. The fishway prescriptions do not address energy distribution facilities, and therefore do not have any direct impact on the distribution of energy. Moreover, as regional energy supply impacts are *de minimis*, there is no basis to support an inference that there will be any measurable indirect impacts on energy distribution.

Cost: The impact of fishway prescriptions on energy cost is judged not significant. PacifiCorp's filings in its recent rate case in California explains that the project is an unreliable source of power and that its energy, when available, is used to displace other, more expensive sources.[14] Accordingly, PacifiCorp views the replacement value of project energy as PacifiCorp's decremental generation cost, which is unaffected by any changes in Klamath Project operations.[15]

Use: Neither the fishway prescriptions nor PacifiCorp's proposed alternative are expected to have any impact on energy use. PacifiCorp did not submit information to suggest such an impact, and the Services are not otherwise aware of particular information that would suggest any impact on patterns of consumption of energy.

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[14] See for example PacifiCorp in its Opening Brief in U-901-E before the Public Utilities Commission of the State of California, filed August 28, 2006, included in the record in the filing of the California Energy Commission on December 1, 2006.

[15] "Decremental Generation Cost" is a term used by PacifiCorp in its Opening Brief in U-901-E before the Public Utilities Commission of the State of California, filed August 28, 2006. It refers to the cost that would otherwise be incurred but for the availability of the Klamath power. Since the most readily available alternative to Klamath would be for PacifiCorp to purchase additional power under its existing supply arrangements, the average cost of purchased power reflects this decremental generation cost. See especially pages 30 – 35.

2. Flood control

Because the Project's reservoirs are relatively small compared with the Klamath River's annual runoff (e.g., Iron Gate reservoir impounds only 4 percent of annual runoff, and Copco No. 1 reservoir only 5 percent), the Project reservoirs are generally *not* operated for flood control ((PacifiCorp 2004b), Ex E, Page 3-181). While Project reservoirs are drawn down to some extent prior to spring runoff, this can provide only very limited flood control during high flow events. (PacifiCorp 2004, Ex B Page 2-7).

PacifiCorp identified no difference in flood control between the Services' prescription and PacifiCorp's proposed alternative for anadromous fish, resident fish, and Keno(PacifiCorp 2006, Page 87, 102, and 113). None of the alternatives analyzed in this section would result in any change to the currently very limited flood control.

3. Navigation

There is no large-scale commercial navigation on the Klamath River, as the dams are not equipped with locks for barges.

PacifiCorp identified no difference between the Services' prescriptions and PacifiCorp's proposed alternatives (PacifiCorp 2006, Page 87, 103 and 113). None of the alternatives analyzed in this section would result in any change to navigation.

4. Water Supply

PacifiCorp's Final License Application did not identify any Project-induced effects on municipal or irrigation water supply (PacifiCorp 2004b), Exhibit E, Page 9-54). PacifiCorp identified no difference between the Services' prescriptions and PacifiCorp's proposed alternative for resident fish or the Keno reach (PacifiCorp 2006, Page 103 and 113).

The Applicant includes fishways at Fall or Spring Creek in their Alternative (page 101). At Fall Creek and Spring Creek, pursuant to Section 18, the Service has prescribed that the ladder, and the screen and bypass facilities, shall provide for the uninterrupted passage of fish over the full range of flows. The Department notes the City of Yreka's (City) concerns that the impacts to the City's water facilities are appropriately considered and mitigated (City of Yreka, letter to FERC dated November 29, 2006).

No flows to meet the fishway requirements are specified. However, assuming that the Applicant still proposes an instream flow of 5 cfs for the bypassed reach of Fall Creek (this is unclear), no additional water in addition to the 5 cfs would be necessary to meet the requirement for fish passage. The Applicant's proposed instream flow would divert the 5 cfs to a point downstream from the City of Yreka's water intake structure and the fish hatchery intake structure. However, given that flows in Fall Creek rarely drop below 30 cfs (Coots 1954) and the difference between 5 cfs and the minimum 30 cfs would accommodate the City's 15 cfs water right, neither the Applicant's Alternative nor the Service's Modified Prescriptions for fishways pursuant to Section 18 would impact the

quantity of water the City has a right to or impact facilities necessary to manage the City's water supply. The Applicant's Alternative for fishways may impact water quantity to the California Department of Fish and Game hatchery at Fall Creek. However, it appears that if it were necessary to return a portion of the 5 cfs to a point above the fish hatchery intake structure (or the City of Yreka's water intake structure) this could be engineered with minimal cost or difficulty.

The Services have also prescribed a tailrace barrier at the Fall Creek powerhouse, unless studies show that it is not necessary. Should construction of a tailrace barrier be necessary, this location lies immediately above the City's water supply intake and the fish hatchery intake structure. Impacts to water quality for these facilities could be avoided by diverting penstock water around the powerhouse or limiting construction to periods of low water demand and hatchery shut down.

None of the alternatives analyzed in this section would result in any change to the water supply.

5. Air Quality

PacifiCorp stated that there is no difference in the effects of the Services' prescription and their alternative on air quality (PacifiCorp 2006, Page 88, 103, and 113). None of the alternatives analyzed in this section would result in any change to air quality.

6. Preservation of Other Aspects of Environmental Quality

PacifiCorp claimed that the Services' Prescriptions negatively affect Iron Gate Hatchery operations, disease in the lower river, and trout genetics (PacifiCorp 2006, Page 88,103). However, we disagree with PacifiCorp's position on these issues. The Services' Prescriptions would not impact operations of Iron Gate Hatchery (see our Subsection 4e in Section 3, above). PacifiCorp's Alternative is more likely to exacerbate pathogen and fish disease risks to anadromous fish (see our Subsection 6 in Section 3, above). PacifiCorp is incorrect in stating that a major concern of genetic introgression between coastal and redband trout exists (see our Subsection 15 in Section 3, above). With respect to its alternative for Keno and Link River, PacifiCorp did not identify any differences in effects to other aspects of environmental quality from the Services' prescriptions (PacifiCorp 2006, Page 114).

Other aspects of environmental quality that would be improved by volitional passage in the Klamath River include ecosystem benefits such as the re-establishment of marine nutrient transfer to upstream ecosystems through migration of anadromous fish. This nutrient addition could significantly increase production of fish and other plant and animal populations in upstream areas.

Section 4. Response to Comments

The joint regulations implement the statutory direction to consider evidence available to the Secretary. The regulations direct the Services to "consider evidence and supporting material provided by any license party or otherwise available to" the Agencies, including but not necessarily limited to certain categories of documents. *See* 50 C.F.R. § 221.73(a); 43 C.F.R. § 45.73(a). Among the sources of potentially relevant evidence and supporting material are the following listed sources: (1) any evidence on the implementation costs or operational impacts for electricity production of the proposed alternative; (2) any comments received on the Services' preliminary prescription; (3) any ALJ decision on disputed issues of material fact; (4) comments received on any draft or final NEPA documents; and (5) the license party's proposal filed pursuant to the regulations. *See* 50 C.F.R. § 221.73(a)(1)-(5); 43 C.F.R. § 45.73(a)(1)-(5).

Accordingly, the Services have considered, *inter alia*, comments received on the Preliminary Prescriptions and the FERC DEIS, to the extent they provide substantive information relevant to the evaluation of PacifiCorp's Proposed Alternative and to the development of the Modified Prescriptions. The comments reviewed include:[16]

1) *PacifiCorp's Alternative to the Joint United States Fish and Wildlife Service and National Marine Fisheries Service Preliminary Fishway Prescriptions, dated April 25, 2006 (*Alternative) *and PacifiCorp's December 1, 2006, Addendum to PacifiCorp's Alternative to the Joint United States Fish and Wildlife Service and National Marine Fisheries Service Preliminary Prescriptions* (Addendum).

2) *PacifiCorp's Response to Comments and Documents Submitted by Stakeholders on the FERC DEIS related to Fish Passage, Water Quality, Instream Flows, and Ramping Rates*, dated December 29, 2006 (PacifiCorp DEIS Response Comments).

3) Various comments by Stakeholders other than PacifiCorp that concern the Preliminary Fishway Prescriptions were filed with the Commission, some of which were in direct response to the DEIS, or were received directly by the Services. Comments that raise substantive issues concerning the Preliminary Prescriptions were received from the City of Yreka (Comment on the DEIS filed with FERC), the Hoopa Valley Tribe (responding to the PacifiCorp Alternative and Addendum, submitted directly to the Services), Oregon Department of Fish and Wildlife (responding to the PacifiCorp Alternative and submitted directly to the Services), the Conservation and Fisheries Groups (commenting on

[16] The Services note that they received *PacifiCorp's Comments Regarding the Williams Report (2007), the Steward Report (2007) and Related Issues*, which was dated January 25, 2007. Due to the Services' regulatory deadline for filing the Modified Prescriptions and Alternatives Analysis, and the logistical steps required to timely meet that deadline, and PacifiCorp's extremely late filing of these comments, PacifiCorp did not provide the Services a reasonable opportunity to analyze and respond to these comments in this filing. However, the Services will review the comments and, to the extent the comments set forth evidence and supporting material bearing on the Services' basis for this decision document, the Services may supplement or amended this filing.

PacifiCorp's Alternative and Addendum and submitted directly to the Services), and the Yurok Tribe (commenting on the Alternative and Addendum and submitted directly to the Services). In addition, as discussed below, numerous other comments submitted to FERC in response to the DEIS were reviewed to ensure that all substantive comments relating to the prescriptions are considered.

PacifiCorp Comments Dated April 25, 2006 and December 1, 2006

PacifiCorp's Alternative to the Joint United States Fish and Wildlife Service and National Marine Fisheries Service Preliminary Fishway Prescriptions dated April 25, 2006, and PacifiCorp's Addendum to PacifiCorp's Alternative to the Joint United States Fish and Wildlife Service and National Marine Fisheries Service Preliminary Prescriptions dated December 1, 2006 provide extensive comments, which have been fully considered in the analysis and development of the Services' Modified Prescriptions. Specific comments relating to the analysis of the Alternative under section 33 of the FPA are addressed in Section 3 of this document; other comments are addressed here or incorporated into the Modified Prescriptions. As discussed above in reference to Section 3 of this document, the Addendum does not constitute an Alternative under the FPA section 33 and implementing regulations, as it was submitted beyond the regulatory deadline. The Services have reviewed the Addendum and include herein responses to substantial new information that it raises.

The Services note first that PacifiCorp raised many of the issues it asserts here to support the Alternative in its request for hearing under the FPA. Such issues as the potential spread of disease, introgression of coastal and interior stock, and the availability of donor stock were subjected to a full evidentiary hearing before the ALJ, in which numerous scientific experts offered testimony, and resulted in the ALJ's Decision, and in the adoption of Findings of Fact supporting the Services' view. Accordingly, in response to numerous comments of PacifiCorp which address these same issues that have already been litigated in this process, the Services below cite to the ALJ's Findings and by reference, to the underlying scientific support for the Findings.

Comments Related to Reintroduction Issues:

As discussed above, PacifiCorp confuses the overarching issue of reintroduction of fish to the Klamath River with the Services' actions in this licensing proceeding, which are to mitigate for Project impacts to the passage of fish. Its Alternative and Addendum filings reflect this confusion by emphasizing issues pertaining to reintroduction and not on the immediate issue of fish passage. In Attachment A, page 3 of the Alternative, PacifiCorp quotes a portion of page 38 (Huntington et al. 2006) from what they call the "Intertribal Reintroduction Plan." The connotation is that the Tribes' proposed approach to reintroduction supports PacifiCorp's Alternative. This is not the case. First, as noted previously, reintroduction is a separate process from the Services' goals here to mitigate for Project impacts to fish passage. The Tribes' plan addresses the larger issue, reintroduction, and in that endeavor, the Tribes support an experimental approach for fish passage (not the general reintroduction effort). The Tribes do not support a trap-and-haul alternative (PacifiCorp's Alternative) because it fails to restore fish within the Project reach, and will prevent restoration of steelhead runs. The Intertribal Reintroduction Plan clearly and repeatedly states that dam removals offer the best option for restoring anadromous salmonids. The Tribes' position is that if dams are not removed, then volitional passage is the only approach with the potential to meet Tribal objectives for all anadromous species (Larry Dunsmoor, Klamath Tribe, pers. comm.).

PacifiCorp has taken the Tribes' interest in experimental approaches out of context, by omitting the first two sentences from the paragraph quoted. The full quotation should read:

> **We suggest that a reintroduction effort should begin with early experimentation, before dam removals occur or functional fish passage facilities are provided within the KHP-bounded area. The intent of this early experimentation would be to study test groups of anadromous fish released into areas above Link River Dam that are still isolated from the remainder of the Klamath Basin by the lack of dam passage.** Such experimentation could focus on confirming or refining hypotheses about how the younger freshwater life-stages of the fish to be reintroduced will perform in differing areas, on whether performance differences among particular candidate stocks are as anticipated, or on addressing other issues. Whatever the focus, it would provide an opportunity to test several assumptions and narrow a few uncertainties. The opportunity might be particularly important to future efforts toward spring Chinook reintroduction, because selection of a donor stock for this race of fish may come from what appears to be a group of less-than-optimal candidates. Selection from among these candidates might be aided by tests of fish that managers might initially be hesitant to release into the area unless they are confident that minimal numbers of the fish might end up in the mid-Klamath basin. (Huntington et al. 2006 at 38) (emphasis added).

The Tribes' intent for this section was to emphasize the utility of beginning **immediately** with experimental work, before fish passage is provided through dam removal or other means (Larry Dunsmoor, Klamath Tribe, pers. comm.). By so doing, managers could focus on how best to implement active reintroduction above Upper Klamath Lake.

Fish passage is a necessary precursor to a broader reintroduction effort. The Services see no reliable evidence or analysis suggesting that reintroduction efforts could not succeed.

Chinook and coho salmon, steelhead trout, and anadromous lampreys have persisted in the Klamath River since the completion of Copco 1 Dam (ALJ Decision at 13, FOF 2A-11; ALJ Decision at 37, FOF 8-2). Reintroduced fish would be subject to similar variables in the natural and managed environment that are currently faced by existing runs of these fish (ALJ Decision at 14, FOF 2A-13; ALJ Decision at 35, FOF 7-6). The major differences between existing runs and potential runs above the dams would be passage around and through hydropower facilities and increased migration distances.

Over time, natural recolonization of the Project area, and of the upper Basin, would occur once fish passage is established at Project facilities. Colonization and re-colonization of riverine habitats are considered to be part of the natural evolutionary biology, or strategy, of anadromous salmonid fishes (ALJ Decision at 13, FOF 2A-10; ALJ Decision at 32, FOF 6-3). Straying provides an evolutionary mechanism for salmonids to invade and colonize new habitats.

This may be a slow process to some areas, relying on adequate spawner escapements from ocean and river fisheries, and on within-river straying rates. Hatchery supplementation could considerably increase the recolonization rate, and there are a number of potential stocks available. A cooperative study between the Federal and State agencies has shown that Iron Gate Hatchery fall-run Chinook salmon held in Upper Klamath Lake are physiologically ready to migrate to the ocean and, thus, are suitable as a donor stock for reintroduction efforts (Maul et al. 2007).

Substantial watershed and aquatic habitat restoration efforts are underway, and these efforts are likely to continue (ALJ Decision at 35, FOF 7-7). A key component of the work by State, Federal, and non-governmental organizations in the Klamath River Basin is protection and restoration of the aquatic habitat upon which endangered fish and fish available to Tribal, commercial, and sport fishers depend. Restoration projects include many activities such as stream narrowing, stream bank stabilization, and fencing cattle out of riparian zones. These efforts will have significant benefits to potential anadromous fish habitat as well.

There are numerous examples of successful introductions of anadromous salmonids to new habitats from Alaska (Blackett 1981; Bryant et al. 1999; Wright et al. 1997) (Blackett 1981; Bryant et al. 1999; Wright et al. 1997)as well as New Zealand, Chile, and the Great Lakes (Groot and Margolis 1991). In the Pacific Northwest, reintroduction and/or restoration via dam removal or passage improvement efforts at FERC hydroelectric projects are underway on the Elwha, Deschutes, Lewis, Cowlitz, Skagit, Umpqua, Hood, White Salmon, Sandy, Clackamas, Willamette, and Upper Columbia rivers.

Among other findings that provide support for the Services' Prescriptions, the ALJ found that there are numerous examples from other streams and rivers systems that provide persuasive evidence that anadromous fish possess the capacity and capability to successfully adapt and colonize new habitat or recolonize historic habitat, including streams or river systems with lakes and reservoirs (ALJ Decision at 16, FOF 2A-23; see also ALJ Decision at 16, FOF 2A-24). The Services see no reliable evidence that salmonids cannot be successfully reintroduced in the Klamath above Iron Gate Dam over time. Hydropower project impacts, including fish passage, must be addressed through relicensing. Once this necessary precursor to reintroduction is addressed, Federal, State, Tribal, and local governments, along with other land owners, can exercise their responsibilities to appropriately manage fish occupying new habitat and can plan for their future.

PacifiCorp (2006, page 53-54) states that passage through the Project jeopardizes establishment of viable populations of anadromous fish above Upper Klamath Lake because more and better quality habitat for anadromous fish production occurs in the basin above Upper Klamath Lake than in the Project area and upper basin fish would be forced, both as adult and juvenile migrants, "to encounter significant sources of mortality within the Project area (such as delayed travel time, predators, disease, impaired water quality resulting from nutrient load in UKL, and juvenile screening and bypass systems)." (Alternative, at 54). Similarly, PacifiCorp (2006, page 70) states that its trap-and-haul Alternative provides the best chance of successful reintroduction to the Upper Klamath Basin because it would allow fish to avoid high risk areas in the Project area "so as to provide the greatest possible opportunity for the reintroduction effort in the upper basin to succeed."

As noted above, fish passage is a necessary precursor to the larger reintroduction effort, and the focus in this proceeding is on mitigating Project impacts to the passage of fish. The Services fully intend to manage future reintroduction efforts to optimize benefits to anadromous and resident fish and return native fish to historically occupied habitats. The fishways prescribed herein will be used to adjust and refine the direction of the future reintroduction program. The Services are currently proceeding with studies to determine how reintroduction would best proceed (e.g., Maul et al. 2007). However, such efforts are separate from the Services' prescriptions and beyond the jurisdiction of this licensing proceeding.

We further note that PacifiCorp's comments concerning the risks potentially faced by anadromous fish through volitional passage were addressed in the ALJ hearing process. (See, *inter alia,* the ALJ's Findings of Fact for Issue 2(B), as discussed below in reference to specific PacifiCorp comments concerning the risk of disease; ALJ Decision at 15, Finding of Fact 2A-19 ("Predation of outmigrating salmonids above Iron Gate Dam is likely to be low."); ALJ Decision at 14, Finding of Fact 2A-14 ("Warm water temperatures in the summer and cold water temperatures in the winter will not preclude anadromous fish from successfully utilizing habitat above Iron Gate Dam."); ALJ Decision at 14, Finding of Fact 2A-

17 ("The amount of delay associated with anadromous fish migrating above Iron Gate Dam is uncertain."): ALJ Decision at 15, Finding of Fact 2A-19 ("Predation of outmigrating salmonids above Iron Gate Dam is likely to be low.); ALJ Decision at 15, 2A-20).

PacifiCorp (2006, page 64) states that all of the comparable large-scale reintroduction programs in the western United States rely on trap and haul to pass both juvenile and adult fish life stages, and that these programs have been recommended, developed, or approved by many of the same Federal and State fishery agencies involved here. PacifiCorp believes that there is no legitimate reason for those agencies to propose a different passage scheme for the Klamath River.

The Services prescribe volitional passage as the most effective method for re-establishing fish passage across dams. This is primarily due to the successes achieved with volitional passage in similar river systems in comparison to the risks associated with trap and haul; including the handling and transport of adult upstream migrants, in combination with the long term uncertainty of funding, maintenance and operation of trap and haul programs (National Marine Fisheries Service 2004). Volitional ladders have been accepted as effective and appropriate fishways, whereas trap-and-haul methods are generally considered when ladders are not technically feasible, desirable, or management goals include trapping anyway (National Marine Fisheries Service 2004a). There are numerous examples of successful introductions or reintroductions of anadromous salmonids using ladders (Blackett 1981; Bryant et al. 1999; Wright et al. 1997).

PacifiCorp (2006, page 67) states that their trap-and-haul Alternative would include collection, sorting, inspection for tags, and provisions for fish marking, and thus would help meet the monitoring and assessment needs associated with the reintroduction program.

The Services' Prescription includes 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. PIT or similar technology is being used increasingly on the Columbia River system for management (Burke and Jepson 2006). This technology has several advantages over radio telemetry and it is critical to representative stocks of fish PIT tagged as juveniles to understand the consequences of hydropower decisions and provide information to manage anadromous populations (Mundy 1994; Burke and Jepson 2006).

PacifiCorp acknowledges the FERC staff conclusion in the DEIS that anadromous fish restoration through access to habitat within the Project area is largely within PacifiCorp's control. (Addendum, at 9, citing DEIS at 5-37). The Services agree with this assessment.

Comments Related to Disease Issues

PacifiCorp (2006, page 74) states that "the available spring Chinook stock in the lower river is known to have been exposed to IHN disease, which could seriously affect the native trout population in UKL." PacifiCorp (2006, page 88) states that "PacifiCorp's Alternative, which includes an adaptive program for reintroducing anadromous fish (Attachment A), would be able to address concerns about the introduction of fish diseases to upper Klamath basin. The Services' volitional fishway Prescription would potentially allow disease organisms found in lower river fish to be introduced into the upper basin, thereby potentially causing significant losses of native fish, such as redband trout, as well as added losses of anadromous fish for which the facilities are intended." PacifiCorp (2006, page 76) states that "[T]he alternative to collecting adults at Iron Gate Dam in the early years of the reintroduction program would be to transfer only eyed eggs or fry to the upper basin for release in areas expected to support juvenile rearing. In this way the eggs and/or fry could be certified as disease-free."

The disease issues were fully addressed in the ALJ hearing process. The ALJ found based on the evidence that many pathogens are already present in the upper and lower Klamath Basin (ALJ Decision at 20, FOF 2B-2; ALJ Decision at 21, FOF 2B-10; ALJ Decision at 22, FOF 2B-11 and 2B-17), and thus concluded that migration of anadromous fish would not be a significant factor contributing to disease in resident fish (ALJ Decision at 23, FOF 2B-22). He further found that there is insufficient evidence to determine whether IHN exists in either the lower or upper basin of the Klamath River (ALJ Decision at 21, FOF 2B-4 and 2B-5). The record evidence indicates that the existence of the virus IHN in the Klamath River system is "exceedingly rare." (ALJ Decision at 20, FOF 2B-3). Moreover, to date, there has been no research or studies completed concerning the actual occurrence of IHN in the upper basin of the Klamath River (ALJ Decision at 21, FOF 2B-4). The ALJ concluded that any suggestion that IHN exists in either the lower or upper Klamath Basin would be mere speculation (ALJ Decision at 62), and that facilitating the movement of anadromous fish through the prescribed fishways presents a relatively low risk of introducing pathogens to resident fish above Iron Gate Dam (ALJ Decision at 85, UFOF 4).

In the Addendum, PacifiCorp states its agreement with a statement in the DEIS that "disease related mortality to anadromous fish within the Klamath basin may have significant impacts on anadromous fish restoration efforts." (Addendum at 44, citing DEIS at 5-38). PacifiCorp goes on to note FERC staff's observation that "neither the Services' joint preliminary prescriptions nor PacifiCorp's April 25, 2006 Alternative sufficiently addresses disease issues in the lower river migratory corridor." (Addendum at 44). As PacifiCorp notes, much of the Commission staff's analysis and conclusions conflict with much of the testimony of the Federal and state fisheries agencies, the Tribes and the Conservation and Fisheries Group during the ALJ hearing process and with the subsequent findings of the ALJ. (Addendum at 45). The Services addressed this issue in their comments on the DEIS (see, for example, the Department of the Interior's DEIS comments at 23, stating that staff's conclusions are overstated and incorrect, and at page 25, expressing concerns with FERC staff's suggested development of a disease monitoring and management plan).

Comments Concerning Introgression

PacifiCorp (2006, page 88) states that "PacifiCorp's Alternative would not allow coastal-lineage steelhead trout to ascend above Iron Gate Dam without assurances that inbreeding with the upper basin interior lineage redband trout could be prevented. The Services' Prescription has no provision for the major concern of genetic introgression between coastal and redband trout."

The issue of introgression was fully addressed in the ALJ hearing process. The ALJ found that "[f]acilitating the movement of wild anadromous steelhead trout above Iron Gate Dam via prescribed fishways presents a low risk of residualization (a phenomenon most common among hatchery steelhead trout)." (ALJ Decision at 86, Ultimate Finding of Fact 5). During the hearing, PacifiCorp's sole witness on this issue conceded that the residualization of steelhead is not really an issue of concern. (ALJ Decision at 61, citing *PAC-Ols-R-1*). The ALJ noted that the issue of concern to PacifiCorp and Siskiyou County is the genetic effects on the resident trout. (ALJ Decsion at 61-62, citing *PAC-Ols-R-1*). He found it to be undisputed that resident trout have the genetic capacity to adopt anadromy and outmigrate to the ocean, where passage exists. (ALJ Decision at 62, citing Finding of Fact 2C-7). The ALJ noted that, historically, anadromous steelhead trout extended up to and used tributaries of Upper Klamath Lake. (ALJ Decision at 62, citing Findings of Fact 2A-3, 2A-5, and 2C-2).

In the Addendum, PacifiCorp asserts that its proposed Fisheries Technical Committee would provide necessary adaptive management to address potential problems with genetic introgression between coastal and redband trout, and claims that the Services' Prescriptions do not have a similar provision. (Addendum, at 46-7). This statement ignores the provision in the Services' Prescription for the upstream fishway at Iron Gate Dam, which includes the language: "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." These features will allow fishery managers to sort fish and to manage as necessary to deal with the types of potential problems raised by PacifiCorp.

Comments Concerning the Availability of Donor Stock

PacifiCorp (2006, page 76) states that there is not suitable donor stock of steelhead from within the basin that could adapt to the unique environmental conditions in the upper basin.

This issue was fully addressed in the ALJ hearing process. The ALJ found that "[s]tocks of anadromous fish suitable to conditions above Iron Gate Dam are available to use prescribed fishways." (ALJ Decision at 85, Ultimate Finding of Fact 3).

Comments concerning Additional Research and Monitoring Facilities and Operations

In the Addendum, PacifiCorp proposes to adopt certain elements of the Services' Preliminary Prescriptions. However, PacifiCorp then goes on to add that all of these prescribed facilities shall be studied by its consultants and that (following studies) a Fisheries Technical Committee (of unknown composition) shall have the authority to decide (by consensus) on whether to implement construction and operation of new facilities. This unnecessarily delays the design, construction, and operations timelines of needed facilities and improvements. Whether any facilities would be approved by consensus and whether the studies would provide reliable scientific information on which to base decisions remains unclear.

PacifiCorp proposes an extensive suite of multi-year studies aimed at tagging, tracking, monitoring, and managing the health and movements of adult and juvenile fish of different species. PacifiCorp proposes to use radio telemetry to determine the spawning locations of adult fall-run Chinook salmon, coho salmon, and steelhead. The effort and cost required to conduct all of the post-licensing studies proposed by PacifiCorp are considerable. Much of the study and tracking operations, as proposed by PacifiCorp, can be avoided through the Services' volitional fish passage strategies. Costs of these proposed studies, along with facilities necessary for juvenile and adult fish monitoring at numerous locations throughout the Project habitat, are not clearly enumerated.

As discussed in Section 3 of this document, and in this section, PacifiCorp's Alternative was fully considered in the Services' analysis and development of the Modified Prescriptions. In addition, PacifiCorp's Addendum was fully considered as new information in the Services' analysis and development of the Modified Prescriptions.

PacifiCorp Comments Dated December 29, 2006

In their December 29, 2006, filing titled *Response to Comments and Documents submitted by Stakeholders on the FERC DEIS related to Fish Passage Water Quality, Instream Flows, and Ramping Rates*, PacifiCorp provided the Services with comments on *other parties'* comments to the FERC DEIS. (PacifiCorp DEIS Response Comments). The Services note that such a category of document is not specifically recognized in the FERC regulations or the Services' joint regulations implementing the EPAct amendments to the FPA, and these comments do not appear to have been timely filed as comments on the DEIS. Nevertheless, in the time available, the Services have reviewed these comments and have considered any relevant evidence and supporting material provided therein.[17]

[17] With respect to the December 29, 2006, document, the Services respond here only to substantive comments and evidentiary claims relevant to the Services' exercise of mandatory authority to prescribe fishways under FPA Section 18 (*i.e.,* Section II of the document). The material relating instead to the Services' recommendations for instream flows and ramping rates (*i.e.,* Section III of the document) are not at issue in development of the Modified Fishway Prescriptions.

On page 4 of its DEIS Response Comments, PacifiCorp mischaracterizes NMFS' goals and objectives for the Preliminary Prescriptions in several places. The Services' goals and objectives are described in detail on pages A-7 to A-12 of NMFS' Preliminary Prescriptions, and pages C-2 through C-6 of the Service's Preliminary Prescriptions. While the Services' goals are consistent with the Klamath River Basin Fisheries Task Force Long Range Plan (LRP), they encompass a much broader scope than PacifiCorp's simplified suggestion. Further, as discussed in greater detail in Section 1 above, the goal to establish and maintain self-sustaining anadromous fish runs in the Upper Klamath River Basin, while a key part of the region's overall, long-term management objectives, is not the immediate objective of these Prescriptions. Consistent with the focus of Section 18 of the Federal Power Act, the Services' emphasis in this proceeding is to address the impacts of the Project and expand access to historical and currently suitable habitat above Iron Gate Dam.

On page 5, PacifiCorp states "NMFS … fails to reconcile its viewpoint on the high delayed mortality rates of trap-and-haul with its approval and inclusion of a trap-and-haul system in the preliminary prescriptions for use at Keno and Link dams during periods of high water temperatures to increase survival of fish to the upper basin."

Again, at page 8, PacifiCorp states:

> NMFS's DEIS comments also note that trapping and hauling fish when stream temperatures exceed 68^{o}F may result in unacceptable mortality rates. *See* NMFS DEIS comments at 63. However, this statement contradicts the use of trap-and-haul in NMFS's proposed prescriptions. The proposed prescriptions require trap-and-haul of both juveniles and adults arriving at Link and Keno Dam from late June through early October when stream temperatures exceed this threshold temperature value.

The Services do not agree with these statements. In general, the Services prescribe volitional passage as the most effective method for re-establishing fish passage across dams in the Project. However, there are instances where trap-and-haul may be the only viable option for a particular site, as specifically noted in NMFS' Anadromous Salmonid Passage Facility Guidelines and Criteria (NMFS 2004). In their Preliminary and Modified Prescriptions, the Services include an interim, seasonal trap-and-haul operation between Keno and Link dams to address an isolated, seasonal, possibly temporary water quality condition that occurs only in some water year types and impacts only certain species. Flow rate changes and restoration programs in the Klamath River are expected to improve water quality conditions in this reach in the future and render the interim measure unnecessary.

The Services' rationale for this measure states at A-66, C-61:

> 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 20°C 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).

Although not specified, the Applicant apparently refers to fall-run Chinook salmon which may be up-migrating during October, when water quality may be sub-optimal (on a temporary basis until water quality can be improved). It is to their advantage for fall-run fish to enter the system and proceed as far upstream as possible, and it is well-known that these fish will hold in the lower parts of California river systems until conditions improve. The intent of the prescription is to provide passage past Keno Reservoir and Lake Ewauna as soon as fish are present below Keno Dam. The Services consider that this seasonal trap and haul would occur during those instances when water quality is marginally tolerable for Chinook salmon below Keno Dam, but water quality is less tolerable in Keno Reservoir and Lake Ewauna. For example, Keno Dam may add enough oxygen to the tailwater so that concentrations become tolerable. In this manner, the prescription provides for the opportunity for the fish to "decide" when they prefer to up-migrate. This limited trap-and-haul approach conserves the expression of the early-run phenotype, which may be important to the health of the genome.

PacifiCorp is unclear regarding which juveniles may be affected; however, its Alternative states that juvenile salmon would not be present above J.C. Boyle during the referenced time period (PacifiCorp 2006):

> At J.C. Boyle Dam, water temperatures during March and April, when juvenile salmon would be expected to arrive at the dam, would be suitable (42°C) for sorting and tagging.

Apparently PacifiCorp has confused anadromous salmonid temperature tolerances with other species which can tolerate higher temperatures. As the above quotes provide, the year-round operation of volitional fishways provides for passage of resident salmonids, suckers, and other species which may have broader temperature tolerances than adult Chinook.

Trap-and-haul at all dams would expose fish to higher levels of handling stress and mortality during these marginal periods, as well as during better water quality conditions. While the Services generally require volitional passage, this interim measure to handle this specific, limited situation is a reasonable approach given the specific conditions.

On pages 7 and 8, PacifiCorp refers to KlamRAS results in an effort to establish that the Services' comments regarding fish passage are not supported by existing scientific studies. PacifiCorp cites "KlamRAS Methods for Fish Passage Simulations on the Klamath River" as containing KlamRAS results. These results are not found in the cited document, but in a different document entitled "KlamRAS Results for Fish Passage Simulations on the Klamath River." PacifiCorp's discussion of KlamRAS results is highly selective: PacifiCorp does not report KlamRAS results that favor volitional passage over trap-and-haul methods. With respect to the results PacifiCorp does cite, it is doubtful 8 and 2 percentage point differences are large enough to be meaningful.

KlamRAS is not a scientific study. It is a numerical model that has not been calibrated against actual field results. It applies to one species only and results are not valid for spring run Chinook, steelhead, or lamprey. It does not account for a myriad of biological parameters important to fish passage, such as benefits to population viability for ESA listed species.

PacifiCorp's December 29, 2006, Response to NEPA Comments has been fully considered in the Services' analysis and development of the Modified Prescriptions.

Comments by Stakeholders other than PacifiCorp that concern the Preliminary Fishway Prescriptions.

The Services considered several types of documents falling within this category, to include comments filed directly with the Commission that relate to the Preliminary Fishway Prescriptions or PacifiCorp's Alternative; comments filed with FERC responding to the DEIS that relate to the Preliminary Fishway Prescriptions or PacifiCorp's Alternative (PacifiCorp dated its Addendum the same day as the close of the comment period on the DEIS); and comments filed directly with the Services that relate to the Preliminary Fishway Prescriptions, PacifiCorp's Alternative and/or PacifiCorp's Addendum.

The Services reviewed documents filed with FERC, as listed on the FERC Online eLibrary for the Klamath Project, for the period between the filing of the Preliminary Prescriptions in March 2006 and December 1, 2006, the close of the comment period on

the DEIS. A keyword search was conducted on the filings submitted during this period, and most were determined not to relate to the Preliminary Fishway Prescriptions or PacifiCorp's Alternative and thus were not further considered.[18] Eleven comments (excluding those filed by PacifiCorp which are discussed separately, above) reviewed were found to contain comments inconsistent with the Preliminary Prescriptions, but only one was determined to raise substantive issues. This comment, a DEIS comment from the City of Yreka, is discussed below. Comments filed directly with the Commission that were consistent with the Preliminary Prescriptions were reviewed but are not discussed further here. Below, we address the City of Yreka's comments to the Commission on the DEIS and comments filed specifically with the Services that address the Preliminary Fishway Prescriptions, the Alternative and/or the Addendum.

City of Yreka

In comments submitted November 29, 2006, to the Commission in response to the DEIS for the Klamath Project, the City of Yreka concurs with the FERC staff analysis regarding the installation of fish ladders at the Fall Creek Diversion Dam (citing to pages 2-18 and 3-276 of the DEIS). The City states that the fishway prescription seems inappropriate and of very limited value to the fishery since it serves only a limited stream reach accessible to resident fish and makes negligible contribution to improving either water quality or fishery habitat. This information was fully considered by the Services in the analysis and development of the Modified Prescriptions.

Comments of the Hoopa Valley Tribe

By letter dated November 29, 2006, the Hoopa Valley Tribe submitted Comments on PacifiCorp's Proposed Alternative to NMFS and the Service, which request that the Services reject PacifiCorp's less protective alternative and adopt the volitional fishway prescriptions as the final prescriptions. The Tribe notes that PacifiCorp raised many of the arguments supporting its Alternative in the ALJ hearing, but failed to prove its case on each issue, including stock suitability, water temperature, habitat needs, juvenile migration survival, disease introduction, and impacts on coho. The Tribe asserts that PacifiCorp's alternative relies on flawed data, science, and analysis. The Tribe further comments that trap-and-haul is not as protective as volitional passage, citing NMFS policy disfavoring the use of trap-and-haul due to concerns with trap rejection; ineffective diversion of fish into traps; intensive operation and maintenance costs; extensive fish handling, resulting in significant fish stress, injury and mortality; poor downstream passage; and evidence from other river systems that shows significant limitations of trap-and-haul as a means to pass fish. The Tribe further faults PacifiCorp's proposal for

[18] Documentation of the FERC eLibrary listing of filings during the relevant time period, a memorandum explaining the search action conducted by the Services, and a spreadsheet detailing the results of the keyword search are included in the Services' Supplemental Administrative Record, under the following headings: FERC eLibrary Listing of Filings in the Klamath Project proceeding; Theiss, Eric. Memorandum Synthesis of Comments Pertaining to Klamath River Hydroelectric Project Section 18 Fishways Prescription Alternatives Analysis; and Table: Alternatives Analysis: Comment Synthesis Details.

failing to recognize the varying needs and life histories of the different species targeted for reintroduction, including Pacific lamprey and steelhead, and for bypassing suitable habitat within the Project area. Noting that the alternative does not address the water quality concerns in Lake Ewauna, the Tribe asserts that this failure is another aspect in which the Alternative is less protective than the fishway prescriptions. The Tribe further faults PacifiCorp for selective reliance on EDT and KLAMRAS modeling data. This information was fully considered by the Services in the analysis and development of the Modified Prescriptions.

On December 12, 2006, the Hoopa Valley Tribe submitted additional Comments to NMFS and the Service, on PacifiCorp's December 1, 2006, Addendum, urging the Services not to consider the Addendum as an alternative, as it was not timely submitted, but instead to consider it as "evidence and supporting material" in accordance with the Services' regulations. The Tribe faults PacifiCorp's proposal in several ways, including its failure to provide for restoration of fish to the Upper Klamath Basin; its inappropriate reliance on passage survival rates to compare trap-and-haul with volitional passage, which ignores delayed mortality resulting from trap-and-haul; and its failure to indicate how it would return fish to the correct spawning grounds. This information was fully considered by the Services in the analysis and development of the Modified Prescriptions.

Comments of Oregon Department of Fish and Wildlife

By letter dated December 1, 2006, the Oregon Department of Fish and Wildlife (ODFW) provided comments to NMFS and the Service on PacifiCorp's Fish Passage Alternative. ODFW expresses the view that PacifiCorp failed to explain why its trap-and-haul proposal was favorable to the Preliminary Fishway Prescriptions. ODFW further expresses its support for the Services' volitional prescriptions, based in large part on Oregon statutory and management direction to restore passage and natural flow conditions, to provide upstream and downstream passage for native migratory fish (including anadromous and resident fish species), and to install screening or bypass devices. ODFW faults PacifiCorp's Alternative, finding it unclear on the methods for proposed introduction, lacking support or description of the passage conditions, lacking connectivity between Project reaches needed by both anadromous and resident species, lacking direct mitigation for Project impacts, and states that PacifiCorp's studies are lacking in credibility. The Alternative would bypass many miles of suitable habitat and tributaries within the Project boundary, and would present risks of handling and transport and other noted problems with trap-and-haul (including trap rejection, extensive fish handling, system disruption, higher risk of disease and crowding, water temperature effects, and delayed adult mortality). This information was fully considered by the Services in the analysis and development of the Modified Prescriptions.

Comments of Conservation and Fisheries Groups

On January 12, 2007, the Conservation and Fisheries Groups (American Rivers, California Trout, Friends of the River, Institute for Fisheries Resources, Klamath Forest Alliance, National Center for Conservation Science and Policy, Northcoast Environmental Center, Oregon Wild, Pacific Coast Federation of Fishermen's Associations, Salmon River Restoration Council, Trout Unlimited, Water Watch of Oregon) submitted comments to NMFS and the Service on PacifiCorp's Alternative and its December 1, 2006, Addendum, urging the Services to reject the alternative and the Addendum as the alternative fails to meet the "no less protective" standard set forth in section 33 of the FPA, and that the Services adopt the Preliminary Prescriptions. The Conservation and Fisheries Group note that many of the most important facts relied on by PacifiCorp to support its alternative conflict with the Findings of Fact from the ALJ Decision and that other assertions are unsupported by the scientific evidence in the record. The Conservation and Fisheries Group attach Comments from Rick Williams, PhD, that fault PacifiCorp's trap-and-haul alternative for its reliance on management actions that are primarily technological in nature, and which ignore issues of natural timing, biological diversity and fish behavior. Such technologically-based actions have often in the past resulted in unanticipated adverse biological effects on the target species. Dr. Williams' comments include an examination of recent efforts on the Columbia River system, and results showing increased survival for wild fish that migrated in-river, as opposed to those transported in a barge system. He states that transported fish showed decreased homing ability, increased rates of straying, increased fallback at dams, and increased unaccounted losses during adult return migration. Dr. Williams states that dam removal is the preferred choice, with volitional passage an acceptable alternative choice; he states that trap-and-haul is the least desirable choice and one likely to result in lowered performance by individual stocks and the possibility of unexpected adverse results. This information was fully considered by the Services in the analysis and development of the Modified Prescriptions.

Comments of the Yurok Tribe

By letter dated January 16, 2007, the Yurok Tribe submitted Comments on PacifiCorp's Addendum and Modifications to PacifiCorp's Proposed Alternative Section 18 Prescriptions and Section 4(e) Conditions for the Klamath Hydroelectric Project to NMFS, the Service and to the Commission. In its comments, the Yurok Tribe urges the Services to reject the modifications submitted in PacifiCorp's Addendum as untimely and in conflict with the regulations guiding the alternative prescriptions process. The Yurok Tribe notes that PacifiCorp's filings conflict with the Findings of the ALJ and with the weight of scientific evidence considered in the ALJ hearing process. The Yurok Tribe faults PacifiCorp for failing to provide scientific evidence supporting its claim that its alternative would be no less protective to fish than the Services' Fishway Prescriptions. The Yurok Tribe further faults PacifiCorp's hatchery production proposal for failing to address mortality of species other than fall Chinook. The Yurok Tribe states trap-and-haul is extremely stressful to adult anadromous fish, causing immediate and delayed mortality as well as sub-lethal effects that will increase mortality. The Yurok Tribe includes with its comments a report by Steward and Associates, entitled "Assessment of

Volitional and Non-Volitional Fish Passage Systems Relative to the Klamath River Hydroelectric Project," which compares and focuses on the ecological impacts of volitional fish passage and trap-and-haul systems. This report examines issues for upstream passage including: collection efficiency, passage success through ladders and reservoirs, selective transport by species and stream of origin, transportation stress for adult fish, and the use of transport in unique circumstances for adult salmonids; an examination of passage options, collection efficiency, and transportation stress for adult anadromous lamprey; and passage efficiency and sorting requirements for resident fish. For downstream passage, the report examines collection efficiency, reservoir impacts, transportation effects on homing, stress effects of collection and transport, transportation effects on survival on juvenile anadromous salmonids; steelhead kelts; juvenile lamprey; and resident fish. This information was fully considered by the Services in the analysis and development of the Modified Prescriptions.

Section 5. Reservation of Authority to Prescribe Fishways

The Services have prepared their Modified Prescriptions for Fishways in response to the proposals under consideration by the Commission in this proceeding, comments received by the Services and by the Commission relating to the Preliminary Fishway Prescriptions, and after full consideration of the Alternative submitted under section 33 of the FPA. If any of the underlying proposals for licensing of the Project are modified prior to licensing, as a result of licensing, or during the term of the new license, then the Services will require adequate opportunity to reconsider each prescription and make modifications deemed appropriate and necessary for submittal to the Commission.

In their Preliminary Prescriptions, the Services submitted for Commission inclusion in any new license issued for the Project, separate conditions reserving their respective section 18 authority. The discussions underlying those reservations of authority are hereby incorporated by reference. At this time and for purposes of the Modified Prescriptions, the Services file this joint Modified Reservation of Authority for the Commission to include in any new license issued for the Project:

> Authority is reserved for the Services to prescribe the construction, operation, and maintenance of additional or modified fishways at the Klamath River Hydroelectric Project, Project No. 2082, as appropriate, including measures to determine, ensure, and 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, resident trout, 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 Services to prescribe an upstream fishway to sucker criteria at Keno Dam pending the evaluation of the need for such a fishway. The Services are 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.

The preamble to the Joint Regulations implementing the EPAct states that "license parties cannot request a hearing regarding the reservation of authority itself, or submit alternatives to such reservation." 70 Fed. Reg. 69804, 69808 (November 17, 2005). In its Alternative submittal to the Services, PacifiCorp did not submit an alternative to the reservation of section 18 authority but did raise legal arguments relating to the Services' reservations of authority. PacifiCorp asserts that the Services' "broad reservation of authority would vitiate the due process rights conferred by Congress and contravene the plain language of the ...." EPAct. (PacifiCorp 2006 at 11). As noted in the preliminary prescription filing, the Services' reservation of authority has been accepted by the Commission and judicially affirmed. *Wisconsin Public Service Corp.,* 62 FERC ¶61,905 (1993), *aff'd, Wisconsin Public Service Corporation v. FERC*, 32 F.3d 1165 (7th Cir. 1994). As recognized recently by the Commission with respect to a reservation of the Department's section 4(e) authority, "[a] reservation of authority is a well-recognized means of obtaining the licensee's consent to modifications that may be necessary during the term of the license." *Public Utility District No. 1 of Pend Oreille County, Washington,* 117 FERC ¶ 61,205 (2006) p. 32, para. 88. Both the Court of Appeals and FERC recognize that future exercise of the reserved authority would require notice and an opportunity for hearing. *Id., Wisconsin Public Service, 32 F.3d at 1170.* Moreover, the joint regulations implementing the EPAct further recognize that the hearing and alternatives process will be available if and when the Services exercise this reserved authority. 43 C.F.R. § 45.1(c); 50 C.F.R. § 221.1(c).

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ATTACHMENT 1

SECTION C

U.S. DEPARTMENT OF THE INTERIOR AND NATIONAL MARINE FISHERIES SERVICE MODIFIED PRESCRIPTIONS FOR FISHWAYS FOR THE KLAMATH HYDROELECTRIC PROJECT

These prescriptions for the Klamath Hydroelectric Project (FERC Project No. 2082; hereafter Project) include design specifications and implementation schedules, operating requirements and procedures, and specifications for post-installation implementation, evaluation, and maintenance. The U.S. Fish and Wildlife Service (Service) and National Marine Fisheries Service (NMFS) (collectively the Services) have carefully reviewed these modified 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 the California Department of Fish and Game (CDFG), the Oregon Department of Fish and Wildlife (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 2004). 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 modified 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.

Throughout the document, each Modified Prescription is preceded by its supporting rationale. This convention and the numbering system are consistent with the organization of the Preliminary Prescriptions and are provided for ease in comparing the two documents.

The Services' Modified Prescriptions are based upon consideration of the available evidence, including comments received on the preliminary prescriptions and in response to the Commission's draft NEPA analysis, the ALJ's decision and supporting record in the Klamath Project trial-type hearing under Section 18 of the Federal Power Act, as amended by the Energy Policy Act of 2005, and the Applicant's proposed alternative submitted pursuant to section 33 of the Federal Power Act. As explained more fully in the main document, the Services also considered as new information, to the extent it presented "evidence and supporting material" as

provided in the Departments' joint regulations,[1] the December 1, 2006 Addendum submitted by the Applicant. The Addendum was not considered as a new alternative under FPA Section 33, because it was submitted beyond the applicable regulatory deadline. *See* 43 C.F.R. § 45.71(a)(2); 50 C.F.R. § 221.71(a)(2).

Rationale for Modified General 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 the type of design review procedure required by this prescription to be instituted for any fishway plans proposed by the Licensee. This is particularly true where Federal and State oversight is provided 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: As explained in greater detail below in the rationale for modified specific 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 passage. For example, adult fish migrating upstream via a fish ladder 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: The Services prescribe the development of design and construction plans to ensure that the developed fishways are approved by the Services to meet the requirements of providing safe, timely, and effective passage. Review by the FTS will ensure that the most effective designs are adopted and implemented. The phased schedule ensures that fishways are installed to meet the needs of the fish and avoid injury or mortality to fallback fish.

Access to Developments and Records: Reasonable access to developments and Project records is necessary so that Agency personnel will be able to evaluate fishway performance, inspect fishway facilities, and help to optimize facility performance.

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

[1] See 43 C.F.R. § 45.73(a) (DOI); 50 C.F.R. § 221.73(a) (DOC).

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 2004). 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 passage 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 2004).

Operation, Inspection, and Maintenance Plans: 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 2004). 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 affected Tribes) for immediate inspection to ensure proper implementation of and compliance with fishway operation and maintenance conditions. The required plan will include these necessary elements to ensure that operation, inspection, and maintenance are planned and approved by the Services.

Fishway Evaluation and Modification Plans: It is important that the Licensee complete Fishway Evaluation and Modification Plans (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: 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: Minimizing excessive migration delays during spawning runs is an important objective in the design of upstream fishways for anadromous fish. Should excessive delays occur in their journey to find suitable spawning habitats, reproductive failures may result. This is because anadromous fish have evolved with finite energy reserves during spawning migrations to complete their reproductive cycle. Upstream fishways and their bypass reaches must be designed and operated so as to facilitate safe, timely, and effective fish passage, including the minimization of excessive migration delays. The concept of attraction flow for fishway designs is central to this theme, and is further explained below.

The definition of a "fishway" includes "*…project operations and measures related to [and]…necessary to ensure the effectiveness of [the]…structures, facilities or devices..."* that constitute the fishway.[2] The Services interpret this definitional phrase to include sufficient flow regimes that will consistently attract migrating fish into the fishway entrances and bypass reaches without excessive delay. In other words, these flows are related to and necessary to ensure the effectiveness of the structures, facilities, or devices for fish. Such flows, in fish passage terms, are here generically referred to as "attraction flows."

Failure to provide the necessary attraction flows at key locations could result in significant migration delay, or failure of fish to find the fishway entrances. Thus, these attraction flows are "*…project operations and measures related to [and]…necessary to ensure the effectiveness of [the]…structures, facilities or devices..."* that constitute the fishway.

Attraction Flow for Bypass Reaches

When adult anadromous fish approach the confluence of an extended fish passage bypass reach with a powerhouse discharge, they will frequently explore the powerhouse outflow because it is usually flowing with greater water volume. However, fish will choose to swim up the bypass reach if they can sense a jet of higher velocity flow originating from the adjacent stream. The hydraulic conditions of this high velocity jet are critical cues to migrating fish looking for a path upstream (Ferguson et al. 2005). Therefore, where Project facilities include extended bypass reaches, fishway engineers must not only create the hydraulic conditions needed to attract fish into the fishway entrance pools; but they must also ensure that flows and hydraulic conditions are sufficient to attract fish at the point of confluence between the bypass reaches and downstream powerhouse discharges.

[2] National Energy Policy Act of 1992, P.L. No. 102-486, section 1701(b) "...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."

Attraction Flow at Fishway Entrances

Once at a dam, adult anadromous fish search across the downstream face looking for passage routes. Entrance preferences are for deep/wide openings with significant attraction flow. Fish may be particularly attracted to the large volumes of flow and high velocities associated with tailrace discharges and spillways, typically causing false attraction and migration delay. To counter this tendency for false attraction, a correctly designed fishway entrance must produce a significant percentage of total stream flow combined with the correct hydraulic characteristics; such that it is capable of attracting fish into the relatively lesser flow emanating from a fishway entrance (Ferguson et al. 2005).

Experience with other fish facilities often shows that lack of adequate attraction flow can limit fish passage effectiveness because migrating fish have difficulty detecting the correct route to swim upstream. Providing enough attraction flow and correct hydraulic conditions at key attraction points is critical to the success of any fishway system design (National Marine Fisheries Service 2004). However, water allocated for attraction flow is typically unavailable for electricity generation.

The Services recognize the competing interests for available flows at each of the Licensee's Klamath hydropower developments. The Services further recognize the need to achieve an optimal flow allocation such that safe, timely, and effective fish passage is consistently achieved, while at the same time preserving as much flow as possible for hydropower generation. While the Services provide some guidelines for fishway design in corresponding project-specific sections below, flow optimization functions can only be derived from a detailed analysis during the design process and through post-construction facility evaluations. Therefore, all fishways must have the capacity to deliver ample water to consistently provide safe, timely, and effective fish passage. The licensee may commission further scientific studies to demonstrate optimal allocations of flows for specific fishways during fish migrations, specifically including flows at the confluences of bypass reaches and hydro-turbine discharges. Optimization means scientifically determining a combination of attraction flows through the fishways and bypass reaches that consistently produce fish passage efficiencies equivalent to full attraction flow releases, according to the design guidelines given for each individual project. All post-construction flow optimization studies for fishway and bypass attraction flow performance shall be conducted consistent with the Modified General Prescriptions below.

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 in a safe, timely, and effective manner.

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 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, timely, and effective 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 and site conditions may require that these design streamflows be modified for a particular site (National Marine Fisheries Service 2004).

Modified General Prescriptions:

The following modified general prescriptions for fishways apply to each of the Services' specific prescriptions for the construction, operation, and maintenance of upstream and downstream fishways at the Project. These modified prescriptions are intended 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, 2004). The Licensee, or their authorized and qualified agent(s),[3] shall have all designs reviewed by the Fisheries Technical Subcommittee (FTS) (which is to be established by the Services and comprised of engineers, biologists, and other fish passage specialists). The Licensee and its agents must establish close consultation with the Services' 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 Licensee must obtain concurrence from the Services with all preferred alternatives for each independent facility, or any major feature of a facility. The Licensee shall 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 to review and approve 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.

[3] "Authorized agents" will typically be qualified engineering and/or biological consulting firms who specialize in this area of work.

1.1.2. *Access to Developments and Records*: The Licensee shall provide timely site access to the Services, CDFG, ODFW, and affected Tribes 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 fish 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 action in a timely manner and in a manner satisfactory to NMFS-Engineering and the Service. 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.

1.1.4. *Fishway Operation, Inspection, and Maintenance Plans*: The Licensee shall, in consultation with the Services, affected Tribes, CDFG, and ODFW, develop fishway operation, inspection, and maintenance plans 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 at the same time as 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 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 to the Services on the monitoring and evaluation of the developments annually for the term of the new license. Specifically, the plans shall 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; and an implementation schedule. 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 the Services to review the evaluation plans. The Licensee shall fund and implement the approved plans and any plan modifications, and operational or physical changes necessary for the safe, effective, and timely passage of fish as may be required by the Services. After approval by the Services, the Licensee shall file these plans 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 Services, CDFG, ODFW, and affected Tribes shall begin as soon as fishways are operational. 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. A 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 ODFW, CDFG, and 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 the 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 the Services' approval, the Licensee shall 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. After receiving the Services' approval, the Licensee shall submit each Annual Work Plan to the Commission.

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. If other mandatory license conditions or regulatory conditions

require greater flows, the Licensee shall provide attraction flows and design flows consistent with those greater flows.

A. Design Streamflow Range
In consultation with the FTS and the Services and according to the terms of Modified General Prescriptions applicable to facility designs, 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, in accordance with NMFS guidelines and criteria (National Marine Fisheries Service 2004), unless site-specific analysis conducted in consultation with the Services and results approved by the Services demonstrate a more suitable flow that meets the objectives of safe, timely, and effective fish passage.

B. Project-Specific Fishway Attraction Flows
Fishway attraction flow is the total amount of flow discharged from the fishway entrance pool at any given time. The Licensee shall design, construct, operate, maintain, and evaluate physical facilities for each upstream passage facility to produce attraction flow equal to at least 10 percent of High Fish Passage Design Flow determined in accordance with NMFS guidelines and criteria (National Marine Fisheries Service 2004), as measured at a point upstream of the hydropower diversion, unless site-specific analysis conducted in consultation with the Services and the results approved by the Services, demonstrate a more suitable flow that meets the objectives of safe, timely, and effective fish passage. After approval by the Services, the Licensee shall file with the Commission the results of any such site-specific analyses that demonstrate a more suitable flow that meets the objectives of safe, timely, and effective fish passage. During facility evaluations, the Licensee may alter or balance attraction flows 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. Bypass Channel Attraction Flows and Conditions
For the Copco II and J.C. Boyle bypass channels, the Licensee shall, in consultation with the Services, design, construct, operate, maintain, and evaluate physical structures, facilities, devices or channel modifications necessary to ensure that migrating anadromous fish are consistently attracted into the bypass reach without excessive delays, unless the Services determine based on site-specific evaluations that such physical facilities or channel modifications are unnecessary. The Licensee shall conduct engineering and biological analysis in consultation with the FTS and the Services during the facility design phase for Copco II and J.C. Boyle facilities, to determine the attraction flow and hydraulic conditions

at the point of confluence between the fishway bypass reach and the hydropower discharge. Based on these analyses, or other analyses of fishway effectiveness conducted under applicable prescriptions, the Licensee shall determine, in consultation with the Services, any physical facilities or channel modifications necessary to ensure that migrating anadromous fish are consistently attracted into the bypass reach without excessive delays.

Modified Specific Fishway Prescriptions for Klamath Hydroelectric Project Fishways

All modified general prescriptions above shall apply to the specific prescriptions below. The modified prescriptions for developments in the Project are summarized in Table 4.

In the Preliminary Prescriptions, the Services provided the rationale and scientific evidence providing the basis for the prescriptions. The Applicant subsequently submitted a request for hearing on disputed issues of material fact related to the preliminary prescriptions pursuant to the Federal Power Act as amended by the Energy Policy Act of 2005 (see 43 C.F.R. Part 41 and 50 C.F.R. Part 221), in which the Applicant disputed facts supporting the Services' prescriptions. After an evidentiary hearing that included direct written testimony, live cross-examination, some re-direct examination, and submission of thousands of pages of scientific studies and other evidence, the Administrative Law Judge (ALJ) in his decision made Preliminary and Ultimate Findings of Fact and Conclusions of Law, citing to the evidence submitted in the trial-type hearing process. The Modified Prescriptions incorporate by reference all of the scientific evidence cited by the Services in their preliminary prescriptions; in addition, the Services provide additional or revised discussions below in the Modified Specific Prescriptions that are based on relevant ALJ Findings, including short form citation to the relevant Findings. Where the Modified Specific Prescriptions reference the ALJ's Findings, the underlying citations to those Findings incorporate by reference supporting evidence and testimony developed in the hearing process. These citations offer further scientific support to the Services' prescriptions.

These prescriptions also conform to a stipulation reached in the trial-type hearing regarding spillway modifications and tailrace barriers.

1. Iron Gate Dam

Upstream Prescription Rationale: Historically coho salmon, steelhead, and spring-run and fall-run Chinook salmon (Hamilton et al. 2005; ALJ Decision at 12, FOF 2A-3 through 2A-6) 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 suitable habitat in perennial streams such as Fall and Jenny Creeks (ALJ Decision at 34, FOF 6-11; ALJ Decision at 35, FOF 7-9), intermittent streams such as Camp and Scotch Creeks (ALJ Decision at 12, FOF 2A-5; ALJ Decision at 34, FOF 6-14; ALJ Decision at 35, FOF 7-9), and the main stem (ALJ Decision at 33, FOF 6-10; ALJ Decision at 35, FOF 7-9). The goal of the Services and the Klamath River Basin Fisheries Task Force is to successfully restore anadromous salmonids to

their historical range and suitable habitat. A goal of the Service is to successfully restore resident fish to their historical range and suitable 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. These goals will be met with the provision of effective facilities, which will mitigate for the impacts of the dam. A holding, sorting, and counting facility is necessary to segregate and mark fish for management purposes. The 5 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Table 4. Summary of Modified 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[1]**	**Screens and Bypass**	**Spillway Modifica-tions[1]**	**Interim, Seasonal Trap and Haul**
Copco 2 Bedrock Sill	Salmonids (includes Resident trout), lamprey	2 yrs (Bypass Barrier/Impediment Elimination)	Not Applicable (NA)	NA	NA	NA
J.C. Boyle (Bypass)	Salmonids, lamprey	2 yrs (Bypass Barrier/Impediment Elimination)	NA	NA	NA	NA
Eastside	Salmonids, lamprey, suckers	BOR current facility	3 yrs[2]	3 yrs[3] (to sucker criteria)	NA	Seasonal downstream trapping and hauling for Chinook
Westside	Salmonids, lamprey, suckers	BOR current facility	3 yrs[2]	3 yrs[3] (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[4]	3 yrs	NA	NA
Spring Creek	Resident trout	3 yrs (0.5 ft/drop and ≤ 10% slope)	NA	3 yrs	NA	NA
Keno	Salmonids, lamprey	3 yrs (0.5 ft/drop and ≤ 10% slope)	NA	NA	3 yrs	Seasonal upstream trapping and hauling for Chinook
J.C. Boyle	Salmonids, lamprey	4 yrs (0.5 ft/drop and ≤ 10% slope)	4 yrs	4 yrs	4 yrs	NA
Iron Gate	Salmonids, lamprey	5 yrs (0.5 ft/drop and ≤ 10% slope)	NA	5 yrs	5 yrs	Modify existing trapping facility
Copco 2	Salmonids, lamprey	6 yrs (0.5 ft/drop and ≤ 10% slope)	8 yrs[4]	6 yrs	6 yrs	NA
Copco 1	Salmonids, lamprey	6 yrs (0.5 ft/drop and ≤ 10% slope)	8 yrs[4] (if adults in C2 pool)	6 yrs	6 yrs	NA

[1] As described in detail below, in accordance with a stipulation with the Applicant, the Services have revised the prescriptions for spillway modifications and tailrace barriers in the Modified Prescriptions to allow the Applicant to conduct site-specific studies on the need for and design of spillway modifications

[2]Study of impacts to and the potential design and construction of tailrace barrier is given priority due to the presence of federally listed suckers

[3] Screen and bypass system given priority due to the presence of federally listed suckers

[4]Timing of Tailrace Barrier design and construction deferred for study to determine optimal design

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 Iron Gate 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), access to habitat would benefit coho salmon by: a) extending the range and distribution of the species, thereby increasing the reproductive potential; b) increasing genetic diversity in the coho stocks; c) reducing the species vulnerability to the impacts of degradation; and d) increasing the abundance of the coho population (ALJ Decision at 86, Ultimate Finding of Fact 9; ALJ Decision at 36, FOF 7-16). National Research Council (National Research Council 2003) considered the amount of tributary habitat between Iron Gate Dam and the next barrier upstream to be substantial. Coho salmon were reported in Scotch Creek in 1950 (California Department of Fish and Game 2006) and 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). Little documentation is available for 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 likely 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 of the Preliminary Prescription, hereafter referred to as 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 again have access to this habitat. 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 gain access to habitat, including tributaries and the Copco 2 bypass reach (Table 3) between Iron Gate Dam and the next barrier upstream (Copco 2 Dam). Although the historical upstream distribution of Pacific lamprey is unknown, suitable habitat for spawning and juvenile rearing is available within tributaries and stream reaches in the Project area (ALJ Decision at 37, FOF 8-3). Access to habitat would benefit Pacific lamprey by increasing their viability through: a) extending the range and distribution of the species; b) providing additional spawning and rearing habitat; c) increasing the genetic diversity of the species; and d) increasing the abundance of the Pacific lamprey population (ALJ Decision at 38, FOF 8-9).
- 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 have also been reported in Scotch and Camp creeks (California Department of Fish and Game 2006). 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 including Scotch, Camp, and Fall Creeks (ALJ Decision at 12, FOF 2A-5) as well as Slide and Jenny creeks. Seasonal migration of steelhead and access to refugial areas would be restored.

Downstream Prescription Rationale: Downstream fishways as modified herein 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, salmon and steelhead would return to hold, spawn, and rear in habitat where they were present historically (Hamilton et al. 2005, ALJ Decision at 12, FOF 2A-3 through 2A-6; ALJ Decision at 14, FOF 2A-12). However, the progeny of these fish must negotiate not only the reservoir but the dam, powerhouse, and spillway during their outmigration. Migration is one of several defining life history characteristics of resident trout and anadromous fish, especially salmonids (ALJ Decision at 27, FOF 3-7; ALJ Decision at 13, FOF 2A-10). 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. 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). It is estimated that "several tens of thousands of resident fish" are annually entrained at "each of the Projects" facilities (ALJ Decision at 28, FOF 4-2). It is anticipated that annual entrainment of anadromous fish would be on the same order of magnitude, if not greater. Once entrained, the fish face a high risk of mortality. For juvenile fish, the risk is between 10 to 30 percent (ALJ Decision at 29, FOF 4-5). 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 5 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

Spillway Prescription Rationale: Spill survival estimates for salmonids are numerous and range from 76 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 (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 on the Columbia River (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, a 5 year timeline is necessary to meet resource goals and objectives as quickly as possible.

In the Preliminary Prescriptions, the Services based specific spillway prescriptions on the evidence cited above. In its request for hearing on disputed issues of material fact, the Applicant disputed facts supporting the spillway prescriptions. The Applicant subsequently withdrew its request for hearing regarding spillway prescriptions based on a stipulation with the Services (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number 2006-NMFS-0001, Order Granting the Applicant's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). In accordance with the stipulation, the Services have revised the spillway prescriptions in the Modified Prescriptions below to allow the Applicant to study the need for and design of spillway modifications for anadromous and native resident fish. The Applicant must perform any such studies in consultation with the Services, and provide the results of any such studies to the Services for approval before design and construction of the spillway modifications in order to inform the need for and design of spillway modifications. However, unless and until such site-specific studies are done, the Services must rely on the available information in concluding that spillway modifications are necessary for the safe, timely, and effective fish passage where prescribed.

Tailrace Barrier: The Services have not prescribed the construction of tailrace barriers at Iron Gate Dam because anadromous and resident fish are currently present below the dam and the Services are aware of no reported problems with fish injury or delay during upstream migration to the hatchery.

Iron Gate Dam Upstream Fishway

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 2004) or alternative criteria for other species approved 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, or a suitable alternative source. The AWS shall be screened 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 suitable water quality and quantity to effectively attract fish. The fish ladder and AWS together must be designed to supply attraction flows according to the terms of Modified General Prescriptions 1.1.7. 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 in Preliminary Prescription herein referred to as 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 shall be constructed to current criteria for passage of Pacific lamprey and the existing ladder to the CDFG trap and holding tanks shall be modified to current criteria (Table 1) for lamprey passage and resident trout passage. 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 upstream migrating fish (or fish identified using similar technology). The Licensee shall develop design and construction plans according to the terms of Modified General Prescriptions 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 Modified 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 the Modified General Prescriptions 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 Modified General Prescriptions, above.

1.3 Iron Gate Spillway

1.3.1 Spillway Modification: Unless the Services determine based on site-specific studies that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 1.3.2 and 1.3.3, 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, Pacific lamprey, 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 Modification Studies: The Licensee may, in consultation with the Services, study the need for and design of hydraulically-engineered spillway modifications to improve volitional downstream fish passage at Iron Gate Dam for Chinook and coho salmon, steelhead trout, Pacific Lamprey, and redband trout. The Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and submit study results and recommendations on the need for and design of spillway modifications for review and approval by the Services consistent with the provisions for timing of the spillway design consultation under Modified Specific Prescriptions 1.3.3.

1.3.3 Spillway Design Consultation: Unless the Services determine based on site-specific studies that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 1.3.2, within 3 years of the issuance of the new license, the Licensee shall develop design and construction plans according to the terms of the Modified General

Prescriptions 1.1.1 above for review and approval by the Service and NMFS-Engineering.

1.3.4 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified 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 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 (but no bypass) 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 Services conclude 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). With the 5 cfs proposed for instream flows by the Applicant 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 to the powerhouse. Coots (1954; 1957; 1962) reported steelhead, coho, and Chinook salmon in Fall Creek downstream from the powerhouse. Depending on powerhouse operations, draft tube discharge velocities at Project facilities are between 3.4 and 10.4 feet per second (fps) (CH2MHill 2006); 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 2004). The 5 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

In the Preliminary Prescriptions, the Services based specific tailrace barrier prescriptions on the evidence cited above. In its request for hearing on disputed issues of material fact, the Applicant disputed facts supporting the tailrace barrier prescriptions. The Applicant subsequently withdrew its request for hearing regarding tailrace barrier prescriptions based on a stipulation with the Services (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number 2006-NMFS-0001, Order Granting the Applicant's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). In accordance with the stipulation, the Services have revised the tailrace barrier prescriptions in the Modified Prescriptions below to allow time for the Applicant to study the need for and design of tailrace barriers for anadromous and native resident fish. The Applicant must perform any such studies in consultation with the Services, and provide the results of any such studies to the Services for approval before design and construction of the tailrace barriers in order to inform the need for and design of tailrace barriers. However, unless and until such site-specific studies are done, the Services must rely on the available information in concluding that tailrace barriers are necessary for the safe, timely and effective upstream passage of fish at Fall Creek Diversion Dam.

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 NMFS criteria (National Marine Fisheries Service 2004) 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. 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 the Modified General Prescriptions 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 Modified 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. 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 the Modified General Prescriptions 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 Modified General Prescriptions, above.

2.3 Fall Creek Powerhouse Tailrace Barrier

2.3.1 Tailrace Barrier Construction: Unless the Services determine, based on site-specific studies, that a tailrace barrier is unnecessary in accordance with Modified Specific Prescriptions 2.3.2 and 2.3.3, the Licensee shall construct a tailrace barrier and guidance system at Fall Creek Powerhouse to provide for the safe and effective protection and guidance of Chinook salmon, coho salmon, steelhead, and redband trout away from the 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 Studies: The Licensee may, in consultation with the Services, study the need for and design of tailrace barriers to protect

upstream migrating Chinook salmon, coho salmon, steelhead, and redband trout at the Fall Creek Powerhouse. The Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and submit study results and recommendations on the need for and design of tailrace barriers for review and approval by the Services consistent with the provisions for timing of the tailrace barrier design under Modified Specific Prescriptions 2.3.3

2.3.3 Tailrace Barrier Design: Unless the Services determine based on site-specific studies that tailrace barriers are unnecessary in accordance with Modified Specific Prescriptions 2.3.2, the Licensee shall, within 3 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 the Modified General Prescriptions 1.1.1 above.

2.3.4 Tailrace Barrier Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified 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 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. 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 2004) 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. 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 the Modified General Prescriptions 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 Modified 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. 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 the Modified General Prescriptions 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 Modified General Prescriptions, above.

4. Copco 2 and Copco 1 Dams

Copco 2 and Copco 1 Upstream Prescription Rationale: Historically coho salmon, steelhead, and spring-run and fall-run Chinook salmon (Hamilton et al. 2005; ALJ Decision at 12, FOF 2A-3 through 2A-6) and resident trout migrated above the site of Copco 2 and Copco 1 dams to reach holding, spawning, incubation, and rearing habitat. Copco Dams are a barrier to this passage and thus to suitable habitat in Shovel Creek, a perennial stream (ALJ Decision at 34, FOF 6-11; ALJ Decision at 35, FOF 7-9), intermittent streams such as Beaver and Deer Creeks (ALJ Decision at 34, FOF 6-14; ALJ Decision at 35, FOF 7-9), habitat areas cooled by springs (thermal refugia) in the J.C. Boyle bypass (ALJ Decision at 33, FOF 6-10), and the main stem (ALJ Decision at 33, FOF 6-10; ALJ Decision at 35, FOF 7-9).

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 suitable habitat. The Service goal is to successfully restore resident fish to their historical range and suitable 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 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. Access to habitat within the Project would benefit coho salmon by: a) extending the range and distribution of the species thereby increasing the reproductive potential; b) increasing genetic diversity in the coho stocks; c) reducing the species vulnerability to the impacts of degradation; and d) increasing the abundance (ALJ Decision at 86, Ultimate Finding of Fact 9; ALJ Decision at 36, FOF 7-16). Between Copco 1 and Copco 2 Dams and the next barrier upstream (J.C. Boyle Dam), coho salmon would have access to suitable habitat, including the J.C Boyle peaking and bypass reaches of the Klamath River mainstem (Table 3; ALJ Decision at 35, FOF 7-9). 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^{o}F throughout the year (USDI Bureau of 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; ALJ Decision at 33, FOF 6-10; ALJ Decision at 34, FOF 6-11; ALJ Decision at 34, FOF 6-14 and ALJ Decision at 86, Ultimate Finding of Fact 8). Snyder (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 would allow access to habitat, including tributaries and the mainstem Klamath River (Table 3). This access to habitat would benefit Pacific lamprey by increasing their viability through: a) extending the range and distribution of the species; b) providing additional spawning and rearing habitat; c) increasing the genetic

diversity of the species; and d) increasing the abundance of the Pacific lamprey population (ALJ Decision at 38, FOF 8-9).

- 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; ALJ Decision at 33, FOF 6-10; ALJ Decision at 34, FOF 6-11; ALJ Decision at 34, FOF 6-14 and ALJ Decision at 86, Ultimate Finding of Fact 8). 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 including Shovel Creek (ALJ at Decision 12, FOF 2A-5), Beaver and Deer Creeks (ALJ Decision at FOF 34, 6-14; ALJ Decision at 35, FOF 7-9), as well as Long Prairie, Edge, Frain, Negro, Tom Hayden, and Topsy Creeks (Table 3).

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, 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. Migration is one of several defining life history characteristics of resident trout and anadromous fish, especially salmonids (ALJ Decision at 27, FOF 3-7; ALJ Decision at 13, FOF 2A-10). 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). It is estimated that "several tens of thousands of resident fish" are annually entrained at "each of the Projects" facilities (ALJ Decision at 28, FOF 4-2). It is anticipated that annual entrainment of anadromous fish would be on the same order of magnitude, if not greater. Once entrained, the fish face a high risk of mortality. For juvenile fish, the risk is between 10 to 30 percent (ALJ Decision at 29, FOF 4-5). 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 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, draft tube discharge velocities at Project facilities are between 3.4 and 10.4 feet per second (fps) (CH2MHill 2006); 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 2004). 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 Service 2004). The 8 year construction timeline is necessary to meet resource goals and objectives as quickly as possible.

In the Preliminary Prescriptions, the Services based specific tailrace barrier prescriptions on the evidence cited above. In its request for hearing on disputed issues of material fact, the Applicant disputed facts supporting the tailrace barrier prescriptions. The Applicant subsequently withdrew its request for hearing regarding tailrace barrier prescriptions based on a stipulation with the Services (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number 2006-NMFS-0001, Order Granting the Applicant's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). In accordance with the stipulation, the Services have revised the tailrace barrier prescriptions in the Modified Prescriptions below to allow the Applicant to study the need for and design of tailrace barrier s for anadromous and native resident fish. The Applicant must perform any such studies in consultation with the Services, and provide the results of any such studies to the Services for approval before design and construction of the tailrace barriers in order to inform the need for and design of tailrace barriers. However, unless and until such site-specific studies are done, the Services must rely on the available information in concluding that tailrace barriers are necessary for the upstream passage of fish at Copco 1 and 2 Dams.

Spillway Prescription Rationale: Spill survival estimates for 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 (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. Therefore, spillway modifications and a 6 year timeline are necessary to meet resource goals and objectives as quickly as possible.

In the Preliminary Prescriptions, the Services based specific spillway prescriptions on the evidence cited above. In its request for hearing on disputed issues of material fact, the Applicant disputed facts supporting the spillway prescriptions. The Applicant subsequently withdrew its request for hearing regarding spillway prescriptions based on a stipulation with the Services (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number 2006-NMFS-0001, Order Granting the Applicant's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). In accordance with the stipulation, the Services have revised the spillway prescriptions in the Modified Prescriptions below to allow the Applicant to study the need for and design of spillway modifications for anadromous and native resident fish. The Applicant must perform any such studies in consultation with the Services, and provide the results of any such studies to the Services for approval before design and construction of the spillway modifications in order to inform the need for and design of spillway modifications. However, unless and until such site-specific studies are done, the Services must rely on the available information in concluding that spillway modifications are necessary for the safe, timely and effective passage of fish at Copco 1 and 2 Dams.

Transverse Bedrock Sill Fish Barrier Evaluation/Elimination Rationale: A transverse bedrock sill is located about River Mile 197.3 or 0.5 mile 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.). Physical structures, facilities, or devices or sill modification are necessary to eliminate the barrier. 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 2004) or alternative criteria approved 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 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 to attract fish. The fish ladder and AWS together must be designed to supply attraction flows according to the terms of Modified General Prescriptions 1.1.7 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 the Modified General Prescriptions 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 Modified 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 fish 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 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 the Modified General Prescriptions 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 Modified General Prescriptions, above.

4.3 Copco 2 Spillway

4.3.1 Spillway Modification: Unless the Services determine based on site-specific studies that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 4.3.2 and 4.3.3, 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 Modification Studies: The Licensee may, in consultation with the Services, study the need for and design of hydraulically-engineered spillway modifications to improve volitional downstream fish passage at Copco 2 Dam for coho salmon, steelhead trout, Pacific lamprey, and redband trout. The Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and submit study results and recommendations on the need for and design of spillway modifications for review and approval by the Services consistent with the provisions for timing of the spillway design under Modified Specific Prescriptions 4.3.3.

4.3.3 Spillway Design: Unless the Services determine based on site-specific studies that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 4.3.2, the Licensee shall develop design and construction plans according to the terms of the Modified General Prescriptions 1.1.1 above within 4 years of the issuance of the new license for review and approval by the Service and NMFS Engineering prior to construction.

4.3.4 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified General Prescriptions, above.

4.4 Copco 2 Tailrace Barrier

4.4.1 Tailrace Barrier Construction: Unless the Services determine based on site-specific studies that tailrace barriers are unnecessary in accordance with Modified Specific Prescriptions 4.4.2 and 4.4.3, the Licensee shall construct a tailrace barrier and guidance system 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 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 Studies: The Licensee may, in consultation with the Services, study the need for and design of a tailrace barrier and guidance system at Copco 2 Dam. The Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and submit study results and recommendations on the need for and design of tailrace barriers for review and approval by the Services consistent with the provisions for timing of the tailrace barrier design under Modified Specific Prescriptions 4.4.3.

4.4.3 Tailrace Barrier Design: Unless the Services determine based on site-specific studies that tailrace barriers are unnecessary in accordance with Modified Specific Prescriptions 4.4.2, the Licensee shall develop design and construction plans according to the terms of the Modified General Prescriptions 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.

4.4.4 Tailrace Barrier Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified General Prescriptions, above.

4.5 Copco 2 Bypass Channel Barrier/Impediment Elimination

4.5.1 Barrier Modification: The Licensee shall construct physical structures, facilities, or devices or 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 physical structures, facilities, devices or barrier modification according to the terms of the Modified General Prescriptions 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 physical structures, facilities, devices or barrier

modification shall be constructed within 2 years of license issuance, in accordance with specified guidelines and criteria for fish passage (National Marine Fisheries Service 2004), including, if the sill is not bypassed, 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 Modified 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 2004) or alternative criteria approved by the Services. The ladder shall provide for the uninterrupted passage of fish over the full 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 be designed to supply attraction flows according to the terms of Modified General Prescriptions 1.1.7 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 the Modified

General Prescriptions 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.

5.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified 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 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 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 the Modified General Prescriptions 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 Modified General Prescriptions, above.

5.3 Copco 1 Spillway

5.3.1 Spillway Modification: Unless the Services determine, based on site-specific studies, that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 5.3.2 and 5.3.3, 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 Modification Studies: The Licensee may, in consultation with the Services, study the need for and design of hydraulically-engineered spillway modifications to improve volitional downstream fish passage at Copco 1 Dam for Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and submit study results and recommendations on the need for and design of spillway modifications for review and approval by the Services consistent with the provisions for timing of the spillway design under Modified Specific Prescriptions 5.3.3.

5.3.3 Spillway Design: Unless the Services determine based on site-specific studies that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 5.3.2, the Licensee shall develop design and construction plans according to the terms of the Modified General Prescriptions 1.1.1 above within 4 years of the issuance of the new license for review and approval by the Service and NMFS prior to construction.

5.3.4 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified General Prescriptions, above.

5.4 Copco 1 Tailrace Barrier

5.4.1 Tailrace Barrier Construction: Unless the Services determine based on site-specific studies that tailrace barriers are unnecessary in accordance with Specific Modified Prescriptions 5.4.2 and 5.4.3, the Licensee shall construct a tailrace barrier and guidance system 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 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 Studies: The Licensee may, in consultation with the Services, study the need for and design of a tailrace barrier and guidance system at Copco 1 Dam. The Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and submit study results and recommendations on the need for and design of tailrace barriers for review and approval by the Services consistent with the provisions for timing of the tailrace barrier design under Modified Specific Prescriptions 5.4.3.

5.4.3 Tailrace Barrier Design: Unless the Services determine based on site-specific studies that tailrace barriers are unnecessary in accordance with Modified Specific Prescriptions 5.4.2, the Licensee shall, within 5 years of the issuance of the new license, develop design and construction plans according to the terms of the Modified General Prescriptions 1.1.1 for review and approval by the Service and NMFS-Engineering prior to construction.

5.4.4 Tailrace Barrier Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified General Prescriptions, above.

6. J.C. Boyle Dam

Upstream Prescription Rationale: Historically coho salmon, steelhead, and spring-run and fall-run Chinook salmon (Hamilton et al. 2005; ALJ Decision at 12, FOF 2A-3 through 2A-6) 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). Suitable habitat for anadromous fish occurs in Spencer Creek, a perennial stream (ALJ Decision at 34, FOF 6-11; ALJ Decision at 35, FOF 7-9), intermittent streams (ALJ Decision at 34, FOF 6-14; ALJ Decision at 35, FOF 7-9), and the main stem (ALJ Decision at 33, FOF 6-10; ALJ Decision at 35, FOF 7-9).

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 suitable habitat. The Service goal is to successfully restore resident fish to their historical range and suitable 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 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 et al 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 2006). 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 redband trout 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 (Hamilton et al. 2005). Access to habitat within the Project would benefit coho salmon by: a) extending the range and distribution of the species thereby increasing the reproductive potential; b) increasing genetic diversity in the coho stocks; c) reducing the species vulnerability to the impacts of degradation; and d) increasing the abundance (ALJ Decision at 86, Ultimate Finding of Fact 9; ALJ Decision at 36, FOF 7-16). With passage at J.C. Boyle Dam, coho salmon would regain access to suitable habitat (Table 3; ALJ Decision at 35, FOF 7-9). 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 gain access to habitat, including tributaries and the mainstem Klamath River (Table 3) between J.C. Boyle Dam and the next dam upstream (Keno Dam). This access to habitat would benefit Pacific lamprey by increasing their viability through: a) extending the range and distribution of the species; b) providing additional spawning and rearing habitat; c) increasing the genetic diversity of the species; and d) increasing the abundance of the Pacific lamprey population (ALJ Decision at 38, FOF 8-9).
- 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 17.1 miles of habitat including Spencer Creek (ALJ Decision at 12, FOF 2A-5), Hunters Park and Miners Creeks, as well as the mainstem Klamath River (ALJ Decision at 35, FOF 7-9) below Keno Dam (Table 3; ALJ Decision at 33, FOF 6-10; ALJ Decision at 34, FOF 6-11; ALJ Decision at FOF 34, 6-14 and ALJ Decision at 86, Ultimate Finding of Fact 8). 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) Fish Resources FTR). 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 2006). 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; ALJ Decision at 86, Ultimate Findings of Fact 6 and 7). With the construction of a functional adult fish ladder at J.C. Boyle Dam, 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. Migration is one of several defining life history characteristics of resident trout and anadromous fish, especially salmonids (ALJ Decision at 27, FOF 3-7; ALJ Decision at 13, FOF 2A-10). 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); ALJ Decision at 29, FOF 4-10). 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 (ALJ Decision at 30, Decision 4-11) rather than the 12 to 36 percent range estimated by the Applicant (PacifiCorp 2004a), Exhibit E 4-113). It is estimated

that "several tens of thousands of resident fish" are annually entrained at "each of the Projects" facilities (ALJ Decision at 28, Decision 4-2). It is anticipated that annual entrainment of anadromous fish would be on the same order of magnitude, if not greater. Once entrained, the fish face a high risk of mortality. For juvenile fish, the risk is between 10 to 30 percent (ALJ Decision at 29, Decision 4-5). 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.

PacifiCorp recognizes that entrainment at J.C. Boyle dam is a "problem that needs to be addressed" (ALJ Decision at 30, FOF 4-12). 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 Elimination Prescription Rationale: 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 and resident 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. Physical structures, facilities, devices or barrier removal are necessary to achieve the safe, timely, and effective passage through the channel past this obstruction and would be consistent with 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 3,000 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, draft tube discharge velocities at Project facilities are between 3.4 and 10.4 feet per second (fps) (CH2MHill 2006); 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 2004) as are resident fish. 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.

In the Preliminary Prescriptions, the Services based specific tailrace barrier prescriptions on the evidence cited above. In its request for hearing on disputed issues of material fact, the Applicant disputed facts supporting the tailrace barrier prescriptions. The Applicant subsequently withdrew its request for hearing regarding tailrace barrier prescriptions based on a stipulation with the Services (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number 2006-NMFS-0001, Order Granting the Applicant's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). In accordance with the stipulation, the Services have revised the tailrace barrier prescriptions in the Modified Prescriptions below to allow the Applicant to study the need for and design of tailrace barriers for anadromous and native resident fish. The Applicant must perform any such studies in consultation with the Services, and provide the results of any such studies to the Services for approval before design and construction of the tailrace barriers in order to inform the need for and design of tailrace barriers. However, unless and until such site-specific studies are done, the Services must rely on the available information in concluding that tailrace barriers are necessary for the safe, timely and effective upstream passage of fish at J.C. Boyle Dam.

Spillway Prescription Rationale: Spill survival estimates for juvenile salmonids are numerous and range from 76 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 (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.

In the Preliminary Prescriptions, the Services based specific spillway prescriptions on the evidence cited above. In its request for hearing on disputed issues of material fact, the Applicant disputed facts supporting the spillway prescriptions. The Applicant subsequently withdrew its request for hearing regarding spillway prescriptions based on a stipulation with the Services (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number 2006-NMFS-0001, Order Granting the Applicant's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). In accordance with the stipulation, the Services have revised the spillway prescriptions in the Modified Prescriptions below to allow the Applicant to study the need for and design of spillway modifications for anadromous and native resident fish. The Applicant must perform any such studies in consultation with the Services, and provide the results of any such studies to the Services for approval before design and construction of the spillway modifications in order to inform the need for and design of spillway modifications. However, unless and until such site-specific studies are done, the Services must rely on the available information in concluding that spillway modifications are necessary for the safe, timely, and effective passage of fish at J.C. Boyle Dam.

6.1 J.C. Boyle Bypass Channel

6.1.1 Barrier Elimination: The Licensee shall construct physical structures, facilities, or devices to provide passage around or 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 the Modified General Prescriptions 1.1.1 above within 1 year of the issuance of the new license for review and approval by the Service and NMFS prior to construction.

6.1.3 Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified 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 2004) or alternative criteria approved 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 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 be designed to supply attraction flows according to the terms of Modified General Prescriptions 1.1.7. 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 shall 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 the Modified General Prescriptions 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 Modified 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 the Modified General Prescriptions 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 Modified General Prescriptions, above.

6.4 J.C. Boyle Spillway

6.4.1 Spillway Modification: Unless the Services determine based on site-specific studies that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 6.4.2 and 6.4.3, 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, Pacific lamprey, 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 Modification Studies: The Licensee may, in consultation with the Services, study the need for and design of hydraulically-engineered

spillway modifications to improve volitional downstream fish passage at J.C. Boyle Dam for Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. The Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and submit study results and recommendations on the need for and design of spillway modifications for review and approval by the Services consistent with the provisions for timing of the spillway design under Modified Specific Prescriptions 6.4.3.

6.4.3 Spillway Design: Unless the Services determine based on site-specific studies that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 6.4.2, the Licensee shall develop design and construction plans according to the terms of the Modified General Prescriptions 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.

6.4.4 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified General Prescriptions, above.

6.5 J.C. Boyle Tailrace Barrier

6.5.1 Tailrace Barrier Construction: Unless the Services determine based on site-specific studies that tailrace barriers are unnecessary in accordance with Modified Specific Prescriptions 6.5.2 and 6.5.3, the Licensee shall construct a tailrace barrier and guidance system at J.C. Boyle Dam to provide for the safe, timely, and effective 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 4 years of the issuance of the new license

6.5.2 Tailrace Barrier Studies: The Licensee may, in consultation with the Services, study the need for and design of a tailrace barrier and guidance system at the J.C. Boyle Powerhouse. The Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and submit study results and recommendations on the need for and design of tailrace barriers for review and approval by the Services consistent with the provisions for timing of the tailrace barrier design under Specific Modified Prescriptions 6.5.3.

6.5.3 Tailrace Barrier Design – Unless the Services determine based on site-specific studies that tailrace barriers are unnecessary in accordance with Modified Specific Prescriptions 6.5.2, the Licensee shall, within 3 years of the issuance of the new license, develop design and construction plans according to the terms of the Modified General Prescriptions 1.1.1 for

review and approval by the Service and NMFS-Engineering prior to construction.

6.5.4 Tailrace Barrier Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified General Prescriptions, above.

7. Keno Dam

Upstream Prescription Rationale: Historically steelhead, spring-run and fall-run Chinook salmon (Hamilton et al. 2005; ALJ Decision at 12, FOF 2A-3 through 2A-5), 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 suitable habitat. The goal of the Service is to successfully restore resident fish to their historical range and suitable 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 provision of effective fish passage facilities will meet these goals and provide mitigation 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 20°C 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). For steelhead trout, the Services expect that adult returns would occur primarily from October through March. Major runs of spring-run Chinook and fall-run Chinook salmon would occur from March to June and September to December, respectively. Because of their run timing, passage of fall-run Chinook may be affected by conditions in Lake Ewauna. Interim, seasonal, upstream trap and haul for primarily fall-run adult Chinook salmon around Keno Reservoir and Lake Ewauna would be necessary during the period June 15 to November 15 when DO and temperature are out of criteria for this life stage of this species (U.S. Environmental Protection Agency 2003) and water quality conditions may not be suitable for migration. The Services expect trap and haul to be an effective interim, seasonal fish passage method for adult fall-run Chinook salmon during the period June 15 to November 15 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 and based on the recommendations of the Agencies 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 (Huntington 2006; Oregon Department of Fish and Wildlife 1997). 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 Service 2005). However, the potential contribution of the J.C. Boyle Reservoir population occupying habitat below Keno Dam 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 reserves its 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, The Bureau of 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; ALJ Decision at 12, FOF 2A-3 through 2A-5). 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 both the Williamson River and the Sprague River 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 acifiCorp,</authoas 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. Access to habitat above Keno Dam would likely benefit Pacific lamprey by increasing their viability through: a) extending the range and distribution of the species; b) providing additional spawning and rearing habitat; c) increasing the genetic diversity of the species; and d) increasing the abundance of the Pacific lamprey population (ALJ Decision at 38, FOF 8-9). Resident lamprey would benefit from a fishway that meets current criteria to accomplish lamprey passage.

Spillway Prescription Rationale: Spill survival estimates for salmonids are numerous and range from 76 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 (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.

In the Preliminary Prescriptions, the Services based specific spillway prescriptions on the evidence cited above. In its request for hearing on disputed issues of material fact, the Applicant disputed facts supporting the spillway prescriptions. The Applicant subsequently withdrew its request for hearing regarding spillway prescriptions based on a stipulation with the Services (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number 2006-NMFS-0001, Order Granting the Applicant's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). In accordance with the stipulation, the Services have revised the spillway prescriptions in the Modified Prescriptions below to allow the Applicant to study the need for and design of spillway modifications for anadromous and native resident fish. The Applicant must perform any such studies in consultation with the Services, and provide the results of any such studies to the Services for approval before design and construction of the spillway modifications in order to inform the need for and design of spillway modifications. However, unless and until such site-specific studies are done, the Services must rely on the available information in concluding that spillway modifications are necessary for the safe, timely and effective passage of fish at Keno Dam.

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 Chinook salmon 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, volitional passage shall be employed during this time in periods when dissolved oxygen concentrations are greater than 6 mg/L and temperatures lower than 20^{o}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 steelhead, Chinook salmon, redband trout, 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 alternative criteria approved by the Services. 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 be designed to supply attraction flows according to the terms of Modified General Prescriptions 1.1.7 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 the Modified General Prescriptions 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 Chinook salmon 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 Modified General Prescriptions, above.

7.2 Keno Spillway

7.2.1 Spillway Modification: Unless the Services determine, based on site-specific studies, that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 7.2.2 and 7.2.3, 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 Modification Studies: The Licensee may, in consultation with the Services, study the need for and design of hydraulically-engineered modifications to the radial gate(s) to provide a spillway (s) 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 Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and

submit study results and recommendations on the need for and design of spillway modifications for review and approval by the Services consistent with the provisions for timing of the spillway design under Modified Specific Prescriptions 7.2.3.

7.2.3 Spillway Design: Unless the Services determine, based on site-specific studies, that spillway modifications are unnecessary in accordance with Modified Specific Prescriptions 7.2.2, the Licensee shall develop design and construction plans according to the terms of the Modified General Prescriptions 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.

7.2.4 Spillway Monitoring, Reporting, and Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in the Modified General Prescriptions, above.

Eastside and Westside Developments

Eastside and Westside Downstream Prescription Rationale: The Applicant's Eastside and Westside developments divert water at Link River Dam to downstream powerhouses. Migration is one of several defining life history characteristics of resident trout and anadromous fish, especially salmonids (ALJ Decision at 27, FOF 3-7; ALJ Decision at 13, FOF 2A-10). Significant numbers of redband trout and other resident fish are presently moving downstream from Upper Klamath Lake and being entrained by the Applicant's Eastside and Westside developments, including tens of thousands of larvae and juveniles of federally listed suckers annually (Gutermuth et al. 2000). 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, 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 also negotiate not only the reservoir but the dam, powerhouse, and spillway during their outmigration. Unless protected by fish screens and bypasses, both resident and anadromous fish 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 the Applicant's Eastside and Westside developments, have an average mortality of about 24 percent. It is estimated that "several tens of thousands of resident fish" are annually entrained at "each of the Projects" facilities (ALJ Decision at 28, FOF 4-2). It is anticipated that annual entrainment of anadromous fish would be on the same order of magnitude, if not greater. Once entrained, the fish face a high risk of mortality. For juvenile fish, the risk is between 10 to 30 percent (ALJ Decision at 29, FOF 4-5). Based upon these studies and findings, turbine similarities, and known entrainment, the Services conclude that turbine entrainment at the Applicant'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 the Applicant'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. 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^{o}C from mid-June through mid-November (Jason Cameron, BOR, pers. comm.). While there is evidence that some juvenile Chinook salmon can tolerate temperatures near 20^{o}C in Upper Klamath Lake (Maule et al. 2007), these conditions are not within criteria (U.S. Environmental Protection Agency 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 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: These developments have no tailrace barriers and have never been tested for mortality to federally listed suckers, other resident fish, or anadromous salmonids. Water discharging from the Eastside and Westside powerhouses represents a significant portion of the total river flow of the Klamath River. 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, draft tube discharge velocities at Project facilities are between 3.4 and 10.4 feet per second (fps) (CH2MHill 2006); 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 2004). 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.

In the Preliminary Prescriptions, the Services based specific tailrace barrier prescriptions on the evidence cited above. In its request for hearing on disputed issues of material fact, the Applicant disputed facts supporting the tailrace barrier prescriptions. The Applicant subsequently withdrew its request for hearing regarding tailrace barrier prescriptions based on a stipulation with the Services (*In the Matter Of: Klamath Hydroelectric Project*, Docket Number 2006-NMFS-0001, Order Granting the Applicant's Motion to Withdraw USFWS/NMFS Issues 5 and 9, September 14, 2006 (Administrative Law Judge 2006b)). In accordance with the stipulation, the Services have revised the tailrace barrier prescriptions in the Modified Prescriptions below to allow the Applicant to study the need for and design of tailrace barrier s for anadromous and native resident fish. The Applicant must perform any such studies in consultation with the Services, and provide the results of any such studies to the Services for approval before design and construction of the tailrace barriers in order to inform the need for and design of tailrace

barriers. However, unless and until such site-specific studies are done, the Services must rely on the available information concluding that tailrace barriers are necessary for the safe, timely, and effective upstream passage of fish at the Eastside and Westside developments.

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 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. Fish would then continue through the bypass facility downstream except during the period from June 15 and November 15, when trap and haul downstream to below Keno Dam would be employed for the purposes of restoration and the safe, effective, and timely passage of fish. If agreed to by the Services, seasonal trap and haul downstream shall be discontinued and fish routed downstream through the bypass when dissolved oxygen concentrations are greater than 6 mg/L and temperatures lower than 15^{o}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 steelhead, redband trout, 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 in Preliminary Prescription), 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 the Modified General Prescriptions 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 Modified General Prescriptions, above.

8.2 Tailrace Barriers at Eastside and Westside Developments

8.2.1 Tailrace Barrier Construction: Unless the Services determine, based on site-specific studies, that tailrace barriers are unnecessary in accordance with Modified Specific Prescriptions 8.2.2 and 8.2.3, the Licensee shall construct a tailrace barrier and guidance system at the Eastside and Westside powerhouses to provide for the safe, timely, and effective upstream passage of Chinook salmon, steelhead trout, suckers, redband trout, and lamprey. 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 Studies: The Licensee may, in consultation with the Services, study the need for and design of a tailrace barrier and guidance system at Eastside and Westside Developments. The Licensee shall submit a plan for any such studies to the Services for review and approval prior to conducting studies. After approval of any such plan, the Licensee shall complete the studies and submit study results and recommendations on the need for and design of tailrace barriers for review and approval by the Services consistent with the provisions for timing of the tailrace barrier design under Modified Specific Prescriptions 8.2.3.

8.2.3 Tailrace Barrier Design: Unless the Services determine based on site-specific studies that tailrace barriers are unnecessary in accordance with Modified Specific Prescriptions 8.2.2, the Licensee shall, within 1 year of the issuance of the new license, develop design and construction plans according to the terms of the Modified General Prescriptions 1.1.1 for review and approval by the Service and NMFS-Engineering prior to construction.

8.2.4 Tailrace Barrier Evaluation: The Licensee shall complete reporting, monitoring, and evaluation of this facility as specified in Modified General Prescriptions, above

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