Endangered Species Act
Section 7(a)(2) Consultation

Biological Opinion

and

Magnuson-Stevens Fishery Conservation and Management Act Consultation

Pelton Round Butte Hydroelectric Project
FERC Project No. 2030
Deschutes River, Jefferson County, Oregon

Action Agency: Federal Energy Regulatory Commission

Consultation Conducted by: NOAA Fisheries
Northwest Region
Hydropower Division

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ACRONYMS AND ABBREVIATIONS

AR	at risk
BLM	Bureau of Land Management
BOR	U.S. Bureau of Reclamation
BRT	Biological Review Team
cfs	cubic feet per second
CTWS	Confederated Tribes of the Warm Springs Reservation of Oregon
CWA	Clean Water Act
DO	dissolved oxygen
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FERC	Federal Energy Regulatory Commission
FJAA	Final Joint Application Amendment
ft	foot, feet
FR	Federal Register
FTS	Fisheries Technical Subcommittee
HGMP	Hatchery and Genetic Management Plan
HUC	Hydrologic Unit Code
IHN	Infectious Hematopoietic Necrosis
Joint Applicants	Portland General Electric and the Confederated Tribes of the Warm Springs Reservation of Oregon
LWD	large woody debris
MCR	Middle Columbia River
MSA	Magnuson-Stevens Fishery Conservation and Management Act
msl	mean sea level
NGO	non-governmental organizations
NOAA Fisheries	National Marine Fisheries Service
NPF	not properly functioning
OAR	Oregon Administrative Rule
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
Opinion	Pelton Round Butte Hydroelectric Project Biological Opinion
PFC	properly functioning condition
PFMC	Pacific Fishery Management Council
PGE	Portland General Electric
PME	protection, mitigation and enhancement
PPM	parts per million
Project	Pelton Round Butte Hydroelectric Project
RM	river mile
SWW	selective water withdrawal
TRT	Technical Recovery Teams

ACRONYMS AND ABBREVIATIONS (continued)

USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VSP	Viable Salmonid Populations
WQMMP	Water Quality Monitoring and Management Plan

1.0 OBJECTIVES

1.1 Introduction

The Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.) establishes a National program for the conservation of threatened and endangered species of fish, wildlife, and plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the National Marine Fisheries Service (NOAA Fisheries) and the U.S. Fish and Wildlife Service (USFWS), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species. This Biological Opinion (Opinion) is the product of an interagency consultation pursuant to Section 7(a)(2) of the ESA and implementing regulations found at 50 CFR §402. This Opinion also considers adverse effects on Essential Fish Habitat (EFH) and provides recommendations to conserve EFH; therefore, this analysis also fulfills requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

The Federal Energy Regulatory Commission (FERC) proposes to issue an operating license to the Portland General Electric Company (PGE) and the Confederated Tribes of the Warm Springs Reservation of Oregon (hereafter, the Joint Applicants) for the continued operation of the Pelton Round Butte Hydroelectric Project (FERC Project No. 2030), located on the Deschutes River in Jefferson County, Oregon. The purpose of the Project is to generate and sell electricity. FERC is proposing to issue the license according to its authority under the Federal Power Act, and has determined that issuance of the proposed new license would adversely affect Middle Columbia River (MCR) steelhead (*Oncorhynchus mykiss*), listed as threatened under the ESA.

The objective of this Opinion is to determine whether issuance of a new license for the Pelton Round Butte Hydroelectric Project (hereafter, the Project) is likely to jeopardize the continued existence of the MCR steelhead Evolutionarily Significant Unit (ESU). MCR steelhead were listed as threatened on August 18, 1997 in the Federal Register (FR) (62 FR 43937). Critical habitat was designated for this species on February 16, 2000 (65 FR 7764). However, on April 30, 2002, the U.S. District Court for the District of Columbia approved a NOAA Fisheries consent decree withdrawing critical habitat designations for 19 salmon and steelhead populations on the West Coast, including that for MCR steelhead. Therefore, this Opinion does not address designated critical habitat for this species.

1.2 Application of ESA Section 7(a)(2) Standards - Analysis Framework

This section reviews the approach used in this Opinion in order to apply the standards for determining jeopardy as set forth in Section 7(a)(2) of the ESA and as defined by 50 CFR §402.02 (the consultation regulations). Additional guidance for this analysis is provided by the Endangered Species Consultation Handbook, March 1998, issued jointly by NOAA Fisheries and USFWS. In conducting analyses of actions under Section 7 of the ESA, NOAA Fisheries uses the following steps according to the consultation regulations:

1. Evaluate biological requirements and current status of the species at the ESU level and within the particular action area (Section 4).

2. Evaluate the relevance of the environmental baseline in the action area to action area biological requirements and the species' current range-wide and action-area status (Section 5).

3. Determine the effects of the proposed or continuing action on the species and on any designated critical habitat (Section 6).

4. Determine and evaluate any cumulative effects within the action area (Section 7).

5. Evaluate whether the effects of the proposed action, taken together with any cumulative effects and added to the environmental baseline, can be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the affected species, or is likely to destroy or adversely affect their designated critical habitat (Section 8). (See CFR § 402.14(g).)

In completing step 5, NOAA Fisheries determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species or adversely modify critical habitat. If so, NOAA Fisheries must identify any reasonable and prudent alternatives for the action that avoid jeopardy or adverse modification of critical habitat and meet the other regulatory requirements (See CFR §402.02.).

1.2.1 Step 1: Evaluate Range-Wide Biological Requirements and Current Status

NOAA Fisheries applies ESA Section 7(a)(2) to the listed ESUs of salmon and steelhead by first defining the species' range-wide biological requirements and evaluating their status relative to those requirements. The risk currently faced by each ESU informs NOAA Fisheries' determination of whether a reduction in the productivity, abundance, or distribution of the species would reasonably be expected to "appreciably reduce" the likelihood of both survival and recovery in the wild (step 5). The greater the current risk, the more likely that any additional risk resulting from the proposed action's effects on productivity, abundance, or distribution of the listed species will constitute an "appreciable reduction in the likelihood of both survival and recovery."

ESU range-wide biological requirements for long term survival and recovery are met when a sufficient number and distribution of populations comprising the ESU are "viable." Viable populations are those that are large enough to safeguard the genetic diversity of the listed ESUs, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment. McElhany et al. (2000) describe "viable salmonid populations" (VSP) as having a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100 year time frame. The attributes associated with viable salmonid populations include adequate abundance, productivity, spatial structure, and diversity. These attributes are influenced by survival, behavior, and experiences throughout the entire life cycle. These factors, in turn, are influenced by the habitat and environmental conditions encountered by individuals within each population. NOAA Fisheries established Technical Recovery Teams (TRTs) to describe the component populations in each ESU, viability criteria for each of those populations, and the number and distribution of populations that must be viable for an ESU to attain recovery. In many cases, the status of an ESU was informed by the condition of habitat necessary to meet the species' biological requirements. Habitat attributes important to the species can be described in terms of physical, chemical, and biological parameters affected by the action under consultation (NMFS 1999).

1.2.2 Step 2: Evaluate Relevance of the Environmental Baseline in the Action Area to Biological Requirements and the Species' Current Status

In this step, NOAA Fisheries analyzes the effects of past, present, and certain future human factors within the action area to which the effects of the proposed action would be added. The environmental baseline, together with cumulative effects (step 4), provides the starting point for evaluating whether the action would cause, directly or indirectly, a reduction in the productivity, abundance, or distribution of the listed species or diminish any essential physical or biological feature of critical habitat. Also, steps 1 and 2 collectively inform NOAA Fisheries' determination of whether reductions in abundance, productivity, or distribution associated with effects of the proposed action would "appreciably reduce" the likelihood of both survival and recovery. The worse the status of the ESU and the greater the current risk to the species within the action area under the environmental baseline, the more likely that additional adverse effects within the action area will appreciably reduce the likelihood of the ESUs survival and recovery. A number of sub-steps are required to describe and evaluate the environmental baseline. These are summarized below and evaluated in Section 5.

Describe the Action Area. The action area includes all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). The action area is not delineated by the migratory range of the species affected by the project. The action area for this consultation is defined in Section 5.1.

Describe Biological Requirements and Essential Habitat Features within the Action Area. As discussed above, the range-wide biological requirement of an ESU is a sufficient number and distribution of populations that meet the VSP requirements of adequate abundance, productivity, spatial structure, and diversity. If the action area is sufficiently large, there is no distinction between the range-wide biological requirements and those associated with a particular action area. However, biological requirements for action areas that encompass a limited portion of the population's range may be expressed in terms such as 1) adequate survival rates through particular life history stages and/or; 2) habitat characteristics that are expected to result in adequate survival and distribution of individuals within a population. This consultation includes elements of both approaches.

Describe the Environmental Baseline. The environmental baseline includes "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, including the anticipated impacts of all proposed Federal projects in the action area that have undergone Section 7 consultation and the impacts of State and private actions that are contemporaneous with the consultation in progress" (50 CFR §402.02).

Describe the Environmental Baseline Relative to Biological Requirements and Species Status. In step 2 of the analysis, which is included in Section 5, NOAA Fisheries compares existing habitat conditions and their continuing effects, as well as the effects of qualifying future Federal projects and contemporaneous State and private actions, to the action area biological requirements described above for the listed salmonid ESUs affected by the proposed action. The extent to which the conditions under the environmental baseline fall short of the species' biological requirements indicates, for the action area, the current status of the species. The species' status is important for the ESA Section 7(a)(2) determinations in step 5 because it is more likely that any additional adverse effects caused by the proposed action will be significant if the species status is poor and the baseline is degraded at the time of the consultation.

1.2.3 Step 3: Describe the Effects of the Proposed Action

Effects of the action, which are evaluated in Section 6, are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR §402.02). Direct effects occur at a project site and may extend upstream or downstream based on the potential for reducing survival or impairing important habitat elements. Indirect effects are defined in 50 CFR §402.02 as "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur." They include the effects on listed species of future activities that are induced by the proposed action and that occur after the action is completed. "Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration" (50 CFR §402.02).

1.2.4 Step 4: Describe Cumulative Effects

Cumulative effects, which are described in Section 7, take into consideration the effect of future actions on the listed species' ability to survive and recover, as with the effects of the environmental baseline, by focusing on the likely resulting conditions for the species in the action area relative to the biological requirements. Cumulative effects include future State or private activities, not involving a Federal action, that are reasonably certain to occur within the action area under consideration (past and present effects of non-Federal actions are part of the environmental baseline). Indicators of actions "reasonably certain to occur" may include, but are not limited to: approval of the action by State, tribal, or local agencies or governments (e.g., permits, grants); indications by State, tribal, or local agencies or governments that granting authority for the action is imminent; a project sponsor's assurance that the action will proceed; obligation of venture capital; or initiation of contracts. The more State, tribal, or local administrative discretion remaining to be exercised before a proposed non-Federal action can proceed, the less reasonable certainty the project will be authorized. Speculative non-Federal actions that may never be implemented are not factored into the cumulative effects analysis. At the same time, "reasonably certain to occur" does not require a guarantee the action will occur. There may be economic, administrative, and legal hurdles remaining before the action proceeds.

The key outcome of this step will be an assessment of whether or not the net impact of the cumulative effects would be to improve or degrade the baseline and to estimate, to the extent practical, the magnitude of that change. The purpose of this step is to further assess the species' status and risk in the action area, in order to inform NOAA Fisheries' determination of what constitutes an "appreciable reduction" in survival and recovery. For example, if the status of the environmental baseline is very poor but a suite of beneficial cumulative effects are likely, NOAA Fisheries may tolerate a greater adverse effect of a proposed action before considering it an "appreciable reduction," compared to the level of tolerance absent the beneficial cumulative effects. By the same token, expected harmful cumulative effects could reduce the tolerance level. As in the evaluation of the net effects of the proposed action, professional judgment will be required to make this determination.

1.2.5 Step 5: Conclusion

In Section 8, NOAA Fisheries considers whether the aggregate effects of the action, when added to the effects of the environmental baseline and cumulative effects in the action area, and viewed against the range-wide status of the species, reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of the survival and recovery of the listed species or to destroy or adversely modify designated critical habitat. As described above, this evaluation focuses on the juvenile and adult survival rates expected under the proposed action.
If, in step 3, NOAA Fisheries determines that the proposed action would either not affect or would result in a net improvement in survival or habitat condition for a given ESU, NOAA Fisheries would conclude that the action is not likely to jeopardize that ESU or adversely modify critical habitat. Because there would be no net reduction in the productivity, abundance or distribution of the ESU, there could not be an appreciable reduction in the likelihood of both survival and recovery in accordance with the regulatory definition of "jeopardize the continued existence of" (50 CFR § 402.02).

If NOAA Fisheries determines in step 3 that the proposed action would reduce the abundance, productivity, or distribution of a given ESU, NOAA Fisheries then determines whether that reduction constitutes an appreciable reduction in the likelihood of survival and recovery. If so, NOAA Fisheries would conclude that the action would be likely to jeopardize the continued existence of listed species. This decision depends upon the magnitude of the reduction, the distribution of that reduction between component populations and major population groups within an ESU, and the risk experienced by the ESU, both over its range and within the action area.

If NOAA Fisheries determines that the proposed action is likely to jeopardize listed species or adversely modify critical habitat, it must identify a reasonable and prudent alternative for the action that avoids these effects and satisfies the species' biological requirements.

2.0 BACKGROUND

2.1 Description - Pelton Round Butte Hydroelectric Project

The Project is located on the Deschutes River in Jefferson County near Madras, Oregon. It occupies lands and waters of Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS), lands and waters under the jurisdiction of the Bureau of Land Management (BLM), and National Forest lands supervised by the U.S. Forest Service (USFS). The Project was originally licensed in 1951, and constructed between 1956 and 1964. The 467-megawatt Project comprises of three developments: The Round Butte, Pelton, and Reregulating developments (Figure 2-1).

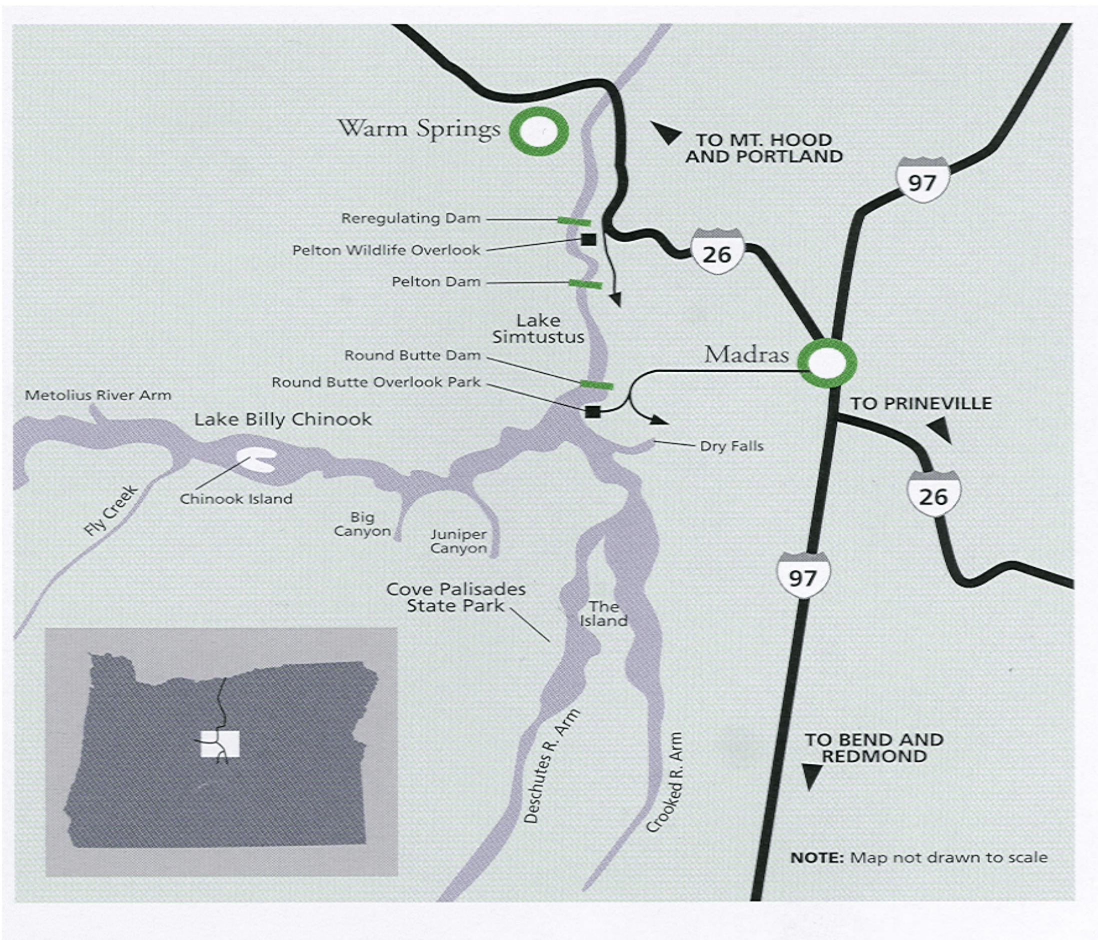

Figure 2-1. The Pelton Round Butte Hydroelectric Project area. Source: Final Joint Application Amendment, June, 2001.

The Pelton and Reregulating developments were constructed first and began operating in 1958. In 1960, PGE received a license amendment to construct the Round Butte development upstream of the Pelton and Reregulating developments and began operating in 1964. In 1980, the CTWS received authorization to construct a powerhouse at the Reregulating Dam and began generating electricity in 1982. The original license for the Project expired on December 31, 2001, and it now operates under annual licenses issued by FERC.

2.1.1 Reregulating Development

Starting at the Project's downstream end, the Reregulating development is the first of the three-dam complex and is located at river mile (RM) 100. The dam is an earthen structure with a concrete spillway and is 88-ft high and 1,067-ft long. The Reregulating reservoir has a gross storage capacity of 3,500 acre-ft and approximately 190 surface-acres at maximum operating pool (1,435' mean sea level (msl)). Because the upper two developments, Pelton and Round Butte, are operated as peaking facilities, the Reregulating reservoir is used to store peak flows from those projects and release flow downstream in a more even manner. The reservoir's daily elevation change ranges between 20 and 27-ft. The powerhouse is located near the dam's left bank abutment and contains a single, horizontal Kaplan-type turbine with a generating capacity of 19 megawatts.

2.1.2 Pelton Development

The Pelton development, located at RM 102.5, is a variable-radius concrete structure approximately 204-ft high and 636-ft long at its crest. Pelton Dam impounds Lake Simtustus, a 540 surface-acre reservoir with a gross storage capacity of 31,000 acre-ft at maximum operating pool (1,580' msl). Lake Simtustus backs up to the tailrace of the Round Butte development. A reinforced concrete spillway consisting of two 34-ft wide by 22-ft high tainter gates is located on the left bank. The powerhouse intake is incorporated into the face of the dam and consists of three, 16-ft diameter penstocks that convey water to three Francis-type turbines. The maximum generating capacity is 110 megawatts. This development is operated as a peaking facility.

2.1.3 Round Butte Development

The Round Butte development is the upper most development at about RM 110. Round Butte Dam is an earthen structure roughly 440-ft high and 1,382-ft-long. A spillway intake structure is located roughly 600-ft upstream of the dam crest and consists of a 30-ft high by 36-ft-wide radial gate and a 1,800-ft long, 21-ft diameter spill tunnel which discharges into the Round Butte tailrace. The powerhouse intake structure is located roughly 700-ft upstream of the dam crest. The top of the intake is located about 240-ft below the reservoir surface at maximum operating pool (1,945' msl). Water is conveyed to the powerhouse through a 23-ft diameter, 1,425-ft long tunnel, which terminates in a reinforced concrete-encased steel trifurcation consisting of three, 14-ft diameter penstocks. The powerhouse contains three Francis-type turbines with a generating capacity of 338 megawatts. The dam impounds Lake Billy Chinook, a 4,000 surface-acre reservoir with a gross storage capacity of 535,000 acre-ft at maximum operating pool [1,945-ft msl], and a maximum depth of 400-ft. The reservoir backs up the Metolious River canyon 13 miles, the Deschutes River canyon roughly nine miles, and the Crooked River canyon seven miles.

2.2 Fish Passage History

Maintenance of anadromous fish runs was of paramount concern for fishery resource managers when the Project was first licensed. Hence, fish passage facilities were included in the original construction of the Pelton and Reregulating Dams, and consisted of a Buckley-style adult fish trap (Pelton Trap), fish ladder, and a juvenile fish surface collector. The trap was originally installed to capture upstream migrating adults and transport them to an area upstream of the Pelton and Reregulating Dams while under construction. The fish ladder was constructed on the right bank (east side) starting at the Reregulating Dam and ending with a fish exit point at the right bank abutment of the Pelton Dam. The ladder gained 230-ft in elevation more than 2.8 miles, allowing adult salmonids to volitionally migrate around and upstream of the Pelton and Reregulating Dams. The downstream migrant surface collector was located at the right bank abutment of Pelton Dam. Smolts were routed from the collector to the fish ladder for continued migration downstream (Ratliff et al. 1999).

Completion of Round Butte Dam presented a difficult challenge for upstream passage due to its location in a deep, narrow canyon, a 400-ft elevation gain, and a reservoir operation that could include up to 85-ft of drawdown. The latter making it extremely difficult to construct a safe exit point for adults. To overcome this problem, a tramway system was constructed at the dam where adults would be captured in a large bucket and lifted over the dam and moved out over the reservoir where the bucket would then be lowered into the water and the adults released at depth of 15-ft. The downstream migrant facility consisted of a surface collector located at the right bank abutment of Round Butte Dam where collected fish could be either routed to Lake Simtustus or trucked to a point downstream of the Reregulating Dam (Ratliff et al. 1999).

In short, none of these facilities worked as expected. Adult migrants tended to reject the ladder, particularly during the summer months. Thus, the Pelton Trap continued to be used for moving adult salmon and steelhead above the Project. The Pelton surface collector was evaluated from 1959 to 1962 under the supervision of an interagency steering committee, and was operated from 1958 to 1968. The Round Butte surface collector was evaluated in 1965 and 1966 and was operated from 1965 to 1969. Performance of the Round Butte surface collector was dismal, and it was thought at the time that juvenile migrants, for various reasons, were not reaching the collector. In 1966, the steering committee began contemplating the use of a hatchery to maintain anadromous fishery resources and in 1968 fish passage was terminated in favor of a hatchery. PGE was directed in 1969 by the State of Oregon to construct a hatchery (Ratliff et al. 1999). The target annual production goal was set at 1,200 returning spring chinook salmon adults and 1,800 returning steelhead adults.

2.3 Pre-Consultation History

Portland General Electric began holding pre-consultation meetings in 1996. To address aquatic-related issues, a Fisheries Advisory Committee was formed in 1997 and consisted of representatives from Federal and State agencies, tribes, and non-governmental organizations (NGO). This was a large forum and thus it was agreed by the members that each organization appoint one technical representative to a subcommittee to address the challenge of reintroducing anadromous fish above the Project. This smaller committee became the Fisheries Technical Subcommittee[1] (FTS) in that same year (1997). At present, the FTS continues to be the primary working group addressing fish passage and other aquatic issues for the Project.

On December 18, 1998, PGE filed its Draft License Application with FERC. Even though CTWS were co-licensees, it filed a competing Draft License Application with FERC on April 9, 1999. In December of 1999, both PGE and CTWS filed competing Final License Applications for the Project. However, PGE and CTWS, along with the U.S. Department of Interior, signed a Global Settlement Agreement and filed it with FERC on April 20, 2000. FERC approved the Global Settlement on November 21, 2000, and on June 29, 2001, PGE and CTWS filed a Final Joint Application Amendment (FJAA) with FERC. The FJAA reconciled differences between the competing applications and presented a single relicensing proposal to FERC.

The Oregon Department of Environmental Quality (ODEQ) and the CTWS Water Control Board issued water quality certifications for the Project on June 24 and 25, 2002, respectively. On August 12, 2002, FERC issued its *Notice of Application Ready for Environmental Analysis*. On November 8, 2002, NOAA Fisheries filed its preliminary terms and conditions and fishway prescriptions for the Project. There was relatively good agreement between the Joint Applicants' protection, mitigation and enhancement (PME) measures proposed in the FJAA, and NOAA Fisheries' fishway prescriptions and recommended terms and conditions. However, some issues such as the schedule for implementing the fish passage program were different than the FJAA. Other resource agency mandatory terms and conditions, as well as recommended terms and conditions from various interveners, were not in agreement with the FJAA as well. To resolve these issues, the Joint Applicants initiated settlement negotiations in January of 2003.

In August of 2003, FERC noticed its Draft Environmental Impact Statement and in a letter dated September 24, 2003, initiated formal consultation under the ESA with NOAA Fisheries. On November 5, 2003, NOAA Fisheries filed a letter with FERC pointing out that consultation under the ESA was premature due to the ongoing settlement negotiation with the Joint Applicants. On December 29, 2003, the Joint Applicants files with FERC a *Description of Proposed Preferred Alternative*, which was the product of nearly a year of negotiations and

[1] The FTS members include representatives from PGE; CTWS, Natural Resources Branch; NOAA Fisheries; USFWS; USFS, BLM; ODFW; ODEQ; and one individual representing a coalition of NGOs.

represented the settling parties'[2] preference for Project operations and PME measures. As settlement negotiations progressed, the Joint Applicants submitted an *Updated Description of Proposed Preferred Alternative* to FERC on April 27, 2004. FERC issued its Final Environmental Impact Statement on June 4, 2004, and requested ESA Section 7(a)(2) consultation with NOAA Fisheries in a letter dated June 18, 2004. On July 13, 2004, a Settlement Agreement for the relicensing of the Project was signed by the settling parties. On July 20, 2004, NOAA Fisheries filed a letter with FERC stating that consultation under the ESA was initiated. Finally, on July 30, 2004, the Joint Applicants filed the Settlement Agreement with FERC.

[2] The settling parties are PGE; CTWS; USFWS; Bureau of Indian Affairs; the BLM; USFS; NOAA Fisheries; ODEQ; ODFW; Oregon Water Resources Department; Oregon Parks and Recreation Department; Deschutes County, Oregon; Jefferson County, Oregon; City of Bend, Oregon; City of Redmond, Oregon; City of Madras, Oregon; Avion Water Company; American Rivers, Oregon Trout, The Native Fish Society; Trout Unlimited; and WaterWatch of Oregon.

3.0 PROPOSED ACTION

In this section, we provide a brief description of the proposed action's various elements that may affect MCR steelhead. The proposed action is the issuance of a new license by FERC for an existing hydroelectric facility, the Pelton Round Butte Hydroelectric Project (FERC No. 2030). A new license would authorize the Joint Applicants to carry out the activities described in this section. A detailed description of these activities can be found in the July 13, 2004, Settlement Agreement and its attachments. More details can be found in the relevant sections of the June 2001, FJAA; the Joint Applicants December 2003, Description of Proposed Preferred Alternative; the April 22, 2004, Revised Biological Evaluation; the Joint Applicants April 2004, Updated Description of Proposed Preferred Alternative; and FERC's June 2004, Final Environmental Impact Statement.

Components of the proposed action that may affect MCR steelhead include the following:

- Reintroduction of MCR steelhead above the Project.
- Construction and operation of upstream and downstream fish passage facilities.
- Passage infeasibility.
- Fish health management program.
- Round Butte Hatchery.
- Project operations.
- Water quality.
- Large wood management.
- Lower river gravel augmentation and study.
- Lower river habitat enhancement.
- Test and Verification Studies.
- Pelton Round Butte Fund.

3.1 Fish Passage Plan - Reintroduction of MCR Steelhead

In their June, 2001, FJAA and July 13, 2004, Settlement Agreement, the Joint Applicants provided a detailed and rigorous implementation plan (Fish Passage Plan) for pursuing fish passage for resident and anadromous species, including MCR steelhead, at the Project. The basic framework for the fish passage program reflected in the Fish Passage Plan was developed in consultation with the FTS using a structured decision-making process to identify important uncertainties related to achieving successful fish passage. The fish passage program is designed as a four-phase effort based on an appropriate timing and sequencing of continuing research and evaluation efforts aimed at addressing uncertainties, reducing risks associated with fish passage to an acceptable level, and carrying out components of the program in a logical sequence. Critical uncertainties addressed through this program include risk of disease, implications for reservoir and downstream water quality, and efficacy of downstream passage through Lake Billy Chinook. Key components of the fish passage program include design and construction of downstream passage facilities; Testing and Verification of the performance of those facilities;

and evaluation and implementation of volitional downstream and upstream passage at the Project, if volitional passage is determined to be feasible and appropriate. Throughout implementation of the Fish Passage Plan, the Joint Applicants will consult with the Pelton Round Butte Fisheries Committee[3] (Fish Committee), and where specified seek approval from the appropriate resource agencies.

This fish passage program is intended to accomplish specific goals and objectives developed by the FTS to support Federal, State, and tribal resource management plans and NOAA Fisheries' resource goals and objectives relevant to the Project. The Fish Passage Plan will be conducted according to the tenets of adaptive management. The essence of adaptive management is to view management actions as having an experimental component designed to both protect the resource as well as produce critical information about the resource, and to make changes in future management actions that reflect the knowledge gained through these measures. Thus, adaptive management includes three main components 1) the completion of specific protection, mitigation and enhancement measures designed to avoid or minimize the impact of a project on specific resources; 2) monitoring and evaluation of the measures to evaluate their performance towards the agreed-upon criteria, resource goals, objectives and expectations; and 3) carrying out alterations and management changes that improve future performance if criteria, resource goals, objectives and expectations are not met. This approach helps to reduce uncertainty by providing a broader base of project specific knowledge and experience that helps focus more effectively resource protection measures.

3.2 Phased Approach to Fish Passage

To accomplish the lengthy and complex implementation of the fish passage program, and the complex design and construction of the fish passage facilities, a four-phase adaptive management process was developed by the Joint Applicants. The purpose of proceeding in phases is to maintain flexibility in the design process, capture the necessary tools to ensure a competent design, and allow for Fish Committee review and input. The Fish Passage Plan provides for a methodical, step-by-step evaluation and decision process to maximize the probability of restoring passage and to minimize risks. This approach is used to facilitate The Fish Passage Plan's four phases which are *Baseline, Experimental*, *Interim*, and *Final*. The *Baseline* phase was completed during development of the Draft and Final License Applications. The Joint Applicants initiated the *Experimental* phase in 1999, which is nearing closure as all of its tasks are almost completed. Also, a major prerequisite for transition to the *Interim* phase is receipt of a new license, which NOAA Fisheries anticipates occurring in early 2005. Therefore, this Opinion analyzes the last two phases, *Interim* and *Final*, as part of the proposed action for this consultation. The major components of these phases are described below.

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[3]The formation of the Pelton Round Butte Fisheries Committee is a product of the July 13, 2004, Settlement Agreement and will be the primary consulting body for fishery issues pertaining to the Project. It is essentially the continued function and support of the FTS (see Section 2.3), with the addition of the U.S. Bureau of Indian Affairs to the Committee.

3.2.1 Interim Phase

The bulk of the work to reintroduce MCR steelhead above the Project, and to improve habitat downstream of the Project, will occur during this phase. The temporary downstream and upstream fish passage facility design will be completed, then constructed, operated, and evaluated; the most suitable MCR steelhead stock will be selected for initiating Project passage; smolt survival and passage efficacy evaluated; adult migration and spawning studies conducted; disease management program implemented; water quality and temperature of Project discharge evaluated; and potential volitional upstream passage facility concepts evaluated.

3.2.1.1 Downstream Fish Passage

Round Butte Dam
The Joint Applicants will construct and operate a new powerhouse intake tower in Lake Billy Chinook immediately upstream of the existing intake. The existing intake draws water between the depths of 240-ft to 270-ft (top of intake to invert of intake) at full pool. The new intake will be a selective water withdrawal (SWW) tower coupled to the existing structure at the bottom where water is currently drawn into the power tunnel. The new intake will allow water withdrawal from both the surface (warmer epilimnion during summer and early-fall) and bottom (cooler hypolimnion) of the reservoir. The purpose of the SWW is two fold: 1) help the Project meet temperature and water quality goals and standards in the lower river as required in the Project's Clean Water Act (CWA), Section 401 certifications; and 2) allow the withdrawal of surface water during juvenile salmonid migration periods to facilitate the collection of smolts emigrating from Lake Billy Chinook in support of the anadromous fish reintroduction program.

The total hydraulic capacity of the Round Butte powerhouse will be 14,000 cubic feet per second (cfs). All generation flow will be screened at both the bottom and surface intakes. The surface intake screens will be used to prevent powerhouse entrainment and to collect smolts for transport below the Project. The surface intake will be capable of screening about 9,000 cfs. The fish collection component of the surface intake will be a conventional V-screen configuration with a maximum hydraulic capacity of 3,000 cfs. About 2,900 cfs will be used for generation and 100 cfs will transport fish over a bypass weir for collection. Once juvenile fish are entrained over the bypass weir, about 85 cfs will be dewatered from the collection system and the remaining 15 cfs will transport fish to a sorting facility (site to be determined). All juvenile steelhead migrants will then be marked so that those returning to the Pelton Trap as adults can be identified as having originated above the Project. The V-screen component will meet NOAA Fisheries' criteria for fingerling-sized salmonids (≥60.0 millimeters or 2.36 inches).[4] The remainder of the surface screen facility will consist of exclusion plates with a maximum flow capacity of 6,100 cfs. The exclusion screens will meet NOAA Fisheries' fingerling criteria for approach velocity but not sweeping velocity or contact time (see Section 6).

[4]Approach velocity of 0.80-ft per second, sweeping velocity that exceeds the approach velocity, and a contact time of ≤60.0 seconds.

Because Round Butte is operated as a peaking facility, generation is greatly reduced during daylight hours which will result in a substantial reduction of flow through the proposed SWW. To address this issue, the design of the surface screen facility will also include the ability to add pumps with a total capacity of 3,000 cfs. If the Fish Committee determines that pumps are needed, the Joint Applicants will install them.

The bottom intake screen will have a maximum design flow of 7,500 cfs and will meet NOAA Fisheries' screen criteria for fingerling-sized salmonids for approach velocity. The bottom screen will have no fish collection function, and be used strictly to exclude fish from being entrained in the Round Butte turbines.

The SWW and fish collection facilities will be operational for the 2008 spring outmigration. Deschutes Basin steelhead typically migrate to the ocean as 2-year old fish. Therefore, disease-free steelhead fry from the Round Butte Hatchery will be outplanted in tributaries above Lake Billy Chinook beginning in 2006 with the expectation that the downstream passage facility will be on line in 2008.

Monitoring activities to evaluate the effectiveness of the SWW will be conducted. A decision to pursue the fish passage program for the term of the new license will be based on achieving ≥50% collection of a statistically significant sample of tagged juvenile steelhead or spring chinook salmon released in one of the reservoir's tributaries. If the 50% goal is not achieved initially, any feasible modifications or measures will be carried out to reach the target. These measures could include predator controls, adjustments to the sport fishery, and modifications to the facility. If ≥50% collection is achieved, the goal will be to maintain a ≥75% reservoir passage efficiency for the term of the new license. Once it is determined to continue the passage effort for the term of the license, the same measures (predator control, adjustments to the sport fishery, and facility modifications) will be implemented to achieve the ≥75% goal if warrented.

Pelton Dam

The Joint Applicants will transport all juvenile salmonids captured at the Round Butte downstream passage facility during the primary emigration period (February 1 through July 31) to the Lower Deschutes River, bypassing the Pelton Dam reservoir (Lake Simtustus) and the Reregulating Reservoir. During the remainder of the year (August 1 through January 31) the Joint Applicants would, at the request of the Fish Committee, and with NOAA Fisheries' approval, transport downstream-migrating salmonids into Lake Simtustus to take advantage of the lentic habitat it provides.

Should the Fish Committee determine that downstream migrating salmonids be put into Lake Simtustus, the Joint Applicants will develop a plan to install a guidance net system at the Pelton Dam and operate the Pelton downstream passage facility (Pelton Skimmer) during part or all of the primary migration season (February 1 through July 31) for transporting downstream migrants to the Lower Deschutes River.

3.2.1.2 Upstream Fish Passage

The Joint Applicants would continue to operate the existing Pelton Trap to collect upstream migrating adults for transport by truck to Lake Billy Chinook. Only fish that originated from upstream of the Project will be passed above the Project. Juveniles collected at the Round Butte downstream fish facility will have been marked so that returning adults can be readily identified as having originated above the Project. This is to prevent species of unknown origin from mixing with stocks used to inaugurate the reintroduction program.

Lake Billy Chinook stratifies during the summer months and the epilimnion can reach temperatures at or above 70^{o} F. Therefore, to prevent heat shock from rapid exposure to warmer water, an adult release facility will be designed to release summer migrating adults below the thermocline in the forebay of Round Butte Dam. Adult steelhead will be allowed to volitionally migrate upstream from the release facility. The facility is scheduled to be operational in the summer of 2006.

3.2.1.3 Passage Infeasibility

The reintroduction of anadromous fish at this Project is an immensely complex task. The Settlement Agreement provides for alternative mitigation in the event passage is determined to be infeasible. The Fish Passage Plan and the Settlement Agreement set out a number of requirements before the passage program is terminated. These include:

- An analysis of reservoir predation and potential solutions if determined to be a problem.
- An analysis of recreational fishing impacts, if any.
- An analysis and implementation of alternative fish passage measures.

If these measures are determined by the Fish Committee, with NOAA Fisheries' approval, to be unsuccessful, and that downstream fish passage is completely infeasible, then the Joint Applicants would provide alternative mitigation in an amount equivalent to the net present value of the cost of the operations and maintenance of fish passage facilities that would have otherwise been incurred over the remaining term of the license.

If the Fish Committee, with NOAA Fisheries' approval, determined downstream fish passage to be infeasible for some but not all species, the Joint Applicants will provide alternative mitigation related to those species for which passage is infeasible in an amount equivalent to the net present value of the reduction in the cost of operations and maintenance of the fish passage facilities as a result of this determination.

If, after the Joint Applicants have begun non-passage mitigation, new information demonstrates that downstream fish passage may be feasible, the Joint Applicants would, within 60 days of receiving such information, notice a meeting of the Fish Committee to determine whether downstream fish passage should be reinitiated. If the Fish Committee, with approval by NOAA Fisheries, determines that downstream fish passage should be reinitiated, the Joint Applicants would develop a fish passage plan based on the new information. Such a plan would be developed in consultation with the Fish Committee.

3.2.1.4 Fish Health Management

One of the critical uncertainties regarding reintroduction of anadromous fish is the potential to introduce new pathogens to important native resident fish species upstream of the Project. Also, pathogens could constrain self-sustainable natural reproduction of anadromous fish above the Project, and could introduce new pathogens to the Round Butte Hatchery. There is an existing problem with high numbers of out-of-basin stray steelhead spawning in the Lower Deschutes River and its tributaries, and these fish could bring in new pathogens not currently present in the Deschutes Basin.

To address this uncertainty, the Joint Applicants worked with Oregon Department of Fish and Wildlife (ODFW) pathologists and the Department of Microbiology at Oregon State University to determine the level of risk and how to manage it. The fish pathogens that emerged as the most consequential and having the most significant potential to negatively impact fish stocks were the Type two strain of Infectious Hematopoietic Necrosis (IHN) virus and *Myxobolus cerebralis*, the causative agent of whirling disease. In addition, bacterial kidney disease, furunculosis and Erythrocytic Inclusion Body Syndrome virus represent diseases that could have serious impacts on certain groups of resident and anadromous fish stocks (Bartholowmew 1999; Engelking 1998, 1999, 2003a).

In order to manage and reduce the risk of introducing new pathogens above the Project, ODFW pathologists developed a Fish Health Management Plan (Engelking 2003b). Details of this plan can be found in the Joint Applicants (2004). During the *Interim Phase*, some sacrificing of MCR steelhead, both adults and juveniles, is expected in order to effectively monitor for the pathogens listed above.

3.2.1.5 Round Butte Hatchery

Under the new proposed license, the Joint Applicants will continue to fund the Round Butte Hatchery at current production levels for the life of the license. The current mitigation requirement for MCR steelhead is 1,800 adult returns to the Lower Deschutes Basin annually. The hatchery will continue to run as it does under the existing FERC license, and would be used to support the fish passage program. The Round Butte Hatchery stock of MCR steelhead would likely be the primary source for that species' reintroduction effort for a number of years.

3.2.1.6 Project Operations

Under the proposed new license, the Project will continue to operate as a modified run-of-river, peaking facility. The Joint Applicants will carry out the following measures regarding reservoir operations, flow measurement, ramping rates, and lower river flows.

Reservoir Operations

- Restrict seasonal drawdown of Lake Billy Chinook from the current allowed limit of 80-ft to 20-ft during normal winter operations, except during the following extraordinary circumstances 1) flood events during which drawdown is needed for safe passage of flood flows to minimize damage to life and property; 2) unforseen occurrences during drawdowns necessary to complete emergency repairs on Project facilities; and 3) periodic scheduled maintenance activities that require drawdown to complete repairs on Project facilities; and for regional power system emergencies.

- Restrict reservoir fluctuations of Lake Billy Chinook to a maximum of 1-ft [between elevations 1,944 and 1945-ft msl] between May 15 and September 15 of each year.

- Use water stored in Lake Billy Chinook to augment outflows from the Project to maintain an instantaneous release of 3,000 cfs downstream of the Reregulating Dam from September 16 to November 15. Augmentation of outflows would be subject to a maximum drawdown of Lake Billy Chinook of 4-ft.

Flow Measurement

- Improve accuracy of the Madras U.S. Geological Survey (USGS) gage (No. 14092500), in coordination with the USGS. The Madras gage is located downstream of the Reregulating Dam.

- Install additional reservoir level monitoring stations in Lake Billy Chinook and new real-time gages in its tributaries (Crooked, Deschutes, Metolious Rivers).

Ramping Rates

- Limit changes to the lower river stage downstream of the Reregulating Dam to 0.05-ft per hour and 0.20-ft per day between May 15 and October 15, and 0.10-ft per hour and 0.40-ft per day from October 16 to May 14, except under extraordinary circumstances.

Lower River Flows

- Maintain average minimum flows equal to monthly target flows, as measured at the Madras USGS gage downstream of the Reregulating Dam, of 4,500 cfs in December through February; 4,571 cfs in March; 4,170 cfs in April; 4,000 cfs in May through July; 3,500 cfs in August; 3,800 cfs in September through October; and 4,049 cfs in

November, or inflow to Lake Billy Chinook, whichever is less,[5] with a 150 cfs allowance for refilling Lake Billy Chinook[6] to meet the summer operating condition of maintaining the reservoir within the top 1-ft between May 15 and September 15 each year.

- Adjust minimum outflows from the Regregulating Dam on a daily, rather than weekly, basis.
- Hold lower river flows to within ±10% of the average daily inflow to Lake Billy Chinook.
- Use water stored in Lake Billy Chinook to augment outflows from the Project to maintain an instantaneous release of 3,000 cfs downstream of the Reregulating Dam from September 16 to November 15. Augmentation of outflows would be subject to a maximum drawdown of Lake Billy Chinook of 4-ft.

3.2.1.7 Water Quality

The Project currently violates water quality standards for temperature and dissolved oxygen (DO) in the lower river. Numeric modeling (Breithaupt et al. 2001, Khangaonkar et al. 1999 and 2002, Yang et al. 2000) has shown that blending of surface and bottom water will alleviate temperature effects and improve DO. Therefore, ODEQ and the CTWS Water Control Board are requiring the construction of the SWW in their CWA Section 401 certifications. In addition, the CWA Section 401 certifications require the Joint Applicants to develop a Water Quality Monitoring and Management Plan (WQMMP). Under the WQMMP, the Joint Applicants will monitor temperature, DO, pH, and phytoplankton growth in the Project's reservoirs. The monitoring sites will be the same as those used for baseline information so that data collected after construction of the SWW can be compared with baseline data to identify trends associated with modified Project operations. This monitoring approach will be used to help evaluate the success of SWW in achieving the predicted compliance with water quality standards. If post construction monitoring indicates compliance is not being achieved, then ODEQ or the CTWS Water Control Board may require the Joint Applicants to modify the blend of surface and deep water being discharged from the SWW, within a specified range of blends. The Fish Committee will review the potential effects of any such request on all water quality and fish passage parameters (PGE 2004).

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[5]When the lowest daily inflow during the previous 7 days is below the target flow, the allowed minimum flow would be equal to the lowest daily inflow recorded during the last 7 days.

[6]When inflows are equal to or greater than 3,650 cfs, the Project operators would be allowed to reduce outflows by 150 cfs less than the monthly target flow, or inflow, bewtween November 15 and May 15 to ensure refill of Lake Billy Chinook to its summer operating elevation. From March through June, if daily inflows are less than 3,650 cfs and greater than 3,500 cfs, the refill allowance would be the difference between the daily inflow and 3,500 cfs. If daily inflows are 3,500 cfs or less, the refill allowance would be 0. From November through February, if daily inflows are less than 3,150 cfs and greater than 3,000 cfs, the refill allowance would be the difference between the daily inflow and 3,000 cfs. If daily inflows are 3,000 cfs or less, the refill allowance would be 0.

3.2.1.8 Large Wood Management

Under the new license, the Joint Applicants will develop a Large Wood Management Plan in consultation with the Fish Committee, within one year of license issuance. The purpose of the plan is to provide for 1) the management of floating wood greater than eight inches in diameter (at the small end) by 10-ft long that enters Lake Billy Chinook; and 2) the placement of large wood along the Project reservoir shorelines for the protection of riparian vegetation. The plan would include a monitoring component to be carried out through the term of the license for the effectiveness evaluation of placed wood, including river transport for wood moved below the Project, use by fish and wildlife, and erosion control. The Large Wood Management Plan shall provide that the management of large wood will be adapted to reflect improvements identified through monitoring to improve the erosion control function of shoreline wood and the habitat value of all wood placements for riparian vegetation, fish and wildlife.

3.2.1.9 Lower River Gravel Augmentation Study

Under the new license, the Joint Applicants will carry out a gravel augmentation study in the lower river. The study consists of two components 1) A field-based sediment transport monitoring program; and 2) experimental gravel augmentation between the Reregulating Dam and Shitike Creek (about 3 RMs downstream). The objective of the monitoring and augmentation study is to assess Project impacts on downstream gravel availability and channel morphology. This study would build on the extensive research completed to date and will be an important component for understanding sediment transport thresholds and sediment dynamics in the Deschutes River. The second component of this study includes gravel augmentation experiments to 1) Monitor the mobility of placed spawning gravels, to determine overall bed mobility and sediment transport in the subject reach, and to inform future gravel augmentation efforts; and 2) monitor the quality of the augmented gravels for salmonid spawning and their use by spawning fish. The test program will involve adding a total of 300 cubic yards of gravel distributed among at least three sites between the Reregulating Dam and Shitike Creek. Sites would be chosen in consultation with the Fish Committee to minimize potential adverse effects from the augmented gravel, including disturbance to existing spawning habitat.

Based on the results from this study, and any other relevant information, the Fish Committee will determine whether a long term gravel augmentation action plan should be implemented. If a long term plan is required by the Fish Committee, the Joint Applicants will develop and carry out the plan in coordination with the Fish Committee, under adaptive management principles, and include monitoring of depth, velocity, armoring, percent fines, intergravel DO, and permeability at augmentation sites annually for at least the first ten years. Before any actions are taken under the gravel plan, a detailed proposal would be submitted to the Fish Committee, including NOAA Fisheries, for approval.

3.2.1.10 Lower River Habitat Enhancement

Under the Settlement Agreement, the Joint Applicants will fund a habitat enhancement project on Trout Creek, a tributary to the Lower Deschutes River roughly 12 miles below the Reregulating Dam. This activity would primarily benefit MCR steelhead. The Joint Applicant will target a reach of Trout Creek that has been substantially degraded as a result of erosion from the flood of 1964, and subsequent artificial straightening and channelization. This project will involve regrading, reshaping, and realignment of the stream channel to make the channel more hydraulically stable, and revegetation of the riparian zone. The project was identified in cooperation with the USFS, BLM, ODFW, and the CTWS Brand of Natural Resources. The detailed enhancement plan would be developed in consultation with the Fish Committee within one year of license issuance.

3.2.1.11 Test and Verification Studies

As a way to track progress and complete necessary changes to the fish passage program, the Joint Applicants will develop and complete a test and verification study plan in consultation with the Fish Committee. As an element of the plan, progress report and work plans would be developed for the Fish Committee review. Each work plan will include objectives, tasks and evaluation/decision criteria. Test and verification studies will be developed and carried out for the following:

- Facility evaluation.
- Fish health.
- Reservoir changes with SWW.
- Juvenile Salmonid Studies – reintroduction of anadromous stocks upstream of the Project.
- Juvenile salmonid studies – rearing, juvenile densities, and habitat.
- Juvenile salmonid studies – juvenile migration.
- Juvenile salmonid studies – reservoir survival, predation, fishery, and disease.
- Juvenile salmonid studies – Round Butte juvenile collection, downstream transportation and release.
- Adult salmonid studies – adult upstream trap-and-haul and volitional passage.
- Adult salmonid studies – adult migration, survival, and spawning.

Based on results of the individual test and verification studies, and after consultation with the Fish Committee and obtaining approval from appropriate resource agencies, the Joint Applicants will file plans with FERC for making any modifications to the facilities needed to ensure safe, timely and effective fish passage.

3.2.1.12 Pelton Round Butte Fund

Under the new license, the Joint Applicants will make contributions totaling $21.5 million (2003 dollars) to establish the Pelton Round Butte Fund. The fund would support habitat restoration, acquisition or lease of of insteam water rights, and water conservation projects in the Deschutes Basin. The Pelton Round Butte Fund Implementation Plan (Joint Applicants 2004) provides detail on how the fund will be administered over the life of the new license. It prescribes how the Fund will be established, maintained and governed, and how expenditures will be made and reviewed. The Fund would be administered by a Governing Board consisting of representatives of the Joint Applicants, NOAA Fisheries, and other of the parties to the Settlement Ageement.

3.2.2 Final Phase

The Final Passage Phase will be completed after interim downstream passage is determined to be successful, water quality requirements have been satisfied, and the risk of introducing new diseases is determined to be manageable or no longer a significant concern. Key activities that will occur during this phase include a decision by the Fish Committee, with NOAA Fisheries' approval, to allow volitional adult passage and terminate the juvenile fish marking program. This phase would continue through the balance of the new license period. In the event that volitional upstream passage is determined to be infeasible, or if the decision is deferred, upstream passage using trap-and-haul facilities will continue during the Final Passage Phase.

4.0 RANGE-WIDE STATUS OF THE LISTED SPECIES

The first step NOAA Fisheries uses when applying ESA Section 7(a)(2) to the listed ESU considered in this Opinion includes defining the species' biological requirements within the action area. Biological requirements are population characteristics necessary for the listed ESUs to survive and recover to naturally reproducing population sizes at which protection under the ESA would become unnecessary. The listed species' biological requirements may be described as characteristics of the habitat, population or both (McElhany et al. 2000).

4.1 Current Listing Status of MCR Steehead

The MCR steelhead ESU, listed as threatened on March 25, 1999 (64 FR 14517), includes all natural-origin populations in the Columbia River Basin above the Wind River, Washington, and the Hood River, Oregon, up to and including the Yakima River, Washington (Snake River excluded). This ESU includes the only populations of winter inland steelhead in the United States (in the Klickitat River, Washington, and Fifteenmile Creek, Oregon). On June 14, 2004, NOAA Fisheries published its proposed ESU listing determinations for Pacific salmon and steelhead (69 FR 33102) in response to the *Alsea* decision (Section 1.1). There is no proposed change to the listing status of MCR steelhead. However, NOAA Fisheries proposes to add over 100 hatchery populations and resident populations of *O. mykiss*, including the Round Butte Hatchery population. This is because NOAA Fisheries determined that the hatchery population is genetically no more than moderately divergent from the natural populations. Thus, the Round Butte Hatchery stock is proposed for listing as threatened. NOAA Fisheries must make final decisions on the proposed listing rule by June 14, 2005. NOAA Fisheries expects to adopt a final hatchery listing policy several months before issuing the final listing revisions rule. NOAA Fisheries will use that final policy in making its final listing decisions.

NOAA Fisheries' June 14, 2004 listing proposal did not resolve the ESU membership of native resident populations that are above recent (usually man-made) impassable barriers but below natural barriers. It was provisionally proposed that these resident populations not be considered part of the revised MCR steelhead ESU until such time as significant scientific information becomes available, thereby affording a case-by-case evaluation of their ESU relationships.

4.2 Current Range-Wide Status of MCR Steelhead

In this step, NOAA Fisheries also considers the current status of the listed species within the action area, taking into account population size, trends, distribution, and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species and also considers any new data that is relevant to the species' status. The biological requirements, life histories, migration timing, historical abundance, factors for decline, and current range-wide status of MCR steelhead have been well documented (BRT 2003, Busby et al. 1996, NMFS 1996a and 1997). In addition, the reader can refer to website Appendix A;

(http://www.nwr.noaa.gov/1habcon/habweb/habguide/bioptemplate_app_a.pdf) which includes a discussion of the general life history of MCR steelhead. The following sections briefly describe relevant biological information for MCR steelhead.

Consideration of Recent Ocean Conditions in the Listing Determinations

NOAA Fisheries considered the recent high returns for many ESUs in its proposed listing determinations (69 FR 33114), from which the following information is excerpted. In the last decade, evidence has shown recurring, decadal-scale patterns of ocean-atmosphere climate variability in the North Pacific Ocean. These oceanic productivity ''regimes'' have correlated with salmon population abundance in the Pacific Northwest and Alaska. Survival rates in the marine environment are strong determinants of population abundance for Pacific salmon and steelhead. However, because the confidence with which ocean-climate regimes can be predicted into the future is limited, man's ability to project the future influence of ocean-climate conditions on salmonid productivity is limited. Even under the most optimistic scenario, increases in abundance might be only temporary and could mask a failure to address underlying factors for decline. It is reasonable to assume that salmon populations have persisted over time under pristine conditions through many such cycles in the past. Less certain is how the populations will fare in periods of poor ocean survival when their freshwater, estuary, and nearshore marine habitats are degraded.

4.3 Steelhead General Life History

Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration. The stream-maturing type, or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, whereas others only have one run type.

In the Pacific Northwest, summer steelhead enter freshwater between May and October (Busby et al. 1996). During summer and fall, before spawning, they hold in cool, deep pools. They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early-spring, and then spawn (Meehan and Bjornn 1991). Winter steelhead enter freshwater between November and April in the Pacific Northwest (Busby et al. 1996), migrate to spawning areas, and then spawn in late-winter or spring. Some adults do not, however, enter coastal streams until spring, just before spawning (Meehan and Bjornn 1991). Difficult field conditions (snowmelt and high stream flows) and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning.

Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females. Iteroparity is more common among southern steelhead populations than northern populations (Busby et al. 1996). Multiple spawnings for steelhead range from 3% to 20% of runs in Oregon coastal streams.

Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity, is required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn further upstream than winter steelhead (Behnke 1992).

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992).

Juveniles rear in freshwater from one to four years, then migrate to the ocean as smolts. Steelhead populations generally smolt after two years in freshwater (Busby et al. 1996). Steelhead typically reside in marine waters for two or three years before returning to their natal stream to spawn at four or five years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby et al. 1996). Age structure appears to be similar to other west coast steelhead, dominated by four-year-old spawners (Busby et al. 1996).

Based on purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer, rather than migrating along the coastal belt as do salmon. During fall and winter, juveniles move southward and eastward. Oregon steelhead tend to be north-migrating (Pearcy et al. 1990, Pearcy 1992).

4.4 ESU Population Dynamics and Distribution

The Interior Columbia Basin Technical Recovery Team (TRT) identified 15 populations in four major population groups (Cascades Eastern Slopes Tributaries, John Day River, the Walla Walla and Umatilla Rivers, and the Yakima River) and one unaffiliated independent population (Rock Creek) in the MCR steelhead ESU. There are two extinct populations, the Deschutes River above Pelton Dam and the White Salmon (Interior TRT 2003).

The abundance of natural populations in the MCR steelhead ESU has increased substantially over the past five years. The Deschutes and Upper John Day Rivers have recent five year mean abundance levels in excess of their respective interim recovery target abundance levels (BRT 2003). Due to an uncertain proportion of out-of-ESU strays in the Deschutes River, the recent increases in this population are difficult to interpret. The Umatilla River recent five year mean natural population abundance is approximately 72% of its interim recovery target abundance level. However, the natural populations in the Yakima River, Klickitat River, Touchet River, Walla Walla River, and Fifteenmile Creek remain well below their interim recovery target abundance levels. Long term trends for 11 of the 12 production areas in the ESU were negative, although it was observed that these downward trends are driven, at least in part, by a peak in returns in the middle to late 1980s, followed by relatively low escapement levels in the early 1990s. Short-term trends in the 12 production areas were mostly positive from 1990 to 2001.

The continued low number of natural returns to the Yakima River (10% of the interim recovery target abundance level, for a subbasin that was a major historical production center for the ESU) generated concern in the West Coast Biological Review Team (BRT). However, steelhead remain well distributed in the majority of subbasins in the ESU. The presence of substantial numbers of out-of-basin (and largely out-of-ESU) natural spawners in the Deschutes River raised substantial concern regarding the genetic integrity and productivity of the native Deschutes population. The extent to which this straying is a historical natural phenomenon is unknown. The cool Deschutes River temperatures may attract fish migrating in the comparatively warm Columbia River, inducing high stray rates. The BRT noted the particular difficulty in evaluating the contribution of resident fish to ESU-level extinction risk. Several sources indicate that resident fish are very common in the ESU and may greatly outnumber anadromous fish. The BRT concluded that the relatively abundant and widely distributed resident fish in the ESU reduce risks to overall ESU abundance but provide an uncertain contribution to ESU productivity, spatial structure, and diversity (BRT 2003).

Life history information for MCR steelhead indicates that most fish smolt at two years of age and spend one to two years in salt water (i.e., one-ocean and two-ocean fish, respectively). After re-entering freshwater, they may remain up to a year before spawning (Howell et al. 1985). Within the ESU, the Klickitat River is unusual in that it produces both summer and winter steelhead, and the summer steelhead are dominated by two-ocean steelhead (most other rivers in this region produce about equal numbers of both one- and two-ocean steelhead).

There are seven hatchery steelhead programs considered to be part of the MCR steelhead ESU. These programs propagate steelhead in three of 16 ESU populations and improve kelt (post-spawned steelhead) survival in one population. There are no artificial programs producing the winter-run life history in the Klickitat River and Fifteenmile Creek populations. All of the ESU hatchery programs are designed to produce fish for harvest, although two are also implemented to augment the naturally spawning populations in the basins where the fish are released.

Hatchery fish are widespread and stray to spawn naturally throughout the region. Recent estimates of the proportion of natural spawners of hatchery origin range from low (Yakima, Walla Walla, and John Day Rivers) to moderate (Umatilla and Deschutes Rivers). Most hatchery production in this ESU is derived primarily from within-basin stocks. NOAA Fisheries' assessment of the effects of artificial propagation on ESU extinction risk concluded that these hatchery programs collectively do not substantially reduce the extinction risk of the ESU in total. ESU hatchery programs may provide a slight benefit to ESU abundance. Artificial propagation increases total ESU abundance, principally in the Umatilla and Deschutes Rivers. The kelt reconditioning efforts in the Yakima River do not augment natural abundance but do benefit the survival of the natural populations. The Touchet River Hatchery program has only recently been established, and its contribution to ESU viability is uncertain. The contribution of ESU hatchery programs to the productivity of the three target populations and the ESU in-total is uncertain. The hatchery programs affect a small proportion of the ESU, providing a negligible contribution to ESU spatial structure. Overall, the impacts to ESU diversity are neutral. Collectively, artificial propagation programs in the ESU provide a slight beneficial effect to ESU abundance but have neutral or uncertain effects on ESU productivity, spatial structure, and diversity (NMFS 2004a).

4.5 Deschutes River Basin Population Dynamics and Distribution

Nehlsen (1995) provides a comprehensive review of historical steelhead runs and their environment in the Deschutes River Basin upstream from the Project. Steelhead spawned in major tributaries of the Upper Deschutes River above the Project (Squaw Creek and the Crooked River). Steelhead were documented up to 120 miles from the mouth of the Crooked River (Nehlsen 1995). Historical presence of MCR steelhead in the Metolious River is less certain and questionable (Lichatowich *et al.* 1998).

Deschutes River adult summer steelhead enter the lower river from June through October. Steelhead pass Sherars Falls from July through October, with peak movements normally occurring in late September. Summer steelhead spawn in the mainstem Lower Deschutes River, the Warm Springs River system, Shitike Creek, Skookum Creek, Wapinitia Creek, Eagle Creek and Nena Creeks, the Trout Creek system, Bakeoven Creek system, and the Buck Hollow Creek system (CTWS 1999). Warm Springs River is a significant steelhead producer, as is Shitike Creek (U.S. Bureau of Reclamation (BOR) 2003). Potential spawning habitat in the White River is limited to the lower two miles by an impassable falls. ODFW does not routinely survey the White River and is uncertain whether steelhead occur in this area (BOR 2003), although a 2001 BLM and USFS biological assessment indicated that spawning occurs there (BLM and USFS 2001). The Warm Springs National Fish Hatchery operates a collection weir at RM 9 on the Warm Springs River, where it sorts migrating adult salmonids and retains sufficient fish for hatchery production. The hatchery releases wild steelhead back into the river to spawn naturally (BOR 2003). Good quality spawning habitat exists upstream from the Warm Springs National Fish Hatchery.

Spawning in the relatively warmer eastside tributaries, such as Trout Creek and Bakeoven Creek, occurs from January through mid-April. Spawning in the Lower Deschutes River and the cooler westside tributaries such as Warm Springs River and Shitike Creek, may begin in mid-March and continues through May (Zimmerman and Reeves 2000a). Based on spawning surveys on the mainstem Deschutes River, when water conditions allow, it appears that the majority of steelhead spawning occurs upstream of the White River. Westside tributaries are generally colder than eastside tributaries since their flows mostly originate from snowmelt on the eastern slopes of the Cascades, while eastside tributaries are mostly groundwater fed (BOR 2003). Eastside tributaries also likely have reduced flows during the hotter part of the summer. Steelhead appear to be opportunistic and in some years ascend small tributaries during short periods of high water to spawn in late winter and spring. Zimmerman and Reeves (1997) found that intermittent tributaries like Tenmile Creek, a Trout Creek tributary, provide important rearing habitat for juvenile steelhead where they do not have to compete with resident rainbow trout. Fry observed in Tenmile Creek were larger than fry found in the Deschutes River. The majority of the juvenile steelhead rear for two years before smolting and emigrating to the ocean. However, smolt ages can vary from one to four years. Steelhead generally rear in the ocean for two years before returning to the Deschutes River system as adults to spawn.

Where resident and anadromous forms of *O. mykiss* co-occur, the relationship between these two forms has been questioned as to whether resident *O. mykiss* contribute to the population dynamics and abundance of anadromous *O. mykiss* and provide a buffer against steelhead extinction. The two forms represent genetically distinct populations or two "ecophenotypes" within a single gene pool (Zimmerman and Reeves 2000a). Zimmerman and Reeves (2000a) reported that in the Deschutes River, based on microprobe analysis of Sr/Ca (strontium/calcium) ratio in otoliths, steelhead and rainbow trout are reproductively isolated. That is to say, adult steelhead from the Deschutes River that they tested were progeny of steelhead females and resident rainbow trout were progeny of resident rainbow trout females. There was also spatial and temporal separation of spawning in these two forms (Zimmerman and Reeves 2000b). Zimmerman and Reeves (2000b) also found that mainstem Deschutes River rearing habitat was primarily used by rainbow trout progeny and the lower ends of intermittent tributaries were exclusively used by steelhead progeny. Although the majority of juvenile steelhead rear in tributaries, some juvenile steelhead do rear in the mainstem Deschutes River. The mainstem Deschutes is likely more important for rearing juvenile steelhead during low water years when flows in tributaries are low. Juvenile salmonids prefer shallower water than adult fish because it provides suitable velocities, access to food, and security from predators. Since shallow water habitat is very limited in the Lower Deschutes River, the edges of the river with overhanging vegetation are important for rearing.

Evaluating the status of wild Deschutes River summer steelhead is a complex task because four different groups of steelhead occur in this basin (Chilcote 1998, NMFS 2000a). They include hatchery fish produced within the basin at Round Butte Hatchery, hatchery strays from the Snake and Upper Columbia River Basins, wild strays also from these upriver locations, and wild fish produced within the Deschutes River Basin. The Deschutes River also contains conspecific resident rainbow/redband trout (Behnke 1992).

NMFS (2000b) indicates that one of the most significant sources of risk to steelhead in the MCR ESU is the recent and dramatic increase in the percentage of hatchery fish escapement in the Deschutes River Basin. ODFW has estimated from capture of adult steelhead at Sherars Falls (RM 42) that in recent years, the percentage of hatchery steelhead strays in the Deschutes River has exceeded 70%, and many of these are believed to be long distance strays from outside the ESU, based on differential marking (BOR 2003). Coincident with this increase in the percentage of strays was a corresponding decline in the abundance of native wild steelhead in the Deschutes River. Straying has been observed during periods when the water of the Deschutes River is cooler than that of the Columbia River. The cooler water provides a thermal refugium for upstream-migrating adult steelhead. Straying behavior may occur as steelhead seek cooler water, it may be associated with transportation, and may be an adaptation that enhances survival (NMFS 2000b).

The number of adult steelhead captured at the Sherars Falls Trap has fluctuated substantially since 1977, with a substantial increase in 2001(BOR 2003). In 2001, 3,904 hatchery and 957 wild steelhead were captured there compared to 1,635 hatchery and 931 wild steelhead in 2000. The proportion of hatchery to wild steelhead in the Deschutes River has increased substantially since 1977, with over 80% of the fish being hatchery fish since 1991, except for 1999 and 2000. In 2001, 80.31% of the 4,861 steelhead captured at the Sherars Falls Trap were hatchery-origin, while 19.69 % were wild. In 1995, 90.56 % of the 1,950 steelhead captured were hatchery-origin, which was the highest for the period of record. NMFS (2000a) stated that in combination with the increasing trend in hatchery fish in the Deschutes River, estimates of increased proportions of hatchery fish in the John Day and Umatilla River Basins pose a risk to native wild steelhead due to negative effects of genetic and ecological interactions with hatchery fish.

5.0 ENVIRONMENTAL BASELINE

The environmental baseline is defined as: "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, including the anticipated impacts of all proposed Federal projects in the action area that have undergone Section 7 consultation and the impacts of State and private actions that are contemporaneous with the consultation in progress" (50 CFR 402.02). It is an analysis of "the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat and ecosystem, within the action area," including designated critical habitat. It does not include the effects of action under review (ESA Section 7 Consultation Handbook [March 1998] p. 4-22).

When the consultation is for an ongoing action, the task of assessing the effects on the environmental baseline is complicated by the fact that certain preexisting aspects of the ongoing project are also part of the environmental baseline, while other proposed aspects represent the proposed action that is the subject of the consultation. It is important to recognize a fundamental principle of an ESA § 7(a)(2) consultation. Section 402.03 provides: "Section 7 and the requirements of this part apply to all actions in which there is discretionary involvement or control." Accordingly, the ESA requires a Federal agency to consult on actions that it proposes to authorize, fund, or carry out pursuant to its discretionary authority. See also 50 CFR § 402.02 "action" and ESA § 7(a)(2). Thus it follows that the ESA does allow consultation and analysis of conditions that are within the action agencies discretionary authority. In other words, the ESA provides for analysis of baseline conditions without the Project since FERC, the action agency, has discretionary authority to require removal of the Project.

Environmental baseline effects are evaluated in relation to the biological requirements of the listed species. The biological requirements of MCR steelhead within the action area include adult migration and holding, spawning, incubation, and juvenile rearing and migration. The biological requirements of the species include conditions sufficient to satisfy these uses, thus contributing to the survival and recovery of the ESU to a naturally reproducing and self-sustaining population size such that protection under the ESA would become unecessary. In describing the environmental baseline, NOAA Fisheries emphasizes important habitat indicators for MCR steelhead affected by the proposed action.

5.1 Action Area

The action area for an ESA consultation is "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). For this consultation, the action area is the historical range of MCR steelhead in the Deschutes River Basin, downstream to its confluence with the Columbia River. The historical range above the Project includes the Metolious River Basin, the Deschutes River upstream to Big Falls (a natural barrier), Squaw Creek drainage (a tributary to the Deschutes River), and the Crooked River Basin up to Bowman Dam.

5.2 Biological Factors Affecting MCR Steelhead in the Action Area

5.2.1 Hatcheries

Artificial propagation of steelhead began in Squaw Creek in 1951. Brood stock was collected from a weir on Squaw Creek, the adults spawned and juveniles reared at Wizard Falls Trout Hatchery on the Metolius River. From 35,000 to 50,000 yearling smolts were released annually between Squaw Creek, the Metolius, and Deschutes Rivers most years from 1952 through 1957. The present hatchery program began in 1967 and production was shifted to Round Butte Hatchery with its completion in 1973 (Ratliff and Schulz 1999). The initial brood stock for this program were wild Deschutes River fish taken from the Pelton Trap. However, in 1982 the infusion of wild genes into the Round Butte Hatchery brood stock was discontinued due to concerns that IHN virus could be established from out-of-basin strays. Wild steelhead returning to the Pelton Trap were returned to the river. Wild steelhead were again incorporated into the Round Butte Hatchery brood stock (wild, hatchery) beginning in 1988 (Ratliff and Schulz 1999) and continued until the late 1990s. Currently, wild fish are not being used as a source of hatchery brood stock.

The majority of steelhead produced in the Deschutes River Basin are hatchery spawned and reared (Section 4.5). The Deshutes River hatchery program may increase abundance, may be decreasing population diversity, and has a neutral or uncertain effect on productivity and spacial structure[7] (69 FR 33139). As discussed above (Section 4.5), the straying and possible spawning of out-of-basin hatchery steelhead in the Deschutes River Basin remains a worry.

5.2.2 Predation

Juvenile steelhead spawned above the Round Butte Development must pass through Lake Billy Chinook during their seaward migration. One potent predator that exists in large numbers within Lake Billy Chinook is bull trout, an ESA-listed species. Other possible predators include northern pikeminnow, smallmouth bass, brown trout, and rainbow trout. The potential impacts from predation on reintroduced steelhead are unknown at this time.

5.3 Habitat Factors Affecting MCR Steelhead in the Action Area

The Deschutes River drains an area of about 10,500 square miles and empties into the Columbia River near the Dalles, Oregon, 203 miles upstream of the Pacific Ocean. The major spring-fed tributaries from the Cascades enter the Deschutes River from the south and west and include Fall River (RM 205), the Little Deschutes River (RM 193), Spring River (RM 190), Tumalo Creek

[7] "A population's spatial structure is made up of both the geographic distribution of individuals in the population and the processes that generate that distribution. Spatially structured populations are often generically referred to as "metapopulations," though the term metapopulation has taken on a number of different meanings. A population's spatial structure depends fundamentally on habitat quality, spatial configuration, and dynamics as well as the dispersal characteristics of individuals in the population" (McElhany et al. 2000).

(RM 160), Squaw Creek (RM 123), the Metolius River (RM 111), Shitike Creek (RM 97), the Warm Springs River (RM 84), and White River (RM 46). Major tributaries entering the Deschutes River from the Ochoco Mountains to the east are the Crooked River (RM 114) and Trout Creek (RM 87) (PGE 2004). Three major irrigation storage reservoirs are located near the headwaters of the Deschutes River and two in the Crooked River Basin. Their combined storage capacity is nearly 535,000 acre-ft (BOR 2004).

The Deschutes River is one of the most hydrologically stable rivers of its size in the nation, which is attributable to the proportionally large contribution of groundwater springs to its streamflow. Over 80% of the flow past the Project on an annual basis comes from ground water (Gannett et al. 2003). These springs are associated with the porous volcanic rocks and debris present in the western portion of the Deschutes River Basin. Fassnacht (1997) notes that the stable nature of the Lower Deschutes River is apparent in its channel morphology and vegetation growth. There are very few meander bends and point bars which are more common in active alluvial channels. The point bars that are present are well vegetated, indicating that they are several years old. Alluvial fans from tributaries constrain the river and are stable with mature vegetation covering them (Fassnacht 1997). As a result of this channel and flow stability, riparian vegetation is not subject to the scouring effects found in more flashy systems, and vegetation does not experience drought conditions during summer months due to the constancy of base flow (Minear 1999). Therefore, there are grasses, sedges, cattails, willows, and alder at the edge of the river that provide good overhead cover and complex edge rearing habitat. Shallow water juvenile habitat is a limiting factor in the Lower Deschutes River, because of rapidly increasing depths along the banks, so the habitat complexity provided by the overhanging vegetation is important for rearing salmonids.

5.3.1 Habitat Baseline Indicators

Habitat-altering actions can negatively affect salmon population viability. However, it is often difficult to quantify the effects of a given habitat action in terms of its impact on biological requirements for individual salmon. Thus it follows that while it is possible to draw an accurate picture of a species' range-wide status - and in fact doing so is a critical consideration in any jeopardy analysis - it is difficult to determine how that status may be affected by a given habitat-altering action. With the current state of the science, typically the best that can be done is to determine the effects an action has on a given habitat component and, since there is a direct relationship between habitat condition and population viability, extrapolate that to the impacts on the species as a whole. Thus by examining the effects a given action has on the habitat portion of a species' biological requirements, NOAA Fisheries has a gauge of how that action will affect the population variables that constitute the rest of a species' biological requirements and, ultimately, how the action will affect the species' current and future health.

Ideally, reliable scientific information on a species' biological requirements would exist at both the population and the ESU levels, and effects on habitat should be readily quantifiable in terms of population impacts. In the absence of such information, NOAA Fisheries' analyses must rely on generally applicable scientific research that one may reasonably extrapolate to the action area and to the population(s) in question. So, for actions that affect freshwater habitat, NOAA Fisheries usually defines the biological requirements in terms of a concept called properly functioning condition (PFC) (NMFS 1996b). PFC is the sustained presence of natural habitat forming processes in a watershed (e.g., riparian community succession, bedload transport, precipitation runoff pattern, channel migration) that are necessary for the long term survival of the species through the full range of environmental variation. PFC, then, constitutes the habitat component of a species' biological requirements. The indicators of PFC vary between different landscapes based on unique physiographic and geologic features. For example, aquatic habitats on timberlands in glacial mountain valleys are controlled by natural processes operating at different scales and rates than are habitats on low-elevation coastal rivers.

In the PFC framework, baseline environmental conditions are described as *properly functioning condition* (PFC), *at risk* (AR), or *not properly functioning* (NPF). If a proposed action would likely impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long term progress of impaired habitat toward PFC, it will usually be found likely to jeopardize the continued existence of the species or adversely modify its critical habitat, or both, depending upon the specific considerations of the analysis. Such considerations may include the species' status, the condition of the environmental baseline, the particular reasons for listing the species, any new threats that have arisen since listing, and the quality of the available information.

5.3.1.1 Water Quality: Temperature

NOAA Fisheries defines PFC for water temperature as temperatures not exceeding 57°F; water temperatures between 57°F and 60°F are considered AR for spawning and between 57°F and 64°F are AR for migration and rearing; temperatures exceeding 60°F in spawning habitat and 64°F in rearing and migration habitat are considered to be NPF (Table 5-1).

TABLE 5-1. Water temperature standards for salmon and steelhead (NMFS 1996b).

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Water Quality	Temperature	50-57°F	57-60°F (spawning) 57-64°F (migration & rearing)	>60°F (spawning) >64°F (migration & rearing)

The following description has been largely extracted from PGE (2004).

<u>Tributaries above the Project</u>

Temperature was measured during 1994 through 1996 in the Metolius, Crooked, and Deschutes Rivers once monthly during the daytime, and also about every half hour by automated monitoring devices. The monthly data show distinct differences between the tributary rivers. The Metolius River is notably cooler than the others. The Deschutes is intermediate and the

Crooked River is the warmest. The annual cycle of temperature is more marked in the Deschutes River than in the other tributaries. All three tributary rivers are strongly influenced by springs, which tend to moderate annual temperature cycles. The Crooked River has wide variations in water temperature in its upper reaches. However, it is also notable for the relatively narrow range of temperatures it exhibits during most of the year at the point it enters Lake Billy Chinook. This can be attributed to the large amount of ground water (≈1,500 cfs) entering the Crooked River from the Opal Spring complex a short distance upstream from the reservoir (Raymond et al. 1997). These springs keep the Lower Crooked River warmer during the winter except during periods of snow melt and runoff from the Upper Crooked River Basin.

Metolious River

The Metolious River has been designated by ODEQ as bull trout spawning and rearing habitat. Bull trout require clean, cold water and ODEQ's temperature standard for this species is a maximum of 53.6°F. The Metolius River immediately above Lake Billy Chinook exceeds 50°F only for a few hours each afternoon from mid-June through August (USGS gage number 14091500). ODEQ also designated the Metolious River as rearing and migration habitat for Salmon and trout, but did not designate salmon or steelhead spawning standards for this river because it is upstream from the Project. For spawning, migration and rearing, NOAA Fisheries rates the Metolious River as PFC for temperature.

Deschutes River

ODEQ has designated the Deschutes River upstream of Lake Billy Chinook as salmon and trout rearing and migration habitat. Stream temperatures measured in this reach are warmest during the months of August and September, where the maximum temperature measured during the period of study (July 1994 through October 1996) was 59.5°F. This indicateds that for MCR steelhead rearing and migration, this reach is AR for temperature during the summer months and PFC during the rest of the year. Salmon and steelhead spawning criteria has not been designated by ODEQ for areas above the Project. However, for this same reach, stream temperatures during months MCR steelhead spawn (late-February to mid-May) range from about 45°F to 55°F for theperiod of study. Therefore, this reach of the Deschutes River would be PFC for spawning.

Crooked River

ODEQ has designated the Crooked River upsteam of Lake Billy Chinook as salmon and trout rearing and migration habitat. Like the Deschutes River, stream temperatures measured in this reach (below Opal Springs) are warmest during the months of August and September, where the maximum temperature measured during the period of study (July 1994 through October 1996) was 57.7°F. Thus, for MCR steelhead rearing and migration, this reach may be AR for temperature during the summer months in some years and at PFC in others. This reach is PFC during the rest of the year. Salmon and steelhead spawning criteria has not been designated by ODEQ for areas above the Project. However, for this same reach, stream temperatures during months MCR steelhead spawn (late-February to mid-May) range from about 46°F to 54°F for the period of study. Therefore, this reach of the Deschutes River would be PFC for spawning.

Project Reservoirs

Lake Billy Chinook usually begins to stratify in May with the thermocline developing at a depth of 30 to 35-ft. The thermocline begins to break down in October but the reservoir does not become fully isothermal. Lake Simtustus is thermally stratified in the summer from about mid-May until mid-September, with a thermocline developing at roughly 13-ft. Stratification breaks down in September and the reservoir is vertically isothermal by late-October. The reservoir continues to cool until March or April (Raymond et al. 1997).

Temperatures in Lake Billy Chinook and Lake Simtustus typically exceed 50°F at all depths from June through October. The warming that occurs in the hypolimnion is the result of inflow of warm water from tributary streams. During stratification, temperatures can exceed 70°F in the epilimnion of Lake Billy Chinook (Round Butte Dam forebay), and 68°F in the epilimnion of Lake Simtustus (Pelton Dam forebay). In the forebay of Round Butte Dam, the thermocline (temperature gradient between the epilimnion and hypolimnion) can extend nearly 81-ft (25 meters). At about 33-ft, where the thermocline begins, summer temperature can reach about 64°F (Raymond et al. 1997).

During the period of reservoir statification in Lake Billy Chinook and Lake Simtustus, surface temperatures are NPF for MCR steelhead and AR in the upper portion of the thermocline. It is important to note that our description here is simplified. Variation occurs both within and between years. To gain a better understanding of temperature behavior in the Project's reservoirs, the reader should refer to Raymond et al. (1997).

Lower Deschutes River (Below Project)

Water temperature data for the Lower Deschutes River at the USGS Madras gage for the period 1972 to 1988 were compiled by Huntington et al. (1999) and provide a reasonably comprehensive assessment of recent water temperatures (Table 5-2). During this period, the average water temperatures immediately below the Reregulating Dam (RM 100) remain within PFC (≤57°F) for MCR steelhead spawing, rearing and migration. However, temperature time series monitoring conducted by PGE from 1997 through 1999 shows that temperature increases moving downsteam. For instance, at RM 94, RM 83, RM 50, and RM 4, water temperatures during the MCR steelhead adult migration period (June through October) can peak at about 60°F, 64°F, 65°F, and >70°F, respectively. Maximum temperatures at these site typically occur during the August to September time frame (Breithaupt et al. 2001).

TABLE 5-2. Mean weekly water temperatures for the Lower Deschutes River at the USGS gage near Madras, Oregon from 1972-1988.

Month	Number of Weeks	Mean Weekly
October	54	12.5°C (54.5°F)
November	59	10.3°C (50.5°F)
December	61	8.1°C (46.6°F)
January	63	6.6°C (43.9°F)
February	60	6.2°C (43.2°F)
March	68	6.9°C (44.4°F)
April	68	8.0°C (46.4°F)
May	68	9.6°C (49.3°F)
June	69	11.3°C (52.3°F)
July	62	12.7°C (54.9°F)
August	58	13.5°C (56.3°F)
September	52	13.6°C (56.5°F)

Data extracted from Huntington et al. 1999, Table 6.

During the MCR steelhead spawning period (late-January through May), stream temperatures appear to be at PFC at RM 94, PFC at RM 83, and PFC for early spawners and possibly AR for late spawners at RM 50.

Detailed temperature modeling of the Deschutes River shows that the years for which there are sufficient data, the temperatures measured in the Deschutes River below the Reregulating Dam during the summer are equal to or lower than what would have been expected in the absence of the dams (Huntington et al. 1999). Temperatures in the late-summer and fall are slightly warmer than would have been expected in the absence of the Project. Computer simulations, based on detailed temperature data collected in 1997 and 1998 suggest that weekly mean temperatures immediately below the Reregulating Dam have been shifted in time so that they are warmer by about 1.3°F (range:0.36 to 2.7°F) from early-August to mid-December and cooler by an average of about 3.1°F (range:0.4 to 6.3°F) during the remainder of the annual cycle as a result of the Project (Huntington et al. 1999).

5.3.1.2 Water Quality: Dissolved Oxygen

The Oregon Adminstrative Rule (OAR) 340-041-0565(2)(a) establishes minimum DO concentrations for Oregon water bodies. NOAA Fisheries defines PFC as DO concentrations that meet or exceed this OAR. The State of Oregon's standard for DO in the action area is 11.0 parts-per-million (ppm) (30-day mean minimum) or 95% saturation if barometric pressure, altitude and temperature preclude achievement of the 11.0 ppm standard. When intergravel DO remains at 8.0 ppm or greater, DO levels may be as low as 9.0 ppm without violating the standard.

Tributaries above the Project

The annual ranges of DO values in the three tributaries above the Project measured during the daytime are similar. The Metolius River has somewhat higher DO values (median = 11.8 ppm) than the Deschutes River (median = 11.2 ppm) and Crooked River (median = 10.7 ppm). Daytime DO values measured between 1994 and 1996 in the Metolius and Deschutes Rivers were typically greater than 11.0 ppm. DO in the Crooked River was usually close to 11.0 ppm.

Project Reservoirs

Lake Billy Chinook is well oxygenated during the winter throughout its depth, although DO concentration varies slightly with depth, even when the reservoir appears to be well mixed. In the reservoir, DO falls below the 8.0 ppm standard in the hypolimnion during the summer. DO values of less than 4.0 ppm can occur near the bottom at the deepest sites. DO typically remains above 8 ppm at depths less than 50-ft. At depths between 50-ft and 246-ft, the majority of DO measurements were greater than 8 ppm. Near the surface, DO values stay at or above 10.0 ppm throughout the year.

Lake Simtustus shows seasonal vertical stratification in DO concentration similar to Lake Billy Chinook, but does not exhibit significant depletion of oxygen in the hypolimnion during the summer. During the winter, the reservoir has a uniform DO concentration throughout its depth. In May, as stratification sets in, the epilimnion begins to display elevated DO concentration. DO reaches a peak in the epilimnion in June, well above saturation levels. The hypolimnion remains well oxygenated throughout the year.

The prolific algal growth in the epilimnion of Lake Billy Chinook and Lake Simtustus would lead to the expectation of even greater oxygen depletion in the hypolimnion than actually occurs. Such extreme oxygen depletion does not occur in Lake Billy Chinook because well-oxygenated water from the Metolius and Deschutes Rivers tends to flow at depth to replace water removed through the power intake. A similar situation occurs in Lake Simtustus where relatively well-oxygenated water from mid-depths in Lake Billy Chinook flows through the hypolimnion. The short residence time (four to five days) in the hypolimnion in Lake Simtustus during the summer reduces the opportunity for oxygen depletion.

In a highly productive system, DO can be depleted from surface waters at night as the result of biological respiration. Diurnal measurements were made between two hours before sunrise and 2 hours after sunset in July 1995 and August 1997. In the epilimnion, where the diurnal effects of photosynthetic activity are most dramatic, DO ranged between 8 ppm and 12 ppm in July 1995 in Lake Billy Chinook. In August 1997, measurements taken in Lake Simtustus ranged between approximately 8 ppm and 17 ppm. In Lake Billy Chinook the range was approximately 8 ppm to 12 ppm in the epilimnion, with somewhat lower values in the hypolimnion.

Lower Deschutes River

DO becomes depleted during the summer month in the hypolimnion of Lake Billy Chinook at the level of the powerhouse intake. This water continues through Lake Simtustus in the hypolimnion and is withdrawn through the power intake and discharged to the Reregulating Reservoir. Residence time in the Reregulating Reservoir is too short to provide for complete aeration before discharge through the Reregulating Dam powerhouse to the Lower Deschutes River. Therefore water leaving the Reregulating Reservoir is undersaturated in DO.

The Lower Deschutes River from the Reregulating Dam to the mouth of the White River (RM 46) is included on the ODEQ 303(d) list of water quality limited water bodies because it fails to meet the DO standard for spawning salmonids (11 ppm or 95% saturation) from October 1 to July 31 (Lewis and Raymond 2000). Raymond et al. (1997) took DO measurements at the Highway 26 bridge from 1994 to 1996. Of 24 monthly daytime samples, 11 were below the State standard of 11 ppm or 95% saturation. However, conditions of temperature, altitude, and pressure sometimes precluded reaching the 11 ppm standard. Of the 24 monthly measurements, eight were below 95% saturation. During the course of the 1994 through 1996 study, one monthly value of DO less than 8 ppm was recorded below the Project. Most values were between 9 ppm and 13 ppm as physical and biological processes rapidy re-aerate the river below the Project (Raymond et al. 1998). By the time it reaches Trout Creek (RM 88) it displays characteristics of production and respiration expected for a river system approaching equilibrium with respect to dissolved gases (Eilers et al. 2000).

Intergravel DO

Measurements made immediately below the Project from mid-summer to early fall have at times been at 8 ppm or about 90% saturation. This raised concern that the intergravel DO concentration could be falling below ODEQ's minimum intergravel DO standard of 6 ppm. Lewis and Raymond (2000) evaluated intergravel DO in 1999. Differences in DO concentrations between ambient and intergravel water were found to be little to none. At all sites, median intergravel DO concentration was greater than 6 ppm. When water was released at the Reregulating Dam, through a spill of 1/3 the total flow, intergravel DO concentrations at RM 100 rose above 8 ppm. An increase from no spill to 1/3 spill resulted in a DO increase of 11%, from 6.0 ppm to above 8.0 ppm, while an increase from 1/3 spill to full spill resulted in a further increase of 9%. The effect of spill on DO concentration decreased with distance from the Reregulating Dam. The DO at full spill increased 23% just below the Reregulating Dam but was just 4% higher below the mouth of Trout Creek (RM 87) (Lewis and Raymond 2000).

With the Lower Deschutes River on Oregon's 303(d) list of water quality limited water bodies for DO, NOAA Fisheries concludes that this indicator may be AR for that portion of the action area, PFC for areas above the Project, and PFC within the Projects reservoirs (with the exception of deep reservoir waters which are not generally considered as salmonid habitat).

5.3.1.3 Water Quality: Chemical Contamination/Nutrients

NOAA Fisheries defines PFC as low levels of contamination with no CWA 303(d) designated reaches. The category AR is defined as one 303(d) designated reach, and NPF as having more than one 303(d) designated reach (Table 5-3).

TABLE 5-3. Contamination/Nutrient standards for salmon and steelhead (NMFS 1996b).

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Water Quality	Chemical Contamination/ Nutrients	Low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients, no CWA 303(d) designated reaches.	Moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients, one CWA 303(d) designated reaches.	High levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients, more than one CWA 303(d) designated reaches.

<u>Tributaries above the Project</u>

The abundance of chlorophyll *a* in the reservoirs is the result of nutrients, primarily silica, nitrogen, and phosphorus, entering the reservoirs from the tributary rivers and streams. All of the tributary streams to the Project flow through areas that have been affected by various disturbances, but the Metolius River is relatively undisturbed; therefore, nutrient concentration in the Metolius River can be taken to represent near-natural conditions. Nutrient concentration in some tributary streams is quite high. Willow Creek, which flows into Lake Simtustus, and the Crooked River are notably high in nitrogen. Phosphorus is higher in the Crooked River than in the other rivers and streams.

<u>Project Reservoirs</u>

The phosphorus content in the Project reservoirs is largely natural in origin. The concentration of phosphorus in the Metolius River is the result of the abundance of phosphorus in the basaltic bedrock of the basin. Basaltic bedrock is also a source for much of the phosphorus in the Deschutes River, and possibly the Crooked River, although these rivers may be artificially enriched in phosphorus. If the concentration of phosphorus in the relatively undisturbed Metolius is taken to be equal to the concentration derived from natural sources in the Deschutes and Crooked Rivers, then perhaps more than 70% of the phosphorus load to Lake Billy Chinook is from natural sources.

Late-summer dominance by blue-green algae often occurs in lakes that have been artificially enriched with excessive phosphorus from anthropogenic sources. Even complete elimination of excess phosphorus load from the Deschutes and Crooked Rivers would have little overall impact on chlorophyll *a* abundance in Lake Billy Chinook because nearly 40% of the total phosphorus load to Lake Billy Chinook is from the Metolius River. Even if average phosphorus concentration could be reduced by as much as 60%, the reservoir would remain in the range of eutrophic lakes.

Both Lake Simtustus and Lake Billy Chinook stratify during the summer when biological activity is at its peak. Because water from the Crooked River and Willow Creek, which are the major sources of nitrogen to Lake Billy Chinook and Lake Simtustus, tends to be located in the epilimnion of each reservoir during the summer, the biological activity, and hence the nutrients, tend to be located there as well. Water that leaves the reservoirs at depth might be expected to show a reduction in nutrient concentration because of the isolation of nutrients in the epilimnion.

Lower Deschutes River

The Lower Deschutes River appears to be nitrate-limited with decreasing nitrate proceeding downstream, which limits plant growth. It was not believed that phosphorus limits plant growth in the Lower Deschutes River. Proceeding downstream, phosphorus concentrations decreased to a much lesser extent than nitrogen.

Because there are no water bodies within the action area that are listed on Oregon's 303(d) list for nutrients, NOAA Fisheries concludes that this indicator is PFC.

5.3.1.4 Water Quality: pH

NOAA Fisheries defines PFC for pH (hydrogen ion concentration) as waters that have no CWA 303(d) designated reaches. Most streams in the State of Oregon have pH values falling somewhere between 6.5 and 8.5, and ODEQ has set the pH standard for the Deschutes Basin to be within this range (ODEQ 2002). The following description is excerpted from PGE (2004).

Tributaries above the Project

The Metolius River has the lowest overall pH of the tributary streams. The Deschutes River and the Crooked River have similar overall pH, but the pH in the Deschutes River is more variable than in the Crooked River. During the 1994 through 1996 limnology study (Raymond et al. 1997), pH exceeded 8.5 in the Deschutes and Crooked Rivers above the Project on several occasions. Values of pH in the Metolius River exceeded 8.0.

Project Reservoirs

The seasonal pattern of pH in Lake Billy Chinook is similar to that of temperature and DO. Values of pH near the surface regularly exceed 8.5 during the summer months, with a maximum value of 9.4 and a median value of 8.6 based on monthly daytime samples in 1994 through 1996. Values at depth are not extreme, with a median of 7.5 and a maximum of 8.3 at the approximate depth of the powerhouse intake. Even with the breakdown of stratification in the winter, pH in Lake Billy Chinook maintains a vertical gradient throughout the year.

Seasonal patterns of pH in Lake Simtustus are similar to Lake Billy Chinook. During the summer months, pH values at the surface commonly exceed 9.4, based on monthly daytime samples; the median pH was 8.8 and the maximum 9.7. The pH in Lake Simtustus is vertically uniform during the winter.

Lower Deschutes River

Values of pH in excess of 8.5 have been measured at multiple times and locations in the lower river, corresponding to reaches with high oxygen saturation levels. Values for pH tend to climb throughout the day due to photosynthesis. Diurnal changes in pH are the consequence of carbon dioxide depletion through photosynthetic activity. Visual observation of the river bed during surveys from 1997 through 1999, and from water samples collected in 1999, recorded high chlorophyll *a* abundance and high abundance of filamentous green algae (*Cladophora* sp.) and attached macrophytes (*Elodea* sp.) growing throughout the length of the Lower Deschutes River. Photosynthetic activity is sufficient to reduce the nitrogen concentration to near zero at times in the water near the mouth of the Deschutes River (Raymond et al. 1998). Measurements taken at different points in the river in July and September of 1997 show that pH increases throughout the day along the length of the river, often exceeding the standard of 8.5 (Raymond et al. 1997). Modeling conducted on the Lower Deschutes River indicates that pH in excess of 8.5 can be expected during summer afternoons mostly in the ten miles below the Project, and then dropping with increasing distance downstream of the Project (PGE 2004).

Becasue pH can exceed 8.5 during certain times of the year, NOAA Fisheries concludes that the action area may be AR for pH.

5.3.1.5 Water Quality: Total Dissolved Gas

OAR 340-041-0565(2)(n)(a) establishes maximum total dissolved gas concentrations for Oregon water bodies as $\leq$110.0%. NOAA Fisheries defines PFC as total dissolved gas concentrations that satisfy this OAR.

Lewis and Raymond (2000) took measurements of total dissolved gas below the Reregulating Dam during a spill in 1999. No excessive values were recorded. Conditions characteristic of producing high concentrations of total dissolved gas—deep-plunging spill—do not occur at the

Project. Spill rareley occurs at the Project, and when it does, the spill plume either lands on concrete aprons or in shallow water.

This indicator is PFC within the action area because total dissolved gas levels do not exceed the maximum state standard of 110%.

5.3.1.6 Habitat Access: Physical Barriers

Table 5-4 identifies NOAA Fisheries standard for man-made fish passage barriers in salmon and steelhead bearing streams.

TABLE 5-4. Man-made, fish passage barrier standards for salmon and steelhead (NMFS 1996b).

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Habitat Access	Physical Barriers	Any man-made barriers present in a watershed that allow upstream and downstream fish passage at all flows.	Any man-made barriers present in a watershed that do not allow upstream/ downstream fish passage at base/low flows.	Any man-made barriers present in a watershed that do not allow upstream/ downstream fish passage at a range of flows.

Access to the Metolious, Upper Deschutes, and Crooked Rivers - MCR steelhead's historical habitat - and their tributaries was eliminated with the construction of the Project. The lack of fish passage blocks access to approximately 100 miles of salmonid habitat in the Crooked River Basin, about 30 miles in the Deschutes River Basin, and approximately 41 miles in the Metolius River Basin (PGE 2004). Except for some attempts at passing adult fish around the Pelton-Round Butte Project in the 1960s and an ongoing hatchery operation, MCR steelhead are now restricted to the Lower Deschutes River and its tributaries downstream from the Project.

This indicator is NPF for MCR steelhead.

5.3.1.7 Habitat Elements: Substrate

NOAA Fisheries defines PFC as predominantly gravel and cobble substrate with clear interstitial spaces and <20% embeddedness. The supply and movement of sediment in a river system can affect aquatic habitat and water quality. Bedload sediment, which moves by rolling and hopping along the bed of a river, is important for shaping aquatic habitat and providing spawning and rearing areas for fish and invertebrates.

Round Butte Dam has trapped roughly 1.6 million cubic yards of sediment since it was constructed, which is considered to be a small amount relative to the size of the watershed. Most of the sediment is located in the Crooked and Deschutes arms of Lake Billy Chinook. Limited sampling was done in 1998 to determine sediment composition. The majority of sediment appears to be sand, silt, and clay, with some gravel located on the apex of the deltas (O'Connor et al. 2003). A multiyear geomorphic study of the Lower Deschutes River suggests that transport events are very infrequent and that gravel downstream of the dam is relatively stable (Fassnacht et al. 2003). Flows competent to mobilize the streambed occur less frequently than on other alluvial rivers. Analysis of gage data collected just below the Reregulating Dam reveals slow, minor degradation of the channel over the entire period of record, indicating the dams have not noticeably accelerated long term incision rates (Fassnacht et al. 2003). There is some indication of armoring of the streambed in the 3 mile reach from the Reregulating Dam downstream to Shitike Creek. However, this was not found to be statistically significant in a detailed analysis of longitudinal trends in surface and subsurface grain sizes (McClure 1998). Studies published by the American Geophysics Union indicate that the Deschutes River is a very stable alluvial system. This stability appears to be due to a uniform flow regime and low rate of sediment supply, neither of which has been significantly altered by the Project (Fassnacht et al. 2003, Grant et al. 2003).

Bed material particle size distribution in the Lower Deschutes River ranged from D_{50} values of 2.93 inches to 3.74 inches with no trends with distance downstream. Particle size appears to be controlled more by local hydraulics and local sediment sources than by distance downstream (Fassnacht 1997).

Based on the discussion above, NOAA Fisheries concludes that substrate is PFC within the action area.

5.3.1.8 Habitat Elements: Large Woody Debris

For east side (east of the Cascade Range) streams, such as those in the Deschutes Basin, NOAA Fisheries defines PFC as >20 pieces of wood per mile which are >12 inches in diameter and >35-ft long (Table 5-5).

TABLE 5-5. Large woody debris standards for salmon and steelhead (NMFS 1996b).

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Habitat Elements	Large Woody Debris	Coast: >80 pieces/mile >24" diameter >50-ft. length. East Side: >20 pieces/mile >12" diameter > 35-ft. length; and adequate sources of woody debris recruitment in riparian areas.	Currently meets standards for properly functioning but lacks potential sources from riparian areas of woody debris recruitment to maintain that standard.	Does not meet standards for properly functioning and lacks potential large woody debris recruitment.

The Project currently blocks the movement of large woody debris (LWD) from the Upper Deschutes, Crooked, and Metolius Rivers to the Lower Deschutes River (Minear 1999). The Crooked River and a portion of the Deschutes River upstream of the Project flow through largely unforested terrain, though large mature Ponderosa pines are present in these river's riparian areas. Floods of a magnitude to transport large wood from the Metolius Basin are rare events, and only two events, December 1964 and February 1996, occurred during the period of the Project's first FERC license. During the 1996 flood, a considerable amount of large wood was transported out of Shitike Creek, Warm Springs River and White River as these streams had floods of record. However, very little of this wood was deposited in channel. This was a bank topping event and wood transported by these large flows was deposited for the most part high on the outside of bends or on ancient flood bars out of channel (Minear 1999).

The LWD greater than 50-ft in length is sparse in the Lower Deschutes River (Minear 1999). In 1995, 13 occurrences of very large wood were recorded in the 100 miles of the Lower Deschutes River, compared to seven pieces in 1944. Most of this wood was in the main channel of the river, and more was associated with curves than straight sections of the channel. Large wood greater than 13-ft in length, not including estimated pieces of wood in logjams and rootwads, was more abundant in the upper 30 miles of the lower river and less so between RM 50 and 70, and had an overall density of 31.5 pieces per RM (Minear 1999). By including the estimated amount of wood pieces in logjams and rootwads, the amount of wood increased to 53.4 pieces per mile. Most of this large wood (88%) occurred in the main channel. However, after the 1996 flood event, less wood was present in the upper 50 miles of river compared to the lower 50 miles of river, and there was less wood overall, 24.5 pieces per RM compared to 31.5 before the flood. Minear (1999) described the source of LWD to the Lower Deschutes River, its composition, and stated that the results of the study indicated that there is a greater abundance of large wood in the Lower Deschutes River than is typical of other streams in the region. One possible reason for this is that the constant base flow of the river does not subject the riparian vegetation to annual periods of desiccation that occurs in many other high desert streams, so the relatively abundant riparian vegetation, including white alder and cottonwood, contribute to a greater supply of in-channel wood.

Under historical conditions, white alders were probably the primary source of LWD to the Lower Deschutes River (PGE 2004). Of the 153 islands in the Lower Deschutes River that appeared at least once in maps and photos since 1911, none were documented to be formed by accumulations of large wood (Pribyl et al. 1997). The lower 100 miles of the Deschutes River flows through non-forested land, and large wood coming from tributary streams has probably never been a principal habiat element.

NOAA Fisheries concludes that the Lower Deschutes River is likely PFC for LWD.

5.3.1.9 Channel Condition

TABLE 5-6. Channel condition standards for salmon and steelhead (NMFS 1996b).

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Channel Condition & Dynamics	Stream Bank Condition	>90% stable; i.e., on average, less than 10% of banks are actively eroding	80-90% stable	<80% stable
	Floodplain Connectivity	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetaion and succession.	Reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation.	Severe reduction in hydrologic connectivity between off-channel, wetland, floodplain and riparian areas; wetland extent drastically reduced and riparian vegetation altered significantly.

Channel conditions within the Project's footprint are NPF due to inundation by the dams and associated reservoirs. Channel morphology along the Lower Deschutes River is generally stable, with few meander bends and point bars (Fassnacht 1997). The low frequency of bedload transport and relatively low supply of sediment suggests a more limited occurrence of armoring, channel degradation, and morphological change (Fassnacht et al. 2003) than would be expected downstream of a large impoundment. Historical cross-sections and aerial photograph analyses are consistent with this interpretation (PGE 2004).

<u>Streambank Condition</u>

In general, riparian habitat quantity and quality along the Lower Deschutes River are affected by land uses such as railways, roads, and livestock grazing. Grazing has been excluded from the lower 25 miles of the lower river since 1985, and riparian vegetation has increased substantially since that time (Minear 1999). The BLM changed their grazing strategies from season-long grazing to late-winter/early-spring grazing along the Deschutes River which has led to an improved riparian condition. Minear (1999) compared historic photographs with current conditions at 14 sites between RM 87 and 30.5 of the Lower Deschutes River. Of these, ten sites showed marked improvement in riparian conditions and four showed little change. This indicator for the Lower Deschutes River (mainstem) is recovering and is probably AR to PFC.

5.3.1.10 Change in Peak/Base Flows

NOAA Fisheries defines PFC for the watershed hydrograph as being similar in terms of peak flow, base flow, and timing characteristics of the pre-development condition in the action area or an undisturbed watershed of similar size, geography, and geology. Pronounced changes to the hydrograph are classified as NPF (Table 5-7).

TABLE 5-7. Peak/base flow standards for salmon and steelhead (NMFS 1996b).

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Flow/Hydrology	Change in Peak/Base Flows	Watershed hydrograph indicates peak flow, base flow and flow timing characteristics comparable to an undisturbed watershed of similar size, geology, and geography.	Some evidence of altered peak flow, base flow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography.	Pronounced changes in peak flow, base flow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography.

Fassnacht et al. (2002) reports that the Lower Deschutes River has a relatively uniform and stable flow, with about a six-times difference between minimum and maximum flow at the mouth of the river. The small variation in discharge is mostly due to the highly permeable geology providing large deep groundwater contributions. Table 5-8 shows daily mean flows in cfs on a monthly basis on the Deschutes River near Madras along with 10 %, 5%, and 90% exceedance values. Over 80% of the water passing through the Project on an annual basis is from groundwater sources (Gannett et al. 2003). Some large floods have occurred historically; during the period of the Project's current license, two large flood events have occurred (1964 and 1996). The 1996 event is the flood of record with an instantaneous flow of 70,300 cfs on the eighth of February.

TABLE 5-8. Daily average streamflow (cfs) and exceedance flows on a monthly basis for the Deschutes River near Madras for water years 1990-2001.

Gage Location	% Excee-dance	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Deschutes River - Near Madras													
Average		5185	5523	5378	5067	4456	4296	3968	3917	3955	4290	4699	5010
Near Madras	90%	3708	4053	4023	4055	3952	3906	3739	3637	3643	3424	3586	3566
	50%	3977	4305	4525	4591	4836	4775	4149	4081	3923	3777	3832	3773
	10%	5410	5714	7253	9600	8974	7732	7643	5807	5899	4863	4695	4911
Information from: http://www.wrd.state.or.us/													

The Project operates overall as a modified run-of-the-river system, such that the average daily discharge from the Reregulating Dam is nearly equal to the average daily inflow to the Round Butte Development. Typical summer operations result in discharge from the Project from April 1 through September 30 between 4,300 and 4,430 cfs, with typical winter discharges from October 1 through March 31, averaging between 5,000 and 5,140 cfs (Joint Applicants 2001).

While Lake Billy Chinook accounts for over 40% of the potential water storage in the Deschutes Basin (Fassnacht 1997), the Project accounted for an average of just 7% of annual active storage in the basin during the first license period. This is because Lake Billy Chinook was drafted an average of just 10-ft annually. In addition, the Pelton and the Reregulating developments had no active storage during the first license period. Most of the basin's active storage occurs at three major irrigation storage reservoirs located near the head waters of the Deschutes River, and two in the Crooked River Basin. There combined storage capacity is nearly 535,000 acre-ft (BOR 2004) and up to 94% of monthly streamflow in these reaches can be diverted at the height of the irrigation season (Fassnacht 1997).

The storage and release of water from BOR dams upstream of the Project and irrigation withdrawals has likely altered the timing of peak and base flow from natural conditions in the Deschutes Basin (NMFS 2004b). Therefore, NOAA Fisheries concludes that this indicator is probably AR for the Deschutes Basin.

6.0 ANALYSIS OF EFFECTS OF THE PROPOSED ACTION

6.1 Introduction and Methods

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR §402.02). Direct effects occur at the Project site and may extend upstream or downstream based on the potential for impairing important habitat elements. Indirect effects are defined in 50 CFR §402.02 as "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur." They include the effects on listed species of future activities that are induced by the proposed action and that occur after the action is completed. "Interrelated actions are those that are part of a larger action and depend on the larger action for their justification" (50 CFR §403.02). "Interdependent actions are those that have no independent utility apart from the action under consideration" (50 CFR §402.02).

In step 3 of the jeopardy analysis, NOAA Fisheries evaluates the effects of proposed actions on listed steelhead in the context of their biological requirements, as described in Sections 4 and 5.

NOAA Fisheries may use either or both of two independent techniques in determining whether the proposed action jeopardizes a species' continued existence. First, NOAA Fisheries may consider the impact in terms of how many listed salmon will be killed or injured during a particular life stage, and then gauge the effects of that take on population size and viability. Alternatively, NOAA Fisheries may consider the effect on the species freshwater habitat requirements, such as water temperature, stream flow, etc. The habitat analysis is based on the well-documented cause and effect relationships between habitat quality and population viability. While the habitat approach to the jeopardy analysis does not quantify the number of fish adversely affected by habitat alteration, it considers this connection between habitat and fish populations by evaluating existing habitat condition in light of habitat conditions and functions known to be conducive to salmon conservation (Spence et al. 1996). In other words, it analyzes the effect of the action on habitat functions that are important to meet salmonid life cycle needs. The habitat approach then links any failure to provide habitat function to an effect on the population and to the ESU as a whole. For this consultation, NOAA Fisheries uses the habitat approach in considering the biological requirements best described by important habitat characteristics. The effects are summarized with respect to whether they impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long term progress of the impaired habitat toward PFCs (NMFS 1999).

6.2 Effects of the Proposed Action

Unless described otherwise in this section, effects of the proposed action are the same as described in the environmental baseline (Section 5).

6.2.1 Fish Passage

Clearly, the largest impact on MCR steelhead from the Project is the loss of access to historical spawning and rearing habitat, and inundation of nearly 41 miles of rearing habitat. NOAA Fisheries' primary goal, with respect to the relicensing of the Project, is to establish self-sustaining anadromous fish runs in the Deschutes Basin to fully utilize the available habitat and production capability for the purpose of recovering MCR steelhead. Additionally, a number of Deschutes Basin resource management plans have the goal of re-establishing anadromous fish above the Project.[8] In support of relicensing the Project, two reports focused on Deschutes Basin-wide processes and fish populations. The *Ecosystem Diagnostics and Treatment Assessment* performed as a part of the CTWS relicensing effort strongly supported anadromous fish reintroduction (Mobrand Biometrics 1999).[9] The assessment indicated that the greatest overall benefit to anadromous fish in the Deschutes Basin would be achieved by providing restoration of passage at the Project. The *Conceptual Foundation for the Management of Native Salmonids in the Deschutes River*, prepared as part of the PGE relicensing process, recommended that future management activities take an ecosystem perspective and promote life history diversity and habitat connectivity (Lichatowich 1998). The fish passage program proposed by the Joint Applicants advances these objectives.

Fish passage at the Project is a sizeable and complex undertaking. To address the many challenges that this endeavor presents, the FTS developed a structured decision-making process (Oosterhout 1998). One of the reasons for developing this process was to allow the passage program to be divided into its decision components for evaluation. Through this process, the FTS identified a number of uncertainties facing reintroduction of anadromous fish, and used these uncertainties to direct a study effort to reduce the level of uncertainty inherent in such a complex undertaking. The major uncertainties identified by the FTS during the structured decision-making process included 1) transfer of new pathogens above the Project; 2) downstream smolt collection efficacy; 3) habitat quality and quantity; 4) predation; and 5) upstream passage.

To address these uncertainties, a number of analytical tools were employed to assist in the feasibility evaluation. These tools will also be used to adaptively manage the Joint Applicants fish passage program once begun. These tools include the following:

- Three-dimensional hydrodynamic model (Khangaonkar 1999, Yang et al. 2000) to assist in the prediction of juvenile collection efficacy at Lake Billy Chinook.
- Water quality models to evaluate the potential effects of SWW on reservoir and downstream water quality (Yang et al. 2001; Breithaupt et al. 2001).

[8]Plans relevant to fisheries restoration in the Project area include the ODFW Fisheries Management Plans, Federal Forest and Land management Plans, National Wild and Scenic River Plans, and CTWS Integrated Resource Plans.

[9]This assessment evaluated spring chinook salmon (not steelhead) as its diagnostic species. However, much of the assessment's conclusions and recommendations are applicable to steelhead.

- GIS database (HABRATE) to assist in the evaluation of upstream habitat quality and quantity (Riehle 1999 and 2000).
- Life history simulation model for steelhead to similarly assist in the evaluation of the relative impacts of major uncertainties on all life stages of steelhead (Cramer and Beamesderfer 2001).
- Fish Disease Risk Matrix to assist PGE, the tribes and the managing agencies in identifying and answering important disease risk questions (Engelking 1998).

The passage effort will be carried out in phases (Section 3.2). The purpose of phasing is to maintain flexibility in the design process, capture the necessary tools to ensure a competent design, and allow for Fish Committee review, input and approval. The Fish Passage Plan provides for the Joint Applicants to advance fish passage development from one phase to the next based on achieving specified prerequisites and approvals of the Fish Committee, including NOAA Fisheries. This approach is used to facilitate a methodical, step-by-step evaluation and decision process to maximize the probability of restoring passage and to minimize risks.

NOAA Fisheries anticipates that re-establishing passage over the Project will have a positive effect on steelhead numbers, specifically for the Deschutes Basin population, but also for the ESU overall. Passage is expected to provide access to an estimated 100 miles of spawning and rearing habitat on the Crooked River, 30 miles on the Deschutes River, and 41 miles on the Metolius River (PGE 2004).

6.2.1.1 Downstream Fish Passage

Measures designed to accomplish downstream passage of juveniles are described in Section 3.2, above, and in greater detail in the Joint Applicants Fish Passage Plan (Joint Applicants 2004). The foremost challenge for the fish passage program is the collection of juvenile anadromous salmonids from Lake Billy Chinook. The combination of water chemistry and temperature of the three reservoir tributaries, reservoir morphology, the Project's deep withdrawal, and the large volume of water stored behind Round Butte Dam create dynamics in the reservoir that confound a fish's ability to find its way downstream. It is anticipated that the proposed SWW and downstream passage facilities will improve downstream passage efficacy by reorienting surface currents in Lake Billy Chinook such that downstream migrants can make their way to a location where they will be collected and moved downstream. Nevertheless, uncertainty remains whether enough juvenile migrant steelhead (and unlisted spring chinook salmon) can be collected to establish a self-sustaining run.

Juvenile steelhead outmigrants collected at the Round Butte Dam fish passage facility will be transported downstream of the Reregulation Dam for release in the Lower Deschutes River. The downstream collection facility at Round Butte Dam will be designed to meet NOAA Fisheries' juvenile screen criteria for fingerling-sized (>60 mm) salmonids (smolt criteria), which will minimize injury and mortality. It is not expected that steelhead fry (≤60 mm) will be encountering the new passage facility (Ratliff 2001). The downstream migrant collection facility will also include a sampling area to allow for biological evaluation of the fish screens, and a device to prevent the accumulation of sediment and debris that may cause delay, injury, or mortality of downstream migrating fish at Round Butte Dam. The survival goal for the temporary downstream passage facility is 93% survival, while the goal for the permanent downstream passage facility is 96% survival. The deep intake will have an exclusion screen that will meet all NOAA Fisheries smolt criteria except for sweeping velocity and contact time. This is not expected to impact juvenile steelhead as they are not expected to occur that deep in the reservoir. Both the surface and deep intakes will be tested to ensure they meet hydraulic criteria. The facilities will also be monitored under the proposed program of Testing and Verification studies to ensure that they meet the fish passage criteria and goals. Juvenile steelhead could be affected by the downstream passage collection, sorting, transport, and release activities.

Mortality or injury due to handling, transport, and screening are potential adverse effects of downstream passage. The initial temporary downstream passage facility will be modified as needed to assure exceedence of the 93% safe passage standard proposed for steelhead smolts. Monitoring will be used to help ensure that objectives regarding safe passage are met. Results from monitoring studies will be used to improve the design for a permanent downstream passage facility. If a permanent downstream passage facility is constructed, a 96% safe passage standard will be adopted. These target percentages for safe passage also include possible mortality due to downstream physical transport (i.e., trucking from capture to release location). It is anticipated that mortality resulting from transport will be less than 1% (PGE 2004).

The existing environmental baseline effects with respect to passage (i.e., barrier to passage) will continue until the spring of 2008 when it is expected that steelhead fry outplanted in 2006 will migrate downstream to the Pacific Ocean. Juvenile survival studies will be conducted for a minimum of 4 years (2008-2011) to determine passage efficacy. Results from the survival studies will factor into the Fish Committee's determination on whether to continue or discontinue the fish passage program, or to implement measures to improve passage survival.

The proposed fish passage program is experimental in nature and so has an inherent uncertainty associated with it. For that reason, it is difficult to approximate when the reservoir survival goals will be achieved. NOAA Fisheries anticipates that it will take at least four generations of steelhead, or a minimum of 12 years (starting with the first fry outplant in 2006 until about 2018), before the potential of the program is known. It is anticipated that surplus hatchery steelhead from the Round Butte Fish Hatchery will be used to start the fish passage program and continue for several generations. Consequently, NOAA Fisheries does not anticipate there will be impacts to existing steelhead populations below the Project. If the Fish Committee determines in the future that steelhead progeny from wild Deschutes Basin stocks are to be used for seeding areas above the Project, NOAA Fisheries would consult on the taking of those fish in a separate consultation under Section 10 of the ESA.

6.2.1.2 Upstream Fish Passage

During the interim passage phase, adult MCR steelhead will be passed upstream via trap-and-haul, as described in Section 3 and in greater detail in the Fish Passage Plan (Joint Applicants 2004). Although trap-and-haul is an interim method, it could become the final approach used for upstream passage if during the final passage phase it is determined that volitional upstream passage is unfeasible.

MCR steelhead passed upstream via the trap-and-haul will be sorted to minimize genetic and disease risks. Some injury and mortality could occur due to handling and crowding at the Pelton Trap. Only those adults that originated from above the Project, and are not carriers for new pathogens would be passed upsteam of the Project. During the peak of the run, the Pelton Trap will be operated daily. The maximum time between adults entering the fish entrances at the Reregulating Dam and release into Lake Billy Chinook is not expected to be more than 24 hours during the peak of the run. Delay is not expected to be more that 48 hours during the tails of the run. The elapse of time when adult steelhead first arrive at the Reregulating Dam and entrance into the fishways is not currently know. The Pelton Trap has been in operation since the late 1960s and the techniques used to capture and transport fish are well established. Mortality from this trap-and-haul program has been less than 1% (Don Ratliff, Project Biologist, PGE, pers. comm., November 5, 2002). Mortality could also occur from predation by river otters and could be about 2% (PGE 2004).

Adult steelhead could also be injured or killed during release at an upstream location. Construction of the Round Butte adult release facility should help minimize this effect, as the facility will enable summer-migrating adults to be released below the thermocline in the forebay of Round Butte Dam. Therefore, adult steelhead should not experience adverse effects due to rapid temperature change. This facility will also be evaluated based on radio-tag studies described in Joint Applicants (2003). Upstream passage survival, from the Pelton Trap through the Adult Release Facility, has a standard set at 95% during the first five years of operation of the upstream passage facilities. A 98% survival standard has been set for within five years of final modifications.

The feasibility and desirability of volitional upstream passage will be determined in the final passage phase, based on engineering feasibility and cost, as well as performance of the existing trap-and-haul operation, success of downstream passage, acceptable stray rates for out-of-basin fish, low disease risk, and low rates of injury/mortality compared to trap-and-haul approach. Volitional upstream passage will be attained through either enhancements to existing facilities (Pelton fish ladder) or construction of new facilities. Final passage facilities will be evaluated by counting adults entering and leaving, determining individual travel times, and recording mortality frequencies by species and tendencies to hold in or reject the facility.

6.2.1.3 Passage Infeasibility

Given the complexity and number of challenges facing the fish passage program, a decision process was developed (Sections 3.2.1.3 and 6.2.1.1) to address the potential for termination. While NOAA Fisheries' analysis of the effects of the proposed action are based on the expected success of the fish passage program. Discontinuation of the fish passage program is considered an unlikely event, the biological impacts of which have not been evaluated in this biological opinion.

6.2.1.4 Fish Health Management

The Fish Health Management Plan currently being drafted by ODFW will manage disease risk, which is a result of the decision to implement fish passage. This aspect of the fish passage program will impact adult steelhead through injury and mortality via the collection and sampling for pathogens. In the long term, it will have a positive effect on the reintroduction of MCR steelhead above the Project by minimizing the risk of establishing lethal pathogens in habitat above the Project.

6.2.2 Round Butte Hatchery

NOAA Fisheries has proposed the Round Butte Hatchery stock for listing as threatened under the ESA. NOAA Fisheries currently anticipates that the Round Butte Hatchery stock will be used for the intial effort to re-establish MCR steelhead above the Project. Wild Deschutes Basin steelhead were used for years as a source of brood stock for this hatchery program, but have not been used since the late 1990s (Section 5.2). NOAA Fisheries concluded that this stock is only moderately divergent from wild stocks within the MCR steelhead ESU. Use of the Round Butte Hatchery stock for the intial years of the fish passage effort will have the benefit of not taking wild fish for the same purpose.

The Joint Applicants will continue to fund current Round Butte Hatchery operations to maintain current mitigation levels. This is expected to have some benefit for listed MCR steelhead by providing a harvestable population in the Lower Deschutes River, reducing fishing pressure on natural spawning fish. This operation is being covered under a separate consultation with NOAA Fisheries.

6.2.3 Project Operations

Minimum Instream Flows and Flow Measurement

The Project will continue to be run as a modified run-of-river operation. That is, the average daily inflow will nearly equal the average daily outflow. The Project will essentially follow the Deschutes Basin hydrograph, which is altered by upstream storage and irrigation projects. The proposed action will provide more protective minimum instream flows downstream of the Project by requiring higher target minimum flow releases. Instream flows are described in detail in Joint Applicants (2004) proposed License Article No.12. In addition, the Joint Applicants will be required to hold flows to within plus or minus 10% of measured Project inflow under most conditions. Contingency plans allow the Joint Applicant's to release up to 200 cfs over inflow between September 16 and November 15 of each year if the Project inflows are less than 3,000 cfs.

Improvements to the USGS gages and installation of *real time* gages will allow the Project to more accurately monitor Project inflow and discharge which should translate into better management of downsteam flows and maintenance of the proposed minimum flow targets. All these measures will be monitored and enforced under the terms of an Operations Compliance Plan that will be filed by the Joint Applicants within six months of license issuance.

The instream flows will reduce Project impacts to Lower Deschutes River habitats used by MCR steelhead by allowing the Project to release more water into the Lower Deschutes River, which is expected to have a positive effect on spawning, rearing and migration habitat.

Ramping Rates

Under the proposed action, the Joint Applicants will implement more restrictive stage change limits (Section 3.2). These are somewhat more restrictive than those used under the existing license and are expected to improve rearing conditions in the lower river for steelhead fry, which use margin habitat after emergence. Together with the requirement to restrict lower river flow changes to within plus or minus 10% of measured Project inflow under most conditions, these measures minimize ramping rate effects to rearing steelhead juveniles in the Lower Deschutes River.

6.2.4 Water Quality and SWW Construction

Measures designed to improve water quality parameters such as temperature, DO, and pH are described in Section 3.2, above, and in greater detail in the Joint Applicants (2004). The Joint Applicants will construct the SWW tower in the Round Butte Dam forebay. The SWW will allow the Project to draw water from warmer surface layers during the spring months, and from colder deep waters during the fall. This will restore Lower Deschutes River water temperatures closer to pre-Project conditions. Changing the depth and pattern of water withdrawal from Lake Billy Chinook will also allow the Project to pass more oxygenated surface waters downstream. In addition, the Project's CWA Section 401 certification requires the Joint Applicants to monitor water quality according to the Water Quality Management and Monitoring Plan filed with ODEQ and the CTWS Water Control Board.

Implementation of the SWW, as required by the Project's CWA 401 certifications, is expected to improve conditions in the lower river with respect to temperature and DO. The existing environmental baseline conditions for pH will continue in the lower river. For temperature and DO, the proposed action will have positive effects on MCR steelhead, and is expected to have neutral effects for this species regarding pH.

SWW Construction

As previously noted in this Opinion, the Joint Applicants are still designing the SWW and its associated juvenile fish collection facility. Construction of this facility will not begin until 2007, thus NOAA Fisheries has not reviewed any plans associated with construction. However, inwater activities associated with constructing the SWW will occur upstream of three dams and over 10 miles upstream of current steelhead habitat. This, combined with measures required in Section 9 of this Opinion, should adequately protect MCR steelhead.

6.2.5 Lower River Habitat Enhancements

The proposed action provides for several mitigation projects in the Lower Deschutes River Basin. These include a large wood management program (Section 3.2.1.8), lower river gravel study (Section 3.2.1.9), and a Trout Creek habitat enhacement project (Section 3.2.1.10).

Large Wood Management
The Project will continue to block large wood from moving downstream. However, the Joint Applicants will develop and implement a Large Wood Management plan in consultation with the Fish Committee, including NOAA Fisheries. The plan will include actions to remove LWD from Lake Billy Chinook for placement in the Lower Deschutes River. Placement will be done in consultation with the Fish Committee. This action would provide some additional cover for juvenile steelhead rearing in the lower river; and would provide additional habitat for macroinvertebrates which juvenile steelhead forage on. Wood placement may have some short-term negative effects such as increased turbidity and channel disturbance. Implementation of the Large Wood Management plan will compensate for the continued obstruction of its passage to the lower river.

NOAA Fisheries anticipates that this action will have a positive effect on steelhead haibitat in the Lower Deschutes River.

Lower River Gravel Study
The Project will continue to trap sediment behind Round Butte Dam. However, this probably does not have a significant impact on spawning because NOAA Fisheries finds that the Lower Deschutes River is at PFC for substrate (Section 5.3.1.7). During settlement negotiations, the Joint Applicants agreed to conduct additional studies of the potential effects of substrate obstruction (Section 3.2.1.9). This study study involves placement of up to 300 cubic yards of spawning gravel at three test sites between the Reregulating Dam and the mouth of Shitike Creek (about 3 RM). The Joint Applicants will consult with the Fish Committee before any gravel is placed to minimize any potential impacts to existing spawning habitat. It is anticipated that 300 cubic yards of test spawning gravel will not significantly alter the Lower Deschutes River's channel structure in the test reach or downstream from it. NOAA Fisheries anticipates that this action will have either a neutral or postitive effect on MCR steelhead spawning habitat.

Trout Creek Habitat Enhancement
The Joint Applicants will conduct habitat restoration work on Trout Creek, a tributary to the Lower Deschutes River. A work plan will be developed in consultation with the Fish Committee

within one year of license issuance. Fish Committee review and input to the Joint Applicant's plan should ensure that the restoration project will contain appropriate measures and implementation methods. The proposed restoration involves returning portions of the stream channel to more natural conditions (Section 3.2.1.10). The Trout Creek subbasin is of great value for MCR steelhead production. While there will be short term effects resulting from working in the stream (e.g., suspension of sediment, harrassment of listed steelhead), NOAA Fisheries expects that with the oversight of the Fish Committee, including NOAA Fisheries, the proposed restoration activity will improve steelhead habitat in the long term.

6.2.6 Testing and Verification Studies, Long Term Monitoring, and Work Plans

The proposed action requires the Joint Applicants to carry out a Testing and Verification Studies program (Joint Applicants 2004) to track near-term implementation of downstream passage, and a separate program of the Long Term Monitoring of the downstream passage facilities. This information will be used to modify and adapt fish passage activities. This extensive program of monitoring will ensure that measures taken to protect natural resources, including steelhead, are modified and completed as needed. Actions taken under both the Testing and Verification Studies and Long Term Monitoring programs may affect steelhead.

The Testing and Verification Studies program will go into effect after temporary fish passage facilities are constructed in 2008, and will last until about 2015. These studies include actions such as 1) evaluating fish passage facilities using marked and tagged fish, including steelhead; operating smolt traps in Project tributaries; and, 2) studying predation by various species, including bull trout, using fish marked with radio-tags, PIT tags, and sampling stomach contents using gastric lavage. These studies are described in more detail in Appendix III of Joint Applicants (2004).

The Long Term Monitoring program will go into effect when measures of success for permanent passage facilities are achieved, as determined by the Testing and Verification Studies program. This is expected to be about 2015. The duration of the studies will depend on the studies results, but will continue at some reduced level of intensity for the duration of the new license's fish passage program. Studies will include: spawning surveys, including habitats used by steelhead; redd counts, including habitats used by steelhead; studies of predation by various species using gastric lavage; evaluating competition between reintroduced anadromous and resident species, using population and redd count studies in steelhead habitats; monitoring tributary habitat quantity, effectiveness, and riparian condition; and monitoring upstream and downstream fish passage efficacy for various species, including steelhead, through observation of physical condition of passed fish. These studies are described in more detail in Appendix IV of Joint Applicants (2004).

While the Testing and Verification, and the Long Term Monitoring program's proposed study methodologies are commonly used, some steelhead will likely be injured by activities such as radio-tagging, PIT-tagging, and acoustic-tagging. Handling steelhead during removal from smolt traps, and subsequent data collection activities such as anesthesia, weighing, measuring, and marking may also cause a minor amount of injury or death. The proposed redd count surveys, spawning surveys, and habitat studies can harass steelhead as observers move along stream margins and in the stream channel. Snorkel surveys for steelhead and other species may also harass steelhead. Avoidance response by steelhead can result in unnecessary energy expenditures and adverse physiological response. However, sampling and monitoring procedures will be designed to minimize stress and potential injury to steelhead. Furthermore, the studies and monitoring are necessary to ensure the long term success of re-establishing MCR steelhead above the Project.

NOAA Fisheries anticipates that a small amount of incidental mortality and injury is likely to occur from tagging activities. These effects are not expected to rise to the level of negatively impacting the MCR steelhead ESU or the Deschutes Basin population. The Test and Verification and Long Term Monitoring programs are expected to provide long term benefits as it will inform the fish passage effort and should lead to improved passage survival rates for MCR steelhead.

6.2.7 Pelton Round Butte Fund

The Pelton Round Butte Fund will support resource protection measures for Project related impacts that are not otherwise addressed by the proposed action. The Fund will receive a series of payments between 2005 and 2020 that will total $21.5 million in 2003. These monies will be spent on mitigation and enhancement projects for fish, wildlife, and their habitats. Though these projects have not yet been identified, it is likely that many will directly or indirectly benefit steelhead. We expect that any related short term adverse impacts, usually from construction activities, will be limited in duration. Projects which require discretionary Federal actions and which may affect Federally listed species, including steelhead, will receive ESA Section 7 consultation with NOAA Fisheries. The existing guidelines for the Pelton Fund expenditures, together with the opportunity for additional consultation on proposed projects, minimize potential adverse impacts to MCR steelhead.

NOAA Fisheries expects that long term benefits will occur as a result of the Pelton Round Butte Fund. Steelhead rearing and spawning habitat will gradually improve as various projects are implemented, leading to increased natural production of MCR steelhead.

6.3 Indirect Effects

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action. If they are reasonably certain to occur, indirect effects may include other Federal actions that have not undergone Section 7 consultation, but will result from the action under consideration. One indirect effect of the proposed action that has yet to undergo Section 7 consultation with NOAA Fisheries is implementation of a new Hatchery and Genetic Management Plan (HGMP) for operation of the Round Butte Hatchery. The HGMP has been completed and is awaiting environmental review before Section 7 consultation is completed.

NOAA Fisheries will address the use of Round Butte Hatchery steelhead for outplanting in areas above the Project in the Section 7 consultation on the HGMP.

6.4 Summary of Project Effects

Unless otherwise stated, Project effects are identical to those described in the environmental baseline (Section 5). In the PFC framework, baseline environmental conditions are described as *properly functioning*, *at risk*, or *not properly functioning*. If a proposed action would be likely to impair properly functioning habitat (Impair), appreciably reduce the functioning of already impaired habitat (Reduce), or retard the long term progress of impaired habitat toward PFC (Retard), it will usually be found likely to jeopardize the continued existence of the species, or adversely modify its critical habitat, or both, depending on the specific consideration of the analysis. Such considerations may include, for example, the species' status, the condition of the environmental baseline, the particular reasons for listing the species, any new threats that have arisen since listing, and the quality of available information. Actions which do not compromise a species' biological requirements to the degree that appreciably reduces the species' viability and chances of survival in the action area are considered not to reduce or retard (NR).

The Project has been a complete barrier to fish passage for about 36 years. The proposed reintroduction of MCR steelhead, if successful, will partially mitigate for extirpation of upstream populations. Reestablishment of MCR steelhead above the Project is dependent on the success of upstream and downstream passage measures described in the proposed action. Upstream fish passage above the Project remains dependent on trap-and-haul operations for at least the next 10-15 years. Construction of volitional fish passage facilities is dependent on establishing self-sustaining populations, volitional passage feasibility, and resource management direction.

Reestablishment of the Deschutes Basin population of MCR steelhead above the Project should reduce the negative effects on the ESU. The viability of the Deschutes Basin population should be improved through increased distribution and production. These efforts are dependent on the efficacy of upstream and downstream passage efforts described in Section 3.2 of this Opinion and in Joint Applicants (2004). NOAA Fisheries believes that reestablishment efforts could be limited by the efficacy of upstream and downstream passage, reservoir survival, habitat condition upsteam of the Project (outside of the Project's footprint and FERC's jurisdiction), and the time required to reach passage survival targets specified in this Opinion and Joint Applicants (2004). However, with restoration of passage, the indicator for habitat access would move from NPF to AR (see Table 6-1). NOAA Fisheries rates this indicator as AR (as opposed to PFC) because the Project will continue to exist in its current arrangement and will be wholly an anthropogenic endeaver, thus always maintaining some level of uncertainty in satisfying the species biological requirements for both adult and juvenile migration. Nevertheless, NOAA Fisheries concludes that the proposed fish passage program will not negatively affect the existing population of Deschutes Basin steelhead or the Midddle Columbia River ESU as a whole, or retard its potential for recovery.

The proposed operation of the SWW should reduce negative Project impacts and improve conditions relative to historical Project operations in the Lower Deschutes River for temperature and DO. Current conditions for DO and pH, while not meeting CWA requirements, likely have neutral effects on steelhead. Summer temperatures, particulary in August and September, are NPF for steelhead migration in the lower 50 miles of the river; and may be AR up to about RM 90 for this same time period. Operation of the SWW should slightly improve DO values in the upper portion of the Lower Deschutes River.

Summer temperatures in the epilimnion of the Project's reservoirs are NPF for steelhead. This condition will improve adequately (relative to biological requirements) with operation of the SWW as surface water in Lake Billy Chinook is pulled off and the reservoir fills with cooler Metolious River water. In addition, adult steelhead would be released in Lake Billy Chinook below the epilimnion where temperatures are cooler. Juvenile steelhead that may use the reservoir for rearing would avoid the warmer surface water during the summer months. Operation of the SWW would improve temperatures in the Project's reservoirs toward PFC (NR).

The proposed habitat enhancement projects (Large Wood Management, Gravel Augmentation Study and the Trout Creek Enhancement) will reduce negative Project effects on steelhead habitat in the Lower Deschutes River. NOAA Fisheries anticipates that habitat protection and enhancement activities resulting from the Pelton Round Butte Fund will benefit steelhead and advance the reestablishment of steelhead above the Project. If these programs are successful, some improvement in habitat condition downstream of the Project will be achieved, improving the chances of the habitat returning to PFC (NR).

There may be negative effects from construction activities and fish habitat improvement projects. Avoidance of these negative effects will depend on following protocols which limit or eliminate them, such as terms and conditons listed in this Opinion's incidental take statement (Section 9). The extent of potential positive effects of these actions is not possible to analyze at this time because the actions are not fully described, but the overall outcome should be be beneficial.

Table 6-1. Analysis of Project Effects. Summary of effects of proposed action on MCR steelhead.

IMPAIR = impair properly functioning habitat; REDUCE = appreciably reduce the functioning of already impaired habitat; RETARD = retard the long term progress of impaired habitat towards properly functioning condition; NR = not reduce, retard, or impair; NPF = baseline not properly functioning; AR = baseline at risk; PFC = baseline properly functioning conditioning.

Project Feature	Effect Pathway/ Indicator	Area Affected	Baseline Status	Effect of Proposed Action
Pelton Round Butte Project (3 Developments)	Water Quality/Temperature	Project Reservoirs/Lower Deschuts River	NPF/AR	NR/NR
Pelton Round Butte Project (3 Developments)	Water Quality/Dissolved Oxygen	Project Reservoirs (excluding deep water) Lower Deschutes River and Intergravel	PFC/AR	NR/NR
Pelton Round Butte Project (3 Developments)	Water Quality/Nutrients	Project Reservoirs and Lower Deschutes River	PFC	NR
Pelton Round Butte Project (3 Developments)	Water Quality/pH	Project Reservoirs and Lower Deschutes River	AR	NR
Pelton Round Butte Project (3 Developments)	Water Quality/Total Dissolved Gas	Project Reservoirs and Lower Deschutes River	PFC	NR
Pelton Round Butte Project (3 Developments)	Habitat Access/Physical Barriers – Juvenile Passage (2005-2008)	Project Footprint	NPF	Impair
Pelton Round Butte Project (3 Developments)	Habitat Access/Physical Barriers – Juvenile Passage (2008-expiration of new FERC license)	Project Footprint	NPF	NR

Table 6-1. (continued). Analysis of Project Effects. Summary of effects of proposed action on MCR steelhead.

IMPAIR = impair properly functioning habitat; REDUCE = appreciably reduce the functioning of already impaired habitat; RETARD = retard the long term progress of impaired habitat towards properly functioning condition; NR = not reduce, retard, or impair; NPF = baseline not properly functioning; AR = baseline at risk; PFC = baseline properly functioning conditioning.

Project Feature	Effect Pathway/ Indicator	Area Affected	Baseline Status	Effect of Proposed Action
Pelton Round Butte Project (3 Developments)	Habitat Access/Physical Barriers – Adult Passage (2005-about 2010)	Project Footprint	NPF	Impair
Pelton Round Butte Project (3 Developments)	Habitat Access/Physical Barriers – Adult Passage (2010-expiration of new FERC license)	Project Footprint	NPF	NR
Pelton Round Butte Project (3 Developments)	Habitat Elements/Substrate	Project Reservoirs/Lower Deschutes River	NPF[1]/AR to PFC	Retard/NR
Pelton Round Butte Project (3 Developments)	Habitat Elements/Large Woody Debris	Project Reservoirs/Lower Deschutes River	NPF[1]/AR to PFC	Retard/NR
Pelton Round Butte Project (3 Developments)	Channel Condition	Project Reservoirs/Lower Deschutes River	NPF[1]/AR to PFC	Retard/NR
Pelton Round Butte Project (3 Developments)	Hydrology/Peak and Base Flows	Lower Deschutes River	AR	NR
Pelton Round Butte Project (3 Developments)	Ramping Rates	Lower Deschutes River	PFC	NR
Trout Creek Habitat Enhancement	Steelhead Habitat	Trout Creek (Lower Deschutes Tributary)	NPF	NR

[1] For steelhead, continued presence of the dams and reservoirs retards PFC for this indicator within the Project's footprint.

7.0 CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR §402.02 as "those effects of future State, tribal, local or private actions, not involving Federal activities, that are reasonably certain to occur in the action area and considered in this biological opinion." Future Federal actions, including the ongoing operation of hatcheries, fisheries, and land management activities, are not considered within the category of cumulative effects for ESA purposes because they require separate consultations pursuant to Section 7 of the ESA after which they are considered part of the environmental baseline.

The Endangered Species Consultation Handbook (USFWS and NMFS 1998) describes this standard as follows:

> Indicators of actions "reasonably certain to occur" may include, but are not limited to: approval of the action by State, tribal or local agencies or governments (e.g., permits, grants); indications by State, tribal or local agencies or governments that granting authority for the action is imminent; project sponsors' assurance the action will proceed; obligation of venture capital; or initiation of contracts. The more State, tribal, or local administrative discretion remaining to be exercised before a proposed non-Federal action can proceed, the less there is a reasonable certainty the project will be authorized.

There are numerous non-Federal activities that have occurred in the action area in the past, which have contributed to both the adverse and positive effects of the environmental baseline. This step of the analysis for application of the ESA Section 7(a)(2) standards requires the consideration of which of those past activities are "reasonably certain to occur" in the future within the action area.

First, any of these actions that involve Federal approval, funding, or other involvement are not considered "cumulative effects" for this analysis (see ESA definition, above). This Federal involvement will trigger ESA Section 7(a)(2) consultation in the future. Once the consultation on those actions is completed, the effects may be considered part of the environmental baseline, consistent with the ESA-regulatory definition of "effects of the action" (50 CFR §402.02). Thus, for example, State efforts to improve water quality in compliance with the Federal CWA will not be considered, because of the involvement of the Environmental Protection Agency, until separate ESA consultations are completed. Other examples include irrigation water withdrawals involving the USFS (right-of-way permits for irrigation canals) and agricultural practices that receive Federal funding through the U.S. Department of Agriculture.

Next, actions that do not involve Federal activities must meet the "reasonably certain to occur" test for NOAA Fisheries to consider their effects in this Opinion. Economic diversification has contributed to population growth and movement, and this trend is likely to continue, i.e., reasonably certain to occur. Such population trends will result in greater overall and localized demands for electricity, water, and buildable land in the action area; will affect water quality directly and indirectly; and will increase the need for transportation, communication, and other infrastructure. In particular, the population of Bend and the surrounding area is increasing. According to the U.S. Census Bureau[10], from April 1, 2000 to July 1, 2003, the population of Deschutes County increased by 12.2% while the population of the State of Oregon increased by only 4.0%. Crook County grew by 7.4% and Jefferson County grew about 3.5% during the same time period. The impacts associated with these economic and population demands will probably affect habitat features such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect will likely be negative, unless carefully planned for and mitigated.

[10]U.S. Census Bureau at *http://quickfacts.census.gov/qfd/states/41000.html*.

8.0 CONCLUSION

This section presents NOAA Fisheries' biological opinion regarding whether the effects of the factors analyzed under the environmental baseline (Section 5), combined with the effects of the proposed action (Section 6) and the cumulative effects (Section 7) in the action area, when viewed against the current rangewide status of the species (Section 4), are likely to jeopardize the continued existence of MCR steelhead. To "jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (CFR §402.02). The conclusions are based on the proposed actions described in Section 6 occurring as specified in the license, including in a timely manner according to the timelines submitted as part of the July 13, 2004, Settlement Agreement.

After reviewing the current status of MCR steelhead, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is NOAA Fisheries' opinion that the proposed action is not likely to jeopardize the continued existence of these species.

In reaching its conclusion, NOAA Fisheries finds that there will be continuing adverse impacts to MCR steelhead. These impacts are described in Section 6 and include 1) continuation of the Project resulting in the loss of some spawning and rearing habitat caused by the reservoirs, the potential for delay, injury or mortality associated with collection and transporting both adult and juvenile MCR steelhead past the Project, the potential for injury or mortality from Test and Verification Studies and the Long Term Monitoring Program; and, 2) some harrassment or injury resulting from instream construction activities associated with habitat enhancement projects. Adaptive management is a cornerstone of how measures will be developed to minimize adverse impacts to the species.

Although some level of adverse effects will continue, in Section 6.5 of this Opinion, NOAA Fisheries determined that these effects are reduced to levels that are not likely to reduce the functioning of already impaired habitat or retard the progress of impaired habitat towards PFCs. In particular:

- Reintroducing MCR steelhead to historical habitat above the Project should improve the viability of the Deschutes Basin population through increased distribution and production.

- Implementation of passage structure and activities designed to achieve a long term juvenile and adult passage survival standard of 75% and 98%, respectively, should ensure the success of the fish passage program.

- Operation of the SWW would improve water quality in the Project's reservoirs and the Lower Deschutes River.

- The proposed ramping rates, new flow gages, and minimum flows will protect steelhead spawning and rearing habitat in the Lower Deschutes River.

- The Gravel Augmentation Study, Large Wood Management Program, and Trout Creek Enhancement project, coupled with habitat and water conservation projects completed through the Pelton Round Butte Fund, should result in a low likelihood of the Project reducing the functioning of downstream spawning and rearing habitat. In addition, habitat and water conservation projects carried out through the Pelton Round Butte Fund will advance the reestablishment of MCR steelhead above the Project by improving spawning and rearing habitat.

9.0 INCIDENTAL TAKE STATMENT

Sections 4(d) and 9 of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. Harm is further defined in 50 CFR §222.102 as "an act that may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering." Harass is defined as actions that create the likelihood of injuring listed species to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is take of listed species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the RPMs.

9.1 Amount and Extent of Anticipated Take

NOAA Fisheries anticipates that the proposed action will result in more than a negligible amount of incidental take of MCR steelhead within the action area for the term of the license for the reasons presented in this Opinion. Take examples may include harm to adult and juveniles caused by handling of fish for trap-and-haul operations, Test and Verification Studies, Long Term Monitoring Program, and delay or injury during adult and juvenile passage at Project dams. Because NOAA Fisheries anticipated the potential for incidental take of MCR steelhead and entered into extensive, upfront analysis and negotiations to identify and minimize incidental take occurring from the proposed action, it requires few additional minimization requirements within the incidental take statement. NOAA Fisheries assumes that FERC will adopt as license conditions all actions identified in the July 13, 2004, Settlement Agreement. NOAA Fisheries emphasizes the need for FERC to require these actions of the Joint Applicants in order to minimize incidental take.

Despite the use of the best scientific and commercial data available, NOAA Fisheries cannot quantify a specific number of incidental take of individual fish for this action. However, the July 13, 2004, Settlement Agreement establishes adult and juvenile performance goals for the various elements of Project passage. Therefore, NOAA Fisheries defines the level of take as a proportion of the total population of steelhead that is passed both upstream and downstream of the Project. The level of allowable take of MCR steelhead shall be as follows:

9.1.1 Adult Steelhead

Harassment

Harassment, as defined above, will be permitted for 100% of individuals collected at the Pelton Round Butte trap to liberation from the adult release facility above the Project; and for 100% of individuals used for Test and Verification and Long Term Monitoring purposes. NOAA Fisheries expects that the most common form of harassment will be the altering of normal migration behavior. This form of harassment is not expected to negatively impact ESU or Deschutes Basin population numbers.

Mortality

Mortality shall be limited to 5% of the individuals collected at the Pelton Round Butte trap to liberation from the adult release facility above the Project for the first five years after initiation of adult upsteam passage; and shall not exceed 2% thereafter.

Mortality is likely to occur on a small number of individuals used for Test and Verification Studies, Long Term Monitoring, sampling for pathogens, reservoir passage, and possibly other elements of Project operations. The level of lethal incidental take resulting from these activities cannot be reasonably estimated or quantified at this time, and therefore is defined as unquantifiable.

9.1.2 Juvenile Steelhead

Harassment

Harassment, as defined above, will be permited for 100% of individuals collected at the juvenile passage facility to release below the Reregulating Dam, and for 100% of individuals used for Test and Verification and Long Term Monitoring purposes. NOAA Fisheries anticipates that the most common form of harassment will be the altering of normal migration behavior. This form of harassment is not expected to negatively impact ESU or Deschutes Basin population numbers.

Mortality

Motality shall be limited to 7% of the total number of individuals collected, handled, marked, transported, and released below the Reregulating Dam; this shall apply for the first five years of juvenile passage operations (expected to begin in 2008). Mortality shall be limited to 4% of the total number of individuals collected, handled, marked, transported, and released below the Reregulating Dam thereafter.

Mortality is likely to occur on a small number of individuals used for Test and Verification Studies, Long Term Monitoring, and possibly other elements of Project operations. The level of lethal incidental take resulting from these activities cannot be reasonably estimated or quantified at this time, and therefore is defined as unquantifiable. In addition, the July 13, 2004, Settlement Agreement idenifies reservoir passage performance goals for Lake Billy Chinook. However, the temperal scale upon which these goals would be achieved is uncertain and experimental in nature. Adaptive managment will be employed to achieve the performance goals and managment decisions will require review and approval by NOAA Fisheries. Therefore, the level of lethal incidental take resulting from passage through Lake Billy Chinook cannot be reasonably estimated or quantified at this time, and therefore is defined as unquantifiable.

9.2 Effect of Anticipated

As analyzed in this Opinion, NOAA Fisheries has determined that this extent of anticipated take is not likely to jeopardize the continued existence of MCR steelhead.

9.3 Reasonable and Prudent Measures

Reasonable and Prudent Measures are non-discretionary measures to minimize take that are not already part of the description of the proposed action. They must be implemented as binding conditions for the exemption in Section 7(a)(2) to apply. FERC has the continuing duty to regulate the activities covered in this incidental take statement. If FERC fails to require the licensee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are in the license, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. Activities carried out in a manner consistent with these RPMs, except those otherwise identified, will not necessitate further site-specific consultation. Activities that do not comply with all relevant RPMs will require further consultation.

The following RPMs are necessary and appropriate to minimize the effect of anticipated incidental take of MCR steelhead. FERC must require Joint Applicants to:

1. Carry out all protection, mitigation, and enhancement measures identified in the July 13, 2004, Settlement Agreement and its attachments which avoid or minimize effects to MCR steelhead.

2. Use the best available science to adaptively manage Project operation, maintenance, and construction activities to avoid or minimize effects to MCR steelhead during the period of the new Project license.

9.3.1 Terms and Conditions

In order to be exempt from the take prohibitions of Section 9 of the ESA and regulations issued pursuant to Section 4(d) of the ESA, FERC must include in the new license the following terms and conditions, which implement the RPMs listed above.

1. FERC must require the Joint Applicants to construct and operate the Project facilities identified in the July 13, 2004, Settlement Agreement; carry out the Fish Passage Plan; adhere to the Fish Passage Schedule; implement the Testing and Verification studies, Long Term Monitoring, Annual Work

Plans and Reports, and Native Fish Monitoring Program; implement the Trout Creek restoration Project, LWD managment plan, and gravel augmentation study; and other measures identified in the July 13, 2004, Settlement Agreement.

2. FERC must require the Joint Applicants to establish the Fish Committee required by the July 13, 2004, Settlement Agreement, and to adhere to the consultation and dispute resolution provisions of the Settlement Agreement.

3. FERC must require the Joint Applicants to comply with all Project construction activity best management practices (App. F, Joint Applicants 2004), including measures to prevent concrete products from entering Project waters, measures to control erosion and sedimentation, and measures to control pollutants of any kind.

10.0 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or to develop additional information. NOAA Fisheries has no conservation recommendations to make at this time, because the proposed action includes all measures that could minimze adverse effects of the proposed project on MCR steelhead.

11.0 REINITIATION OF CONSULTATION

This concludes formal consultation on the proposed action. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation, unless such action is not expected to constitute an irreversible or irretrievable commitment of resources that has the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures that would not violate 16 USC §1536(a)(2).

As described in Section 6.2.1.3, NOAA Fisheries assumes that the fish passage program will be successful and only analyzed effiicts of the proposed action under that assumption. In the event that the Fish Committee discontinues the fish passage program, NOAA Fisheries will recommend that FERC reinitiate consultation.

12.0 MAGNUSON-STEVENS FISHERY CONSERVATION & MANAGEMENT ACT

12.1 Statutory Requirements

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan.

Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (Section 305(b)(2));

- NOAA Fisheries must provide conservation recommendations for any Federal or State action that may adversely affect EFH (Section 305(b)(4)(A));

- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (Section 305(b)(4)(B)).

The EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA Section 3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

The EFH consultation with NOAA Fisheries is required for any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action may adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects on EFH.

12.2 Identification of EFH

Pursuant to the MSA the Pacific Fishery Management Council has designated EFH for three species of Federally-managed Pacific salmon: Chinook (*Oncorhynchus tshawytscha*); coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*) (Paficic Fishery Management Council (PFMC) 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). The Lower Deschutes Hydrologic Unit Code (HUC) and portion of the Upper Deschutes and Lower Crooked HUCs contain EFH for chinook salmon (*O. tshawytscha*). The Lower Deschutes HUC has also been designated EFH for coho salmon (*O. kisutch*), but coho did not occur here historically.

12.3 Proposed Action

The proposed action is detailed above in Sections 3.0 and 5.1 of this Opinion. The area affected by the proposed action includes habitat that has been designated as EFH for various life-history stages of chinook and coho salmon.

12.4 Effects of Proposed Action

As described in detail in Section 6 of this Opinion, the proposed action may result in adverse effects to a variety of habitat parameters. These adverse effects are identified in Section 6 of this Opinion.

12.5 Conclusion

NOAA Fisheries concludes that the proposed action will adversely affect designated EFH for chinook salmon and coho salmon.

12.6 EFH Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which adversely affect EFH. The proposed action includes a number of measures for fish protection and enhancements. Because these measures are part of the proposed action, NOAA Fisheries does not need to include them as EFH recommendations. However, these measures are necessary for conservation and protection of EFH and would have been included as EFH conservation recommendations if they were not already part of the proposed action and part of the July 13, 2004, Settlement Agreement. While NOAA Fisheries understands that these measures described in the license will be implemented by the Joint Applicants and enforced by FERC, it does not believe that these measures are sufficient (although they will help) to address the adverse impacts to EFH described above. However, the terms and conditions in the incidental take statement (Section 9 of this Opinion) are applicable to designated EFH for chinook salmon and coho salmon and minimize these adverse effects. Consequently, NOAA Fisheries adopted all the terms and conditions in its incidental take statement (Section 9 of this Opinion) as its EFH recommendations.

12.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR §600.920(j), FERC is required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

12.8 Supplemental Consultation

FERC must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR §600.920(k)).

13.0 LITERATURE CITED

Barnhart, R. A. 1986. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest) - steelhead. U.S. Fish Wildl. Serv. Biol. Rep. 82 (11.60), 21p.

Bartholowmew, J. 1999. Fish disease risk assessment: whirling disease and ceratomyxosis. 1998 Annual Report. Department of Microbiology and Center for Salmon Disease Research, Oregon State University, Corvallis, Oregon. Prepared for Portland General Electric, Portland, Oregon. 24p.

Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society Monograph 6, Bethesda, Maryland.

BOR (Bureau of Reclamation). 2003. Biological assessment on continued operation and maintenance of the Deschutes River Basin Projects and effects on Essential Fish Habitat under the Magnuson-Stevens Act. Lower Columbia Area Office, Portland, Oregon

BOR 2004. Major storage reservoirs in the Deschutes River Basin. U.S. Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho. Information at www.usbr.gov/pn/hydromet/destea.html.

Breithaupt, S., T. Khangaonzar, Z. Yang, and C. DeGaspari. 2001. Water quality model of the Lower Deschutes River. Final Report. Foster Wheeler Environmental Corporation, Bothel, Washington. 157p

BRT (Biological Review Team). 2003. Draft Report, Preliminary Conclusions Regarding the Updated Status of Listed ESUs of West Coast Salmon and Steelhead (Co-Manager Review Draft). National Marine Fisheries Service, Seattle, Washington.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. NOAA Tech. Memo. NMFS-NWFSC-27, Northwest Fisheries Science Center, Coastal Zone and Estuarine Studies Division, 2725 Montlake Blvd. E., Seattle, WA 98112-2097.

Chilcote, M.W. 1998. Conservation Status of Steelhead in Oregon. Oregon Department of Fish and Wildlife, Information Reports Number 98-3. Portland, Oregon.

Cramer, S.P., and R. Beamesderfer. 2001. Population Dynamics, Habitat Capacity, and a Life History Simulation Model for Steelhead in the Deschutes River, Oregon. S.P. Cramer & Associates. Gresham, Oregon. Draft report prepared for Portland General Electric, Portland, Oregon.

CTWS (Confederated Tribes of the Warm Springs Reservation). 1999. Final license application, the Confederated Tribes of the Warm Springs Reservation of Oregon and Warm Spring Power Enterprises. FERC Project No. 2030. Warm Springs, Oregon. Four Volumes.

Eilers, J. M., R. B. Raymond, and K. B. Vache′. 2000. Water quality of the Lower Deschutes River, Oregon. In: PGE (Portland General Electric). 2004. Pelton Round Butte Hydroelectric Project revised biological evaluation. Portland General Electric Company, Portland, Oregon. 150p.

Engelking, M. 1998. Pelton Round Butte fish disease risk study: draft study plan. *In*: Portland General Electric Pelton Round Butte Fisheries Workshops, Spring 1998. Portland General Electric, Portland, Oregon.

Engelking, H. M. 1999. Fish disease risk study associated with potential anadromous fish passage at the Pelton Round Butte Project. 1998 Annual Report. Prepared for Portland General Electric, Portland, Oregon.

Engelking, H. M. 2003a. Fish disease risk study associated with potential anadromous fish passage at the Pelton Round Butte Project: summary report 1997-2002. Prepared for Portland General Electric, Portland, Oregon. 41p. + app.

Engelking, H. M. 2003b. Draft fish health management plan for the Pelton Round Butte Project. Prepared for Portland General Electric, Portland, Oregon. 11p. + app.

Fassnacht, H. 1997. Frequency and magnitude of bedload transport downstream of the Pelton-Round Butte Dam complex, Lower Deschutes River, Oregon. Master's thesis. Oregon State University, Corvallis. In: PGE (Portland General Electric). 2004. Pelton Round Butte Hydroelectric Project revised biological evaluation. Portland General Electric Company, Portland, Oregon. 150p.

Fassnacht, H., E. M. McClure, G. E. Grant, and P. C. Klingeman. 2003. Downstream effects of the Pelton-Round Butte Hydroelectric Project on bedload transport, channel morphology, and channel-bed texture, Lower Deschutes River, Oregon. In J. E. O'Connor and G. E. Grant, editors. A peculiar river: geology, geomorphology, and hydrology of the Deschutes River, Oregon. P. 169-202. Water Science and Application Series No. 7. American Geophysical Union, Washington, D. C.

Gannett, M. W., M. Magna, and Jr. K. E. Lite. 2003. Groundwater hydrology of the Upper Deschutes Basin and its influence on streamflow. J. E. O'Connor and G. E. Grant, editors. A peculiar river: geology, geomorphology, and hydrology of the Deschutes River, Oregon. Water Science and Application Series No. 7. American Geophysical Union, Washington, D. C.

Grant, G. E. and J. E. O'Conner, Editors. 2003. A peculiar river: geology, geomorphology, and hydrology of the Deschutes River, Oregon. Water Science and Application Series No. 7. American Geophysical Union, Washington, D. C.

Howell, P., K. Jones, D. Scarnecchia, L. LaVoy, W. Kendra, D. Ortmann, C. Neff, C. Petrosky, and R. Thurow. 1985. Stock assessment of Columbia River anadromous salmon - Volume II. Final Report to Bonneville Power Administration, Portland, Oregon (Project 83-335).

Huntington, C., T. Hardin, and R. Raymond. 1999. Water temperatures in the Lower Deschutes River, Oregon. Portland General Electric, Portland, Oregon.

Interior TRT (Interior Columbia Basin Technical Recovery Team). 2003. Independent populations of chinook, steelhead, and sockeye for listed evolutionarily significant units within the Interior Columbia River Domain. Interior Columbia Basin Technical Recovery Team, Northwest Fisheries Science Center, Seattle, Washington.

Joint Applicants (Portland General Electric and the Confederated Tribes of the Warm Springs Reservation). 2001. Final Joint Application Amendment for the Pelton Round Butte Hyroelectric Project. FERC Project No. 2030. Portland General Electric Company. Portland, Oregon. Three volumes.

Joint Applicants. 2004. Settlement Agreement - Concerning the relicensing of the Pelton Round Butte Hydroelectric Project, FERC Project No. 2030. Portland General Electric Company, Portland, Oregon, and Confederated Tribes of the Warm Springs Reservation of Oregon, Warm Springs, Oregon. July 13, 2004.

Khangaonkar, T. Z. Yang, C. DeGasperi, P. Johnson, and C. Sweeney. 1999. Preliminary temperature and hydrodynamic modeling of Lake Billy Chinook - Pelton Round Butte Hydroelectric Project: Summary of modeling activity to date. Technical Memorandum for the Pelton Round Butte Technical Fisheries Committee, June 2, 1999. Portland General Electric, Portland, Oregon. 7p.

Khangaonkar, T., Z. Yang, and S. Breithaupt. 2002. Selective withdrawal operation and its effect on temperature and water quality during drought conditions. Foster Wheeler Environmental Corporation, Bothell, Washington. Presented at the Pelton Round Butte Project Annual Fisheries Workshop, March 6, 2002. Portland General Electric, Portland, Oregon.

Lewis, S. D. and R. Raymond. 2000. Lower Deschutes River dissolved oxygen study, 1999. Portland General Electric, Portland, Oregon.

Lichatowich, J., R. Williams, and J.H. Nathan. 1998. A Conceptual Foundation for the Management of Native Salmonids in the Deschutes River. Prepared for Portland General Electric Company, Portland, Oregon. 170 p.

McElhany, P., M. Ruckleshaus, M. J. Ford, T. Wainwright, and E. Bjorkstedt. 2000. Viable Salmon Populations and the Recovery of Evolutionarily Significant Units. U. S. Dept. Commer., NOAA Technical Memorandum NMFS-NWFSC-42.

McClure, E. M. 1998. Spatial and temporal trends in bed material and channel morphology below a hydroelectric dam complex, Deschutes River, Oregon. Master's thesis. Oregon State University, Corvallis. In: PGE (Portland General Electric). 2004. Pelton Round Butte Hydroelectric Project revised biological evaluation. Portland General Electric Company, Portland, Oregon. 150p.

Meehan, W. R., and T. C. Bjornn. 1991. Salmonid distributions and life histories. In W. R. Meehan, Editor: Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19, Bethesda, Maryland. pp. 47-82.

Minear, P. 1999. Historical riparian conditions and large in-channel wood, Deschutes River, Oregon. Prepared for Portland General Electric, Portland, Oregon.

Mobrand Biometrics, Inc. 1999. Analysis of factors affecting aquatic resources of the Deschutes watershed: with an application to relicensing the Pelton Round Butte Project, EDT analysis. Prepared for the Warm Springs Power Enterprise. *In:* CTWS. 1999. Final license application, the Confederated Tribes of the Warm Springs Reservation of Oregon and Warm Spring Power Enterprises. FERC Project No. 2030. Confederated Tribes of the Warm Springs Reservation of Oregon, Warm Springs, OR.

Nehlsen, W. 1995. Historical Salmon and Steelhead Runs of the Upper Deschutes River and Their Environments. Prepared for Portland General Electric Company, Portland, Oregon. 65 p. plus references and two appendices.

Nickelson, T. E, J. W. Nicholas, A. M. McGie, R. b. Lindsay, D. L. Bottom, r. J. Kaiser, and S. E. Jacobs. 1992. Status of anadromous salmonids in Oregon coastal basins. Oregon Department of Fish and Wildlife, Research and Development Section, Corvallis, Oregon, and Ocean Salmon Management, Newport, Oreogn.

NMFS. (National Marine Fisheries Service). 1996a. Factors for decline. A supplement to the Notice of Determination for west coast steelhead under the Endangered Species Act. National Marine Fisheries Service, Protected Species Branch, Portland, Oregon. 83 p.

NMFS. 1996b. Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale. Habitat Conservation Division, Portland, Oregon.

NMFS. 1997. Status review update for west coast steelhead from Washington, Idaho, Oregon, and California, July 7, 1997. Prepared by the West Coast Steelhead Biological Review Team. National Marine Fisheries Service, Protected Resources Division, Portland, Oregon.

NMFS. 1999. Memorandum re. Habitat approach to NMFS/NWR staff from R. Applegate, NMFS, Portland, Oregon and D. Darm, NMFS, Seattle, Washington. August 26.

NMFS. 2000a. Passage of Juvenile and Adult Salmonids Past Columbia and Snake River Dams. White paper. Northwest Fisheries Science Center, Seattle, Washington. 38 p.

NMFS. 2000b. A Standardized Quantitative Analysis of Risks Faced by Salmonids in the Columbia River Basin. Cumulative Risk Initiative. 123 p. plus appendix and tables.

NMFS. 2004a. Artificial propagation evaluation workshop report. NOAA Fisheries, Northwest Region, Protected Resources Division. May 18, 2004. Available at: www.nwr.noaa.gov/1srd/Prop_Determins/

NMFS. 2004b. Draft biological opinion on ongoing operation and maintenance of the Deschutes River Basin projects: Deschutes River, Crooked River, and Clear Creek, Crook, Deschutes, Jefferson, and Wasco Counties, Oregon. National Marine Fisheries Service, Portland, Oregon.

O'Connor, J. E., G. E. Grant, J. H. Curran, and H. Fassnacht. 2003. Overview of geology, hydrology, geomorphology, and sediment budget of the Deschutes River Basin, Oregon. In: J. E. O'Connor and G. E. Grant, editors. A peculiar river: geology, geomorphology, and hydrology of the Deschutes River, Oregon. Pp 7-30. Water Science and Application Series No. 7. American Geophysical Union, Washington, D. C.

ODEQ (Oregon Department of Environmental Quality). 2002. Final evaluation and findings report on the application for certification pursuant to Section 401 of the Federal Clean Water Act. Oregon Department of Environmental Quality, Portland, Oregon.

Oosterhout, G.R. 1998. Structured decision-making: fish passage at Pelton Round Butte hydroelectric project on the Deschutes River (Oregon). Prepared for Portland General Electric, Portland, Oregon.

Pearcy, W. G., R. D. Brodeur, and J. P. Fisher. 1990. Distribution and biology of juvenile cutthroat Oncorhynchus clarki clarki and steelhead O. mykiss in coastal waters off Oregon and Washington. Fisheries Bulletin 88:697-711.

Pearcy, W. G. 1992. Ocean ecology of North Pacific salmonids. University of Washington Press, Seattle.

PFMC (Pacific Fishery Management Council). 1999. Amendment 14 to the Pacific coast salmon plan. Appendix A: Description and identification of essential fish habitat, adverse impacts and recommended conservation measures of salmon. PFMC, Portland, Oregon.

PGE (Portland General Electric). 2004. Pelton Round Butte Hydroelectric Project revised biological evaluation. Portland General Electric Company, Portland, Oregon. 150p.

Pribyl, S., J. Newton, and R. Stauff. 1997. Lower Deschutes River subbasin management plan. Oregon Department of Fish and Wildlife, Mid-Columbia Fish District, Portland, Oregon. In: PGE. 2004. Pelton Round Butte Hydroelectric Project revised biological evaluation. Portland General Electric Company, Portland, Oregon. 150p.

Ratliff, D., C. Fagen, M. Riehle, M. Powell, S. Carlon, P. Lickwar, A. Stuart, P. DeVito, M. Gauvin, and J. Eisner. 1999. Alternatives for renewing fish passage at the Pelton Round Butte Hydroelectric Project, Madras, Oregon. Portland General Electric Company, Portland, Oregon. 116p.

Ratliff, D. E. and E. E. Schulz. 1999. Fisheries program at the Pelton Round Butte Hydroelectric Project (Oregon), 1956 - 1995. Portland General Electric Company, Portland, Oregon. 181p.

Ratliff, D. 2001. Screening criteria for the new downstream migrant facility at Round Butte Dam: a discussion paper. Portland General Electric, Portland, Oregon. 21p.

Raymond R. B., J. M. Eilers, K. B. Vache′, and J. W. Sweet. 1997. Limnology of Lake Billy Chinook and Lake Simtustus, Oregon. Final report. E&S Environmental Chemistry, Inc., Corvallis, Oregon. Prepared for Portland General Electric, Portland, Oregon.

Raymond, R. B., J. M. Eilers, J. A. Bernert, and K. B. Vache′. 1998. Lower Deschutes River studies, water quality and biota. 1997 final report. E&S Environmental Chemistry, Inc., Corvallis, Oregon. Prepared for Portland General Electric, Portland, Oregon

Riehle, M. 1999. Habitat quality for anadromous fish upstream of the Pelton Round Butte Hydroelectric Project. Presented at the Portland General Electric Spring 1999 Fisheries Workshop, April 20, 1999. Portland General Electric, Portland, Oregon.

Riehle, M. 2000. Habitat availability and limiting factors for anadromous fish habitat upstream of Pelton Round Butte Project Dams - Progress Report. Presented at the Portland General Electric Annual Fisheries Workshop, March 7, 2001. Portland General Electric, Portland, Oregon.

Spence, B.C., G.A. Lomnicky, R. M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. Report No. TR-4501-96-6057. ManTech Environmental Research Services Corporation, Corvallis, Oregon.

U.S. Census Bureau. 2004. QuickFacts for Deschutes, Jefferson and Crook Counties, Oregon. Available at *http://quickfacts.census.gov/qfd/states/41000.html*.

USFWS (U.S. Fish and Wildlife Service) and NMFS. 1998. Endangered Species Act consultation handbook: procedures for conducting Section 7 consultations and conferences. National Marine Fisheries Service, Portland, Oregon.

Yang, Z., T. Khangaonkar, C. DeGaspari, W. Boles, L. Khan, and C. Sweeney. 2000. Calibration and verification of hydrodynamic and temperature models of Lake Billy Chinook. Final report. Portland General Electric, Portland, Oregon.

Yang, Z., T. Khangaonkar, C. DeGaspari, and S. Greithaupt. 2001. The Pelton Round Butte Hydroelectric Project fish passage program: water quality model of Lake Simtustus. Final report prepared for Portland General Electric, Portland, Oregon.

Zimmerman, C.E. and G.H. Reeves. 1997. Steelhead and rainbow trout early life history and habitat use in the Deschutes River, Oregon. 1996 Annual Report prepared for Portland General Electric Company. Pelton Round Butte Hydroelectric Project FERC No. 2030.

Zimmerman, C.E. and G.H. Reeves. 2000a. Population structure of sympatric anadromous and nonanadromous *Oncorhynchus mykiss*: Evidence from spawning surveys and otolith microchemistry. Can. J. Fish. Aquat. Sci. 57:2152-2162.

Zimmerman, C.E. and G.H. Reeves. 2000b. Utilization of mainstem and tributary habitats by steelhead and resident rainbow trout (*Oncorhynchus mykiss*) in the Deschutes River, Oregon. *In* Zimmerman Ph.D. Dissertation, Oregon State University, Corvallis.