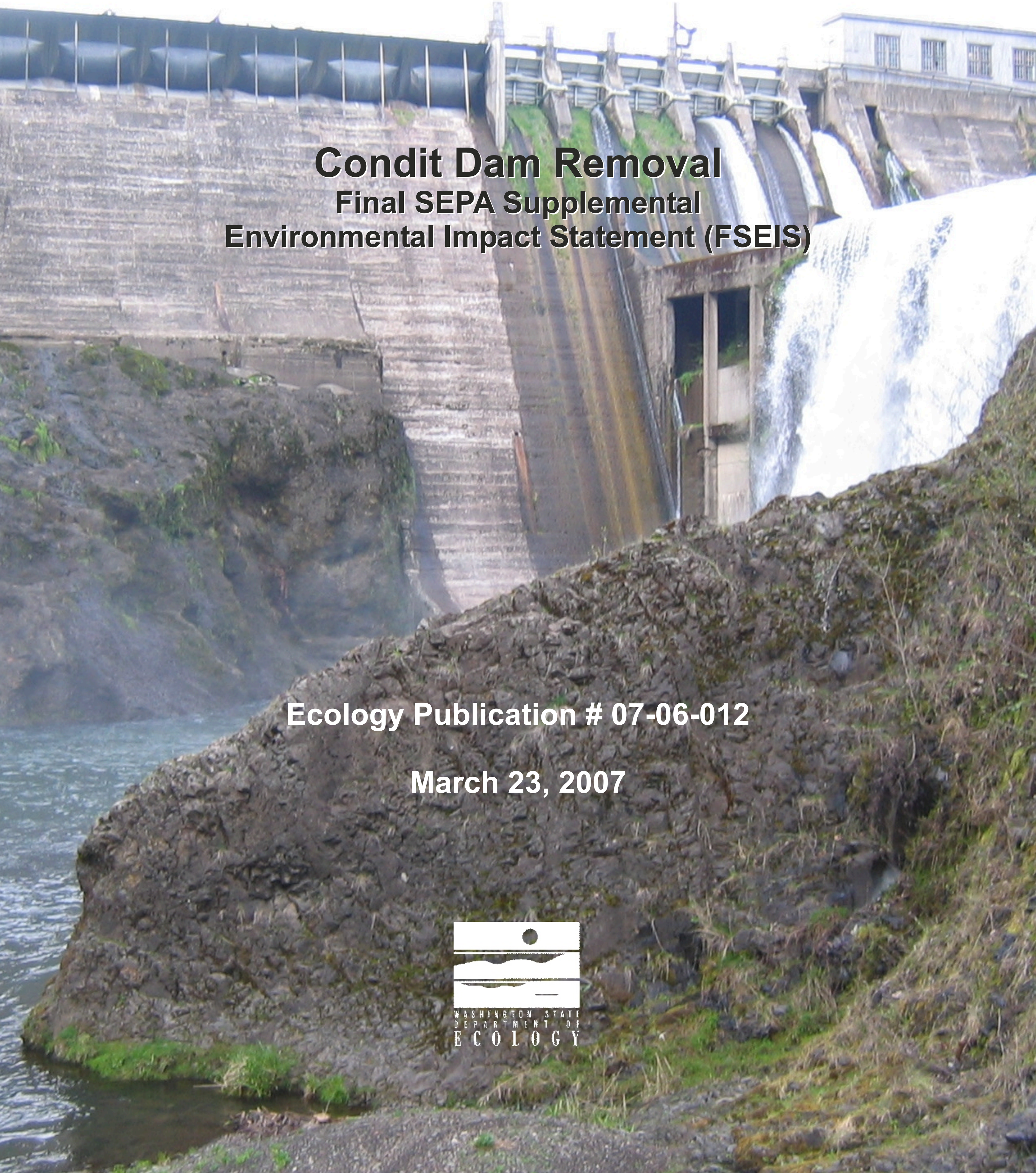

Condit Dam Removal

Final SEPA Supplemental Environmental Impact Statement (FSEIS)

Ecology Publication # 07-06-012

March 23, 2007

WASHINGTON STATE DEPARTMENT OF ECOLOGY

CONDIT DAM REMOVAL SEPA SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

This report is available on the Department of Ecology Web site at:
http://www.ecy.wa.gov/biblio/0706012.html

For a CD or printed copy of this report contact:

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Refer to Publication number 07-06-012

If you need this publication in an alternate format, please contact Tim Schlender in Ecology's Shorelands and Environmental Assistance Program at (360) 407-6096. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call (877) 833-6341.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
15 West Yakima, Suite 200 • Yakima, Washington 98902-3452 • (509) 575-2490

March 23, 2007

Dear interested parties:

The Washington State Department of Ecology (Ecology) has prepared and issued this State Environmental Policy Act (SEPA) Final Supplemental Environmental Impact Statement (FEIS) to address the proposal by PacifiCorp to remove the Condit Hydroelectric Project on the White Salmon River, a tributary of the Columbia River. The Final SEIS supplements the following National Environmental Policy Act (NEPA) documents: *Condit Hydroelectric Project Final Environmental Impact Statement, FERC No. 2342-005, Washington* (Federal Energy Regulatory Commission, October 1996); and *Final Supplemental Final Environmental Impact Statement, Condit Hydroelectric Project, Washington, FERC Project No. 2342,* (Federal Energy Regulatory Commission, June 2002). As part of the SEIS, Ecology is adopting these documents pursuant to provisions of WAC 197-11-610 and 630.

The aforementioned documents identify and evaluate a range of reasonable alternatives to the proposal, identify probable significant impacts associated with the proposal and its alternatives, and address mitigation measures to be imposed by the Federal Energy Regulatory Commission. The NEPA documents were evaluated to verify, from the Department of Ecology's perspective, whether a reasonable range of alternatives were considered and whether all probable significant adverse impacts associated with the proposal were adequately identified and assessed. Based on that evaluation, it was determined that, while the NEPA documents form a substantial basis for environmental review of the project and largely meet Ecology's environmental review standards, some supplemental evaluation of probable significant adverse impacts would be needed to satisfy the requirements of SEPA. Among the issues associated with the proposal that are addressed in the Final SEIS are the potential for sedimentation and turbidity in the White Salmon and Columbia Rivers; effects of dam removal activities on fish, including those listed under the Endangered Species Act; removal of potential barriers to fish passage; loss of wetlands; impacts to surrounding land use; noise, air quality, and aesthetic effects; provisions for public safety; and impacts to public services and utilities.

Sincerely yours,

Derek I. Sandison
Central Regional Director

Fact Sheet

Project Title

Condit Dam Removal

Proponent

PacifiCorp
825 NE Multnomah St., Suite 1500
Portland, Oregon 97232-2135

Proposed Action

PacifiCorp proposes to remove the Condit Hydroelectric Project on the White Salmon River in accordance with the Condit Hydroelectric Project Settlement Agreement, as amended in 2005. Removal of the project would enable the river and watershed to return to the conditions of a free-flowing river. Originally completed in 1913, Condit Dam has since accumulated sediment and blocked fish passage. Removing the dam is expected to provide access to as much as 33 miles of river and tributary habitat for anadromous steelhead and salmon and restore connectivity to foraging, spawning, rearing, and overwintering habitat for bull trout in the lower White Salmon River. The removal also would restore natural bed load movement processes in the river. Combined with a stable and natural flow regime, dam removal would result in increased salmonid (steelhead, salmon, and bull trout) production potential.

The proposed action includes draining the reservoir through a tunnel that would be constructed through the dam, removing the dam, removing the wood stave pipeline, the surge tower and the two penstocks, and filling in the tail race at the power house. Concrete from the dam and wood from the pipeline would be disposed of and/or temporarily stored for recycling on property near the dam.

Previous NEPA EISs were prepared by the FERC, but were found by Ecology not to adequately cover all SEPA issues. This Final Supplemental Environmental Impact Statement (Final SEIS) is intended to address the environmental impacts of removal of the Condit Dam and is being prepared pursuant to the State Environmental Policy Act (SEPA). This EIS evaluates one alternative, the Proposed Action to remove the Condit Dam and associated facilities.

Lead Agency Information

Responsible Official and Contact:

Derek Sandison and Joanne Wellner
Washington State Department of Ecology
Central Regional Office
15 W Yakima Ave, Ste 200
Yakima WA 98902-3452
(509) 575-2680

Permits, Certifications, and Licenses, and Other Required Actions or Approvals

Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers

Clean Water Act Section 401 Water Quality Certification from the Department of Ecology

Construction Stormwater General NPDES permit

Hydraulic Project Approval from the Department of Fish and Wildlife (unless preempted by the Federal Power Act)

It was not known at the time of publication of this Final SEIS if FERC or the courts will determine that the Federal Power Act would preempt state and local permits as PacifiCorp has asserted. If the Federal Power Act is determined not to preempt local authority, then permits from Klickitat County and/or Skamania County may be required.

Date of Issue of Draft SEIS

September 30, 2005

Date of Issue of Final SEIS

March 23, 2007

Document Availability

Information regarding the availability of this Final SEIS will appear in the Skamania County Pioneer and the White Salmon Enterprise. The Final SEIS can be viewed on line at http://www.ecy.wa.gov/biblio/0706012.html. Hard copies of the Final SEIS can be obtained at a cost of $40 per copy. The FINAL SEIS is also available on CD at no charge. Hard copies or CDs can be obtained by contacting Joanne Wellner. Please specify the desired format. **Persons with disabilities may request this information be prepared and supplied in alternative formats.**

Copies of the Final SEIS can be reviewed at the Department of Ecology's Central Regional Office, 15 W Yakima Avenue, Ste. 200, Yakima, Washington or at the following libraries:

White Salmon Valley Community Library
#5 Town & Country Square
White Salmon, WA
98672

Goldendale Community Library
131 West Burgen
Goldendale, WA
98620

Location of Background Material

The Condit Hydroelectric Project Final Environmental Impact Statement, FERC No. 2342-005, Washington (Federal Energy Regulatory Commission, October 1996); and Final Supplemental Final Environmental Impact Statement, Condit Hydroelectric Project, Washington, FERC Project No. 2342, (Federal Energy Regulatory Commission, June 2002), both adopted as part of this SEIS, were both distributed to a broad range of tribes, agencies, and the public by the Federal Energy Regulatory Commission. Copies of these documents are on file at the Department of Ecology's Central Regional Office, 15 W Yakima Avenue, Ste. 200, Yakima, Washington.

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ACRONYMS AND ABBREVIATIONS

ADT	average daily traffic
AST	aboveground storage tank
bgs	below ground surface
BMP	best management practice
CFR	Code of Federal Regulations
CWA	Clean Water Act
cfs	cubic feet per second
dBA	A-weighted decibels
DPS	distinct population segment
DSFEIS	Draft Supplemental Final Environmental Impact Statement
EA	extensive agriculture
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
ESU	evolutionarily significant unit
EVC	existing visual conditions
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
FSFEIS	Final Supplemental Final Environmental Impact Statement
g/L	grams per liter
gpm	gallons per minute
HDPE	high-density polyethylene
Hz	hertz
KCC	Klickitat County Code
km	kilometer
kV	kilovolt
LOS	level of service
mcy	million cubic yards
mg/L	milligram per liter

mm	millimeter
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NCRS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
OS	open space
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
ppm	parts per million
RL	resource lands
RM	river mile
RR	rural residential
SCC	Skamania County Code
SEIS	Supplemental Environmental Impact Statement
SEPA	State Environmental Policy Act
SR	State Route
SWCAA	Southwest Clean Air Agency
TSS	total suspended solids
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
vpd	vehicles per day
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

Glossary

Aggregate: Sand and gravel.

Adfluvial (fish): A fish population that migrates into tributary streams to spawn. This term is sometimes applied in the literature to fluvial-adfluvial fish.

Anadromous (fish): A fish population that migrates from the sea into freshwater streams to spawn.

Aquifer: Any saturated permeable geologic unit that under normal conditions can transmit significant quantities of water.

A-weighted decibels: The weighted decibel scale that best approximates the response of the human ear to noise.

Bed: The smallest division of a stratified geologic series, and marked by a plane from its neighbors above and below. Generally these are regional in scale and will have similar physical properties throughout their extent.

Benthic Macroinvertebrate: Usually applies to aquatic insect larvae that live on or in the substrate of a stream (or lake). It can apply to clams, worms, and crustaceans (any non-microscopic invertebrate) that live at the bottom of a lake or stream.

Capacity: The maximum sustainable flow rate of persons or vehicles that can reasonably be expected to travel through a segment of roadway or other facility in a specified time period. Typically stated in persons per hour (pph), vehicles per hour (vph), or passenger car equivalents per hour (pcph).

Decibels: Unit on a scale used to measure noise.

Delay: Additional travel time experienced by a driver or passenger while traveling at speeds below the posted speed. Freeway delay comprises traffic delay (including mainline and ramp meter delay) and incident delay. Surface street delay typically comprises traffic delay and signal delay.

Ecotype: A population of organisms adapted to a particular set of environmental conditions. A steelhead is a rainbow trout ecotype adapted to long distance migrations into the ocean (anadromous), while a resident rainbow is an ecotype adapted to maturing and remaining in freshwater.

Ephemeral stream: Any stream which can vary from dry to running with the seasons.

Facies: The physical appearance of a geologic unit used to describe its origins in relation to other units.

Fall-run Chinook salmon: Chinook salmon that return to freshwater in the fall as mature fish and spawn soon after. Fall-run Chinook are generally ocean-type fish that outmigrate from freshwater as sub-yearling smolts.

Fluvial: Derived from or pertaining to rivers and their processes.

Fluvial (fish): A fish population that rears in a stream or river. This term is often applied to fluvial-adfluvial fish, which are fluvial fish rearing in larger streams that spawn in tributaries to their rearing stream. Fluvial can be used as a general term that includes fluvial-adfluvial fish.

Fluvial-adfluvial (fish): A migatory fish population that rears in a mainstem river environment and migrates to tributaries to spawn. The life history is also sometimes called "fluvial" or "adfluvial" in the literature, but this term more accurately refers to a fish that both rears and spawns in the same stream. Although this document refers to the rainbow and coastal cutthroat trout that rear in the mainstem of the White Salmon River as fluvial-adfluvial, a sizable portion of the mainstem rainbow trout population appears to spawn in the mainstem and are true "fluvial" trout.

Fugitive dust: Dust emissions caused by dispersion of dust particles by prevailing winds and/or the turbulence caused by moving machinery and trucks.

Genotype: The internally coded, inheritable (genetic) characteristics of an individual or an average individual from a population of organisms.

Glacial: Pertaining to or characteristic of, produced by, or derived from a glacier.

Hydrogeologic unit: A single continuous geologic layer with similar physical properties throughout.

Incident Delay: Additional travel time experienced as a result of a breakdown, crash, or other occurrence that impedes the flow of traffic.

Introgression: Hybridization of a population of organisms with another population that produced fertile offspring (i.e. a coastal cutthroat trout population can become introgressed with hatchery rainbow trout).

Lacustrine: Derived from or pertaining to lake environments.

Lacustrine (fish): A fish population that rears in a lake environment. This term is often applied to lacustrine-adfluvial fish, which are lacustrine fish that spawn in tributary streams. Lacustrine can be used as a general term that includes lacustrine-adfluvial fish. Fish populations that spawn in outlet streams are allacustrine.

Lacustrine-adfluvial (fish): Lacustrine refers to lake rearing and adfluvial refers to making spawning migrations into inlet streams, hence this term refers to a lake rearing fish population that makes spawning migrations into tributary streams.

Lens: A discontinuous hydrogeologic unit.

Level of service: A measure of the quality of traffic flow based on speed and travel time, freedom to maneuver, and traffic interruptions. Level of service (LOS) is rated from A to F, with A being the best (free-flow) conditions and F being the worst.

Limnetic: Pertaining to or inhabiting fresh water.

Littoral: Pertaining to or existing on or near shore.

Mode: A particular variety or form. In this EIS, usually a particular form of transportation such as automobile, bus, carpool or bicycle.

Natal: Pertains to the birthplace of an organism.

Ocean-type: Refers to a Chinook salmon that migrates from its natal stream to the ocean as a sub-yearling (age 0 fish).

Off-Peak: Any time during the day outside the peak travel period, typically when traffic flows are not constrained by roadway or facility capacity.

Outmigrant: An outmigrant is a salmonid smolt that migrates from the stream where it was spawned to the ocean (the migration can also be to a larger stream or lake).

Peak Direction: Direction of maximum traffic flow during the peak hour. For example, this may be westbound during the AM peak hour and eastbound during the PM peak hour.

Peak Hour: The hours within the day during which the maximum volume of traffic passes a defined roadway point: one hour in the morning (AM) and one hour in the afternoon (PM). The peak hour typically correlates to "rush hour."

Peak Period: A time period during which the maximum volume of traffic passes a defined roadway point. In the DEIS, both three-hour and six-hour periods are considered.

Phenotype: The outward physical manifestation or physical characteristics of an individual or an average individual from a population of organisms.

Queuing: In the context of traffic analysis, vehicles lined up awaiting a turn or change of traffic signal.

Recharge: The entry into the saturated zone (i.e., aquifers) from surface water infiltration.

Redd: A salmonid "nest" where eggs are buried in gravel. Redds appear as clean depressions in stream gravel during spawning surveys.

Resident Rainbow Trout: Refers to a rainbow trout that never leaves freshwater.

Residual: An individual in a population that is characteristically sea-run that never goes to sea ("residualized"). "Residuals" are typically precocious males that mature earlier and at a smaller size than anadromous individuals. Approximately four times more male juvenile steelhead residualize than female juveniles.

Riparian: Pertaining to the banks of a body of water, especially including the vegetation.

River Mile (RM): River mile above the mouth of a stream.

Salmonid: A member of the family Salmonidae, which in North America includes Pacific salmon (coho, Chinook, pink, sockeye, and chum salmon), Atlantic salmon, brown trout, western trout (rainbow and cutthroat trout), char (brook trout, bull trout, lake trout, and Dolly Varden), grayling, and whitefish. Pacific salmon and western trout belong to the genus Oncorhynchus, Atlantic salmon and brown trout belong to the genus Salmo, char to the genus Salvelinus, grayling to the subfamily Thymallinae, and whitefish to the subfamily Coregoninae.

Smolt: A juvenile salmonid that has gone through a physiological change in freshwater before migrating to the ocean. Usually, this entails developing the physiological capacity to osmoregulate in salt water. Smolts also take on a silvery appearance, their scales become looser, and their bodies become more streamlined.

Slough: A place of deep mud or mire; an inlet on a river; or a creek or marsh in a tide flat.

Spawner: A sexually mature fish that will soon reproduce (spawn) or is undergoing a migration to spawn (spawning migrations can occur before a fish is sexually mature).

Spring-run Chinook Salmon: Chinook salmon that return to freshwater as immature adults in the spring and spawn in the fall. They also tend to spawn higher in a stream basin than fall-run Chinook salmon.

Stream Resident Rainbow Trout: Refers to a rainbow trout that remains in smaller tributary streams throughout its life.

Steelhead Trout: An anadromous (sea-run) rainbow trout. The capacity to become a steelhead is usually an inherited trait, but juvenile steelhead can remain in freshwater (residualize) without migrating to saltwater. A steelhead can be considered an ecotype, phenotype, or genotype of the rainbow trout.

Summer-run Chinook salmon: Chinook salmon that return to freshwater in the summer and spawn in the fall. Summer-run Chinook are generally ocean-type fish that outmigrate from freshwater as sub-yearling smolts

Summer-run Steelhead Trout: Steelhead that return to freshwater as immature adults in the spring or summer (although inland steelhead may not reach their natal stream until late fall or winter). Summer-run steelhead mature and spawn during the spring or early summer of the following year after returning to freshwater.

Stream-type: Refers to a Chinook salmon that migrates from its natal stream to the ocean as a yearling (age 1 fish). Stream-type Chinook salmon generally return as immature adults in the spring and spawn in the fall. They also tend to spawn higher in a stream basin than ocean-type Chinook salmon.

Traffic Delay: Reduction in speed below free-flow conditions as a result of vehicle interaction.

Viewscape/viewshed: The area visible from a designated viewpoint.

Water table: The point at which the zone of saturation meets the zone of aeration, or the point at which hydraulic pressure equals atmospheric pressure. This corresponds to the top of an unconfined or perched aquifer.

Winter-run Steelhead Trout: Steelhead that return to freshwater in the late fall and winter as mature adults and spawn from late winter through early summer.

1.0 SUMMARY

1.1 INTRODUCTION

The Condit Hydroelectric Project, located on the White Salmon River in Klickitat and Skamania Counties, Washington, was constructed in 1912 and 1913 and has produced electricity since that time. PacifiCorp is proposing to cease electricity generation at the Condit Hydroelectric Project on October 1, 2008 and commence removal later the same month. The Washington State Department of Ecology (Ecology) is conducting an environmental review under the State Environmental Policy Act (SEPA) comparing the effects of continued operation of the dam (the no-action alternative) with the removal of the dam (proposed action).

1.2 PROJECT BACKGROUND

On December 27, 1991, PacifiCorp filed an application with the Federal Energy Regulatory Commission (FERC) for a new license to continue operating the Condit Hydroelectric Project. In October 1996, FERC issued a National Environmental Policy Act (NEPA) Final Environmental Impact Statement (FEIS) that analyzed the environmental and economic effects of five alternatives: 1) continuing to operate the project with no additional mitigation or enhancement measures (no-action alternative); 2) operating the project as proposed by PacifiCorp; 3) operating the projects as proposed by PacifiCorp with additional staff-recommended measures; 4) a staff-developed alternative for dam removal; and 5) a staff-developed alternative involving partial removal of the dam with a new upstream diversion. In the 1996 FEIS, FERC staff recommended the third alternative, PacifiCorp's licensing proposal with modifications that included fish passage facilities and several other changes to benefit fish.

On October 29, 1999, PacifiCorp filed an application to amend the current license to extend the license term to October 1, 2006, and to incorporate the terms and conditions of a Settlement Agreement that provided for removal of the dam upon the expiration of the proposed amended license term and established a date for commencing the removal. The Settlement Agreement also established PacifiCorp's financial commitment to dam removal with a capped monetary limit.

FERC determined that the October 1999 application filed by PacifiCorp was in essence an application to surrender the existing license to operate the dam. Thus, the surrender alternative, reached through settlement negotiations, became the proposal before FERC. A NEPA Supplemental Environmental Impact Statement (SEIS) was prepared by FERC to augment the October 1996 FEIS. The Final Supplemental FEIS (FSFEIS) (June 2002) assessed the effects of surrendering the dam operating license, including dam removal, removal with mitigation measures, and project retirement without dam removal.

Between November 16, 2004 and February 8, 2005, the parties to the Settlement Agreement all signed a Memorandum of Agreement (MOA) modifying the Condit Hydroelectric Project Settlement Agreement. A fundamental conclusion implicit in each signatory entity's approval of the Settlement Agreement and the modification was that, from their perspective, the long-term and overall benefits would outweigh the short-term impacts of implementing the Settlement

Agreement. That MOA modifies the Settlement Agreement by changing the implementation date for dam removal from 2006 to 2008; increasing the cap on mitigation costs; and increasing the total cost cap. In February 2005, PacifiCorp filed an application with FERC to amend the decommissioning application to be consistent with the terms of the MOA.

Ecology is both the Lead Agency for SEPA and the regulatory decisionmaker for a portion of the permits that require SEPA documentation to support permit decisions. Ecology determined that the 1996 and 2002 NEPA documents analyzing the impacts of the dam removal were not adequate to meet all requirements of SEPA and that a SEPA SEIS would be required.

This SEPA SEIS builds on previous environmental documents. The 1996 FERC FEIS on relicensing of the Condit Dam described and analyzed the effects of a no-action alternative which would continue operation of the Condit Hydroelectric Project under the terms and conditions of the existing license. That analysis of the no-action alternative and other pertinent information are adopted as part of this SEPA SEIS. The 2002 FERC FSFEIS addressing the license surrender proposal and removal of Condit Dam analyzed a range of dam removal alternatives. Under SEPA, no further analysis of the alternatives other than the proposed action is required, as the other alternatives would have greater impacts than the proposed alternative or are already adequately analyzed.

1.3 ADOPTION OF NATIONAL ENVIRONMENTAL POLICY ACT DOCUMENTS

The Draft SEIS supplements the following NEPA documents:

- Condit Hydroelectric Project Final Environmental Impact Statement, FERC No. 2342-005, Washington (FERC 1996)
- Final Supplemental Final Environmental Impact Statement, Condit Hydroelectric Project, Washington, FERC Project No. 2342 (FERC 2002)

These documents identify and evaluate a range of reasonable alternatives to the proposal, identify probable significant impacts associated with the proposal and its alternatives, and addresses mitigation measures to be imposed by FERC. The NEPA documents were evaluated to verify, from Ecology's perspective, whether a reasonable range of alternatives were considered and whether all probable significant adverse impacts associated with the proposal were adequately identified and assessed. It was determined that, while these documents form a substantial basis for environmental review of the project and largely meet Ecology's environmental review standards, some supplemental evaluation of probable significant adverse impacts, would be needed to satisfy the requirements of SEPA (Chapter 43.21C RCW) and SEPA Rules (Chapter 197-11 WAC).

Pursuant to the provisions of WAC 197-11-610 and 630, Ecology hereby adopts the aforementioned NEPA documents to partially satisfy its requirements for SEPA compliance.

1.4 FOCUS OF SEPA SEIS

The focus of this SEPA SEIS will primarily be on the "Settlement Agreement with Modifications" Alternative since it was the FERC staff-recommended alternative in their FSFEIS. The issues identified by Ecology for additional assessment as part of the SEPA process include: increased erosion, sedimentation, and turbidity in the White Salmon River from dam breaching and removal; impacts to water quality in the White Salmon River and Columbia River; impacts to groundwater quality; increased turbidity in stormwater runoff; effects on fish; potential barriers to fish passage; potential effects on priority species and habitats due to clearing vegetation or grading staging areas; loss of wetlands; sedimentation or scour of wetlands; impacts to local roadways; impacts to air quality and potentially to human health from fine particles; construction noise; land use impacts; visual impacts from reservoir and vegetation removal; public safety; impacts to public services including temporary interruption of water supplies and increased need for services of local police and fire personnel; and possibly local permits. (See Section 2.4 for a complete list of issues.)

1.5 DESCRIPTION OF PROPOSED ACTION

The existing Condit Hydroelectric Project includes a concrete dam, an approximately 1.8-mile-long reservoir, a 13.5-foot-diameter wood-stave pipeline of approximately one mile in length, a reinforced-concrete surge tower, two 650-foot-long penstocks (one steel and one wood), and a powerhouse structure housing two turbines with an installed capacity of 14,700 kilowatts (Figure 1-1).

The proposed action includes draining the reservoir through a tunnel that would be constructed through the dam, removing the dam, removing the wood stave pipeline, the surge tower and the two penstocks, and partial filling of the tail race at the power house. Concrete and wood from the pipeline would be disposed of and/or staged for recycling on property near the dam. Details of the proposed action are described in the Condit Hydroelectric Project, FERC Project No. 2342, Project Description (PacifiCorp 2004). The project description includes numerous plans designed to minimize or eliminate potential impacts related to the project. The stages of the project are: pre-dam removal activities, dam breaching and removal, and post-removal management. The activities associated with each of these stages and the project schedule are summarized below.

1.5.1 Pre-Dam Removal Activities

- In order to perform the removal and associated restoration work, temporary work areas, staging areas, and access roads would need to be established and utilized. These staging areas and access roads are located on the east side of the White Salmon River in proximity to the dam.

- A fueling station would be located at staging area SA-2 adjacent to the dam. Fueling of remote equipment, such as cranes or highlines would be accomplished by tank trucks and would use required preventative and protective measures against spills.

- A new temporary water supply pipeline would be installed across the lake with a cable support system before the dam is breached in order to assure that service from the existing pipeline is not interrupted by a potential failure during dam breaching. After the reservoir is drained and sediment has been stabilized, a new permanent water line would be installed.

- The supports for Northwestern Lake Bridge, located 1.8 miles upstream from the dam, would be modified to enable the bridge to withstand the long-term scouring action of the river channel.

- Mount Adams Orchard currently withdraws irrigation water from Northwestern Lake. A new intake and pump system or well would be designed and installed near the current dam in coordination with Mount Adams Orchard personnel to assure the needs of the orchard are met.

- Prior to draining Northwestern Lake, the hardware on the crest of Condit Dam would be removed and a 12-foot-high by 18-foot-wide, slightly bell-shaped drain tunnel would be excavated from the downstream side near the base of the dam to provide rapid reservoir drainage.

1.5.2 Dam Breaching and Removal

- Prior to the blast that opens the final 15 feet of the drain tunnel, a barge-mounted clamshell crane would be used to excavate sediment and debris from the upstream face of the dam in the area where the tunnel would be opened.

- The final 15 feet of the tunnel would be breached by blasting out the remaining concrete. The tunnel size would allow an approximate maximum flow of 10,000 cubic feet per second (cfs) to pass through. At this tunnel size, the reservoir pool is expected to lower to stream level within six hours, causing substantial amounts of sediment and woody debris currently trapped behind the dam to be flushed downstream.

- In order to assure that the drawdown/stabilization process is successful, an assessment of slope conditions would be made to determine whether active management of the sediment would be required. Options for active management of the sediment include the use of water cannons, blasting charges, and/or mechanical means.

- Once the reservoir is drained, the concrete dam would be cut and blasted into large blocks or rubble. This concrete would be loaded with either a crane or a highline yarder-type system onto trucks and then hauled to an 8-acre storage/disposal area located a few thousand feet upstream of the dam and owned by PacifiCorp. If a concrete recycling recipient is available, then the disposal site would be a transfer site or a temporary storage site.

- Historic photographs and drawings show that a cofferdam system was used in the original construction of the dam and was left behind in the reservoir and subsequently flooded. It is hoped that this structure can be removed by blasting and the use of a

Figure 1-1 Location Map

Color. Takes 2 pages. Start on odd numbered page.

Figure 1-1 (Continued)

- logging highline yarder, but it may be necessary to construct an access road into the area so that other equipment can assist in this work.

- The wood stave flowline and the two penstocks would be removed and transported to a temporary storage area located a few hundred feet east of the flowline.

- The steel-reinforced concrete surge tank would be disassembled using conventional track-mounted breakers along with drilling and blasting. The above-grade portions of the existing concrete spillway that extends from the surge tank to the river would be demolished. Excess materials that are not used to fill the spillway channel would be trucked to the concrete disposal site.

- As part of the removal activities, PacifiCorp would reconfigure the two 69 kilovolt (kV) transmission lines that terminate at the Condit Hydroelectric Project.

- PacifiCorp would not remove the project powerhouse and associated parking area. The powerhouse tailrace retaining wall would, however, be removed and hauled to the disposal area. The upper portion of the tailrace would be filled in with rock.

1.5.3 Post-Removal Management

- At the conclusion of the proposed action, all temporarily disturbed areas, including the staging areas, disposal areas, and the former reservoir area, would be revegetated.

- Monitoring is proposed to demonstrate that performance criteria are met for several of the management plans included in PacifiCorp's project description (PacifiCorp 2004). For several of these plans, monitoring would continue during the post-removal management period. Depending on the results of the monitoring, additional actions may be required. The duration of the monitoring is variable, but would generally continue until specific performance criteria are met.

1.5.4 Schedule

The Settlement Agreement was entered into in 1999 to resolve all issues in the proceeding for relicensing the project by FERC. It was amended in 2005. Under the Settlement Agreement and upon FERC approval, PacifiCorp would continue to operate the project under the terms of its existing FERC license until October 1, 2008, whereupon PacifiCorp would cease generating power at the project.

If all applicable permits, easements, and contracts have been obtained, project removal activities would commence in August 2008. The demolition and removal of Condit Dam and other project facilities are estimated to take one year. Monitoring would then continue until performance criteria are met.

1.6 IMPACTS AND MITIGATION MEASURES

1.6.1 Beneficial Effects of Dam Removal

Since a major impetus for removing the Condit Dam is to provide benefits to fish, it is appropriate to summarize the beneficial effects that are expected. This will allow a direct comparison of the adverse effects in order to understand the tradeoffs of the proposed action.

The most notable beneficial effects would accrue to the fish and aquatic organisms that would use the free-flowing stream. Potentially, 32 miles of new steelhead habitat and 15 miles of new salmon habitat may be accessed by anadromous salmonids after dam removal, increasing the run size of anadromous salmonids in the White Salmon River and increasing the availability of salmon and steelhead angling opportunities in the White Salmon river basin. New thermal refuge habitat for migrating Columbia River anadromous salmonids from other sub-basins also will be accessible after the removal of Condit Dam. Additional stream habitat for resident fish will be created in the lakebed of the former reservoir. Additionally, the small increase in water temperature below Condit Dam from the discharge of warmed reservoir surface water will be eliminated, improving the quality of thermal refuge, and the recruitment of gravel and large woody debris from sources above the dam site will be reestablished. Foraging, wintering, and refuge habitat, and possibly spawning habitat, will be created for Columbia River bull trout. Juvenile anadromous salmonids will provide forage for bull trout, and salmon carcasses in the watershed above the site of Condit Dam will provide an additional source of marine-derived nutrients to the watershed. There will be more suitable substrate for stream-dwelling aquatic macroinvertebrates after the stream substrate has stabilized.

In addition to benefits to aquatic organisms, there will be other changes that will benefit some users and adversely affect others. For example, while there would no longer be reservoir-based recreation opportunities, there would be river-based recreation opportunities, such as kayaking and stream fishing.

1.6.2 Direct Impacts and Mitigation Measures

The impacts and mitigation measures for the proposed action alternative (dam removal) are summarized by element of the environment in Table 1-1 at the end of this chapter.

1.6.3 Significant Unavoidable Adverse Impacts

Geology, Soils and Sediments

Downstream from the dam, movement of sediment through the channel and floodplain redevelopment and formation are unavoidable adverse impacts. Therefore, much more sediment will be deposited in the Bonneville pool of the Columbia River than with the Condit Dam in place, especially at and near the in-lieu site at the mouth of the White Salmon River. The natural sediment flux in the lower White Salmon River will then deposit into the Bonneville pool rather than a free-flowing Columbia River. The sediment deposition will be a result of the Bonneville dam.

Water Resources

Significant unavoidable adverse impacts identified with respect to surface water include massive turbidity and sediment transport as part of the dam breaching and removal. Total suspended solids (TSS) within the six hours after the dam breach could range from 100,000 to 250,000 Parts per million (ppm) and turbidity values could range from 50,000 to 127,000 nephelometric turbidity units (NTUs). Elevated TSS and NTU are expected through the first year following the dam breach as bank and river channel stabilization occurs. These turbidity spikes are predicted to near background levels within 3 to 5 years. Elevated turbidity levels are expected in the Bonneville pool, where the waters of the Columbia River and the White Salmon River mix. Clay particles will likely remain suspended in the Columbia River, thus temporarily increasing turbidity, all the way to the mouth of the Columbia River.

Significant unavoidable adverse impacts were not identified with respect to groundwater.

Aquatic Resources

All fish and aquatic macroinvertebrates within the White Salmon River channel downstream of the dam will likely be killed or displaced by the load of suspended solids that will occur during dam breaching. While the actions having the effects will be short-term in duration and will diminish as the level of suspended sediments is reduced over time, the effect on populations of macroinvertebrates will likely take several years to fully reestablish.

One potential year-class of the few naturally spawned chum salmon imprinted to return to the White Salmon River is expected to be lost due to the high concentrations of suspended and deposited sediment and their inability to access stream habitat above the dam or cofferdam. Chum salmon spawners that pass Bonneville Dam will not enter the White Salmon River during the fall and winter months following dam removal and will spawn in other Columbia River tributary or mainstem habitat. Run size during the years the lost year-class would be expected to return as mature spawners will be reduced and composed entirely of spawners from other year-classes. This impact will be long-term (potentially several generation cycles for chum salmon). In addition, it is likely that the spawning substrate necessary for their reproduction will be impaired by fine sediment during the second year (and not fully recovered for 1 to 3 years after that). New gravel recruited from upstream may not reach the lower 2.6 miles during that time. The result will be essentially a loss of several year-classes of chum salmon. The small number of chum salmon spawners currently documented to occur in the White Salmon are likely strays from a population below Bonneville Dam and do not represent a viable population. The NMFS Biological Opinion (NMFS 2006) provides for the incidental take. The long-term increase in available chum salmon spawning habitat is expected to increase chances of successful recolonization of the White Salmon River basin by chum salmon.

During the period immediately following the breaching of the dam, suspended sediment concentrations entering the Bonneville Pool will be relatively high and the discharge of the White Salmon River will make up approximately seven percent of the Columbia River flow. Columbia River fish may be displaced from the most sediment-laden portions of the plume until it has completely mixed with the Columbia River, approximately three miles downstream from the mouth of the White Salmon River (PacifiCorp 2005). Beyond this point, the plume may briefly interfere with foraging behavior and predator-prey relationships through the Bonneville Pool and downstream of Bonneville Dam (PacifiCorp 2005, Korstrom and Birtwell 2006).

Because listed fish would be in the Bonneville Pool at that time, they could be displaced by the heavy sediment plume, which has been considered a “take” under the Endangered Species Act (NMFS 2006).

There would be an unavoidable short-term impact to available thermal refuge in the White Salmon River until sediment deposited in: (1) pools between river mile (RM) 0.5 and RM 3.3; and (2) the lake bed between RM 3.3 and RM 5.0 is transported to below RM 0.5 and a channel forms below RM 0.5. However, new thermal refuge habitat will be available above RM 5.0 as soon as passage is possible past the dam and cofferdam sites.

Blasting during the removal of Condit Dam, the cofferdam, sediment slopes, or woody debris jams would create hydrostatic shock waves that cause direct mortalities to any fish in the vicinity of a blast. A short-term unavoidable adverse impact to local fish populations would occur due to the mortality of fish in the proximity of in-water blasting activities (if blasting activities occur when fish are present).

Sediments flushed out of the reservoir would bury and kill any adult California floater mussels, if they are present in the river below RM 3.3. If any adult California floaters are present in Northwestern Lake, they could be flushed downstream and deposited in pools. California floaters that are deposited near the surface of the substrate in appropriate habitat may survive, while those that are buried or deposited in fast riffles and runs are unlikely to survive. Depending on the presence of adult California floaters upstream of the reservoir or the reestablishment of a population from the migration of host fish into the river reach below RM 5.0, a short- or long-term unavoidable adverse impact may occur if California floaters are present in the White Salmon River below RM 5.0.

After dam breaching, sediment accumulations with an average depth of approximately 5 feet will occur in the Columbia River downstream from the mouth of the White Salmon River. This area will extend into the Columbia River channel about 1,500 feet and downstream for about 1 mile, and cover about 100 acres (PacifiCorp 2005). The Bonneville pool is about 4,000 feet wide at this location and sediment depth is expected to be zero in the navigation channel. Benthic macroinvertebrates, such as crustaceans, aquatic insects, and freshwater mussels will be physically buried (PacifiCorp 2005). With the exception of mussels, recolonization should occur within 6 months to a year. Mussels have longer life-spans and are relatively slow growing and will take more time to recolonize new substrates.

Wetland Resources

Unavoidable adverse wetland impacts include the loss of approximately 2.8 acres of lake fringe wetlands. These impacts are expected to be mitigated by the establishment of riverine and slope wetlands within 1 to 5 years of dam removal.

Terrestrial Resources

There will be no significant unavoidable adverse impacts.

Transportation

With the implementation of the identified mitigation measures, no significant unavoidable adverse impacts are expected to occur to transportation or traffic.

Air Quality

There are unlikely to be any significant unavoidable adverse impacts from demolition of the Condit Dam if the mitigation measures are implemented fully and in a timely fashion.

Noise

Several residences (i.e., sensitive noise receptors) are located adjacent to the dam, the concrete disposal site, and the roads along which trucks and construction equipment would travel during the proposed action. Intermittently, construction noise levels at these residences would significantly exceed the modeled noise levels. The noise levels at these sensitive receptors due to construction activities do not exceed state or local noise standards due to exemptions for construction in the Klickitat County, Skamania County, and State of Washington noise regulations. However, construction noise impacts to adjacent residential properties would be significant due to the duration and intensity of noise that would be received. Therefore, construction noise impacts to adjacent residential properties are considered a short-term significant unavoidable adverse impact for the proposed action.

Land Use/Critical Areas

If the PacifiCorp Sediment Assessment and Management, Bank Stabilization, and Canyon and Woody Debris Management Plans (PacifiCorp 2004) are implemented, no long-term unavoidable significant adverse impacts to land use/critical areas are anticipated. There would be short-term unavoidable impacts to sites along or near the reservoir that would be used for work areas, construction staging or for disposal, and from the access roads that would be built in several locations.

Aesthetics and Scenic Resources

Short-term significant unavoidable adverse impacts to views along the reservoir would occur until revegetation occurs and the free flowing river is reestablished. One overall significant long-term change to aesthetics and scenic resources would remain and would be unavoidable. That would be the change from a lake view to a view of a stream corridor. However, depending on one’s perception, this may or may not be a significant impact.

Public Safety

If the proposed mitigation measures for public safety are implemented, no significant unavoidable impacts are expected.

Public Services

If the Public Safety and Traffic Control Management Plans prepared by PacifiCorp (2004) are implemented, no significant unavoidable adverse impacts are expected.

1.6.4 Secondary and Cumulative Effects

Secondary or indirect effects are those that are caused by the proposed project that are later in time or farther removed in distance than direct impacts, but which are still reasonably foreseeable. Examples are changes in land use and economic vitality (including rate of new development, growth related to improved or changed access and travel conditions, pressure to more intensively develop existing areas, and population changes), and related effects on water quality and natural resources.

Cumulative effects are impacts on the environment that result from the incremental consequences of a project when added to other past or reasonably foreseeable future actions (regardless of who would take the future action). The cumulative effects may be undetectable when viewed individually, but add to other disturbances and eventually lead to a measurable change. Examples are changes to land use, the loss of wetland areas, the elimination of wildlife habitats, changes in traffic and transportation, or increased noise levels.

The removal of Condit Dam would have direct impacts on a number of elements of the environment during the pre-dam, dam breaching and removal, and post-removal management. Secondary and cumulative effects would primarily be limited to aquatic resources, transportation, and land use.

Aquatic Resources

The primary consideration for cumulative effects on aquatic resources is concern whether anadromous salmonid stocks that are already depressed by the effects of dams and reservoirs on the Columbia River and other influences will have the ability to recover from additional impacts of the sediment released from Northwestern Lake from the breaching of Condit Dam. The mitigation proposed to protect the fall Chinook salmon is trapping and hatchery rearing one year-class appears to address the concern for that species. Another species of potential concern is the Columbia River chum salmon. It is probably not feasible to trap them for hatchery rearing, and it may not be possible to restore suitability in the following year to their spawning gravel unless storm flows in the White Salmon River are particularly favorable. However, long-term effects are viewed as beneficial.

Transportation

The proposed project would create approximately 25 full-time jobs and an estimated 200 vehicle trips per day from the dam removal site. With the majority of trips being located on-site (removal of debris to areas a few thousand feet upstream of the dam), the small increase in trips on local roads associated with the proposed project is not anticipated to create traffic congestion or a diminution of the level of service (LOS) at any affected intersection.

Other approved projects in the area are not anticipated to have overlapping construction and/or demolition periods. It is anticipated that construction/demolition vehicles for these overlapping projects traveling into or out of Washington State would be via State Route (SR) 14 and not result in cumulative impacts on SR 141 or Powerhouse Road.

Land Use/Critical Areas

The change from a dam and lake to a free-flowing stream will likely change the long term land use characteristics around the stream. Future land use will be controlled by the comprehensive plan and zoning designations of the respective counties.

Table 1-1
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Geology, Soils, and Sediments	
Pre-Dam Removal Activities	***Pre-Dam Removal Activities***
Haul Roads and Staging Areas	**Haul Roads and Staging Areas**
• Disturbed areas would tend to erode by wind and water	• Areas where soil has been disturbed would be revegetated in accordance with the Plan for Revegetation of Reservoir Area and Other Areas Disturbed by Construction Activities (PacifiCorp 2004). Erosion control for construction activities as described in the Upland (non-reservoir area) Stormwater and Erosion Control Plan (PacifiCorp 2004). • At the conclusion of the proposed action all work sites would be regraded and revegetated in accordance with these plans. This work is expected to stop erosion and sediment release to the White Salmon River associated with these activities.
• Fill for temporary roads on reservoir sediment might interfere with revegetation.	• Fill placed in support of temporary roads on the reservoir sediments would be removed once the roads are no longer needed.
• Compliance requirements extend beyond construction period.	• Compliance monitoring would be independent from construction activities.
Northwestern Lake Bridge	**Northwestern Lake Bridge**
• Bridge support structure work would allow sediment to get into the lake.	• As described in the Sediment Assessment and Management Plan (PacifiCorp 2004), silt curtains would be used during sheet pile installation to minimize silt entrainment in the water, or construction would be performed as the water level is being lowered. In either case, silt entering the water column would be minimized (PacifiCorp 2004).
• Work on the bank could allow sediment to get into the water.	• Any work near the river would use erosion control mats and silt fencing to protect the river from sediment release.
Dam Breaching and Removal	***Dam Breaching and Removal***
Drain Tunnel	**Drain Tunnel**
• Woody debris released from the reservoir sediment might clog the drain tunnel and interfere with draining the reservoir.	• The tunnel will be slightly bell shaped with the large end downstream. Measures to prevent clogging and means of clearing clogs (crane, blasting) will be implemented as needed.

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Geology, Soils, and Sediments (Continued)	
Sediment Transport • The longer the sediment takes to exit the reservoir, the greater the impacts on water quality and aquatic organisms. • Much sediment would be deposited in the in-lieu site.	**Sediment Transport** • The dam would be breached in October to minimize the risk of harm to seasonal fish runs and to take advantage of the rainy season when there would be fewer adverse effects on aquatic life and recreation. The higher seasonal flows would aid the transport of sediment from the reservoir. • Dislodging unstable sediment and woody debris would help to ensure that the reservoir sediment is transported downstream quickly, therefore within the predicted three- to five-year period, and does not affect long-term water quality. It might also help to mitigate downstream flooding related to sediment transport and deposition. • If possible, the Bonneville pool level would be lowered by the Corps of Engineers when the dam would be breached to facilitate sediment moving past the in-lieu site. • As part of the Settlement Agreement, funds would be provided to the tribes. These funds could be used for maintenance, including dredging, at the "in lieu" site. Because of the natural flux of sediment that would be transported downstream after the dam is removed, removal of sediment from the "in lieu" site may need to be accomplished repeatedly after dam breaching. Any dredging would be subject to a separate environmental review and permit process.
Post-Removal Management **Upstream Sediment Management** • Unstable sediment slopes in the former reservoir area pose safety and aquatic organism impact concerns.	***Post-Removal Management*** **Upstream Sediment Management** • Sediment that remains in the former reservoir area would be evaluated for stability in accordance with the Bank Stabilization Plan (PacifiCorp 2004), and unstable sediment would be dislodged in a way that protects public and worker safety and the environment. • Use of mechanical means to modify unstable sediment slopes would require building temporary access roads across the reservoir sediment. Access roads across reservoir sediment would be removed after they are no longer necessary. • To avoid fish passage and erosion issues the delta at Mill Creek will have a stable channel cut through it by equipment that is onsite for other sediment management activities if fish passage does not develop naturally by May 1 of the year following dam breaching.

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Geology, Soils, and Sediments (Continued)	
• There is a potential for ongoing erosion of exposed sediments by wind and water.	• To minimize long-term erosion and transport of sediment to the White Salmon River and tributary streams, revegetation would be initiated as described in the Plan for Revegetation of Reservoir Area and Other Areas Disturbed by Construction Activities (PacifiCorp 2004). Revegetation efforts would take place once underlying sediment has been stabilized.
Water Resources	
Pre-Dam Removal Activities **Haul Roads and Staging Areas** • Erosion of exposed work areas could allow sediment to affect downslope water quality.	***Pre-Dam Removal Activities*** **Haul Roads and Staging Areas** • Implement the BMPs as described in the Upland Stormwater and Erosion Control Plan (PacifiCorp 2004). Proper implementation of these BMPs should minimize turbidity in stormwater runoff related to disturbance of soil in the upland areas. The BMPs may not be as effective in areas where there are steep slopes (such as along roads that may be constructed down into the canyon and in the area of the surge tank spillway).
Petroleum Products and Hazardous Materials • Spills of fuel or other hazardous materials would impair water quality.	**Petroleum Products and Hazardous Materials** • Implement PacifiCorp's proposed Spill Prevention and Containment Plan (PacifiCorp 2004). • PacifiCorp would use BMPs during the construction, dam removal, and restoration activities at the project site, thus minimizing the potential for spills and other releases of hazardous substances. • Because a portion of the equipment fueling would take place where surface water could be impacted by a spill or release (such as fueling of the demolition crane situated on the dam spillway), prevention and management of spills, such as through temporary containment, would be practiced.
Dam Breaching and Removal **Drain Tunnel** • Concrete particles getting in the river could affect pH.	***Dam Breaching and Removal*** **Drain Tunnel** • Water used in drilling into the dam to develop the drain tunnel would be collected and removed from the site. Air drilling may be used, in which case water collection would not be needed. • Large blocks of concrete would be removed from the stream. Downstream from the powerhouse, pH will be monitored continuously and compared with background levels. • Blasting would be accomplished in accordance with the Blasting Plan.

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Water Resources (Continued)	
• Deposition of sediment in the in-lieu site could potentially raise flood elevations near the mouth of the White Salmon River until the sediment is flushed out.	• Potential changes in the floodplain downstream of the dam, although they appear to be small, could be minimized if the dam breaching were to occur at a time when the Bonneville pool elevation is near the lower end of its range of fluctuation. Breaching the dam during a time when the Bonneville pool is low would reduce the flood elevations at the in-lieu site. PacifiCorp would consult with the U.S. Army Corps of Engineers to determine the feasibility of lowering the Bonneville pool prior to dam breaching, in the event that the pool elevation is near the higher end of its range of fluctuation.
Reconstruction of Mt. Adams Orchard Diversion • Replacing the irrigation diversion will have impacts	**Reconstruction of Mt. Adams Orchard Diversion** • Instream sediment management during the diversion construction should be similar to in-stream mitigation measures for the reinforcement of Northwestern Lake Bridge (e.g., use of silt curtains). • As the specific plans for the diversion construction are developed, the scope of work would include mitigation measures to minimize impacts to surface water quality. • A well could substitute for withdrawal from the river and eliminate those impacts. Wells are generally considered preferable to surface water withdrawals. Since a change in the point of diversion would be required, a well would be strongly considered and used if permits can be secured in time.
Post-Removal Management • The potential for water quality effects will extend past the initial activities planned for dam removal and sediment stabilization.	***Post-Removal Management*** • To assess the effectiveness of the Sediment Management and Revegetation Plans (PacifiCorp 2004), long-term water quality monitoring is proposed. • Monitoring of applicable water quality parameters, including turbidity, total suspended solids, and pH, as well as observation and documentation of banks and fish passage, will continue from a month before the commencement of dam removal activities until such time that performance criteria are met (PacifiCorp 2004). In addition, PacifiCorp would conduct turbidity monitoring in the Bonneville pool for 4 weeks after the dam is breached and conduct turbidity monitoring at three locations in the White Salmon River for a period of 10 years after the dam is breached.

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Aquatic Resources	
Pre-Dam Removal Activities **Haul Roads, Staging Areas, and Disposal Sites** • Sediment movement and deposition as well as other water quality effects could affect aquatic organisms. **Northwestern Lake** • Work at the Northwestern Lake bridge could affect aquatic organisms.	***Pre-Dam Removal Activities*** **Haul Roads, Staging Areas, and Disposal Sites** • Mitigation measures applied for water quality maintenance and sediment management will also protect aquatic organisms. **Northwestern Lake** • Silt curtains will be used during sheet pile installation to minimize silt entrainment in the water, or construction will be performed as the water level is lowered. In either case, silt entering the water column will be minimized (PacifiCorp 2004). Any work near the river will use erosion control mats and silt fencing to protect the river and aquatic fauna from sediment release. • Hazardous chemicals and fuel would be stored in secured storage areas with secondary containment. Spill prevention and spill containment plans would be in place for the contingency of a spill occurring or chemical contaminants reaching the lake or river.
Dam Breaching and Removal **Drain Tunnel** • An increase in pH from concrete particles in water could kill aquatic organisms if it goes above pH 9. • Blasting in the water can directly kill fish that are too close to the source. • Spilled fuel is toxic to aquatic organisms.	***Dam Breaching and Removal*** **Drain Tunnel** • Water used in drilling into the dam to develop the drain tunnel will be collected and removed from the site. Air drilling may be used, in whch case water collection would be needed. • Concrete rubble from construction of the tunnel will be captured and prevented from entering the river. After dam breaching, any blocks of concrete that get in the stream will be removed. Downstream from the powerhouse, pH will be monitored continuously and compared with background levels. • Blasting will be accomplished in accordance with the Blasting Plan (PacifiCorp 2004). • A fuel spill and clean up plan will be in place to mitigate any spills of fuel or hazardous chemicals that occur.

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

<table>
<tr><th>Impacts</th><th>Mitigation</th></tr>
<tr><th colspan="2">Aquatic Resources (Continued)</th></tr>
<tr><td>Sediment Transport
Transport of the mass of sediment from the reservoir downstream to the Columbia River will kill most aquatic organisms. The longer the high concentrations continue, the longer or more difficult it will be for fish to recolonize the reach of the White Salmon River below the Condit Dam site or anadromous fish to migrate up the White Salmon River.
Salmon trying to enter the White Salmon River to spawn while the mass of sediment is passing would be killed and no reproduction of anadromous fish will occur until levels of suspended fall below lethal levels and migration upstream above the upstream end of the reservoir to suitable spawning gravels becomes possible.
Sediment will likely fill the fish-rearing channels of the U.S. Fish and Wildlife Service's fish rearing facility at river mile 1.4.</td><td>Sediment Transport
The dam will be breached in October to minimize the risk of harm to seasonal fish runs. The timing would also take advantage of the rainy season when there will be fewer adverse effects on recreation and aquatic life. The high flows of the season will aid in transporting sediment from the reservoir.
Dislodging unstable sediment and woody debris will help ensure that the reservoir sediment is transported downstream quickly, therefore within the predicted 3–5 year period, and does not affect long-term water quality, pool depths, or spawning gravels.
PacifiCorp has proposed to capture and transport to a hatchery the fall Chinook returning to the White Salmon River before the dam is breached in October to prevent the loss of a Chinook year-class.
PacifiCorp will take measures to protect the fish rearing facility from high flows and reservoir sediments.</td></tr>
<tr><td>Dam and Appurtenance Removal
The old cofferdam in the reservoir upstream of the dam is expected to be a barrier to upstream migration by anadromous fish.</td><td>Dam and Appurtenance Removal
Cofferdam removal will either occur as soon as possible after dam removal and be accomplished by blasting while suspended sediment levels exclude upstream migrating fish, or mechanical means will be used rather than blasting. The cofferdam will be removed by May following dam breaching so that steelhead returning to the river can pass quickly upstream to less turbid areas of the stream or its tributaries.</td></tr>
<tr><td>Post-Removal Management
Upstream Sediment Management
Unstable or erodible sediments could continue to adversely affect the substrate habitat for aquatic organisms and slow recovery of habitable substrate.
The delta at the mouth of Mill Creek is likely to be a barrier to access by fish from the river.</td><td>Post-Removal Management
Upstream Sediment Management
After the initial dam breaching, sediment management will be conducted above the dam until all unstable slopes have been stabilized and areas of bare sediment in the former lakebed are revegetated.
If the delta is a barrier on May 1 at the year following dam removal, heavy equipment would be used to cut through the delta and lake sediments overlaying the Mill Creek (RM 4.0) channel to avoid barriers to fish passage forming at head-cuts and to shorten the time required to stabilize the stream channel.</td></tr>
</table>

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Aquatic Resources (Continued)	
• Blasting in the water can kill fish.	• If blasting is used to stabilize slopes or remove debris, it would be confined to daylight hours when salmonids are least likely to be actively moving. This will reduce the number of fish exposed to hydrostatic shock from blasting activities.
Wetland Resources	
• About 2.8 acres of reservoir-fringe wetlands will no longer be wetlands.	• Wetlands will reestablish along the river, tributaries, and seeps on the slopes that will be similar in area.
• A small area of seep-supported wetlands and reservoir-fringe wetlands will be excavated or filled for construction of access roads.	• Some of the wetlands will be restored in place as the access roads are decommissioned. Others will be offset by new areas of wetland developing along seeps and tributaries.
Terrestrial Resources	
• Natural habitat will be cleared for construction of access roads and staging areas.	• PacifiCorp has provided a revegetation plan designed to encourage development of natural habitats. When the reservoir is gone and the slopes have revegetated, more natural terrestrial habitat will be there than before the dam is removed. • PacifiCorp will contribute $25,000 (1999 dollars) for habitat enhancement.
Transportation	
• Construction and worker vehicles will increase traffic hazards for other drivers.	**Construction safety:** Provide traffic safety signs during the 8-month peak demolition period warning vehicles traveling along SR 141, SR 14, and Powerhouse Road of upcoming truck access points. **Traffic and Parking:** Promote ride-share and vanpool programs during the 8-month peak construction period for construction workers to reduce vehicle trips.
• Removal of the reservoir may increase the scouring of materials around the bridge piers and increase the risk of bridge failure.	**Northwestern Lake Road (Bridge):** Implement the mitigation measures listed in the report by DCI Engineers (2004), including: • Drive a steel sheet pile to refusal at bedrock depth around the two central piers in a semi-circular pattern to create two separate cofferdams bounding the river channel. • Build concrete wing walls and a crib structure, tying the existing bridge abutments to the new sheet pile cofferdams with circumferential galvanized cables near the top of the cofferdam wall.

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Transportation (Continued)	
	• If embedment depth of piles into the bedrock cannot be ascertained by a geotechnical engineer, excavate the soil and dewater inside the cofferdam to an elevation near the bottom tip of the sheet piles. Provide temporary bracing to the existing piers and sheet pile walls in stages as required for temporary construction stability while the cofferdam soil is removed.
	• Install reinforced concrete grade ties from the existing concrete pile caps to the new concrete wing walls to increase the lateral strength and stability of the pile caps. Anchor wing walls to the bedrock above the river channel with high strength grouted Dywidag Threadbar rock anchors. • Backfill the cofferdam and concrete crib structure with granular structural fill to finish grade elevations. • Provide riprap along river revetment slopes on both sides to protect shore from high velocity flow.
Air Quality	
• Construction activities will generate dust that could affect nearby residents. • Exposed sediment could become dry and airborne by the wind, thus affecting nearby residents.	• Implement the PacifiCorp proposed dust control plan with appropriate BMPs to reduce emissions generated by demolition activities and vehicular traffic. • Implement the PacifiCorp proposed revegetation plan and BMPs for erosion and sedimentation control. When the reservoir is drained, sediments would be exposed to sun and wind. The revegetation plan would require implementation to reduce local dust generation, although the sediments are probably too large to be carried beyond the immediate area, and would have no likelihood of impacting the Gorge areas. • Blasting will be conducted according to the Blasting Plan to minimize both worker and public exposure to dust and concrete pollutants.
Noise	
• Noise during quiet times can affect people’s rest. • Construction noise can affect nearby residents and recreationists	• Construction activities will not be conducted within ¼ mile (1,320 feet) of an occupied dwelling on weekends, legal holidays, or between 10 pm and 7 am on other days • All construction equipment would be equipped with noise control devices no less effective than those provided on the original equipment • Operation of equipment with unmuffled exhaust systems would not be allowed

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Noise (Continued)	
	• Noise reduction measures should be required during construction, including turning off idling equipment and using the quietest effective back up alarms • Blasting during weather conditions that could exacerbate the noise effects at nearby sensitive receptors should be avoided • Blasting will be managed by a blasting consultant to minimize noise effects. • Nearby sensitive receptors (e.g., residences) should be alerted of the impending blast noise by means of a warning horn or similar device • Blasting operations will not be performed within ¼ mile (1,320 feet) of an occupied dwelling on weekends, legal holidays, or between 8 pm and 8 am on other days
Land Use/Critical Areas	
• Municipal water supply systems could be disrupted by dam removal activities.	• Coordinate with the City of White Salmon to protect Well No. 2 by not conducting work within the well setback area. Provide protection measures around the disposal site to prevent potential long term leaching. • Provide temporary pipe to maintain the water supplied by the water line that crosses Northwestern Lake, and replace the line across the reservoir once the sediment has stabilized.
• Changed land use opportunities after dam removal will require public safety measures	See Public Safety below.
Aesthetics and Scenic Resources	
• Bare sediment exposed on the reservoir slopes will adversely affect scenic resources.	• Implement the revegetation plan on suitable substrate along the former shoreline and slopes. The revegetation efforts may take several years. The vegetation would be monitored over time.
• The visual opportunities will be changed by removal of the reservoir, dam, and associated facilities.	• New visual opportunities will develop. Construct new or enhance existing recreational facilities to facilitate enjoyment of new visual opportunities. Specifically, extend the boat launch at Northwestern Lake Park to access the river.

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Public Safety	
• Various members of the public could be at risk during dam breaching and sediment stabilization activities.	• Implement the Public Safety Plan (PacifiCorp 2004). Key elements of the Public Safety Plan include: issuing a countywide (Klickitat and Skamania Counties) public notice prior to commencement of any major construction activities; and coordinating with local police and fire personnel for potentially hazardous areas and the schedule for blasting and dam breaching. • Standard construction safety practices include isolating the public and workers from direct exposure to hazards including tunnel-driving and dam removal operations. • Any blasting used as part of dam removal activities would be accomplished in areas isolated from the public as described in the Blasting Plan (PacifiCorp 2004). Key elements of the Blasting Plan include: blasting shall be performed only by trained and authorized personnel and in accordance with OSHA safety standards; and signs shall be posted to restrict public trespass within the vicinity of blasting activities.
	• Just before the final blast that breaches the dam is to be detonated, the White Salmon River would be cleared of people along its banks all the way from the dam to the mouth of the river. • At the same time, access to the river downstream from the Northwestern Lake Bridge would be prevented. This will prevent fishers, boaters, kayakers or other water sports enthusiasts from entering the river and being caught in hazardous waters, facilities, or sediments as the reservoir drains. • The general public would be barred from traversing the reservoir sediments or using the White Salmon River below Northwestern Lake Bridge until after the unstable sediments have been stabilized as described in the Sediment Assessment and Management and Bank Stabilization Plans prepared by PacifiCorp (2004). • Public notices will ensure that the general public is educated about public safety issues, including ones associated with new opportunities for access and recreation. They will also provide information about new conditions to be expected.

Table 1-1 (Continued)
Summary of Impacts and Mitigation Measures

Impacts	Mitigation
Public Services	
• Public services will be temporarily disrupted by dam removal activities.	• Coordinate with local police, fire and emergency service personnel on potentially hazardous areas, the schedule for blasting and dam breaching, and public notification. Continue this coordination for post-removal management activities. • Coordinate with the Washington State Patrol during dam removal and post-removal management activities relative to traffic impacts on state highways. • Implement a traffic control plan during dam removal and post-removal management activities that provides for police, fire and emergency service access to minimize impacts to response times. • In coordination with the City of White Salmon, install a temporary water supply (probably 14-inch HDPE pipe) across the lake with a cable support system before the dam is breached. Install a permanent line after the dam is breached, low enough to be protected from river scour.

2.0 PROJECT BACKGROUND

2.1 INTRODUCTION

The Condit Hydroelectric Project, located on the White Salmon River in Klickitat and Skamania Counties, Washington, was constructed in 1912 and 1913 and has produced electricity since that time. PacifiCorp is proposing to remove the Condit Hydroelectric Project following the October 1, 2008, expiration of its license extension with FERC. Ecology is conducting an environmental review under SEPA comparing the effects of continued operation of the dam (the no-action alternative) with the removal of the dam (proposed action).

2.2 FERC RELICENSING PROCESS SINCE 1991

On December 27, 1991, PacifiCorp Electric Operations, which has since changed its name to PacifiCorp, filed an application with FERC for a new license authorizing the continued operation and maintenance of the Condit Hydroelectric Project.

In response to PacifiCorp's application, FERC issued a NEPA FEIS in October 1996 that analyzed the environmental and economic effects of five alternatives: 1) continuing to operate the project with no additional mitigation or enhancement measures (no-action alternative);
2) operating the project as proposed by PacifiCorp (PacifiCorp's licensing proposal);
3) operating the projects as proposed by PacifiCorp with additional staff-recommended measures (PacifiCorp's licensing proposal with modifications); 4) a staff-developed alternative involving project retirement (1996 FEIS dam removal alternative); and 5) a staff-developed alternative involving partial removal with a new upstream diversion (partial dam removal alternative). In the 1996 FEIS, FERC staff recommended PacifiCorp's licensing proposal with modifications that included fish passage facilities and several other changes to benefit fish.

Subsequently, on October 29, 1999, PacifiCorp filed an application to amend the current license to extend the license term to October 1, 2006 (increasing the current license term from 28 to 41 years), and to incorporate the terms and conditions of a Settlement Agreement that provides for removal of the dam upon the expiration of the proposed amended license term. The Settlement Agreement, formally entitled Condit Hydroelectric Project Settlement Agreement, was signed in September 1999 by PacifiCorp, the National Marine Fisheries Service (NMFS), the U.S. Department of the Interior, the U.S. Forest Service (USFS), the Columbia River Intertribal Fish Commission, the Yakama Indian Nation, Ecology, the Washington Department of Fish and Wildlife (WDFW), and a number of other organizations including American Rivers, American Whitewater Affiliation, Columbia Gorge Audubon Society, Columbia Gorge Coalition, Columbia River United, Federation of Fly Fishers, Friends of the Columbia Gorge, Friends of the Earth, Friends of the White Salmon, The Mountaineers, Rivers Council of Washington, The Sierra Club, Trout Unlimited, Washington Trout, and the Washington Wilderness Coalition. The Settlement Agreement incorporated a dam removal plan and established a date for commencing the removal. The Settlement Agreement also established PacifiCorp's financial commitment to dam removal with a capped limit. Terms for modification, withdrawal, and termination of the Settlement Agreement were also specified. A key factor for approval from each signatory agency or organization was that, from their perspective, the long-term and overall benefits would outweigh the short-term impacts.

In a declaratory order issued December 21, 2001, FERC determined that the amendment/settlement application is in essence an application to surrender the existing license to operate the dam with a future effective date, and would be treated as such. Thus, the surrender alternative, reached through settlement negotiations, became the proposal before FERC. A NEPA SEIS was prepared by FERC to augment the October 1996 FEIS. The June 2002 FSFEIS assessed the effects associated with approval and implementation of the Settlement Agreement, including staff-identified modifications, as well as other surrender alternatives, including project retirement without dam removal.

In its declaratory order, FERC noted that it sees no statutory barrier to deferring the processing of a timely-filed relicense (previously this was referred to as a "new license") application while it considers an alternative proposal reached through settlement negotiations. Therefore, if the surrender is not granted, or is granted and not accepted by PacifiCorp, it is possible that the relicensing proceeding might resume. In order to save any additional time and effort that might be required if this occurs, the FSFEIS also provided updated data related to the relicense proposals presented in the 1996 FEIS. Rather than increasing the term of the license, FERC has granted year-by-year extensions.

Between November 16, 2004 and February 8, 2005, the parties to the Settlement Agreement all signed an MOA modifying the Condit Hydroelectric Project Settlement Agreement. That MOA modifies the Settlement Agreement by changing the implementation date from 2006 to 2008; changing the $2,000,000 cap on mitigation costs to $5,300,000; and changing the total cost cap from $17,150,000 to $20,450,000. PacifiCorp then filed an application with FERC for amendment of decommissioning and request for continued abeyance of decommissioning and licensing proceedings on February 25, 2005.

2.3 NEED FOR STATE ENVIRONMENTAL REVIEW

Ecology is both the Lead Agency for SEPA and the regulatory decisionmaker for a portion of the permits that require SEPA documentation to support permit decisions. In December 2001, during the time that FERC was developing their FSFEIS, Ecology initiated an evaluation of SEPA procedural requirements relative to the removal of the Condit Dam, and the extent to which the NEPA process adequately covered issues that needed to be addressed under SEPA, including those raised during the SEPA public scoping process conducted by Ecology in late 2001. Based on that evaluation, Ecology determined that the NEPA documents were not adequate to meet all requirements of SEPA, a SEPA SEIS would be required, and the preparation of this SEPA SEIS was initiated.

Pursuant to Washington Administrative Code (WAC) 197-11-620, the SEPA SEIS focuses on issues not adequately covered in the FERC FEIS or the FSFEIS. A number of items have been included because some SEPA requirements differ from those of NEPA. Also, the FERC documents did not provide adequate information for State decisions. In other cases, the SEPA requirements demanded more detailed description of actions that would cause impacts; therefore, the SEPA SEIS evaluates potential impacts related to details of the project that were provided after the FERC FSFEIS. Those SEPA elements determined to be adequately covered under the FERC NEPA document were: recreation, energy and natural resources, housing (no impacts), light and glare, historic and cultural preservation, and utilities.

This SEPA SEIS builds on previous environmental documents. The 1996 FERC FEIS on relicensing of the Condit Dam described and analyzed the effects of a no-action alternative which would continue operation of the Condit Hydroelectric Project under the terms and conditions of the existing license. That analysis of the no-action alternative and other pertinent information are adopted as part of this SEPA SEIS. The no-action alternative is the only 1996 alternative that was considered relevant to this SEPA SEIS. All other alternatives considered in the 1996 FEIS were adequately analyzed or would have greater impacts than the proposed action and are therefore not required by SEPA to be included in this SEIS.

The process used to evaluate the adequacy of the FERC Draft Supplemental FEIS (DSFEIS) (2001) and the FSFEIS for SEPA purposes and to determine the scope of a SEPA SEIS included several steps. After determining the SEPA requirements for the project, Ecology submitted comments on the FERC DSFEIS in order to cover as many SEPA issues as possible in the FSFEIS. After completion of the FSFEIS, URS in consultation with Ecology prepared the Condit Dam Phase III SEPA Adequacy Review Report (URS 2003) that identified SEPA issues and potential impacts not adequately addressed in the FSFEIS.

PacifiCorp subsequently produced additional documents to help address issues identified by Ecology. The following documents have been produced since the FSFEIS and have been used to update the project description and assess impacts in this SEPA SEIS:

- Wetland Delineation and Functional Assessment Report for the Condit Hydroelectric Project Removal, FERC Project No. 2342, CH2M Hill, dated August 20, 2003
- Northwestern Lake Bridge Evaluation Report, DCI Engineers, dated March 16, 2004
- Revised Project Description, PacifiCorp, dated June 4, 2004, including:
  - Revegetation Plan
  - Wetland Mitigation Plan
  - Sediment Assessment and Management Plan
  - Bank Stabilization Plan
  - Canyon and Woody Debris Management Plan
  - Stormwater and Erosion Control Plan
  - Blasting Plan
  - Dust Control Plan
  - Spill Prevention and Containment Plan
  - Traffic Control Plan
  - Public Safety Plan
- Condit Hydroelectric Project Sediment Behavior Analysis Report, G&G Associates, dated May 2004

- Condit Hydroelectric Project Sediment Behavior Effects on Beneficial Uses Report, G&G Associates, dated May 2004

Since the SEPA DSEIS, the following additional documents have been produced and were used to complete this Final SEIS:

- Letter to Jim Hemstreet, Senior Engineer, at PacifiCorp re: Condit Dam and Northwestern Lake Hydrographic Surveys, Finley Engineering Company, dated August 8, 2006

- Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Consultation. NMFS Northwest Region, Hydropower Division. NMFS Log Number 2002/00977, dated October 12, 2006

2.3.1 Issues Resolved

Some of the potential impacts and unresolved issues initially identified by Ecology have since been determined not to be significant or have been resolved. These issues and impacts and the manner in which they have been resolved are discussed below and not further addressed in this SEPA Final SEIS.

Issue 1: The natural gas pipeline crossing the upper end of the reservoir could be impacted by erosion and scour following removal of the dam.

Resolution: Available information and drawings regarding the gas pipeline indicate that it is buried in a trench through bedrock. It is therefore not expected to be affected by scour.

Issue 2: Critical aquifer recharge areas adjacent to the reservoir could be affected by removal of the dam and reservoir.

Resolution: No adjacent area around the reservoir has been designated a critical aquifer recharge area by either Skamania or Klickitat Counties. Consequently, there would be no impact to critical aquifer recharge areas.

Issue 3: Thermal refuge for fish at the mouth of the White Salmon River could be lost.

Resolution: According to information provided by PacifiCorp, thermal refuge in the White Salmon River would not be lost, but would change in location. The bypass reach between the dam and the powerhouse is not a depositional area and contains deep pools that would provide thermal refuge for dip-in fish. Also, cold water from the White Salmon River after dam removal would provide thermal refuge near the mouth of the White Salmon River. Thermal refuge also would be available upstream of river mile 5 after dam removal. Finally, according to PacifiCorp's analysis, after dam removal, water in the lower reach of the White Salmon River is expected to become colder even in those areas that become shallower, because the removal of the reservoir would eliminate a source of warming.

Based on telephone conversations with local WDFW, National Oceanic and Atmospheric Administration (NOAA) (formerly NMFS), and USFWS biologists, observed behavior patterns of dip-in anadromous salmonids indicate that they utilize deep pools throughout the bypass reach for thermal refuge. The increased flows in the bypass reach and colder water after dam removal would increase both the quality and quantity of thermal refuge habitat, compensating for any potential loss of thermal refuge below the bypass reach.

Issue 4: Temporary migration impacts to steelhead associated with the presence of the cofferdam after the dam is removed could occur.

Resolution: PacifiCorp has committed to remove the cofferdam by May 1 of the year following dam removal to prevent blocking passage for migrating salmonids. The FSFEIS (FERC 2002) indicates that the entire year-class of age-0 (juveniles produced during the spring of the year of dam removal) winter-run steelhead are expected to be lost as a result of turbidity levels in the river associated with the proposed dam removal. According to PacifiCorp, the cofferdam would be removed in time for the following summer run to pass unobstructed. PacifiCorp does not anticipate migration impacts to winter or summer steelhead from the cofferdam.

The FSFEIS acknowledges the loss of most of the fish in the river channel at the time of dam removal and the loss of a year-class of winter-run steelhead as a result of turbidity levels associated with dam removal. The cofferdam would be removed in time for summer steelhead, salmon, and subsequent year-classes of winter-run steelhead passage to upstream habitat. Thus, unavoidable impacts to fish from dam removal have been recognized. There is enough overlap in the life history of winter-run steelhead (i.e., a portion of adult winter-steelhead from other year-classes will return to the White Salmon River during the years that adults from the lost year-class would have potentially returned) that the run from that year-class would likely rebuild over the long term.

Issue 5: There is a potential for erosion and scour impacts to the structural stability of the two downstream bridges (one highway, one railroad) across the White Salmon River.

Resolution: The supports for the downstream highway and railroad bridges are located in the slack water pool at the mouth of the river created by Bonneville Dam. These bridge supports have withstood historical flood flows, including the flow from the 1996 flood estimated at 45,000 cfs. The highest flow anticipated from the dam breach is 10,000 cfs. Because the dam breach flows are less than one-quarter the flow from the 1996 flood, no significant erosion or scour impacts are anticipated from the short-term high flows associated with the dam breach.

2.4 SCOPE OF THIS SEIS

The focus of this SEPA SEIS is the “Settlement Agreement with Modifications” alternative, since it was the FERC staff-recommended alternative in the FSFEIS. The description of that alternative has been supplemented with additional detail provided by PacifiCorp. The no-action alternative and its analysis from the FEIS is adopted and not further addressed. In the FSFEIS, FERC considered an adequate range of alternatives, which are not addressed further here.

The issues identified by Ecology that required additional assessment as part of the SEPA process are:

Local Permits

- Whether or not Klickitat County and Skamania County must issue permits, such as a land use Conditional Use Permit, to allow concrete disposal outside of the shoreline near the dam site.

Geology, Soils, and Sediment

- Increased erosion, sedimentation and turbidity in the White Salmon River from dam breaching and removal, cofferdam removal, woody debris removal, and sediment management.

Water Resources

- Impacts to water quality in the White Salmon River from concrete and explosives residue contamination that may result from the construction of the drain tunnel or from dam breaching and removal of the dam.
- Impacts to groundwater quality from leachate from disposal of concrete and other construction debris.
- Increased turbidity in stormwater runoff resulting from construction of access roads and disposal of dam hardware, woody debris, concrete, and cofferdam.
- Increased turbidity in Northwestern Lake or the White Salmon River as a result of reinforcing Northwestern Lake Bridge and reconstructing the Mt. Adams Orchard diversion.
- Impacts to water quality from fuel or oil spills from equipment or storage areas during removal of the cofferdam, woody debris, or sediment.

Aquatic Resources

- Effects on fish (such as vibration from pile driving and spills from equipment) in Northwestern Lake as a result of reinforcing Northwestern Lake Bridge and installing the temporary water supply pipeline.
- Impacts to salmonids from increased turbidity, pH, or spills/leaks from mechanical equipment in the reservoir or river.
- Impacts to salmonids from blasting during cofferdam and woody debris removal.

- Impacts to salmonids from turbidity and sedimentation resulting from dam breaching, cofferdam removal, and sediment management.
- Potential impacts to the California Floater mussel that may be present downstream of the dam in the White Salmon River or the Bonneville pool.
- Potential barriers to fish passage into tributary streams because of delta materials.

Terrestrial Resources

- The potential effects on priority species and habitats from clearing vegetation and grading of staging areas, disposal sites, the Mt. Adams Orchard diversion structure, work areas for the temporary water supply pipeline, and access roads.
- Loss of reservoir wetland areas and wetland functions from dam removal.
- Sedimentation or scour of downstream wetlands from dam removal and woody debris removal.

Transportation

- Impacts (accelerated wear and tear) to local roadways and transportation infrastructure from increased traffic including heavy trucks and equipment.

Air Quality

- Impacts to air quality and potentially to human health from fine particles of soil or concrete that may become entrained in the air during drilling, blasting, grading, and construction activities.

Noise

- Noise from construction activities (grading, drilling, blasting etc.), increased traffic on local roadways, and woody debris or sediment management activities.

Land Use/Critical Areas

- Potential impacts to land use/critical areas from work in or near critical areas.

Aesthetics and Scenic Resources

- Visual impacts related to the removal of vegetation at staging and disposal sites, construction of access roads, drainage of the reservoir, removal of the dam, disposal of the dam components, and management of sediment and woody debris.

Public Safety

- Potential impacts to public safety resulting from the dam breaching and reservoir dewatering.

- Potential impacts to public safety resulting from potentially unstable slopes in the area of the former reservoir.

Public Services

- Temporary interruption of water supply during the installation of a temporary or permanent water supply pipeline.

- Potential impacts to local police and fire departments from emergencies or other incidents that may occur during the dam breaching and reservoir dewatering activities that would warrant a response.

3.0 PROPOSED ACTION

PacifiCorp proposes to remove the Condit Hydroelectric Project on the White Salmon River in accordance with the Condit Hydroelectric Project Settlement Agreement, as amended (Appendix A). Removal of the project would enable the river and watershed to return to its natural free-flowing condition. Originally completed in 1913, Condit Dam has since accumulated sediment and blocked fish passage. Removing the dam would begin the process of reversing many of the original impacts from building and operating the dam and hydroelectric facilities. Restoring river flow without the dam would provide access to as much as 15 to 32 miles of river and tributary habitat for anadromous salmon and steelhead, respectively, and would restore connectivity to foraging, spawning, rearing, and overwintering habitat for bull trout in the lower White Salmon River. The removal also would restore natural bed load movement processes in the river. This would result in an increased gravel supply for bull trout spawning habitat. Combined with a stable and natural flow regime, dam removal would result in increased salmonid (steelhead, salmon, and bull trout) production potential.

The existing Condit Hydroelectric Project includes a concrete dam, an approximately 1.8-mile-long reservoir, a 13.5-foot-diameter wood-stave pipeline of approximately one mile in length, a reinforced-concrete surge tower, two 650-foot-long penstocks (one steel and one wood), and a powerhouse structure housing two double-runner horizontal Francis turbines with an installed capacity of 14,700 kilowatts.

The proposed action includes draining the reservoir through a tunnel that would be constructed through the dam, removing the dam, removing the wood stave pipeline, the surge tower and the two penstocks, and filling in the tail race at the power house. Concrete from the dam and wood from the pipeline would be disposed of and/or staged on property near the dam. Details of the proposed action are described in the Condit Hydroelectric Project, FERC Project No. 2342, Project Description (PacifiCorp 2004). The project description includes numerous plans designed to minimize or eliminate potential impacts related to the project. The stages of the project are: (1) pre-dam removal activities, (2) dam breaching and removal, and (3) post-removal management.

3.1 PRE-DAM REMOVAL ACTIVITIES

In order to implement the terms of the Settlement Agreement and perform the removal and associated restoration work, temporary work areas, staging areas, and access roads would need to be established and utilized. All locations were chosen to minimize potential impacts by establishing them in or near previously used access roads and work areas when possible.

Table 3-1 summarizes access road names and their proposed uses. Figures 3-1 through 3-6 show the dam, associated facilities, staging areas, and haul routes.

3.1.1 Staging Areas and Disposal Areas

Sites would be required to stage the heavy equipment that would be used for building or upgrading access roads and preparing the dam and associated facilities for demolition. The

Table 3-1
Summary of Access Road Names and Proposed Use

Designation	Road Name	Proposed Use
WA-1	Work Area at Dam Site	Dam removal and dam access.
AR-2	Powerhouse Road to dam	Access to upstream side of dam.
SA-1	Staging Area adjacent to Powerhouse Road at dam	Staging area for work at dam site. PacifiCorp Property.
SA-2	Staging Area at Powerhouse Road Bend	Staging area for work at dam site.
AR-3	Access Road to dam and Staging Area 3	Access road to dam and Staging Area 3.
AR-4	Powerhouse Road to Staging Area 3	Access to Staging Area 3 via Tamarack Lane.
SA-3	Staging Area 3	Staging area and stockpile materials.
AR-5	Powerhouse Road to dam (Lower)	Access road to downstream side of dam and flow line.
WA-2	Work Area for Flow line Removal	Remove flow line, approx. 1 mile.
AR-7	Powerhouse Road to Flow line (Lower)	Access to lower portion of flow line.
SA-4	Staging Area for Flow line (Upper)	Staging area for removal of flow line.
WA-3	Penstock Removal	Remove two 9-foot diameter penstocks, each approximately 650 feet long.
AR-8	Access Road for Penstock Removal (Upper)	Access to upper portion of penstocks.
AR-9	Access Road for Penstock Removal (Lower)	Access to lower portion of penstocks at the powerhouse.
WA-4	Work Area for Surge Tank Removal	Remove surge tank.
WA-5	Work Area for Tail Race Backfill	Fill in tailrace.
AR-11	Access Road for Tail Race Grading	Access road for tail race grading or backfill.
WA-6	Work Area for Substation Removal	Remove substation and reconnect to BPA lines.
AR-12	Access Road for Substation Removal	Access road for substation removal.
WA-7	Work Area for Powerline Removal	Removal of approx 1 mile of powerline from the powerhouse to the dam.
AR-13	Access Road from Powerhouse to Staging Area 5	Access road from powerhouse to Staging Area 5.
SA-5	Staging Area at Becker Site	Staging area for flow line materials and dam removal equipment.
AR-14	Graves Road to Lake	Access road to lake for management of unstable slopes and large woody debris.
AR-15	Cabin Road to Lower Lake	Access road to lower lake for management of unstable slopes and large woody debris.
AR-16	Cabin Road to Mid Lake	Access road to mid lake for management of unstable slopes and large woody debris.
AR-17	Highway SR 141-A and Powerhouse Road	Primary access to Condit Hydroelectric Project area.
AR-18	Highway SR 141-A to Big White Fish Ponds	Access to Big White Fish Ponds.
WA-8	Big White Fish Ponds	Cleaning ponds of any sediment and woody debris.
AR-19	Northwestern Lake Road to Northwestern Lake Park	Access to Northwestern Lake Park.
WA-9	Northwestern Lake Bridge	Enable modifications to the bridge.

Figure 3-1 Project Facilities Index

[2 pages; odd-no. page]

Figure 3-1 (Page 2)

Figure 3-2 Project Facilities, Sheet 1

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Figure 3-2 (Page 2)

Figure 3-3 Project Facilities, Sheet 2

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Figure 3-3 (Page 2)

Figure 3-4 Project Facilities, Sheet 3

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Figure 3-4 (Page 2)

Figure 3-5 Project Facilities, Sheet 4

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Figure 3-5 (Page 2)

Figure 3-6 Project Facilities, Sheet 5

[2 pages; odd-no. page]

Figure 3-6 (Page 2)

staging areas also would be used for a temporary office trailer, equipment parts and supplies storage, equipment and vehicle parking, equipment fueling, and an explosives magazine. Staging areas include sites adjacent to Powerhouse Road next to the dam. SA-2 is occupied by a private residence (which would have to be purchased) and SA-1 is occupied by a shed owned by PacifiCorp. Disposal areas (e.g., SA-3 and SA-5) may temporarily double as staging areas. Additional small flat areas adjacent to access roads would also be used as staging areas (for example, SA-4 adjacent to the flowline to be removed). At the primary sites, preparation would include removal of existing buildings, some grading, and laying an all-weather surface with gravel. Smaller sites would require clearing of vegetation, grading, and gravelling.

The concrete to be removed from the dam and surge tank would either be recycled or buried and covered on SA-3, the 8-acre site a few thousand feet upstream of the dam and owned by PacifiCorp. About 7 acres of SA-3 would be available for use, as the site is subject to City of White Salmon well-setback limitations for the water supply well located at the eastern end of the parcel. The 2 to 3 acres nearest to the lake are proposed for temporary storage or permanent disposal. This section would need to be cleared of forest vegetation. Topsoil would be removed and stockpiled, probably between the disposal location and an adjacent residence. Some additional redistribution of earth would likely be necessary to facilitate disposal and covering of the concrete. When work on this parcel is complete, the area would be graded to naturally drain to the west (as before) and the entire site would be revegetated.

Concrete recycling, the preferred disposal method, would occur at a site not yet identified that is assumed to have the following characteristics. The recycling site would be independent of the Condit project and would have or would acquire its own permits. For analysis purposes, the site is assumed to be within 30 miles of Condit Dam and would require hauling the concrete on SR 14 and SR 141. Any concrete crushing would occur at the recycling site.

A temporary disposal/storage area for the wood from the wood-stave flowline and penstock would be established on property owned by the Becker family located a few hundred feet east of the flowline (SA-5). The site is a grass field that may be used as is or graded to accommodate stacking the treated lumber staves and loading them onto trucks to go to the recycling site. The driveway (AR-13) would require upgrading to accommodate truck traffic. The wood may go to a facility to be remilled for use in other wood-stave pipelines or remilled as lumber. The steel from the flowline hoops and other facility components may be temporarily stored at the Becker site or staging locations before it is hauled away for recycling.

At the conclusion of the proposed action, all temporarily disturbed areas, including the staging areas, would be regraded and revegetated consistent with the proponent's revegetation plan.

3.1.2 Access Roads

Access roads throughout the project area are necessary to perform the removal operations defined by the Settlement Agreement and the associated reclamation and monitoring activities (Figures 3-1 through 3-6). Although most of the work areas can be accessed using established roads, some areas would require reestablishing roads that have become overgrown and others where new segments of road would be built to access specific facilities.

To access the top of the dam, the access road to the current boat launch area near the dam (AR-2) would be upgraded. It diverges from Powerhouse Road, passes through the parking area at the boat launch, and continues to the dam. It would be widened, requiring removal of adjacent trees.

The proposed concrete disposal area can be accessed via Tamarack Lane, a private road owned by SDS Lumber Company. However, to reduce the amount of traffic on Tamarack Lane, a second, direct access road (AR-3) would be established along the eastern banks of the reservoir in the same alignment as an old road, part of which has become overgrown with vegetation. This road would connect from the boat-launch parking area near the dam across a small stream via a temporary culvert, and would follow the old road route to the concrete disposal site (SA-3). It would require widening and grading, and perhaps some minor realignment through a mature forested area. This road may branch by ramping down the tributary canyon to the existing cofferdams and to other reservoir areas that may require access for reservoir sediment stabilization.

An access road to the lower side of the dam (AR-5) would be required early in the removal process in order to get the equipment in place to tunnel through the dam. This road would extend west to near the flowline from Powerhouse Road south of the dam along an existing small access road that would be upgraded. From that point, the road would be new and would follow a topographic bench approximately parallel with the flowline to where the flowline would be bridged. A bridge over the flowline would be necessary to keep the flowline operating until the dam is breached. The road would extend to the spillway of the dam, where a large crane would be set up to move equipment and materials to the tunneling area. The road surface would be cleared, graded, and gravelled.

Additional short segments of new or upgraded access roads would be required for access to the lower part of the flowline and the surge tank (AR-7 and AR-8), the penstock (AR-9), and the powerhouse and tailrace (AR-11).

Access roads would be required within the current reservoir footprint to stabilize slopes, for revegetation, and to help manage woody debris. One such road would be an extension of Graves Road (AR-14) about halfway up the reservoir extending from SR 141 to the east side of the reservoir. This road would also access the temporary waterline replacement area. Other access points would probably be at Northwestern Lake Park at the upper end of the reservoir, at the waterline on the west side of the reservoir, and off Cabin Road on the lower west side of the reservoir (AR-15 and AR-16). The needed upgrades on these roads or the exact locations have not been determined at this time, as the topography that would exist after reservoir draw-down and the specific needs cannot be known before the reservoir is drained. Parts of these temporary roads would be built in the remaining reservoir sediment and would be reinforced using imported materials. When these temporary access roads are no longer needed, fill material used within the floodplain would be removed and all areas would be revegetated. The removed fill materials may be used as backfill for construction staging area reclamation and for filling in the tailrace.

3.1.3 Temporary Water Supply

Currently, a 14-inch municipal water line is located across the reservoir, approximately 1 mile upstream of the dam, buried in the sediment of the lake. In order to assure service is not interrupted by a potential failure during dam breaching, a temporary high-density polyethylene (HDPE) pipeline would be installed across the lake with a cable support system before the dam is breached. After the reservoir is drained and sediment has been stabilized in the area of the pipeline, a permanent water line would be installed below the pre-dam thalweg, low enough to be protected from river scour. New water line construction is anticipated to occur in the spring following reservoir breaching and would be completed prior to the beginning of the fall rainy season. This would be during the period of active sediment management and stabilization and before reestablishment of full use of the area by aquatic organism. Design and construction of the temporary and permanent water lines would be coordinated with the municipality. Best management practices would be used during construction.

3.1.4 Northwestern Lake Bridge

Northwestern Lake Bridge, located 1.8 miles upstream from the dam (Figure 1-1), would be modified to enable it to withstand the long-term scouring action of the river channel. PacifiCorp commissioned a study, completed by DCI Engineers in 2004, to produce a plan for the protection of the bridge piles. This report details the proposed sheet pile system that would be installed prior to draining the reservoir in order to assure long-term stability of the structure.

In-water work would be performed utilizing silt curtains for trenching and any required cofferdams. Work performed on the bank of the reservoir would be stabilized with erosion control mats and silt fencing. BMPs contained in Section 2.9 Spill Prevention and Containment Plan of the Project Description would be utilized (PacifiCorp 2004).

3.1.5 Mount Adams Orchard Water Supply Relocation

Mount Adams Orchard currently operates an orchard directly east of the dam site. The orchard utilizes a water right for 0.7 cfs (314.2 gallons per minute [gpm]) for irrigation. This water is currently withdrawn from Northwestern Lake. A new intake and pump system would be designed and installed in coordination with Mount Adams Orchard personnel in order to assure the needs of the orchard are met. The system would be near the current dam in a location that would allow reliable operation and access. The intake would be screened using a configuration that meets current WDFW criteria for irrigation diversions. To help mitigate any impacts from construction of the new irrigation diversion, work would be performed after the dam has been breached and completed prior to the spring irrigation season. Alternatively, the possibility of changing the surface water appropriation to a groundwater appropriation would be investigated. If the change can be approved in time, this may become the preferred approach.

3.1.6 Hardware Removal and Tunneling

Prior to draining Northwestern Lake, the reservoir behind Condit Dam, the hardware on the crest of Condit Dam would be removed. The hardware on the dam crest includes a 167-foot-long Obermeyer spillway gate, a 6-foot-wide vertical timber lift gate, and five 10-foot-wide by 10-foot-high radial gates.

A 12-foot-high by 18-foot-wide drain tunnel (somewhat bell shaped with the larger end downstream) would be excavated from the downstream side near the base of the dam (at elevation 174 feet) to provide rapid reservoir drainage. Concrete would be excavated from the tunnel (by drilling and explosives) and would be transported by truck to the proposed concrete disposal area. A rough-terrain crane would be used to load trucks with the excavated concrete.

Tunnel drilling would begin at the downstream face of the dam and continue through the dam until within 15 feet of the upstream water-face of the dam, whereupon a final explosive charge would be used to remove the final 15 feet of concrete. Except for the final blast, the concrete materials from the tunnel would be kept away from the river and hoisted out of the canyon using a crane.

3.1.7 Petroleum Products and Hazardous Materials

A vehicles and equipment fueling station would be located at staging area SA-2 adjacent to the dam (Figure 3-4). The station would consist of an aboveground storage tank (AST) placed on a portable trailer. Fueling of remote equipment, such as cranes or highlines, would be accomplished by tanker trucks. Equipment such as the crane used to remove concrete from the dam site would be located in proximity to surface water at the site. The Spill Prevention and Containment Plan in Section 2.9 of the Project Description (PacifiCorp 2004) would be followed.

Other hazardous materials stored at the site may include equipment lubricants and herbicides. These materials would be stored in secured storage with secondary containment, and the aggregate volume of these materials is not expected to exceed 100 gallons.

3.2 DAM BREACHING AND REMOVAL

3.2.1 Removal of Woody Debris Upstream of Tunnel

Prior to the blast to open the final 15 feet of the drain tunnel in October, PacifiCorp would float a barge-mounted clamshell crane to the dam, or position one atop the dam, to excavate sediment and debris from the upstream face of the dam where the tunnel would be opened. This would help assure the drain tunnel would not become blocked by accumulated woody debris directly in front of the tunnel. The cranes would remove the woody debris and move it to the boat ramp area, where it would be stored for habitat enhancement use. Sediment would be deposited in the reservoir immediately upstream of the removal area. In the event that the woody debris could not be used on site, it would be disposed of off site. At this time, it is estimated that the on-site storage area would occupy an area of approximately 25 feet by

25 feet, but this area could be larger or smaller, depending on the amount of debris encountered.

3.2.2 Dam Breaching

The final 15 feet of the tunnel would be breached by blasting out the remaining concrete. The tunnel size would allow an approximate maximum flow of 10,000 cfs to pass through. At this tunnel size, the reservoir pool is expected to lower to stream level within six hours, causing substantial amounts of sediment and some woody debris currently trapped behind the dam to be flushed downstream. Because of the large size and bell shape of the tunnel, it is unlikely that it would plug up with woody debris. However, if a plug occurs, a crane could be used to clear it, or explosives would be lowered into the plugged area and blasted to open the tunnel.

3.2.3 Bank Stabilization

During the rapid drawdown of the reservoir, saturated fine sediment within the entrenched canyon would become unstable and the slopes would fail. Once the reservoir is drained, the river would carve through the sediment toward its former channel, further destabilizing the sediment and causing further slope failures. This process would continue until the bank becomes stable by reaching its natural angel of repose. In order to assure a successful drawdown/stabilization process, an assessment of slope conditions would be made to determine whether active management of the sediment would be required. Where sediment slopes are steeper than expected (i.e., steeper than the natural angle of repose), PacifiCorp would attempt to determine the cause. If the cause is "natural" (i.e., rock cliff or other feature pre-existing dam construction), the sediment on the slope would not be actively managed. If the steeper than expected slope is "artificial" or is not expected to remain stable, active management of the sediment would be considered. Options for active management of the sediment include the use of water cannons, blasting charges, and/or mechanical means. The actual method used to dislodge the slopes would be chosen by the onsite engineer.

3.2.4 Concrete Dam Demolition

Once the reservoir is drained, dam excavation would begin at the east end of the dry, upper portion of the structure. Beginning at the top of the dam, crews would remove pieces of the dam in a series of top slicing cuts at 10-foot intervals. The two upper 10-foot horizontal cuts of the dam, and the sections along the downstream and upstream faces in each cut would then be blasted into large blocks (4 feet deep by 6 feet wide by 10 feet high). Blasting would be limited to the use of 12 pounds of explosives per delay (delay time more than 8 milliseconds between detonations). These blocks would be loaded with either a crane or a highline yarder-type system onto trucks and then hauled off the dam to the designated storage/disposal area SA-3 (Figure 3-4). PacifiCorp would drill and blast the inner portions of the dam into rubble that would be loaded onto trucks with an excavator and hauled off the dam to the disposal area. As the top slice cuts proceed below elevation 225 feet (approximately 75 feet below the top of the dam), a crane would be deployed to the spillway slab to hoist concrete from the lower area. As the excavation reaches the level of the drain tunnel, center portions of the dam adjacent to the tunnel would be excavated down to the bedrock. The edges of the dam along the tunnel and the upstream and downstream faces would be left in place to keep the river flow out as the concrete is removed from within the edges of the dam. When the inner portions of the dam are removed down to the bedrock so that only the edges remain, the edges of the dam would be blasted into blocks and hoisted out of the river channel. It is estimated that dam removal would take approximately one year.

3.2.5 Concrete Dam Removal, Storage, and Disposal

Approximately 29,000 cubic yards of concrete would be removed from the dam. About 2,500 cubic yards of steel reinforced concrete would be removed from the spillway and surge tank. Concrete remaining from dam and spillway would be hauled to the proposed concrete disposal/storage site, where it would be transferred to trucks that would haul it to an off-site recycling facility, or it would be buried in place. Concrete rubble would be temporarily stored or permanently disposed of over 2 to 4 acres at the concrete disposal area. The haul route is proposed to be a one-way loop up the new access road from the dam to the disposal site, with empty trucks returning via Tamarack Lane and Powerhouse Road. If use agreements with SDS Lumber (the owner of Tamarack Lane) and the County (for Powerhouse Road) cannot be reached, then the trucks would travel both directions on the new access road. Trucks hauling to an off-site recycling facility could use the access road and Powerhouse Road or Tamarack Lane and Wallace Road or Powerhouse Road to get to SR 141 (Figures 3-1 and 3-4).

Prior to demolition, PacifiCorp would conduct a marketing study to determine whether recycling is a viable alternative. In order for recycling to be a viable alternative, the buyer would have to have permits or be able to get them, and have enough demand for the materials to take all or most of the approximately 30,000 cubic yards of concrete. The materials would also have to be accepted when PacifiCorp needs to get rid of them. If recycling is an option, then the disposal site could become a transfer site or a temporary storage site.

3.2.6 Upstream Cofferdam Removal and Disposal

Historic photographs and drawings show that a cofferdam system was used in the original construction of the dam and was left behind in the reservoir and subsequently flooded. This cofferdam would be removed by the May following dam breaching. This date was selected at the request of federal and state resource agencies and the Yakama Nation to minimize adverse impacts on fishery resources. It is hoped that this structure can be removed by blasting and the use of a logging highline yarder but it may be necessary to construct an access road into the area so that other equipment can assist in this work. If necessary, this access road would come off the dam as demolition progresses downward to approximately elevation 235 and it would run along the east slope of the drained reservoir. The concrete, stones, boulders, and original timber members of the cofferdam would be excavated, placed onto trucks, and transported to one of the nearby disposal areas. Some of the timbers from the cofferdam may be washed downstream as the structure is taken apart.

3.2.7 Wood Stave Pipeline and Wood and Steel Penstock Removal and Disposal

The 5,100-foot-long, 13.5-foot-diameter wood stave flowline located along the east bank of the lower White Salmon River and the two 9-foot-diameter, 650-foot-long (one steel and one wood stave) penstocks would be removed from the site. Minor access road construction would be required to gain access to selected areas to facilitate demolition and removal. Recycling these wood products is preferable to permanent disposal. A total of 2 acres at the Becker disposal site would be required to store the wood once it is dismantled and until it can be sold as commercial lumber. The timber would need to be stored in the open, in well ventilated, loosely stacked piles to allow air drying. PacifiCorp estimates that the dismantling and stockpiling work would take 7 weeks.

3.2.8 Concrete Surge Tank Removal and Disposal

The 40-foot diameter, 45-foot-high steel-reinforced concrete surge tank would be disassembled using conventional track-mounted breakers along with drilling and blasting. The above-grade portions of the existing concrete spillway that extends from the surge tank to the river would be demolished. The concrete material removed from the surge tank and the aboveground parts of its spillway would be used to fill in that spillway and bring it back to near the original contours. At the conclusion of all demolition work, the area would be graded to match the natural surrounding conditions and revegetated. Excess materials that are not used to fill the spillway channel would be trucked to the concrete disposal site.

3.2.9 Power Facilities Removal and Disposal

As part of the removal activities, PacifiCorp would reconfigure the two 69 kV transmission lines that terminate at the Condit Hydroelectric Project. The existing Condit to Bald Mountain 69 kV line and the Condit to Bingen 69 kV line would be reconfigured to form a Bald Mountain to Bingen 69 kV line. In addition, the power line that currently supplies power from the substation near the powerhouse to the dam would be removed.

PacifiCorp would not remove the project powerhouse and associated parking area, as it is a historical structure and it is not necessary to remove it. The powerhouse tailrace retaining wall would, however, be removed and hauled to the disposal area. At least the upper portion tailrace would be filled in with rock. This work is being done to eliminate the potential for fish stranding in this deep section. Rock would be hauled to the tailrace area on the access road.

3.3 POST-REMOVAL MANAGEMENT

3.3.1 Site Revegetation

During a post-reservoir draining assessment, areas for seeding (i.e., revegetation areas) would be identified. Seeding may occur in different revegetation areas of the reservoir footprint on a varying schedule depending on site factors affecting likely success. No irrigation of the seeded area is expected.

Seeding is expected to discourage surface erosion and minimize noxious weed establishment in advance of natural revegetation. Following the initial seeding during the spring following dam breaching, subsequent localized spot seeding may be necessary to accomplish performance criteria for revegetation. This work is expected to be completed by the fall of the same year as initial seeding. Subsequent reseeding would be conducted as needed with the goal of reaching the vegetative cover performance criteria within two years.

3.3.2 Management of Sediments and Woody Debris

Most of the estimated 24,000 cubic yards of woody debris would be washed downstream along with the sediment during the initial movement of the sediment out of the reservoir. Whatever remains behind in the sediments would be moved downstream by subsequent high flow events. PacifiCorp proposes to allow this large woody debris to be released over time along with the sediment within which it is contained. According to the USFWS Biological Opinion (USFWS 2005), although the gradient and confined channel would preclude large accumulations of large woody debris, some would collect, at least temporarily, below the dam and may be beneficial in the creation of backwater zones and niches for juvenile fish and the production of macroinvertebrates. However, intervention in this process would occur if woody debris were to cause unstable slope conditions, as defined in the Bank Stabilization Plan, Section 2.4 of the Project Description (PacifiCorp 2004), or if woody debris were found to be adversely affecting fish passage. A decision to remove large woody debris would only be made with the guidance of the fish management agencies.

When this condition exists, the preferred action would be to mechanically remove the woody debris using equipment such as dozers and excavators and move the woody debris to a storage area until it can be recycled or utilized for habitat enhancement. If the debris is in a location that is unsafe to access with equipment, or if doing so would cause adverse environmental impacts, the materials would be dislodged manually or with explosives and allowed to mobilize downstream. Since this material would then be washed downstream where it could potentially cause physical fish passage issues, the stream below the action area would be assessed after the reservoir is drained. If the woody debris has accumulated or positioned itself where it is creating a physical fish barrier, it would be remobilized or removed at the downstream location.

3.3.3 Monitoring

Monitoring is proposed to demonstrate that performance criteria are met for several of the management plans included in the Project Description (PacifiCorp 2004). For several of these plans, monitoring would continue during the post-removal management period. The proposed monitoring would include:

- Continuous turbidity monitoring at a minimum of three new water quality monitoring sites using electronic data loggers
- Visual inspection of all fugitive dust sources and effectiveness of dust control methods
- Monitoring revegetation and presence of noxious weeds

- Topographic sediment mapping to assess effectiveness of bank stabilization
- Visual inspection of stormwater erosion control measures and their effectiveness
- Identification and monitoring of wetland establishment areas
- Fish passage evaluation and record keeping

The duration of the monitoring is variable, but would generally continue until specific performance criteria are met.

3.4 SCHEDULE

The Settlement Agreement was entered into in 1999 to resolve all issues in the proceeding for relicensing the project by FERC. It was amended in 2005. Under the Settlement Agreement and upon FERC approval, PacifiCorp would continue to operate the project under the terms of its FERC license until October 1, 2008, whereupon PacifiCorp would cease generating power at the project. Certain conditions, as specified in Section 5 of the Settlement Agreement, could preclude PacifiCorp from removing the dam and facilities at the end of the amended license term. Examples of these conditions include PacifiCorp's inability to: (1) obtain required permits consistent with the Settlement Agreement (including the expiration of application permit appeal periods and resolution of all appeals); (2) obtain required easements, rights-of-way, other interests in property, or third-party consent; or (3) obtain contracts to perform the removal and mitigation consistent with Settlement Agreement and required permits.

If all applicable permits, easements and contracts have been obtained, commencement of the agreed-upon construction schedule would occur no later than August 1, 2008. Project removal would commence during October 2008. The demolition and removal of Condit Dam and other project facilities are estimated to take one year. There are no plans to remove the powerhouse.

Under Section 4.4 of the Settlement Agreement, the Settlement parties would consider commencing removal at an earlier date (October 2007 or earlier) if additional funding is available to PacifiCorp to implement the removal plan and all necessary permits and authorizations have been obtained. In either case, removal is scheduled to be completed by December 31, 2009. The project schedule is outlined in Table 3-2.

Table 3-2
Proposed Project Schedule

Time Period	Action
March–May 2008	Mt. Adams Orchard water supply relocation
August 2008	Mobilization
August – September 2008	Construction of access roads including road to spillway slab below dam
August – October 2008	Site layout – setup and clearing staging areas, set up barge in reservoir
September 2008	Construct drain tunnel

Table 3-2 (Continued)
Proposed Project Schedule

Time Period	Action
September – October 2008	Remove Obermeyer gates, Tainter gate and radial gates Install temporary water line Northwestern Lake Bridge modification Remove debris from drain tunnel location
October 2008	Remove debris from drain tunnel location Blast tunnel plug and drain reservoir
October 2008 – April 2009	Cofferdam removal
November 2008	Demolish headworks
November 2008 – July 2009	Demolish dam
February – April 2009	Fill in tail race
March – May 2009	Remove flowline, penstocks, and surge tank
March 2009 – March 2010	Remove transmission line and substation
August 2009	Demobilization for dam removal activities

Source: PacifiCorp 2004

4.0 AFFECTED ENVIRONMENT, IMPACTS, MITIGATION MEASURES, AND SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

4.1 GEOLOGY, SOILS, AND SEDIMENTS

This section describes the affected environment and the effects of dam breaching and removal activities and processes on geology and soils. It also describes sediment movement and potential sedimentation that could occur from the dam removal and other removal activities. For a discussion of the impacts of sedimentation on water quality, please see Section 4.2 (Water Resources). Mitigation for sedimentation effects on the environment is described below, along with significant unavoidable impacts.

4.1.1 Affected Environment

The affected environment for geology, soils, and sediments includes Northwestern Lake (Condit Dam reservoir), the area immediately surrounding Condit Dam, access roads to work areas and staging areas, the tailrace from the power plant, the corridor occupied by the wood stave pipe and the power line, and the spillway from the surge tank to the White Salmon River. It includes the White Salmon River and its floodplain from the dam down to and including part of the pool for the Bonneville Dam on the Columbia River.

The project site is located on the White Salmon River in an area of rugged topography approximately three miles upstream from the confluence of the White Salmon and Columbia Rivers (USGS 1994). Soils in the White Salmon River Basin are generally characterized as loams and silt-loams derived from the regional basaltic bedrock, andesite, and pumice. Near Condit Dam, these soils are shallow and typically underlain by an intermediate gravel unit above the bedrock. Bedrock outcrops are common in areas of steeper topography along the river (FERC 1996).

Immediately west of the dam, the geology is dominated by colluvial deposits, capped by coarse glacial outwash material at the rim of the canyon. East of the dam, the topography is somewhat less severe, supporting a thin veneer of soil over the basaltic bedrock. North of the dam, the soils along the shores of Northwestern Lake are composed principally of the Hood loam (USDA 1990). Bedrock is present over much of the channel of the White Salmon River below the dam.

At the time of dam removal, an estimated 2.7 million cubic yards of sediment (2.3 million according to Finley 2006), primarily silt and sand with some gravel, will have accumulated in Northwestern Lake since the construction of Condit Dam in 1913. More than 7,500 feet upstream from the dam and primarily upstream from Northwestern Lake Bridge, the size of reservoir sediments is dominantly in the sand (.075-4.75 mm) and gravel (4.75-75 mm) range. Closer to the dam, the sediments are primarily sand and silt (.0039-.075 mm), and finally silt and clay (<.0039 mm) nearest the dam. Tributary streams to the reservoir have formed deltas into the reservoir with sand and gravel as well as cobbles (75-300 mm). The fine-grained portion of the river's suspended load has either passed through the dam to the lower reaches of the river or collected in the reservoir basin behind the dam. Laboratory analysis of the lake sediments indicated a limited distribution of low to trace concentrations of chlorinated pesticide residue and selected metals. Metals were generally present at concentrations consistent with established background levels. Volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), dioxins, and polychlorinated biphenyls (PCBs) were not detected in the lake sediment samples (FERC 1996).

4.1.2 Impacts

Pre-Dam Removal Activities

Pre-dam removal activities that affect soils, geology, and sediment transport include new haul road construction, upgrading existing roads, staging areas, and stabilization of the Northwestern Lake Bridge.

Haul Roads, Staging Areas, and Disposal Sites

Soil, rock and vegetation would be removed from the site as part of road widening for the new or upgraded access roads as described in Table 3.1. Although these actions are not expected to trigger slope instability, there would be erosion from bare soil surfaces prior to revegetation. Vehicle use on gravel access roads would generate sediment. Staging areas would be converted from natural vegetation and residential uses to a gravel pad. Disposal sites would be cleared of vegetation and topsoil. Water runoff may increase, and the runoff would carry sediment. Access roads within the current reservoir area would require fill materials to be placed on the sediment. All of these impacts are considered short-term construction effects and would be minimized by routine application of best management practices (BMPs).

Northwestern Lake Bridge

As discussed in the Northwestern Lake Bridge Evaluation Report (DCI Engineers 2004), the potential scouring of the footings of Northwestern Lake Bridge would be addressed by isolating the bridge piers with sheet piles (PacifiCorp 2004). No impact to the lake is expected to occur from this construction, except for minor disturbance of the bottom sediment as the sheet piles are driven in place. Work near the riverbanks would cause sediment to be released to the lake, if the work occurs before the reservoir is drained.

Dam Breaching and Removal

PacifiCorp proposes moving as much reservoir sediment as possible downstream as quickly as possible. To accomplish this rapid sediment transport, initial dam breaching would involve draining the reservoir using a tunnel advanced into the base of the dam from the downstream side. According to G&G Associates (PacifiCorp 2004), additional reservoir sediment would continue to move downstream over the next three to five years, as described below. More limited sediment transport would be associated with removal of the dam itself, and removal of dam appurtenances.

Sediment Transport

Absent any obstructions in the tunnel, the reservoir would drain during the first six hours immediately after breaching Condit Dam. The dam would be breached in late fall so that most of the reservoir sediment would be transported downstream during the fall-winter rainy season.

Immediately after the dam is breached, sediment-laden waters would begin pouring out of the reservoir at a rate of approximately 8,000 to 10,000 cfs. Approximately 75 percent of the accumulated reservoir sediment is in a size range that would readily be suspended in the river and transported downstream to the mouth of the White Salmon River and ultimately into the Columbia River. Sediment would erode from the reservoir through river channel formation by the White Salmon River and its tributaries in the reservoir area, surface erosion of the reservoir sediment, and floodplain development.

River Channel Formation

Immediately after dam breaching, river channel formation would be a dominant factor in the erosion of reservoir sediments trapped by the dam. Initially, a narrow slot would be cut in the sediments. As that slot deepens and widens, sediment would slough into the new river channel and be removed through the breach in the dam. Woody debris likely present in the reservoir sediments may interfere with draining the lake through the drain tunnel; however, provisions have been made before and after breaching to remove debris using blasting techniques or a crane. As the river channel widens and erodes down to bedrock, reservoir sediment would continue to erode.

In addition to direct erosion and transport by the White Salmon River, tributary streams would erode the reservoir sediment adjacent to those channels. Where deltas have been built into the reservoir by the tributaries, those tributary streams would erode their former deltas when streamflow is sufficiently high to mobilize the sediments. Erosion of deltaic sediments would proceed more slowly than the erosion of the finer reservoir sediments, because of the larger size of these materials. This delayed erosion may present a barrier to fish passage until a stable channel through the delta is formed. Coarser sediment in both the deltas and the upstream portion of the reservoir (more than 7,500 feet upstream) would be transported primarily at the bottom of the stream channel (bed load) and would likely be retained by the cofferdam thought to be present in the bottom of the channel near the dam. However, the cofferdam may be full of sediment that cannot be eroded by the flows at the time the dam has been removed and before the cofferdam is removed. In this case, the bed load sediments would be transported over the top of the cofferdam and likely would fill in downstream pools in the White Salmon River.

Although it may take longer than three to five years to move accumulated gravel and cobbles downstream, flows that move these materials would occur, and eventually the downstream pools in bedrock would be filled with gravels. This delay would help to avoid the deposition of fine reservoir sediment in the space between gravel particles. The movement of these gravels and the time it takes to achieve a stable channel configuration are of concern because of the role that gravels without fine sediment play in providing fish habitat. Carving graded channels in the deltaic materials with construction equipment as soon as they are accessible would accelerate the channel stabilization process and decrease the time that is needed to evacuate sediments downstream. This would prevent the deltaic materials from acting as a barrier to fish passage into Mill Creek.

Surface Erosion

Surface erosion and transport of reservoir sediments that are not eroded and transported by the White Salmon River or its tributaries would continue until vegetation is fully established. Because of the steep underlying bedrock topography, steep unstable slopes on the reservoir sediment may be present. The water content of these sediments would make site access initially difficult.

Flood Scouring

Once the White Salmon River has established a stable channel through the reservoir sediments, successively higher flood levels would erode areas not previously reached by floods. This process would continue over time, but the frequency and magnitude of the erosion events would vary over time. Computer model simulations by G&G Associates using actual flow records for the White Salmon River show that only two floodplain widening events are likely to occur subsequent to the fifth year after breaching (PacifiCorp 2004).

Downstream Effects

As the water levels fall after dam breaching, coarser sediment would be stranded within floodplain areas downstream of the dam. Finer sediment would be suspended and continue to be transported downstream. Pools in the river might fill with some larger sediment present along the current stream bank; however, reservoir and deltaic gravels would not yet have been moved by the river unless very high river flows occur soon after breaching occurs. A large portion of the reservoir sediment would be deposited in the lower 0.8 mile of the river, which is part of the Columbia River Bonneville Dam pool. Approximately 0.6 million cubic yards of the predicted 1.6 to 2.2 million cubic yards of sediment eroded from the reservoir would be deposited in the lower portion of the river known as the “in lieu site.” Finer suspended materials would form a plume that extends into the Bonneville pool. The sediment concentration of this plume would decline downstream because of settling in the water column, spreading of the plume, and dilution with flow from tributaries. The mixing zone would extend approximately three miles downstream from the mouth of the White Salmon River (PacifiCorp 2004). After the first six hours, when the flow would return to normal, sediment concentrations in the Columbia River would drop dramatically and continue to drop to background levels within approximately one to two weeks. Brief spikes may occur over approximately the first two months.

As long as sediment retained behind the dam is subject to river transport, even on an intermittent basis, turbidity levels in the White Salmon River would be affected. Computer model simulations have been used in an attempt to address expected erosion of the reservoir sediments; however, the actual rates of erosion depend on the unknown bedrock geometry, sediment sizes, rainfall, and river flow conditions. These unknown factors may affect the model predictions and require additional sediment management, as described below.

Dam and Appurtenance Removal

Impacts associated with dam and appurtenance removal are associated with the use of haul roads, staging areas, and disposal sites. As part of removal of the structures associated with the dam, the surge tank tailrace would be filled in.

The original cofferdam present beneath the reservoir sediment would be removed by blasting and log yarding equipment with little impact to the geology, soils, and sediment. If removal by that means is not possible, an access road would be required. The access road would require blasting and would change the topography. After cofferdam removal, the sediment trapped behind the cofferdam would be released.

As concrete is removed from the dam, concrete particles could enter the White Salmon River.

Post-Removal Management

Upstream Sediment Management

After the initial dam breaching, PacifiCorp would manage areas above the dam until all unstable slopes have been stabilized and areas of bare sediment in the former reservoir area have been revegetated. Sediment management also may be needed downstream of the dam until sediment deposited downstream during breaching is transported to the mouth of the river, and sediment transport attains a stable post-dam pattern.

Efforts to stabilize unstable reservoir sediment embankments would cause sediment to be released into the river quickly. Mechanical equipment or water cannons also would cause increases in sediment released to the river. Woody debris that may collect in the White Salmon River channel upstream or downstream from the dam after breaching would be removed, if deemed necessary by fish management agencies, using heavy equipment, which could create additional turbidity in the river during the removal operations.

Cofferdam removal would release any sediments trapped behind it into the White Salmon River. If an access road needs to be built as part of cofferdam removal, additional sediment may be shed into the river during road building and later road reclamation.

Over the long term, the natural sediment load of the White Salmon River currently retained behind Condit Dam would be transported downstream. This sediment load is estimated at about 30,000 cubic yards per year. It would create turbidity levels in the river below the former location of the dam that have not been present, except at flood stage, since the dam was built. It also would maintain and locally build sand and gravel bars in the White Salmon River that were built during the initial dam breaching. These long-term changes would return the river to a condition somewhat similar to its condition prior to dam construction. Where the White Salmon River current becomes slack adjacent to the Columbia River, sediment would be deposited during periods of low flow, only to be transported into the Columbia pool during higher flows.

Downstream Sediment Management

Immediately after breaching of the reservoir, sediment would be deposited in the floodplain areas at progressively lower levels as the river flow subsides. This sediment would be transported downstream during natural flood events. Woody debris would wash downstream during the reservoir draining, and could lodge in various areas between the dam and the river mouth. Ultimately the woody debris would be transported to the Bonneville reservoir pool. The debris could interfere with downstream transport of sediment and development of natural riverbanks. As the river approaches the in-lieu site, deposition of reservoir sediment would occur as the result of slack water created by the pool formed behind the Bonneville Dam on the Columbia River.

The sediment currently retained by the dam would be allowed to move downstream via natural flux of river flow, thereby increasing downstream turbidity. Downstream turbidity would include a transport of sediment into the Bonneville pool along a mixing zone that is approximately three miles long. This flux would be similar to the one that was present before the dam was built. Initially, pools in the White Salmon River below the dam would be filled by coarser sediment from the upper portion of the reservoir and from erosion of the tributary deltas. Over the longer term, natural sediment flux would periodically fill these pools. Alternate scouring and filling of these pools based on the ability of the river to erode and transport coarser sediments is a natural process and a consequence of the river being returned to a more natural state. Deposition of sediment in the Bonneville pool may be similar to that at the month of the Klickitat River assuming relative sediment loads are similar. Any contaminants in the sediment would move with the sediment. The small amount detected in the samples and the overall mixing and dilution would make the levels very small and the consequences of mobilizing it minor.

4.1.3 Mitigation Measures

Pre-Dam Removal Activities

Haul Roads and Staging Areas

- Areas where soil has been disturbed would be revegetated in accordance with the Plan for Revegetation of Reservoir Area and Other Areas Disturbed by Construction Activities (PacifiCorp 2004).

- Fill placed in support of temporary roads on the reservoir sediments would be removed once the roads are no longer needed.

- Erosion control for construction activities outside the dam and reservoir area as described in the Upland (non-reservoir area) Stormwater and Erosion Control Plan (PacifiCorp 2004). This plan provides for erosion stabilization for all roads, storage or construction staging areas.

- Compliance monitoring would be independent from construction activities.

- At the conclusion of the proposed action all work sites would be regraded and revegetated in accordance with these plans. This work is expected to stop erosion and sediment release to the White Salmon River associated with these activities.

Northwestern Lake Bridge

- As described in the Sediment Assessment and Management Plan (PacifiCorp 2004), silt curtains would be used during sheet pile installation to minimize silt entrainment in the water, or construction would be performed as the water level is being lowered. In either case, silt entering the water column would be minimized (PacifiCorp 2004).

- Any work near the river would use erosion control mats and silt fencing to protect the river from sediment release.

Dam Breaching and Removal

Drain Tunnel

- The drain tunnel would be constructed with a slight bell shape with the largest diameter downstream to prevent large woody debris from clogging the tunnel.

Sediment Transport

- The dam would be breached in late autumn to take advantage of the rainy season when there would be fewer adverse effects on aquatic life and recreation.

- Removing unstable sediment and woody debris would help to ensure that the reservoir sediment is transported downstream quickly, therefore within the predicted three- to five-year period and does not affect long-term water quality. It might also help to mitigate downstream flooding related to sediment transport and deposition.

- As part of the Settlement Agreement, funds would be provided to the tribes. These funds could be used for maintenance, including dredging, at the "in lieu" site. Because of the natural flux of sediment that would be transported downstream after the dam is removed, the tribes may elect to remove sediment from the "in lieu" site more than once after dam breaching. Any dredging would be subject to a separate environmental review and permit process.

Post-Removal Management

Upstream Sediment Management

- Sediment that remains in the former reservoir area would be evaluated for stability in accordance with the Bank Stabilization Plan (PacifiCorp 2004), and unstable sediment would be removed in a way that protects public and worker safety and the environment.

- Use of mechanical means to modify unstable sediment slopes would require building temporary access roads across the reservoir sediment.

- Access roads would be built to manage any unstable sediment and would be removed after they are no longer necessary.

- To avoid fish passage and erosion issues for deltas built into the reservoir by tributary streams, stable channels need to be cut through them. Artificially carving a stable channel would prevent these deltas from being a barrier to fish as well as a sediment source that extends beyond the currently anticipated three- to five-year time frame. If natural stream flow does not create a channel passable to fish through the Mill Creek delta by May 1 of the year following dam breaching, it will be done using construction equipment. This effort would be accomplished in the field under the oversight of an engineering geologist or field engineer once the reservoir has been drained and the geometry of the deltas is known.

- To minimize long-term erosion and transport of sediment to the White Salmon River and tributary streams, revegetation would be initiated as described in the Plan for Revegetation of Reservoir Area and Other Areas Disturbed by Construction Activities (PacifiCorp 2004). Revegetation efforts would take place once underlying sediment has been stabilized.

Downstream Sediment Management

- As described in the Canyon and Woody Debris Management Plan (PacifiCorp 2004), the White Salmon River canyon below the dam would be surveyed to identify and dislodge any woody debris that may be hindering fish passage. Removal of such blockage would facilitate downstream transport of sediment and the natural formation of riverbanks. Log jam removal would only be done in consultation with the fish management agencies.

4.1.4 Significant Unavoidable Adverse Impacts

Downstream from the dam, movement of sediment from the reservoir through the channel and floodplain redevelopment and formation are unavoidable adverse impacts. Therefore, large volumes of sediment will move through the lower White Salmon River and into the Bonneville pool of the Columbia River. The in-lieu site is likely to be filled with sediment until flood flows flush it into the Bonneville pool. These deposition effects could be viewed as resulting from Bonneville Dam creating a slack-water pool, rather than as a result of removing Condit Dam.

4.2 WATER RESOURCES

The water resources discussed in this section include surface water features such as rivers, streams, and lakes, as well as groundwater that might be affected by activities associated with removal of Condit Dam, the resulting actions during removal, or the absence of the reservoir. Adjacent areas that might affect the water also are discussed.

4.2.1 Affected Environment

The affected environment for water resources includes Northwestern Lake, the White Salmon River downstream from Condit Dam, and the portion of the Columbia River downstream at the confluence with the White Salmon River (Figure 4.2-1). Upland areas where work would occur that could affect water resources include the area immediately surrounding Condit Dam, access roads to work areas and staging areas, the tailrace from the power plant, the corridor occupied by the wood stave pipe and power line, and spillway from the surge tank to the White Salmon River.

Surface Water

The White Salmon River basin is approximately 386 square miles in area. The drainage basin is typically rugged, and the river has eroded canyons into the basalt bedrock. The river is generally narrow (30 to 60 feet in width), except at Northwestern Lake and near the mouth of the river at its outlet into the Columbia River. Basin stream gradients are relatively steep, falling approximately 6,800 feet from the headwaters to the Columbia River, although the gradient decreases significantly in the last river mile. At river mile (RM) 0.5, the river emerges from the narrow canyon and widens in an area referred to at the 'Riffles' prior to flowing into the Columbia River.

The headwaters of the basin derive their water from snowmelt and glacial melt from the White Salmon and Avalanche glaciers on Mount Adams at an elevation of approximately 7,500 feet above sea level. Major tributaries to the river include Spring Creek, Cascade Creek, Trout Lake Creek, and Rattlesnake Creek. Stream discharge is monitored at USGS gauging station #14123500 at Underwood, approximately one river mile downstream of Condit Dam. Condit Dam currently alters natural streamflow, and discharges vary based on inflow rates, seasonal recreational use, and electrical power demand. Normal observed flows at the gauging station average 900 cfs, with monthly averages ranging from approximately 550 cfs in October to 1,600 cfs in April (FERC 1996).

The White Salmon River is classified as a Class A (excellent) water body by Ecology. Several studies of the White Salmon River have indicated that values for most water quality indices are generally consistent with Ecology standards. In addition to hydroelectric power generation, surface water in the project area is used for municipal and domestic supply and limited irrigation (FERC 1996).

In addition to the White Salmon River, Northwestern Lake is fed by several smaller tributaries that discharge directly into the lake. These tributaries include Buck Creek, Spring Creek, Little Buck Creek, and Mill Creek to the west, as well as several small unnamed drainages on the east and west sides of the lake. The streams entering the lake on the western side typically have headwaters located along peaks and ridgelines at elevations of 2,500 to 3,000 feet in the Gifford Pinchot National Forest. Where the drainages enter the lake, small deltas have been deposited.

Groundwater

Groundwater in the project vicinity occurs in both unconsolidated sediments overlying the basalt bedrock and within the bedrock, typically within interflow zones (Ecology 1979). Groundwater discharges as springs where the basalt bedrock is exposed along the valley walls and contributes a significant amount of baseflow to the White Salmon River in the project vicinity (Ecology 1979). Specific groundwater flow direction information was not readily available, but based on the project vicinity geology and topography, groundwater flow is expected to be to the west-southwest toward the White Salmon and Columbia Rivers on the eastern side of the river and lake, where the majority of activities (road construction, staging areas, demolition, etc.) will take place.

A review of well logs in the project vicinity indicated that the majority of wells in the area appear to be completed to depths from 150 to 600 feet (Ecology 2005). The wells typically utilize groundwater occurring within the basalt, as surficial deposits tend to be fine-grained and thin in nature and do not represent a productive aquifer. Groundwater in the basalt aquifer is typically confined, and depths to groundwater within these wells ranged from 0 to over 200 feet below ground surface (bgs) (Ecology 2005). With the exception the City of White Salmon well, wells in the site vicinity are relatively small and are used for domestic purposes.

The City of White Salmon Production Well #2 is located within the project area (Figure 3-4). This well is located adjacent to the east edge of Staging Area SA-3, which is proposed for use as concrete debris storage and/or disposal. The well was drilled to a total depth of 1,242 feet bgs and cased and sealed to 804 feet bgs, with open hole to the total depth. According to the driller’s log (Ecology 2005), silt to silty clay was encountered between ground surface and a depth of 91 feet bgs. Basalt bedrock was encountered at 91 feet bgs, and the boring encountered multiple basalt flows between 91 feet and the total depth of the well. A copy of the well log is included as Appendix B.

The aquifer at the city well location is confined in nature, and the static water level in the well was at ground surface at the time of the well’s construction. The well was pump-tested at 1,380 gpm. Water quality information for the well was not readily available.

4.2.2 Impacts

The individual activities that may affect water resources are described in more detail in the following subsections. Surface and groundwater features for this project are presented on Figure 4.2-1.

Pre-Dam Removal Activities

Pre-dam removal activities that may affect surface water and/or groundwater include:

- Reinforcement of the Northwestern Lake Bridge

Figure 4.2-1 Surface Water and Groundwater Features

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Figure 4.2-1 (Continued)

- Reconstruction of Mt. Adams Orchard diversion and temporary water supply pipeline
- Construction or upgrading of haul roads
- Preparation of staging areas and disposal sites
- Preparation of work areas
- Potential fuel or oil spills from equipment and storage areas

Potential impacts related to each of these activities are described below. All of these potential impacts are considered short-term construction effects.

Reinforcement of the Northwestern Lake Bridge

The bridge was designed and constructed in 1958 to replace an existing bridge spanning Northwestern Lake. The bridge was constructed well after accumulation of sediments in the lake had begun, and there is concern that the rapid drawdown and accompanying erosion of the accumulated sediments will destabilize the bridge. To alleviate this problem, seven measures are proposed to protect the bridge:

- Sheet pile around two central piers
- Concrete wing walls and crib structure to tie existing bridge abutments to new sheet pile cofferdams
- Temporary bracing to existing piers and sheet pile walls in stages, as required for temporary construction stability
- Reinforce concrete grade ties from the existing concrete pile caps to new concrete wingwalls
- Possible construction of new base footing within cofferdam
- Backfill of cofferdam and concrete crib structures
- Armor rock along river revetment slopes on both sides of the bridge near the abutment approaches

Fine grained sediments would be suspended in the water surrounding the bridge piers, potentially increasing turbidity during installation of the sheet pile, construction of the wing walls and crib structure, construction of a new base footing (contingency), backfilling of cofferdam and crib structures, and placement of armor rock. Coarse-grain sediments disturbed during this process would not migrate due to this construction activity. In accordance with the Sediment Assessment and Management Plan (PacifiCorp 2004) silt curtains would be installed to help minimize migration of suspended fines. With the implementation of the proposed measures, the amount of fines that would migrate from the construction area for the Northwestern Lake Bridge is expected to be small and would occur over a short duration, and therefore is considered to be a less than significant impact.

Reconstruction of Mt. Adams Orchard Diversion

The replacement of the water supply diversion would take place after the dam has been breached, but prior to the commencement of the spring irrigation season. As part of the replacement, a pipeline and intake would be constructed at a location that allows reliable access and operation. Sediment and erosion control for the disturbed upland areas associated with pipeline and intake installation would be addressed under BMPs as described in the Project Description (PacifiCorp 2004).

It is likely that instream work would be required to install the diversion structure. Similar to the instream work associated with the Northwestern Lake Bridge, fine grained sediments would be suspended in the water surrounding the intake structure, potentially increasing turbidity during installation.

Alternatively, the possibility of changing the surface water appropriation to a groundwater appropriation would be investigated. If the change can be approved in time, that may become the preferred approach. If that change occurred, there would be no direct effects on surface waters. Effects on groundwater would be negligible.

Haul Roads

Soil, rock and vegetation would be removed from the road sites as part of road widening for the new or upgraded access roads and staging areas as described in the Project Description (PacifiCorp 2004). Although most of the project work areas would be accessible by existing roads, new or improved roadways would be required, such as former (now overgrown) reservoir access roads along the east side of the lake, and road extensions necessary to access proposed work areas (such as access to the lower portion of the dam). Access roads have been identified as being required for the dam decommissioning project:

AR-2	Powerhouse Road to dam	existing
AR-3	Access road to dam and SA-3	existing and new
AR-4	Powerhouse Road to SA-3	existing and new
AR-5	Powerhouse Road to dam (lower) and to Flowline (upper)	existing and new
AR-7	Powerhouse Road to surge tank, flowline (lower) & penstock (upper)	new
AR-9	Access road for penstock removal (lower)	existing
AR-11	Access road for tailrace grading	existing and new
AR-12	Access road to substation	existing
AR-13	Access road from Powerhouse to SA-5	existing and new
AR-14	Graves Road to lake	existing
AR-15	Cabin Road to lower lake	existing and new
AR-16	Cabin Road to lower lake	existing and new

Segments of all roads are relatively steep (8 percent or greater). New construction would require clearing, excavation and fill along the designated rights-of-way. Existing roads may be realigned and upgraded, but would require significantly less right-of-way preparations.

During construction, access roads would be vulnerable to rainfall, prior to placement of roadway surfacing and installation of cut/fill slope protection. Vehicle use on gravel access roads would generate sediment, and stormwater runoff may increase and would carry sediment. Access roads within the current reservoir area would require fill materials to be placed on the sediment.

BMPs would be implemented to minimize erosion and thus turbidity, as described in the Upland Stormwater and Erosion Control Plan (PacifiCorp 2004). Applicable BMPs should be effective for reducing the coarser grained sediment through even the small sand grain sizes. However, colloidal materials would not be removed and runoff would be turbid. If stormwater events occur during the construction phase, stormwater flows to the lake and to the White Salmon River would locally contribute suspended solids to the receiving water bodies. Because of the size of the receiving water bodies and the timing of construction (normally a dry period in most years), the impact of stormwater total suspended solids (TSS) from the construction areas is considered to be less than significant.

Preparation of Staging Areas and Disposal Sites

Prior to removal of the dam, the staging areas would be prepared for the concrete storage (perhaps for several years) and disposal (SA-3) and for temporary storage of the decommissioned wood stave pipe materials (SA-5). Other staging areas (SA-1, SA-2, and SA-5) would be temporary through the decommissioning work, but would be revegetated at the end of the decommissioning project. Except for SA-5 and SA-4, all sites that would be cleared of native vegetation are grass-covered. SA-5 has been cleared of apple trees recently (in transition to a pear orchard). A stand of deciduous trees covers part of SA-4. Staging areas would be converted from natural vegetation and residential uses to a gravel pad. Disposal sites would be cleared of vegetation and topsoil.

During site preparation of all staging areas, standard BMPs, as described in the Upland Stormwater and Erosion Control Plan (PacifiCorp 2004) would be employed to prevent sediment from being carried by stormwater to Northwestern Lake. BMPs also would be employed to minimize soil from the staging area being deposited on access roads, where stormwater could carry accumulated sediment into Northwestern Lake. The grades on the staging areas and disposal sites are generally less than the steeper grades associated with the roads, and therefore the degree of erosion and increased levels of TSS in stormwater is considered to be less than significant.

Preparation of Work Areas

A total of seven work areas would be utilized for this project. Preparation of each work area would be nearly identical to preparation of staging areas, and the same BMPs would be implemented to control erosion and minimize turbidity in stormwater runoff. As a result, the amount of sediment that stormwater could transport to the receiving waters is considered to be less than significant.

Petroleum Products and Hazardous Materials

Potential impacts related to the use and storage of petroleum products include contamination of stormwater runoff or surface water by accidental petroleum product spills associated with fueling or the potential rupture of a small tank or drum that may contain petroleum products. Petroleum hydrocarbons (such as diesel fuel) would be the most likely contaminants. Large volumes of petroleum hydrocarbons would be stored in double-wall tanks/tractor-trailer with secondary containment, making high volume spills unlikely.

The possibility of spills during fueling of the cranes or other equipment could impact surface water. The largest quantity of potential pollutants without secondary containment would be contained in a 55-gallon drum or in fuel tanks of large machinery. Therefore, a potential release would not be expected to exceed 55 gallons. Prevention of releases of hazardous substances and responses to releases, if they were to occur, would be mitigated in accordance with procedures outlined in the Spill Prevention and Containment Plan (PacifiCorp 2004). With proper planning and implementation of the Spill Prevention and Containment Plan, the potential for a release of petroleum products or hazardous substance that would cause a significant water quality impact is considered to be low.

Dam Breaching and Removal

Dam breaching and removal would result in water quality impacts in the White Salmon River. Management of the concrete from the dam would include stockpiling and/or disposal of the concrete debris on the 8-acre site owned by PacifiCorp (SA-3) (Figure 3-4). Potential surface water and groundwater quality impacts include increased sediment load and changes to pH. Impacts from storage of petroleum products and fueling of equipment would be similar to those described above.

Drain Tunnel Construction and Dam Removal

Concrete debris from drain tunnel construction and dam removal may alter surface water quality downstream of the dam. Squier Associates performed a bench-scale test of the alkalinity effects from pulverized concrete on behalf of PacifiCorp (Squier Associates 1998). Four concrete core samples collected from the dam were pulverized and fine sand size and smaller fragments (less than 0.25 millimeter diameter) were mixed into solution with river water samples at concentrations from 0 grams per liter (g/L) to 100 g/L. The samples were held at a stable temperature and pH values were recorded periodically over 30 days. At the end of the test period, solutions of 5.0, 10.0, 25.0, and 100.0 g/L concrete fragments demonstrated pH values of greater than 10 standard units. The maximum pH values recorded during the test typically occurred between 7 and 16 days. Squier Associates estimated that the majority of surface water impact from pH would occur as a result of the initial creation of the lake drainage tunnel through the dam. According to PacifiCorp, the discharge from the lake would be approximately 10,000 cfs for a period of approximately 6 hours. Based on the discharge volume and estimated volume of concrete pulverized during the final blasting of the tunnel, Squier Associates (1998) estimated that the river water pH immediately downstream of the dam would immediately increase to approximately 11.4 standard units, then decrease to a slightly elevated level within 5 hours. A check of the assumptions used by Squier Associates and recalculation revealed that any spike in pH is likely to be diluted to less than lethal levels in less than a minute and be near normal in 15 minutes or less. This impact is considered to be a very localized and short-term effect that would not extend very far downstream and would not, for example, be likely to reach the Bonneville pool on the Columbia River.

Water used in drilling into the dam to develop the drain tunnel will be collected and removed from the site. Larger blocks of concrete in the stream will also be removed. As part of the Sediment Assessment and Management Plan (PacifiCorp 2004), pH levels will be monitored continuously at the powerhouse downstream of the dam and compared to background pH levels to observe potential effects from the concrete cutting and blasting.

Immediately after breaching Condit dam, absent any obstructions in the tunnel, the reservoir would be drained during the first six hours. The dam would be breached in late fall so that most of the reservoir sediment would be transported downstream during the fall-winter rainy season. Immediately after the dam breaching sediment-laden waters would begin pouring out of the reservoir at a rate of approximately 8,000 to 10,000 cfs, draining the reservoir in about 6 hours. Suspended sediment concentrations in the White Salmon River during the initial spike could briefly reach 250,000 ppm. During the first day, while the reservoir is draining and soft sediments are sliding into the river, the average sediment concentration could be 150,000 ppm. The elevated turbidity levels would extend from the dam downstream and into the Bonneville pool and clay particles are expected to remain suspended all the way to the mouth of Columbia River, where it discharges into the Pacific Ocean. These suspended sediment concentrations are predicted to become episodic (e.g., pulses in response to streamflow and surface runoff) and fall off rapidly to about 3,000 ppm in the White Salmon River after three months and 200 ppm after 6 months.

During the high flows immediately following the beaching of the dam, the White Salmon River would compose approximately 7 percent of the average flow of the Columbia River (G&G Associates 2004a and 2004b, PacifiCorp 2005). During the period immediately following the breaching of the dam, suspended sediment concentrations would be relatively high. After mixing with the Columbia River for about three miles downstream from the mouth of the White Salmon River, water in the reservoir may have suspended sediment concentrations of 2,300 to 5,800 ppm; at Bonneville Dam, the concentrations may range from 1,100 to 2,600 ppm; and in the lower Columbia River, the concentrations may range from 900 to 2,200 ppm (G&G Associates 2004a and 2004b and PacifiCorp 2005). The range of estimated concentrations reflects the potential variability of flow in the Columbia River and the uncertainty of the volume of sediments that will be eroded initially following dam breaching and the amount of sediment that will settle out in the White Salmon River near the in-lieu site and in the Columbia River. In any event, the concentrations are predicted to generally decrease downstream as sediments are deposited in the White Salmon River and in the Bonneville pool. Dilution would also occur downstream of the Bonneville Dam as a result of tributary flows and longitudinal spreading of sediment as it move downstream at different velocities (G&G 2004b).

After the initial six hours, the White Salmon River would return to a normal flow and make up only approximately 0.6 percent of the Columbia River flow. This would dramatically reduce suspended sediment concentrations as they mix with the Bonneville pool. The anticipated concentrations would range from 200 to 1,700 ppm after complete mixing with the Columbia River a few miles downstream from the mouth of the White Salmon River; from 100 to 750 ppm at Bonneville Dam; and from 80 to 625 ppm in the lower Columbia River (G&G Associates 2004a and 2004b and PacifiCorp 2005). After approximately the first week, sustained concentrations in the Columbia River would be at essentially background levels, with brief spikes in concentrations occurring over the first month. Any contaminants in the sediment would move with the sediment. The small amount detected in the samples and the overall mixing and dilution would make the levels very small, and the consequences on water quality from mobilizing the contaminants would be minor.

During this period, water quality criteria in the White Salmon River and portions of the Columbia River are not expected to meet numeric criteria under Washington State Water Quality Standards for surface water.

Sediment management may include the use of explosives or other mechanical means to accelerate the movement of sediment downslope and into the river. If explosives are used as part of these efforts, explosive residues such as ammonium nitrate or nitroglycerin would likely be introduced to the river, but in very dilute concentrations. Mechanical equipment or water cannons also would cause increases in sediment and thus spikes in turbidity. Likewise, woody debris that may collect in the White Salmon River channel upstream or downstream from the dam after breaching would be removed using heavy equipment, if woody debris is hindering downstream transport of sediment. This would be expected to create additional turbidity in the river.

Concrete Disposal

If on-site disposal of the concrete debris is selected as the preferred disposal option, approximately 7 acres of the SA-3 parcel would be used for permanent disposal of concrete removed from the dam and the surge tank. A City of White Salmon well site is located adjacent to SA-3, and groundwater from beneath this area likely discharges into the White Salmon River as baseflow. The concrete disposal area would not intrude on the required setback required by Ecology for well-site protection.

Groundwater at the SA-3 disposal area may be affected by concrete debris. If on-site disposal occurs, concrete debris (approximately 30,000 cubic yards) would be buried at the disposal site. The majority of the concrete debris would be the result of concrete cutting and blasting during the dam removal process, and would be large debris, limiting the surface area of fresh concrete faces. Only a very small amount of concrete powder would be expected to adhere to these larger pieces of concrete debris. According to the well log of the City of White Salmon production well (Appendix B), the upper 91 feet of soils at the location consist of silts and silty clays, with limited granular materials. Water from precipitation or stormwater runoff could accumulate within the debris and perch on the surface of the fine-grained soils underlying the disposal site excavation. The pH of this water may increase due to exposure to the concrete. However, impacts to groundwater at the disposal area vicinity are expected to be limited to localized increases in pH. The aquifer utilized by the City of White Salmon well is greater than 800 feet bgs, and the well is cased and sealed to a depth of 804 feet bgs. The disposal site is not considered to be within a regional recharge area for the deeper aquifer. Infiltration through the fine-grained surficial deposits in the project vicinity would be expected to be slow and insignificant with respect to regional aquifer recharge and underflow. Additionally, the fine-grained soils at the site would be expected to buffer the pH levels over time. Overall, pH levels in shallower groundwater may increase slightly, but would not be expected to impact the city well or water quality in the White Salmon River.

In the event that concrete debris is temporarily stored at the SA-3 staging area prior to transport to an off-site recycling facility, minor changes to pH of stormwater exposed to the debris may occur. However, due to the relatively short exposure time and surface area of the large debris fragments, concrete storage would not be expected to create a significant impact at the project site. Implementation of BMPs should minimize any offsite impacts to water quality related to turbidity.

Post-Removal Management

After the first year, sediment concentrations are expected to return to background concentrations with less frequent spikes in turbidity as unstable embankments of reservoir sediment fail. Limited duration spikes in turbidity are expected to continue for 3 to 5 years after breaching (PacifiCorp 2004). Duration and intensity of the spikes would depend on flow rates in the river, the intensity and duration of storm events, sediment sizes, and the effectiveness of the sediment stabilization and revegetation. Water quality criteria would be expected to meet Washington State Water Quality Standards for surface water (Ecology 2003) within this three- to five-year period.

Over the long term, the natural sediment load of the White Salmon River retained behind Condit Dam would be transported downstream. This sediment load is estimated at about 30,000 cubic yards per year. It would create turbidity levels in the river below the former location of the dam that have not been present, except at flood stage, since the dam was built. These long-term changes would return the river to a condition similar to what existed prior to dam construction.

The removal of the dam would result in changes to the floodplain in the immediate vicinity of Northwestern Lake. The floodplain in the area would return to a configuration similar to the configuration prior to the construction of the dam, except for the presence of the Bonneville pool. The deposition of sediment in the lower reaches of the White Salmon River also may have some small effect on the floodplain below the dam. In this case, the level of the floodplain may temporarily rise due to deposition of sediment. The changes in the floodplain would not extend into the lowest reach of the river that is inundated by the Bonneville pool. During the flushing of the reservoir, the water elevations below the dam will temporarily increase. However, the levels would be substantially lower than during the 1996 flood event. The only potentially vulnerable structures of note are at the in-lieu site.

4.2.3 Mitigation Measures

Pre-Dam Removal Activities

Haul Roads and Staging Areas

- Implement the BMPs as described in the Upland Stormwater and Erosion Control Plan (PacifiCorp 2004). Proper implementation of these BMPs should minimize turbidity in stormwater runoff related to disturbance of soil in the upland areas. The BMPs may not be as effective in areas where there are steep slopes (such as along roads that may be constructed down into the canyon and in the area of the surge tank spillway).

Petroleum Products and Hazardous Materials

- Implement PacifiCorp's proposed Spill Prevention and Containment Plan (PacifiCorp 2004).

- PacifiCorp would use BMPs during the construction, dam removal, and restoration activities at the project site, thus minimizing the potential for spills and other releases of hazardous substances.

- Because a portion of the equipment fueling would take place where surface water could be impacted by a spill or release (such as fueling of the demolition crane situated on the dam spillway), prevention and management of spills, such as through temporary containment, would be practiced.

Additional mitigation measures are not recommended.

Dam Breaching and Removal

Drain Tunnel

- Water used in drilling into the dam to develop the drain tunnel would be collected and removed from the site.

- Large blocks of concrete would be removed from the stream. Downstream from the powerhouse, pH would be monitored continuously and compared with background levels.

- Blasting would be accomplished in accordance with the Blasting Plan (PacifiCorp 2004).

- Implementation of the plans developed by PacifiCorp should minimize the impacts related to the drain tunnel, and no additional mitigation measures are recommended.

- Potential changes in the floodplain downstream of the dam, although they appear to be small, could be minimized if the dam breaching were to occur at a time when the Bonneville pool elevation is near its lower end of the range of fluctuation. Breaching the dam during a time when the Bonneville pool is low would reduce the flood elevations at the in-lieu site. PacifiCorp should consult with the U.S. Army Corps of Engineers to determine the feasibility of lowering the Bonneville pool prior to dam breaching, in the event that the pool elevation is near the higher end of its range of fluctuation.

Reconstruction of Mt. Adams Orchard Diversion

The instream work associated with this diversion has the potential to suspend sediments in the river, thus increasing turbidity.

- Instream sediment management during the diversion construction should be similar to in-stream mitigation measures for the reinforcement of Northwestern Lake Bridge (e.g., use of silt curtains).

- As the specific plans for the diversion construction are developed, the scope of work should include mitigation measures to minimize impacts to surface water quality and should consider alternative replacement options. This plan would need to include an application for a change in the point of diversion.

- A well could substitute for withdrawal from the river and eliminate those impacts. Wells are generally considered preferable to surface water withdrawals. Since a change in the point of diversion would be required, a well would be strongly considered.

Post-Removal Management

- To assess the effectiveness of the Sediment Management and Revegetation Plans (PacifiCorp 2004), long-term water quality monitoring is proposed.

- Monitoring of applicable water quality parameters, including turbidity, total suspended solids, and pH, as well as observation and documentation of banks and fish passage, will continue from the commencement of dam removal activities until such time that performance criteria are met (PacifiCorp 2004). Infrequent, short-term turbidity spikes are expected to continue for three to five years, and the monitoring would continue at least as long as the reservoir sediment-induced turbidity spikes are still evident.

- If on-site disposal of the concrete debris is selected as the preferred disposal option, shallow groundwater monitoring downgradient of the concrete disposal site would be performed to confirm that groundwater quality meets applicable standards.

- Periodic water quality analyses are performed as part of normal public water supply well requirements at the City of White Salmon production well to document water quality and track changes to water chemistry over time. Impacts are not anticipated; therefore, additional sampling or mitigation is not recommended.

4.2.4 Significant Unavoidable Adverse Impacts

Significant unavoidable adverse impacts identified with respect to surface water include massive turbidity and sediment transport as part of the dam breaching and removal. Total suspended solids in the White Salmon River within the six hours after the dam breach could range from 100,000 to 250,000 ppm and turbidity values could range from 50,000 to 127,000 NTUs. Elevated turbidity levels also are expected in the Bonneville pool, where the water of the Columbia River and the White Salmon River mixes. Clay particles will likely remain suspended in the Columbia River, thus increasing turbidity, all the way to the mouth of the Columbia River. Decreasingly frequent episodes of elevated TSS and NTUs are expected through the first year following the dam breach, as bank and river channel stabilization occurs. These turbidity spikes are predicted to return to near background levels within three to five years.

Significant unavoidable adverse impacts were not identified with respect to groundwater.

4.3 AQUATIC RESOURCES

Aquatic resources in this document are the fish, aquatic insects, and other aquatic invertebrates that live in the waters of the project, as well as the habitat elements within and adjacent to the waters that they rely upon. Other organisms, including amphibians and some reptiles, birds, and mammals, spend significant parts of their life cycles in the water or have critical linkages to the water. These organisms could be considered aquatic resources, but in this document, they are primarily covered in the wildlife section.

4.3.1 Affected Environment

The affected environment for aquatic resources includes Northwestern Lake, the White Salmon River below Condit Dam, the Bonneville pool of the Columbia River, the river and stream channels inundated by Northwestern Lake, and the White Salmon River and its tributaries above Condit Dam up to the maximum upstream extent that anadromous and fluvial salmonids may be expected to migrate. The aquatic resources will be affected by removal of the dam and reservoir and may be affected by activities in the area immediately surrounding Condit Dam, the access roads, and the work areas and staging areas.

Barrier Falls

The upstream extent that anadromous and fluvial salmonids may be expected to migrate is defined by barriers to fish passage. Known barriers to upstream fish migration within the range of anadromy in the White Salmon River basin after the removal of Condit Dam are shown on Figure 4.3-1. Where local names are commonly applied to existing waterfalls by kayakers, rafters, fishermen, and local residents, they are used in this SEIS. Where needed to identify locations, such as waterfalls and barriers to fish migration, river miles (RMs) are placed in parenthesis after the location. Tributaries that flow directly into the White Salmon River are identified by the RM (in parenthesis) where they join the river. Tributaries that do not flow directly into the White Salmon River are identified in parenthesis by the name and RM or the tributary they flow into.

The upstream limit of all anadromous fish migration, except possibly Pacific lamprey (*Lampetra tridentata*), in the White Salmon River is Big Brother Falls (RM 16.2). BZ Falls (RM 12.4) is likely to be a barrier for all salmonids, except for steelhead trout (*Onchorynchus mykiss*) and possibly spring-run Chinook salmon (*O. tshawytscha*). Husum Falls (RM 7.6) was a historic barrier to fall-run Chinook salmon, sea-run coastal cutthroat trout (*O. clarki clarki*), and perhaps coho salmon (*O. kisutch*), but the height of the falls was reduced shortly after the construction of Condit Dam to facilitate construction of a highway bridge (LLA 1981). Husum Fall is not currently a barrier to the passage of adult resident or anadromous salmonids, but is likely a barrier to the upstream passage of juvenile salmonids and adult chum salmon. A barrier to the passage of juvenile salmonids and possibly adult chum salmon is also located at RM 2.6 of the White Salmon River and numerous barrier falls ≥ 4 feet in height on the river between Husum and Big Brother Falls are partial or complete barriers to the upstream migration of juvenile salmonids (LeMier and Smith 1955).

With the exception of steelhead and possibly coho salmon under ideal flow conditions, falls at RM 1.5 on Rattlesnake Creek and RM 0.8 on Mill Creek are barriers to upstream migration for all salmonids. A diversion dam at RM 1.9 on Buck Creek is a barrier to the upstream migration of salmonids < 9 inches in length (Bair et al. 2002). A waterfall at RM 3.2 on Buck Creek (RM 5.0) and at the hydro project dam at RM 0.7 on Spring Creek (RM 6.6) are complete barriers to upstream salmonid migration, as is a fall at RM 10.6 on Rattlesnake Creek.

Additional information about barriers to fish passage and their effects on fish distribution can be found in Section 1 of Appendix C.

Fish Resources above Condit Dam

The current distribution of native salmonids above Condit Dam is shown on Figure 4.3-2 and the potential anadromous salmonid stream habitat above Condit Dam is shown on Figure 4.3-3. Potential anadromous salmonid habitat above Condit Dam is listed in Table 4.3-1. Additional information concerning the distribution of salmonids in the White Salmon River basin is given in Sections 1, 2, and 4 of Appendix C.

Resident Coastal Rainbow Trout

Resident rainbow trout are found throughout the White Salmon River basin. Hatchery rainbow trout planted in Northwestern Lake are quickly caught and have not established any known reproducing populations (Weinheimer 2005). Tributary streams such as Buck and Rattlesnake Creeks are known spawning tributaries for fluvial-adfluvial rainbow trout residing in the mainstem of the White Salmon River (Allen et al. 2003, Bair et al. 2002). Although migrations of several miles have been documented in tagged rainbow trout, most resident rainbow trout in the mainstem of the White Salmon River remain within approximately one half mile of their birth location (Allen et al. 2003), indicating that resident rainbow trout spawn in the limited spawning gravels of both the river's mainstem and its tributaries.

Coastal Cutthroat Trout

Resident coastal cutthroat trout have been documented in Rattlesnake, Indian (RM 0.5 of Rattlesnake Creek), Mill (RM 4.0), Spring (RM 6.6), and Little Buck (RM 3.5) Creeks (Rawding 2005, Connolly et al. 2002, Allen et al. 2003, Blakley et al. 2000, Thiesfeld 2005). A population of coastal cutthroat has been documented in the White Salmon River between RM 3.3 and RM 7.6 (Connolly 2005c). They may rear in the stream or lake and spawn in tributaries.

Bull Trout

Two sightings of bull trout have been reported above Condit Dam, both by WDFW biologists. One fish (10.75 inches long) was captured in a gill net set in the spring of 1986 in Northwestern Lake (WDFW 1998, Weinheimer 2005). The other fish (about 12 inches long) was checked in the opening day creel census in April 1989 (WDFW 1998, Weinheimer 2005). Two reliable sightings were reported by sport anglers below Condit Dam in recent years (WDFW 1998, Weinheimer 2005). A total of four surveys of potential bull trout spawning habitat throughout the White Salmon River have not detected any bull trout (Bryne 2005), but

Figure 4.3-1 Fish Passage Barriers

Color. Takes 2 pages, Starts on an odd numbered page.

Figure 4.3-1 (Continued)

Figure 4.3-2 Current Documented Distribution of Native Salmonids Above Condit Dam

Color. Takes 2 pages, Starts on an odd numbered page.

Figure 4.3-2 (Continued)

Figure 4.3-3 Potentially Accessible Anadromous Salmonid Habitat Above Condit Dam

Color. Takes 2 pages, Starts on an odd numbered page.

Figure 4.3-3 (Continued)

Table 4.3-1
Potentially Accessible Anadromous Salmonid Stream Habitat Above Condit Dam

New Stream Habitat[a]	Steelhead[b]	Salmon[c]
Main Channel Habitat (miles)		
White Salmon River between RM 3.3 and 16.2	12.9	9.1
Total Main Channel Habitat	12.9	9.1
Tributary Habitat (miles)		
Rattlesnake Creek (enters White Salmon River at RM 7.6)	10.6	1.5
Indian Creek (enters Rattlesnake Creek at RM 0.5)	1.4	0
Mill Creek (enters Rattlesnake Creek at RM 8.7)	1.7	0
Spring Creek (enters White Salmon River at RM 6.6)	0.7	0.7
Buck Creek (enters White Salmon River at RM 5.0)	3.2	3.2
Mill Creek (enters White Salmon River at RM 4.0)	1.9	0.8
Total Tributary Habitat	20.1	4.9
Total New Stream Habitat	32.4	15.3

Note: See Section 1 of Appendix C for more detailed information.

a. Resident coastal cutthroat trout have had the opportunity to colonize the White Salmon River above Husum Falls (RM 7.6) since the falls was reduced from its historic height, but have not (possibly due to a total lack of tributary spawning habitat between Husum and BZ Falls). Pacific lamprey (Lampetra tridentata) could have access above Big Brother Falls (RM 16.2). Fluvial-adfluvial coastal cutthroat trout populations with spawning habitat below barriers in Mill Creek, Indian Creek, and Mill Creek may establish anadromous (sea-run cutthroat) populations.

b. Assumes that: (1) steelhead will be able to pass barriers at RM 12.4 on White Salmon River, RM 1.5 on Rattlesnake Creek, RM 1.9 on Buck Creek, and RM 0.8 on Mill Creek and (2) steelhead juveniles will rear through accessible portions of tributary streams (road culverts on Indian Creek are likely to prevent juvenile access to upper reaches of stream). The lack of spawning tributaries and favorable habitat conditions for the resident ecotype may restrict steelhead populations in the White Salmon River between BZ Falls (RM 12.4) and Big Brother Falls (RM 16.2).

c. Assumes that: (1) Chinook and coho salmon will not be able to pass BZ Falls (RM 12.4), Lower Rattlesnake Falls, Spring Creek above the hydro project dam (RM 0.7), and Mill Creek above falls (RM 0.8) and (2) fall-run Chinook salmon and coho salmon will be able to pass Husum Falls (RM 7.6), which has been reduced from its historical height since the construction of Condit Dam (before the height of Husum Falls was reduced, spring-run Chinook and coho were the only salmon likely capable of passing Husum Falls). Individual coho salmon may be able to occasionally pass the lower barriers on Rattlesnake and Mill Creeks under ideal flow conditions and individual spring-run Chinook salmon may be able to occasionally pass over BZ Falls when flow conditions are perfect, but because of the low frequency of such conditions, viable populations could not be established or maintained, and for the purposes of this table, the habitat above the barriers is not considered accessible to these species. Coho salmon utilization of the White Salmon River above Husum Falls (RM 7.6) may be restricted due to a lack of spawning tributaries and restricted upstream passage for coho juveniles due to numerous waterfalls and cascades.

difficult access and safety concerns prevented surveys of the mainstem of the White Salmon River between RM 7.6 and RM 32.5 and Spring Creek (RM 6.6) above the hydro project dam. The final report concluded that a small population of bull trout may exist in the basin above Condit Dam at a very low population density (Bryne 2005).

Nonsalmonid Fish

Three species of nonsalmonid fish that are likely to occur in the Bonneville pool, and potentially in the lower White Salmon River below Condit Dam, were not documented in the 1996 FEIS (FERC 1996) or 2002 FSFEIS (FERC 2002) for the Condit Hydroelectric Project. These are the leopard dace (*Rhinichthys falcatus*), mountain sucker (*Catostomus platyrhynchus*), and river lamprey (*Lampetra ayresi*), which are documented to occur in the Bonneville Reach of the Columbia River (Wydoski and Whitney 2003). All three of these species are Washington state Candidate species. If these species occur in the White Salmon River, they most likely are found in the large pool at the in-lieu site.

Three species of nonsalmonid fish, longnose dace, western brook lamprey, and shorthead sculpin have been documented to occur in the White Salmon River above Condit Dam (Allen et al. 2003).

Aquatic Invertebrates

California Floater (Anodonta californiensis)

The California floater is a Washington state Candidate Species. In the Draft White Salmon River Subbasin Summary prepared for the Northwest Power Planning Council WDFW 2002, Dan Rawding states, "Freshwater mussels are known to inhabit certain portions of the basin; however, the current species assemblages, distribution, and status are unknown." A large population of freshwater mussels is known to exist in Rattlesnake and Indian Creeks (Parker 2005). The priority species status review by the WDFW documents their presence in the Columbia River about 20 miles upstream from the mouth of the White Salmon River. There is no known survey for benthic invertebrates closer to the project area. Molly Hallock, a WDFW biologist, stated in a phone conversation that she was unaware of any mollusk surveys that have been conducted by WDFW or USFWS in the White Salmon River Basin (Hallock 2005). Additional information is available in Section 3 of Appendix C.

Benthic Macroinvertebrates

The benthic macroinvertebrate community in the White Salmon River below Condit Dam is currently adapted to a cold, well oxygenated, relatively high gradient confined glacial river channel flowing through a basaltic bedrock canyon. Gammon (1970) studied substrate types and their relation to benthic macroinvertebrate numbers. Rubble substrates, such the one in the White Salmon River, were one of the most occupied substrates, while silt rated lowest. Although the primary productivity necessary to maintain high population densities is constrained by low water temperatures, the White Salmon River benthic habitat maintains a healthy and diverse macroinverterbrate community (caddisflies, stoneflies, mayflies, etc.) typical of large freestone streams.

Threatened and Endangered Fish Species

The status of all federally listed Chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), steelhead trout (*O. mykiss*), coastal cutthroat trout, and bull trout (*Salvelinus confluentus*) likely to be found in the White Salmon River has been reevaluated since the June 2002 publication of the FSFEIS for the Condit Hydroelectric Project. In addition, critical habitat has been withdrawn and new critical habitat was proposed and finalized for six of the listed Pacific salmon and steelhead evolutionarily significant units (ESUs), and critical habitat has been designated for the Columbia River bull trout distinct population segment (DPS) on October 6, 2004 and redesignated on September 15, 2005.

Changes in Endangered Species Act (ESA) listing status and critical habitat designation for federally listed, proposed, or candidate salmonids in the White Salmon River and Bonneville pool of the Columbia River are listed in Tables 4.3-2 and 4.3-3. Additional information concerning changes in ESA listing status or critical habitat designations can be found in Section 4 of Appendix C. Federally listed threatened and endangered fish species and

Table 4.3-2
Changes in Endangered Species Act Listing Status and Critical Habitat Designations for Federally Listed, Proposed, or Candidate Salmonids in the White Salmon River

Salmonid Species	Evolutionarily Significant Unit (ESU) or Distinct Population Segment (DPS)	Previous Endangered Species Act Listing Status	Current Endangered Species Act Listing Status[a]	Previous Critical Habitat Designation	New or Proposed Critical Habitat Designation
Sockeye Salmon	Snake River	Endangered (R)	Endangered (F)	Yes	Original designation is in effect
Chinook Salmon	Upper Columbia River Spring-run	Endangered (R)	Endangered (F)	Yes	Final
	Snake River Spring/Summer-run	Threatened (R)	Threatened (F)	Yes	Original designation is in effect
	Snake River Fall-run	Threatened (R)	Threatened (F)	Yes	Original designation is in effect
	Lower Columbia River	Threatened (R)	Threatened (F)	Yes	Final
Coho Salmon	Lower Columbia River	Candidate (R)	Threatened (F)	None	None
Chum Salmon	Columbia River	Threatened (R)	Threatened (F)	Yes	Final
Steelhead	Upper Columbia River	Endangered (R)	Threatened (P)	Yes	Final
	Middle Columbia River	Threatened (R)	Threatened (P)	Yes	Final
	Snake River Basin	Threatened (R)	Threatened (P)	Yes	Final
Coastal Cutthroat Trout	Columbia River/	Threatened (P, R)	Species of Concern	None	None
Bull Trout	Columbia River	Threatened	Threatened	None	New Final

Note: See Section 4 of Appendix C for more detailed information.
a. Status of resident rainbow/steelhead trout populations under review.

R=Listing action under review since FERC 2002
P=Proposed new rule
F=New final rule

Table 4.3-3
Changes in Critical Habitat Designations for Endangered Species Act Federally Listed Salmonids in the White Salmon River and Bonneville Pool

Salmonid Species	Evolutionarily Significant Unit (ESU) or Distinct Population Segment (DPS)	Critical Habitat Designation[a]
Sockeye Salmon	Snake River	Unchanged
Chinook Salmon	Upper Columbia River Spring-run	Columbia River Freshwater Migration Corridor (proposed change)
	Snake River Spring/Summer-run	Unchanged
	Snake River Fall-run	Unchanged
	Lower Columbia River	White Salmon River below Condit Dam (proposed change)
Coho Salmon	Lower Columbia River	None proposed
Chum Salmon	Columbia River	White Salmon River below Condit Dam (proposed change)
Steelhead	Upper Columbia River	Columbia River Freshwater Migration Corridor (proposed change)
	Middle Columbia River	White Salmon River below Condit Dam (proposed change)
	Snake River Basin	Columbia River Freshwater Migration Corridor (proposed change)
Bull Trout	Columbia River	White Salmon River on non-federal lands that have greater than ½ mile of river frontage from Big Brother Falls at RM 16.2 to its mouth (new)

a. See Section 4 of Appendix C for more detailed information.

proposed and candidate species likely to be found in the White Salmon River are listed below.

Snake River Sockeye Salmon

Although the ESA listing status came under review, the listing as endangered was retained in the final listing. Migrating adults and juveniles are expected to use the lower White Salmon River for thermal refuge. Sockeye salmon are the *Oncorhynchus* species most vulnerable to elevated water temperatures and are most dependent on thermal refuge sites along their migratory corridors for survival.

Snake River Spring/Summer-Run Chinook Salmon

Although the ESA listing status came under review, the listing as threatened was retained in the final listing. Migrating adults and juveniles are expected to use the lower White Salmon River for thermal refuge.

Snake River Fall-Run Chinook Salmon

Although the ESA listing status came under review, the listing as threatened was retained in the final listing.

At the publication of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) it was assumed that fall-run Chinook salmon juveniles in the Snake River basin adhered strictly to an ocean-type life history characterized by saltwater entry at age 0 and first-year wintering in the ocean. Recent research has shown that some fall-run Chinook salmon juveniles in the Snake River basin spend their first winter in a reservoir and resume seaward movement the following spring at age 1 (Connor et al. 2005). This newly-discovered ecotype has been defined as a "reservoir-type" juvenile. Ocean-type juveniles average 4.4 to 5.5 inches in length, while reservoir-type juveniles average 8.7 to 8.8 inches. The large size of reservoir-type juveniles suggests a high potential for ocean survival. The reservoir-type juveniles may spend more time in locations such as the in-lieu site at the mouth of the White Salmon River. Because reservoir-type juveniles use the Bonneville pool for both rearing and downstream migration, they are expected to utilize thermal refuge in the White Salmon River more than other species of anadromous salmonids that use Bonneville pool primarily as a migratory corridor.

Upper Columbia River Spring-Run Chinook Salmon

Although the ESA listing status came under review, the listing as endangered was retained in the final listing. A new critical habitat designation has been proposed and finalized. Migrating adults and juveniles are expected to use the lower White Salmon River for thermal refuge.

Lower Columbia River Chinook Salmon

Although the ESA listing status came under review, the listing as threatened was retained in the final listing. A new critical habitat designation has been proposed and finalized. Migrating adults and juveniles from other sub-basins are expected to use the lower White Salmon River for thermal refuge.

Columbia River Chum Salmon

Although the ESA listing status came under review, the listing as threatened was retained in the final listing. A new critical habitat designation, including the White Salmon River from Condit Dam to its mouth, has been proposed and finalized. The White Salmon River is the only Washington tributary of the Columbia River above Bonneville Dam in which adult chum salmon have been detected (Ehlke and Keller 2003). Due to the late fall migration of spawning adults, absence of known populations upstream from the White Salmon River, and the quick downstream migration of smolts after emergence from spawning gravels; chum salmon are unlikely to utilize the White Salmon River as thermal refuge from elevated water temperatures in the Columbia River.

Snake River Basin Steelhead

Although the ESA listing status came under review, the listing as threatened was retained in the proposed listing. A new critical habitat designation has been proposed and finalized.

Unpublished data from adult tracking studies conducted by Peery and Keefer at the University of Idaho suggests that significant numbers of "drop-in" steelhead hatchery-strays from other basins move into the Deschutes River temporarily, then return downstream to the Columbia and continue to other watersheds (Cramer et al. 2003). Steelhead collected at Bonneville Dam were outfitted with transmitters. These fish were later detected in the

Deschutes River at RM 0.3 and RM 43 (Sherars Falls). Approximately 60–70 percent of the steelhead detected within the mouth of the Deschutes were later detected in other watersheds, and 30–40 percent of steelhead detected near Sherars Falls were later detected in other watersheds. Up to 25 percent of the radio-tagged steelhead known to have traveled as far upstream as Sherars Falls were later found in the Snake River. Although these “drop-in” steelhead are primarily hatchery steelhead from the Snake River basin, the lower portion of the Deschutes was famous in the 1950s for sports catches of large wild B-run steelhead trout of 20 pounds or more (Migdalski 1962) that were likely “drop-in” fish from the Snake River basin. Based on this information, it is likely that “drop-in” steelhead (and other andromous salmonids) from Columbia River and Snake River ESUs upstream of the White Salmon River will utilize pools for refuge from high summer water temperatures in the Bonneville pool throughout the reaches of the White Salmon River that become accessible after the removal of Condit Dam.

Although Snake River steelhead are not residents of the White Salmon River, adults are attracted to and stray into the cooler waters of the White Salmon River during the summer. The lower White Salmon River provides an excellent thermal refuge for summer steelhead migrating upstream in the Columbia River (WDFW 2000), and the Peery and Keefer research presented in Cramer et al. (2003) indicates that Snake River basin steelhead will likely utilize thermal refuge as far upstream as RM 16.2 after dam removal. Migrating juveniles also are expected to use the lower White Salmon River for thermal refuge.

Upper Columbia River Steelhead

The ESA listing status came under review and down-listing the ESU from endangered to threatened has been proposed. A new critical habitat designation has been proposed and finalized.

Upper Columbia River steelhead are not residents of the White Salmon River; however, they may use pools in the White Salmon River as thermal refuge (as described above under Snake River basin steelhead). Migrating juveniles also are expected to use the lower White Salmon River for thermal refuge.

Middle Columbia River Steelhead

Although the ESA listing status came under review, the listing as threatened was retained in the proposed listing. A new critical habitat designation has been proposed and finalized. Migrating adults and juveniles from other sub-basins are expected to use the lower White Salmon River for thermal refuge.

Bull Trout

Critical habitat for the Columbia River bull trout DPS has been proposed and a final rule published. Adult and sub-adult bull trout using the Columbia River as a migratory corridor between spawning, foraging, and wintering habitat in other sub-basins are expected to use the lower White Salmon River for thermal refuge. The White Salmon River is currently thought to be used by bull trout from other sub-basins as foraging, wintering, and thermal refuge habitat. After dam removal, migratory fluvial bull trout may establish a new spawning population in the upper White Salmon River that utilizes habitat in the lower White Salmon River, Bonneville pool, and nearby sub-basins. Bull trout are the salmonid species most vulnerable to elevated water temperatures and require stepping-stone thermal refuge sites along their migratory corridors during periods of elevated water temperatures in the Bonneville pool.

Southwest Washington/Columbia River Cutthroat Trout

The NMFS transferred jurisdiction for coastal cutthroat trout to the USFWS, which withdrew the proposed rule to list the southwestern Washington/Columbia River DPS of the coastal cutthroat trout as threatened. The coastal cutthroat trout in the White Salmon River basin is now considered a species of concern by the USFWS. As Columbia River gorge populations recover, migrating adults and juveniles from other sub-basins are expected to use the lower White Salmon River for thermal refuge.

Lower Columbia River/Southwest Washington Coho Salmon

The ESA listing status came under review and the status of the ESU was changed from candidate to threatened in the final listing determination. A critical habitat designation has not been proposed. Migrating adults and juveniles from other sub-basins are expected to use the lower White Salmon River for thermal refuge.

4.3.2 Impacts

Pre-Dam Removal Activities

Pre-dam removal activities that may affect aquatic resources include new access road construction, upgrading existing roads, preparation of staging areas and disposal sites, preparation of work areas, potential fuel or chemical spills from equipment and storage areas, and stabilization of the Northwestern Lake Bridge. The main effects will be temporary turbidity and sedimentation in the aquatic habitat, which might affect productivity of aquatic insects or the usability of the habitat. All of these potential impacts are considered short-term construction effects.

Access Roads, Staging Areas, and Disposal Sites

Vegetation, topsoil, and rock in some locations would be removed from the sites as part of construction or road widening for the new or upgraded access roads, staging areas, and storage/disposal sites, as described in the Project Description (PacifiCorp 2004). Most of the project work areas would be accessible by existing roads, but roads would require widening, upgrading, and, in some cases, realignment. A former reservoir access road along the east shore of the lake would have to be rebuilt. This road would cross a small stream (Condit Creek) and associated wetland. Road extensions would be necessary to access proposed work areas at the base of the dam, surge tank, and other staging and work areas. Vehicle use on gravel access roads would generate sediment that may affect stream habitat.

Seven work areas would be utilized for the project (Figures 3-1 through 3-5). Except for parts of SA-3 and SA-4, all sites are cleared of native vegetation and are grassy fields. SA-5 was recently cleared of apple trees in preparation for planting pears. Part of a stand of second-growth conifer forest would be removed at SA-3. Part of a stand of deciduous trees would be removed to create SA-4. Staging areas would be converted from their present uses to gravel pads, and disposal sites would be cleared of vegetation and topsoil.

Water runoff would increase, and that runoff would carry sediment to the tributaries, the reservoir, or the river. Access roads within the current reservoir area would require fill materials to be placed on the sediment. The movement of sediment and effects of sediment on aquatic habitat would be considered short-term construction effects and would be minimized by routine application of BMPs. Applicable BMPs would not prevent the smallest sediment particles from transport by surface runoff during storm events, and some fine sediment would flow into receiving bodies such as the lake and river. The sediment delivery to the river is most likely to occur during the period when turbidity would be high from the sediment in the reservoir being removed. Because of the size of the receiving bodies and the application of BMPs, the impact of suspended sediment from construction areas to the aquatic environment would likely be small and inconsequential.

A fueling station would be located at staging area SA-2. Fueling of remote equipment would most likely be accomplished by tanker trucks. Besides fuel, chemicals that could potentially be spilled include lubricants and solvents. Hazardous chemicals would be stored in secured storage areas with secondary containment. Spill prevention and spill containment plans would be implemented for preventing or addressing the contingency of a spill occurring or chemical contaminants reaching the lake or river.

Northwestern Lake

Stability of Northwestern Lake Bridge would be addressed by isolating the bridge piers with sheet piles (PacifiCorp 2004). A minor disturbance of the bottom sediment is expected to occur as the sheet piles are driven in place. Work near the riverbanks would cause sediment to be released into the lake if the work occurs before the reservoir is drained. Pile driving would create hydrostatic shock waves. Sound waves from impact pile driving have been associated with direct mortality to fish (Hastings and Popper 2005). Direct mortalities can occur due to the rupture of swim bladders. In studies reviewed by Burgess et al. (2005), the levels that led to damage of the ear were 60 to over 100 dB above threshold levels, as determined behaviorally (Fay 1988). Fish in the vicinity of a pile driver often exhibit a startle response, but do not move away from the source of the sound. A short-term unavoidable adverse impact to local fish populations would occur due to the mortality of fish in the immediate proximity of pile driving activities. Other short-term adverse impacts include those caused by increased turbidity (minor effects) or accidental spills of hazardous chemicals such as fuel.

Dam Breaching and Removal

Drain Tunnel

Water used in drilling into the dam to develop the drain tunnel would be collected and removed from the site. The concrete rubble from creating the tunnel would be captured to prevent it from getting into the river. When the last 15 feet of the tunnel is blasted to release the reservoir, it will be impossible to capture the concrete. That concrete might raise the pH of the river water temporarily. If the pH rises too much, aquatic organisms can be adversely affected, and levels above pH 9 are likely to be increasingly lethal to salmonids, especially if the increase is rapid (Wagner et al. 1997). Downstream from the powerhouse, the pH would be monitored continuously and compared with background levels. Blasting would be accomplished in accordance with the Blasting Plan (PacifiCorp 2004). According to a report by Squier Associates (1998), immediately after the final blast to breach the tunnel in the dam, the pH of the stream may reach lethal levels (pH of about 11.4) quickly and then decrease to nominal levels. A check of the assumptions used by Squier Associates and recalculation revealed that any spike in pH is likely to be diluted to less than lethal levels in less than a minute and be near normal in 15 minutes or less. Elevated pH water is not likely to go downriver as far as the powerhouse.

Any fish in the vicinity of blasting in-water prior to breaching, especially in the reservoir, would likely suffer hydrostatic shock and die from a ruptured air bladder. A reasonable assumption, based on projected levels of total suspended solids in the water, is that all fish within the White Salmon stream channel below the dam are likely to be killed by the load of suspended solids that would occur directly following dam breaching. Some fish may survive the sediment and be flushed into the Bonneville pool of the Columbia River. Many of the fish in the reservoir would be flushed downstream at this time and most of these fish probably would be killed. Fish that are not flushed below the dam after the initial breaching would either be stranded on the dewatered reservoir substrate or end up in the new stream channel created in the bed of the reservoir. The load of suspended solids would likely kill most of these fish, but some may survive to migrate downstream to the Bonneville pool or upstream into tributaries or the river above the reservoir.

All of the benthic macroinvertebrates present in the stream channel, such as freshwater mussels and aquatic insects, also are likely to be killed by suffocation or burial. The level of suspended sediments would diminish over time. Within 7 to 30 days, the average sustained levels of suspended sediments should drop to concentrations that are not immediately lethal (with an exposure of 12–24 hours), but still lethal over an exposure period of several days (Bash et al. 2001). However, where populations of aquatic organisms are eliminated, they will have to recolonize. The length of time needed for recolonization will depend on how rapidly the substrate returns to habitable condition for the species and the distance, accessibility, and mechanisms the colonizing organisms must overcome. Full recolonization is likely to take several years and possibly longer for some. However, there should be more accessible habitat for all of the species except those adapted for reservoir existence.

Potential impacts related to petroleum products and erosion in upland areas would be similar to those described above for pre-dam removal activities.

Once space is available, a trash rack would be installed on the upstream side of the tunnel to collect woody debris that might plug the tunnel and interfere with sediment transport and fish passage (PacifiCorp 2004). As the tunnel is constructed, holes would be drilled in the sides of the tunnel to provide resting pockets for fish as they pass through the tunnel. This is intended to reduce the velocity barrier to migrating salmonid passage until the dam is completely removed.

Sediment Transport

Immediately after draining the reservoir, sediment would be deposited downstream in the floodplain areas as the river flow subsides. This sediment would then be further transported downstream during natural storm and flood events and additional sediment from the reservoir and upstream would be moved downstream by the river, especially during storm flows and when reservoir sediment slumps occur. The repeated movement of high concentrations of sediment in the water would have major effects on fish and other aquatic organisms for several months.

Increases in sediment would prevent fish from entering the river until the concentration of suspended sediments reduces to a level that fish can tolerate during upstream migration (at least the first three months). Fish remaining in the river channel that develops in the bed of the reservoir or chum salmon and winter steelhead migrating through the Bonneville pool may attempt to enter or migrate through the lower White Salmon River after the initial breaching of Condit Dam. Temporary reductions in suspended sediment concentrations may occur during dry periods with low flows, but if fish move into the river, they would be vulnerable to the next spike of sediment concentration. The only refuge habitat would be in accessible reaches of Mill Creek, Buck Creek, and the White Salmon River and its tributaries between RM 5.0 and RM 16.2. These areas would not become accessible to fish moving upriver from below the dam until the removal of the cofferdam in May of the following year. Spawning or rearing habitat would therefore not be available for anadromous salmonids until the removal of the cofferdam. It is reasonable to assume that no natural recruitment of fall-run Chinook salmon or chum salmon would occur during the fall and winter following the breaching of the dam and that one year-class of fry naturally produced in the White Salmon River would be lost. Chum salmon are not likely to enter Bonneville pool or its tributaries until after Condit Dam is breached. The high levels of suspended sediments in the White Salmon River below the dam site are expected to prevent chum salmon spawners from entering, and any chum salmon that may have been expected to spawn in the White Salmon River will either spawn in other tributaries of the Columbia River or drop back over Bonneville Dam and spawn in the Columbia River mainstem. No chum salmon smolts would be produced in the White Salmon River and be imprinted to return to the White Salmon River during the years following dam removal. Hence, a potential year-class of chum salmon smolts imprinted to return to the White Salmon River would not be produced. The number of adult chum salmon documented in the White Salmon River in recent years is very small and is likely composed of strays from a spawning population in the mainstem of the Columbia River below Bonneville Dam. Stray chum salmon from the spawning population in the Columbia River below Bonneville Dam have the potential of providing seed stock for the eventual recolonization of the White Salmon River by chum salmon, but do not represent a viable White Salmon River population.

Although natural spawning of fall-run Chinook would not occur during the year of dam removal, PacifiCorp has proposed to capture and transport to a hatchery the fall Chinook returning to the White Salmon River before the dam is breached in October. Out-planting of the juveniles back to the White Salmon River after river conditions are again suitable would have a high chance of preventing a major effect on the year-class. As a result, although a year-class of naturally spawned fall-run Chinook salmon would be lost, the year-class would be supplemented by hatchery smolts produced from spawning Chinook salmon captured from the White Salmon River.

Run size during the years the lost year-class would be expected to return as mature spawners would be reduced and composed entirely of spawners from other year-classes. This impact would be long-term (at least several 3- to 5-year generation cycles for Chinook and chum salmon). There is some variation in age-at-return for Chinook and chum salmon year-classes and over several generations, the lost year-class would rebuild. The number of generation cycles required would be dependent on the survival rates of year-classes immediately prior and subsequent to the year-class lost. In the case of chum salmon, the number of documented spawning adults in the White Salmon River is very low and likely represents strays from a population below Bonneville Dam that have the potential of eventually recolonizing the White Salmon River basin and reestablishing a viable population. The loss of one or two stray chum salmon during the removal of Condit Dam would not be expected to have a measurable effect on the number of potential chum salmon colonists entering the White Salmon River and other Columbia River tributaries above Bonneville Dam.

Sediments released during the initial draining of the reservoir also have the potential to damage or fill-in the intake structure and ponds of the U.S. Fish and Wildlife Service's fish rearing facility at RM 1.4. PacifiCorp would take measures to protect and restore the rearing facility from high flows and reservoir sediments.

During the high flows immediately following the beaching of the dam, the White Salmon River would compose approximately 7 percent of the average flow of the Columbia River (G&G Associates 2004a and 2004b, PacifiCorp 2005). During the period immediately following the breaching of the dam, suspended sediment concentrations would be relatively high. After mixing with the Columbia River for about three miles downstream from the mouth of the White Salmon River, water in the reservoir may have suspended sediment concentrations of 2,300 to 5,800 ppm; at Bonneville Dam, the concentrations may range from 1,100 to 2,600 ppm; and in the lower Columbia River, the concentrations may range from 900 to 2,200 ppm (G&G Associates 2004a and 2004b and PacifiCorp 2005). Except for the immediate vicinity of the mouth of the White Salmon River, Columbia River fish are unlikely to be harmed by sediment entering the river, but they may be displaced from the most sediment-laden portions of the plume until it has completely mixed with the Columbia River, approximately three miles downstream from the mouth of the White Salmon River. Beyond this point, the plume will continue to dissipate through settling and further dilution by Columbia River tributaries, but may briefly interfere with foraging behavior and predator-prey relationships through the Bonneville pool and downstream of Bonneville Dam (PacifiCorp 2005, Korstrom and Birtwell 2006). Predation upon juvenile salmonids will be minimized because dam breaching will occur after the downstream migration of salmonid smolts through the Bonneville pool has been completed, when few juvenile salmonids are present or rearing.

After the initial six hours, the White Salmon River would return to a normal flow and make up only approximately 0.6 percent of the Columbia River flow. This would dramatically reduce suspended sediment concentrations as they mix with the Bonneville pool. The anticipated concentrations would range from 200 to 1,700 ppm after complete mixing with the Columbia River a few miles downstream from the mouth of the White Salmon River; from 100 to 750 ppm at Bonneville Dam; and from 80 to 625 ppm in the lower Columbia River (G&G Associates 2004a and 2004b and PacifiCorp 2005). After approximately the first week, sustained concentrations in the Columbia River would be at essentially background levels, with brief spikes in concentrations occurring over the first month. Fish should only be displaced from an area on the north side of the river downstream of the mouth of the White Salmon River, and migration in the Columbia River should not be impacted. Downstream of this area, interference with foraging behavior and predator-prey relationships may persist for two to three days and intermittently for several weeks within Bonneville pool. Downstream of Bonneville Dam, no potentially adverse effects are anticipated after the initial sediment plume passes (PacifiCorp 2005).

Even after episodic suspended sediment levels drop to sub-lethal levels (probably by six months) fish may exhibit avoidance behavior and stray to nearby watersheds. Sub-lethal levels of average sustained concentrations of suspended sediments would continue for approximately an additional six months, causing sub-lethal (physiological, behavioral, or habitat) effects to fish and other aquatic organisms. Once migration resumes for steelhead trout in the lower river, fish can migrate to less turbid habitat upstream of the lakebed where resting pools are available. If one assumes that no barriers to migration exist at the dam and coffer dam sites in spring and early summer, summer-run steelhead returning to the river in the summer following dam breaching should be able to pass upstream to suitable spawning habitat above the reservoir site. High levels of turbidity during the first six months following dam removal may prevent winter-run steelhead from entering the White Salmon River. These fish would likely seek out other rivers in which to spawn. If White Salmon River winter-run steelhead remain in the Bonneville pool until turbidity levels drop in the spring, they may not be able to pass the cofferdam site until removal is completed. If winter-run steelhead cannot access spawning gravels above RM 5.0 before late spring (May or June), a year-class of age-0 (juveniles produced during the spring of the year of dam removal) winter-run steelhead will be lost. This would substantially reduce the number of expected returning adult winter-run steelhead 4 years in the future, when the majority of the lost year-class would have been expected to return. During that year, the return of winter-run steelhead would be primarily composed of 3-year-old steelhead and strays from other river basins. Returns of winter-run steelhead would likely be reduced every fourth year for several generation cycles. A portion of the previous year-class of steelhead juveniles (age-1 fish) would also be lost. This impact will be long term and recovery will occur in a similar fashion to that of chum and fall-run Chinook salmon.

Until fine sediments deposited from the reservoir are cleaned out of gravels by higher velocity storms or spring runoff and the effects of salmon cleaning their redds during spawning, gravels will be embedded and egg-to-fry survival would be poor in the reach of the river from the head of the lake bed (RM 5.0) to the mouth of the river. As levels of suspended sediment are reduced over time and channel-building flow events redistribute bedload through the stream channel, pool habitat would deepen and gravels and cobble will become less embedded. Deposition of fine sediment between gravel particles is a natural process that happens in riverbeds. The spikes in sediment concentration in the White Salmon River described in Section 4.1-4 are related to potential major floods that would provide sufficient movement of bedload sediments to mitigate the plugging of gravels by fine sediment. The predicted spikes in sediment concentration after five years are minor compared to the amount of natural sediment carried in a glacial river draining the Cascade Mountains during flood stage. West coast salmonids evolved in and are adapted to a natural environment that sends periodic pulses of suspended and bedload sediments down river channels.

Spawning gravels in the lower 5 miles of the White Salmon River should begin to become usable by spawning salmonids within one to two years of dam breaching as fines are flushed from the embedded gravels during higher flows (Beschta and Jackson 1979, Bash et al. 2001), and fines embedded within the interstitial spaces of spawning gravels should reach a point of equilibrium with the environmental baseline level within three to five years. The benthic macroinvertebrate community in the lower 5 miles of the river would not recover to baseline levels until the substrate composition approaches an equilibrium condition, where gravel recruitment and fine sediment deposition reach a balance with bedload transport, gravel storage, and flushing flows. During the first year or two after dam breaching, much of the benthic substrate would be composed largely of silt and sands. Benthic macroinvertebrates colonizing this habitat from upstream reaches of the river would not find appropriate habitat until channel building processes produce a suitable substrate, similar to that of the river above Condit Dam. The benthic macroinvertebrates are an important component of salmonid rearing, so a secondary impact of the dam removal would be the effect on salmon and steelhead rearing from the slow recovery of the benthic invertebrates that are the primary food base for the juvenile fish. The recovery of both the macroinvertebrate populations and spawning and rearing habitat for anadromous salmonids are likely to occur over approximately the same time frame. In the long run, substantially more suitable area will be available than before the dam is removed.

Following the 1980 eruption of Mount St. Helens, many fishery managers predicted that recovery of aquatic organisms and salmonid populations would take decades because riverine habitats had been so extensively damaged. The two major Toutle River tributaries (South Fork Toutle River and Green River) eroded through mudflow or tephra-fall deposits and returned to preeruption streambeds within a few years (Bisson et al. 2005).

Returning adult salmon and steelhead to the Toutle River watershed were scarce for the first 3 years after the eruption (Lieder 1989). Peak suspended sediment concentrations of 1,770,000 mg/L were recorded in the Toutle River and were often greater than 10,000 mg/L for several years after the eruption, yet some adult steelhead returned to the river during the first year after the eruption (Bisson et al. 2005). Mudflows continued in the Toutle River system for years following the 1980 eruption. Numbers of steelhead redds (egg deposition sites) observed in the mainstem of South Fork Toutle River rose from 0 in 1980 to an average of 5.7 redds/km in 1984 and further to 21.5 redds/km in 1987 (Lucas and Pointer 1987).

After an initial population crash from direct mortality from debris flows and exposure to high temperatures and levels of suspended sediments, a rapid posteruption rebound in primary productivity, aquatic and terrestrial invertebrate populations, and rearing salmonid populations occurred (Bisson et al. 2005). Within 2- to 3-years, productivity and the abundance of invertebrates and rearing fish reached preeruption levels and by 5-years, productivity and abundances exceeded preeruption levels. A gradual return to the range of preeruption abundance occurred after the initial spike in abundance, with a return to the natural range approximately 15 years after the eruption (Bisson et al. 2005).

The larger sediment particles (gravel and larger) would not move downriver of the dam until the dam and probably the cofferdam are removed. The deposition of granular material in the in-lieu site and development of a stable channel may eventually provide a habitat similar to that which naturally occurred at the mouth of the White Salmon River before the creation of the Bonneville pool. It is likely that the majority of the production of fall-run Chinook salmon before the construction of Condit Dam occurred in the lower 2.6 miles of the river and particularly in the low gradient reach near the mouth of the river. Juveniles produced in this stretch are limited to the habitat available below falls such as the one at RM 2.6, because they cannot ascend over any but the most minor falls. This section of the river would not experience significant recruitment and production of Chinook and chum salmon until spawning gravels become established and free of fines in approximately 3 to 5 years. Chinook salmon would be able to spawn in gravels in the river and several tributary streams upriver after the removal of the cofferdam, where available spawning and rearing habitat appears to equal or exceed that presently available below Condit Dam. Compared to Chinook salmon, chum salmon have less capacity to leap water falls and generally do not migrate as far upstream as Chinook salmon, particularly in higher gradient rivers with frequent falls, such as the White Salmon River (Johnson et al. 1997). Reiser et al. (2006) set the maximum jumping height of chum salmon as 4 feet. The fall at RM 2.6 on the mainstem of the White Salmon River and other falls on the mainstem may be barriers to the upstream migration of chum salmon adult spawners. Because chum salmon characteristically utilize the lower reaches of high-gradient streams, they may not be able to access this habitat, and additional year-classes may be lost until clean spawning gravels are formed in the lower couple of miles of river channel. The documentation of two adult chum salmon is not evidence that chum salmon are actually reproducing in the White Salmon River at the present time, but represents the potential for eventual recolonization of the river if suitable spawning habitat is available. The long-term effect would be an improvement of spawning conditions for chum salmon and fall-run Chinook salmon, but it is not known at this time if chum salmon would be able to utilize additional habitat above the dam.

After coarse sediments can move past the dam, pools in the river below the dam will be filled with coarse sediments. It would then likely be 1 to 2 years before the stream power of the river could remove and redistribute enough bedload to restore the pools, depending on storm flows. Once migration resumes for steelhead trout in the lower river, fish could migrate to less turbid habitat upstream of the lakebed where resting pools are available.

Any California Floater mussels present in the river channel or the in-lieu site would be killed through physical burial during the flushing of sediments from the reservoir. The river channel would not be reseeded again with young California Floaters until host fish reenter the river channel as flow and suspended sediments subside. More area suitable to them may be available after the substrate upriver of the dam becomes suitable.

After dam breaching, sediment accumulations with an average depth of approximately 5 feet would occur in the Columbia River downstream from mouth of the White Salmon River. This area would extend into the Columbia River channel about 1,500 feet and downstream for about one mile, and cover about 100 acres (PacifiCorp 2005). The Bonneville pool is about 4,000 feet wide at this location and sediment depth would be expected to be zero in the navigation channel. Benthic macroinvertebrates, such as crustaceans, aquatic insects, and freshwater mussels will be physically buried (PacifiCorp 2005). With the exception of mussels, recolonization should occur within 6 months to a year. Mussels have longer life-spans and are relatively slow growing and would take more time to recolonize new substrates.

As part of the Settlement Agreement, sediment deposited at the in lieu site could be removed by the Tribes with mitigation money for maintenance in order to ensure boat access. Any such actions would be undertaken at the discretion of the Tribes and would be the subject of separate permits and review. Channel dredging and deepening at the in lieu site might reduce the total area of spawning gravel created at the mouth of the White Salmon River after dam breaching and might therefore have a long-term impact on available spawning habitat for Chinook and chum salmon.

Dam and Appurtenance Removal

Impacts associated with dam and appurtenance removal are primarily associated with the use of haul roads, staging area, and disposal sites. These impacts have been described above. When the surge tank tailrace is filled in for safety reasons, BMPs would be used to avoid the release of fine sediments or concrete particles into the river channel. Impacts to fish from spills and leaks of fuel and hazardous chemicals would be similar to those described above.

As described above under sediment transport, the cofferdam could create a barrier to the passage of winter-run steelhead to usable spawning gravel above RM 5.0 during the first year following dam breaching. Blasting during cofferdam removal would create short-term effects by killing any fish in the vicinity of the blast through hydrostatic shock. If the cofferdam is removed soon after the reservoir is drained and while the sediment levels exclude winter-run steelhead, then blasting would have little or no effect. If the cofferdam cannot be removed until later, when both winter-run and summer-run fish may be stopped just below it, then blasting would have major mortalities unless the fish were trapped and removed or the cofferdam was removed mechanically without blasting.

Tributary Deltas

After dam breaching, Little Buck Creek and Mill Creek would not be able to down-cut through the cobble and large gravel deposited in the deltas created where the streams enter Northwestern Lake until major storm events transport the material to the White Salmon River or the material is removed during post dam removal sediment management. The likely result would be a fish barrier at Mill Creek that would probably prevent upstream migration of fish from the river. Until Mill Creek down-cuts to its original channel and access to migratory salmonids is restored, a short- or long-term adverse impact would occur to fluvial and anadromous salmonids. The channel could be modified mechanically to remove the barrier, and PacifiCorp has agreed to do that once at the time equipment is in the vicinity for sediment management work, after the reservoir is drained.

At Mill Creek, the residual delta sediments, if left to wait for storm removal, might provide a relatively large slug of sediment that could produce safety or habitat concerns later. The sediments at tributary deltas will be evaluated as part of the evaluation of unstable sediments following draining of the reservoir.

Potential Impact of Anadromous Salmonids on Resident Rainbow Trout

The establishment of anadromous rainbow trout (steelhead) above Condit Dam is unlikely to have a measurable impact on the population of river-resident rainbow trout in the mainstem of the White Salmon River where conditions are most favorable for resident rainbow trout (Cramer et al. 2003 and 2005, Nielsen 2005). It is, however, possible that a portion of the production of small stream resident rainbow trout and juvenile rainbow trout in the Rattlesnake Creek subbasin may convert to juvenile steelhead trout. This would be due to the low flows and high temperatures of the Rattlesnake Creek watershed favoring the production of steelhead juveniles over resident rainbow trout. Cooler tributaries entering from the west (Buck and Mill Creeks) are likely to have habitat more favorable to resident rainbow trout (Cramer et al. 2003 and 2005). Production of steelhead smolts upstream of Husum Falls is likely to be low due to the mainstem habitat being favorable to the production of resident rainbow trout and difficult upstream passage for juvenile steelhead trout produced in tributary streams below the falls. Additional information about the interactions of resident and anadromous rainbow trout ecotypes can be found in Section 5 of Appendix C.

If hatchery supplementation is used to reintroduce a reproducing population of steelhead trout, impacts to resident rainbow trout populations can be minimized by methodologies listed in Section 5 of Appendix C.

Beneficial Effects of Dam Removal on Fish

Potentially, 32.4 miles of new steelhead habitat and 15.3 miles of new salmon habitat may be accessed by anadromous salmonids after dam removal, increasing the run size and long-term viability of anadromous salmonid populations in the White Salmon River and increasing the availability of salmon and steelhead angling opportunities in the White Salmon River basin. The benefits of restoring access to anadromous and migratory salmonid habitat in the White Salmon River through the removal of Condit Dam are discussed in the Washington Conservation Commission WRIA 29 limiting factors report (WCC 1999) and the White Salmon River subbasin summary prepared for the Northwest Power Planning Council by WDFW (2000) and are part of the larger recovery effort for ESA-listed salmonids in the lower Columbia River. New thermal refuge habitat for migrating Columbia River anadromous salmonids from other sub-basins also would be accessible after the removal of Condit Dam. Additional stream habitat for resident fish would be created in the lakebed of the former reservoir. Additionally, the small increase in water temperature below Condit Dam from the discharge of warmed reservoir surface water would be eliminated, improving the quality of thermal refuge, and the recruitment of gravel and large woody debris from sources above the dam site would be reestablished. Foraging, wintering, and refuge habitat, and possibly spawning habitat, would be created for Columbia River bull trout. Juvenile anadromous salmonids would provide forage for bull trout, and salmon carcasses in the watershed above the site of Condit Dam would provide an additional source of marine-derived nutrients to the watershed. There would be more suitable substrate for stream-dwelling aquatic macroinvertebrates after the stream substrate has stabilized.

Post-Removal Management

Upstream Sediment Management

Unstable slopes, high angles of repose, and lateral channel migration until the river and its tributaries downcut to their original bedrock channels would create temporary pulses of suspended sediments that can have physiological and behavioral impacts to fish that can result in injuries, stress, reduced foraging efficiency, increased predation rates, etc. (Bash et al. 2001).

Coarse sediment and large woody debris released during dam removal may create debris dams that create fish passage issues. The banks of the channel created by the river down-cutting through lakebed sediments are likely to be deep and have a very steep angle of repose. Deep drawdowns for dam maintenance operations on dams in the Boise River watershed of Idaho created extensive flats of mud and sand through which the river down-cut, creating steep banks that slough continually as the river migrated laterally (Salow 2004). Bank sloughs can have lethal consequences for fish as radio tagging studies have shown. During a study by Salow (2004) stationary tags often had to be dug out of a bank slough along with the tagged fish that was buried during the collapse of the streambank (Salow 2004). This could be a problem for returning fish, especially during the first year after breaching the dam.

Blasting to stabilize slopes or remove debris jams during the migration of winter- and summer-run steelhead in the spring and summer following dam breaching would expose steelhead to hydrostatic shock, and some fish mortalities are likely to occur in proximity to blasts.

Any fish occupying lacustrine habitat at the time of dam removal would probably be flushed through the tunnel and downstream to the Bonneville pool. Many will be killed by high concentrations of suspended solids suffocating them or direct physical injury, but those that survive the trip down to the Bonneville pool would probably resume a lacustrine or lacustrine-adfluvial life history in the pool.

Downstream Sediment Management

Immediately after breaching of the reservoir, sediment would be deposited in the floodplain areas at progressively lower levels as the river flow subsides. This sediment would be transported downstream during natural storm and flood events. Woody debris trapped behind the dam would be washed downstream and accumulate at various points along the river, creating log-jams. If woody debris in the river does not interfere with downstream transport of large quantities of bedload or normal development of streambanks, it would help to store gravel in the river channel to eventually be used as spawning gravel. If blasting is required to redistribute large woody debris, any fish in the proximity of blasts would likely be killed by hydrostatic shock. Attempts to scare fish away from blasting are unlikely to be successful unless some form of chemical can be used as a repellent (perhaps the scent of a predator).

The deposition of granular material in the in-lieu site and development of a stable channel may eventually provide a habitat similar to that which naturally occurred at the mouth of the White Salmon River before the creation of the Bonneville pool. It is likely that the majority of the production of fall-run Chinook salmon before the construction of Condit Dam occurred in the lower 2.6 miles of the river and particularly in the low gradient reach near the mouth of the river. Juveniles produced in this stretch are limited to the habitat available below falls such as the one at RM 2.6 because they cannot ascend over any but the most minor falls.

The banks of the channel created by the river down-cutting through sediments deposited at the in-lieu site also may e deep and have a very steep angle, well above the stable angle of repose. Bank sloughs can have lethal consequences for fish, as described above in the upstream sediment management section. The situation may be prevented if the dam is breached at a time when the Bonneville pool is at the low end of the range of pool depths.

4.3.3 Cumulative Impacts

The notable potential cumulative impacts from removal of the Condit Dam relate to management of the fish and fisheries in the river. The new fish stocks that will occur above the current dam site would undoubtedly attract fishermen. A definite potential exists for the fishermen to adversely affect resident trout populations while pursuing anadromous fish. This would be both an indirect and a cumulative impact, since fishermen currently catch resident trout in the reservoir and the river system above it. The impacts are manageable by WDFW fishing regulation modifications and enforcement. Therefore, there is no need to consider the effects to be either significant or unavoidable.

The other potential adverse cumulative effect could result from supplemental hatchery actions that might be used to help the anadromous fish stocks to become established after the dam is removed. If fish stocks are brought in from elsewhere to get a start or supplement the establishment, there are risks of causing unintended adverse impacts on other stocks, such as interactions with residual steelhead, or introgression that might reduce their fitness, or outright competition. Specific measures can be taken to minimize or avoid such impacts (Nielsen 2005). Therefore, these effects also are avoidable or manageable to a level that would probably be insignificant. All such actions would be managed by the state and federal resource agencies responsible for the fish.

There would also be long-term cumulative beneficial impacts, since there are regional efforts to recover populations of anadromous salmonids. The regional efforts would be furthered by the removal of Condit Dam.

4.3.4 Mitigation Measures

Pre-Dam Removal Activities

Haul Roads, Staging Areas, and Disposal Sites

- To reduce the delivery of fine sediments to the White River stream channel, areas where soil has been disturbed will be revegetated in accordance with the plan for revegetation of the reservoir area and other areas disturbed by construction activities (PacifiCorp 2004).

- Fill placed in support of temporary roads on reservoir sediments will be removed once roads are no longer needed, and erosion stabilization will be used for all roads, storage areas, or construction staging areas.

- Compliance monitoring will be independent from construction activities. At the end of the proposed action, all work sites will be regraded and revegetated to stop erosion and the release of fine sediments into the White Salmon River associated with these activities.

- The spill prevention and spill clean-up plans will be used to prevent or minimize impacts to fish from spills and leaks of fuel and hazardous chemicals.

Northwestern Lake

- Silt curtains will be used during sheet pile installation to minimize silt entrainment in the water, or construction will be performed as the water level is lowered. In either case, silt entering the water column will be minimized (PacifiCorp 2004). Any work near the river will use erosion control mats and silt fencing to protect the river and aquatic fauna from sediment release.

- Hazardous chemicals and fuel would be stored in secured storage areas with secondary containment. Spill prevention and spill containment plans would be in place for the contingency of a spill occurring or chemical contaminants reaching the lake or river.

Dam Breaching and Removal

Drain Tunnel

- Water used for drilling into the dam to develop the drain tunnel will be collected and removed from the site.

- Concrete rubble from construction of the tunnel will be captured and prevented from entering the river. After dam breaching, any blocks of concrete that get in the stream will be removed. Downstream from the powerhouse, pH will be monitored continuously and compared with background levels.

- Blasting will be accomplished in accordance with the Blasting Plan (PacifiCorp 2004). A temporary weir below the dam site or cofferdam could prevent upstream migrating winter and summer steelhead from approaching closely enough to be injured during blasting, if their presence interferes with removal activities.

- A fuel spill and clean up plan will be in place to mitigate any spills of fuel or hazardous chemicals that occur.

Sediment Transport

- The dam will be breached in late autumn to take advantage of the rainy season when there will be fewer adverse effects on aquatic life.
- Dislodging unstable sediment and woody debris will help ensure that the reservoir sediment is transported downstream over the predicted three- to five-year period and does not affect long-term water quality, pool depths, or spawning gravels.
- Heavy equipment should be used to cut channels through tributary lake sediment delta at Mill Creek to hasten the creation of a stable stream channel and prevent fish passage blockage by the sediment.
- PacifiCorp has proposed to capture and transport to a hatchery the fall Chinook returning to the White Salmon River before the dam is breached in October to prevent the loss of a Chinook year-class.
- PacifiCorp will take measures to coordinate with managers and protect the USFWS fish rearing facility at RM 1.4 from high flows and reservoir sediments.

Dam and Appurtenance Removal

- Use of BMPs will avoid or minimize impacts associated with the use of haul roads, staging area, and disposal sites, and filling the surge tank tailrace.
- Cofferdam removal will either occur as soon as possible after dam removal and be accomplished by blasting while suspended sediment levels excluded upstream migrating fish, or mechanical means will be used rather than blasting. The cofferdam will be removed by May following dam breaching so that steelhead returning to the river can pass quickly upstream to less turbid areas of the stream or its tributaries.

Post-Removal Management

Upstream Sediment Management

- After the initial dam breaching, sediment management will be conducted above the dam until all unstable slopes have been stabilized and areas of bare sediment in the former lakebed are revegetated.
- Heavy equipment should be used to cut through the delta and lake sediments overlaying the Mill Creek (RM 4.0) channel to avoid barriers to fish passage forming at head-cuts and to shorten the time required to stabilize the stream channel.
- If blasting is used to stabilize slopes or remove debris, it should be confined to daylight hours when salmonids are least likely to be actively moving. This will reduce the number of fish exposed to hydrostatic shock from blasting activities.

4.3.5 Significant Unavoidable Adverse Impacts

All fish and aquatic macroinvertebrates within the White Salmon River channel downstream of the dam would likely be killed or displaced by the load of suspended solids released during dam breaching. While the actions having the effects will be short-term in duration and will diminish as the level of suspended sediments is reduced over time, the effect on populations of macroinvertebrates would likely take several years to fully reestablish.

One potential year-class of chum salmon naturally spawned in the White Salmon River would be lost because of the high concentrations of suspended and deposited sediment and their inability to access stream habitat above the dam or cofferdam. Potential chum salmon spawners that enter the Bonneville pool during the fall and winter immediately following dam removal would spawn in other tributaries of the Columbia River or in the mainstem of the Columbia River. Potential chum salmon production is not expected to be lost, but chum salmon smolts that are imprinted to return to the White Salmon River would not be produced. This impact would be long term (at least several 3- to 5-year generation cycles for chum salmon), but slight because chum salmon are in the early stages of recolonizing tributaries of the Bonneville pool through the process of straying from natal spawning grounds below Bonneville Dam. Because of their poor jumping ability relative to other species of salmon in the White Salmon River, adult chum salmon may not be able to pass a fall located at RM 2.6 on the mainstem of the White Salmon River to utilize spawning habitat located upstream of Condit Dam. In addition, it is likely that the spawning substrate necessary for their reproduction will be impaired by fine sediment during the second year (and not fully recovered for 1 to 3 years after that). New gravel recruited from upstream may not reach the lower 2.6 miles during that time, and what gravel does reach the lower portion of the stream will likely be heavily embedded with fine sediments. The result would be essentially a potential loss of several naturally produced year-classes of chum salmon smolts that have been imprinted to return to the White Salmon River. The number of documented spawning adult chum salmon in the White Salmon River is very low and likely represents strays from a population below Bonneville Dam that have the potential of eventually recolonizing the White Salmon River basin and reestablishing a viable population. The loss of these stray chum salmon during the removal of Condit Dam and recovery of spawning gravels in the lower White Salmon River would not be expected to have a measurable effect on the number of potential chum salmon colonists entering the White Salmon River and other Columbia River tributaries above Bonneville Dam. The increase in available spawning habitat in the White Salmon River after natural channel building processes remove deposited fine sediments should increase the potential for a successful recolonization of the White River basin by chum salmon. The removal of Condit Dam may also open available chum salmon spawning habitat above the dam, but chum salmon characteristically spawn in the lower reaches of high-gradient rivers and may not migrate past the fall at RM 2.6 or upstream above the Condit Dam site. Large returns of chum salmon can cause competition for spawning gravel and cause chum salmon to migrate farther upstream than normal. However, even if none of the falls present in the river below Condit dam or under reservoir sediments is a barrier to chum salmon migration, this is unlikely to occur at the present levels of chum salmon occurrence in the White Salmon River.

Natural spawning by the year-class of fall-run Chinook salmon returning to the White Salmon River during the year of dam removal would be lost due to the high concentrations of suspended and deposited sediment and their inability to access stream habitat above the dam or cofferdam. Although natural spawning of fall-run Chinook will not occur during the year of dam removal, PacifiCorp has proposed to capture and transport to a hatchery the fall Chinook returning to the White Salmon River before the dam is breached in October to mitigate for the loss of natural spawning for one year-class of Chinook salmon. After restoration of passage through the dam site and the removal of the cofferdam, fall-run Chinook salmon would be able to access upstream spawning and rearing habitat. Therefore, subsequent year-classes should have adequate spawning and rearing areas in the upstream reaches.

Sediments flushed out of the reservoir would settle at the mouth of the White Salmon River and fill in the large pool between RM 0 and RM 0.5. These sediments also would likely fill in the pools and runs in the lower 2.8 miles of the White Salmon River between RM 0.5 and RM 3.3. High flow events subsequent to dam removal would transport the sediments deposited in pools above RM 0.5 and form a channel over 100 feet wide and up to 17 feet deep through the deposited sediments. This would likely occur within one year of dam removal. There would be an unavoidable short-term impact to available thermal refuge until sediment deposited in 1) pools between RM 0.5 and RM 3.3 and 2) the lake bed between RM 3.3 and RM 5.0, is transported to below RM 0.5 and a channel forms below RM 0.5. However, new thermal refuge habitat would be available above RM 5.0 as soon as passage is possible past the dam and cofferdam sites. When passage is restored past the cofferdam, there would be a net gain in available thermal refuge that would increase over time as sediments deposited in pools after dam breaching are removed by high flow events. The quality of thermal refuge below the dam site will also be slightly improved because of lower water temperatures after dam removal.

During the period immediately following the breaching of the dam, suspended sediment concentrations entering the Bonneville pool would be relatively high and the discharge of the White Salmon River would make up approximately seven percent of the Columbia River flow. Columbia River fish may be displaced from the most sediment-laden portions of the plume until it has completely mixed with the Columbia River, approximately three miles downstream from the mouth of the White Salmon River (PacifiCorp 2005). Beyond this point, the plume may briefly interfere with foraging behavior and predator-prey relationships through the Bonneville pool and downstream of Bonneville Dam (PacifiCorp 2005, Korstrom and Birtwell 2006). Because there are listed fish that would be in the Bonneville pool at that time, this has been considered a take by NMFS (2006).

After the initial six hours, the White Salmon River would return to a normal flow and make up only approximately 0.6 percent of the Columbia River flow, dramatically reducing suspended sediment concentrations as they mix with the Bonneville pool. After approximately the first week, sustained concentrations in the Columbia River would be at essentially background levels, with brief spikes in concentrations occurring over the first month. Fish may be displaced from an area on the north side of the river downstream of the mouth of the White Salmon River, but migration in the Columbia River should not be impacted (PacifiCorp 2005). Downstream of this area, interference with foraging behavior and predator-prey relationships may persist for two to three days and intermittently for several weeks within Bonneville pool. Downstream of Bonneville Dam, no potentially adverse effects are anticipated after the initial sediment plume passes (PacifiCorp 2005).

After dam breaching, sediment accumulations with an average depth of approximately 5 feet would occur in the Columbia River downstream from mouth of the White Salmon River. This area would extend into the Columbia River channel about 1,500 feet and downstream for about one mile, and cover about 100 acres (PacifiCorp 2005). The Bonneville pool is about 4,000 feet wide at this location and sediment depth is expected to be zero in the navigation channel. Benthic macroinvertebrates, such as crustaceans, aquatic insects, and freshwater mussels would be physically buried (PacifiCorp 2005). With the exception of mussels, recolonization should occur within six months to a year. Mussels have longer life-spans and are relatively slow growing and would take more time to recolonize new substrates.

Blasting during the removal of Condit Dam, the cofferdam, sediment slopes, or woody debris jams would create hydrostatic shock waves that cause direct mortalities to any fish in the vicinity of a blast. It is unlikely that fish in the vicinity of a charge, such as upstream migrating steelhead spawners, can be removed or scared away before detonation, and removal before blasting would be impractical. A short-term unavoidable adverse impact to local fish populations would occur due to the mortality of fish in the proximity of blasting activities (if blasting activities occur when fish are present).

Northwestern Lake would no longer exist to provide lake habitat for lake-resident trout and char or lacustrine fish species. The loss of the reservoir sport fishery would be a long-term adverse impact, but not significant to the fish.

Sediments flushed out of the reservoir would bury and kill any adult California floaters, if they are present in the river below RM 3.3. If any adult California floaters are present in Northwestern Lake, they would be flushed downstream and deposited in pools. California floaters that are deposited near the surface of the substrate in appropriate habitat may survive, while those that are buried or deposited in fast riffles and runs are unlikely to survive. Depending on the presence of adult California floaters upstream of the reservoir or the reestablishment of a population from the migration of host fish into the river reach below RM 5.0, a short- or long-term unavoidable adverse impact may occur if California floaters are present in the White Salmon River below RM 5.0.

4.4 WETLAND RESOURCES

This section evaluates wetland resources that could be affected as a result of the proposed action.

4.4.1 Affected Environment

Three types of wetlands associated with the project may be affected by the removal of the Condit Dam and reservoir. Lake-fringe wetlands located along the edge of the reservoir (Northwestern Lake) depend entirely on the reservoir for water. Riverine wetlands associated with tributary streams receive their water from the stream. Slope wetlands are fed as seeps by groundwater discharge. Where tributary streams intersect the lake, the delta wetlands are influenced by both the lake and stream water. Likewise, where seep wetlands extend to the lake, the intersecting edge is influenced by both sources of water. Wetlands downstream from the dam are stream margin/floodplain (riverine) wetlands.

In 1991, Ebasco identified 17 wetlands with a total acreage of 3.4 acres (Ebasco 1991). CH2M Hill updated the wetland delineation in 2003, locating 22 wetlands totaling about 6.7 acres (CH2M Hill 2003). Differences between the 1991 and 2003 surveys are likely due to a number of causes, including but not limited to temporal changes, wetland type and boundary definition differences, increased survey accuracy, and use of digital orthophotography. URS staff identified one additional wetland (Wetland 26) in May 2005 that is associated with a recent revision to the access road corridor.

Wetland numbers assigned during the 1991 Ebasco survey were retained by CH2M Hill in 2003. However, this resulted in the omission of some wetland numbers. Remaining wetland numbers are not consecutive. For example, the 2003 wetland delineation combined some wetlands (Wetlands 4 and 9 became Wetland 9), reclassified one wetland as a “vegetated shallow” (Wetland 1), and omitted others not observed during the 2003 assessment (Wetlands 13 and 14). New wetlands were given higher consecutive numbers.

All delineated wetlands are identified as non-tidal palustrine wetlands dominated by trees, shrubs, or persistent emergent vegetation. Existing wetland conditions are summarized in Table 4.4-1. Detailed descriptions of Wetlands 2 through 25 are available in the Wetland Delineation and Functional Assessment Report for the Condit Hydroelectric Project Removal (CH2M Hill 2003). Wetlands 2 through 25 are shown on Figure 4.4-1.

There are twelve lake-fringe wetlands (Wetlands 2, 3, 7, 9, 11, 17-20, and 23-25) around Northwestern Lake, one of which (Wetland 3) contains a substantial slope wetland component. Lake-fringe wetlands total about 4 acres in area. Wetlands 2 and 3 account for 2.4 of these acres and are rated as Category III wetlands using the Washington Department of Ecology Rating System for Eastern Washington (Ecology 2002). The remaining ten lake-fringe wetlands are rated as Category IV wetlands. Three additional slope wetlands occur on the slopes of the reservoir (Wetlands 6A, 6B, and 21). Slope wetlands total just over one acre. All four of the slope wetlands are rated as Category III wetlands. Four riverine wetlands (Wetlands 5, 8, 10, and 12) are situated on deltas associated with tributary streams

Table 4.4-1
Summary of Wetland Areas, Classes, and Ratings

Wetland ID	Total Acreage	Acreage by Cowardin Class			Acreage by Hydrogeomorphic Class[a]			Ecology Rating Category for Eastern Washington		WSDOT Functional Assessment	
		PEM[b]	**PFO[c]**	**PSS[d]**	**Lake Fringe**	**Riverine**	**Slope**	**Based on Functions**	**Based on Special Characteristics**	**Functional Assessment Description**	**Rating Category (H/M/L)[e]**
Northwestern Lake Reservoir											
2	1.6	1.0	0.6		1.6			III	N/A	Likely	High
3	1.3	0.8	0.5		0.8		0.5	III	N/A	Likely	High
5	0.4	0.4	0.0[f]		0.0[f]	0.4		II	N/A	Likely	High
6A	0.2		0.2				0.2	III	N/A	Not Likely	Low
6B	0.3		0.3				0.3	III	II	Likely	Moderate
7	0.1	0.1			0.1			IV	N/A	Not Likely	Moderate
8	0.1	0.0[f]	0.1		0.0[f]	0.1		II	II	Likely	High
9	0.8	0.8			0.8			IV	N/A	Not Likely	Moderate
10	0.1	0.0[f]	0.1		0.0[f]	0.1		II	II	Likely	High
11	0.2	0.2			0.2			IV	N/A	Not Likely	Moderate
12	0.4	0.1	0.3		0.1	0.3		III	N/A	Likely	High
17	0.0[f]	0.0[f]			0.0[f]			IV	N/A	Likely	Moderate
18	0.0[f]	0.0[f]			0.0[f]			IV	N/A	Not Likely	Moderate
19	0.2	0.2			0.2			IV	N/A	Not Likely	Moderate
20	0.0[f]	0.0[f]			0.0[f]			IV	N/A	Not Likely	Moderate
21	0.0[f]		0.0[f]				0.0[f]	III	N/A	Not Likely	Low
23	0.0[f]	0.0[f]			0.0[f]			IV	N/A	Not Likely	Moderate
24	0.0[f]	0.0[f]			0.0[f]			IV	N/A	Not Likely	Moderate
25	0.0[f]	0.0[f]			0.0[f]			IV	N/A	Not Likely	Moderate
26	0.0[f]	0.0[f]					0.0[f]	IV	N/A	Not Likely	Low
Total	*5.7*	*3.6*	*2.1*	*0*	*3.8*	*0.9*	*1.0*				
Downstream of Condit Dam											
15	0.5			0.5		0.5		III	N/A	Likely	High
16	0.3	0.3			0.3			IV	N/A	Likely	Moderate
22	0.2	0.2			0.2			IV	N/A	Likely	Moderate
Total	1.0	0.5		0.5	0.5	0.5					

a. Hydrogeomorphic class highlighted in bold used for Ecology Rating.
b. PEM - palustrine emergent wetland
c. PFO - palustrine forested wetland
d. PSS - palustrine scrub/shrub wetland
e. Rating Category for WSDOT Functional Assessment added for clarification; defined by number of function categories provided: High = 11-14; Moderate = 6-10; Low = 0-5
f. 0.0 indicates where wetlands were delineated but were less than 0.05 acre, which is rounded to zero.

Source: CH2M Hill (2003) with wetland 26 added by URS Corporation.

Figure 4.4-1 Wetlands 2 Through 25 in the Project Vicinity

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Figure 4.4-1 (Continued)

and contain one edge that is lake fringe. Delta wetlands total 0.9 acre in area. Wetlands 5, 8, and 10 are rated as Category II and Wetland 12 along Condit Creek is rated as Category III.

Wetland 26 was identified by URS staff during a May 30, 2005 site visit to review recent changes in the proposed deconstruction plan. It is shown on Figure 4.4-2. This 4-foot-wide by 45-foot-long (0.004 acre) roadside wetland is located about 1,000 feet southeast of Condit Dam directly west of Powerhouse Road. This palustrine emergent slope wetland is watered by a seep that appears to receive seasonal groundwater discharge fed by an irrigated orchard about 100 feet upslope on the opposite side of Powerhouse Road. Water moves through the small wetland and continues across the surface of the existing dam access road before infiltrating underground further down the slope. In the winter there may be more flow causing the downslope section to be an ephemeral stream for a short distance, but there are no wetland characteristics beyond the area delineated as Wetland 26. Soils were saturated to the surface with free water at 10 inches in the soil pit during the May 30, 2005 site visit. The dark brown (10YR 3/3) A soil horizon to 9 inches over a deep dark grayish brown (10YR 3/2) B soil horizon generally matches the Hood loam soil series identified for this site in the Natural Resources Conservation Service (NRCS) Soil Survey of Klickitat County (CH2M Hill 2003, Haagen 1990). Soils are possibly relic disturbed or fill material from the adjacent two roadways. Dominant vegetation includes the herbaceous giant horsetail (*Equisetum telmateia*/FACW) and bluejoint reedgrass (*Calamagrostis canadensis*/FACW+). Other species present include cleavers (*Galium aparine*/FACU), small fruited bulrush (*Scirpus microcarpus*/OBL), and creeping bentgrass (*Agrostis stolonifera*/FAC). Wetland 26 is rated as a Category IV wetland. The wetland data sheet is available in Appendix D.

4.4.2 Impacts

Pre-Dam Removal Activities

Wetland 12 would be partially filled for construction of a haul road between the eastern end of the dam and the proposed concrete storage/disposal area. A culvert is anticipated to be placed within the wetland at the Condit Creek crossing. At the probable crossing location, the delta wetland is up to 25 feet wide on each side of the creek where it meets the lake. Because the road would need to turn just past the crossing, it is presumed that a culvert 40 feet long would be required. Up to 1,000 square feet of wetland on each side of the Condit Creek crossing could be filled.

At Wetland 21, a maximum of 875 square feet of wetland would be filled in order to complete the concrete storage/disposal area haul road, if it follows the old road route at this point. Since this would include the point of discharge of the seep that feeds the wetland, it is presumed that the seep would be culverted to allow it to continue supplying water to the downslope part of the wetland. It appears that the road could be rerouted at this location to avoid part of the wetland and put the road farther from a cabin. If that is done, the wetland impact is estimated to be about 440 square feet.

Wetland 26 would be filled during expansion of the access road from Powerhouse Road to the lower side of the dam for construction vehicles and machinery. It is presumed that all of Wetland 26 (180 square feet) would be excavated and/or filled in order to build the access road to the lower part of the dam. However, the seep would continue to generate water. The new slope between the Powerhouse Road and the access road is likely to regrow wetland vegetation. Therefore, there may be only a short temporal loss of wetland area and function at this location.

Altogether, up to 3,055 square feet, or 0.07 acre of wetland would be filled for the access road construction. About 2,000 square feet of the affected Wetland 12 would be dewatered by the draining of the lake and would lose a key feature that makes it a wetland.

Dam Breaching and Removal

Lake-fringe Wetlands 2, 3, 7, 9, 11, 17, 18, 19, 20, 23, 24, and 25 would lose their primary hydrologic source with the drawdown of Northwestern Lake. It is reasonable to assume that all of Wetlands 7, 9, 11, 17, 18, 19, 20, 23, 24, and 25 would no longer be wetlands. However, it is also reasonable to assume that part of Wetlands 2 and 3 would remain as wetlands watered by a seep (Wetland 3) or an ephemeral stream (Wetland 2) or other runoff and seepage from the slope not previously identified. Therefore, it is reasonable to assume that Wetland 3 would shrink from a total of 1.3 acres to about 0.8 acre and that Wetland 2 would shrink from 1.6 acres to about 0.6 acre. The total reduction in lake-fringe wetland would be approximately 2.8 acres.

Tributary riverine Wetlands 5, 8, 10, and 12 would decrease in size and extent below the point where these streamside wetlands are influenced by the hydrologic patterns of Northwestern Lake. Over time, the streams would cut down through the deposited delta sediments and the adjacent wetland areas would no longer have wetland hydrology. A reasonable assumption is that the wetland area would be reduced by half (0.5 acre total). This reduction includes the 2,000 square feet of Wetland 12 that would be filled for the access road. However, the tributaries will continue to be tributaries, and pockets of wetland may develop along the route between the current lake edge and the restored confluence with the White Salmon River. It is not unreasonable to expect that among the dozen or so tributaries, that the collective area of associated new wetland would total 0.5 acre, and perhaps as much as 2 acres (PacifiCorp 2004).

Slope/lake fringe Wetlands 3, 6A, 6B, and 21 would lose their lake-fringe components. However, it is reasonable to assume that the seeps would influence additional areas downslope at each location. This phenomenon has been accounted for regarding Wetland 3. Wetlands 6A and 6B are located toward the upper end of the reservoir, where the slope exposed by removal of the reservoir would be less than further downstream. However, the sediments in the lake are relatively deep in that area, and any residual deposits directly wetted by the seep or spring from above would likely become wetland. It is therefore reasonable to conclude that Wetlands 6A and 6B would increase in size to 0.3 and 0.45 acre, respectively. Wetland 21 is in an area with steeper and higher sidewalls, so it would probably remain very narrow and increase less than 0.1 acre in size. The net increase in wetland area at Wetlands 6A, 6B, and 21 would be expected to be 0.25 acre. It is also likely

Figure 4.4-2 Wetland 26 in the Project Vicinity

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Figure 4.4-2 (Continued)

that removal of the reservoir would expose many more seeps that would support wetland vegetation over time. A modest estimate would be that a total of 0.5 acre of new wetland seeps would appear within the reservoir. One likely problem with the developing wetlands is the spread of reed canarygrass and other invasive species from areas that are now lake-fringe wetlands. These mitigation wetlands are expected to be similar to ones being lost, but not ideal for mitigation. Active management would be required to prevent dominance by reed canarygrass near where thriving populations of it occur.

Wetlands 15, 16, and 22, located downstream of the dam, would experience higher than normal levels of scouring and sedimentation as Northwestern Lake is drawn down and built-up sediments within the reservoir are flushed downstream. The flows would be within the range of normal seasonal flood events and much smaller than the 1996 flood, but the sediment load would be dramatically higher. Two wetlands identified by Ebasco in 1991 apparently disappeared with the 1996 flood and were not found in 2003 by CH2M Hill. Any wetlands that are at seeps would probably recover as wetlands after the sediments have stabilized. Wetlands that are located on sediment adjacent to the river in this reach would recover in place if the sediment and wetness during the growing season are about the same after the dam breaching events are past and sediments have stabilized. However, the equivalent areas (sediments adjacent to the river that are wetted during the growing season by the river) could either be smaller or larger than prior to dam removal. Since this reach of the river has been sediment-starved because the dam has stopped downstream movement of sediment, it is reasonable to expect that the net area of such streamside wetlands would increase as a result of deposition of sediment from the reservoir and continued movement of sediment through the system. A conservative estimate is that such wetlands would occupy twice as much area in this reach of the river as previously. That would be a net increase of 1 acre. However, the lower segment of the river is part of the Bonneville pool of the Columbia River. There will be more sediment dropped in this segment both during dam breaching and by ongoing sediment movement in the river thereafter. Therefore, a more realistic estimate of wetland increase as wetland vegetation colonizes the sediment kept wet by the river in the lower part of the White Salmon River would be higher, perhaps as high as 2 acres total. Of course, the streamside wetlands would be subject to variation in size and character as a result of flooding effects.

Some wetland development is expected along the river upstream of the dam in areas where sediment deposition occurs. A conservative estimate is that it would be comparable to the area currently downstream of the dam, or somewhere between 0.5 and 1.0 acre.

Post-Removal Management

The primary effects of activities after dam removal on wetlands will be from two activities. If wetlands have to be crossed by access roads to stabilize the sediments or remove woody debris, then there would be additional wetland loss, at least temporarily. If tributary delta sediments have to be manipulated in order to prevent fish passage barriers from developing, then the activities of machines such as dozers and trackhoes may hasten the conversion of some delta wetlands to uplands.

4.4.3 Mitigation Measures

This is a project with very little opportunity to avoid wetland impacts. There may be an opportunity to route the access road from the dam to the concrete storage/disposal area to minimize impacts to Wetland 21, but that will depend on engineering feasibility and impact trade-offs with forest clearing. Wetlands directly associated with the reservoir or the river cannot be avoided nor impacts minimized.

On the other hand, the changes associated with removing the dam and reservoir provide the natural regeneration of wetlands that will be worthy of consideration as compensation for the unavoidable losses of wetlands. In addition, other benefits of dam removal tend to offset impacts on lake-associated wetlands. The wetland impacts and expected new wetlands are summarized below.

While these totals (both impacts and mitigation) differ somewhat from those in the Wetland Mitigation Plan (PacifiCorp 2004), it appears that the total area of currently existing wetland would be very similar to that after the Condit Project is gone and the system has stabilized (1 to 5 years). The specific functions would be different for some wetlands and the same for others. Overall, the wetlands being lost are category III or IV lake-fringe wetlands. These wetlands would probably be replaced with Category III wetlands, with potential for some to become Category II over time. If monitoring as proposed by PacifiCorp (2004) shows that a smaller amount of wetlands develop than shown in Table 4.4-2, it would be necessary to determine whether manipulation of residual reservoir sediment may be possible to increase the amount of wetland in certain areas.

Table 4.4-2
Summary of Impacted Wetland Areas and Expected New Area

Wetland Type	Impact Area (acres)	Expected New Area (acres)
Lake-fringe wetlands	2.8	—
Slope wetlands	0.024	0.75
Tributary riverine wetlands	0.5	0.5 or more
Mainstem riverine wetlands	1.0 temporary impact	2 downstream, 1 upstream
Totals	3.324 permanent, 1 temporary	4.25 or more

4.4.4 Significant Unavoidable Adverse Impacts

Unavoidable adverse wetland impacts include the loss of approximately 2.8 acres of lake-fringe wetlands. These impacts are expected to be mitigated by the establishment of riverine and slope wetlands within 1 to 5 years of dam removal.

4.5 TERRESTRIAL RESOURCES

4.5.1 Affected Environment

The vegetation cover was well described in the 1996 FERC FEIS (FERC 1996). The FEIS described 13 upland plant community types in the study area. About two-thirds of the upland area was occupied by relatively undisturbed plant communities, primarily forests and woodlands. About a third of the study area was occupied by modified cover including pastures, orchards, and residential areas. Those cover types are essentially the same in 2005.

The 1996 FEIS described six habitats of special concern. The Oregon White Oak Forest is found on slopes above the lower part of the White Salmon River and will not be affected by removal of the Condit Project. Wetlands are discussed in Section 4.4 of this SEPA SEIS. Old-growth forests do not occur in the immediate vicinity of the project. Some patches of mature second-growth forest do occur, and one of these mature stands will be affected by the access road from the dam to the concrete storage/disposal site. Riparian areas occur along tributaries that enter the reservoir and along the river downstream from the dam. The lake fringe has some areas of vegetation that are riparian in nature and that will be far from the water after the dam and reservoir are gone. Cliffs were noted as a prevalent habitat occupying two percent or about 59 acres. The 1996 FEIS concluded that the project lands do not provide suitable deer wintering habitat.

The 1996 FEIS adequately described most of the wildlife resources of the project area, potentially including 84 species. Additional language covering the northwestern pond turtle (*Clemmys marmmorata*) and Canada lynx (*Lynx canadensis*) was added to the FSFEIS (FERC 2002). Neither the 1996 FEIS nor 2002 FSFEIS addressed insects. There is some potential that the Columbia River tiger beetle (*Cicindela columbica*) may use sand shores of the Bonneville pool and lower reaches of the White Salmon River (Leffler 1976 and 1979). This species depends on sandy, unvegetated habitats, in which they lay eggs and burrow. Larvae dig tunnels as deep as 12 inches where they prey on other insect species. The Columbia River tiger beetle is a Washington State candidate species (WDFW 2005).

The threatened and endangered species potentially in the project area were discussed in the 1996 FEIS and in the 2002 FSFEIS. The 1996 FEIS discussed five plant species listed by the state of Washington as sensitive or monitor species. Based on 2005 information, the green-fruited sedge and the yellow sedge are either no longer considered sensitive species or are not reported from Klickitat County.

4.5.2 Impacts

Pre-Dam Removal Activities

Site inspections of 1) the areas to be cleared of vegetation and graded at the staging areas and disposal sites, 2) the Mt. Adams Orchard diversion structure replacement area, 3) the work areas for the temporary water supply pipeline, and 4) the access roads showed that none of the priority species or habitats occur in those locations. Therefore, there will be no impacts on the protected plant or animal species.

Dam Breaching and Removal

Sedimentation or scour of downstream riparian habitat from dam removal and woody debris removal is likely to remove or kill much of the vegetation. The new deposits of sediment along the river edge will be colonized by riparian vegetation. The end result will be a similar amount of riparian area, but there will be some temporal loss.

Sediment will probably cover and kill any existing Columbia River tiger beetle larvae occupying sandy beach habitat along the White Salmon River. The amount of available sandy beach habitat in the lower reach of the river should increase significantly after dam breaching and Columbia River tiger beetle populations, if they exist in the project area, should recover quickly to a higher than pre-project levels due to the increase in available habitat. This increase should be long-term, but will decrease over time as sandy sediments are transported from the lower reach of the river and into the Bonneville pool.

Post-Removal Management

No new impacts are expected.

4.5.3 Mitigation Measures

- PacifiCorp has provided a revegetation plan designed to encourage development of natural habitats.
- PacifiCorp will contribute $25,000 (1999 dollars) for habitat enhancement.

4.5.4 Significant Unavoidable Adverse Impacts

There will be no significant unavoidable adverse impacts.

4.6 TRANSPORTATION

This section addresses the impacts of the proposed action on transportation and traffic in the project area. The project area extends from the Northwestern Lake Bridge to the White Salmon River's confluence with the Columbia River at the in-lieu site near the Underwood in-lieu site. The methodology adopted for impact assessment process included contacts with federal, state, and local agencies, as well as field observation.

4.6.1 Affected Environment

Site Area Roadway System

The proposed project would be located in an area west of SR 141, north of the junction of SR 141 and SR 14 in Skamania and Klickitat Counties. The dam would be accessed during demolition by SR 141 and Powerhouse Road and/or new access roads when they are developed. The existing roadway system in the vicinity is shown on Figure 4.6-1. The roadways potentially affected by the proposed project include:

- **SR 141 –** SR 141 is a northwest/southeast limited access roadway that originates at the Indian Heaven Wilderness in the Gifford Pinchot National Forest and ends at SR 14. The posted speed limit is 55 mph and it is classified as a Rural Major Collector by the Washington State Department of Transportation (WSDOT). The 2004 WSDOT *Annual Traffic Report* shows traffic on SR 141 north of the spur intersection is approximately 4,000 vehicles per day.

- **SR 14 –** SR 14 is an east/west highway that runs along the Washington State side of the Columbia River from I-82 in Benton County to I-5 in Clark County. SR 14 is classified as a Rural Principal Arterial by WSDOT. The posted speed limit in the study area is 55 mph. The *Annual Traffic Report* (WSDOT 2005) shows traffic along the SR 14 corridor before the SR 141 intersection to be 6,500 vehicles per day (vpd), with 5,700 vehicles per day east of the intersection with SR 141.

- **Powerhouse Road –** Powerhouse Road is a 2-lane (one lane in each direction) local access road in Klickitat County with a 25 mph posted speed limit. The first 0.6 mile off SR 141 is paved, with the rest (approximately 1.78 miles) composed of gravel surface on an easement provided by Northwestern Electric in 1939. Previous traffic counts on Powerhouse Road 0.3 mile west of SR 141 showed a count of 211 vpd on July 21, 2001, and 108 vpd on May 13, 2003. It is likely the 2001 count included seasonal traffic, resulting in a higher than average count. For the 2003 count, vehicle classification counts showed truck percentages of 10.7 percent in the southbound direction and 3.8 percent in the northbound direction for the pm peak hour. Klickitat County reports no accidents on this roadway in the past three years.

- **Graves Road –** Graves Road is a paved 2-lane (one lane in each direction) local access road in Klickitat County without a posted speed limit (speed limit is based on conditions up to 50 mph). There is no existing count, but it is estimated that 50 vpd use this roadway. There have been no accidents reported to Klickitat County in the past three years on this roadway.

- **Northwestern Lake Road –** Northwestern Lake Road is a paved 2-lane (one lane in each direction) local access road in both Klickitat and Skamania Counties with a posted speed limit of 35 mph. Previous traffic counts (taken on Northwestern Lake Road east of the Northwestern Lake Bridge) shows a count of 874 vpd in 2001 and 939 vpd in 2003. For the 2003 traffic count, vehicle classification counts showed a truck percentage of 4.4 percent in the westbound direction and 5.8 percent in the eastbound direction for the pm peak hour. It should be noted that the 2003 count was a Saturday count and classification counts may not be accurately reflected. The bridge that crosses the lake (Northwestern Lake Bridge, located 1.8 miles upstream from the dam) has load restrictions on it and is posted as one-way truck traffic. In other words, a truck must wait until there is no oncoming traffic and drive down the middle of the bridge. Sufficient sight distance exists in both directions. There have been no accidents reported in Klickitat County in the past three years on this roadway.

- **Cabin Road –** Cabin Road is a private roadway within Skamania County, but isn't owned or maintained with County funds. This roadway may be used as a portion of an access roadway in conjunction with post removal management efforts. See Figure 3-4 for location. (Cabin Road is designated AR-15 on the figure.)

- **Tamarack Lane –** Tamarack Lane is a private roadway in Klickitat County owned by SDS Lumber Company that may be used to access the concrete disposal area. Only temporary use of this roadway is projected. See Figure 3-4 for the location.

Existing Traffic Volumes

Traffic data for SR 14 and SR 141 were obtained from WSDOT. In addition, manual traffic count data was obtained from Skamania and Klickitat Counties and presented above. Not all roadways had counts available.

The average daily traffic (ADT) for the study area roadways is shown in Table 4.6-1. Using a conservative factor of 1 percent per year growth (even though traffic counts in the area for 2002 through 2004 showed no change or a slight decline), an estimate of traffic on each roadway can be calculated and is shown in Table 4.6-1.

For the pm peak travel period on Powerhouse Road, approximately 10.7 percent of all vehicles were trucks traveling in the southbound direction and approximately 3.8 percent of all vehicles were trucks for the northbound direction. For conversion from vehicles/day to peak hour, 10 percent of all daily traffic usually occurs within the peak period. For the volumes listed below, these are two-way counts. To obtain a northbound/southbound or eastbound/westbound split, more information would be necessary.

Figure 4.6-1 Existing Roadway System

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Figure 4.6-1 (Continued

Table 4.6-1
Existing and Estimated Future Traffic Volumes

Location	Year of count	Traffic count (vehicles/day)	Year 2008 Estimated Traffic (beginning of Demolition) (vehicles/day)[a]
SR 141 (north of SR 141 spur)	2004	4,000	4,162
SR 141 (south of Glenwood Highway)	2004	2,400	2,497
SR 14 (west of SR 141 intersection)	2005	6,500	6,697
Powerhouse Road (0.3 miles west of SR 141)	2003	108	114
Graves Road	-	50 (estimated)	55 (estimated)
Northwestern Lake Road (east of Bridge)	2003	939	987
Cabin Road	--	--	--

Notes: State road counts (SR 14 and SR 141) were included in the Annual Traffic Report (WSDOT 2005). Other roadway counts were provided by Klickitat County.

a Estimates of 2008 traffic are based on known traffic counts and applying a 1percent growth rate from the last known years' traffic count and projected to 2008.

Existing Level of Service

Roadway Level of Service

Using the highway segment analysis for a 55 mph two-lane rural highway (SR 141 and SR 14), the LOS of the roadway segment can be calculated. LOS is an estimate of the performance efficiency and quality of a roadway as established by the Transportation Research Board's Highway Capacity Manual (2000). The system used in the manual measures the degree of delay along segments of roadway and at intersections using the letter rating "A" for the least amount of congestion and letter rating "F" for the largest amount of congestion, as shown in Table 4.6-2 for segments and Table 4.6-3 for intersections. An LOS of C or better is typically considered to be acceptable for a rural setting such as found in this project. If the LOS falls below the allowable threshold, improvements are required to improve the capacity of the intersection or roadway section in question.

Table 4.6-2
Level of Service Standards for Roadways (per lane per hour)

Facility Type	Free-flow Speed	A	B	C	D	E
Freeway	55 mph	550	880	1,320	1,744	2,250
Principal Arterial	50 mph	540	900	1,260	1,503	1,800
	45 mph	510	850	1,190	1,419	1,700
	35 mph	453	756	1,058	1,261	1,600
	30 mph	378	630	882	1,051	1,500
Minor Arterial	35 mph	398	664	928	1,105	1,400
	30 mph	369	616	862	1,025	1,300
	20 mph	284	474	663	789	1,000
Collectors	30 mph	398	663	927	1,105	1,400
	25 mph	341	568	795	947	1,200
Local Streets	25 mph	-	-	250	-	-

Source: Transportation Research Board (2000), Table 12-15

Table 4.6-3
Level of Service Standards for Intersections

Level of Service	Signalized Intersections	Unsignalized Intersections	Expected Delay to Minor Street Traffic
A	delay ≤ 10 seconds	delay < 10 seconds	Little or no delay
B	10 seconds < delay ≤ 20 seconds	10 seconds < delay ≤ 15 seconds	Short traffic delay
C	20 seconds < delay ≤ 35 seconds	15 seconds < delay ≤ 25 seconds	Average traffic delay
D	35 seconds < delay ≤ 55 seconds	25 seconds < delay ≤ 35 seconds	Long traffic delay
E	55 seconds < delay ≤ 80 seconds	35 seconds < delay ≤ 50 seconds	Very long traffic delay
F	80 < delay	50 < delay	Even longer traffic delays

Source: Transportation Research Board (2000), page 10-15 and 17-2.

Using the classification of R1 (Rural Principal Arterial for SR 14 with a speed limit of 55 mph) and R2 (Rural Major Collector for SR 141 with a speed limit of 55 mph), along with Table 4.6-1, which lists the known daily traffic counts in the area, the LOS for the roadway segment can be found. Table 4.6-2 shows capacity per hour per lane. Therefore, in the pm peak hour (the worst case scenario), approximately 12 percent of the daily traffic can be attributed to that one hour. Therefore, for SR 14, SR 141, and the remaining roadways in the study area, the number of vehicles occurring in any one hour would result in an LOS A classification.

Intersection Level of Service

The second type of LOS calculation examines the intersection delay given the turning movements at a location. Table 4.6-3 shows the calculation for both signalized and unsignalized intersections.

No existing intersection turning movement counts were available. Therefore, intersection LOS data was not calculated, although with the low traffic volumes on SR 141 in the vicinity of the project, the LOS of the unsignalized intersection with Powerhouse Road (the proposed access point for all vehicles) should operate well within established acceptable levels of service.

Estimated Future Traffic Volumes

The proposed demolition of the Condit Dam is expected to begin in 2008. Traffic volumes in 2008 without the addition of demolition vehicles were estimated for the study area. The 2008 traffic volumes serve as the baseline condition for examination of the effects of the proposed project. Background traffic volumes were assumed to increase one percent annually between the last available traffic count year (2003 to 2005) and beginning of demolition (2008). This growth factor was based on the average annual population and labor force growth in the local region and from historical traffic data obtained from WSDOT. The resulting am and pm peak hour volumes along SR 141, SR 14 and Powerhouse Road are shown in Table 4.6-1. Since no intersection turning movement counts were available, no intersection LOS calculations were performed. With the increase in traffic occurring in the am and pm peak hours, and the minimal traffic occurring along SR 141 currently and projected in the future, the delay to vehicles traveling on SR 141 would be minimal.

Estimated Future Level of Service

The LOS analysis for the projected 2008 conditions show that peak hour traffic volumes along Powerhouse Road and SR 141 will continue to experience little delay, even with the assumed growth in background auto and truck traffic. Roadway segment LOS for SR 141 will remain at LOS A for 2008 without the additional traffic associated with the removal of Condit Dam. If concrete recycling is determined to be feasible and it occurs, the roadway segment and intersection LOS for SR 141 and SR 14 would not be reduced during construction, because the change in traffic volume is so small.

Parking and Demolition Site Access

Currently, the demolition site(s) for the dam are difficult to access directly. Northwestern Lake is adjacent to the demolition site to the east. Powerhouse Road is a partially paved local access roadway that intersects SR 141. Traffic associated with the current operations at the dam is minimal and seasonal at best.

Demolition access would be off Powerhouse Road with the possible construction of temporary access roads to staging or disposal sites.

4.6.2 Impacts

Pre-Dam Removal and Dam Breaching and Removal

The proposed project would affect traffic flow on roadways in the site area during construction (or demolition). During construction/demolition of the proposed project, an average of 25 workers would be employed at the site during the peak of dam removal. Approximately 75 truck roundtrips are anticipated for dam removal activities. The work is anticipated to occur from 8:00 am to 5:00 pm Monday through Friday. It is anticipated that 29,059 cy of concrete and 2,532 cy of steel-reinforced concrete material would be removed and relocated a few thousand feet upstream from the dam. Additionally, 5,100 lineal feet of wood stave flowline would be removed, stockpiled, and recycled. Further, the existing concrete surge tank (40-foot diameter, 45-foot-high steel reinforced concrete) would be disassembled and used to fill the spillway with the remainder to be recycled. All affected areas would be revegetated at the end of the project.

The proposed demolition of Condit Dam would bring additional truck trips to the area during demolition. An existing portion of Powerhouse Road as well as SR 141 and SR 14 would be impacted. New access roads would be built to accommodate access to/from dam removal and staging areas.

As the preferred method of disposal of the concrete, concrete recycling may occur if a suitable recycling operation is found. A scenario for this possibility is discussed under Trip Generation below.

Trip Generation

Construction activities for the proposed project would extend for approximately 12 months and would result in increased traffic activity in the area. Traffic delays could occur during the maneuvering of large vehicles and from the overall number of additional vehicles arriving at or leaving the proposed demolition site via Powerhouse Road. These additional vehicles would include construction workers and trucks delivering and removing materials.

Peak construction activity is estimated to last up to 8 months, with approximately 25 construction workers entering and leaving the plant site on a daily basis. It is likely no carpooling would occur to this site. Daily truck activity is estimated to be as high as 150 daily truck trips (75 truck roundtrips) during this peak construction period.

The concrete within the dam would be removed from the existing site, trucked to a location a few thousand feet upstream of the dam via project access roads, and staged for recycling or buried and covered on a site that is owned by PacifiCorp. The wood-stave flowline and the steel located in the site would be removed and temporarily stored at another site within a few thousand feet before recycling.

The distribution of construction traffic trips would be mostly on site, with the proposed removal of concrete to a site a few thousand feet upstream of the dam. Therefore, all construction workers would enter the site in the am peak period and leave in the pm peak period with trucks operating within the site throughout the day. Short-term delays are anticipated during the pm peak at the intersection of SR 141 and Powerhouse Road. No significant construction impact is anticipated.

SR 141 is a limited access highway, which allows for efficient travel time and increases overall safety of the SR 141 corridor. Short-term minimal potential impacts to travel safety may occur due to the turning movements of trucks onto and off of SR 141 at Powerhouse Road in the am and pm peak periods during peak construction.

Using projected work force and anticipated debris removal quantities, the number of anticipated vehicle trips for this project was calculated. A worst-case assumption was used assuming a workforce slightly higher than anticipated (25 employees) with each employee driving to work alone and accounting for 50 daily site trips (25 entering and 25 exiting). In addition, it is estimated that 150 daily site trips (75 entering and 75 exiting) would occur for service vehicles and haul trucks at the peak period. Therefore, a total of 200 daily vehicle trips (100 entering and 100 exiting) would be generated by the proposed project. It is anticipated that, under this scenario, the majority of truck trips would stay on site, removing concrete to a location a few thousand feet upstream of the dam.

The peak-hour generation includes a total of 43 vehicle trips per hour (all workers arriving and 18 truck trips for that hour). The am peak hour would result in approximately 34 vehicles entering and 9 vehicles exiting, while the pm peak hour would be the reverse, with 34 vehicles exiting and 9 vehicles entering.

It is anticipated that most of the employees and trucks to the Condit Dam demolition would come from SR 141 spur off of SR 14. Most of the trucks would use very short haul routes, under this scenario, to move concrete to the site a few thousand feet upstream of the dam and to temporary sites at a similar distance for storage of the wood-stave flowline and steel removal.

The potential project-generated traffic volumes were distributed onto the surrounding roadway network for the beginning and ending trips per day because most of the internal trips are on private or local roadways. Peak hour traffic volumes that include the proposed project (a total of 34 vehicle trips) were developed.

A peak hour LOS analysis for the roadway segments in the project area was undertaken. The results show that the small increase in traffic traveling to the study area as well as the intersection of SR 141/Powerhouse Road would cause little or no perceptible change to operations. As stated above, the maximum change would involve the addition of 9 truck trips and 25 vehicle trips (employees) traveling to the project site during the am and pm peak hours. This increase in truck and vehicle traffic only changes the operations minimally for any vehicle turning from Powerhouse Road onto SR 141 (the worst-case scenario).

If concrete recycling occurs, the location of the recycling would be off-site, assumed to be within 30 miles. Under this scenario, the approximately 30,000 cubic yards of concrete would require 3,000 truck loads, assuming 10 yards per load. If that is distributed evenly over the 8-month deconstruction period, it would be less than 3 loads per hour entering SR 141. The same number of empty trucks would return to the site. Those truck trips would be added to the vehicle trips noted above expected to travel on Powerhouse Road, SR 141 and SR 14. Under this scenario, the truck traffic would increase from 9 to 12 per hour. This change would not reduce the LOS on roadways and at intersections throughout the day. The additional trucks would slightly increase the potential for accidents.

Parking/Staging

Parking and staging areas would be necessary. Primary sites for staging are adjacent to Powerhouse Road next to the dam. These sites include an area occupied by a private residence (which would have to be purchased) and by a shed owned by PacifiCorp. There are additional small flat areas adjacent to access roads that would also be used as staging areas and parking areas. Areas would require the removal of existing buildings, clearing of vegetation, grading and gravelling (where necessary).

Alternative Access Roads

It is anticipated that alternative access roads would need to be constructed to allow access to different parts of the dam demolition. The project vehicle trip generation would be the same as described above. The building of alternative access points would still need to intersect Powerhouse Road or SR 141 at some point.

An alternative access road for removal of the demolished dam materials would result in the same trip generation. It is anticipated that most truck trips would be from the dam site to a few thousand feet upstream, the proposed concrete disposal site.

Post-Removal Management

Due to the demolition of the dam, stability concerns concerning the Northwestern Lake Road bridge have been raised in a report by DCI Engineers (2004). Sediment around the H-piles would be washed away, resulting in a decrease in lateral load capacity and a decrease in axial load buckling strength, possibly resulting in a collapse of the bridge. Erosion of the banks may cause settlement and collapse of the abutments and bridge piers. DCI Engineers has proposed a scheme to protect the four bridge piers and approach pavements.

4.6.3 Cumulative Impacts

The proposed project would create approximately 25 full-time jobs and an estimated 200 vehicle trips per day from the dam removal site. If the majority of trips being located on-site (removal of debris to areas approximately 1,000 feet upstream of the dam), the small increase in trips on local roads associated with the proposed project is not anticipated to create traffic congestion or a diminution of the LOS at any affected intersection. If concrete recycling occurs, there would be an increase in trips on local roads. This would result in some increase in traffic congestion and a slight increase in accident risk, particularly at intersections.

Other approved projects in the area are not anticipated to have overlapping construction and/or demolition periods. It is anticipated that construction/demolition vehicles for these overlapping projects traveling into or out of Washington State would be via SR 14 and not result in cumulative impacts on SR 141 or Powerhouse Road.

4.6.4 Mitigation Measures

This section discusses the proposed mitigation measures that would be implemented to reduce project-related impacts to traffic circulation in the project area.

Construction safety: Provide traffic safety signs during the 8-month peak demolition period warning vehicles traveling along SR 141, SR 14, and Powerhouse Road of upcoming truck access points.

Traffic and Parking: Promote ride-share and vanpool programs during the 8-month peak construction period for construction workers to reduce vehicle trips.

Access Roadways: Continued monitoring of access roadways constructed for this project to minimize erosion and stabilization problems. All access roadways should minimize alteration of existing native vegetation. If concrete recycling occurs, coordinate increased truck traffic on Powerhouse Road, SR 141, and SR 14 with WSDOT and local agencies. A traffic management plan would be developed and coordinated with the agencies.

If needed, repave or resurface roadway surfaces along Powerhouse Road, SR 141, SR 14 and other local roadways that may experience increased loading and volumes.

Northwestern Lake Road (Bridge): Implement the mitigation measures listed in the report by DCI Engineers (2004), including:

- Drive steel sheet pile to refusal at bedrock depth around the two central piers in a semi-circular pattern to create two separate cofferdams bounding the river channel.

- Build concrete wing walls and a crib structure, tying the existing bridge abutments to the new sheet pile cofferdams with circumferential galvanized cables near the top of the cofferdam wall.
- If embedment depth of piles into the bedrock cannot be ascertained by a geotechnical engineer, excavate the soil and dewater inside the cofferdam to an elevation near the bottom tip of the sheet piles. Provide temporary bracing to the existing piers and sheet pile walls in stages as required for temporary construction stability while the cofferdam soil is removed.
- Install reinforced concrete grade ties from the existing concrete pile caps to the new concrete wing walls to increase the lateral strength and stability of the pile caps. Anchor wing walls to the bedrock above the river channel with high strength grouted Dywidag Threadbar rock anchors.
- Backfill the cofferdam and concrete crib structure with granular structural fill to finish grade elevations.
- Provide riprap along river revetment slopes on both sides to protect shore from high velocity flow.
- Include provisions for navigational markers and, if necessary, signage on the bridge in accordance with accepted design standards.

4.6.5 Significant Unavoidable Adverse Impacts

With the implementation of the mitigation measures identified above, no significant unavoidable adverse impacts are expected to occur to transportation or traffic.

4.7 AIR QUALITY

This section addresses air quality impacts associated with the proposed removal of Condit Dam on the White Salmon River. The White Salmon River is the border between Klickitat and Skamania Counties and is also on the border between two cognizant air pollution control agencies.

4.7.1 Affected Environment

The region of interest to air quality is the immediate dam area and roadways that would be used by work crews and trucks for removing demolition materials. This extends from approximately the Columbia River to the upper end of the reservoir.

The White Salmon River is the boundary between Skamania County, which is in the Southwest Clean Air Agency (SWCAA) jurisdiction, and Klickitat County, which is under Ecology jurisdiction. Therefore, all activities that have the potential to affect air quality must be resolved with the appropriate agency. In actions such as this, the agencies often agree that a single agency will take the lead for engineering review and regulatory inspections. The lead agency for air quality is often the one that would issue a permit for permanent or temporary sources of air pollution, such as rock crushers or asphalt plants. No such facilities are identified in the project description or supporting documents. General rules regarding fugitive dust and non-permitted sources of air pollution are considered here.

Assuming a high degree of coordination and similarity of missions, the rules and policies of the SWCAA will be used as guidance in this analysis. The SWCAA is responsible for enforcing federal, state, and local outdoor air quality standards. This means areas outside of residences and businesses to which the public may reasonably have access. SWCAA has jurisdiction over all the sources of air pollution during dam removal except automobiles, which are the responsibility of Ecology statewide. SWCAA prohibits burn barrels and outdoor burning of all materials except natural vegetation grown on the property, and bans outdoor burning for fire safety, to avoid nuisances, and when air quality is impaired.

SWCAA and Ecology maintain air quality standards for a number of pollutants (Table 4.7-1). The standards specify the maximum concentration and duration of each pollutant, and the agencies operate a number of monitoring stations to ensure that air quality stays below the health and welfare standards.

Currently, all of these standards are attained in the project area. Because the project is in the Columbia Gorge, the additional air quality concern of visibility is a very significant factor in determining project impacts. Gorge visibility is protected from degradation by gaseous and particulate emissions.

Table 4.7-1
Ambient Air Quality Standards

Ambient Air Quality Standards

Pollutant	National Primary	National Secondary	Washington State
Total Suspended Particulates			
Annual Geometric Mean	No Standard	No Standard	60 μg/m^3
24 - Hour Average	No Standard	No Standard	150 μg/m^3
Lead (Pb)			
Quarterly Average	1.5 μg/m^3	1.5 μg/m^3	No Standard
Particulate Matter (PM_{10})			
Annual Arithmetic Mean	50 μg/m^3	50 μg/m^3	50 μg/m^3
24 - Hour Average	150 μg/m^3	150 μg/m^3	150 μg/m^3
Particulate Matter ($PM_{2.5}$)			
24-Hour	65 μg/m^3	65 μg/m^3	65 μg/m^3
Annual Arithmetic Mean	15 μg/m^3	15 μg/m^3	15 μg/m^3
Sulfur Dioxide (SO_2)			
Annual Average	0.03 ppm	No Standard	0.02 ppm
24 - Hour Average	0.14 ppm	No Standard	0.10 ppm
3 - Hour Average	No Standard	0.50 ppm	No Standard
1 - Hour Average	No Standard	No Standard	0.40 ppm [A]
Carbon Monoxide (CO)			
8 - Hour Average	9 ppm	9 ppm	9 ppm
1 - Hour Average	35 ppm	35 ppm	35 ppm
Ozone (O_3)			
1 - Hour Average	0.12 ppm	0.12 ppm	0.12 ppm
8 - Hour Average [B]	0.08 ppm	0.08 ppm	No Standard
Nitrogen Dioxide (NO_2)			
Annual Average	0.053 ppm	0.053 ppm	0.05 ppm

[A] 0.25 not to be exceeded more than two times in any 7 consecutive days.
Primary standards are listed in this table as they appear in the federal regulations.
[B] Eight-hour ozone standard went into effect on September 16, 1997. But implementation is limited.

- ppm = parts per million
- μg/m^3 = micrograms per cubic meter
- Ambient concentrations are rounded using the next higher decimal place to determine whether a standard has been exceeded. The data charts in this report are shown with these unrounded numbers.
- Details of the National Standards are available in 40 CFR Part 50.

Available on-line at: http://www.access.gpo.gov/nara/cfr/waisidx_99/40cfr50_99.html

4.7.2 Impacts

Pre-Dam Removal Activities

There are no existing regulated emission sources at the project site, and any temporary or permanent new sources associated with dam removal are not expected to cause significant adverse air quality impacts. Pre-dam removal impacts could result from drilling the tunnel that would be used to drain the reservoir. Assuming liberal use of water during concrete drilling, little or no concrete dust should be made airborne during this activity. PacifiCorp project mitigation documents (dust control, etc.) do not speak to the potential to create dust during tunnel drilling. The final 15 feet of concrete would be blasted; however, the rush of water into the tunnel should negate that impact to the air.

Road building would be necessary to gain access to the various areas of demolition. Road construction companies are familiar with regulations to minimize fugitive dust emissions, and use water and chemical binders during dry periods. Since much of the work would be during the wet season, road construction emissions are unlikely to present a problem. Ecology provides a number of pamphlets to assist construction companies to comply with fugitive dust rules, such as Windblown Dust (Publication #04-02-009); Building and Construction Projects (Publication 95-1004); and Outdoor Burning (Publication 92-04).

Dam Breaching and Removal

Temporary and intermittent dust would be created by the combination of concrete cutting and blasting used in the dam demolition. During blasting operations, blasting compounds sometimes create very localized hazardous and/or toxic emissions. These emissions would be of concern to workers during demolition activities. Blasting emissions are very intermittent and are not regulated by the agencies as a source. Demolition contractors will control safety of blasting operations and report to industrial oversight agencies.

Post-Removal Management

Post-demolition concerns are probably greatest for the sediments deposited in the reservoir. Some of these sediments would be fine particles capable of becoming airborne during dry weather with high winds. Since winds are channeled up and down the river valley, the potential to impact visibility in the Gorge would be a potential concern. PacifiCorp has scheduled the dam breaching for the typical beginning of the wet season and has taken care to provide dust control plans and characterize the sediments. Stabilization and revegetation is important for a number of reasons, including maintaining good air quality in the vicinity. Toxic chemicals such as pesticides were reported in only one sediment sample in the sediments, so it is assumed that the sediments are not a hazardous or toxic air pollutant concern. Wood debris exposed by draining the reservoir are unlikely to be of a fine enough grain size to become airborne off site, causing public exposure.

4.7.3 Mitigation Measures

Mitigation measures are detailed in the dust control and revegetation plans (PacifiCorp 2004). PacifiCorp will implement all of the BMPs for dust control and revegetation of the sediments. Air quality in the area attains all standards, and visibility is a highly important natural attribute of the Columbia Gorge, which must be maintained during and after demolition. Some of the measures outlined in the mitigation plans are included below.

- Implement the PacifiCorp proposed dust control plan with appropriate BMPs to reduce emissions generated by demolition activities and vehicular traffic.

- Implement the PacifiCorp proposed revegetation plan and BMPs for erosion and sedimentation control. When the reservoir is drained, sediments would be exposed to sun and wind. The revegetation plan would require implementation to reduce local dust generation, although the sediments are probably too large to be carried beyond the immediate area, and would have no likelihood of impacting the Gorge areas.

4.7.4 Significant Unavoidable Adverse Impacts

If the mitigation measures noted above are implemented fully and in a timely fashion, no significant unavoidable adverse impacts are expected.

4.8 NOISE

This section addresses potential impacts from noise associated with the Proposed Action. The two main sources of noise are anticipated to be blasting during dam removal, and construction activities prior to and after dam removal.

4.8.1 Affected Environment

The affected environment for the Proposed Action is composed of the areas along Northwestern Lake (reservoir) and the White Salmon River in the vicinity of the Condit Dam. This would include areas both upstream (e.g., Northwestern Lake) and downstream (e.g., White Salmon River) of the dam. Based on background measurements conducted for similar projects, current ambient noise levels in the vicinity of the Proposed Action are likely between 30 and 40 A-weighted decibels (dBA) (Klickitat County 2005). Exceptions include areas near the dam, major roads, population centers, and industrial areas. In addition, background noise levels would be higher near natural features such as streams and waterfalls. Sensitive receptors in the vicinity of the dam include several residences located immediately north of the dam and between the dam and the proposed concrete disposal site. There are also residences located near the property that would be used to store the wood staves from the flowline.

Klickitat County Regulations[1]

Klickitat County Code (KCC), Chapter 9.15: Public Disturbance Noises prohibits any person from causing or allowing sound that is a public disturbance noise. Under KCC 9.15.010, public disturbance noises include:

- Frequent, repetitive or continuous motor vehicle noise in residential areas
- Public address systems operated between the hours of 8:00 pm and 7:00 am
- Any loud or raucous sounds within 1,000 feet of a school or medical facility that unreasonably interferes with the operation of the facility or the peace, comfort, or repose of the people within
- Sounds from motor vehicle audio systems at volumes audible greater than 50 feet away

The following would be exempt from the provisions of KCC 9.15.010 under the specified conditions:

- Sounds from horns or sirens when used as a warning of danger or required by law

[1] Note that state and local regulations would apply if not preempted by the Federal Power Act.

- Noise created by safety and protective devices, where noise suppression would defeat the safety intent of the device
- Noise created by fire alarms and emergency equipment
- Noise created by warning devices not operated continuously for more than 30 minutes per incident
- Noise emanating from temporary construction sites between the hours of 7:00 am and 10:00 pm on weekdays, and between the hours of 8:00 am and 6:00 pm on weekdays and holidays

The KCC does not regulate specific noise levels. Instead, noise levels emanating from a site or operation would be regulated by Ecology through WAC 173-60.

Skamania County Regulations[2]

Skamania County has established maximum permissible environmental noise levels, which are found in Skamania County Code (SCC) Chapter 8.22: Noise Regulations, Section 8.22.090: Maximum Noise Levels. The SCC noise limits (summarized in Table 4.8-1) are based on the land use (i.e., Class A – residential, Class B – commercial, Class C – industrial) of the emitting and receiving parcels, the time of day, and the duration of the noise-emitting activity during the loudest hour. The noise limits apply at the closest property line of the receiving parcel, regardless of whether there are any occupied structures or activities at the property line.

Table 4.8-1
Maximum Permissible Environmental Noise Levels

Duration of Noise Source	Daytime Noise Limit at Receivers (dBA)			Nighttime[a] Noise Limit at Receivers (dBA)		
	Residential	Commercial	Industrial	Residential	Commercial	Industrial
Continuous noise (L_{eq})[b]	60	65	70	50	65	70
15 cumulative minutes per hour (L_{25}) [c]	65	70	75	55	70	75
5 cumulative minutes per hour ($L_{8.33}$) [a]	70	75	80	60	75	80
1.5 cumulative minutes per hour ($L_{2.5}$) [e]	75	80	85	65	80	85

Notes:
Sources: Skamania County Code (SCC) Title 8: Health and Safety, Chapter 8.22 Noise Regulations, Sub-sections 8.22.090 Maximum Noise Levels and 8.22.100: Deviations from Noise Levels; and Washington State Department of Ecology, WAC 173-60, Maximum Environmental Noise Levels.
Listed noise limits apply for Class C (e.g., industrial) noise sources impacting Class A (e.g., residential), Class B (e.g., commercial) and Class C (e.g., industrial) receiving properties.
“Nighttime” is defined as 10:00 pm through 7:00 am.
a. L_{eq} = equivalent sound level over the given noise measurement period

[2] Note that state and local regulations would apply if not preempted by the Federal Power Act.

b. L_{25} = the sound level exceeded during 25 percent of the measurement period (i.e., 15 minutes per hour)
c. $L_{8.33}$ = the sound level exceeded during 8.33 percent of the measurement period (i.e., 5 minutes per hour)
d. $L_{2.5}$ = the sound level exceeded during 2.5 percent of the measurement period (i.e., 1.5 minutes per hour)

Noise sources covered by this regulation would include voices (e.g., yelling, shouting, etc.), horns or sirens (unless used as a warning device or required by law), motor vehicles and construction equipment. Noise generated by operations at the project site would be required to comply with SCC 8.22.090. However, the noise emanating from the Proposed Action area during construction activities would largely be exempt from the SCC regulations.

The following would be exempt from the provisions of SCC 8.22.090 under the specified conditions:

- Sounds created by blasting operations between the hours of 7:00 am and 10:00 pm
- Sounds created by vehicles operating for onsite construction between the hours of 7:00 am and 10:00 pm
- Sounds created by motor vehicles when operated on public roadways
- Sounds created by motor vehicles when operated off public roadways (e.g., on the project site), except when such sounds are received in residential properties
- Sounds created by warning devices not operated continuously for more than five minutes
- Sounds created by safety and protective devices where noise suppression would defeat the intent of the device or is not economically feasible

Washington State Regulations[3]

As they apply to the Proposed Action, the noise regulations enforced by Ecology (WAC 173-60) are identical to the Skamania County regulations described in Section 4.8.1.

4.8.2 Impacts

Anticipated Noise Sources

As stated previously, the blasting and construction noise to be generated by the Proposed Action are not specifically regulated by Klickitat County, and are exempt from the maximum permissible noise levels enforced by Skamania County and Ecology. However, in order to satisfy the requirements of SEPA, URS assessed anticipated noise levels in the vicinity of the Proposed Action area due to construction activities.

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[3] Note that state and local regulations would apply if not preempted by the Federal Power Act.

Based on the project description and management plans provided by PacifiCorp, URS assembled an inventory of operations and equipment that would generate noise during each phase of construction. Table 4.8-2 summarizes the operations associated with the Proposed Action, and the types and numbers of equipment that are expected to be operating during each phase of work. Reference noise emission data for blasting and each piece of equipment (compiled during previous construction noise assessments conducted by URS for similar projects) are also summarized in Table 4.8-2. For the purposes of this assessment, each piece of equipment was assumed to operate continuously during daytime hours (defined by Skamania County and Ecology as 7:00 am to 10:00 pm), Monday through Friday. Predictive noise modeling and potential noise impacts for each activity related to the Proposed Action are described in the following sections.

Table 4.8-2
Anticipated Noise Sources

Action	Sources	Reference Noise Level	Reference Distance	Number On Site
Pre-Dam Removal Activities				
Hardware Removal & Tunneling	Blasting	122 dBPeak[a]	¼ mile[c]	NA
	Drill rig	74 dBA[b]	200 feet	1
	Rough terrain crane	88 dBA	50 feet	1
	Barge-mounted clamshell crane	88 dBA	50 feet	1
	Loader	85 dBA	50 feet	2
	Excavator	82 dBA	50 feet	2
	Dozer	85 dBA	50 feet	2
	Truck	88 dBA	50 feet	10
	Pickup	72 dBA	50 feet	2
Dam Breaching & Removal				
Concrete Dam Demolition	Blasting	122 dBPeak	NA	NA
	Crane	88 dBA	50 feet	1
	Loader	85 dBA	50 feet	2
	Dozer	85 dBA	50 feet	2
	Truck	88 dBA	50 feet	10
	Pickup	72 dBA	50 feet	2
Concrete Removal, Storage, Disposal	Crane	88 dBA	50 feet	1
	Loader	85 dBA	50 feet	2
	Excavator	82 dBA	50 feet	2
	Scraper	89 dBA	50 feet	2
	Dozer	85 dBA	50 feet	2
	Truck	88 dBA	50 feet	10
	Pickup	72 dBA	50 feet	2
Coffer Dam Removal	Blasting	122 dBPeak	NA	NA
	Crane	88 dBA	50 feet	1
	Loader	85 dBA	50 feet	2
	Dozer	85 dBA	50 feet	2
	Truck	88 dBA	50 feet	10
	Pickup	72 dBA	50 feet	2
Wood Stave Pipeline Removal & Disposal	Loader	85 dBA	50 feet	2
	Truck	88 dBA	50 feet	10
	Pickup	72 dBA	50 feet	2
Concrete Surge Tank Removal & Disposal	Blasting	122 dBPeak	NA	NA
	Drill rig	74 dBA	200 feet	1
	Loader	85 dBA	50 feet	2
	Excavator	82 dBA	50 feet	2
	Scraper	89 dBA	50 feet	2
	Truck	88 dBA	50 feet	10
	Pickup	72 dBA	50 feet	2
Power Facilities Removal & Disposal	Loader	85 dBA	50 feet	1
	Dozer	85 dBA	50 feet	10
	Pickup	72 dBA	50 feet	2

Table 4.8-2 (Continued)
Anticipated Noise Sources

Action	Sources	Reference Noise Level	Reference Distance	Number On Site
Post-Removal Management				
Management of Sediment and Woody Debris following Dam Removal	Blasting	122 dBPeak	NA	NA
	Drill rig	74 dBA	200 feet	1
	Loader	85 dBA	50 feet	2
	Excavator	82 dBA	50 feet	2
	Scraper	89 dBA	50 feet	2
	Truck	88 dBA	50 feet	10
	Pickup	72 dBA	50 feet	2

Notes:
a. dBPeak = Peak decibels (C-weighted)
b. dBA = A-weighted decibels
c. URS assumes the blast charges for the Proposed Action would be sized to produce peak acoustical overpressures below 122 dBPeak (C-weighted) at ¼ mile from the project site, i.e., the distance from Condit Dam to the nearest residential property (sensitive land use). Typically, blast charges are sized so as to produce peak acoustical overpressures below 122 dBPeak (the threshold of annoyance for blasts recommended by the U.S. Army) at any sensitive land uses.

Predictive Modeling of Project Noise Levels

Sound propagating outdoors through the atmosphere generally decreases in level with increasing distance between the noise source and receiver. In the vicinity of the Proposed Action, this attenuation is the result of several mechanisms, discussed in the following sections.

Attenuation by Geometrical Divergence (A_{div})

Because sound energy spreads spherically as it radiates from a source, its apparent loudness also decreases. For a single point source, the sound level decreases at a rate of 6 dBA per doubling of the distance from the source due to geometrical divergence. Attenuation due to divergence of sound energy (A_{div}) is the same for all frequencies, and is independent of any weighting scale used. In the absence of hills or berms, distance is the primary mechanism for decreasing the noise from a site.

Attenuation of noise levels generated by construction activities associated with the Proposed Action site due to geometrical divergence over specific distances from the sources was calculated using the following equation (Piercy and Daigle 1991):

$$A_{div} = 20 \log_{10} r + 10.9 - C$$

where: *r* = distance from the noise source to the receiver in meters
C = correction term (dependent on temperature and atmospheric pressure)

Because A_{div} depends on temperature and atmospheric pressure, attenuation may differ slightly between summer and winter months. According to the construction schedule included in the Project Description (PacifiCorp 2004), the Proposed Action would occur during both summer and winter months. Therefore, A_{div} was calculated under both summer (i.e., 20°C, 1 atmosphere) and winter (i.e., 0°C, 1 atmosphere) atmospheric conditions.

Attenuation Resulting From Air Absorption (A_{air})

Some of the energy in a sound wave is absorbed by the atmosphere. The amount of absorption depends on the frequency of the sound and the temperature and relative humidity of the atmosphere. Because of the more effective absorption at higher frequencies, atmospheric absorption would also tend to lower the pitch of noise generated at the site. This effect is small and ignored for short distances, but becomes significant as the distance between the source and the receiver increases.

Attenuation of noise levels generated by construction activities associated with the Proposed Action due to air absorption (A_{air}) over specific distances from the sources was calculated using the following equation (Piercy and Daigle 1991):

$$A_{air} = \frac{\alpha d}{1{,}000}$$

where: α = air attenuation coefficient (dependent on temperature and relative humidity)
d = distance from the noise source to the receiver in meters

Because A_{air} depends on temperature and relative humidity, attenuation may differ slightly between summer and winter months. Therefore, A_{air} was calculated under summer (i.e., 20°C, 30 percent relative humidity) and winter (i.e., 0°C, 90 percent relative humidity) atmospheric conditions.

Attenuation by Foliage ($A_{foliage}$)

Trees and bushes normally provide very little noise attenuation as a result of shielding. However, if the foliage is dense enough to completely obstruct the view and also intercepts the path of acoustic propagation (as in a dense forest), some attenuation can be quantified. A practical upper limit to noise attenuation by foliage ($A_{foliage}$) is reached at a path length through the foliage of approximately 200 meters (656 feet). In addition to distance, the magnitude of $A_{foliage}$ depends on the frequency of the sound.

Attenuation of noise levels generated by construction activities associated with the Proposed Action due to foliage was calculated using the following equation (Piercy and Daigle 1991):

$$A_{foliage} = 0.04\ dB / m$$

where: dB = decibels
m = length of sound propagation path through foliage in meters (maximum 200 meters)

Noise Level Calculations

After appropriate noise sources were identified, noise levels at 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, and one mile from the Proposed Action caused by construction activities were modeled considering the noise reductions caused by distance, topography, foliage, and atmospheric stability and absorption (Piercy and Daigle 1991), Mestre and Wooten 1980), as described in the previous sections. The key assumptions used for the modeling were as follows:

- Sound waves propagate from each source according to hemispherical spreading.
- No attenuation due to ground attenuation from vegetation was assumed.
- The inventory of equipment (noise sources) that would be used during each phase of construction was assembled based on the scope of work presented in the Project Description document.
- No octave-band sound frequency data were available for the construction equipment to be used at the project site. In accordance with ISO Standard 9613-2 "Attenuation of Sound During Propagation Outdoors: A General Method of Calculation" the reference noise levels for these sources were assigned to the 500 hertz (Hz) octave band for purposes of estimating atmospheric absorption.
- All noise sources were assumed to be operational and emitting noise continually during daytime hours.

Table 4.8-3 summarizes calculated cumulative noise levels at specific distances from the Proposed Action due to noise generated by construction activities.

Table 4.8-3
Noise Modeling Results

Action	Distance (miles)	SUMMER Cumulative noise level (dBA)[a]	WINTER Cumulative noise level (dBA)[a]
Pre-Dam Removal Activities			
Hardware Removal & Tunneling	1/8	34	35
	1/4	28	28
	3/8	24	24
	1/2	21	22
	5/8	18	19
	3/4	16	18
	7/8	15	16
	1	14	15
Dam Breaching & Removal			
Concrete Dam Demolition	1/8	34	34
	1/4	27	28
	3/8	23	24
	1/2	20	21
	5/8	18	19
	3/4	16	17
	7/8	14	16
	1	13	14
Concrete Removal, Storage, Disposal	1/8	35	35
	1/4	28	29
	3/8	24	25
	1/2	21	22
	5/8	19	20
	3/4	17	18
	7/8	15	16
	1	14	15

Table 4.8-3 (Continued)
Noise Modeling Results

Action	Distance (miles)	SUMMER Cumulative noise level (dBA)[a]	WINTER Cumulative noise level (dBA)[a]
Coffer Dam Removal	1/8	34	34
	1/4	27	28
	3/8	23	24
	1/2	20	21
	5/8	18	19
	3/4	16	17
	7/8	14	16
	1	13	14
Wood Stave Pipeline Removal & Disposal	1/8	33	33
	1/4	26	27
	3/8	22	23
	1/2	19	20
	5/8	17	18
	3/4	14	16
	7/8	13	14
	1	11	13
Concrete Surge Tank Removal & Disposal	1/8	34	34
	1/4	27	28
	3/8	24	24
	1/2	21	21
	5/8	18	19
	3/4	16	18
	7/8	15	16
	1	14	15
Power Facilities Removal & Disposal	1/8	33	33
	1/8	27	27
	1/8	24	24
	1/8	22	23
	1/8	21	22
	1/8	21	21
	1/8	20	21
	1/8	20	21
Post-Removal Management			
Management of Sediment and Woody Debris following Dam Removal	1/8	34	34
	1/4	27	28
	3/8	24	24
	1/2	21	21
	5/8	18	19
	3/4	16	18
	7/8	15	16
	1	14	15

Note:
a. dBA = A-weighted decibels

The cumulative noise levels in Table 4.8-3 were calculated using the equation below. It should be noted that sound levels do not combine arithmetically. For example, 21 dBA of noise received at a given location due to operation of a pickup, combined with 40 dBA of noise received at the same location due to operation of a dozer does not result in a cumulative noise level of 61 dBA. Instead, the cumulative sound level is a logarithmic sum calculated using the following equation:

$$\textit{Cumulative sound level} = 10 \log_{10} (10^{(Lp1/10)} + 10^{(Lp2/10)})$$

where: Lp1 = sound pressure level of a sound source in decibels
Lp2 = sound pressure level of a second sound source in decibels

Using the example above, the cumulative sound level resulting from 21 dBA of noise from one source reaching a receiver, combined with 40 dBA of noise from another source reaching the same receiver would be:

$$\textit{Cumulative sound level} = 10 \log_{10} (10^{(40/10)} + 10^{(21/10)}) = 40.05 \text{ dBA}$$

Cumulative noise levels at specific distances from the Proposed Action were calculated using the referenced equation. The following sections summarize the cumulative sound levels at 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, and one mile from the Proposed Action. It should be noted that these modeled noise level estimates are "worst-case" scenarios, i.e., all of the noise sources were assumed to be operating at the same time, and all were assumed to be emitting noise continually during daytime hours.

Pre-Dam Removal, Dam Breaching and Removal, and Post-Removal Management

Three types of activities performed for the project would create noise impacts: pre-dam removal activities, dam breaching and removal activities, and post-removal management activities. Section 3.0 includes a detailed description of these activities. Pre-dam removal activities would include hardware removal and tunneling. Dam breaching and removal activities would include concrete dam demolition; concrete removal, storage, and disposal; upstream coffer dam removal and disposal; wood stave pipeline and wood and steel penstocks removal and disposal; concrete surge tank removal and disposal; and power facilities removal and disposal. Post-removal management activities would include management of sediment and woody debris following dam removal.

Construction noise modeling (see Table 4.8-3) indicates that individual and cumulative noise levels at 1/8 mile from the Proposed Action due to these three types of activities, excluding blasting noise, would be:

- Pre-dam removal activities—approximately 34 dBA
- Dam breaching and removal activities—approximately 33–35 dBA
- Post-removal management activities—approximately 34 dBA

These levels are similar to assumed current ambient noise levels (i.e., between 30 and 40 dBA). Assuming an ambient noise level of 35 dBA, the cumulative sound level (calculated using the equation $10 \log_{10} (10^{(40/10)} + 10^{(21/10)}) = 40.05$ dBA at 1/8 mile from the Proposed Action would be approximately 38 dBA. This 3 dBA increase may be perceptible at sensitive noise receptors. However, 38 dBA is still very quiet, and a 3 dBA increase in ambient noise levels would not be expected to elicit an adverse community response.

All three types of activities would include blasting. Blasting noise is considered an impulse noise because of its rapid onset and decay. It can cause temporary and permanent shifts in the threshold of hearing depending on the decibel level. The U.S. Occupational Safety and Health Administration (OSHA) standards do not allow employees to be exposed to an impulse noise that exceeds 140 dB. Studies conducted by the U.S. Army also indicate that no hearing protection is required for single blasts with peak levels below 140 dB. Blast charges are typically sized so as to produce peak acoustical overpressures below 122 dBPeak (C-weighted) (the threshold of annoyance for blasts recommended by the U.S. Army) at any sensitive land uses.

URS assumes the blast charges would be sized to produce peak acoustical overpressures below 122 dBPeak (C-weighted) at 1/4 mile from the Proposed Action, i.e., the distance from Condit Dam to the nearest residential property (sensitive land use), because:

- Pre-dam removal activities would require blasting of only the final 15 feet of concrete on the upstream water-face of the dam.
- The intent of blasting for dam breaching and removal activities would be to fracture the residual concrete of the dam for removal rather than blast it out of place.
- The intent of blasting for post-removal management activities would be only to dislodge woody debris causing unstable slope conditions or adversely affecting fish passage.

Several residences (i.e., sensitive noise receptors) are located near the dam, the concrete disposal site, and the roads along which trucks and construction equipment would travel during the Proposed Action. Intermittently, construction noise levels at these residences would significantly exceed the modeled noise levels. The noise levels at these sensitive receptors due to construction activities do not exceed state or local noise standards due to exemptions for construction in the Klickitat County, Skamania County, and State of Washington noise regulations. However, construction noise impacts to adjacent residential properties would be significant due to the duration and intensity of noise that would be received.

4.8.3 Mitigation Measures

Recommended mitigation measures for the Proposed Action include:

- Construction activities should not be conducted within ¼ mile (1,320 feet) of an occupied dwelling on weekends, legal holidays, or between 10 pm and 7 am on other days
- All construction equipment should be required to be equipped with noise control devices no less effective than those provided on the original equipment
- Operation of equipment with unmuffled exhaust systems should not be allowed
- Noise reduction measures should be required during construction, including turning off idling equipment and using the quietest effective back up alarms

- Explosives used per delay should be reduced to a minimum
- A quiet initiation or bottom hole initiation system should be used during blasting
- The timing of the blasting activities should be coordinated with local agencies and/or residents as needed
- Nearby sensitive receptors (e.g., residences) should be alerted of the impending blast noise by means of a warning horn or similar device
- Blasting operations should not be performed within ¼ mile (1,320 feet) of an occupied dwelling on weekends, legal holidays, or between 8 pm and 8 am on other days

4.8.4 Significant Unavoidable Adverse Impacts

As previously stated, several residences (i.e., sensitive noise receptors) are located adjacent to the dam, the concrete disposal site, and the roads along which trucks and construction equipment would travel during the Proposed Action. Intermittently, construction noise levels at these residences would significantly exceed the modeled noise levels. The noise levels at these sensitive receptors due to construction activities do not exceed state or local noise standards due to exemptions for construction in the Klickitat County, Skamania County, and State of Washington noise regulations. Implementation of the mitigation measures noted above would minimize most impacts. However, construction noise impacts to adjacent residential properties would be significant due to the duration and intensity of noise that would be received. Therefore, construction noise impacts to adjacent residential properties are considered a short-term significant unavoidable adverse impact for the Proposed Action.

4.9 LAND USE/CRITICAL AREAS

This section evaluates land use and critical areas that could be affected as a result of the proposed action. Recreational impacts and mitigation measures were addressed in previous FERC documents and are not addressed in this section. Other discussions related to land use/critical areas are included in Water Resources (Section 4.2), Aquatic Resources (Section 4.3), Public Safety (Section 4.11) and Public Services (Section 4.12).

PacifiCorp has asserted that the Federal Power Act preempts local authority. It is not known at the time of publication of the Draft SEIS whether FERC or the courts will determine that the Federal Power Act would preempt local permits. If the Federal Power Act does preempt local authority, then the discussions in this section would be academic. If the Federal Power Act does not preempt local authority, then procedures to acquire county permits would be required, and the impacts relative to county regulations would be important.

4.9.1 Affected Environment

For the Proposed Action (dam removal), the affected area analyzed would be the area from the Northwestern Lake Bridge extending to the Underwood (in-lieu) site adjacent to the Columbia River. Both Klickitat and Skamania counties, on the east and west sides of Northwestern Lake (reservoir) and the White Salmon River have land use jurisdiction. The USFS manages lands upstream from the reservoir (surface area approximately 92 acres) as part of the Lower White Salmon National Wild and Scenic River area. The USFS also manages the Columbia River Gorge National Scenic Area, which extends over virtually the entire proposed action area. The discussion below includes land use and critical areas.

Land Use

Current land uses in the area include resource lands along the reservoir. Private rural residences occur along the canyon slopes and residences leased from PacifiCorp occur along the shoreline. There are a few orchards and agricultural uses on the upland slopes along the river near the dam. Forest lands are located north of the reservoir and along the higher west slopes. In addition, Northwestern Park is located on or near the northern end of the reservoir. Some of the lands south of the dam are owned by SDS Timber Company.

Current zoning by Klickitat County (east side of reservoir) includes Resource Lands (RL), along the reservoir shoreline and the White Salmon River; Rural Residential (RR) along SR 141; Extensive Agriculture (EA) east of SR 141; Open Space (OS) east of SR 141; and Forest Resources (FR), east of SR 141. There are a number of principal uses permitted outright as well as accessory uses in the RL zone. In addition, there are several conditional uses allowed, subject to a conditional use permit.

The Comprehensive Plan includes lands designated RL along the reservoir shoreline. The RL designation (as all uses noted in the County Land Use Map) is intended as a guide to the development of the county, based on County goals and policies.

Current zoning by Skamania County (on the west side of reservoir) includes Residential (R2 and R5), along the reservoir shoreline to an area just north of the Condit Dam; Open Space (OS) from the reservoir just north of the dam and along the White Salmon River to the Underwood site; Forest (F-3) along the higher west slopes of the White Salmon River; and Agriculture (AG-1 and AG-2), also along the higher west slopes of the White Salmon River. As noted above for Klickitat County, there are uses permitted outright as well as accessory uses for the zoning classifications. In addition, there are conditional uses allowed, subject to a conditional use permit.

The Comprehensive Plan designations include Rural 2 and Conservancy, extending along the west side of the reservoir from the Northwestern Lake Bridge to the Underwood site. These designations also are intended to serve as a guide to the development of the County goals and policies. Skamania County also has development regulations as part of a special management area for the Columbia River Gorge National Scenic Area. The intent of these regulations also is to protect water resources.

Zoning classifications include sections requiring conditional use permits for activities that are not a preferred land use within a zone classification. The activity needing a permit requires a public hearing and is reviewed for consistency with the Comprehensive Plan; if it meets the purpose and intent of the zoning classification; if it is compatible with the existing and permitted uses allowed in the zoning classification; and if it conforms with environmental ordinances and any other findings during review. Permit conditions are established on case by a case-by-case basis, depending on the activity.

Critical Areas and Shoreline Master Programs

Klickitat and Skamania Counties adopted Critical Areas Ordinances in 2003 and 1996, respectively. In addition, both counties have adopted Shoreline Master Programs (the 1996 and 1986 updates, respectively).

Klickitat County Critical Areas include wetlands; critical fish/wildlife habitat conservation areas; geologically hazardous areas; aquifer recharge areas; and frequently flooded areas. Under Klickitat County's Shoreline Master Program, proposed construction activities within 200 feet of a jurisdictional shoreline (such as the reservoir) would require a shoreline substantial development permit. This program lists the proposed action area as a conservancy environment. The purpose and intent of a conservancy environment is to protect, conserve and manage existing natural resources and/or unique, valuable, aesthetic, historic and cultural areas in order to achieve sustained resource utilization and provide recreational opportunities.

Skamania County critical areas include watershed protection areas; wetlands, ponds, lakes, rivers, streams and creeks and associated riparian and buffer areas; frequently flooded areas; aquifer recharge areas; fish and wildlife habitat critical areas; geologically hazardous areas; landslide hazard areas; seismic hazard areas; volcanic hazard areas; mine hazard areas; and rockfall hazard areas. Skamania County's Shoreline Master Program also requires a shoreline substantial development permit for construction activities within 200 feet of a shoreline. This program lists the proposed action area as a conservancy environment. In addition, the County lists the lower White Salmon River as a shoreline of state-wide significance. Shorelines of state-wide significance are recognized as deserving consideration beyond that prescribed to other bodies.

Wetlands, rivers, buffers, fish and wildlife habitat conservation areas, and geologically hazardous, seismic and landslide hazards are all discussed in more detail in other sections. Volcanic and mine hazard areas are outside the proposed action area.

There are no aquifer recharge areas mapped in Klickitat or Skamania Counties in the proposed action area. However, as part of the Shoreline Master Programs, various activities may be reviewed to determine potential effects and may require permits on a case-by-case basis. Although frequently flooded areas are not currently present in most of the project area because of the dam and canyon, floodplains are present. Various activities may be reviewed on a case-by-case basis.

4.9.2 Impacts

Pre-Dam Removal and Dam Breaching and Removal

Land Use

The proposed action would affect land uses along or near the former shoreline both during and after construction. During construction, sites along or near the reservoir would be used for work areas, construction staging, or for disposal. In addition, access roads would be built in several locations.

Work areas identified include one around the dam site for dam removal; one along the flowline for its removal; one near the powerhouse to remove the penstock; one near the surge tank for tank removal; one near the tail race to place fill in the area; one near the substation for substation removal and one along the powerline for powerline removal; one near the Big White Fish Ponds to clean the ponds; one near Northwestern Lake Bridge for bridge modifications; one along Northwestern Lake for sediment stabilization, woody debris management, and boat dock and cofferdam removals; and one along the shoreline about 1 mile above the dam to reestablish a water line below the sediment level. Work areas are shown on Figures 3-1 through 3-6 in Chapter 3.

Staging areas identified include one adjacent to Powerhouse Road near the dam; one near the Powerhouse Road bend; one in the upland area off of Powerhouse Road for staging and stockpiling; one near the flowline; and one at the Becker site for flowline materials and dam removal equipment. Staging areas and associated access roads are shown on Figures 3-1 through 3-6 in Chapter 3.

In the upland staging area, about 7 acres would be located on PacifiCorp's land near Well No. 2 (City of White Salmon) and near proposed Klickitat County plats (near Tamarack Road).

Potential impacts to the well relate to a well setback area (aquifer recharge and protection) and to County subdivision procedures. In addition, a portion of this area (about 2 acres) may be used for concrete storage or disposal.

Critical Areas and Shoreline Master Programs

Some of the proposed work would occur near or affect Klickitat County Critical Areas or buffers. Along the reservoir, small wetlands are situated along the north and west shoreline in Skamania County between Buck Creek and Mill Creek and near the confluence of Little Buck and Spring Creeks and the reservoir (See Section 4.4). On the south and east sides of the shoreline in Klickitat County there are wetlands upstream of the dam. Other small wetland areas exist downstream of the dam (see Section 4.4).

Work would occur near or along the shoreline at various locations along the reservoir and near the White Salmon River downstream from the site. In addition, work at the delta of Mill Creek and at sediment access points and the water pipeline crossing on the north and west shorelines may affect Skamania County Critical Areas or buffers.

Sediment that will be deposited at the mouth of the White Salmon River may change flood elevations. No structures in either county are expected to be affected.

Post-Removal Management

Once the dam has been removed and because of the changed conditions, both counties would need to review land use designations along the former reservoir. In addition, critical areas designations and the Shoreline Management Program would need to be reviewed and perhaps revised. This would result in the redefinition of floodplains and floodplain map revisions under the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (44 CFR, Part 60).

4.9.3 Mitigation Measures

PacifiCorp has prepared several plans and proposed construction BMPs to address impacts from the proposed action. Some measures to address impacts to land use and critical areas include:

- Protect City of White Salmon Well No. 2 by not conducting work within the well setback area. Provide protection measures around the disposal site to prevent potential long term leaching.
- Align access roads to avoid wetlands and minimize impacts to critical area buffers, including well setback (wellhead protection) areas.
- Revegetate disturbed areas after construction.
- Regrade exposed areas and other bank stabilization measures after construction as part of the Sediment Assessment and Management and Bank Stabilization Plans (PacifiCorp 2004).
- Implement the Canyon and Woody Debris Management Plan (PacifiCorp 2004).
- Implement the temporary erosion and stormwater control plan during construction.

4.9.4 Significant Unavoidable Adverse Impacts

If the PacifiCorp Sediment Assessment and Management, Bank Stabilization, and Canyon and Woody Debris Management Plans and other mitigation measures are implemented, no long-term unavoidable significant adverse impacts to land use/critical areas are anticipated. There would be short-term significant unavoidable adverse impacts to sites along or near the reservoir that would be used for work areas, construction staging or for disposal, and from the access roads that would be built in several locations.

4.10 AESTHETICS AND SCENIC RESOURCES

This section evaluates Aesthetics and Scenic Resources that could be affected as a result of the proposed action. Recreational impacts and mitigation measures were addressed in previous FERC documents and are not addressed in this section. Other discussions related to aesthetics and scenic resources are included in Land Use/Critical Areas (Section 4.9) and Aquatic Resources (Section 4.3). A previous document entitled Condit Hydroelectric Project Visual Analysis (PacifiCorp 1991), prepared in conjunction with the FERC NEPA environmental process, is used as a reference for the analysis in this document. The previous documents followed the USFS Visual Management System, Existing Visual Conditions (EVC) evaluation procedure. This method is used in this document.

4.10.1 Affected Environment

For the proposed action, the affected area analyzed is the area from Northwestern Lake (reservoir), extending about 1.8 miles from the dam to approximately the Northwestern Lake Road bridge. Other aesthetic and scenic resources in the vicinity include the Lower White Salmon National Wild and Scenic River area upstream of the reservoir and the Columbia Gorge National Scenic Area, which extends over virtually the entire proposed action area.

The EVC evaluation procedure involves a comparison of the natural appearing landscape with degrees of differences in landscape alteration. Landscapes are classified into six types (Table 4.10-1).

Table 4.10-1
Existing Visual Condition Types

Type I	Areas in which only ecological change has taken place except for trails needed for access. They appear to be untouched by human activities.
Type II	Areas in which changes in the landscape are not visually evident to the average person unless pointed out. They are normally not noticed.
Type III	Areas in which changes in the landscape are noticed by the average forest visitor, but they do not attract attention. The natural appearance of the landscape still remains dominant. They appear to be minor disturbances.
Type IV	Areas in which changes in the landscape are easily noticed by the average forest visitor and may attract some attention.
Type V	Areas in which changes in the landscape are strong and are obvious to the average forest visitor. These changes stand out as a dominating impression of the landscape. They appear to be major disturbances.
Type VI	Areas in which changes in the landscape are in glaring contrast to the natural appearance. Almost all forest visitors would be displeased with the effect. They appear to be drastic disturbances.

Source: USFS 1980

The 2002 Final SEIS evaluated key areas along the reservoir. These areas included the Condit Dam and Forebay Boat Ramp, the Reservoir Shoreline, and Northwestern Lake Park (Figures 4.10-1 through 4.10-10 show the general areas).

Condit Dam/Forebay Boat Ramp

The dam is visible from the forebay boat ramp area, which is about 500 feet north of the dam. Public access is currently available to the dam via Powerhouse Road. Public access to the boat ramp, a small turnaround, and a parking area is off of Powerhouse Road. Views in all directions around the dam are predominantly natural and were classified as Type IV. An EVC rating of III was assigned to the boat ramp area because of the presence of the dam and a nearby residence. The boat launch itself received a rating of Type IV because of the naturally-appearing portions of the lake. Figures 4.10-1 through 4.10-3 show the area around the dam.

Reservoir Shoreline

The reservoir shoreline is visible from a number of residences and viewpoints along both sides. Approximately 35 percent of the reservoir shoreline contains seasonal residences, including private residences and cabins leased from PacifiCorp. Most of the reservoir shoreline was classified as Type 1 and II except near the areas of residential development, which were classified as Type IV and V. Figures 4.10-4 through 4.10-7 were taken in the Ellis Road vicinity (east side of reservoir) and from the opposite (west) side.

Northwestern Park/Northwestern Lake Bridge

Northwestern Park is situated just south of the Northwestern Lake Bridge. It is maintained by PacifiCorp although kiosk information also is provided by USFS. The park, which generally blends into the landscape and is rustic in appearance, has restrooms, a changing facility for water-related activities, wooden tables, a picnic area, a boat launch and deck, and other park amenities. From the bridge or lake surface the park was classified as a combination of Type III and IV. Figures 4.10-8 through 4.10-10 were taken from the bridge.

4.10.2 Impacts

Pre-Dam Removal, Dam Breaching and Removal, and Post-Removal Management

The Proposed Action would change the visual character and the EVC types for the reservoir area from the dam to the Northwestern Lake bridge. The dam would no longer be in place and the White Salmon River would generally return to its former stream canyon channel that existed prior to dam construction as a free flowing stream. The reservoir views would be lost and replaced by views of a stream corridor. Because the White Salmon River downstream from the dam is in a deep canyon and not as visible as the reservoir, short-term aesthetic and scenic resources impacts to the area below the dam would be minimal.

Condit Dam/Forebay Boat Ramp

The area around the dam and the boat ramp would resemble a stream corridor over time. However, initially, the area currently impounded in the reservoir would not be vegetated and some sediments would remain along the former reservoir and along the stream until they are eventually washed downstream as part of a free-flowing stream. The time frame could range from a few months for sediment settling and dispersal to a year or more until vegetation is reestablished. Dam removal would result in impacts to views along the canyon slopes but would be less noticeable here than other areas along the reservoir. The current Forebay Boat

Figure 4.10-1 Looking south toward dam

Figure 4.10-2 Looking south and west toward dam

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Figure 4.10-3 Looking west across lake

Figure 4.10-4 Looking west and north from east side of lake

Takes only 1 pageholder. Printing double-sided.

Figure 4.10-5 Looking north from west side of lake

Figure 4.10-6 Looking east from west side of lake

Takes only 1 pageholder. Printing double-sided.

Figure 4.10-7 Looking south toward cabins from west side of lake

Figure 4.10-8 Looking south from Northwestern Lake Bridge at Northwestern Park

Takes only 1 pageholder. Printing double-sided.

Figure 4.10-9 Looking south from Northwestern Lake Bridge at Northwestern Park

Figure 4.10-10 Looking north (upstream) from Northwestern Lake Bridge

Takes 2 pageholders.

Figures 4.10-9 and 4.10-10 (Continued)

Ramp function would be lost. EVC types may degrade in the short-term from a Type IV to Type V before reverting back to Type IV or Type III or higher in the long term.

Reservoir Shoreline

The area along the former shoreline between the former dam and the Northwestern Lake Bridge would have the same short-term impacts as described above. However, this area is more visible from private homes along or above the current shoreline. EVC Types I and II would temporarily degrade to III and IV. Areas currently classified as Types IV and V could degrade to Type VI. Over time, most of the areas on the slopes will revert to Types II or III.

Northwestern Park/Northwestern Lake Bridge

This area would experience the same impacts as the other areas. Visual impacts from the park or bridge viewpoints would degrade in the short-term from Type III and IV to Type IV and V, then revert back with revegetation of slopes.

4.10.3 Mitigation Measures

PacifiCorp has proposed several measures to mitigate impacts from the Proposed Action. The measures include:

- Implement a revegetation plan on suitable substrate along the former shoreline and slopes. The newly formed river channel is expected to average about 128 feet wide. The revegetation efforts may take a year or more. The vegetation would be monitored over time. Preconstruction photographs and preproject bathymetry show flatter and rockier areas for a few thousand feet above the current dam. About 40 to 50 percent of the acreage along the shoreline would include areas of residual sediments that could be revegetated. The other 50 to 60 percent consists of rocky substrate in an incised channel about 2,000 feet upstream of the existing dam. The goals of the plan would be to minimize the long-term potential for erosion and minimize the presence of noxious weeds. The specific site areas would not be known until after dam removal (See the Revegetation Plan).

- Remove unstable residual sediments as quickly as feasible after dam removal. Sediment assessment and management and bank stabilization plans have been prepared.

- Implement an upland stormwater and erosion control plan.

- Construct new or enhance existing recreational facilities impacted by the Proposed Action. Specifically, extend the boat launch at Northwestern Lake Park to access the river. New recreational opportunities (kayaking, rafting, and stream fishing) would provide different aesthetic/scenic perspectives that may compensate in some ways for the loss of reservoir-based aesthetic/scenic resource perspectives.

4.10.4 Significant Unavoidable Adverse Impacts

Short-term significant unavoidable adverse impacts to views along the reservoir would occur until revegetation occurs and the free-flowing river is reestablished. One overall significant long-term visual impact to aesthetics and scenic resources would remain and would be unavoidable. That would be the change from a lake view to a view of a stream corridor. However, depending on one's perception, this may or may not be a significant impact.

4.11 PUBLIC SAFETY

This section evaluates public safety, which could be affected as a result of the Proposed Action. A related section, Public Services (Section 4.12), also includes relevant public safety discussions.

4.11.1 Affected Environment

The Proposed Action extends over an area including Northwestern Lake (reservoir) to the Condit Dam and along the White Salmon River from the dam to the Underwood (in-lieu) site adjacent to the Columbia River (see Figures 3-1 through 3-6 in Section 3). This would include not only the area, but all points of access (state and local roads).

In addition to PacifiCorp, the public service providers to the area would be involved in coordination of proposed safety plans and measures. The providers include the Klickitat and Skamania County Sheriff's departments, Fire District No. 3 (Klickitat County side), the Underwood Fire Department (Skamania County side), and the Washington State Patrol (state roads). Emergency service providers include ambulances (Stevenson) and other emergency service operations (Skyline Hospital in White Salmon).

4.11.2 Impacts

Pre-Dam Removal Activities

Limited blasting may occur in association with access road building and road widening operations. Because of the locations, this would not have an impact on access to the proposed action area for the service providers and the public.

Dam Breaching and Removal

Drain Tunnel and Dam

Lake tap tunneling is considered among the most dangerous tunneling operations for workers. Blasting operations would be dangerous for members of the public if they were allowed to be too close to the drain tunnel. Water levels in the river would rise rapidly as the reservoir drains, quickly engulfing the river floodplain between the dam and the Underwood site. Water would be drained rapidly through the tunnel and a vortex with strong currents would likely form in the reservoir during the first six hours as the reservoir drains. Dam removal will involve blasting the concrete and hauling it to a disposal site. Blasting will be conducted according to a blasting plan by highly experienced contract specialists.

Sediment Transport

Water would drain out of the reservoir over the first six hours after the dam was breached. The White Salmon River would quickly cut a new course through the reservoir sediments, and the river edge would be unstable and fall into the river, creating a hazard to any person or animal near the river. People will, of course, be excluded. In addition, access to the proposed action area by the service providers could be affected.

Post-Removal Management

Drained reservoir sediments would continue to be unstable adjacent to the White Salmon River and on oversteepened areas that would be exposed until they are stabilized. This would pose a potential safety hazard for recreational and other visitors to the area.

4.11.3 Mitigation Measures

Mitigation measures are listed below for pre-dam removal, dam breaching and removal, and post-removal management activities. PacifiCorp has prepared public safety and blasting plans as part of overall project mitigation:

- Implement the Public Safety Plan (PacifiCorp (2004). Key elements of the Public Safety Plan include: issuing a countywide (Klickitat and Skamania Counties) public notice prior to commencement of any major construction activities; and coordinating with local police and fire personnel for potentially hazardous areas and the schedule for blasting and dam breaching.

- Standard construction practice includes isolating the public and workers from direct exposure to hazards, including tunnel-driving and dam removal activities.

- Any blasting used as part of dam removal activities would be accomplished in areas isolated from the public as described in the Blasting Plan (PacifiCorp 2004). Key elements of the Blasting Plan include: blasting shall be performed only by trained and authorized personnel and in accordance with OSHA safety standards; and signs shall be posted to restrict public trespass within the vicinity of blasting activities.

- Just before the final blast that breaches the dam is to be detonated, the White Salmon River would be cleared of people along its banks all the way from the dam to the mouth of the river.

- At the same time, access to the river downstream from the Northwestern Lake Bridge would be prevented. This will prevent fishers, boaters, kayakers or other water sports enthusiasts from entering the river and being caught in hazardous waters, facilities, or sediments as the reservoir drains.

- The general public would be barred from traversing the reservoir sediments or using the White Salmon River below Northwestern Lake Bridge until after the unstable sediments have been stabilized as described in the Sediment Assessment and Management and Bank Stabilization Plans prepared by PacifiCorp (2004).

- Public notices will ensure that the general public is educated about public safety issues, including ones associated with new opportunities for access and recreation. They will also provide information about new conditions to be expected.

4.11.4 Significant Unavoidable Adverse Impacts

If the mitigation measures described above are implemented, no significant unavoidable impacts are expected.

4.12 PUBLIC SERVICES

This section evaluates public services that could be affected as a result of the proposed action. Public services include police, fire and related emergency services. In addition, two entities operate water supply or intake facilities underneath or from Northwestern Lake (reservoir). Other discussions related to public services are included in Section 4.2, Water Resources.

4.12.1 Affected Environment

The proposed action extends over an area that includes the reservoir from Northwestern Lake Bridge to the Condit Dam and along the White Salmon River from the dam to the Underwood (in-lieu) site adjacent to the Columbia River. Police services to the local area are provided by the Klickitat County and Skamania County sheriffs' departments. Police service along the State highways is provided by the Washington State Patrol, with offices in Vancouver and Goldendale. Fire protection services to the area are provided by Fire District No. 3 (Klickitat County portion) and the Underwood Fire Department (Skamania County portion). A mutual aid agreement is in effect between the County departments and the City of White Salmon. Response times vary from a few minutes for the Klickitat County Sheriff (from the West End Services Building in White Salmon) and the Skamania County Sheriff (Stevenson) to several minutes for the respective fire departments, depending on location and access.

Emergency response services are provided to the area from the cities of Stevenson (ambulance) and White Salmon (Skyline Hospital). The other closest hospital is in Hood River, Oregon. Response times vary from a few to several minutes, depending on location and access.

A 14-inch steel water supply line (PacifiCorp 2004) owned by the City of White Salmon crosses the reservoir midway between the dam and the Northwestern Lake Bridge (about 1 mile north of the dam). The pipe, buried in lake sediments, provides service from the White Salmon water system (wells and storage reservoir) to homes and other facilities on the west side of the reservoir in Skamania County.

4.12.2 Impacts

Pre-Dam Removal and Dam Breaching and Removal

The proposed action would result in impacts to the public service providers. The respective County sheriff and fire departments would need to adjust staff and coordinate with other departments and PacifiCorp to prepare for and respond to the proposed action. The proposed action is planned to occur during the fall of 2008, which may be toward the end of the fire season. If a fire occurs in the vicinity, access to fight the fire could be impaired without some preparation. Likewise, emergency service providers would need to make similar adjustments to those noted above. Response times could be affected without adequate preparation.

The City of White Salmon's 14-inch supply line across the reservoir would be affected by dam breaching and removal activities, potentially resulting in a disruption of service to water use customers.

Post-Removal Management

The proposed action would result in some impacts to the public service providers, although to a lesser extent than the pre-dam removal and dam breaching and removal activities. Impacts related to sediment management and safety could affect staffing as well as response times. Minimal impacts from post-removal management would occur on the water supply utilities if the pre-dam and dam removal impacts are mitigated.

4.12.3 Mitigation Measures

PacifiCorp has proposed several mitigation measures for the pre-dam removal, dam removal, and post-removal management activities, including those listed below. The proposed mitigation measures are described further in the Public Safety and Traffic Control Management Plans prepared by (2004) PacifiCorp.

- Coordinate with local police, fire and emergency service personnel on potentially hazardous areas, the schedule for blasting and dam breaching, and public notification. Continue this coordination for post-removal management activities.
- Coordinate with the Washington State Patrol during dam removal and post-removal management activities affecting state highways.
- Implement a traffic control plan during dam removal and post-removal management activities that provides for police, fire and emergency service access to minimize impacts to response times.
- In coordination with the City of White Salmon, install a temporary water supply (probably 14-inch HDPE pipe) across the lake with a cable support system before the dam is breached. Install a permanent line after the dam is breached, low enough to be protected from river scour.

4.12.4 Significant Unavoidable Adverse Impacts

If mitigation measures noted above are implemented, no significant unavoidable adverse impacts are expected.

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Appendix A

Memorandum of Agreement Modifying the Condit Hydroelectric Project Settlement Agreement

MEMORANDUM OF AGREEMENT
MODIFYING THE
CONDIT HYDROELECTRIC PROJECT SETTLEMENT AGREEMENT

This Memorandum of Agreement (MOA) modifies the Condit Hydroelectric Project Settlement Agreement (Settlement Agreement) by: (a) replacing each occurrence of the term "2006" in the Settlement Agreement with the term "2008"; (b) replacing each occurrence of the term "$2,000,000" in the Settlement Agreement with the term "$5,300,000"; and (c) replacing each occurrence of the term "$17,150,000" in the Settlement Agreement with the term "$20,450,000". Except as provided in this paragraph, the Settlement Agreement shall remain unmodified.

This MOA may be executed in counterparts. No party shall be entitled to a presumption against any other party based on the drafting of this MOA.

IT IS SO AGREED,

PACIFICORP

By A. Jdeenan
Its CEO / President
Date: 2/8/05

AMERICAN RIVERS

By ______
Its ______
Date: ______

AMERICAN WHITEWATER AFFILIATION

By ______
Its ______
Date: ______

COLUMBIA GORGE AUDUBON SOCIETY

By ______
Its ______
Date: ______

COLUMBIA GORGE COALITION

By ______
Its ______
Date: ______

COLUMBIA RIVER UNITED

By ______
Its ______
Date: ______

Appendix B

City of White Salmon Production Well #2 Well Log

File Original with Department of Ecology 98485
Second Copy - Owner's Copy
Third Copy - Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Notice of Intent W07871
UNIQUE WELL I D # AFK718
Water Right Permit No SWC 3474 & 7109

(1) OWNER Name CITY OF WHITE SALMON Address P.O. BOX 2139, WHITE SALMON, WA 98672

(2) LOCATION OF WELL County KLICKITAT SW 1/4 SE 1/4 Sec 3 T 3N N R 10E WM

(2a) STREET ADDRESS OF WELL (or nearest address) POWERHOUSE PRODUCTION WELL #2 ON TAMARACK LANE

TAX PARCEL NO

(3) PROPOSED USE ☐ Domestic ☐ Industrial XX Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐ DeWater

(4) TYPE OF WORK Owner's number of well (if more than one) PROD. #2
XX New Well ☐ Deepened ☐ Reconditioned ☐ Decommission
Method ☐ Dug ☐ Bored XX Cable ☐ Driven XX Rotary ☐ Jetted

(5) DIMENSIONS Diameter of well 14 3/4" inches
Drilled 1242 feet Depth of completed well 1242 ft

(6) CONSTRUCTION DETAILS
Casing Installed
XX Welded 20" Diam from 0 ft to 215.5 ft
☐ Liner installed " Diam from ft to ft
☐ Threaded 16" Diam from +2 ft to 804 ft

Perforations ☐ Yes XX No
Type of perforator used N/A
SIZE of perforations in by in
perforations from ft to ft

Screens ☐ Yes XX No ☐ K-Pac Location
Manufacturer's Name
Type Model No
Diam Slot Size from ft to ft
Diam Slot Size from ft to ft

Gravel/Filter packed ☐ Yes XX No ☐ Size of gravel/sand
Material placed from ft to ft

Surface seal XX Yes ☐ No To what depth? 804 ft
Material used in seal CEMENT
Did any strata contain unusable water? ☐ Yes XX No
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP Manufacturer's Name
Type H P

(8) WATER LEVELS Land-surface elevation above mean sea level ft
Static level 0 ft below top of well Date 4-23-01
Artesian pressure 98 lbs per square inch Date 4-16-01
Artesian water is controlled by 16" GATE VALVE (Cap, valve, etc)

(9) WELL TESTS Drawdown is amount water level is lowered below static level
Was a pump test made? XX Yes ☐ No If yes, by whom? CONTRACTOR
Yield 1380 gal/min with 725 ft drawdown after 24 hrs
Yield gal/min with ft drawdown after hrs
Yield gal/min with ft drawdown after hrs
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
1-5min	340'	10min	93.5'		
4 min	231'	18min	0		
5 min	200'				

Date of test 4-19-01
Bailer test N/A gal/min with ft drawdown after hrs
Airtest N/A gal/min with ft drawdown after hrs
Artesian flow 420 g p m Date 4-23-01
Temperature of water 55°F Was a chemical analysis made? XX Yes ☐ No

(10) WELL LOG or DECOMMISSIONING PROCEDURE DESCRIPTION
Formation Describe by color, character size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information Indicate all water encountered

MATERIAL	FROM	TO
SEE ATTACHED SHEETS		

RECEIVED
MAY 31 2001
DEPARTMENT OF ECOLOGY
WELL DRILLING UNIT

DEPT OF ECOLOGY Received JUN 04 2001 CENTRAL REGION OFFICE

Westerberg Drilling, Inc.
36728 S. Kropf Rd.
Molalla, OR 97038

Work Started 10-15-00 Completed 4-23-01

WELL CONSTRUCTION CERTIFICATION

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards Materials used and the information reported above are true to my best knowledge and belief

Type or Print Name Daniel D Stadeli License No 2097
(Licensed Driller/Engineer)

Trainee Name License No
Drilling Company Westerberg Drilling Inc
(Signed) [signature] License No
(Licensed Driller/Engineer)
Address 36728 S. Kropf Rd. Molalla, OR 97038
Contractor's Registration No WESTEDI005OG Date 5-24-01

(USE ADDITIONAL SHEETS IF NECESSARY)

98485

CITY OF WHITE SALMON
P.O. BOX 2139
WHITE SALMON, WA 98672
KLICKITAT SW¼ SE¼ SEC 3 T3N R10E
POWERHOUSE PRODUCTION WELL #2 ON TAMARACK LANE

36728 S Kropf Rd , Molalla, OR 97038 • Phone (503) 829-2526 FAX (503) 829-7514

WELL LOG:

Material:	From:	To:
gravel fill	0	1
silt brown	1	55
silt brown some clay grey	55	88
silty clay grey some gravels	88	91
basalt broken	91	93
basalt grey med	93	118
basalt fractured grey	118	129
basalt vesicular soft	129	136
gravel loose med	136	142
gravel cemented	142	165
gravel loosely cemented	165	171
gravel cemented	171	180
basalt weathered broken	180	189
basalt fractured brown grey	189	360
basalt fractured grey	360	455
basalt fractured brown grey	455	490
basalt fractured grey	490	610
basalt grey brecha	610	655
basalt fractured grey med	655	720
basalt med grey intermittent fracturing	720	840
basalt med grey fractured	840	870
basalt med grey fractured with grey mineral deposits	870	880
basalt med dark grey fractured some reddish basalt	880	888
basalt med grey very fractured with green & red coloring	888	890
basalt med grey	890	920
basalt med grey very fractured	920	938
basalt med grey hard fractured	938	956
basalt med hard	956	959
basalt med grey fractured	959	982
basalt med grey fractured green & brown	982	995
basalt med grey fractured with some green/brown	995	1020
basalt med grey fractured reddish brown	1020	1035
basalt med grey very fractured broken weathered	1035	1051
basalt med grey fractured with brown coloring	1051	1055
basalt broken weathered brown & green	1055	1066
basalt grey broken heavy iron deposits	1066	1072
weathered basalt some clay like deposits soft	1072	1077
weathered basalt broken iron	1077	1096
loose weathered basalt	1096	1100
light grey basalt med fractured	1100	1112
basalt light grey very hard some fracturing green	1112	1121
basalt grey med fractured green	1121	1127
basalt med grey with grey claystone	1127	1133

cont.

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WELL LOG:

Material:	From:	To:
cont.		
basalt med grey hard	1133	1137
basalt med grey fractured some vesicular	1137	1160
basalt med grey black fractures	1160	1190
basalt med grey fracturing with some green clay	1190	1242

Appendix C

Supplemental Aquatic Resources Information

Appendix C
Supplemental Aquatic Resources Information

Section 1 Fish Distribution Above and Below Barrier Falls

Where local names are commonly applied to existing waterfalls by kayakers, rafters, fishermen, and local residents, they will be used. River miles (RM) will be placed in parenthesis after waterfalls, barriers, and stream locations mentioned in this report. Where needed to identify locations, such as waterfalls and barriers to fish migration, RM will be placed in parenthesis after the location. Tributaries that flow directly into the White Salmon River will be identified by the RM (in parenthesis) where they join the river. Tributaries that do not flow directly into the White Salmon River will be identified in parenthesis by the name and RM or the tributary they flow into.

White Salmon River

An 8-foot waterfall at the RM 2.6 (Chapman et al. 1990) below Condit Dam may represent a barrier to the upstream migration of juvenile salmonids. Husum Falls (RM 7.6) has been estimated to be about 15 feet high before the completion of Condit Dam (Chapman et al. 1990). Dynamiting reduced the height of Husum Falls to approximately 8 to 10 feet (depending upon flows) after the completion of Condit Dam to facilitate construction of a highway bridge over the falls (LLA 1981). Before dynamiting, Husum Falls was a barrier to juvenile salmonids, resident trout, and coho salmon (*Oncorhynchus kisutch*) passage and probably a partial or complete barrier to the passage of Chinook salmon (*O. tshawytscha*). Steelhead would have been able to pass over the falls. Husum falls is still likely a barrier to upstream juvenile salmonid passage, but resident trout, salmon, and steelhead can pass over the Husum Falls during all but the highest or lowest flows.

BZ Falls (RM 12.4) is about 15 to 17 feet high and presents a passage problem for anadromous salmonids (Chapman et al. 1990). BZ Falls blocks upstream passage of juvenile salmonids and resident salmonids and (depending upon flows) is likely a barrier to upstream passage for all salmonids except steelhead trout (*O. mykiss*) and possibly spring-run Chinook salmon. Modification of BZ Falls to allow better passage is unlikely due to the reach between Buck Creek (RM 5.0) and Gilmer Creek (RM 12.7) being within a designated wild and scenic classification area (Chapman et al. 1990). Chapman et al. (1990) considered the two falls at RM 16.2 to be a complete block to all anadromous fish passage at all times. The upper falls (Big Brother) has a drop of 21 feet and the lower falls (Little Brother) has a drop of 16.5 feet (Chapman et al. 1990). The height of the drops, lack of resting spots for intermediate jump starts, and shallow plunge pools present an insurmountable obstacle to all upstream migrating fish species except perhaps Pacific lamprey (Chapman et al. 1990). Historic reports of steelhead occurring above Big Brother Falls (LLA 1981) appear to have been due to observers mistaking large resident rainbow trout (*O. mykiss*) for steelhead (Chapman et al. 1990, Bair et al. 2002). There are also numerous falls over 4 feet in height between Husum and Big Brother Falls that limit the upstream migration of juvenile and all but the largest resident trout (LeMier and Smith 1955).

Resident rainbow trout are the dominant salmonid documented to occur in the mainstem White Salmon River below Big Brother Falls, with small numbers of brook trout (*Salvelinus fontinalis*) and coastal cutthroat trout (*O. clarki clarki*) documented to occur below Husum Falls. During spring redd counts of the White Salmon River conducted during the spring (March to June) of 2001, two redds were observed at RM 9.4 and five redds were found immediately below the first riffle at the confluence of the White Salmon River with Northwestern Lake (Bair et al. 2002). These would have been wild trout because the only hatchery fish currently being planted in the basin are Goldendale strain rainbow trout, which spawn between October and January (Weinheimer 2005, Crawford 1979). Hatchery rainbow trout (catchables, fry, and broodstock) planted in Northwestern Lake are quickly caught by the sport fishery with very few carryovers from year to year and have not established reproducing populations (Weinheimer 2005). The brook trout is an introduced species that was introduced into many of the tributaries of Trout Creek (a tributary of the upper White Salmon River above RM 16.2) where it has become locally abundant. Occasional brook trout "drop-downs" may occur in the White Salmon River below the confluence of Trout Creek, but brook trout are most commonly encountered in the vicinity of the confluence of Spring Creek (RM 6.6). Based on surveys of tributary streams, shorthead sculpin (*Cottus confusus*), longnose dace (*Rhinichthys osculus*), western brook lamprey (*Lampetra richardsoni*) may occur in reaches of the mainstem of the White Salmon River. With the exception of the Trout Creek subbasin, native resident rainbow (found throughout the basin) are the dominant salmonid in the upper White Salmon River basin above RM 16.2, with the trout becoming progressively smaller and less abundant as the elevation increases.

Rattlesnake Creek (RM 7.5)

There are two sets of barrier falls in Rattlesnake Creek, which enters the White Salmon River a few hundred yards downstream from Husum Falls. The lower waterfall on the mainstem of Rattlesnake Creek at RM 1.5 is composed of three individual drops, with the middle one being the largest (about 11.8 feet in total height, but with a step and 4.5 foot pocket at 6.8 feet) (Allen et al. 2003). This lower fall (RM 1.5) is most likely a barrier to resident fish (including trophy size resident rainbow trout), but may not have been a barrier to large salmonids, such as salmon and, particularly, steelhead (Allen et al. 2003, Connolly 2005a, 2005b). The upper falls at RM 10.6 has two separate drops of about 72 to 82 feet each to form a complete barrier to the upstream migration of fish. A total of 2.2 miles of the lower 9 miles of Rattlesnake Creek were surveyed by electroshocking methodology (primarily single pass) in 2001 and 2002 (Allen et al. 2003). The average gradient in surveyed reaches of Rattlesnake Creek varied from 1.3 to 2.7 percent and the maximum temperatures measured varied from 68.5ºF in the highest reach measured to 75.4ºF in the lower reaches.

Six species of fish (rainbow trout, coastal cutthroat trout, brook trout, shorthead sculpin, longnose dace, and western brook lamprey) have been captured in Rattlesnake Creek below the lower water fall (RM 1.5). A single brook trout captured in Rattlesnake Creek below the lower fall is the sole representative of this species captured in the Rattlesnake Creek watershed during continuing studies between 2001 and 2002 (Connolly 2005b, 2005c). Because of the issue of bull trout (*Salvelinus confluentus*) in the White Salmon River watershed, a tissue sample from the brook trout was collected for genetic analysis, but results are not available at this date. Brook trout occur in small numbers in the White Salmon River below Husum Falls, but no 0 age brook trout have been collected in the Rattlesnake Creek watershed during intensive sampling for over two years and it is not believed that a reproducing population of brook trout exists in the Rattlesnake Creek basin (Allen et al. 2003). Only rainbow trout, longnose dace, and shorthead sculpin are found above the lower waterfall on Rattlesnake Creek, with all three species found as far upstream as the lower 9 miles of the stream that were surveyed. A Pacific giant salamander (*Dicamptodon tenebrosus*) was collected in the reach immediately above the lower set of waterfalls.

Although resident rainbow trout were relatively robust throughout Rattlesnake Creek, the biomass of longnose dace was approximately double that of salmonids and longnose dace generally outnumbered salmonids by an order of magnitude. Age 0 salmonids were far more numerous than older salmonids throughout Rattlesnake Creek. The maximum size of rainbow trout sampled in summer was less than 7 inches in fork length (FL) below the lower waterfall at RM 1.5 and as high as 10 inches immediately above the lower waterfall. A continuing survey of resident rainbow trout tagged with PIT tags in Northwestern Lake, the White Salmon River and Rattlesnake Creek subbasin became operational in 2001 (Jezorek and Connolly 2003). A companion study was conducted with radio tagged rainbow trout that were collected in the White Salmon River. A total of 64 fish received radio tags (Connolly 2005c). A portion of the rainbow trout tagged above the lower waterfall on Rattlesnake Creek were observed to migrate downstream into the lower reach of Rattlesnake Creek and into the White Salmon River (Jezorek and Connolly 2003, Connolly 2005a, 2005b). Most of the tagged resident rainbow trout from the White Salmon River that have been detected at the site were from the section of the White Salmon River within 220 yards upstream (below Husum Falls) and 660 yards downstream of the confluence with Rattlesnake Creek. Over 600 PIT tags in 2001 and 900 PIT tags in 2002 were inserted in fish from the mainstem White Salmon River and the Rattlesnake Creek watershed. The study is ongoing and fish are still being collected and tagged in Northwestern Lake, the White Salmon River and the Rattlesnake Creek watershed. Although 139 fish have been tagged in the White Salmon River outside of the half mile section at the confluence of Rattlesnake Creek, very few have been detected in Rattlesnake Creek (Jezorek and Connolly 2003, Connolly 2005a, 2005b). The length and growth of recaptured rainbow trout in Rattlesnake Creek below the lower falls showed annual growth, but a lack of growth during the summer months. Virtually no movement of Rattlesnake Creek trout was recorded in July, August, or September. Rattlesnake downstream migrants were recorded in all other months except February. White Salmon River migrants were recorded in Rattlesnake Creek during the months of December, February, March, and April. During redd surveys, large rainbow trout were observed on redds in Rattlesnake Creek below the lower falls (Connolly 2005c). These fish are much larger than those observed during population surveys conducted in the summer and are believed to be fish from the White Salmon River that use Rattlesnake Creek for spawning. Large resident wild rainbow trout that were tagged in the White Salmon River have been recorded spawning in both Rattlesnake Creek below the lower waterfall and in Indian Creek above the lower road culvert (Connolly 2005a, 2005b, 2005c). During the spring of 2001, a large wild rainbow trout radio tagged in Northwestern Lake was observed spawning in Rattlesnake Creek below the lower falls (Bair et al. 2002, Connolly 2005a, 2005b, 2005c).

Indian Creek is a tributary of Rattlesnake Creek, entering at RM 0.5. There is a culvert less than 0.1 mile from the mouth of Indian Creek that was thought to be a potential barrier to fish migration (Allen et al. 2003). Resident rainbow and coastal cutthroat trout captured and tagged in the White Salmon River and Rattlesnake Creek below the lower falls have since been recorded in Indian Creek above the lower road culvert (Connolly 2005a, 2005b, 2005c). This indicates that Indian Creek is used by spawning fluvial-adfluvial rainbow and coastal cutthroat trout from the White Salmon River. Resident trout occur in Indian Creek at least as far upstream as permission to survey has been granted (1.9 miles). A total of 1.1 miles of Indian Creek was surveyed by single pass electroshocking methodology in 2001 and 2002 (Allen et al. 2003). Over 81 percent of the age 1 or older salmonid population collected were coastal cutthroat trout, with the rest of the salmonids composed of rainbow trout. All but one trout captured in the upper 0.6 miles of surveyed stream were coastal cutthroat trout. The upper 0.6 miles of surveyed stream was above 2 road culverts that apparently restrict access by spawning rainbow trout from Rattlesnake Creek and the White Salmon River to the upper reaches of Indian Creek. The only other fish documented in Indian Creek were shorthead sculpin, which occurred throughout the surveyed reaches. The average gradient of Indian Creek varied from 2.8 percent in the lower surveyed reach to 4.7 percent in the upper surveyed reach and the maximum temperature measured during the summer was 71.2ºF. During a survey of the lower 0.5 mile of Indian Creek in August, rainbow trout had a maximum of 6 inches FL and coastal cutthroat trout had a maximum of 8 inches FL. The majority of rainbow collected were age 0 fish, while the majority of coastal cutthroat collected were age 1 or older fish.

Mill Creek is a tributary of Rattlesnake Creek entering at RM 8.7. It was surveyed from its mouth to 0.6 mile upstream and for 196 yards starting at a point 1.6 miles upstream (Allen et al. 2003). It contained resident rainbow trout and shorthead sculpin in the lower surveyed reach and only rainbow trout in the upper surveyed reach. The average gradient of Mill Creek was 8.1 percent and the maximum water temperature measured during the summer was 60.3ºF. During a survey in October, resident rainbow trout up to 7.3 inches FL were collected in the lower 0.6 mile of Mill Creek. The majority of trout collected were age 1 or older fish.

Spring Creek (RM 6.6)

A private hydro dam at RM 0.7 is a complete barrier to fish passage (Chapman et al. 1990). Coastal cutthroat have been documented in Spring Creek above the dam (Rawding 2005, Blakley et al. 2000). Resident rainbow trout were documented below the dam during snorkel surveys on August 13, 2001 (Thiesfeld et al. 2001). Water temperature during the surveys was recorded as 53ºF and the average gradient was 1.2 percent. Spring Creek had a rainbow trout density of 13.79 fish per 100 yards^2. A few brook trout (1.11 fish per 100 yards^2) and sculpin (*Cottus* sp.) were seen during night snorkeling.

Buck Creek (RM 5.0)

A diversion dam at RM 1.9 (Chapman et al. 1990) is a partial barrier to fish passage. U.S. Forest Service biologists observed fish attempting to jump over this structure and noted that trout over approximately 9 inches in length were able to pass over the structure (Bair et al. 2002). The diversion dam located at RM 3.8 and the 12- to 14-foot water fall located at RM 3.2 are complete barriers to the passage of anadromous fish (Chapman et al. 1990, Thiesfeld et al. 2001). Also, the 20-foot falls located at RM 4.0 is a barrier.

Snorkel surveys were conducted on June 26, 2001 at RM 1.4, above the diversion dam at RM 3.9, and in the Middle Fork at RM 0.1 (which enters Buck Creek at RM 4.9). Water temperatures of 50.5ºF (lower site), 54.0ºF (upper site), and 47ºF (Middle Fork) were recorded (Thiesfeld et al. 2001). Average gradients were 3.0 percent (lower Site), 4.1 percent (upper site), and 12.5 percent (Middle Fork). Buck Creek had a rainbow trout density of 9.34 fish per 100 $yards^2$ at RM 1.4 and 9.07 fish per 100 $yards^2$ at RM 3.9. A few sculpin (*Cottus* sp.) were present at RM 1.4, Pacific giant salamanders were found at both RM 1.4 and RM 3.9, while tailed frog (*Ascaphus truei*) tadpoles were found at only RM 3.9. No fish were observed in the Middle fork, but tailed frog tadpoles and Pacific giant salamanders were observed. Rainbow trout were the only salmonids observed in Buck Creek and they were found up to the end of the mainstem of Buck Creek at the confluence of the North and Middle Forks (RM 5.0), RM 0.4 of the North Fork, and RM 0.6 of the South Fork (Thiesfeld 2005).

The temperature of Buck Creek during a walking survey on June 28, 2000 was 46.9ºF (Bryne et al. 2001). Redd surveys conducted on the lower portion of Buck Creek during the spring (March to June) of 2001 counted 49 trout redds between the confluence with Northwestern Lake and the 4 foot high diversion dam at RM 1.9 (Bair et al. 2002, Connolly 2005c). Twelve of the 64 rainbow trout fitted with radio tags were found in Buck Creek during this period and all returned to Northwestern Lake after the spawning season (Bair et al. 2002). Although Buck Creek is within the distribution range of coastal cutthroat in the White Salmon River watershed, rainbow trout are the only salmonid documented in the watershed.

Mill Creek (RM 4.0)

Mill Creek drains into Northwestern Lake. A 5-foot-high natural falls at RM 0.8 probably limits upstream migration of salmon, but steelhead should be able to pass (Chapman et al. 1990). The falls would also prevent upstream migration by resident trout, but rainbow trout are found at least as far upstream as RM 1.7 and may occur as far upstream as RM 2.6. Chapman et al. (1990) considered the stream up to RM 1.05 marginal salmon habitat. Approximately 800 feet of stream channel is inundated by Northwestern Lake and covered by up to 50 feet of granular sediments (Vestra 1990, Squier 1994). Based on depth profiles of the 1927 river bottom and 1990 lake bed (Vestra 1990) and a lake sediment sampling study by Squier Associates (1994), it is estimated that the new Mill Creek stream channel would have an average gradient of about 7 percent and, unless a bedrock barrier fall forms, would not be a barrier to upstream salmonid migration.

A delta has formed at the mouth of Mill Creek where it enters the Mill Creek Arm of Northwestern Lake. During a site visit to Northwestern Lake, a URS geologist estimated the delta at it’s mouth to be approximately 200 feet long and 78 feet wide (Burk 2005). The depth of sediment near the mouth is unknown; however, it was speculated that it could be 10 feet deep. Bedrock was present at both streambanks and the stream flow was approximately 10 to 15 cfs. The sediments in the delta appeared to be primarily in the 0.5 to 1.0 inch range, armored with 4 to 6 inch cobble. After dam breaching, Mill Creek would be expected to begin down-cutting through the sediments and a head-cut would form where Mill Creek enters the new channel of the White Salmon River. A portion of the lake sediments covering the original channel of Mill Creek would be flushed away through the drain tunnel at the time of dam breaching. Over time, this head-cut would move upstream and eventually reach the top of the delta formed at the mouth of Mill Creek. Until this process is finished, the area of active head-cutting is likely to represent either a velocity barrier to salmonid migration or create an actual barrier fall. It is unlikely that the normal flow regime of Mill Creek generates sufficient stream power to transport bedload quickly enough to drive the area of active head-cutting all the way to the head of the current delta and create a stable channel within the three to five years previously estimated to create stable stream channels in the lakebed. After a stable channel forms in the former lakebed, it is estimated that approximately 0.95 mile of stream habitat below the 5-foot barrier fall would be available for salmon (primarily coho), steelhead, fluvial-adfluvial and resident rainbow trout, and resident or sea-run coastal cutthroat trout. Between 0.9 and 1.8 miles of additional stream habitat would become available above the falls for steelhead and resident rainbow trout.

Mill Creek was electroshocked at RM 1.7 on September 20, 2001 (Thiesfeld et al. 2001). Four age classes of rainbow trout up to 6.9 inches FL were the only fish species captured and they were abundant. The sample site had a low gradient and a water temperature of 53.6ºF. Coastal cutthroat trout, rainbow trout, and rainbow/cutthroat hybrids have been documented to occur downstream from the barrier fall (Johnson 2005, Connolly et al. 2002). Redds were observed in Mill Creek during a spring (March to June) 2001 spawning survey, but they appeared to be much smaller than redds observed in Buck Creek and the White Salmon River (Bair et al. 2002). This may be due to the redds being made by smaller resident coastal cutthroat trout.

Little Buck Creek (RM 3.5)

Little Buck Creek drains into Northwestern Lake. Chapman et al. (1990), state that spawning habitat extends upstream to about RM 0.5 and that potential steelhead rearing habitat extends further upstream. Approximately 400 feet of stream channel is inundated by Northwestern Lake and covered by 20 to 25 feet of fine sediments (Vestra 1990, Squier 1994). Based on depth profiles of the 1927 river bottom and 1990 lake bed (Vestra 1990) and a lake sediment sampling study by Squier Associates (1994), it is estimated that the new Little Buck Creek stream channel would have an average gradient of about 24 percent. It is likely that the new channel would either be a velocity barrier to salmonid migration or contain waterfalls that would prevent the upstream passage of salmon. Considering the narrowness of the White Salmon River Canyon at this point, it is unlikely that enough floodplain exists near the river for a very short lower gradient channel to form near Little Buck Creek's mouth.

A delta has formed at the mouth of Little Buck Creek where it enters a small bay of Northwestern Lake formed by the valley of the stream. During a site visit to Northwestern Lake, a delta similar to the delta formed at the mouth of Mill Creek, but on a smaller scale, was observed. The sediments in the delta appeared to be primarily in the 0.5 to 1.0 inch range, armored with 4- to 6-inch cobble. After dam breaching, Little Buck Creek would be expected to begin down-cutting through the fine lakebed sediments and a head-cut would form where Little Buck Creek enters the new channel of the White Salmon River. A portion of the lake sediments covering the original channel of Little Buck Creek would be flushed away through the drain tunnel at the time of dam breaching. Over time, this head-cut would move upstream and eventually reach the top of the delta formed at the mouth of Little Buck Creek. Even with an average gradient of approximately 24 percent, the normal flow regime of Little Buck Creek may not generate sufficient stream power to transport the bedload quickly enough to drive the area of active head-cutting all the way to the head of the current delta and create a stable channel within the 3-5 years estimated time required to create stable stream channels in the lakebed. Until the stream cuts down to the original bedrock channel, erosional processes would continue to deliver substantial quantities of fine sediments to the White Salmon River during storm runoff.

Little Buck Creek was electroshocked during a bull trout population assessment conducted by the Washington Department of Fish and Wildlife (WDFW) and found to contain a robust population of coastal cutthroat trout (Thiesfeld 2005). Tailed frogs and Pacific giant salamanders were noted during the survey. Although due to its steep gradient, it is unlikely that anadromous or fluvial-adfluvial salmonids will be able to utilize Little Buck Creek, the steep gradient should protect a population of resident coastal cutthroat from introgression with resident rainbow trout and steelhead trout. In addition, portions of the channel exposed after dam breaching should create additional stream habitat for the coastal cutthroat population.

Spring Creek (RM 3.45)

Spring Creek drains into Northwestern Lake. The stream is spring fed and water temperatures are cool the year around, but a steep gradient and high water velocities limit its potential for salmonid production (Chapman et al. 1990). The portion of the Spring Creek channel inundated by Northwestern Lake is similar in gradient and sediment depths to that of Little Buck Creek. Erosion of the fine sediments in the new channel would continue to deliver fine sediments to the White Salmon River during storm runoff until the stream cuts down to the original bedrock channel.

Based on the distribution of salmonids in Mill Creek and Little Buck Creek, it is possible that a population of coastal cutthroat trout exist in Spring Creek. Although due to its steep gradient, it is unlikely that anadromous or fluvial-adfluvial salmonids will be able to utilize Spring Creek, the steep gradient should protect any existing population of resident coastal cutthroat from introgression with resident rainbow trout and steelhead trout. In addition, portions of the channel exposed after dam breaching should create additional stream habitat for resident trout.

Potential Anadromous Salmonid Stream Habitat

Based on the above information, fall-run Chinook salmon are only likely to utilize the 9.1 miles of new main channel habitat below BZ Falls at RM 12.4 and may use habitat in the lower portions of Buck Creek (1.9 miles), Rattlesnake Creek (1.5 miles), and Spring Creek at RM 6.6 (0.7 miles) for spawning, rearing, and refuge. It is also possible that a small amount of Chinook salmon habitat may be provided in the lower reaches of Mill Creek (RM 4.0). Spring-run Chinook salmon may occasionally be able to pass over BZ falls during exceptionally favorable flows, but they are unlikely to be able to maintain a viable population above the falls.

Coho salmon are only likely to utilize the 4.3 miles of new main channel habitat below Husum Falls at RM 7.6 because there is no accessible tributary spawning habitat above Husum Falls and juvenile cohos are unlikely to be able to pass over Husum Falls. Coho salmon should be able to utilize all of the tributary habitat listed above for Chinook salmon and may be able to utilize additional tributary habitat.

Chum salmon distribution would be limited to below Husum Falls on the mainstem of the White Salmon River as well as below barrier falls further downstream on the mainstem and on tributaries of the White Salmon River. A partial barrier to fish passage located at RM 2.6 and potential small falls and cascades in the reservoir reach may also prevent upstream passage of chum salmon spawners.

Steelhead should be able to utilize the full 12.9 miles of new main channel habitat, but potential usage above Husum Falls and BZ Falls may become progressively less due to the lack of spawning tributaries and scarcity of spawning gravel in the river and difficulty for juvenile steelhead to ascend upstream past many of the falls and cascades in the river. Cold water temperatures will be limiting factors for steelhead production above Husum Falls, with the resident rainbow trout phenotype likely to be the dominant form (Cramer et al. 2003, Nielsen 2005).

Steelhead should be able to reach much of the available tributary habitat, either as spawning adults or as rearing juveniles (McMichael et al. 2000, Hubble 1992, Zimmerman and Reeves 2002, Cramer et al.2003 and 2005, Nielsen 2005, Everest 1973). Usage will be determined by summer water temperatures and flows, with steelhead primarily produced in the warmer streams with the lowest stream flows (Hubble 1992, Cramer et al. 2003, Nielsen 2005). An impassable fall on Buck Creek limits steelhead access to the stream above RM 3.2.

Fluvial-adfluvial populations of rainbow and coastal cutthroat trout will not be able to access Mill Creek above RM 0.8, Rattlesnake Creek above RM 1.5 (or Mill Creek in the Rattlesnake Creek watershed), and, with the exception of large fish, Buck Creek above RM 1.9. However, PIT tagging studies in the Rattlesnake Creek watershed would seem to indicate that resident populations of trout above barrier falls are contributing to the population of fluvial trout that are resident in the White Salmon River (Allen et al. 2003, Jezorek and Connolly 2003, Connolly 2005a, 2005b, 2005c).

Section 2. Fish Resources

This section updates the status of non-federally-listed state priority species likely to be found in the White Salmon River.

Resident Rainbow Trout

Rainbow trout native to the White Salmon River basin are assumed (Kostow 1995) to belong to the coastal subspecies of rainbow trout (*O. mykiss irideus*) (Behnke 1992 and 2002, Wydoski and Whitney 2003). Stocking of hatchery rainbow trout in the White Salmon River basin began as early as 1934 (Bair et al. 2002), but no hatchery rainbow trout alleles were detected during genetic analysis of five collections of resident rainbow trout from the White Salmon River (Phelps et al. 1990, Phelps et al. 1995, Weinheimer 2005). Genetic analysis of summer-run steelhead collected from the White Salmon River below Condit Dam indicated that they are *O. m. gairdneri* (Phelps et al. 1994) and are genetically distinct from resident rainbow trout collections from above Condit Dam (Larson and Bowdon 1995).

Steelhead from the 3 federally listed upriver steelhead Distinct Populations Segments (DPSs) likely to enter the White Salmon River basin belong to the interior redband subspecies of rainbow, *O. mykiss gairdneri* (Phelps et al. 1994, Behnke 1992 and 2002, Wydoski and Whitney

2003). Hatchery steelhead planted in the White Salmon River have primarily been Skamania Hatchery stocks that belong to the coastal subspecies of rainbow.

Anadromous steelhead and resident rainbow populations within river basins, such as the White Salmon River are more closely related to each other than to populations in other river basins. For example, resident rainbow in the Hood River are more closely related to Hood River winter and summer-run steelhead than they are to White Salmon River resident rainbow. If a native population of steelhead exists in the lower White Salmon River, it would also be a member of the coastal subspecies and closely related to the resident rainbow trout in the upper White Salmon River watershed. Genetic analysis of juvenile steelhead collected from the White Salmon River below Condit Dam indicated a mixture of coastal and interior *O. mykiss* (steelhead or rainbow) subspecies, distinctly different than displayed by native resident rainbow trout populations found above Condit Dam. This indicats that steelhead below Condit Dam are likely descendents of strays from upriver stocks of steelhead (interior subspecies) and out of basin hatchery stocks of the coastal subspecies (i.e. Skamania Hatchery winter- and summer-run steelhead).

Resident coastal rainbow appear to be native and distributed throughout the White Salmon River watershed (Bair et al. 2002, Bryne 2001, Allen et al. 2003, Connolly 2005a, Jezorek and Connolly 2003, Thiesfeld et al. 2001). Native resident rainbow trout are found above many existing natural barriers to fish passage (Connolly 2005a) in the White Salmon River watershed and occur far into the headwaters of many of the tributaries (Thiesfeld 2005). Resident rainbows likely coexisted in the White Salmon River basin with the andromous ecotype (steelhead before the construction of Condit Dam as far upstream as RM 16.2 (Cramer et al. 2003, Nielsen 2005). Based on their present distribution, small resident rainbow trout were probably distributed throughout the headwater streams (Thiesfeld et al. 2001, Allen et al. 2003, Bryne 2001). Large fluvial-adfluvial rainbow trout probably were and still are found in the mainstem of the White Salmon River as far upstream as RM 16.2 and perhaps as far upstream as the Trout Lake area (LLA 1981). Because of the prevailing temperature regimes in the river and its tributaries, the number and size of fluvial-adfluvial rainbow trout diminished as a function of temperature and channel size and flow in the mainstem, with trout becoming smaller in upstream reaches (Cramer et al. 2003 and 2005, Nielsen 2005, Bair et al.2002, Connolly 2005a and 2005b). Although substantial movements are possible, large fluvial-adfluvial rainbow trout in the White Salmon tend to spawn within a mile of their holding and foraging habitat in the mainstem of the river. They will frequently utilize tributaries for spawning when they are close by because gravel is relatively scarce in the main channel of the river.

It is difficult to reconstruct the historic steelhead runs or spawning and rearing habitat available to steelhead before the construction of Condit Dam, but steelhead spawning in the middle Columbia River tributary rivers tends to occur primarily in warmer tributaries, lower in the basins, where low summer flows and high water temperatures limit growth (McMichael et al. 2000, Hubble et al. 1992, Zimmerman and Reeves 2002, Cramer et al. 2003 and 2005, Nielsen 2005, Everest 1973). Steelhead juveniles utilize intermittent reaches, moving down or upstream to perennial reaches or holding in pools (Cramer et al. 2003, 2005, Zimmerman and Reeves 2002, Hubble et al. 1992, Nielsen 2005). While segregated spatially in some basins (Hubble et al. 1992, Zimmerman and Reeves 2000, 2002), the ranges of resident and anadromous ecotypes of both coastal and interior redband rainbow trout often overlap, both spatially and temporally (McMichael et al. 2000, Cramer et al. 2003 and 2005, Nielsen 2005). Under these conditions the resident and anadromous ecotypes of rainbow trout frequently interbreed (McMichael et al. 2000, Cramer et al. 2003, Zimmerman et al. 2003, Nielsen 2005). In some river basins, shifts from one ecotype to another have occurred when habitat conditions change (Marshall et al. 2004, Nielsen 2005).

Coastal Cutthroat Trout

On July 5, 2002, the USFWS withdrew the proposed rule to list southwestern Washington/Columbia River distinct population segment (DPS) of the coastal cutthroat trout as threatened (USFWS 2002b). The coastal cutthroat trout in the White Salmon River basin is now considered a species of Concern by the USFWS (USFWS 2005a). Coastal cutthroat trout populations in the White Salmon River basin are near the end of their interior range and their distribution within the watershed reflects a species near the edge of their range (Rawding 2005, Connolly 2005a).

Cutthroat trout were sampled from Mill Creek (RM 4.0), a tributary of Northwestern Lake, for genetic analysis by NMFS (Johnson 2005, Connolly et al. 2002, Connolly 2005a, Rawding 2005, Campton 2005). The collection took place in Mill Creek between Northwestern Reservoir and the lowest road crossing (Rawding 2005), where 40 trout were selected for their close resemblance to the coastal cutthroat phenotype. Allozyme analysis suggested that the White Salmon coastal cutthroat were relatively similar to cutthroat trout in the Washougal subbasin but, collectively, the White Salmon/Washougal River cutthroat trout were genetically distinct from coastal cutthroat trout elsewhere in the lower Columbia River basin (Connolly et al. 2002). Because of the distinct differences between the White Salmon/Washougal and other populations of coastal cutthroat trout in the lower Columbia River basin, the data was reexamined to determine if this was an artifact of introgression with rainbow trout (i.e., the specimens represent a cutthroat/rainbow trout hybrid swarm) (Connolly et al. 2002, Campton 2005). Analysis of the sample data determined that 16 of the trout were coastal cutthroat trout, 20 were cutthroat/rainbow hybrids, and four were pure rainbow trout (Johnson 2005, Campton 2005).

Coastal cutthroat trout were also collected from Spring Creek (RM 6.6) at the pond behind a private dam at RM 0.7 (Rawding 2005, Blakley et al. 2000). Little Buck Creek was electroshocked during a bull trout population assessment conducted by the WDFW and found to contain a robust population of coastal cutthroat trout (Thiesfeld 2005). The Rattlesnake Creek (RM 7.5) drainage was electroshocked during surveys conducted in 2001 and 2002. Coastal cutthroat trout were found in the lower reaches of Rattlesnake Creek below the lower waterfall (RM 1.5) and throughout the sampled reaches of Indian Creek (a tributary of Rattlesnake Creek, entering at RM 0.5) (Allen et al. 2003). Fluvial-adfluvial cutthroat trout have been observed spawning in these reaches of Rattlesnake and Indian Creeks (Connolly 2005a, 2005b, 2005c).

Coastal cutthroat trout have been observed in the White Salmon River between Husum Falls and Northwestern Lake, but not above Husum Falls. Some of these fish have been documented to spawn in Rattlesnake and Indian Creeks (Connolly 2005a, 2005b, 2005c). Buck Creek is the only surveyed tributary of the White Salmon River between Condit Dam and Husum Falls that hasn’t been documented to contain a population of coastal cutthroat trout. While coastal rainbow trout appear to be native and distributed throughout the White Salmon River watershed, coastal cutthroat trout appear to be native to the White Salmon River and its tributaries from Husum

Falls (RM 7.6), downstream (with spawning populations in at least 5 tributaries) (Connolly 2005a, 2005b, Thiesfeld 2005). It is not known why they haven't been detected between Husum Falls and BZ Falls (RM 12.4). This may be because appropriate spawning habitat is not available for them above Husum Falls. Coastal cutthroat primarily spawn in steeper gradient reaches of tributary streams (Trotter 1987, 1997). There are no spawning tributaries between Husum and BZ Falls. In addition, Chapman et al. (1990) documented Husum Falls to be about 15 feet high before the completion of Condit Dam. Dynamiting reduced the height of Husum Falls to 8-10 feet after the completion of Condit Dam to facilitate construction of a highway bridge over the falls (LLA 1981). At 15 feet in height, Husum Falls would probably have been a barrier to migration for coastal cutthroat trout and even after dynamiting, the lack of suitable spawning habitat may have prevented coastal cutthroat trout from colonizing the White Salmon River between Husum and BZ Falls.

The lack of sea-run cutthroat trout below Condit Dam may be related to the absence of suitable spawning tributaries below Condit Dam. In this case, since a fluvial-adfluvial life history has been documented to currently exist above Condit Dam, it is possible that a portion of this population of coastal cutthroat trout may assume an anadromous life history. There are anecdotal reports of sea-run resident coastal cutthroat trout in the White Salmon River and native sea-run and resident populations occur in the Hood River, Oregon, which enters the Columbia River a short distance upstream of the mouth of the White Salmon River (Blakley et al. 2000, Johnson et al. 1999, Hall et al. 1997).

Hatchery cutthroat westslope cutthroat trout (*O. clarki lewisi*) have been planted in the White Salmon River basin between 1936 and 1941 (Connolly et al. 2002), but extensive surveys throughout the basin for bull trout have not detected the presence of any reproducing populations (Thiesfeld et al. 2001, Byrne 2001, Connolly 2005a). The only other records of cutthroat trout stocked in the White Salmon River basin were plants from the Vancouver hatchery that were stocked in 1966 and 1967 (Connolly et al. 2002). These fish were probably coastal cutthroat trout because Vancouver maintained two strains of coastal cutthroat broodstock (Beaver Creek and Alsea River) at that time for planting in lower Columbia River tributaries in Washington State (Crawford 1979). It is possible that these plants are the source of some of the White Salmon coastal cutthroat populations, but enough genetic samples have been collected that the native status of White Salmon River basin populations could be determined by comparing them to the two hatchery stocks.

Bull Trout

Two sightings of bull trout have been reported above Condit Dam, both by WDFW biologists. One fish (10.75 inches FL) was captured in a gill net set in the spring of 1986 in Northwestern Lake (WDFW 1998, Weinheimer 2005). The other fish (about 12 inches long) was checked in the opening day creel census in April 1989 (WDFW 1998, Weinheimer 2005). Two reliable sightings were reported by sport anglers below Condit Dam in recent years (WDFW 1998, Weinheimer 2005). The bull trout seen below Condit Dam are not believed to reproduce in the White Salmon River and electroshocking in the lower river has not turned up any juvenile bull trout (WDFW 1998). WDFW fisheries biologists believe the bull trout in the lower White Salmon River below Condit Dam are "dip-ins' from the Hood River in Oregon, which contains a small population of bull trout (WDFW 1998).

Bull trout populations in the White Salmon River were assessed by WDFW surveys conducted in 2000 and 2001 (Bryne et al. 2001 and Thiesfeld et al. 2001). In 2000, Bryne et al. (2001) conducted night and day snorkel surveys of the White Salmon River between Husum Falls and Northwestern Lake. They did not survey Spring Creek (RM 6.6), but conducted walking surveys along Buck and Rattlesnake Creeks. They conducted day snorkel surveys of about 4.2 miles and night snorkel surveys of 2 quarter mile reaches of the White Salmon River above RM 36.9. Morrison Creek (RM 32.5) and Cascade Creek (RM 36.9) were surveyed by night snorkeling and Ninefoot Creek (36.2) was day snorkeled. No fish were observed in Morrison Creek and only rainbow trout were observed in the upper White Salmon River, Cascade Creek and Ninefoot Creek. It was determined that Buck Creek was too small to snorkel and no habitat or snorkel surveys were conducted in Rattlesnake Creek because it was considered unsuitable for bull trout due to low flows and high temperatures. No bull trout were observed during day and night snorkel surveys of the White Salmon River below Husum Falls, but many large trophy rainbows (14 to 24 inches in total length) were observed. Although no bull trout were observed, additional areas of cold-water habitat remain to be surveyed (Bryne et al. 2001). The reaches of the White Salmon River between Husum Falls and the upper reaches of the White Salmon River that were surveyed remain to be surveyed (Bryne et al. 2001). The White Salmon River is supplied by glacial run-off and cold groundwater seeping from the canyon walls and bottom. It was concluded that these canyon areas and Spring Creek (RM 6.6) above the private hydro project at RM 0.7 should be investigated as possible bull trout habitat (Bryne et al. 2001, Bryne 2005).

During 2001, Thiesfeld et al. (2001) snorkeled or electroshocked cool water tributaries between RM 4.0 and RM 6.6 (Mill, Buck, Middle Fork Buck, and Spring Creeks) along with tributaries of the White Salmon River above the upper limits of anadromous fish migration at Big Brother Falls (Beaver, Croften, Elmer Canyon, Lost, Smokey, Cultus, Little Goose, Meadow, and Mosquito Creeks and six unnamed tributaries of the White Salmon River headwaters). Only rainbow and brook trout were detected and no bull trout were found during the course of these surveys.

Additional surveys were conducted in 2002 and 2004 and reports (including a final report) for both seasons were written but have not been published (Bryne 2005). The upper reaches of Spring Creek (RM 6.6) were not surveyed due to lack of access on private land, while difficult access and safety concerns prevented surveys of the White Salmon River between RM 7.6 and RM 32.5. The bull trout surveys were unable to locate or identify spawning areas, although a small population of bull trout may exist in the basin above Condit Dam at a very low population density (Bryne 2005).

Although suitable spawning areas for bull trout are limited in the tributaries of the White Salmon River below RM 16.2 and only limited spawning gravel exists in the mainstem of the White Salmon River, the mainstem channel of the White Salmon River does contain excellent cold-water habitat for bull trout. Juvenile bull trout spend much of the daylight hours in the substrate. The high frequency of falls in the mainstem of the White Salmon River also presents a barrier to upstream migration of bull trout, limiting their options for seeking suitable rearing habitat. Although Northwestern Lake provides an excellent source of lacustrine habitat for a lacustrine-adfluvial population of bull trout to have developed since the construction of Condit Dam, it is possible that the limited amount of tributary spawning habitat and scarcity of gravel in the mainstem to provide spawning for adult bull trout and refuge for juvenile bull trout, combined with limits on upstream juvenile migration, have combined to limit the population density of bull trout below a threshold of detectability by any practicable level of surveying.

Nonsalmonid fish

Three species of nonsalmonid fish that are likely to occur in the Bonneville Pool, and potentially in the lower White Salmon River below Condit Dam, were not documented in the 1996 FEIS (FERC 1996) or 2002 FSFEIS (FERC 2002) for the Condit Hydroelectric Project. These are the leopard dace (*Rhinichthys falcatus*), mountain sucker (*Catostomus platyrhynchus*), and river lamprey (*Lampetra ayresi*). All three of these species are Washington state Candidate species. If these species occur in the White Salmon River, they most likely are found in the large pool at the in-lieu site.

Three species of nonsalmonid fish, longnose dace, western brook lamprey, and shorthead sculpin have been documented to occur in the White Salmon River above Condit Dam (Allen et al. 2003).

Section 3 Freshwater Mussels

California Floater (*Anodonta californiensis)*

The California floater is a Washington state Candidate Species. In the Draft White Salmon River Subbasin Summary prepared for the Northwest Power Planning Council by the WDFW, Dan Rawding (2000) states, “Freshwater mussels are known to inhabit certain portions of the basin; however, the current species assemblages, distribution, and status are unknown.” A large population of freshwater mussels is known to exist in Rattlesnake and Indian creeks (Parker 2005). The priority species status review by the WDFW documents their presence in the Columbia River about 20 miles upstream from the mouth of the White Salmon River. This is the closest known survey for benthic invertebrates to the project area. Molly Hallock, a WDFW biologist, stated in a phone conversation that she was unaware of any mollusk surveys that have been conducted by WDFW or USFWS in the White Salmon River Basin (Hallock 2005).

Terrence Frest, one of the malacologists most familiar with Columbia Basin mollusks, stated that he wasn’t aware of any surveys conducted in this portion of the Bonneville Pool. He also acknowledged that suitable habitat was likely present, that the project site was within the historic range of the species, and that a survey would be required to document its absence from the site (Frest 2003, 2004).

The lower reaches of the White Salmon River and Columbia River in the vicinity of the project contains suitable historic habitat for California floaters. Management Recommendations for Washington State priority invertebrate species (Larsen et al. 1995) state that baseline surveys are required to adequately monitor, manage, and mitigate for losses of the California floater and/or its habitat and that this species should be considered when projects are planned which might cause erosion, siltation, or bedload movements in streams. Pending survey/inventory data from the project area documenting the absence of California floaters, documentation from WDFW or USFWS to the effect that baseline inventories of freshwater mussels in the project area have established the absence of California floaters, it is impossible to determine that project-related impacts to California floaters will not occur (Strayer and Smith 2003).

Section 4 Threatened and Endangered Fish Species

The status of all federally listed, proposed, or candidate Chinook salmon, chum salmon (*O. keta*), coho salmon, steelhead trout, and coastal cutthroat trout likely to be found in the White Salmon River has been reevaluated since the June 2002 publication of the FSFEIS for the Condit Hydroelectric Project. In addition, critical habitat has been withdrawn and proposed for six of the listed Pacific salmon and steelhead ESUs and critical habitat for the Columbia River bull trout DPS has been designated.

On February 11, 2002, the National Marine Fisheries Service (NMFS) published a notice of findings for six petitions to delist 15 ESUs of Pacific salmon and steelhead (*Oncorhynchus* spp.) (NMFS 2002). NMFS determined that a status review was warranted for 14 of the petitioned ESUs and added 10 additional listed ESUs as well as a candidate ESU [Lower Columbia River/Southwestern Washington Coho Salmon (*O. kisutch*)] for a total of 25 ESUs to be updated. ESUs likely to be found in the White Salmon River that were reviewed included the Snake River Spring/Summer Chinook Salmon, Snake River Fall Chinook Salmon, Lower Columbia River Chinook Salmon, Upper Columbia River Spring Chinook Salmon, Lower Columbia/Southwest Washington Coho Salmon, Columbia River Chum Salmon, Upper Columbia River Steelhead, Middle Columbia River Steelhead, and Snake River Basin Steelhead. On June 14, 2004, NMFS published proposed listing determinations for 27 ESUs of west coast salmonids (NMFS 2004a). The proposed listing determinations included two additional ESUs, the Snake River Sockeye (likely to be found in the Bonneville Pool) and the Southern California Steelhead. The status of all 10 listed Pacific salmon and steelhead ESUs likely to be found in the White Salmon River has been reviewed and new listing determinations proposed.

On June 28, 2005, NMFS published the final listing determination for 16 ESUs of West Coast Salmon and final 4(d) protective regulations for threatened salmonid ESUs (NMFS 2005a), finalizing the listing determinations for Snake River Spring/Summer Chinook Salmon, Snake River Fall Chinook Salmon, Lower Columbia River Chinook Salmon, Upper Columbia River Spring Chinook Salmon, Lower Columbia/Southwest Washington Coho Salmon, Snake River Sockeye, and Columbia River Chum Salmon.

On June 28, 2005, NMFS published a 6-month extension of the final listing determination for 10 ESUs of West Coast *Oncorhynchus mykiss* (NMFS 2005b), extending the date for the listing determinations of Upper Columbia River Steelhead, Middle Columbia River Steelhead, and Snake River Basin Steelhead for six months. One of the primary issues concerns determining whether resident rainbow trout populations should be included in the ESUs. A final listing determination for steelhead was published on January 5, 2006 (NMFS 2006) which also replaced the ESU designation with a DPS designation. The listed steelhead DPSs are now defined as containing all naturally spawned anadromous *O. mykiss* populations below natural and manmade impassable barriers, but not including resident freshwater populations of rainbow trout (*O. mykiss*) that are sympatric (rearing in the same stream) with anadromous populations.

On April 30, 2002, the U.S. District Court for the District of Columbia approved an NMFS consent decree withdrawing critical habitat designation for 19 salmon and steelhead populations on the west coast (USDC 2002). Critical habitat designation was withdrawn for the 19 ESUs listed in the final rule published on February 16, 2000 (NMFS 2000). Critical habitat designations for the Upper and Lower Columbia River Spring Chinook, Columbia River Chum, Snake River Steelhead, and Upper and Middle Columbia River Steelhead likely to be found in the White Salmon River were included among the 19 ESUs, but critical habitat determinations for the Snake River Spring/Summer and Fall Chinook Salmon and Snake River Sockeye were allowed to remain in effect. The final rule to remove critical habitat designations for these ESUs plus the Northern California Steelhead ESU was published on September 29, 2003 (NMFS 2003). On December 14, 2004 critical habitat designations were proposed for 13 salmonid ESUs, including the six listed ESUs likely to be found in the White Salmon River for which critical habitat was reviewed (NMFS 2004b). Final critical habitat designations were published on September 2, 2005 for 12 salmonid ESUs, including the six listed ESUs likely to be found in the White Salmon River (NMFS 2005c). No changes from the proposed critical habitat designations were made in the project area.

On April 21, 2000, NMFS and the USFWS published a notice transferring jurisdiction for coastal cutthroat trout from NMFS to the USFWS (NMFS and USFWS 2000). All coastal cutthroat trout ESUs were redesignated as DPSs. On July 5, 2002, the USFWS withdrew the proposed rule to list southwestern Washington/Columbia River DPS of the coastal cutthroat trout as threatened (USFWS 2002b).

On November 29, 2002, designation of critical habitat for the Columbia River bull trout DPS was proposed and the availability of a draft recovery plan for the Columbia River bull trout DPS was announced (USFWS 2002a). Critical habitat for the Columbia River bull trout DPS was proposed on June 25, 2004 (USFWS 2004a) and a final rule published on October 6, 2004 (USFWS 2004b). USFWS published a revised final rule for critical habitat of for all bull trout DPSs on September 15, 2005 (USFWS 2005b).

The status by ESU/DPS of federally listed threatened and endangered fish species and proposed and candidate species likely to be found in the White Salmon River is updated below.

Snake River Sockeye Salmon

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) gives a description of the origin, life history, critical habitat designation and ESA listing determination of Snake River sockeye salmon in the White Salmon River and Columbia River/Bonneville Pool as of June 2002. On February 11, 2002 the ESA listing determination of endangered came under review (NMFS 2002). On December 14, 2004, it was proposed that the ESA listing of endangered be continued (NMFS 2004a) and the determination was finalized in a notice published on June 16, 2004 (NMFS 2005a).

Snake River Spring/Summer-Run Chinook Salmon

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) gives a description of the origin, life history, critical habitat designation and ESA listing determination of Snake River spring/summer-run Chinook salmon in the White Salmon and Columbia River/Bonneville Pool River as of June 2002. On February 11, 2002 the ESA listing determination of threatened came under review (NMFS 2002). On December 14, 2004, it was proposed that the ESA listing of threatened be continued (NMFS 2004a) and the determination was finalized in a notice published on June 16, 2004 (NMFS 2005a).

Snake River Fall-Run Chinook Salmon

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) gives a detailed description of the origin, life history, critical habitat designation and ESA listing determination of Snake River fall-run Chinook salmon in the White Salmon River and Columbia River/Bonneville Pool as of June 2002. On February 11, 2002 the ESA listing determination of threatened came under review (NMFS 2002). On December 14, 2004, it was proposed that the ESA listing of threatened be continued (NMFS 2004a) and the determination was finalized in a notice published on June 16, 2004 (NMFS 2005a).

At the publication of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) it was assumed that fall-run Chinook salmon juveniles in the Snake River basin adhered strictly to an ocean-type life history characterized by saltwater entry at age 0 and first-year wintering in the ocean. Recent research has shown that some fall-run Chinook salmon juveniles in the Snake River basin spend their first winter in a reservoir and resume seaward movement the following spring at age 1 (Connor et al. 2005). This newly discovered ecotype has been defined as a "reservoir-type" juvenile. Ocean-type juveniles average 4.4 to 5.5 inches FL, while reservoir-type juveniles average 8.7 to 8.8 inches FL. The large size of reservoir-type juveniles suggests a high potential for ocean survival.

Upper Columbia River Spring-Run Chinook Salmon

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) gives a description of the origin, life history, critical habitat designation and ESA listing determination of Upper Columbia River spring-run Chinook salmon in the White Salmon River and Columbia River/Bonneville Pool as of June 2002. On February 11, 2002 the ESA listing determination of endangered came under review (NMFS 2002). On December 14, 2004, it was proposed that the ESA listing of endangered be continued (NMFS 2004a) and the determination was finalized in a notice published on June 16, 2004 (NMFS 2005a).

The U.S. District Court for the District of Columbia approved an NMFS consent degree on April 30, 2002 (USDC 2002), withdrawing the critical habitat designation. The final rule which removed the critical habitat designation was not published until September 29, 2003 (NMFS 2003). An assessment of critical habitat was prepared by the NOAA Fisheries critical habitat analytical review team (NOAA 2004) and on December 14, 2004 a new critical habitat designation was proposed designating Upper Columbia River spring Chinook critical habitat to include the Columbia River (including Bonneville Pool) (NMFS 2004b). Critical habitat was defined as including the stream channel within the proposed stream reach, including a lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series. Critical habitat in lake areas is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. The Columbia River is defined as a freshwater migration corridor with the following primary constituent elements: free of obstruction and excessive predations, with water quantity and quality conditions and natural cover supporting juvenile and adult mobility and survival. Final critical habitat designations were published on September 2, 2005 (NMFS 2005c). No changes from the proposed critical habitat designations were made in the project area.

Lower Columbia River Chinook Salmon

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002), along with Section 4.3.1.2 and Appendix E of the FEIS for the Condit Hydroelectric Project (FERC 1996) give a detailed description of the origin, life history, critical habitat designation and ESA listing determination of Lower Columbia River Chinook salmon in the White Salmon River and Columbia River/Bonneville Pool as of June 2002. On February 11, 2002 the ESA listing determination of threatened came under review (NMFS 2002). On December 14, 2004, it was proposed that the ESA listing of threatened be continued (NMFS 2004a) and the determination was finalized in a notice published on June 16, 2004 (NMFS 2005a).

The U.S. District Court for the District of Columbia approved an NMFS consent degree on April 30, 2002 (USDC 2002), withdrawing the critical habitat designation and the final rule removing the critical habitat designation was published on September 29, 2003 (NMFS 2003). An assessment of critical habitat was prepared by the NOAA Fisheries critical habitat analytical review team (NOAA 2004) and on December 14, 2004 a new critical habitat designation was proposed designating Lower Columbia River Chinook critical habitat to include the White Salmon River from the base of Condit Dam to its mouth (NMFS 2004b). Critical habitat was defined as including the stream channel within the proposed stream reach, including a lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series. Critical habitat in lake areas is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. The White Salmon River contains the following primary constituent elements: 1) freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; 2) freshwater rearing sites with floodplain connectivity, forage supporting juvenile development, and natural cover; and 3) a freshwater migration corridor with the following primary constituent elements: free of obstruction and excessive predations, with water quantity and quality conditions and natural cover supporting juvenile and adult mobility and survival. Final critical habitat designations were published on September 2, 2005 (NMFS 2005c). No changes from the proposed critical habitat designations were made in the project area.

Columbia River Chum Salmon

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) gives a description of the origin, life history, critical habitat designation and ESA listing determination of Columbia River chum salmon in the White Salmon River and Columbia River/Bonneville Pool as of June 2002. On February 11, 2002 the ESA listing determination of threatened came under review (NMFS 2002). On December 14, 2004, it was proposed that the ESA listing of threatened be continued (NMFS 2004a) and the determination was finalized in a notice published on June 16, 2004 (NMFS 2005a).

The U.S. District Court for the District of Columbia approved an NMFS consent degree on April 30, 2002 (USDC 2002), withdrawing the critical habitat designation and the final rule removing the critical habitat designation was published on September 29, 2003 (NMFS 2003). An assessment of critical habitat was prepared by the NOAA Fisheries critical habitat analytical review team (NOAA 2004) and on December 14, 2004 a new critical habitat designation was proposed designating Columbia River chum salmon critical habitat to include the White Salmon River from the base of Condit Dam to its mouth (NMFS 2004b). Critical habitat was defined as including the stream channel within the proposed stream reach, including a lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series. Critical habitat in lake areas is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. The White Salmon River contains the following primary constituent elements: 1) freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; 2) freshwater rearing sites with floodplain connectivity, forage supporting juvenile development, and natural cover; and 3) a freshwater migration corridor with the following primary constituent elements: free of obstruction and excessive predations, with water quantity and quality conditions and natural cover supporting juvenile and adult mobility and survival. Final critical habitat designations were published on September 2, 2005 (NMFS 2005c). No changes from the proposed critical habitat designations were made in the project area.

The decision to include the White Salmon River from the base of Condit Dam to its mouth was based on spawning ground surveys conducted on the mainstem Columbia River and its tributaries in 2002 (NMFS 2005d, Ehlke and Keller 2003). It's likely the actual spawning escapement upstream from Bonneville Dam is actually less than the dam counts. Of the 188 adult chum salmon observed passing Bonneville Dam in 2002, five salmon were trapped and tagged in November through Thanksgiving and the fish released upstream from the trap (Ehlke and Keller 2003). Two fish were detected downstream from Bonneville Dam and one in the Dalles Dam ladder entrance. Historical counts of chum salmon passing over Bonneville Dam have most likely been underestimated because visual counting at Bonneville was usually terminated on November 15 (Ehlke and Keller 2003). However, video tape studies have shown only about half of the chum salmon passing Bonneville Dam pass through the ladder by mid-November during normal counting periods. Video counts conducted in 2004 from April 1 though October 31 indicate only 21 of the 188 fish (11%) had passed the dam by November 15 (Ehlke and Keller 2003).

The White Salmon River was the only Washington State tributary of the Columbia River in which chum salmon were detected (Ehlke and Keller 2003). A total of one male and one unspawned female chum salmon were observed in the White Salmon River during three surveys conducted between November 6 and 20th, 2000 (Ehlke and Keller 2003). Considering that the majority of chum salmon passed Bonneville Dam after November 15, it is reasonable to assume that more than two chum salmon may have spawned in the White Salmon River during the fall of 2002.

The documentation of two adult chum salmon is not evidence that chum salmon are actually reproducing in the White Salmon River at the present time, but represents the potential for eventual recolonization of the river if suitable spawning habitat is available. It is unknown at this time if chum salmon would be able to access spawning habitat in the White Salmon River above Condit Dam or a partial barrier fall at RM 2.6. However, providing suitable spawning habitat for chum salmon in the White Salmon River would require restoration of gravel recruitment to the river channel that can only be accomplished through the removal of the dam.

Snake River Basin Steelhead

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) gives a description of the origin, life history, critical habitat designation and ESA listing determination of Snake River basin steelhead in the White Salmon River and Columbia River/Bonneville Pool as of June 2002. On February 11, 2002 the ESA listing determination of threatened came under review (NMFS 2002). On December 14, 2004, it was proposed that the ESA listing of threatened be continued (NMFS 2004a) and the date for determination was extended six months on June 16, 2004 (NMFS 2005b). A final listing determination published on January 5, 2006 (NMFS 2006), continuing the ESA listing of threatened and replacing the ESU designation with a DPS designation. The DPS is now defined as containing all naturally spawned anadromous *O. mykiss* populations below natural and manmade impassable barriers and does not include resident freshwater populations of rainbow trout (*O. mykiss*) that are sympatric (rearing in the same stream) with anadromous populations.

The U.S. District Court for the District of Columbia approved an NMFS consent degree on April 30, 2002 (USDC 2002), withdrawing the critical habitat designation and the final rule removing the critical habitat designation was published on September 29, 2003 (NMFS 2003). An assessment of critical habitat was prepared by NOAA Fisheries critical habitat analytical review team (NOAA 2004). On December 14, 2004 a new critical habitat designation was proposed to include the Columbia River (including Bonneville Pool) with the Snake River basin steelhead critical habitat (NMFS 2004b). Critical habitat was defined as including the stream channel within the proposed stream reach, including a lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series. Critical habitat in lake areas is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. The Columbia River is defined as a freshwater migration corridor with the following primary constituent elements: free of obstruction and excessive predations, with water quantity and quality conditions and natural cover supporting juvenile and adult mobility and survival. Final critical habitat designations were published on September 2, 2005 (NMFS 2005c). No changes from the proposed critical habitat designations were made in the project area.

Unpublished data from adult tracking studies conducted by Peery and Keefer at the University of Idaho suggests that significant numbers of "drop-in" steelhead hatchery-strays from other basins move into the Deschutes River temporarily, then return downstream to the Columbia and continue to other watersheds (Cramer et al. 2003). Steelhead collected at Bonneville Dam were outfitted with transmitters. These fish were later detected in the Deschutes River at RM 0.3 and RM 43 (Sherars Falls). Approximately 60-70% of the steelhead detected within the mouth of the Deschutes were later detected in other watersheds, and 30-40% of steelhead detected near Sherars Falls were later detected in other watersheds. Up to 25% of the radio-tagged steelhead known to have traveled as far upstream as Sherars Falls were later found in the Snake River. Although these "drop-in" steelhead are primarily hatchery steelhead from the Snake River basin, the lower portion of the Deschutes was famous in the 1950s for sports catches of large wild B-run steelhead trout of 20 pounds or more (Migdalski 1962) that were likely "drop-in" fish from the Snake River basin. Based on this information, it is likely that "drop-in" steelhead (and other andromous salmonids) from Columbia River and Snake River DPSs upstream of the White Salmon River will utilize pools for refuge from high summer water temperatures in the Bonneville Pool throughout the reaches of the White Salmon River that become accessible after the removal of Condit Dam.

Although Snake River steelhead are not residents of the White Salmon River, adults are attracted to and stray into the cooler waters of the White Salmon River during the summer. The lower White Salmon River provides an excellent thermal refuge for summer steelhead migrating upstream in the Columbia River (Rawding 2000), and the Peery and Keefer research presented in Cramer et al. (2003) indicates that Snake River basin steelhead will likely utilize thermal refuge as far upstream as RM 16.2 after dam removal.

Upper Columbia River Steelhead

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) gives a description of the origin, life history, critical habitat designation and ESA listing determination of Upper Columbia River steelhead in the White Salmon River and Columbia River/Bonneville Pool as of June 2002. On February 11, 2002, the ESA listing determination of endangered came under review (NMFS 2002). On December 14, 2004, it was proposed that the ESU be down-listed to an ESA determination of threatened (NMFS 2004a) and the date for determination was extended six months on June 16, 2004 (NMFS 2005b). A final listing determination published on January 5, 2006 (NMFS 2006), downlisted the Upper Columbia River steelhead and replaced the ESU designation with a DPS designation. The DPS is now defined as containing all naturally spawned anadromous *O. mykiss* populations below natural and manmade impassable barriers but not including resident freshwater populations of rainbow trout (*O. mykiss*) that are sympatric (rearing in the same stream) with anadromous populations.

The U.S. District Court for the District of Columbia approved an NMFS consent degree on April 30, 2002 (USDC 2002), withdrawing the critical habitat designation and the final rule removing the critical habitat designation was published on September 29, 2003 (NMFS 2003). An assessment of critical habitat was prepared by the NOAA Fisheries critical habitat analytical review team (NOAA 2004) and on December 14, 2004 a new critical habitat designation was proposed designating Upper Columbia River steelhead critical habitat to include the Columbia River (including Bonneville Pool) (NMFS 2004b). Critical habitat was defined as including the stream channel within the proposed stream reach, including a lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series. Critical habitat in lake areas is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. The Columbia River is defined as a freshwater migration corridor with the following primary constituent elements: free of obstruction and excessive predations, with water quantity and quality conditions and natural cover supporting juvenile and adult mobility and survival. Final critical habitat designations were published on September 2, 2005 (NMFS 2005c). No changes from the proposed critical habitat designations were made in the project area.

Unpublished data from adult tracking studies conducted by Peery and Keefer at the University of Idaho suggests that significant numbers of “drop-in” steelhead hatchery-strays from other basins move into the Deschutes River temporarily, then return downstream to the Columbia and continue to other watersheds (Cramer et al. 2003). Steelhead collected at Bonneville Dam were outfitted with transmitters. These fish were later detected in the Deschutes River at RM 0.3 and RM 43 (Sherars Falls). Approximately 60-70% of the steelhead detected within the mouth of the Deschutes were later detected in other watersheds, and 30-40% of steelhead detected near Sherars Falls were later detected in other watersheds. Up to 25% of the radio-tagged steelhead known to have traveled as far upstream as Sherars Falls were later found in the Snake River. Although these “drop-in” steelhead are primarily hatchery steelhead from the Snake River basin, the lower portion of the Deschutes was famous in the 1950s for sports catches of large wild B-run steelhead trout of 20 pounds or more (Migdalski 1962) that were likely “drop-in” fish from the Snake River basin. Based on this information, it is likely that “drop-in” steelhead (and other andromous salmonids) from Columbia River and Snake River DPSs upstream of the White Salmon River will utilize pools for refuge from high summer water temperatures in the Bonneville Pool throughout the reaches of the White Salmon River that become accessible after the removal of Condit Dam.

Although Upper Columbia River steelhead are not residents of the White Salmon River, adults are attracted to and stray into the cooler waters of the White Salmon River during the summer. The lower White Salmon River provides an excellent thermal refuge for summer steelhead migrating upstream in the Columbia River (Rawding 2000), and the Peery and Keefer research presented in Cramer et al. (2003) indicates that Upper Columbia River steelhead will likely utilize thermal refuge as far upstream as RM 16.2 after dam removal.

Middle Columbia River Steelhead

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002), along with Section 4.3.1.2 and Appendix E of the FEIS for the Condit Hydroelectric Project (FERC 1996) give a detailed description of the origin, life history, and status of steelhead in the White Salmon River. On February 11, 2002 the ESA listing determination of threatened came under review (NMFS 2002). On December 14, 2004, it was proposed that the ESA listing of threatened be continued (NMFS 2004a) and the date for determination was extended six months on June 16, 2004 (NMFS 2005b). A final listing determination published on January 5, 2006 (NMFS 2006), continuing the ESA listing of threatened and replacing the ESU designation with a DPS designation. The DPS is now defined as containing all naturally spawned anadromous *O. mykiss* populations below natural and manmade impassable barriers but not including resident freshwater populations of rainbow trout (*O. mykiss*) that are sympatric (rearing in the same stream) with anadromous populations.

The U.S. District Court for the District of Columbia approved an NMFS consent degree on April 30, 2002 (USDC 2002), withdrawing the critical habitat designation, and the final rule removing the critical habitat designation was published on September 29, 2003 (NMFS 2003). An assessment of critical habitat was prepared by the NOAA Fisheries critical habitat analytical review team (NOAA 2004) and on December 14, 2004 a new critical habitat designation was proposed designating Middle Columbia River steelhead critical habitat to include the White Salmon River from the base of Condit Dam to its mouth (NMFS 2004b). Critical habitat was defined as including the stream channel within the proposed stream reach, including a lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series. Critical habitat in lake areas is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. The White Salmon River contains the following primary constituent elements: 1) freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; 2) freshwater rearing sites with floodplain connectivity, forage supporting juvenile development, and natural cover; and 3) a freshwater migration corridor with the following primary constituent elements: free of obstruction and excessive predations, with water quantity and quality conditions and natural cover supporting juvenile and adult mobility and survival. Final critical habitat designations were published on September 2, 2005 (NMFS 2005c). No changes from the proposed critical habitat designations were made in the project area.

Bull Trout

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) gives a description of the origin, life history, critical habitat designation and ESA listing determination of the Columbia River bull trout DPS in the White Salmon River and Columbia River/Bonneville Pool as of June 2002. On November 29, 2002, designation of critical habitat for the Columbia River bull trout DPS was proposed and the availability of a draft recovery plan for the Columbia River bull trout DPS was announced (USFWS 2002a). Critical habitat for the Columbia River bull trout DPS was proposed on June 25, 2004 (USFWS 2004a) and a final rule published on October 6, 2004 that designated critical habitat in the project area to include the White Salmon River from Big Brother Falls at RM 16.2 downstream to its mouth, but only for non-federal lands that have greater than ½ mile of river frontage (USFWS 2004b). USFWS published a revised final rule for critical habitat of for all bull trout DPSs on September 26, 2005 (USFWS 2005b).

Critical habitat was defined as including the stream channels within the defined stream reaches indicated on the maps in the critical habitat designation, including a lateral extent from the bankfull elevation on one bank to the bankfull elevation on the opposite bank. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series. If bankfull elevation is not evident on either bank, the ordinary high-water line shall be used to determine the lateral extent of critical habitat. Critical habitat in lake areas is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. The White Salmon River contains the following primary constituent elements: 1) water temperatures ranging from 36 to 59ºF with adequate thermal refugia available for temperatures at the upper end of this range; 2) complex stream channels; 3) substrates that ensure success of egg and embryo survival and fry to juvenile survival; 4) a natural hydrograph or, if regulated a hydrograph that minimizes daily and day-to-day fluctuations and departures from the natural flow cycles; 5) subsurface water connectivity to contribute to water quality and quantity; 6) migratory corridors with minimal impediments between spawning, rearing, overwintering, and foraging habitats; 7) an abundant food base; 8) few or no nonnative predatory, interbreeding, or competitive species present; and 9) permanent water of sufficient quantity and quality for normal reproduction, growth and survival. Critical habitat also excludes non-Federal lands regulated under the Washington Forest Practice Act (RCW Ch. 76.09).

Southwest Washington/Columbia River Cutthroat Trout

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002) gives a description of the origin, life history, and status of Southwest Washington/Columbia River cutthroat trout in the White Salmon River and Columbia River/Bonneville Pool as of June 2002. On April 21, 2000, NMFS and the USFWS published a notice transferring jurisdiction for coastal cutthroat trout from NMFS to the USFWS (NMFS and USFWS 2000). All coastal cutthroat trout ESUs were redesignated as Distinct Population Segments (DPSs). On July 5, 2002, the USFWS withdrew the proposed rule to list the southwestern Washington/Columbia River DPS of the coastal cutthroat trout as threatened (USFWS 2002b). The coastal cutthroat trout in the White Salmon River basin is now considered a species of concern by the USFWS (USFWS 2005a).

Lower Columbia River/Southwest Washington Coho Salmon

Section 3.4.5 of the FSFEIS for the Condit Hydroelectric Project (FERC 2002), along with Section 4.3.1.2 and Appendix E of the FEIS for the Condit Hydroelectric Project (FERC 1996) give a detailed description of the origin, life history, and status of coho salmon in the White Salmon River. On February 11, 2002 the candidate Lower Columbia River/Southwest Washington Coho Salmon ESU was added to a list of 25 west coast salmon and steelhead ESUs to have their status updated (NMFS 2002). On December 14, 2004, it was proposed that the ESU candidate status be changed to an ESA determination of threatened (NMFS 2004a) and the determination was finalized in a notice published on June 16, 2004 (NMFS 2005a).

Section 5 Potential Impact of Anadromous Salmonids on Resident Rainbow Trout

Where there is a strong out-migration of age 1 resident trout from a spawning stream (particular warmer tributaries with low summer flows), the potential exists for a landlocked resident population of rainbow trout to select for an anadromous ecotype when the barrier to migration is removed or habitat conditions change to favor the anadromous ecotype (Marshal et al. 2004).

The following key was developed by Cramer et al. (2003) for determining where in a stream basin trout are most likely to develop anadromous or resident ecotypes

Stream key for anadromy vs. residency

Resident rainbow streams

Streams draining to a river with summer base flow 500–1,000 cfs and mean August temperature of 50-59ºF. Migratory habits of rainbow in the tributary network of the main river would be expected as follows.

- Tributaries with August temperature > 59ºF. Rainbow fluvial to main river.
- Tributaries with summer base flow < 150 cfs. Rainbow fluvial to main river.
- Tributaries with August temperature < 59ºF, and summer base flow > 150 cfs. Rainbow rearing through adulthood, with some fluvial to main river.
- Tributaries with August temperature > 59ºF and summer base flow < 150 cfs. May produce steelhead if abundance of competitors in main stem is high and average survival during smolt migration to the ocean is high.

Anadromous rainbow streams

These are all other streams, most with mean August temperature > 59ºF. Theoretically, there could be a zone of overlap between resident and anadromous populations, but environmental gradients are sharp enough that no clear examples of zones were both types are common were analyzed.

The general assumption among the public and many professional biologists that streams in western Washington never contained significant populations of resident trout is erroneous when it applies to larger streams at low to moderate elevations. In the first half of the 20th century, the Grays River, a tributary of the lower Columbia River, contained an abundance of 16 to 22 inch resident trout (Burns 1953). This was attributed to the remoteness of the river and lack of fishing pressure. Large resident rainbow occurred in the canyon reach of the Puyallup River between Anderson Creek and the Electron Powerhouse in a period from the 1960s through the 1980s

(Nielsen 2005). They also occurred during that period in the Nisqually River for several miles below LaGrande Dam and several spring creeks in the Puyallup River valley (Nielsen 2005). Snorkel surveys of the upper Washougal River that has been closed to fishing for decades (McMillian 1985, 1986) and in the more inaccessible areas of the Wind River Canyon (McMillan and Nawa 1985, McMillan 1988) have found that substantial numbers of resident fluvial rainbow are present in mature breeding ages as estimated by their large size (15 to 22 inches). Limited bank access and catch restrictions was also one of the factors that has enabled the McKenzie River (a westside river) to sustain a trophy fishery for resident coastal rainbows. Limited access or catch restrictions have almost always played a major role in creating or maintaining trophy fisheries in northwestern rivers. The relative lack of trophy rainbow trout (or trophy coastal cutthroat trout and bull trout) in larger western Washington streams is primarily an artifact of regulations that have allowed too high a harvest of larger resident trout (Nielsen 2005).

The potential exists that the genotype for anadromy continues to exist in the resident population of rainbow trout above Condit Dam, particularly the fluvial-adfluvial population spawning in the Rattlesnake and Buck Creek watersheds. The removal of Condit Dam may allow over time for the selection of an anadromous ecotype (Bilby et al. 2005, Sanderson et al. 2004, Nielsen 2005). The genetic traits necessary for anadromy have been documented to persist for decades in landlocked steelhead populations (Thrower et al. 2004a, 2004b). However, genetic drift can cause a loss of fitness for the anadromous ecotype. This can manifest as a reduced survivability during freshwater and particularly marine migrations (Bilby et al. 2005, Sanderson et al. 2004, Nielsen 2005).

If selection for the anadromous phenotype doesn't occur fast enough to be practical, it may be possible to create a native anadromous broodstock by trapping and raising outmigrants (Phelps et al. 2001). Since interbreeding has been documented to occur between anadromous and resident ecotypes of rainbow trout (McMichael et al. 2000, Cramer et al. 2003, Zimmerman et al. 2003, Nielsen 2005), maintaining a close genetic link between the two ecotypes helps to prevent any loss of survival traits that have been selected for in a native population.

Potential for adverse impacts resulting from ecological interactions among wild resident rainbows and hatchery steelhead is greatest when (McMichael et al. 2000, Nielsen 2005 Pearsons et al. 1996):

- Hatchery fish do not emigrate quickly
- Water temperatures are over 8ºC (Hillman et al. 1992)
- Hatchery fish are larger than the wild rainbows
- Habitat and/or food is limiting

Ecological interactions of hatchery steelhead with wild resident rainbows can be minimized by releasing (McMichael et al. 2000, McMichael 1994, McMichael et al. 1994, Pearsons et al. 1996, Nielsen 2005):

- Only actively migrating smolts (no residuals)

- Smolts using an acclimation pond and stop releases when emigrants no longer exhibit smolt characteristics (Viola and Schuck 1995)
- No hatchery steelhead after June 1 (likely to become residuals)
- Fish reared at low density (less than half of traditionally accepted loading densities) (Banks 1994, Ewing and Ewing 1995).
- Hatchery fish of a size that minimizes interaction potential (smaller than wild fish: mean size < 7 inches FL)
- The minimum number necessary to meet management objectives
- Fish that do not exhibit counter-productive and inappropriate behaviors (e.g. less likely to engage wild fish in agonistic encounters)
- When water temperatures are relatively cold (less than 46ºF)
- Hatchery fish at dusk or shortly thereafter (McMichael et al. 1992)

To minimize risks of adverse ecological interactions, hatchery steelhead should only be released in areas where (McMichael et al. 2000).

- Coexisting wild salmonid populations are either absent or abundant and healthy
- Limitations to wild populations exist due to a density-independent pre-smolt stage bottleneck
- Habitat diversity is complex

In situations where hatchery residuals remain in a stream, remove in a way that does not adversely impact wild resident fish. Angling regulations could be adopted that encourage the harvest of hatchery steelhead residuals marked with clipped fins. In addition to angling regulations targeting residual hatchery steelhead, Martin et al. (1993) also recommended releasing hatchery steelhead smolts in locations that were easily accessible to anglers. A season on marked hatchery steelhead can be timed to occur after the period of active smolt migration (June 1). In any case, incidental mortality to wild fish is possible when undersized or unmarked fish are hooked and released (Ferguson and Tufts 1992, McMichael et al. 2000).

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