UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

November 30, 2007

Colonel Michael McCormick
Seattle District
U.S. Army Corps of Engineers
P.O. Box 3755
Seattle, WA 98224-3755
Attn.: Environmental Resources Section (Dillon)

Re: Biological Opinion for ESA Section 7 consultation for the Mud Mountain Dam Flood Control Operations and Maintenance and Barrier Dam Construction. NMFS Consultation No. 2001/01279.

Dear Colonel McCormick:

Enclosed is the Biological Opinion prepared by the National Marine Fisheries Service (NMFS) regarding ongoing operations and maintenance of the Mud Mountain Dam and Barrier Dam construction near Buckley, WA. This document represents NMFS' Biological Opinion of the effects of the proposed action on listed Puget Sound Chinook salmon and steelhead trout in accordance with Section 7 of the Endangered Species Act of 1973 as amended (16 USC 1531 *et seq.*). This represents NMFS response to your September 2001 Biological Assessment and June 2005 Supplemental Biological Assessment requesting consultation.

In this Biological Opinion, NMFS has determined that the proposed action is not likely to jeopardize the continued existence of Puget Sound Chinook salmon or steelhead trout or adversely modify designated critical habitat of Puget Sound Chinook salmon.

Enclosed as Section 12 of the Biological Opinion is a consultation regarding Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). NMFS finds that the proposed action will adversely affect Chinook, coho, and pink salmon and recommends that the terms and conditions of Section 9 of the Biological Opinion be adopted as EFH conservation measures. Pursuant to MSA (§ 305(b)(4)(B)) and 50 CFR 6000.920(j), Federal agencies are required to provide a written response NMFS' EFH conservation recommendations within 30 days of receipt of those recommendations.

Comments or questions regarding this Biological Opinion and MSA consultation should be directed to Steve Fransen at 360-753-6038 (email steven.m.fransen@noaa.gov) or Keith Kirkendall, FERC/Water Diversions Branch Chief, at 503-230-5431 (email keith.kirkendall@noaa.gov).

Sincerely,

D. Robert Lohn
Regional Administrator

Enclosure

Cc: Jeff Dillon, Corps, Seattle
Tim Shaw, Corps, Seattle
Karen Myer, USFWS

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

Biological Opinion

and

Magnuson-Steven Fishery Conservation and Management Act Consultation

On Routine Mud Mountain Dam Operations and Maintenance and Replacement of Existing Barrier Dam at Buckley, Washington

White River, HUC# 17110014

Action Agency:	U.S. Army Corps of Engineers Seattle District
Consultation Conducted by:	National Marine Fisheries Service Northwest Region Hydropower Division
NMFS Log Number:	F/NWR/2001/01279
Date:	November 30, 2007

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TERMS AND ABBREVIATIONS

BA	Biological Assessment
BRT	Biological Review Team
Corps	U.S. Army Corps of Engineers
DPS	distinct population segment
DQA	Data Quality Act
EA	Environmental Assessment
EFH	essential fish habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FERC	Federal Energy Regulatory Commission
HUC5	hydrologic unit code at the fifth field scale
ITS	Incidental Take Statement
LWD	large woody debris
MIT	Muckleshoot Indian Tribe
MMD	Mud Mountain Dam
NMFS	National Marine Fisheries Service
O&M	operation and maintenance
Opinion	this Biological Opinion
PCE	primary constituent element
PMF	probable maximum flood
Proposed Action	Mud Mountain Dam routine operations including: impoundments for flood control and flow release management, woody debris management, sediment management, fish trap operations, routine operations and maintenance activities, interim operations, and construction related impacts from replacement of the White River barrier dam
PS	Puget Sound
PSE	Puget Sound Energy
PSTRT	Puget Sound Technical Recovery Team
PTI	Puyallup Indian Tribe
RPA	reasonable and prudent alternative
RPM	reasonable and prudent measure
SBA	Supplemental Biological Assessment
USFWS	U.S. Fish and Wildlife Service
VSP	viable salmonid population
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington Department of Ecology

1. INTRODUCTION AND BACKGROUND

The Endangered Species Act of 1973, 16 USC §1531 et seq. (ESA), establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants, and the habitat on which they depend. Section 7(a) (2) of the ESA requires Federal agencies to consult with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), as appropriate, to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat. A Section 7 conference is required for activities which are likely to jeopardize the continued existence of species that have been proposed for listing, or are likely to adversely modify or destroy proposed critical habitat.

1.1 Objective

The U.S. Army Corps of Engineers (Corps) is consulting with NMFS to ensure that the proposed action is not likely to jeopardize the continued existence of listed species. The Corps proposes to operate and maintain Mud Mountain Dam (MMD), contract with Puget Sound Energy (PSE) to perform interim operations of the barrier dam at Buckley, and then to replace the existing barrier dam with a new one. Operation and maintenance of MMD provides flood protection to the lower White River and Puyallup River floodplain communities. Operations at MMD include periodic flood water storage and the upstream and downstream passage of fish around the structure (MMD is a barrier to upstream fish migration). Downstream passage through the dam is possible via a tunnel through the dam.

1.2 Consultation History

Puget Sound (PS) Chinook salmon were listed as threatened under the ESA in 1998. The Corps' routine operations at MMD have the potential for take of Chinook. During meetings regarding the White River and during the Section 7 consultation with the Corps on Howard Hanson Dam (a Corps flood control dam on the Green River, WA), we discussed a prospective consultation for MMD to cover incidental take. The Corps, therefore, sought coverage for any incidental take by informally requesting Section 7 consultation in 2000. The Corps and NMFS intended to begin the Section 7 consultation on MMD following completion of consultation on the Howard Hanson Dam Project. The Corps contracted Jones and Stokes (Corps 2001) to prepare a Biological Assessment (BA) of MMD operations and maintenance and presented that to NMFS in late 2001.

Puget Sound steelhead were listed as threatened under the ESA (NMFS 2007). The FR notice of the proposed listing was May 7, 2006, well after the original and supplemental BAs were prepared for this consultation. This Biological Opinion (Opinion) has been revised to include PS steelhead.

In a separate action, PSE was pursuing a Federal Energy Regulatory Commission (FERC) license for its White River Hydroelectric Project since 1981. FERC issued a license order in 1997 that was appealed by PSE and several agencies, including NMFS. PSE alleged that FERC's license terms and conditions made the White River Hydroelectric Project uneconomical

to continue to operate. Formal consultation on MMD was postponed while stakeholders participated in a collaborative process to secure a FERC license for the White River Project and to ensure the continued existence of Lake Tapps, which is the storage reservoir for the White River Project and is home to Pierce County's largest and most popular public park and is the basis for the Lake Tapps Community. PSE decided to retire the White River Hydroelectric Project in January 2004 and withdrew its FERC license application.

PSE, Pierce County, and members of the Lake Tapps Community contacted members of the Washington State Congressional Delegation regarding having the Corps reconstruct the diversion/barrier dam near Buckley. Reconstruction by PSE was one of the many prospective actions under the FERC license. The Federal interest in such a Corps action was fish passage around MMD, which depended on PSE's diversion dam to function as a barrier dam and lead upstream migrating fish into the fish ladder. It also depended on the dam as a barrier, so that fish did not migrate upstream to be blocked at MMD, where there are no fish passage facilities. The Delegation was successful; the Corps received Congressional direction via its FY02 Appropriations Conference Report. It included funding for the Corps ". . . to identify the least-cost environmentally acceptable solution/alternative to provide and ensure long-term safe and efficient upstream passage at Mud Mountain Dam" (Corps 2005a). Subsequent appropriations have funded design work on the preferred alternative replacement structure.

The MMD project has changed with the addition of replacement of the existing PSE diversion dam with a permanent barrier dam for the Corps' fishway operations. Consequently, the Corps prepared a Supplemental BA (SBA) to describe this additional action and assess its effects on listed species. The SBA was presented to NMFS during the summer of 2005, and formal consultation resumed in February 2006.

The Federal-Tribal Trust Responsibility

Under the Federal-Tribal trust responsibility, Federal agencies, including NMFS, have a legal obligation to support the Puget Sound tribes in their efforts to preserve and rebuild treaty salmon fisheries in their usual and accustomed areas. The concept of the Federal-Tribal trust responsibility is derived from the special relationship between the Federal government and Indians, pursuant to treaties and other authorities. In addition, Secretarial Order No. 3206 directs the Department of Commerce and the Department of Interior to carry out their respective responsibilities under the ESA in a manner that harmonizes the Federal-Tribal trust responsibility with tribes, tribal sovereignty, and statutory missions of each department, so as to avoid or minimize the potential for conflict and confrontation. Executive Order 13175 ensures that all Federal Executive departments and agencies consult with Indian tribes and respect tribal sovereignty as they develop policy on issues that impact Native American communities.

The Federal-Tribal trust responsibility extends to two Native American tribes in the context of this project. The Muckleshoot Indian Tribe (MIT) has its Federal reservation along the White River, has Federally protected treaty fishing rights there, and has utilized the river and its fishery since time immemorial. The Puyallup Tribe of Indians (PTI) is located on the Puyallup River, to which the White River is tributary. The Puyallup's interests are similar to, and overlap with, the Muckleshoot. The tribes have broad interests in activities affecting the river basin environment and its fisheries. This is especially so in regard to the ESA-listed White River Chinook salmon.

NMFS met with each tribe to hear their concerns about MMD and the prospective changes to it, so that these could be reflected in this consultation where applicable.

1.3 Relevant Documents

The analysis in this Opinion is based on the best available scientific and commercial information. Primary sources of information are the Corps' BA and SBA. We also reviewed our Draft Opinion for the White River Hydroelectric Project (NMFS 2003), the Corps' Environmental Assessment (EA) for the Construction and Operation of a Replacement Fish Passage Barrier near the Town of Buckley, White River, WA (Corps 2005b), and the 1948 Agreement between the Corps and PSE allowing the Corps to construct and operate a fishway at the Buckley dam (PSE 1948). We further reviewed the listing of Puget Sound Chinook salmon (NMFS 1998, 1999) and Designated Critical Habitat (NMFS 2005b). NMFS also listed PS steelhead as threatened under the ESA (NMFS 2006, 2007).

1.4 Application of ESA Section 7(a) (2) Standards - Analytical Approach

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

- Identifies the action area based on the action agency's description of the proposed action.

- Evaluates the current status of the species at the level of the evolutionarily significant unit (ESU) of salmon or the distinct population segment (DPS) of steelhead with respect to biological requirements indicative of survival and recovery and the primary constituent elements (PCEs) of any designated critical habitat (Section 3).

- Evaluates the relevance of the environmental baseline in the action area to biological requirements and the species' current status, as well as the status of any designated critical habitat (Section 4).

- Determines whether the proposed action reduces the abundance, reproduction, or distribution of the species, or alters any physical or biological features of designated critical habitat (Section 5).

- Determines and evaluates any cumulative effects within the action area (Section 6).

- Evaluates whether the effects of the proposed action, taken together with cumulative effects and the effects under the environmental baseline, can be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the affected species, or are likely to destroy or adversely modify their designated critical habitat (Section 7); see CFR §402.14(g)).

If in completing the last step, NMFS determines that the action under consultation is likely to jeopardize the ESA-listed species or adversely modify critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the proposed action that avoids jeopardy or adverse modification of critical habitat and meets the other regulatory requirements of an RPA (see CFR §402.02). In making these determinations, NMFS must rely on the best available scientific and commercial data.

The critical habitat analysis determines whether the proposed action will destroy or adversely modify designated or proposed critical habitat for ESA-listed species by examining any change in the conservation value of the PCEs of that critical habitat. This analysis focuses on statutory provisions of the ESA, including those in Section 3 that define "critical habitat" and "conservation," in Section 4 that describe the designation process, and in Section 7 that set forth the substantive protections and procedural aspects of consultation. This Opinion does not rely on the regulatory definition of "adverse modification or destruction" of critical habitat at 50 C.F.R. §402.02. Instead, it relies upon the standard articulated in the statute and in the August 6, 2004 9th Circuit Court of Appeals decision (Gifford Pinchot Task Force et al. V. U.S. Fish and Wildlife Service, No. 03-35279,) to complete our analysis with respect to critical habitat.

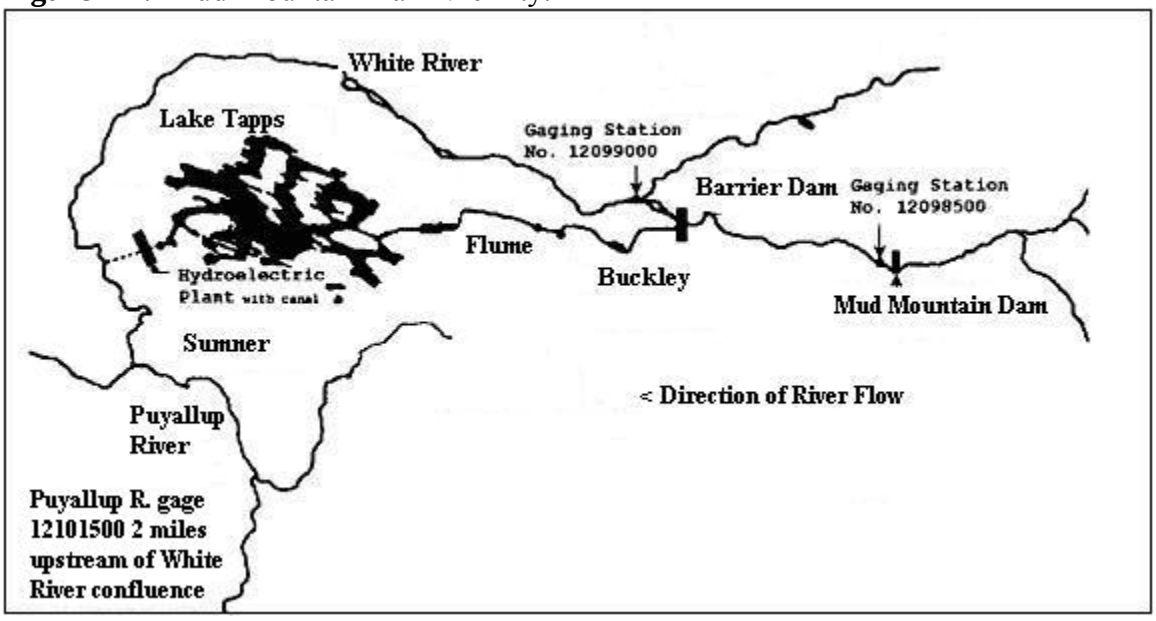
2. PROJECT DESCRIPTION AND PROPOSED ACTION

2.1 Mud Mountain Dam

Mud Mountain Dam is located at RM 29.6 on the White River, which originates at the Emmons Glacier on Mount Rainier. The White River is a tributary to the Puyallup River 10.4 miles above its mouth at Commencement Bay on Puget Sound. The dam is near the downstream end of MMD lands, which are owned by the Corps and include all lands potentially inundated by the dam. Refer to Figure 1-1 to see the MMD vicinity and action area.

Congress authorized construction of MMD with the Flood Control Act of June 22, 1936. Work began in 1939, but was halted by World War II. Construction resumed in 1947, and the dam was completed in 1948. At that time, it was the highest rock and earth-filled dam in the world. The dam's sole purpose is to control floods in the lower White and Puyallup River valleys. The dam currently helps protect the homes and businesses of about 400,000 people. The dam regulates flooding by holding back water from heavy rains and melting snow in the reservoir, then releasing it slowly back into the river. The flood storage period extends from mid-October through March. It would be unusual for the area to experience enough rain and snowfall or snowmelt outside this time period to cause serious flooding, with flooding being less common even in March. The reservoir is empty most of the year, conveying the normal flow of the White River via two tunnels, a 9-foot tall horseshoe-shaped tunnel and a 23-foot-diameter tunnel, that pass through the base of the dam. Completely filled, the reservoir would stretch 5.5 miles upriver and cover 1,200 acres.

Figure 1-1. Mud Mountain Dam Vicinity**.**



There are no upstream fish passage facilities at MMD. Construction of MMD was pre-dated by the construction and operation of the White River Hydroelectric Project, owned and operated by PSE. That project included a low head diversion dam located near Buckley, WA. The Corps, through an agreement with PSE, constructed a fishway, consisting of a small fish ladder and trap and haul facility, at PSE's diversion dam. The Corps has operated the fishway since 1942. However, PSE retired the hydropower project in January 2004. The Corps has since contracted with PSE, the owner of the existing barrier dam, to operate and maintain the structure, so the Corps can continue fishway operations until it constructs its own replacement barrier dam.

The project addressed here includes operation of a fish trap and haul facility operated by the Corps. The facility is located about 6 miles downstream of MMD, at the site of the White River barrier dam (RM 24.3) and the White River Hatchery operated by the MIT. The fish are returned to the river at a site located about 5 miles upstream of MMD, at RM 35.

2.2 Proposed Action

The proposed action includes impoundments for flood control and flow release management, woody debris management, sediment management, fish trap operations, routine operations and maintenance activities, interim operations, and construction related impacts from replacement of the White River barrier dam (Proposed Action).

The proposed action also includes the replacement of an existing Barrier Dam located adjacent to the fish trap outside the town of Buckley. This replacement facility was proposed for construction in 2006 (now 2008) but is included here because the Barrier Dam is associated with operation and maintenance (O&M) fish passage responsibilities.

Flood Control Operations

MMD generally provides flood control during winter peak flow events between November and March. MMD attenuates flows delivered by the White River to the Puyallup River at their confluence 10.4 miles above the mouth of the Puyallup River. Flood problems begin in the lower White River when releases from MMD exceed 6,500 cfs. Major damage along the White River begins when releases exceed 12,000 cfs. Thus, the Corps uses MMD to regulate White River flows to avoid discharges above 12,000 cfs as much as possible and within the dam's hydraulic limits. The control flow on the Puyallup River is limited to 45,000 cfs gage flow at Puyallup. Although the channel capacity in the lower Puyallup is 50,000 cfs, the control flow is established at 45,000 cfs to provide a factor of safety against forecasting errors.

When flow at the Puyallup gage is projected to exceed the control flow within 8 hours, then MMD discharges will be regulated to hold at the control flow (45,000 cfs) until the flood is over. Since MMD controls only 42 percent of the Puyallup River Basin, the required flow reduction at MMD may be substantial; during the flood of record in 1996, for example, MMD discharges were reduced to fewer than 500 cfs for several hours. During flood management impoundments, the level of the reservoir may vary between empty (elevation 895 feet) and full (1,257 feet), although the "full" condition has never been realized and would be realized only in the event of the dam's design flood, the Probable Maximum Flood (PMF). In practice, the highest pool ever

impounded reached an elevation of 1,195.5 feet on February 10, 1996, during the flood of record.

Evacuation (drafting) of reservoir storage will begin after forecasts indicate a falling trend in the flow at Puyallup, and a discharge below the 45,000 cfs control flow for at least 2 consecutive hours. Evacuation will proceed until the reservoir is emptied and normal flows are resumed.

Flow Management Impoundments

"Flow management impoundments" refers to operations that restrict flow and lead to a rise in reservoir level at MMD for any reason other than flood control. Flow management may occur for the following reasons:

- Raising the reservoir to divert flows through the 23-foot tunnel while the 9-foot tunnel undergoes maintenance. The reservoir must be above 910.5 feet in order to pass flow through the 23-foot tunnel. Discharge continues as run-of-river at the higher pool level through the 23-foot tunnel.

- Restricting flows to enable repair or maintenance of the White River barrier dam by PSE. Normally, flow reductions can be planned and scheduled to avoid downstream habitat impacts and to maintain instream flow targets for the river downstream of Buckley. Flow reductions are normally ramped and timed to minimize the risk of fish stranding. However, an operational emergency might require reducing instream flows to as low as several hundred cfs, depending on the circumstances, but full dewatering would not occur under any condition.

- Restricting flows to facilitate search and rescue efforts on the White River downstream of MMD. The Corps' current and proposed policy is to restrict flows from the dam as necessary to enable swift and safe rescue of injured persons or people threatened by water conditions. Flows may be restricted, also short of full dewatering, to permit recovery of objects only after review of the situation by concerned parties, including Corps and Washington Department of Fish and Wildlife (WDFW) biologists.

- Raising the reservoir to enable collection of large woody debris (LWD). LWD clearing is necessary to prevent clogging the intake structure and trash racks by debris too large to pass through the tunnels. This action typically occurs soon after a flood event. However, it may occur any time that a flow management impoundment occurs for one of the three purposes cited above. Thus, LWD collection is commonly a secondary operation during impoundments.

Large Woody Debris

Most woody debris passes through the dam, except for pieces too large to pass through the large trash rack. Those pieces, larger than 2 foot diameter, will be collected for later off-site disposal. The Corps estimates that about 40,000 to 50,000 cubic yards of driftwood accumulate each year around the reservoir margins and on the trash rack. Collection will occur when a storage pool is created, and power vessels towing containment booms will drag the collected wood to storage

positions over debris basins. The wood will remain there after the water recedes. As part of the Proposed Action, the Corps will dispose the wood after the reservoir is evacuated.

Disposal operations generally occur in August, after the basin has dried sufficiently. A small portion of the wood will be salvageable and stockpiled for use in habitat enhancement projects. Such wood usually consists of spruce, Douglas fir, cedar, and cottonwood trees (root structures are often attached). The salvageable LWD is generally between 8 and 12 inches diameter at breast height and between 20-80 feet long. Size and quality vary widely.

The LWD will be allocated according to a priority use system and need. First priority will be use in habitat enhancement projects constructed by the Corps within the White and Puyallup River Basins. Second priority will be use in habitat enhancement projects constructed by the Corps in other drainage basins. Third priority will be use in habitat enhancement projects constructed by other interested parties, such as WDFW, Washington Department of Ecology (WDOE), tribes, and counties, regardless of where those projects are located. In years following extraordinary floods, such as 1996, extremely large volumes of wood may be collected. In such cases, some wood may be allocated to a third party, which is salvaged for timber, firewood, and other uses. The greater volume of unsalvageable wood will be stacked into piles and burned in accordance with requirements of an incident-specific fire permit.

Sediment Management

The amount of sediment transported into the reservoir varies from small quantities at river flows less than 2,000 cfs to huge quantities at flood flows. No quantitative data are available, but based on the mountains of material PSE periodically dredges from the settling basins in the diversion flume, it must amount to thousands of cubic yards.

All sediment transported by the river is conveyed through MMD via the two tunnels. LWD and boulders will be cleared from the trash rack by an excavator while the reservoir is slowly drawn down following a flood event. As the reservoir evacuation process nears completion, the river acquires greater velocity upstream of the dam, and its transport capacity increases. Therefore the amount of transported sediment increases and the river begins to carry bedload and a coarser fraction of suspended load, exporting sediment from the draining reservoir. This export process continues for some time after the river has resumed normal flows, reestablishing storage space for flood control. This process cannot be significantly altered by management actions except that, by using the radial gates to allocate different fractions of flow to the 9-foot and 23-foot tunnels, sediment transport can be completed relatively quickly or slowly.

Sediment removal from the reservoir will include coordination with USFWS, NMFS, and WDFW in order to minimize sediment flushing at times when vulnerable salmonids and or life stages are present in the river downstream from MMD. Thus, whenever possible, these operations will be scheduled at periods when upstream fish migration and spawning are least affected and or operations are scheduled to occur over several days or weeks to limit the rate of sediment flushing into the river.

Fish Trap

The Corps' fish trap has the primary purpose of providing safe transport of all wild fish from below MMD to a release site upstream of the dam. The Corps will continue to work in cooperation with the natural resource agencies to support studies performed for fish conservation. State and tribal fisheries personnel mark sample and sort fish when the Corps operates the trap to collect fish for transport.

The trap is located on the south bank of the White River about 6 miles downstream of MMD, at the site of the White River barrier dam (RM 24.3) and the White River Hatchery[1]. The fish will be returned to the river at a site located about 5 miles upstream of MMD, at RM 35. The Corps designed, and has maintained, and operated in a manner that responds to concerns expressed by NMFS, USFWS, WDFW, MIT, and PTI. Nonetheless, fisheries technicians report that trapped fish sometimes have injuries that appear to have occurred in the trap facility. The purpose of the trap is to facilitate upstream migration of anadromous fish. The Corps has stated that it will use better methods of fish bypass if they can be identified and are scientifically, technologically, and economically justified (Corps 1997).

Sometimes trapped fish will be sorted before transport. This requirement is prompted by the need to recover coded-wire-tagged spring Chinook salmon which will then be conveyed by hatchery personnel to the White River Hatchery.[2] Salmon without coded-wire tags, wild steelhead, and bull trout will be transported upstream of MMD to the fish release site. Hatchery steelhead and strays from other rivers will be returned to the river below the dam. Since the hatchery and wild Chinook salmon must be sorted and since bull trout are often co-mingled with the salmon in the trap, both are routinely dip-netted by PTI, MIT, and WDFW personnel and handed to the Corps operator sitting on top of the truck. The fish are not anaesthetized. The Corps operator releases the fish from the net into the truck tank. Pink and coho salmon often return in large numbers and are transported without sampling. At those times, many fish will not be counted, and total escapements will be under-estimated.

Other O&M Activities

Normal operations will pass all river flow through a smooth, steel-lined, 9-foot-horseshoe-shaped tunnel and a 23-foot-diameter round tunnel. The 9-foot tunnel invert is at 895 feet elevation. It is 1,694 feet long and discharges at water level into the natural canyon, so entrained fish re-enter the river at grade in the thalweg. This tunnel carries flows up to 2,000 cfs before filling completely at which point flows become pressurized. During normal operations, pressurized flow is avoided by partially closing the radial gate on the 9-foot tunnel, thereby diverting excess flow (over the 2,000 cfs threshold) into the 23-foot tunnel. Pressurized flows do commonly occur in the 9-foot tunnel during floods and subsequent reservoir evacuations. The 23-foot tunnel entrance is at 910 feet elevation. It is 1,750 feet long and discharges about 5 feet above water level, at elevation 882 feet. It can carry about seven times the flow of the 9-foot tunnel.

[1] The barrier dam was originally constructed by the predecessor of PSE to divert water to Lake Tapps for the White River Hydroelectric Project.

[2] The White River Hatchery is also located at the White River barrier dam, but on the north side of the river.

Other normal O&M activities include maintenance of the recreational facilities at the dam, maintenance of roads and trails on project lands, and maintenance of the dam structure itself and the support facilities.

2.3 Barrier Dam - Replacement

The original barrier dam at the fish trap site is of wood crib construction. It is now in a deteriorated condition and needs to be replaced. The Corps has conducted an alternatives analysis, National Environmental Policy Act assessment, and detailed design work. At the same time, local interests are investigating opportunities for continued hydropower, development of municipal and industrial water supply, and maintaining existing recreation opportunities and property values associated with Lake Tapps. These local objectives are complemented by replacing the barrier dam in its current location because, absent the barrier dam, the water diversion flume would likely be rendered non-functional.

This element of the Corps' Proposed Action is described in detail in Supplement Number 2 to Feature Design Memorandum Number 28 to Dam Safety Assurance Program, Mud Mountain Dam, and White River, Washington - Mud Mountain Dam Upstream Fish Passage Investigation, dated March 2005. A summary follows:

> The replacement dam would span the White River with a fixed crest weir and two radial gates (16 feet and 35 feet) to create an effective fish barrier. The radial gates will allow mobilization and passage of sediment and debris as well as maintain supply intake screen capacity and enhance attraction hydraulics for the ladder and trap entrance downstream. The 16-foot gate will be located on the left bank directly downstream from the water supply for the fish screens. The 35-foot gate will be immediately north of the 16-foot gate. The concrete weir will span about 300 feet across the river channel and will replace the existing flash board system. The shape and weir height are designed to create a velocity barrier to upstream fish passage.
>
> A maintenance deck about 15 feet wide will be provided along the axis of the dam to provide vehicle access to bridge components. This will provide efficient maintenance of gates, weirs, and other structures. In addition, the deck may provide access to either bank by serving as a bridge. The bridge will also aid transfers of fish that stray to the wrong facility.
>
> The proposed project may result in minor headwater rise during high flows. Levee improvements will be needed to protect the Muckleshoot Hatchery from floods. The improvements will follow the existing levee alignment. The existing access road will be improved to provide reliable access to the trap and haul and barrier facilities at the 100-year flood, and to remain intact at the MMD maximum regulated discharge. The improvements include resurfacing, a bridge over an existing drainage, and erosion control and vulnerable riverbank locations. An existing outbuilding will be improved as an equipment, staff, and materials storage structure. Project construction will commence in 2009, contingent on funding.

Construction Features
Constructing the proposed barrier dam requires clearing of about 2 acres of land around the worksite. The clearing will include areas for equipment storage, sediment control structures, access roads, and materials.

Construction will occur in two phases. Within Phase 1, a cofferdam will be constructed to facilitate construction of the barrier dam. This cofferdam will allow for continued use of the fish hatchery water intake and will protect the worksite during both demolition of the old dam and construction of the new one. The cofferdam will have to remain in place through the winter, and must be designed to withstand potential flooding. The cofferdam construction will occur during the in-water work window. After cofferdam completion, work on the new dam will continue through the fall and winter. This cofferdam will be removed the following summer as Phase 2 construction begins on the left bank of the river.

Phase 2 includes the removal of the first phase cofferdam and construction of a smaller cofferdam to facilitate construction of the control gates, fish trap modifications, and upgrades associated with the diversion flume. The second cofferdam will use the same techniques, precautions, and timing (July - September) as the right bank cofferdam. During this time, the river will be routed between the fish trap, the flume, and the right bank.

The Corps' fish trap will remain operational through construction except for episodic closures or disruptions due to water intake construction or critical upgrades to the fish entrance. These closures will be timed as much as possible to coincide with periods of low fish usage and minimized in duration. To ensure adequate fish passage during construction, improvements will be made to the MIT fish trap. The Corps believes this will ensure effective trapping and fish collection during times when the Corps trap efficiency is reduced or is out of service for upgrades.

2.4 Action Area

The action area for this Proposed Action includes all areas affected directly or indirectly by the Federal action in addition to the immediate area involved in the action. For this Proposed Action, the action area encompasses the White River from the upper extent of the MMD flood storage reservoir downstream into the Puyallup River, and to its mouth in Commencement Bay. The action area includes the bankline, riparian area, and aquatic habitat in the affected reach.

3. BIOLOGICAL INFORMATION

One of the steps NMFS uses when applying the ESA Section 7 (a)(2) to the listed ESUs or DPS considered in this Opinion is to define the species' biological requirements. Biological requirements within the action area are a subset of the rangewide biological requirements of the ESU. Identification of the rangewide biological requirements provides context for subsequent evaluation of action area biological requirements. NMFS must also evaluate the rangewide status of the species and of its designated critical habitat.

3.1 Biological Requirements

Relevant biological requirements are those necessary for the listed ESU or DPS to survive and recover to naturally reproducing population sizes at which protection under the ESA would become unnecessary. This will occur when populations are large enough to safeguard the genetic diversity of the listed ESU and DPS, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

PS steelhead are listed as threatened under the ESA. Their biological requirements do not generally differ significantly from those of PS Chinook salmon. One significant difference is that steelhead have a requirement for summer rearing habitat which is affected by streamflow. Hatchery origin steelhead are not listed and are not stocked in the White River, and thus are not considered in this analysis.

In its recent status review, NMFS (2005a) concluded that the Puget Sound Chinook salmon ESU was likely to become endangered in the foreseeable future throughout all or a fraction of its range, and that the ESU continued to warrant listing under the ESA as a threatened species. The PS Chinook ESU includes the White River spring Chinook salmon hatchery stock, and this hatchery stock is considered both listed and essential to recovery (Table 1 of NMFS 2005a). With respect to Chinook salmon spawning in the White River, both the Puget Sound Technical Recovery Team (PSTRT 2001) and NMFS (2005a) has identified this group (White River Chinook salmon) as a demographically independent population and have determined that its existence is necessary for ESU viability. McElhany et al. (2000) have identified three criteria for ESU viability:

1. Every stratum (life history and ecoregion combination) that historically existed should have two populations, or 50 percent of the historical populations, whichever is greater, that meet or exceed all the criteria for a viable population.

2. Within a stratum, populations should be selected to include "core" populations that were historically most productive, retain genetic diversity, and minimize susceptibility to catastrophic events.

3. All populations, even those which are not restored to fully viable status, should be maintained at least at the current population level, or an effective population size of 500 fish, whichever is greater.

For the ESU to be viable, adequate habitat and life stage-specific survival rates must occur within the action area.

The life cycle of PS Chinook can be separated into five essential habitat types: (1) juvenile summer and winter rearing areas, (2) juvenile migration corridors, (3) areas for growth and development to adulthood, (4) adult migration corridors, and (5) spawning areas. All these except type 3 are distributed throughout the accessible reaches of the White River and its major tributaries. Growth and development to adulthood (type 3) occurs in near-shore (i.e., Puget Sound) and off-shore marine waters, although final maturation takes place in freshwater streams when the adults return to spawn. Within these habitat types, the PCEs of the designated critical habitat include:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

2. Freshwater rearing sites with:
   a. Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
   b. Water quality and forage supporting juvenile development; and
   c. Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

3. Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

4. Estuarine areas free of obstruction and excessive predation with:
   a. Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
   b. Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and
   c. Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

5. Nearshore marine areas free of obstruction and excessive predation with:
   a. Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and
   b. Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation (NMFS 2005b).

3.2 Listed Species and Current Rangewide Status of the Species and Designated Critical Habitat

3.2.1 Puget Sound Chinook Salmon

NMFS listed PS Chinook as threatened under the ESA in March 1999 (NMFS 1999). On February 16, 2000, NMFS designated critical habitat for 19 ESUs of Chinook, chum, and sockeye salmon as well as steelhead trout in Washington, Oregon, Idaho, and California. Shortly after these designations, the U.S. District Court for the District of Columbia issued an order vacating the critical habitat designations but retaining the MSA-essential fish habitat designations (National Association of Homebuilders et al. v. Evans, Civil Action No. 00-2799 [CKK] [D.D.C., April 30, 2002]). Thus, the critical habitat designation for PS Chinook was no longer in effect. NMFS has now designated critical habitat for PS Chinook ESU (NMFS 2005b), which includes the accessible reaches of the White River and its principal tributaries, excepting the nearly 6 mile reach between MMD and the barrier dam near Buckley.

The PS Chinook ESU encompasses all naturally-spawned runs of Chinook salmon that occur downstream of impassible natural barriers in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula (Myers et al. 1998). Several hatchery stocks considered essential for recovery of the natural stocks are also included in the ESU (Table 1 of NMFS 2005a.), including the White River hatchery stock. The PSTRT has tentatively identified 21 independent populations within the PS Chinook ESU (PSTRT 2001). Natural spawning escapement between 1992 and 1996 averaged 13,000 for the north Puget Sound populations (north of Lake Washington) and long- and short-term trends for these populations were negative (Myers et al. 1998). South Puget Sound populations averaged 11,000 spawners for the same period and trends were mainly positive. Myers et al. (1998) concluded that Chinook salmon in this ESU are not presently in danger of extinction, but are likely to become so in the foreseeable future. Overall abundance of Chinook salmon in this ESU has declined substantially from historical levels, and many populations are small enough that genetic and demographic risks are likely to be relatively high.

All accessible reaches of the White River except the nearly 6 miles between MMD and the barrier dam near Buckley are designated as critical habitat. In addition, the accessible reaches of the Clearwater River, Greenwater River, West Fork White River, Boise Creek, and Huckleberry Creek tributaries are also designated. These are divided into two 5th field Hydrologic Unit Codes (HUC5s): the Upper White River (1711001401), above the confluence with and including the Greenwater River; and the Lower White River subbasins (1711001402); and the Lower Puyallup River below the confluence of the White River (1711001405). Critical habitat includes all waterways, substrate, and adjacent riparian zones below long-standing, naturally impassible barriers. The adjacent riparian zone is defined based on key riparian functions which include shade, sediment, nutrient/chemical regulation, streambank stability, and input of large woody debris/organic matter. These features provide physical and biological features essential to the conservation of the species. These include spawning sites, food resources, water quality and quantity, and riparian vegetation.

The Puget Sound Salmon Recovery Plan (Shared Strategy for Puget Sound 2005) states that the White River Chinook population must be viable for the PS Chinook ESU to be considered viable under any recovery scenario. No single prescription for improving the population's status is given. However, the Plan is clear that habitat and instream flow issues must be resolved. The existence and operation of MMD is described as one of the proximate causes of Chinook decline, and that although juvenile passage through the dam has been improved, there may be residual effects that remain unknown. The Plan also describes ongoing impacts to fish at the fish ladder and trap, with the trap remaining a source of injury to the fish collected there.

3.2.2 Puget Sound Steelhead

NMFS listed PS steelhead as threatened under the ESA on May 11, 2007 (NMFS 2007). The status of PS steelhead was part of a comprehensive review of coastal and inland steelhead stocks in California, Oregon, Washington, and Idaho in 1996 (Busby et al. 1996). In the 1996 review, the Biological Review Team (BRT) concluded that Puget Sound steelhead were not in danger of extinction or likely to become endangered in the foreseeable future throughout all or a significant portion of its range. However, the BRT did express concern that 17 out of 21 stocks in the DPS[3] for which there were adequate data exhibited overall declining trends. Positive trends in abundance for the two largest steelhead runs mitigated the immediacy of extinction risk, although there was significant concern regarding the sustainability of some of the others.

NMFS updated its review of Puget Sound steelhead populations (NMFS 2005c). Nearly all exhibited diminished productivity since the last review as indicated by below-replacement population growth rates, and declining short- and long-term trends in natural escapement and total run size. Informed by the assessment of demographic risks for each of these four viable salmonid population (VSP) criteria, an overwhelming majority of the BRT concluded that PS steelhead are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

[3] In the recently published findings of our updated status review of listed West Coast steelhead ESUs (NMFS 2006), we departed from our previous practice of applying the ESU policy to delineate species of *O. mykiss*, and instead applied the joint distinct population segment policy.

4. ENVIRONMENTAL BASELINE

The environmental baseline includes "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation process: (50 CFR §402.02)." In its analysis, NMFS evaluates the relevance of the environmental baseline in the action area to the species' current status. In describing the environmental baseline, NMFS emphasizes important habitat indicators for the listed salmonid ESU affected by the proposed action. The action area is described in Section 2 of this Opinion and, includes all areas affected, directly or indirectly, by the proposed action.

This section includes descriptions of historical project effects and effects of other historical factors on the status of the species and of designated critical habitat within the action area and the future effects of the project that are not modified by the Proposed Action and are therefore assumed to continue through its duration.

4.1 Status of the Species within the Action Area

4.1.1 Puget Sound Chinook Salmon Life History, Distribution, and Abundance in the White River Basin

The White River population of PS Chinook exhibits the basic characteristics and biological requirements of PS Chinook described in Myers et al. (1998). As described in Section 3.1, the PSTRT has identified White River Chinook salmon as an independent population of the PS Chinook ESU (PSTRT 2001). The PS Chinook ESU includes the White River spring Chinook salmon and its corresponding hatchery stock, the latter of which is also listed and considered essential to recovery (Table 1 of 64 FR 14308).

White River Chinook salmon populations include spring and summer/fall runs. The primary means of discerning between the two runs has been administrative. Fish arriving at the Corps' Buckley fish trap before August 15 have been classified as spring Chinook salmon, and fish arriving later have been designated as summer/fall Chinook salmon. Recent DNA studies of downstream migrating smolts[4] and returning adults by WDFW suggest that the White River Chinook salmon population comprises genetically distinct spring and fall stocks (Shaklee and Young 2003). The administrative classifications coincide very well with the documented genetic distinctions.

Migrating fish enter the Puyallup and White Rivers from May to mid-September. Hatchery populations of White River Chinook salmon spawn in September and October. Radio-tagging studies by the Puyallup Tribe observed natural spawning in the White River and tributaries from early September through late October (Ladley et al. 2003), indicating a large degree of overlap in the run timing of the hatchery and natural origin components of the population. Spawning is

[4] Smoltification is the process of physiological and behavioral changes by which a fish transitions from life in freshwater to the saltwater environment. Juvenile fish undergoing the process of smoltification are called "smolts."

known to occur in the upper basin upstream of MMD in Huckleberry Creek, the Clearwater River, the Greenwater River, and the mainstem White River. Spring Chinook salmon, as well as summer/fall Chinook salmon, also spawn in the White River Project bypass reach downstream of the barrier dam. Chinook fry emerge from January through March. Studies indicate that up to 80 percent of spring Chinook salmon smolt and migrate downstream in April and May as subyearlings (WDFW et al. 1996; Dunston 1955). An unknown proportion of the population spawns downstream of the barrier dam. The extremely high turbidity precludes accurate surveys. Chinook are not known to spawn within the perimeter of the MMD reservoir, although they could. However, far better spawning habitat occurs further upstream and in the tributaries.

Estuary rearing is considered to be important for Chinook salmon that outmigrate as subyearlings (Groot and Margolis 1991). Outmigrating smolts feed, grow, and develop their ability to osmoregulate in saltwater during this period. Chinook salmon smolts have been observed in Commencement Bay from March through the end of June. Those wild smolts from the White River that outmigrate as subyearlings probably reside in the estuary from April to May (Kerwin 1999). In contrast, the 20 percent of White River Chinook salmon that stay in the tributaries and outmigrate as yearlings are not believed to spend significant time in the estuary before migrating offshore. Very little data are available on the oceanic phase of the White River Chinook salmon life cycle. White River Chinook salmon return to spawn at ages of 2 to 5 years, with the majority of spawners 3 to 4 years old (WDFW et al. 1996).

Pre-twentieth century levels of White River Chinook salmon production and escapement are unknown. The most dependable source of information, trap counts at the Corps facility, started in 1941 with the construction of MMD, nearly 30 years after the White River Project began operation. All past and current estimates of population size are based on trap counts. Earlier accounts by sportsmen in the 1930s note high numbers of Chinook salmon in the river, but there were no systematic efforts to enumerate escapement (WDFW et al. 1996). Trap counts indicate a steady decline in abundance of White River Chinook salmon from 1942 through the mid-1980s (Figure 4-1). Decreases in abundance occurred in conjunction with increasing anthropogenic actions, including construction of MMD, intensive logging of the upper watershed, and continuing development and flood control efforts in the valley. Increasing counts have been observed following efforts to improve fish passage and survival, including increasing the minimum flows in the reach bypassed by PSE's former hydroelectric project, improving fish passage at MMD in 1995, installing new fish screens at the PSE White River Project in 1996, and releasing White River Chinook salmon raised in captive broodstock and conventional hatchery programs in the 1990s.

Increasing trap counts have been influenced by the release of over 2 million hatchery-reared White River spring Chinook salmon between 1992 and 1999, bolstering both the hatchery and naturally spawning populations. Captive broodstock and conventional hatchery programs began in the 1970s. First efforts at rearing fish and releasing them in the White River were

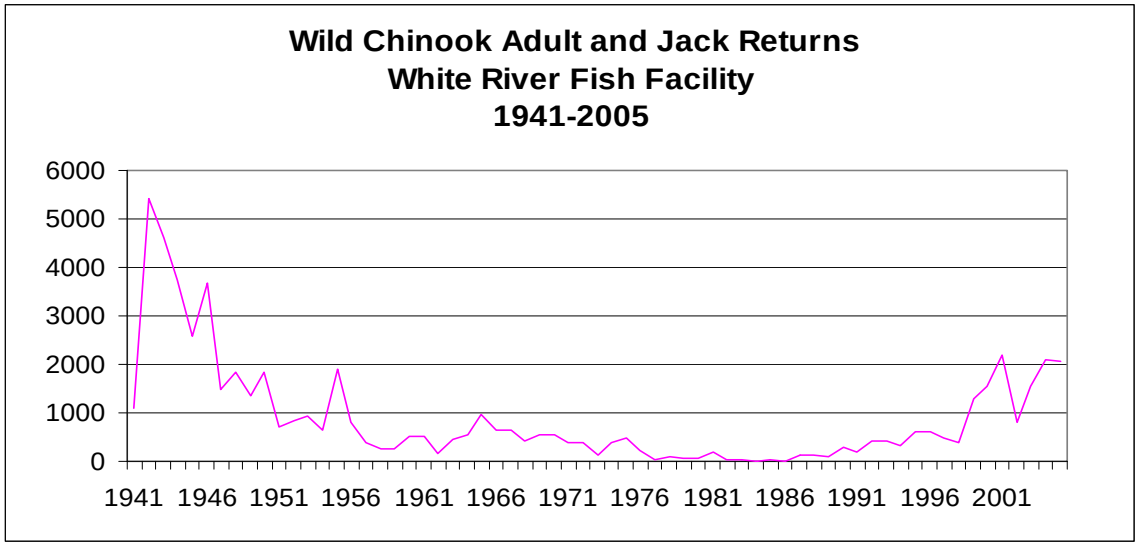
unsuccessful and off-site conservation programs were started.[5] In 1990, smolt releases were resumed in the White River. Fish were held at acclimation sites in the upper basin then transported below the PSE diversion dam for release. MIT opened a hatchery near the site of the PSE diversion dam in 1989, using eggs from the conventional and captive broodstock programs. The first releases were in 1991 and the first adults returned in 1992. Off-site rearing, which is intended to jump-start the natural spawning population, is planned to be phased out when recovery goals are reached. Genetic studies have shown that naturally-spawned and hatchery-reared White River Chinook salmon are very similar, suggesting a strong influence of the hatchery program on wild fish genetics (WDFW et al. 1996).

When the White River hatchery was built, NMFS and WDFW moved the Chinook salmon to the new hatchery, located in the river basin to which the fish were indigenous. Prospect for recovery of the population seem improved by the presence and operation of the hatchery and increased minimum instream flows that commenced in 1987.

The exploitation rate of White River Chinook salmon prior to the release of specific tag groups is unknown, but has been generally estimated by harvest managers at WDFW and NMFS as averaging 69 percent from the years 1979 to 1990, 49 percent from 1991 to 1993, and 16 percent in 2000 (NMFS 2000). High exploitation rates were common to most, if not all, PS Chinook stocks, wild and hatchery alike. However, only the White River population fell to such critically low status that the fishery managers felt it necessary to take the population into "protective custody" and culture it at locations outside the degraded habitat influences within the White River. Much of the harvest has occurred in mixed stock fisheries, where White River Chinook salmon are mixed with numerous other populations. Some of the other populations were then subjected to additional terminal area fisheries during the 1970s and 1980s, a period of time when almost no terminal harvest of White River Chinook salmon occurred, in large part because the run was so small that it no longer produced an adequate number of spawners, let alone any harvestable surplus. The last significant terminal area harvest of White River Chinook salmon appears to have been in 1972, although harvestable returns of wild Chinook salmon returned to other Puget Sound rivers during the 1970s in spite of relatively high mixed stock harvest rates. Not surprisingly, the weakest Chinook salmon populations occur where the combined effects of both harvest and habitat degradation have been most severe. Recent changes in harvest rates have significantly reduced adverse effects on Chinook salmon. For example, harvest rates of White River Chinook salmon have been reduced from an estimated average of 69 percent to 16 percent to assist the survival and recovery of the species.

[5] The run became so severely depressed that White River Chinook salmon were cultured at both NMFS facilities in Manchester, WA, and WDFW facilities at Minter Creek beginning in 1977 to preserve the population from extirpation. As a result, intensive hatchery propagation, including captive broodstock, had to be used to avoid extinction (WDFW et al. 1996).

Figure 4-1. Annual collection of White River Chinook Salmon at the Corps White River Diversion Dam Trap.



For the period of record, all the highest recorded returns of White River Chinook salmon at Buckley occurred during World War II with the highest returns during 1942 and 1943. Returns were significantly lower both before and after the war.

Recent year adult Chinook salmon and steelhead returns to the Buckley trap, including hatchery origin fish, are presented in Table 4-1.

Table 4-1. Buckley barrier dam fish counts, 2001-2005**.**

SPECIES	2001	2002	2003	2004	2005
Chinook	2583	1152	1898	2369	2687
Steelhead	435	528	166	190	159

4.1.2 Puget Sound Steelhead Life History, Distribution, and Abundance in the White River Basin

Steelhead is a common name for the anadromous form of *O. mykiss.* Steelhead range throughout PS tributary streams and rivers. The species exhibit perhaps the most complex suite of life-history traits of any species of Pacific salmonid. Steelhead can be anadromous ("steelhead"), or freshwater residents ("rainbow" or "redband trout"), and under some circumstances yield offspring of the opposite life-history form. The anadromous form can spend up to 7 years in freshwater prior to smoltification, and then spend up to 3 years in salt water prior to first spawning. Most PS steelhead smolt at age two and spend 2 or 3 years in salt water. Steelhead

are also iteroparous (meaning individuals may spawn more than once), whereas the Pacific salmon species are principally semelparous (meaning individuals generally spawn once and die).

Within the range of West Coast steelhead, spawning migrations occur throughout the year, with seasonal peaks of migration. Steelhead runs are usually named after the season in which they make their spawning migration. White River steelhead are known as winter-run type, with most of the fish entering the Buckley trap from January to June, generally peaking in April. Some few steelhead enter the trap during the summer months, but these are no more than 2 or 3 percent of the population.

Hatchery steelhead of both the winter and summer run types are stocked by WDFW in many PS tributaries. None are stocked in the White River. However, many hatchery winter steelhead smolts are stocked in the Puyallup River, to which the White is tributary. It is WDFW's policy to mark with an adipose fin clip all steelhead of hatchery origin. The Corps traps and hauls only unmarked (i.e., wild) adult steelhead from the Buckley trap. Hatchery steelhead are returned to the lower White River downstream of the trap. Recent year adult steelhead returns to the Buckley trap are presented in Table 4-1. Unlike the fall spawning Chinook salmon, steelhead are spring spawners, with peak spawning occurring in April and May. Steelhead fry emerge from the gravel in July and August. Smolts migrate to saltwater in the spring, in the latter half of April and throughout May. Juvenile steelhead do not reside for long in the estuary, and rapidly move off-shore.

PS steelhead are proposed to be listed as threatened under the ESA. They are not yet listed, and no critical habitat for steelhead has been designated. In its March 29, 2006 FR notice, NMFS solicited public input of information relevant to making a critical habitat designation for the PS steelhead DPS. The distribution of PS steelhead in the White River overlaps almost entirely with that used by Chinook for migration, spawning, and rearing habitat. They differ temporally in adult migration and spawn timing and length of juvenile residence. The temporal distinctions are analyzed separately in this Opinion.

4.2 Status of Habitat Features with the Action Area

The complex life cycles exhibited by salmon and steelhead give rise to complex habitat needs, particularly during the freshwater phase (Spence et al. 1996). Spawning gravels must be a certain size and free of sediment to allow successful incubation of the eggs. Eggs also require cool, clean, and well oxygenated waters for proper development. Juveniles need abundant food sources, including insects, crustaceans, and other small fish. They need places to hide from predators (mostly birds and bigger fish), such as under logs, root wads, and boulders in the stream, as well as beneath overhanging vegetation. They also need places to seek refuge from periodic high flows (side channels and off-channel areas) and from warm summer water temperatures (coldwater springs and deep pools). Returning adults generally do not feed in fresh water, but instead rely on limited energy stores to migrate, mature, and spawn. Like juveniles, they also require cool water and places to rest and hide from predators. They also need migratory corridors with adequate passage conditions (safe passage with respect to barriers, water quality, and water quantity) to allow access to the various habitats required to complete their life cycle.

The environmental baseline describes the status of salmonid habitat, which is important for two reasons. It affects the viability of the listed species within the action area at the time of the consultation and also because those habitat areas designated "critical" provide PCEs essential for the conservation of the species. The environmental baseline also describes the status of habitat in the future because it includes the persistent effects of past actions and the future effects of Federal actions that have not taken place but have already undergone Section 7 consultation.

4.2.1 Critical Habitat Within the Action Area

The following sections describe the status of various habitat characteristics, referred to as PCEs of critical habitat, under the environmental baseline, relative to the needs of the species within the action area (the White River from the upstream limit of the MMD reservoir downstream to Commencement Bay). As described in Section 2, the primary effects of the Proposed Action (water impoundment and release, sediment transport, and barrier dam replacement) will occur at the MMD and barrier dam replacement site, with the effects attenuating along a downstream gradient to Commencement Bay. All occupied river reaches of the White River within the action area, except the nearly 6 miles between MMD and the barrier dam near Buckley, have been designated as critical habitat for PS Chinook (Section 3). Critical habitat for PS steelhead has not yet been designated. However, the distribution of steelhead overlaps that of Chinook in the White River and its tributaries, so the discussion pertaining to Chinook is relevant also to steelhead.

Freshwater Spawning Sites

White River Chinook spawn upstream of MMD and downstream of the barrier dam. The Corps' operations minimize the likelihood of Chinook spawning in the undesignated reach between the two dams[6]. All Chinook that enter the Buckley trap at the barrier dam are transferred either to the MIT hatchery located nearby, or upstream of MMD for release and migration to upper river and tributary spawning areas. Not all Chinook salmon in the White River migrate upstream of the barrier dam. Puyallup tribal fishery biologists and technicians regularly survey part of the bypass reach downstream of the barrier dam and document the presence of Chinook salmon spawning.

The headwaters of the White River originate in protected areas of Mt. Rainier National Park and wilderness areas of the national forest. Most of the upper basin Chinook (and steelhead) spawning reaches are surrounded by private and public forests managed exclusively, or in part, for timber production. As a result, the effects of logging and road building are prevalent throughout the major spawning areas. The anthropogenic effects on habitat increase in the downstream direction. Rip rapped and leveed river banks begin just upstream of the barrier dam, and become more frequent from that point on. The river is almost entirely within levees downstream from the City of Auburn. There is very little spawning that occurs downstream of this point. The lowermost river reach is urban and suburban in nature, with commercial development along the banks.

[6] Some Chinook transported upstream of MMD may fall back downstream and coincidentally spawn in the river reach between the two dams.

The White River flows through a series of glacial deposits and the remains of the Osceola Mudflow, which covers the White River valley to a depth of 25 feet. The geologically recent mudflow of approximately 5,700 years ago characterizes the White River as a "young river." As such, it is still in the process of cutting a channel through the mudflows and is characterized by steep gradients, heavy sediment loads, and in places, a deeply incised channel. Sediment input from glaciers at the headwaters adds to the amount entrained by erosion as the White River cuts through the mudflow and ancient glacial sediments. Estimates of annual suspended sediment transport range from 440,000 to1,400,000 tons (WDFW et al. 1996). The name "White River" reflects the turbid appearance of the river caused by high levels of suspended glacial sediments during the summer months. There is a visible gradient at the mouth of the White River as its milky waters join the darker waters of the Puyallup River.

The White River channel, throughout its length, is considered to be inherently unstable (WDFW et al.1996). This is the result of a large suspended sediment load, its deposition as the river enters the gentler gradients in the valleys (filling existing channels), and the relative ease of cutting new channels through the remains of the Osceola Mudflow. The White River Basin receives large amounts of water from heavy precipitation during winter months and from snowmelt in the spring through summer. Since the watershed includes elevations in excess of 4,000 feet, there is typically a heavy snow pack and occasional rain on snow events. Sustained flows are typically highest during May and June and lowest in September and October. Mean flows at Buckley, Washington, are 1440 cfs, although historic peak flows have reached as high as 17,000-28,000 cfs before the construction of Mud Mountain Dam (USGS 2000). Given the highly variable flows of the river in response to rainfall and snowmelt and the unstable nature of the river channel, it is not surprising that the White River valley has historically been subject to severe floods.

Although its description may lead one to postulate that it would be challenging for fish to survive in the White River, spring and fall Chinook, coho, chum and pink salmon, and steelhead and bull trout are native to the drainage. Evaluations of salmonid habitat list unstable banks and shifting channels, cold stream temperatures, and high turbidity, which limits aquatic productivity, and heavy deposits of glacial silt covering potential spawning gravels as natural potentially limiting factors (PSP&LC 1987). However, the last factor noted may not be a significant problem. Most Chinook salmon appear to favor spawning in non-glacial tributaries of the White River, including the Clearwater River, Huckleberry Creek, and the Greenwater River, although spawning also occurs in the mainstem White River. Spawning substrate was rated as "good" in 93 percent of samples from the Clearwater River, 71 percent of samples from Huckleberry Creek, and 42 percent of samples from the Greenwater River, with the remainder rated as "fair" or "poor" (Keown 1998). Steelhead spawn in all the same general areas as Chinook salmon do, with perhaps a greater proportion of the steelhead spawning in the mainstem, since channel instability is less of a factor to spawning success during the spring and summer.

Whereas salmon production in glacial and heavily sediment laden river basins may be lower on a unit area basis, other glacial rivers in western Washington that also carry heavy sediment loads and have reaches of significant channel instability, specifically the Nooksack, Skagit, Puyallup, Nisqually, Cowlitz, Lewis, Hoh, and Queets, are, or were, significant producers of natural spring and summer/fall Chinook salmon. The White River has produced thousands of returning adult

Chinook salmon annually according to Corps' records from the Buckley fish trap, and it does not seem sufficiently different to us from other Chinook salmon rivers to not consider it significant habitat for Chinook salmon.

Surveys by the Muckleshoot and Puyallup Tribes document the persistent use of the bypass reach of the White River for both spawning and rearing by Chinook salmon and other species. A freeze-core analysis by Puget Sound Power and Light Company (PSP&LC) sampled 28 cores of White River substrate in the bypass reach of which four contained salmon eggs or alevins (PSP&LC 1989). The report concludes that "Based on visual inspection...it appeared that the amount of fines present in many of the cores could adversely affect incubation of eggs and or emergence of fry. However, the values of indices that were calculated generally did not fall in the range that would predict high mortality rates."

Freshwater Rearing Sites

Juvenile Chinook salmon rear throughout the lower White River and Boise Creek, as well as in the upper river and its tributaries, extending downstream of the major spawning areas. Rearing juveniles can be observed all the way down to the confluence of the White and Puyallup Rivers.

Freshwater Migration Corridors

Migration corridors are essential for juvenile downstream migration and adult upstream migration. The most obvious impacts to functional migration corridors are obstructions. The major barriers in the White River are MMD and the barrier dam. MMD passed water through a Hal-Bunger valve from the time of its construction until the present tunnel system was added in 1995. The valve is known to have caused high fish mortality. Its replacement coincided with significant increases in the Chinook population, although a modern fish screen was added to the diversion flume, and instream flows were increased at about the same time. Those features, along with the former passage mechanism through the dam are believed to have been the proximate causes of decline of Chinook salmon and steelhead in the White River. Since 1995, downstream migrating fish have passed through the trashrack at MMD and then moved downstream though either the 9- or 23-foot tunnel.

There are no upstream fish passage facilities at MMD. The Corps initially installed passage facilities when the project was under original construction. However, due to hydraulic conditions they could not be maintained in place and washed out. The Corps entered into an agreement with PSE in 1948 to construct and operate a trap and haul fishway at PSE's water diversion (barrier dam) near Buckley at RM 24.3. The barrier dam prevents upstream migration of all fish, except under certain high flow conditions when the flashboards are torn away[7]. The barrier dam has served to guide upstream migrating fish, including Chinook and steelhead, into a fish ladder that leads to the trap and haul facility.

The migration corridor is largely unobstructed throughout the rest of the river. It was affected by the White River Hydroelectric Project powerhouse until its closure in 2004. When the hydro project diverted most of the river, and the powerhouse was generating at high capacity, much

[7] The flashboards were designed to fail under heavy load in order to protect the original wood crib dam before the site was relevant to fish passage at MMD.

more water entered the lower White River from the powerhouse tailrace channel than from the natural (bypassed) river channel. This likely created a false attraction flow for upstream migrants, which would mistakenly sense the tailrace as the natural river channel. The Puyallup Tribe (Ladley et al. 1999) documented the occurrence of false attraction and delay of Chinook salmon in a radio-tagging study, but no quantitative estimates of the adverse effects on population viability have been made. Presumably steelhead may also have been falsely attracted, but there is no documentation to that effect.

The lower river migration corridor, downstream of the hydro tailrace channel, is unimpeded for adult migrants, and steelhead smolts probably have no difficulty either, given their age and size at migration. However, sub-yearling Chinook smolts prefer shallow, lower velocity water and structure, as lent by LWD. The leveed nature of the river channel downstream from Auburn to the mouth is mostly deeper and lacking in LWD.

Estuarine Areas

The White River is tributary to the Puyallup River, and the Puyallup estuary is Commencement Bay. The bay is surrounded by Tacoma, one of Washington State's largest cities. Commencement Bay is intensively developed as a seaport, and is highly industrialized. Over 98 percent of historical wetland habitat has been lost, and Commencement Bay is an U.S. Environmental Protection Agency (EPA) Superfund pollution clean-up site. Although juvenile steelhead are not known to rely much on estuaries for early marine rearing, PS Chinook rely heavily on this habitat type prior to their ocean migration. Estuary rearing appears to be correlated significantly with smolt-to-adult Chinook salmon survival among PS Chinook.

Nearshore Marine Areas

Habitat conditions in Puget Sound, the Strait of Juan de Fuca, and the Pacific Ocean are not within the action area and therefore are not part of the environmental baseline for this consultation.

4.3 Summary of the Status of Biological Requirements and Critical Habitat

Some of the habitat biological requirements of PS Chinook in the White River are not being met under the environmental baseline. These include unimpeded downstream juvenile and upstream adult migration. Any further degradation or delay in improving these conditions would increase the amount of risk the population faces under the environmental baseline.

5. ANALYSIS OF EFFECTS OF THE PROPOSED ACTION

5.1 Effects of the Proposed Action

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

5.2 Methods of Analysis

In this part of its jeopardy analysis, NMFS evaluates the effects of Proposed Action on listed PS Chinook and PS steelhead in the context of their biological requirements, as described in Section 3, including the effects of the Proposed Action on individual members of and on the White River populations of PS Chinook and PS steelhead as a whole, as well as on the PCEs of designated critical habitat.

5.3 Project Operations and Maintenance

MMD maintenance and operations activities affect conditions in the White River up to the upstream limit of water impoundment in the reservoir. Therefore, the action area extends upstream to RM 35, which is also the release site for adult fish trucked upstream from the Buckley trap.

Effects of Impoundment

The major action at MMD is the impoundment (storage) and release of water. The action inundates and then dewaters the banks of the reservoir, which could strand juvenile fish. However, this action usually occurs during the November through March time period, when no adult and very few juvenile Chinook are migrating. March would be the month most likely to coincide with juvenile migration and flood storage, but March is also the month within the flood control season when this operation is least likely to occur (see Section 2.1 and 2.2).

Due to radiant heating, the temperature of water stored during the spring and summer months is elevated above inflow. The White River commonly exceeds EPA temperature criteria (13 °C for Chinook) by as much as five degrees Celsius from the middle of June through September (Puyallup Tribe 2003) without any impoundment, and any storage during this time period is too brief for the reservoir to stratify. Water temperatures elevate but remain below lethal levels for juvenile and adult Chinook. This may potentially contribute to sub-lethal effects to egg viability. No effect on dissolved oxygen has been documented.

Impoundments may require juvenile fish to find their way through a slackwater reservoir, causing migration delay, navigate the trash racks, and then sound into the intake tower, subsequently exiting via either the 9-foot or 23-foot tunnel at MMD. When the reservoir stores water, the tunnels release water under pressure, although pressurized flow does not normally occur (except during flood flows exceeding 14,000 cfs; see Section 2.2). The most likely effects on juvenile fish are descaling or injury from abrasion around the trash racks and in the tunnels. The Corps has not determined whether this type of injury actually occurs, and if so, its extent. However, for the purpose of this analysis, NMFS considers it reasonably likely during spring or early summer impoundments, although these are uncommon or brief when they do occur. Most migrating juveniles are expected to move with the water column and not physically contact the intake tower or the tunnel walls. Therefore, NMFS assumes that a very small proportion – less than 5 percent – of the juvenile population is likely to experience descaling or abrasion due to impoundments. Migration delay also potentially occurs during impoundments.

Summer impoundments, which only occur when needed to enable repairs or maintenance or to facilitate downstream search and rescue operations, are unlikely to increase predation on juvenile Chinook salmon or steelhead, because the water is extremely turbid (5 inch visibility, or less). Predators dependent on vision are hindered by turbidity. The Corps attempts to avoid summer impoundments to the extent practicable under present operations (Corps 2005a). Some of the suspended sediment and bedload in transport probably settle out onto the bottom. However, most spawning takes place further upstream in the non-glacial tributaries or downstream of the barrier dam (Section 4.2).

In addition to elevated water temperatures, spring and summer storage and release operations could subject juvenile fish to potential stranding and desiccation when the reservoir is drawn down. However, spring and summer storage events are uncommon and brief when they do occur, exposing a very small proportion of the juvenile population to this effect.

Winter impoundments of flood flows reduce peak river discharges and reduce Chinook redd scouring that would otherwise occur in the reach downstream of the barrier dam. No data that we are aware of correlate specific discharges in the White River with egg-to-juvenile survival rates, but WDFW (Seiler et al. 2000) observed a strong inverse correlation of peak discharge to survival on the Skagit River. That such a relationship exists also for the White River is reasonable, as subsequent returns of adult Chinook salmon are often correlated with the frequency and severity of peak winter floods, independent of varying marine survival.

In summary, there is likely to be a beneficial effect of the Proposed Action due to flood control and other fishway improvements on juvenile and adult Chinook and steelhead abundance and productivity (due to reduced flood scour on redds). The adverse effects of the Project on the White River populations of PS Chinook or PS steelhead are imperceptible. With respect to critical habitat designated for PS Chinook, adverse effects on PCEs (freshwater spawning and rearing areas) are expected to occur infrequently and to be limited to the reservoir footprint, which is a small proportion of the habitat available within the HUC5 and an even smaller proportion of the habitat within the White River watershed.

Effects of Storage Release

Impounded water is released on the declining limb of the river discharge hydrograph. The peak discharge during a flood or high flow event is lower than that in an unregulated system. The principal effect on Chinook salmon and steelhead is the reduced frequency and severity of flows high enough to scour redds in the reach downstream of the barrier dam. This action does prolong the period of high water in the river, but even if those discharges were of redd scouring magnitude, they would scour to a lesser depth than the preceding high water, causing less damage to incubating eggs.

When the Corps releases water at MMD, some of the stored sediment and bedload is remobilized and transported downriver. Since it is transported at a lower flow, the river has less energy and either does not move the sediment as far, or does not move as large a particle size as the peak event would. The observed result is that sediment drops out and settles in the lower gradient, braided channel reach of the White River as it flows through the Muckleshoot Indian Reservation. The braided channel area is also the highest quality spawning habitat downstream of MMD, so there is some concern that that eggs incubating there may be lost to fine sediment deposition (i.e., if fines interfere with the intergravel flow needed to refresh oxygen and remove metabolic wastes from the redd). As described in Section 4.2, PSP&LC (1989) visually inspected frozen cores from this reach and concluded that the amount of fines present in many of the cores could adversely affect incubation of eggs and/or emergence of fry, but did not indicate the likelihood of high mortality rates. If the conclusions of Seiler (2000) for the Skagit River (above) apply, losses of eggs due to fines could be offset by reduced loss from flood scour in this reach downstream from MMD.

The controlled release of stored water results in fewer overbank, channel forming, and habitat forming flows compared to an unregulated river. However, flows up to 12,000 cfs still occur in the White River, and this discharge is high enough to fulfill the habitat maintenance functions, which are typically satisfied by the 1½ to 2 year flood event. Upper terrace habitat areas are formed and maintained only by infrequent floods at 10 or more year frequency, and this function is affected by flood storage and the subsequent lower flow releases. In any case, upper terrace habitat is mostly unavailable below RM 9 because of the extensive dikes and levees that occur on the lower White River.

The release of stored water is not expected to adversely affect the behavior of juvenile Chinook or steelhead because flows during release are lower than the preceding peak flood flows (from which the juvenile fish would have already sought refuge). The releases could adversely affect spawning of Chinook and steelhead if they occurred while the species were spawning. However, flood storage release operations typically occur during winter, after Chinook spawning and before steelhead spawning.

With respect to critical habitat designated for PS Chinook, the adverse effects of reduced discharge flows on PCEs (freshwater spawning, rearing, and migration areas) are probably limited to the deposition of fines in the low gradient, braided reach. This effect may be offset by reduced losses from redds due to scour.

Downramping

Downramping effects extend from MMD downstream beyond the confluence of the White River with the Puyallup River. However, the rate of downramping attenuates in the downstream direction, varying according to the rate of decrease in discharge at the hydraulic control point at MMD.

The rate at which streamflow is reduced during an impoundment operation directly affects juvenile salmon and steelhead. The Washington State guidelines allow downramping up to 2 inches per hour, during the night hours only, when juvenile Chinook less than 50 mm long are present (Hunter 1992). The guidelines allow downramping up to 1 inch per hour, day and night, when juvenile steelhead less than 50 mm long are present. Small, post-emergent fry are most susceptible to downramping, particularly on river gravel bars. Larger juveniles, even yearling steelhead, are susceptible to the effects of pothole stranding in side channels. The rate of juvenile stranding correlates to both downramping rate and to total amplitude of the downramp event (R.W. Beck Associates 1989). The Corps (2005a) follows the state guidelines as closely as it can, given that the equipment at MMD is old, and was not developed to manage stream flows this precisely. Recent operations by the Corps have demonstrated that they are able to come very close to meeting the guidelines.

Another factor influencing downramping is the critical flow value. That value is the flow at which downramping restrictions are imposed. The inherent assumption about the critical flow is that downramping rate restrictions are of little value at stream flows greater than the critical flow because the streambanks are steeply sloped at such flow rates, and stranding is unlikely. Stranding is also inversely correlated with stream bank slope (R.W. Beck Associates 1989). The critical flow was 1,000 cfs for the bypass reach of the White River at the time of the 2003 fish kill. The Corps began that downramp event at a flow of 1,600 cfs, and flows were rapidly reduced down to the 1,000 cfs mark. The Puyallup tribal fisheries staff (unpublished data, Ladley 2003) found large numbers of juvenile salmon, both fry and yearlings, stranded at the margins of the higher water level, where the rapid downramp began. Further, stranding also occurred on different habitat types (steeper sloped and finer grained substrate) than is associated with the reduced stranding that occurs when the state downramping rate restrictions are employed. As a result of the 2003 fish kill, NMFS changed the critical flow for downramping restrictions for the river reach downstream of MMD to 2,000 cfs. This modification of the critical flow, along with the Corps' continued use of the Washington State downramping guidelines for operations below the critical flow, are expected to limit stranding losses of both juvenile Chinook and steelhead in the White River.

Downramping can adversely affect spawning by moving fish off the gravel before they can complete redds, as well as temporarily exposing established redds to desiccation. However, the Corps' use of the Washington guidelines, and the operational change since 2003 of limiting the frequency and amplitude of downramping operations is expected to significantly reduce the likelihood that these adverse effects will occur.

With respect to critical habitat for PS Chinook, the adverse effects of downramping on PCEs are the potential dewatering of rearing and migration areas at a rate that strands or entraps juvenile fish and the dewatering of redds long enough to desiccate the eggs. The former is likely to happen infrequently because the Corps will continue to follow the Washington State downramping guidelines. The latter is unlikely because the Corps coordinates downramping actions with Federal, State, and tribal fishery agencies who will advise against downramps during the egg incubation seasons.

Fish Trap Operations

The fish trap dates to 1948, and was a prototype for later facilities. It has no holding area or ponds for when fish greater than the trap capacity accumulate. No sorting and sampling facilities are part of its design.

Adult Chinook enter the fish trap from May through October. The White River often warms above optimal temperatures for the viability of Chinook gametes (less than or equal to 13° C) after mid June (Puyallup Tribe, unpublished data, 2003). The Corps conducts Chinook trap-and-haul operations across a range of temperatures, including some that exceed the optimum. Trapped fish are not anesthetized. During trapping operations tribal personnel typically handle each fish in order to enumerate marked and unmarked Chinook and to sort out the fish used as hatchery broodstock. Handling fish, even without mark sampling and sorting, causes some degree of stress that is adverse to the health of the fish. However, incidental mortalities from handling and the trap and haul process have not been recorded. Anecdotal evidence from the Baker River fish trap (which was designed after the White River prototype) indicates that pre-spawning losses of adult sockeye, which are quite sensitive to handling stress, are usually low and in the range of 2 or 3 percent.

Steelhead enter the Buckley trap from January through May, when they are in a more advanced stage of sexual maturity and the water is cold. Fish in this condition are much more resistant to handling stress. Losses from the trap and haul operations are probably less than 1 percent.

With respect to critical habitat designated for PS Chinook, the trap and haul operation has a positive effect on PCEs for migration areas by offsetting MMD's obstruction of the upstream migration corridor. The trap and haul operations have a negligible adverse effect on PS Chinook designated critical habitat and actually offset the negative effect of the MMD as a barrier to upstream migration corridor. The trap and haul operation has a small, but significant adverse effect on the PS Chinook ESU and a negligible effect on the PS steelhead DPS.

5.4 Interim Operations

The Corps' contract with PSE requires it to continue to maintain the diversion/barrier dam at Buckley until the new barrier dam is built. The purpose of the contract is to maintain the functionality of the Corps' fish ladder and of the trap-and-haul facility and its operation. PSE removes the flashboards on the dam in anticipation of high flows (if left in place, which does occasionally occur, they are swept away during winter high flow events). After the risk of winter flooding has passed, PSE places the flashboards back in position.

The original purpose of the flashboards was to divert water from the river into the flume that conveys it to Lake Tapps. The flashboards also enhance adult passage in two ways: (1) by adding height to the dam, which prevents fish from migrating upstream past the fishway and (2) by directing flow toward the fishways on each side of the river. The MIT hatchery fishway entrance is on the right bank, and the entrance to the Corps' fish ladder, that leads to the trap and haul facility, is on the left.

PSE can only replace flashboards when the river flow is low, roughly 500 cfs or less (and preferably 250 cfs or less). The action usually takes less than 8 hours. Since the White River Project was shut down in January 2004, natural and near-natural stream flows have prevailed in the White River downstream of MMD. Salmon and steelhead therefore spawn at higher flows than previously. Reducing flows to less than 500 cfs for the purpose of replacing the flashboards in the spring prior to Chinook emergence therefore places an unknown number of incubating alevins at risk of dewatering. Such a flow reduction also incurs an attendant Chinook fry stranding risk, since emergence is well under way in March and most have emerged by early April.

Interim operations have a negative effect on the PCEs for PS Chinook migration corridors, but this is offset by the positive effect of the Corps' trap-and-haul operation which passes fish around MMD. Flashboard replacement operations during the interim period before the barrier dam is replaced (see below) could dewater the downstream reach, having a negative effect on incubating juvenile Chinook and steelhead. Lastly, the effects of interim operations are short-term.

With respect to critical habitat designated for PS Chinook, the effect of interim operations on PCEs (spawning, rearing, and migration areas) is both positive (guiding adults toward the fishways on each bank of the river) and negative (potential desiccation of incubating yolk-sac fry and stranding and entrapment of emergent fry). The negative effects will be of short-term duration in this reach downstream of the barrier dam, however.

5.5 Barrier Dam Replacement

The effects of replacing the barrier dam are limited to a project area extending approximately 200 yards upstream and 100 yards downstream of the dam. Cofferdams will be constructed on each side of the river, in separate phases, and all construction work will occur within their perimeters and on the associated uplands. The upstream in-water effects are limited to the upper limit of impoundment (i.e., 200 yards upstream, see above) and includes the area around the MIT

hatchery surface water supply intake, similar to the existing PSE dam. Measurable downstream effects are likely to attenuate further downstream. The cofferdams will be constructed during the summer in-water work window when little or no juvenile migration occurs. Therefore, very few juvenile PS Chinook and PS steelhead are likely to experience behavioral disruption, injury, or mortality.

Upstream migration of Chinook and steelhead will also continue during barrier dam replacement. Adult fish will be guided to the MIT hatchery entrance for trapping while construction activities take place on the left bank around and in the fish ladder and water supply. Construction activity in and around the Corps' ladder and trap will be timed to avoid peak migrations of fish that would require handling of hundreds or thousands of fish per day. Downstream migration will continue along the bank of the river that is opposite the side where construction cofferdams are located.

The area between MMD and the barrier dam does not generally support spawning of Chinook salmon or steelhead because fish are transported and released further upstream and few fallback downstream of MMD. The new barrier dam is expected to need few repairs and thus have a reduced need for flow manipulations that could dewater incubating eggs, alevins, and early emergent fry.

Juvenile rearing habitat is fairly limited around the barrier dam site as a consequence of the natural river channel morphology and the sediment accumulation in the forebay of the existing diversion dam. There is very little off-channel habitat, LWD, or undercut banks. An exception is a large pool immediately downstream of the barrier dam that is likely good juvenile rearing habitat. Replacing the barrier dam could change the hydraulics that formed and maintain this pool, but the scouring effects of water releases over the dam are likely to maintain a future pool of about the same dimensions in the vicinity. Thus any negative effect would be short term.

The proposed replacement of the barrier dam is expected to alleviate the causes of injury and incidental mortality to migrating juvenile and adult fish discussed above. Although the barrier dam obstructs volitional upstream migration, it is, along with the associated fish ladder and trap, the vehicle by which upstream migration is achieved. The improved guidance, juvenile fish screens, water supply for the adult ladder and trap, and fish ladder entrance are all expected to increase overall juvenile and adult Chinook and steelhead survival.

With respect to critical habitat designated for PS Chinook, barrier dam replacement will not have a measurable effect on PCEs (rearing and migration areas) because the area is a very small proportion (< 0.1%) of the available habitat of its type in the basin. A few juvenile Chinook and steelhead are likely to disturbed, injured, or killed during the short-term process of constructing each cofferdam. Although appreciable numbers of adult PS Chinook will be in the area at the time, the trap and haul facility will be operated throughout the construction period. Therefore, direct or indirect injury to adult Chinook or steelhead is expected to be limited to a few fish, and mortality is unlikely.

5.6 Summary: Short-Term Effects

Short-term effects of the Proposed Action are mainly the result of the interim operations of the Buckley barrier dam and the construction-related impacts associated with replacement of the barrier dam. The interim operations have the potential to cause dewatering of the river downstream of the barrier dam when water is stored at MMD to facilitate flashboard replacement at the barrier dam. Replacement of the barrier dam requires construction of two temporary cofferdams in the main channel of the White River. That construction may cause injury and mortality to a small number of juvenile Chinook and steelhead and have a correspondingly small effect on PCEs.

5.7 Summary: Long-Term Effects

The long-term effects of the Proposed Action are those associated with the ongoing O&M of MMD and of the new barrier dam. MMD appears to contribute to low-level chronic losses of juvenile Chinook, and possibly steelhead. These are the result of downstream passage deficiencies through the trash rack structure and tunnels through MMD and intermittent water temperature elevations caused by storing water during the summer. Temperature excursions also adversely affect adult Chinook, but the effects are most likely sub-lethal. Physical damage occurs to some adults at the fish trap from outdated hardware and from handling that occurs as part of fish sampling and sorting and from transport.

The long-term effects of the new barrier dam will mostly be beneficial. Improved guidance, screening, and water supply are expected to make juvenile fish impacts negligible and to improve the adult migration process. Ongoing chronic effects from potential delay, and particularly from handling and transport, are expected to continue.

6. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR §402.02 as "those effects of future State, tribal, local, or private actions, not involving Federal activities, that are reasonably certain to occur in the action area."

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

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

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

Any action that will require future Federal approval, funding, or other involvement is not included within the "cumulative effects" for this analysis (see ESA definition, above). Federal involvement of this type would trigger ESA Section 7 (a)(2) consultation in the future which, when completed, would result in the action being considered part of the environmental baseline for later consultations, and its effects analyzed accordingly. Thus, for example, State efforts to improve water quality in compliance with the Federal Clean Water Act will not be considered, because of the involvement of the EPA, until EPA completes consultation with NMFS. Other examples might include irrigation water withdrawals involving the U.S. Forest Service (right-of-way permits for irrigation canals) and agricultural practices that receive Federal funding through the U.S. Department of Agriculture.

NMFS is aware only of the Cascade Water Alliance water supply project as a future non-Federal activity within the action area that would adversely affect PS Chinook or PS steelhead or the critical habitat designated for PS Chinook. The project would divert an average of 100 cfs from the White River to Lake Tapps, where it would be diverted out of basin for municipal and industrial water supply. WDOE has recently issued a draft Record of Examination for the water supply project. The water diversions for Lake Tapps and water supply are subject to minimum instream flow provisions that meet NMFS' minimum flow recommendations under the Interim

Operating Agreement between the Corps and PSE. These flows meet or exceed the no jeopardy minimum flows for PS Chinook evaluated by NMFS in its draft Biological Opinion for the White River Hydroelectric Project (2003)[8] and flows approved in our March 10, 2005 letter to the Corps (see Appendix I).

Given the rapid growth of human population in the vicinity, it is also likely that future private and State actions will continue in the action area at an increasingly accelerated pace. In contrast to adverse effects that increasing population pressures will put on aquatic resources, there is a large scale initiative under way that may benefit PS Chinook habitat in the White River. The Shared Strategy for Puget Sound has prepared a Draft Puget Sound Salmon Recovery Plan (2005). The Shared Strategy is a collaboration of Federal, State and local governments, tribes, and organizations. The draft plan proposes doubling funding for salmon recovery from $60 million per year to $120 million per year. Although it is likely that many of the prospective recovery actions will be implemented, all are too uncertain to be considered cumulative effects for the purposes of this Opinion.

6.1 Inter-Related and Inter-Dependent Effects

PSE has operated a water diversion dam at the barrier dam site since 1912 for a hydroelectric project. That project was closed in January 2004. However, the diversion flume and all appurtenant facilities and structures remain. In addition, PSE continues to divert water from the White River to Lake Tapps reservoir. The reservoir is a 2,700 acre lake that is heavily populated with waterfront homes and hosts Pierce County's most heavily used park. PSE continues to maintain the barrier dam and diverts water to Lake Tapps to maintain seasonal water levels for summer recreation.

PSE's water right claim to the White River allows diversion up to 2,000 cfs for the sole purpose of energy generation. Since energy is no longer produced at the White River Hydroelectric Project, there is no need for water for energy production. However, the Lake Tapps community has expressed a need for water to maintain Lake Tapps to provide benefits in the form of property values, recreation, and water quality. PSE applied to WDOE in late 2005 to expand the beneficial uses of its water right claim to include maintenance of lake levels, recreation, water quality, and other purposes. The application included no proposed qualifications on the claim, leaving the potential amount diverted at 2,000 cfs, with no minimum instream flow provisions for the White River. WDOE has not yet acted on the application.

This application is relevant to this consultation in that, absent PSE's existing dam or the Corps' proposed replacement of that dam with its own facility, the ability to divert water from the White River into the diversion flume would be mostly obviated. The water diversion flume and its operation are therefore inter-related to the Proposed Action, and their effects on listed species are inter-dependent on those of the barrier dam. The water diversion adversely affects listed PS Chinook and PS steelhead and adversely modifies critical habitat if water is diverted at rates that leave less than the minimum instream flows NMFS previously described in its March 10, 2005

[8] The 2003 section 7 consultation with FERC regarding PSE's White River hydroelectric project never went beyond draft stage because PSE elected to withdraw its license application and shut down the unlicensed project. The flows are listed in Appendix I.

letter to the Corps and its October 2003 draft Biological Opinion for the White River Hydroelectric Project. WDOE is taking NMFS' flows and agency flows from the FERC licensing proceeding into account in its draft Record of Examination, and has indicated a preference for flows equaling and exceeding these levels, but has yet to set minimum instream flows for the White River.

7. CONCLUSIONS

This section presents NMFS' Biological Opinion regarding whether the effects of the Proposed Action (Section 5), taken together with the environmental baseline (Section 4), the cumulative effects (Section 6) in the action area, and the current rangewide status of the species and its designated critical habitat (Section 3), are likely to jeopardize the continued existence of PS Chinook or PS steelhead or destroy or adversely modify critical habitat. NMFS' conclusion assumes that the Proposed Action occurs as described in Section 2 and specified in the BA and in the Corps' memorandum regarding replacement of the barrier dam.

7.1 Effects on the Listed Species

NMFS has reviewed the current rangewide status of the PS Chinook ESU and PS steelhead DPS and the environmental baseline, effects of the Proposed action, and cumulative effects within the action area in determining whether the Proposed Action is likely to jeopardize the continued existence of the species. Chinook salmon habitat in the White River Basin has been adversely affected by many activities, but many miles of habitat - both upstream and downstream of MMD and the barrier dam - remain suitable for spawning, incubation, and juvenile rearing.

7.1.1 Effects on PS Chinook

Effects of MMD O&M on PS Chinook

The Proposed Action will cause short-term behavioral disruption, injury, and mortality to small numbers of juvenile and adult Chinook salmon. It may cause low-level chronic losses of juvenile Chinook as a result of downstream passage conditions through the trash rack structure and tunnels at MMD. It is also likely to cause sub-lethal effects to adult Chinook from temperature excursions caused by summer water impoundment actions. But in the long term, the Proposed Action will ensure that the White River population will have access to spawning and rearing habitat in the upper basin, which will continue to support improvements in terms of its abundance, productivity, spatial structure, and diversity.

Effects of Interim Operations on PS Chinook

During the 2 to 5 year period before the barrier dam is replaced, the action will continue to cause intermittent losses of PS Chinook eggs, alevins, and fry when flows are manipulated to facilitate flashboard installation. Interim operations will delay and injure some upstream adult migrants. However, this effect will be short-lived, and interim operations will also maintain the reliability of the upstream adult passage facilities and the improvements in population viability that they support.

Effects of Barrier Dam Replacement on PS Chinook

The Proposed Action will cause the short-term behavioral disruption, injury, and mortality to small numbers of juvenile and adult Chinook salmon. However, the new barrier dam will also maintain the reliability of the upstream adult passage facilities and improve the viability of the White River population.

7.1.2 Effects on PS Steelhead

Effects of MMD O&M on PS Steelhead
The Proposed Action will cause the short-term behavioral disruption, injury, and mortality to small numbers of juvenile and adult steelhead. It may cause low-level chronic losses of juvenile steelhead as a result of downstream passage conditions through the trash rack structure and tunnels at MMD. But in the long term, the Proposed Action will ensure that the White River population will have access to spawning and rearing habitat in the upper basin, which will continue to support improvements in its abundance, productivity, spatial structure, and diversity.

Effects of Interim Operations on PS Steelhead
During the 2 to 5 year period before the barrier dam is replaced, the action will continue to cause losses of PS steelhead eggs, alevins, and fry if flows downstream of the barrier dam are reduced to facilitate flashboard replacement during the summer months. However, this effect will be short-lived, and interim operations will also maintain the reliability of the upstream adult passage facilities and the improvements in population viability that they support.

Effects of Barrier Dam Replacement on PS Steelhead
The proposed action will cause the short-term behavioral disruption and injury and mortality of small numbers of juvenile and adult steelhead. However, the new barrier dam will also maintain the reliability of the upstream adult passage facilities and the improvements in population viability that they support.

7.1.3 Overall Conclusion - Effects on Survival and Recovery

The Proposed Action will continue low-level, chronic losses of juvenile and adults in the White River populations of PS Chinook salmon and PS steelhead. However, some of these losses will be reduced by the replacement of the barrier dam at Buckley. Also, the ongoing operation of the trap-and-haul facility is allowing both populations to use functioning spawning and rearing habitat in the upper White River Basin, which the Shared Strategy (2005) determined would be needed for a viable population of PS Chinook.

After reviewing the rangewide status of the species, environmental baseline, effects of the action, and cumulative effects, NMFS concludes that the Proposed Action is not likely to jeopardize the survival and recovery of PS Chinook salmon or PS steelhead. In making this determination, NMFS has relied on the best available scientific and commercial information.

7.2 Effects on Designated Critical Habitat

Critical habitat has been designated for PS Chinook but not for PS steelhead.

NMFS has reviewed the rangewide status of designated critical habitat for PS Chinook, the environmental baseline for critical habitat in the action area, the effects of the Proposed Action,

and cumulative effects. Some of the PCEs (spawning, rearing, and migration areas) for Chinook salmon in the White River, water quality (temperature), sediment, and unobstructed passage are not met under the environmental baseline.

Effects of MMD O&M on Critical Habitat

By operating and maintaining MMD, the Corps' Proposed Action will minimally modify water temperature and sediment discharge and distribution compared to the environmental baseline. By operating and maintaining the fish trap-and-haul facility, the Corps' Proposed Action will continue to minimize the obstruction of fish passage. In addition, reconstruction of the barrier dam will enhance attraction flows to both the trap and the fish ladder.

Effects of Interim Operations on Critical Habitat

During the 2 to 5 year period before the barrier dam is replaced, interim operations will minimize obstruction of upstream passage by the use of the upstream fish passage facilities. However, impoundments at MMD during this period to allow replacement of the flashboards at the barrier dam are likely to dewater and therefore reduce the conservation value of spawning and rearing areas downstream. However, this effect will be short-lived.

Effects of Barrier Dam Replacement on Critical Habitat

The Corps' Proposed Action of replacing the existing Barrier Dam will have a negligible effect on water temperature and sediment discharge and distribution. The new barrier dam will minimize the obstruction of volitional Chinook salmon and steelhead migration, improving attraction to the entrances to the fish ladder(s), the fish trap-and-haul facility, and the Muckleshoot Hatchery. The new barrier dam will facilitate the continued diversion of water from the White River to Lake Tapps. If the diversions fail to maintain minimum instream flow requirements in the bypass reach of the White River, the conservation value of PCEs will be adversely affected over a significant element of designated critical habitat at the rangewide scale.

Overall Conclusion – Effects on Critical Habitat

The Proposed Action will minimally modify water temperature and sediment discharge and distribution. However, the Proposed Action will also improve conditions at the fish ladder and trap and will minimize the obstruction of upstream fish passage. No changes are expected to downstream fish passage. Consequently, the conservation value of spawning and rearing habitat in designated portions of the basin upstream of MMD will be preserved.

It is likely that a diverting authority will continue to divert water from the White River to Lake Tapps. The draft flows that WDOE has proposed for the bypass reach are expected to equal or exceed NMFS recommended flows. However, WDOE's action is not reasonably certain to occur as defined in USFWS and NMFS (1998) and therefore cannot be considered a cumulative effect for the purpose of this consultation. Therefore, the degree to which the Proposed Action's facilitation of diversions to Lake Tapps will result in adequate or inadequate flows in the bypass reach is uncertain at this time.

After reviewing the rangewide status, environmental baseline, effects of the action, and cumulative effects, NMFS concludes that the Proposed Action is not likely to destroy or adversely modify designated critical habitat for PS Chinook salmon. In making this determination, NMFS has relied on the best available scientific and commercial information.

8. INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the ESA prohibits any taking (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of an endangered species without a specific permit or exemption. Protective regulations adopted pursuant to Section 4(d) extend the prohibition to threatened species. Harm is further defined in 50 CFR §222.102 as "an act that may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering." Harass is defined as actions that create the likelihood of injuring listed species to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is take of listed species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

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

8.1 Amount or Extent of Anticipated Take

NMFS anticipates that the Proposed Action will cause incidental take of PS Chinook within the action area during MMD operation, maintenance, and barrier dam replacement construction. In its analysis of the effects of the Proposed Action, NMFS did not estimate the number of adult or juvenile Chinook salmon that would be delayed, injured, or killed. However, some juveniles are likely to be injured passing downstream of MMD and potentially at the barrier dam, mostly during construction. NMFS believes the number will be very small, less than 1 percent. NMFS estimates that less than 2 percent of the adult Chinook salmon returning to the trap will be injured or killed in the process of trapping and hauling fish upstream. This estimate is based on the observations of sockeye and coho salmon at a similar trap-and-haul facility at the Baker River Hydroelectric Project.[9]

NMFS anticipates that the Proposed Action will cause incidental take of PS steelhead within the action area during project operation, maintenance, and construction. In its analysis of the effects of the proposed activities to operate and maintain MMD and replace the barrier dam, NMFS did not estimate a specific number of adult or juvenile steelhead that would be delayed, injured, or killed. However, some juveniles are likely to be injured passing downstream of MMD and potentially at the barrier dam, mostly during construction. NMFS believes the number will be very small, less than 1 percent. NMFS believes that less than 1 percent of the adult steelhead returning to the trap will be injured or killed in the process of trapping and hauling the fish

[9] Although sockeye are very sensitive to handling mortality, pre-spawning mortality is typically less than one or two percent.

upstream. We estimate the loss at less than 1 percent of the adult population returning to the trap. This estimate is based on experiences and observations of other wild steelhead broodstock capture, transport, holding to maturation, and spawning programs in the Puget Sound region.

The extent of take of critical habitat will be negligible. The new barrier dam will occupy the same aquatic footprint as the existing PSE diversion dam. The river channel approaching the dam and fish ladders will either be unchanged or improved to facilitate fish attraction and passage. The river channel in the dam forebay will remain about the same as it is at present.

8.2 Effect of Anticipated Take

As analyzed in this Opinion, NMFS has determined that this extent of anticipated take is not likely to jeopardize the continued existence of PS Chinook or to adversely modify or destroy designated critical habitat. NMFS has also determined that this extent of anticipated take is not likely to jeopardize the continued existence of PS steelhead.

8.3 Reasonable and Prudent Measures

RPMs are non-discretionary measures to be taken in addition to the Proposed Action in order to satisfy the ESA's requirement to minimize incidental take. RPMs must be carried out as binding conditions if the Proposed Action is to enjoy the exemption from the prohibition of take in Section 7(o)(2) of the ESA. The Corps has the continuing duty to regulate the activities covered in this ITS. If the Corps fails to adhere to the terms and conditions of the ITS, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. Activities carried out in a manner consistent with these RPMs, except those otherwise identified, will not necessitate further site-specific consultation. Activities that do not comply with all relevant RPMs will require reinitiation of consultation.

In addition to carrying out the Proposed Action as described in the BA, the Corps must carry out the following necessary and appropriate RPMs to minimize the effect of anticipated incidental take of PS Chinook. The Corps must also carry out the RPMs to minimize adverse effects on critical habitat. The Corps must:

1. Design, install, and operate real-time streamflow gaging at MMD and the barrier dam. These structures provide flow manipulation capability to the Corps, and the fishery resource agencies require reliable information about modifications to the river environment made by Project operators.

2. Design in collaboration with NMFS and perform a juvenile fish migration investigation at MMD to assess fish passage success and injury and mortality rates. Although increases in Chinook and steelhead (and other species) populations are correlated with improvements made at MMD, no causative effect has been established. Verification is necessary because this Opinion assumes a causative effect. Therefore, this Opinion is subject to change should new information establish a relationship different from what we have assumed.

3. A. Upgrade the adult fish trap at the Buckley barrier dam in collaboration with NMFS fish passage engineers.
   B. Replace the brail with one that meets ½ inch bar spacing requirements.
   C. Modify the brail tower to also load a flume leading to an adult sorting facility.
   D. Upgrade the adult fish handling system to three holding raceways or tanks, with an approximate capacity of 100 salmon each, and add a fish sampling and sorting table.
   E. Add a return-to-river pipe to the adult fish handling system.

4. As a proximate cause of the decline of Chinook salmon, which are listed as threatened under the ESA, the out-of-basin, and now in-basin culture of White River Chinook is necessary. As part of a coordinated recovery action, returning Chinook salmon must be sorted from other species, and sampled for hatchery or wild status, and sampled for marks. The 50-year old adult fishway for MMD requires modernization to satisfy contemporary fishery management and for specific ESA needs. Design an improved fishway in consultation with NMFS.

5. Design and implement improvements to the Muckleshoot Tribal Hatchery fishway in collaboration with NMFS fish passage engineers and MIT for temporary fish collection and transport during the construction phase of the barrier dam replacement.

6. Minimize incidental take from general construction by adhering to the terms and conditions that avoid or minimize adverse effects to water quality, riparian, and aquatic systems as described in Section 8.3.1.

7. Complete a monitoring and reporting program to ensure that these RPMs and the following terms and conditions are effective in minimizing take from permitted activities.

8.3.1 Terms and Conditions

To be exempt from the prohibitions of Section 9 of the ESA, the Corps and its cooperators, if any, must fully comply with conservation measures describe as part of the Proposed Action and the following terms and conditions that complete the reasonable and prudent measures described above. Partial compliance with these terms and conditions may invalidate this take exemption, result in more take than anticipated, and lead NMFS to a different conclusion regarding whether the Proposed Action will result in jeopardy or the destruction or adverse modification of critical habitats.

1. **To implement RPM #1, the Corps must**:
   Design, install, and operate real-time streamflow gaging at MMD and the barrier dam no later than September 2012.

2. **To implement RPM #2, the Corps must**:
   Design in collaboration with NMFS and perform a juvenile fish migration investigation at MMD to assess fish passage success and injury and mortality rates no later than September 2012.

3. **To implement RPM #3, the Corps must**:
   Upgrade the adult fish trap at the Buckley barrier dam in collaboration with NMFS fish passage engineers no later than September 2012.

4. **To implement RPM #4, the Corps must**:
   Design and develop improvements to the Muckleshoot Tribal Hatchery fishway in collaboration with NMFS fish passage engineers and the MIT for temporary fish collection and transport during the construction phase of the barrier dam replacement no later than September 2012.

5. **To implement RPM #5, the Corps must**:
   Design and develop improvements to the barrier dam fishway and trap and haul facility in collaboration with NMFS fish passage engineers and biologists.

6. **To implement RPM #6, the Corps must**:

   A. When the Corps needs to modify the schedule or design of the Proposed Action, the Corps must notify NMFS, USFWS, and WDFW. Should any unanticipated incidental take-related concerns be identified with respect to such modifications, the Corps will informally (and if necessary, formally) consult with NMFS and USFWS consistent with the regulations at 50 CFR 402.16.

   B. Timing of in-water work. Complete work within the active channel of the White River during the in river work period specified in Washington State's Hydraulics Code no later than September 2012. All in-water work must be completed within these dates unless otherwise approved in writing by NMFS.

   C. Minimum area. Confine construction impacts to the minimum area necessary to complete the project.

   D. Cessation of work. Project operations cease under high-flow conditions that may result in inundation of the construction site, except for efforts to avoid or minimize resource damage.

E. Fish screens. All water intakes used for the project, including pumps used to isolate an in-water work area, must have a fish screen installed, operated and maintained according to NMFS' fish screen criteria no later than September 2012.[10]

F. Fish passage. Passage must be provided for any adult or juvenile salmonid species present in the area during construction, except as described in Chapter 5 of the BA. Culvert placement must be consistent with NMFS' Fish Passage Guidelines.

G. Pollution and erosion control plan. A pollution and erosion control plan must be prepared and carried out to prevent pollution related to construction operations. The plan must be available for inspection on request by NMFS no later than September 2012.

H. Plan contents. The pollution and erosion control plan must contain the pertinent elements listed below, and meet requirements of all applicable laws and regulations.
    i. Practices to prevent erosion and sedimentation associated with access roads, stream crossings, construction sites, borrow pit operations, haul roads, equipment and material storage sites, fueling operations and staging areas.
    ii. A description of any hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.
    iii. A spill containment and control plan with notification procedures, specific clean up and disposal instructions for different products, quick response containment and clean up measures that must be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.
    iv. Practices to prevent construction debris from dropping into any stream or waterbody, and to remove any material that does drop with a minimum disturbance to the streambed and water quality.

I. Inspection of erosion controls. During construction, all erosion controls must be inspected daily during the rainy season and weekly during the dry season to ensure they are working.
    i. If inspection shows that the erosion controls are ineffective, work crews must be mobilized immediately to make repairs, install replacements, or install additional controls as necessary.
    ii. Sediment must be removed from erosion controls once it has reached ⅓ of the exposed height of the control.

[10] National Marine Fisheries Service, *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing pump intake screens) (http://www.noaa.gov/1hydrop/hydroweb/ferc.htm).

J. Construction discharge water. All discharge water created by construction (e.g., concrete washout, pumping for work area isolation, vehicle wash water) must be treated as follows.
    i. *Water quality treatment*. Design, build, and maintain facilities to collect and treat all construction and drilling discharge water, using the best available technology applicable to site conditions, to remove debris, nutrients, sediment, petroleum products, metals, and other pollutants likely to be present.
    ii. *Return flow*. If construction discharge water is released using an outfall or diffuser port, velocities may not exceed 4 fps, and the maximum size of any aperture may not exceed 1 inch.
    iii. *Pollutants*. Do not allow pollutants such as green concrete, contaminated water, silt, welding slag, sandblasting abrasive, or grout cured less than 24 hours to contact any waterbody, wetland, or stream channel below ordinary high water.

K. Preconstruction activity. Before significant[11] alteration of the individual construction sites, the following actions must be completed.
    i. *Marking.* Flag the boundaries of clearing limits at the construction site to prevent disturbance of critical riparian vegetation and wetlands.
    ii. *Emergency erosion controls*. Ensure that the following materials for emergency erosion control are onsite.
        a. A supply of sediment control materials (*e.g.*, silt fence, straw bales).
        b. An oil-absorbing, floating boom whenever surface water is present.
    iii. *Temporary erosion controls*. All temporary erosion controls must be in-place and appropriately installed downslope of project activity within the riparian area until construction at the specific site is complete.
        a. Existing ways. Existing roadways or travel paths must be used whenever possible, unless construction of a new way would result in less habitat take.
        b. Steep slopes. Temporary roads will not be built mid-slope or on slopes steeper than 30%.
        c. Minimizing soil disturbance and compaction. When a new temporary road is necessary within 150 feet[12] of a stream, waterbody or wetland, soil disturbance and compaction must be minimized by clearing vegetation to ground level and placing clean gravel over geotextile fabric (geotextile fabric is a woven material that reduces surface erosion and sometimes allows vegetative growth), unless otherwise approved in writing by NMFS.

[11]Significant" means an effect can be meaningfully measured, detected, or evaluated.

[12]Distances from a stream or waterbody are measured horizontally from, and perpendicular to, the bankfull elevation, the edge of the channel migration zone, or the edge of any associated wetland, whichever is greater. "Channel migration zone" means the area defined by the lateral extent of likely movement along a stream reach as shown by evidence of active stream channel movement over the past 100 years; e.g., alluvial fans or floodplains formed where the channel gradient decreases, the valley abruptly widens, or at the confluence of larger streams.

L. Temporary stream crossings.
    i. The number of temporary stream crossings must be minimized.
    ii. Temporary road crossings must be designed as follows.
        a. A survey must identify and map any potential spawning habitat within 300 feet downstream from a proposed crossing.
        b. No stream crossing may occur at known or suspected spawning areas or within 300 feet upstream from such areas if spawning areas may be affected.
        c. The crossing design must provide for foreseeable risks (e.g., flooding and associated bedload and debris) to prevent the diversion of streamflow out of the channel and down the road if the crossing fails.
        d. Vehicles and machinery must cross riparian areas and streams at right angles to the main channel wherever possible.

M. Obliteration. When the project is completed, all temporary access roads and work bridges must be obliterated, the soil must be stabilized, and the site must be revegetated. Temporary roads in wet or flooded areas must be abandoned and restored as necessary by the end of the in-water work period.

N. Heavy Equipment. Use of heavy equipment will be restricted as follows.
    i. *Choice of equipment*. When heavy equipment must be used, the equipment selected must have the least adverse effects on the environment (e.g., minimally sized, rubber tired).
    ii. *Vehicle staging*. Vehicles must be fueled, operated, maintained, and stored as follows:
        a. Vehicle staging, cleaning, maintenance, refueling, and fuel storage must take place 150 feet or more from any stream, waterbody, or wetland or have suitable spill prevention measures at the refueling site if it must be closer.
        b. All vehicles operated within 150 feet of any stream, waterbody, or wetland must be inspected daily for fluid leaks before leaving the vehicle staging area. Any leaks detected must be repaired in the vehicle staging area before the vehicle resumes operation. Inspections must be documented in a record that is available for review on request by NMFS.
        c. All equipment operated instream must be cleaned before beginning operations below the bankfull elevation to remove all external oil, grease, dirt, and mud.

O. Stationary power equipment. Stationary power equipment (e.g., generators, cranes) operated within 150 feet of any stream, waterbody, or wetland must be diapered to contain leaks, unless otherwise approved in writing by NMFS.

P. Isolation of in-water work area. If adult or juvenile fish are reasonably certain to be present, the work area must be well isolated from the active flowing stream using inflatable bags, sandbags, sheet pilings, or similar materials. The work area will also be isolated if in-water work may occur within 300 feet upstream from spawning habitats.

i. After completion of the project, the river channel should be re-watered in a way that will not cause fish stranding.
ii. A WDFW, Corps, or NMFS fish biologist must be onsite to monitor for fish stranding during this process.
iii. The existing flow downstream from the work area must be maintained throughout the construction.

Q. Capture and release. Before and intermittently during pumping to isolate an in-water work area, an attempt must be made to capture and release fish from the isolated area using trapping, seining, electrofishing, or other methods as are prudent to minimize risk of injury.

i. A fishery biologist experienced with work area isolation and competent to ensure the safe handling of all ESA-listed fish must conduct or supervise the entire capture and release operation.
ii. If electrofishing equipment is used to capture fish, the capture team must comply with NMFS' electrofishing guidelines.[13]
iii. The capture team must handle ESA-listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.
iv. Captured fish must be released as near as possible to capture sites.
v. Other Federal, State, and local permits necessary to conduct the capture and release activity must be obtained.
vi. NMFS or its designated representative must be notified 24 hours in advance of capture and release activities to allow for observation of such activities.

R. Earthwork. Earthwork (including drilling, excavation, dredging, filling, and compacting) will be completed as quickly as possible.

i. *Site stabilization.* Stabilize all disturbed areas, including obliteration of temporary roads, following any break in work unless construction will resume within 4 days.
ii. *Source of materials.* Boulders, rock, woody materials, and other natural construction materials used for the project must be obtained outside the riparian area unless otherwise indicated in the design plans addressed in the BA.

[13]National Marine Fisheries Service, *Backpack Electrofishing Guidelines* (June 2000) (http://www.nwr.noaa.gov/1salmon/salmesa/pubs/electrog.pdf).

7. **To implement RPM #7, the Corps must**:

A. Implementation monitoring. A monitoring report must be submitted to NMFS quarterly until project completion describing the action agency's success meeting permit conditions. The monitoring report will include the following information.
   i. Project identification.
      a. Action agency name, Section 7 consultation number, and project name.
      b. Project location, including any compensatory mitigation site(s), by 5th field HUC and by latitude and longitude as determined from the appropriate USGS 7-minute quadrangle map.
      c. The Corps' contact person.
      d. Starting and ending dates for work completed.

B. Work cessation. Dates work cessation was required due to high flows.

C. Fish screens. Compliance with NMFS' fish screen criteria. The Corps must schedule screen inspections prior to watering up after construction.

D. A summary of pollution and erosion control inspections, including any erosion control failure, hazardous material spill, and correction effort.

E. Site preparation.
   ii. Total cleared area – riparian and upland.
   iii. Total new impervious area.

F. Isolation of in-water work area, channel deepening. Number of days that work area is dewatered.

G. Isolation of in-water work area, capture and release (if NMFS staff is not present to observe action).
   i. Supervisory fish biologist – name and address.
   ii. Methods of work area isolation and take minimization.
   iii. Stream conditions before, during and within one week after completion of work area isolation.
   iv. Means of fish capture.
   v. Number of fish captured by species.
   vi. Location and condition of all fish released.
   vii. Any incidence of observed injury or mortality.

H. Monitoring reports will be submitted to:
   National Marine Fisheries Service
   FERC and Water Diversion Branch, Attn: Keith Kirkendall
   NMFS log number 2005/05832
   1201 NE Lloyd Boulevard, Suite 1100
   Portland, OR 97232-2778

9. CONSERVATION RECOMMENDATIONS

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

10. REINITIATION OF CONSULTATION

This concludes formal consultation on the Proposed Action. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

11. MAGNUSON-STEVENS FISHERY CONSERVATION & MANAGEMENT ACT

11.1 Background

The MSA and NMFS' implementing regulations provide procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan. Following the MSA:

1. Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).

2. NMFS must provide EFH conservation recommendations for any Federal or State action that would adversely affect EFH (§305(b)(4)(A)).

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

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

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

The objective of this EFH consultation is to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH, if the action would adversely affect EFH.

11.2 Identification of EFH

Under the MSA the Pacific Fisheries Management Council designated EFH for three species of Federally managed Pacific salmon: Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable artificial barriers (PFMC 1999), and longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for several hundred years). In this case, EFH extends both above and below the Action Area on the White River. Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the Proposed Action is based, in part, on this information.

11.3 Proposed Action

The Proposed Action is detailed in Section 2 of this Opinion.

11.4 Effects of Proposed Action

As described in detail in Section 5 of this Opinion, the Proposed Action may result in short- and long-term adverse effects to a variety of habitat parameters important to Puget Sound Chinook salmon. These adverse effects are identified in Section 5 of this Opinion.

11.5 Conclusion

NMFS concludes that the Proposed Action will adversely affect designated EFH for Puget Sound Chinook salmon.

11.6 EFH Conservation Recommendations

Under Section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions which adversely affect EFH. The Proposed Action includes a number of measures for fish protection and enhancements. Because these measures are part of the Proposed Action, NMFS does not need to include them as EFH recommendations. However, these measures are necessary for conservation and protection of EFH and would have been included as EFH conservation recommendations if they were not already part of the Proposed Action. NMFS understands that these measures described in the BA will be completed by the Corps and believes that the terms and conditions in the Incidental Take Statement (Section 8 of this Opinion) will minimize any additional take by providing details on more general sections of the BA. These terms and conditions are applicable to designated EFH for Chinook salmon and minimize any adverse effects associated with temporary construction and dam replacement. Consequently, NMFS adopts all the terms and conditions in its Incidental Take Statement (Section 8 of this Opinion) as its EFH recommendations.

11.7 Statutory Response Requirement

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

11.8 Supplemental Consultation

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

12. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (the Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

Utility

This document records the results of an interagency consultation. The information presented in this document is useful to two agencies of the Federal government (NMFS and the Corps); the residents of King and Pierce Counties, Washington; and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information is beneficial to citizens of King and Pierce Counties because the underlying project affects natural resources at a site within those counties. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

Individual copies were provided to the above-listed entities. This consultation will be posted on the NMFS Northwest Region website (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity

Information Product Category**:** Natural Resource Plan.
Standards**:** This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).
Best Available Information**:** This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this biological opinion/EFH consultation contain more background on information sources and quality.
Referencing**:** All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.
Review Process**:** This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

13. LITERATURE CITED

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Wagornarsino. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27. pp. 275.

Corps (U.S. Army Corps of Engineers). 1997. Design memorandum 1D: Mud Mountain Dam master plan. Seattle, WA.

Corps (U.S. Army Corps of Engineers). 2001. Biological Assessment for Operations and Maintenance 2002 - 2011, Mud Mountain Dam. Prepared by: Jones and Stokes. September 2001. 76 p.

Corps (U.S. Army Corps of Engineers). 2005. Biological Assessment, Mud Mountain Dam, routine MMD operations and maintenance and replacement of existing Barrier Dam at Buckley, WA. pp. 153.

Corps (U.S. Army Corps of Engineers). 2005. Draft Environmental Assessment for: Construction and Operation of a Replacement Fish Passage Barrier near the Town of Buckley. White River, Washington. pp. 85.

Dunston, W. 1955. White River downstream migration. Puget Sound stream studies (1953-1956). Washington Department of Fisheries, Olympia, WA.

Groot, C. and L. Margolis. 1991. Pacific salmon life histories. University of British Columbia Press, Vancouver, BC, Canada.

Hunter, M.A. 1992. Hydropower flow fluctuations and salmonids: a review of the biological effects, mechanical causes, and options for mitigation. Washington Department of Fisheries. Technical Report 119. 46p.

Keown, C. 1998. Upper White River Spring Chinook Habitat Assessment Study. WA Dept. of Ecology. Publication No. 98-304.

Kerwin, J. 1999. Salmon habitat limiting factors report for the Puyallup River basin (Water Resource Inventory Area 10). Washington Conservation Commission, Olympia, WA.

Ladley, R.C., B.E. Smith, M.K. MacDonald, and T.W. Nelson. 1999. White River spring chinook migratory behavior. Puyallup Tribe Fisheries Division report to the Northwest Indian Fisheries Commission, contract no. 3614

Ladley, R.C. et al. 2003. Unpublished survey records from 2003 White River fish kill.

McElhany et al. 2000. Viable salmon populations and the recovery of evolutionarily significant units. U.S. Dept. Commerce, NOAA Tech Memo, NMFS-NWFSC-42, 156p.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neeley, S.T. Lindley, and R.S. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-35, 443p.

NMFS (National Marine Fisheries Service). 1998. Status review update for west coast chinook salmon *(O. tshawytscha)* from Puget Sound, Lower Columbia River, Upper Willamette River, and Upper Columbia River spring-run ESUs. 23 December 1998. Prepared by the West Coast chinook salmon biological review team. 55 p.

NMFS (National Marine Fisheries Service). 1999. Endangered and threatened species: threatened status for three Chinook salmon Evolutionarily Significant Units in Washington and Oregon, and endangered status of one Chinook salmon ESU in Washington. NMFS, NOAA, Commerce. Fed. Reg. Vol. 64, No. 56. 14308 - 14328.

NMFS (National Marine Fisheries Service). 2000. Effects of Pacific Coast Ocean and Puget Sound Salmon Fisheries During the 2000-2001 Annual Regulatory Cycle. ESA Section 7 consultation by National Marine Fisheries Service, Protected Resources Division.

NMFS (National Marine Fisheries Service). 2003. Draft Biological Opinion and Magnuson-Stevens Fishery Conservation Act Consultation, White River Hydroelectric Project, FERC Project Number 2494-002. F/NWR/1999/01862. 83 p.

NMFS (National Marine Fisheries Service). 2005a. Final Rule: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs. 70 FR 37160 June 28, 2005. Vol. 70, No. 123, pp. 37160.

NMFS (National Marine Fisheries Service). 2005b. Endangered and Threatened Species; Designation of Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho. 79 FR 52630 September 2, 2005. Vol. 70, No. 170, pp. 52630.

NMFS (National Marine Fisheries Service). 2005c. Status Review Update for Puget Sound Steelhead.

NMFS (National Marine Fisheries Service). 2006. Listing Endangered and Threatened Species and Designating Critical Habitat: 12-Month Finding on Petition to List Puget Sound Steelhead as an Endangered or Threatened Species under the Endangered Species Act. Proposed Rules. 71 FR 15666. Vol. 71, No. 60. pp. 15666.

NMFS (National Marine Fisheries Service). 2007. Endangered and Threatened Species: Final Listing Determination for Puget Sound Steelhead. 72 FR 26722 May 11, 2007. Vol. 72, No. 91, pp. 26722.

PFMC (Pacific Fisheries Management Council). 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Portland, Oregon.

PSE. 1948. Agreement between PSE and the Corps for fishway construction and operation.

PSP&LC (Puget Sound Power & Light Co.) 1987. Additional information supplementing application for license, including flow studies and flow recommendations for the project reach of the White River. Appendix 2a.

PSP&LC (Puget Sound Power & Light Co.) 1989. Freeze Core Analysis of White River Substrate. A report prepared by Hosey & Associates Engineering Co. for PSP&LC.

Puget Sound Technical Review Team Co-manager review draft. 2001. Identifying populations of Chinook salmon in Puget Sound.

Puyallup Tribe. 2003. Unpublished water temperature data for White River, WA.

R.W. Beck Associates. 1989. Skagit River salmon and steelhead fry stranding studies. Prepared by R.W. Beck Associates for the Seattle City Light Environmental Affairs Division, March 1989. Seattle, WA, 300 pp.

Seiler, D., L. Kishimoto, S. Neuhauser. 2000. 1999 Skagit River wild 0+ Chinook production evaluation. Annual Report to Seattle City Light. WDFW. Olympia, WA. pp. 74.

Shaklee, J.B. and S.F.Young 2003. White River Chinook DNA Technical Report. Washington Department of Fisheries and Wildlife. pp. 76.

Shared Strategy for Puget Sound. 2005. Draft Puget Sound Salmon Recovery Plan, June 30, 2005.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation, ManTech Environmental Research Services, Inc., Corvalis, Oregon to National Marine Fisheries Service, Habitat Conservation Division, Portland, Oregon (Project TR-4501-96-6057), 12/1/1996.

USFWS and NMFS (U.S. Fish and Wildlife Service and National Marine Fisheries Service). 1998. Endangered Species Consultation Handbook. Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act.

USGS (U.S. Geological Survey). 2000. Flow data for the White River near Buckley station USGS 12098500. http://nwis.waterdata.usgs.gov/wa/nwis/peak/?site_no=12098500&agency_cd_USGS

WDFW (Washington Department of Fish and Wildlife), Puyallup Indian Tribe, and Muckleshoot Indian Tribe. 1996. Recovery plan for White River spring Chinook salmon. 81 p.

APPENDIX I

White River Minimum Flow Values from NMFS White River Hydro BO

MONTH	MINIMUM FLOW
January	350
February	350
March	350
April	400
May	400
June	400
July	500
August	500
September	500
October	500
November	350
December	350