

ORIGINAL

**Biological Evaluation of USFWS Listed, Proposed, and
Candidate species**

**As Related to PacifiCorp and Cowlitz PUD's
Lewis River Hydroelectric Projects**

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1.0 DESCRIPTION OF PROPOSED ACTION

1.1 HISTORY OF FERC RELICENSING

PacifiCorp and Public Utility District No. 1 of Cowlitz County (Cowlitz PUD) have completed a collaborative Federal Energy Regulatory Commission (FERC) relicensing process for the Yale, Swift No. 1, Swift No. 2, and Merwin hydroelectric projects located on the Lewis River, Washington (Figure 1.1-1). The Yale (Project No. 2071), Swift No. 1 (Project No. 2111), and Merwin (Project No. 935) Hydroelectric Projects are owned by PacifiCorp. The Swift No. 2 (Project No. 2213) Hydroelectric Project is owned by Cowlitz PUD and is currently operated by PacifiCorp under a contract with Cowlitz PUD. PacifiCorp and Cowlitz PUD initiated the collaborative relicensing process in response to comments from resource agencies and others that all four projects should be relicensed concurrently to better evaluate cumulative project effects in light of the fact the projects are operationally linked.

1.2 LEWIS RIVER COLLABORATIVE PROCESS

In January 1999, PacifiCorp and Cowlitz PUD filed a request with FERC for approval to use the FERC's alternative licensing procedures (ALP) and for the simultaneous and coordinated processing of the license applications for all four projects. The purpose of ALP is to facilitate communication and collaboration among parties during the relicensing proceeding. On April 1, 1999, FERC approved the requested use of ALP and issued an order accelerating the expiration of the Merwin license to coincide with the other projects (letter from J. Mark Robinson, Director of Licensing and Compliance, FERC to Dave Leonhardt, PacifiCorp and Dennis Robinson, Cowlitz PUD; Order Accelerating License Expiration Date, issued April 8, 1999).

Upon securing FERC's approval for the use of ALP, PacifiCorp and Cowlitz PUD convened meetings on April 29 and April 30, 1999, to initiate the collaborative process. Following the initial meeting, a series of public meetings were held to establish the structure and ground rules of the process, and goals and objectives of the participants. Through these meetings, the participants established the Lewis River Hydroelectric Project Relicensing Steering Committee and Resource Workgroups.

The Steering Committee was responsible for overseeing the collaborative process and establishing work group goals and objectives. The Steering Committee established the following Resource Groups to study and address particular resource issues: (1) Aquatics; (2) Terrestrial/Land Use; (3) Flood Management; (4) Recreation/Aesthetics; (5) Socioeconomics; and (6) Cultural. The Resource Groups defined resource goals and objectives, developed an approach to achieve those goals and objectives, and provided recommendations to the Steering Committee. The Steering Committee acted on Resource Group recommendations, and resolved outstanding issues. Initially, the Resource Groups designed studies to evaluate resource issues and project effects; later, the Groups devised conservation measures to address identified resource issues. In March 2002, Negotiating, Policy, and Legal groups were formed to develop the Lewis

River Settlement Agreement for the implementation of long-term conservation measures for the Projects. The Settlement Agreement was signed on November 30, 2004. The signed Settlement Agreement along with an explanatory statement and supplemental Preliminary Draft Environmental Assessment (PDEA) were conveyed to FERC by PacifiCorp on December 1, 2004 and by Cowlitz PUD on December 3, 2004. The Lewis River Settlement Agreement measures form the basis for the FERC actions that this BE analyzes.

1.3 RELATIONSHIP OF PROPOSED ACTION TO NEW LEWIS RIVER LICENSES

The USFWS listed bull trout (*Salvelinus confluentus*) Columbia River population as a threatened species under the ESA (63 CFR 31647) on June 10, 1998. This species occurs both above and below Merwin Dam including Yale Lake, Swift Creek Reservoir, and Lake Merwin, and the Swift No. 2 power canal.

Section 7(a)(2) of the ESA requires federal agencies to ensure their actions do not jeopardize listed species. Each of the Lewis River Projects is licensed by the FERC, and PacifiCorp and Cowlitz PUD must comply with license articles that direct project operations and natural resource protection. PacifiCorp and Cowlitz PUD have requested that FERC include the appropriate measures from the Lewis River Settlement Agreement as Articles in new licenses. These conservation measures are intended to minimize the effects of incidental take of listed and proposed species as a result of current project operations. FERC's issuance of new project licenses constitutes a federal action triggering the need for section 7 consultation. Recently, FERC designated PacifiCorp and Cowlitz PUD as its non-federal representatives under U.S. Fish and Wildlife Service/National Marine Fisheries Service ESA section 7 regulations (letter from FERC to USFWS and NMFS dated October 14, 2004). PacifiCorp and Cowlitz PUD have prepared this BE in accordance with their designated ESA authority (see 50 CFR § 402.08). It addresses impacts from PacifiCorp's ownership and operation of the Merwin, Yale, and Swift No. 1 projects; and Cowlitz PUD's ownership and operation of Swift No. 2. Cowlitz PUD has contracted with a third party (currently PacifiCorp) to perform certain operation functions for Swift No. 2.

This BE identifies conservation measures that PacifiCorp and Cowlitz PUD propose to implement under the new FERC licenses. The primary goals of these proposed conservation measures are to provide PacifiCorp and Cowlitz PUD with ESA coverage. This BE addresses impacts from PacifiCorp's ownership and role as licensee and operations of the Merwin, Yale and Swift No. 1 projects; and Cowlitz PUD's ownership and role as licensee and operations of the Swift No. 2 project; and the designated operation functions PacifiCorp or another contractor performs pursuant to agreements with Cowlitz PUD for Swift No. 2.

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1.4 PROPOSED ACTION

The proposed action for this consultation is the continued operation of the Lewis River Hydroelectric Projects (Yale Project FERC No. 2071, Swift No. 1 Project FERC No. 2111, Merwin Project FERC No. 935 and Swift No. 2 Project FERC No. 2213), operated under four new licenses with proposed terms of 50 years. The proposed action is described in the Lewis River Settlement Agreement.

The proposed action includes a comprehensive suite of bull trout, steelhead, and salmon protection and restoration measures and actions that will be implemented in a phased approach over the terms of the licenses to primarily benefit bull trout, winter steelhead, spring Chinook and coho. The fish passage elements of the program will be subject to rigorous performance standards. These include overall quantitative survival standards, specific salmonid life stage standards and facility design standards. These will assist in gauging program success and whether there is need for potential facility adjustments or ultimately, modifications.

The overarching goal of the comprehensive program is to achieve genetically viable, self-sustaining naturally reproducing, harvestable anadromous fish populations above Merwin Dam at greater than minimum viable populations. For bull trout, the primary goal is to provide habitat continuity between spawning, rearing, foraging, migration, and overwintering habitats by providing upstream and downstream passage at all project dams. There is recognition that commercial and tribal harvest, and ocean conditions may dramatically affect program results for salmon, but are not within the licensees' control. Status checks are built into the program over time to monitor progress and adaptively manage the program as needed to maximize the expected benefits.

A central, significant feature of the comprehensive program involves reintroduction of extirpated salmon species into their historical range. The program takes a comprehensive approach to salmon protection and reintroduction given the experimental nature of reintroducing extirpated anadromous species into their native range after many decades have passed. A key premise of the program is that it will provide an estimated 174 miles of potential anadromous fish habitat above Merwin Dam. Of this, 117 miles of habitat above Swift No. 1 Dam will become available in the fourth year of the reintroduction program as anadromous fish are trapped at Merwin Dam and transported upstream to above Swift Creek Reservoir. Over the next seventeen years, unless otherwise directed by NOAA Fisheries and the United States Fish and Wildlife Service (the "Services"), each anadromous fish species will be reintroduced to Lake Merwin and Yale Lake via newly constructed upstream fish passage facilities at the Merwin, Yale and Swift Projects and downstream passage at all three facilities. Ultimately, this program will result in upstream fish passage through each of the reservoirs associated with the Lewis River Projects for bull trout, steelhead, and salmon.

The Lewis Projects are high-head projects that pose technological challenges with respect to fish passage. As a result, the program includes many other important and complementary measures to underpin and strengthen the reintroduction effort. These

include habitat preparation activities in tributaries to the project reservoirs prior to species reintroduction, funding for habitat protection and restoration projects on key tributary streams to the reservoirs, and supplementation using hatchery fish over a period of years both to launch the reintroduction effort and provide support over time. The trap and transport effort will include the best available technology and designs to address the specific characteristics of the Lewis projects as high-head, high flow projects. Project operational changes also will be implemented to address impacts on species downstream.

Under the proposed action, it will likely take many years to reap the benefits of all the measures and activities that will be undertaken and for the program to fully succeed:

- Habitat restoration activities need to occur over a period of several years to make the habitat fully functioning and productive;
- It will take several life cycles of salmon to determine whether the program is delivering anticipated benefits and to better understand potential outside impacts on the program such as harvest;
- The program contemplates phasing in reintroduction into the various reservoirs so that experience and knowledge gained from reintroduction above Swift No. 1 Dam can be applied to reintroduction into Yale Lake and Lake Merwin;
- It will take time to construct fish passage facilities and time to determine what is working or what needs to be modified based on established performance standards;
- An aggressive monitoring and evaluation program, overseen by a multi-party committee, will be undertaken over many years to collect new information and scientific data to implement an adaptive management approach to species restoration and protection.

As noted, the proposed action includes rigorous facility and fish survival performance standards and a monitoring and evaluation program to track progress. The program also includes built-in, major "status checks" in years 27 and 37 to provide for a detailed review of program measures and activities and to track progress. As part of these reviews, a "limiting factors analysis" will be undertaken to more precisely determine whether performance and species goals have been met, whether other factors are undermining program performance, and whether other actions could be undertaken to provide biological benefits equivalent to any project-related limiting factor.

In addition to the phased reintroduction of extirpated anadromous species and construction of fish passage facilities, the proposed action also includes hatchery and supplementation programs; flows in the bypass reach; construction of an aquatic habitat channel; funding for aquatic habitat improvement; minimum flows below the Merwin Dam, flow plateau operation and ramping procedures; wildlife habitat acquisition, protection, and management; recreation upgrades and maintenance; cultural and historic resources protection measures; funding of law enforcement; and a visitor's center. Appendix A and the discussion below in this Section 1.4 provide additional details regarding the proposed action analyzed in this BE. All of these may provide indirect

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benefits to aquatic species. The discussion below in this Section 1.4 provides additional details regarding the proposed action to assist in the reader’s understanding of its analysis in this BE; however, the Settlement Agreement is considered the best and most accurate description of the proposed action, and has been relied upon by PacifiCorp and Cowlitz PUD in preparing this BE.

1.4.1 Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action 50 CFR § 402.02(d). The action area for the purposes of this evaluation is the Lewis River basin from its confluence with the Columbia River to the headwaters of the North Fork Lewis River. This area encompasses all direct and indirect effects to listed species.

1.4.2 Lewis River Settlement Agreement Terms

A summary of the measures included in the Lewis River Settlement Agreement is presented in Table 1.4-1. More detailed information describing these measures is provided in the subsequent sections. The section numbers referred to in Table 1.4-1 correspond to sections of the Lewis River Settlement Agreement.

Table 1.4-1 Measures proposed under the Lewis River Settlement Agreement with the Potential to Affect ESA Listed Species.

Resource Area and Section	Resource Component	Proposed Measure	Timing
Section 3	Anadromous Fish Reintroduction Outcome Goals	3.1 Work to achieve genetically viable, naturally spawning, harvestable populations of Chinook, steelhead and coho above Merwin Dam. Check status of goals in Years 27 and 37 of new licenses.	Terms of the New Licenses
Aquatics Section 4	Upstream Fish Passage	4.2 Merwin Trap. Repair the fyke net. Reduce generation when personnel are working the trap. Improve efficiency and human safety of existing Merwin trap and add a new sorting and truck loading facility. Truck spring Chinook, coho & steelhead from the Merwin sorting facility to Swift Creek Reservoir or Yale Lake, per Upstream Transport Plan. Truck bull trout to Yale Lake.	By Year 2, modify trap By Year 4, operate new collection and transport facility
		4.7 Upstream Passage at Yale Dam. Construct an upstream adult trap and sorting/trucking facility.	By Year 17
		4.8 Upstream Passage at the Swift Projects. Construct an upstream adult trap and sorting/trucking facility.	By Year 17
		4.9.1 Collect-and-Haul Programs. Net bull trout in Yale and Swift No. 2 tailraces and transport to Yale Lake or as directed by USFWS. Investigate alternative trapping methods.	Ongoing

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		4.10.2 Bull Trout Passage in the Absence of Anadromous Fish Facilities. If 4.7 and/or 4.8 are not constructed, develop facility to collect bull trout at Yale and at Swift.	By Year 17 at Swift and Yale
	Downstream Fish Passage	4.4 Downstream Transport at Swift No. 1 Dam. Install a floating surface collector system with guide walls and nets at Swift Dam. Collect anadromous fish, sort, mark a sub-sample, and truck to release pond below Lake Merwin. Release bull trout in Yale Lake or below Merwin, depending on developmental stage.	By Year 4.5
		4.4.2 Spring Chinook Satellite Collection Facility. If directed by NOAA-Fisheries, evaluate, design and install a satellite passage facility in Swift Creek Reservoir.	If Required
		4.4.3 Release Pond. Construct release pond below Merwin Dam for downstream migrants.	By Year 4.5
		4.5 Downstream Passage at Yale Dam. Install a floating surface similar to Swift. Collect fish, sort, mark a sub-sample, and truck to release pond below Lake Merwin. Bull trout will be returned to Yale Lake or transported to the downstream release pond, depending on development stage.	By Year 13
		4.6 Downstream Passage at Merwin Dam. Install a floating surface similar to Swift. Collect fish, sort, mark a sub-sample, and truck to a release site below Lake Merwin. Release bull trout in Lake Merwin or as directed by USFWS.	By Year 17
		4.9.3 Yale and Merwin Bull Trout Entrainment Reduction. Evaluate and implement measures to reduce entrainment up to and until downstream floating collector is constructed.	By Year 1 at Yale, when directed by USFWS at Merwin
		4.10.1 Bull Trout Passage in the Absence of Anadromous Fish Facilities. If 4.5 and/or 4.6 not built, develop downstream facility to collect/transport bull trout.	By Year 13 at Yale; after Year 17 at Merwin
Aquatics Section 5	Additional Aquatic Measures	5.1 Yale Spillway modifications. Modify Yale spillway to improve downstream resident fish survival (including bull trout) during spill events.	By Year 4.5 of the Yale License
		5.2 Bull Trout Habitat Enhancement Measures. Manage existing conservation covenants to protect bull trout habitat in perpetuity.	Complete
		5.5 Bull Trout Limiting Factors Analysis. Conduct LFA on Merwin and Swift Creek Reservoir tributaries.	By 2 nd anniversary of Effective Date

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		5.6 Public Information Program to Protect Listed Anadromous Species. Provide signage and educational materials to inform the public of efforts to reintroduce and protect listed anadromous fish to the Lewis River above Merwin Dam.	When Requested
		5.7 Public Information Program to Protect Bull trout. Install signage and distribute flyers to inform public about bull trout in the project area.	Within 6 months
Aquatics Section 6	Bypass Flow	6.1 Bypass Reach. Release flows to the reach of the Lewis River downstream of Swift No. 1 ending at Yale Lake.	Year 1
		6.1.1 Flow releases from canal drain. Release up to 47 cfs.	Upon completion of Swift No. 2 reconstruction
		6.1.2 Construct upper release point. Design and construct upper water release point.	Year 1
		6.1.3 Determine feasibility of constructed channel in bypass reach and fund construction. Interim flow schedule: 60 cfs, July 1 through Oct. 31; 100 cfs, Nov. 1 through Jan, 31; 75 cfs, Feb. 1 through June 30.	Upon completion of upper release structure
		6.1.4 Flow Schedule. Develop an interim and final flow release schedule for the bypass reach.	Start Year 1
	Merwin Flow	6.2.1. Ramping Rates Below Merwin Dam. Up ramping rates limited to 1.5 feet per hour, down ramping limited to 2 inches per hour, with critical flow set at 8,000 cfs; no ramping from February 16 through June 15, one hour before/after sunrise or one hour before/after sunset.	Start Year 1
		6.2.2 Plateau Operations at Merwin Dam. Follow Plateau Operation procedures between February 16 and August 15. Changes in flow will be consistent with ramping restriction of 6.2.1 at or below flows of 8,000 cfs, and flow changes will be limited to no more than one change in any 24-hour period, and 4 times in any 7-day period, or 6 times/month.	Start Year 1
		6.2.3 Stranding Study and Habitat Evaluation. Conduct stranding study and habitat evaluation below Merwin Dam to evaluate operation effects on anadromous salmonids and their habitats.	Complete by Year 3
		6.2.4 Minimum Flows Below Merwin Dam. Minimum flows range from a high of 4,200 cfs (Nov 1 to Dec 15) to 1,200 cfs (July 31 to Oct 12)	Start Year 1

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		6.2.5 Low Flow Procedures. During dry years convene Flow Coordination Committee to implement adaptive management; focused on fish needs, flood management, and reservoir recreational pool levels.	As Needed
Aquatic Habitat Section 7	Habitat Enhancement Actions	7.1 Large Woody Debris Program. Stockpile Large Woody Debris under direction of ACC for use by other entities for habitat projects.	Start Year 1 of Merwin License
		7.1.1 Funding. Provide \$2,000 annually for qualified entities to use for LWD projects and \$10,000 annually for the Aquatics Fund earmarked for habitat projects.	Within 6 months of Merwin License
		7.1.2 LWD Study. Conduct a LWD study to identify issues and opportunities for LWD projects below Merwin Dam.	Within 1 st year of Merwin License
		7.2 Spawning Gravel Program. Develop spawning gravel monitoring and augmentation program below Merwin.	Start within 6 months of Effective Date
		7.3 Predator Study. Conduct one-time study of whether predation in Merwin is a limiting factor to anadromous salmonid survival.	Complete by Year 10
		7.4 Habitat Preparation Plan. Release adult salmon for five years into the reservoirs prior to passage to begin preparing the spawning habitat and to enhance nutrients.	Within 6 months of Effective Date
		7.5 Aquatic Enhancement Fund. Provide funding for aquatic enhancement projects; PacifiCorp to provide \$5.2 million over 14 years, and Cowlitz PUD to provide \$520,000 over 20 years.	PacifiCorp starts in 2005; Cowlitz PUD starts at end of Year 1
		7.6 In Lieu Fund. Establish In Lieu Fund if the Services determine salmonid introduction to Yale or Merwin is not required and passage facilities not built; PacifiCorp to provide up to a total of \$30 million; funds to be spent on aquatic enhancement measures.	Contributions in Years 11-13 and 14-17 of Yale; Years 14-17 of Merwin; Years 14-17 of Swift No. 1
Hatchery Program and Supplementation Section 8	Hatcheries	8.2 Anadromous Fish Hatchery Adult Ocean Recruit Target by Species. Anadromous Fish Hatchery Production. Licensees will produce 86,000 adult ocean recruits according to allocation in Section 8.2.1.	Start in Year 1
		8.3 Anadromous Fish Hatchery Juvenile Production. Juvenile production targets are defined in Table 8.3 for Years 1-3, 4-5, and 6-60.	Start in Year 1
		8.4 Supplementation Program. Licensees will supplement adult and juvenile salmon and steelhead according to allocation in sections 8.4.1, 8.4.2, and 8.4.3.	Varies by species and reservoir

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		8.5 Resident Fish Production. Stock 20,000 lbs. of rainbow annually in Swift Creek Reservoir. Stock 12,500 lbs. of kokanee annually in Lake Merwin.	Start in Year 1
		8.6 Hatchery and Supplementation Plan. Develop a plan for hatchery production and supplementation according to Section 8.6.1 and 8.6.2.	Start between Years 1 and 3
		8.7 Hatchery and Supplementation Facilities, Upgrades, and Maintenances. Fund or undertake upgrades to existing hatcheries in collaboration with WDFW and the ACC.	Per Schedule 8.7
		8.8.1 Locate and install juvenile acclimation sites (if feasible) above Swift Creek Reservoir.	By Year 4
		8.8.2 Install juvenile acclimation sites in Yale Lake and Lake Merwin. Temporary sites in tributary streams.	By Year 13
Monitoring Section 9	Aquatic Monitoring and Evaluation	9.1 Monitoring and Evaluation Plans. Develop monitoring and evaluation plans to evaluate the effectiveness of various aquatic measures. Prepare annual monitoring reports.	By 2 nd anniversary of licenses
		9.2 Monitoring and Evaluation Related to Fish Passage. Monitor performance of upstream and downstream passage facilities according to performance criteria.	As Needed
		9.3 Wild Fall Chinook and Chum. Monitor spawners below Merwin.	Annually
		9.4 Water Quality Monitoring. Monitor water quality and fund NPDES compliance monitoring.	As Required
		9.5 Monitor Hatchery and Supplementation Program. Assess effects of supplementation efforts.	Report as Directed
		9.6 Bull Trout Monitoring. Monitor bull trout collection and test alternate passage facilities.	Start in Year 1
		9.7 Resident Fish Assessment. Monitor kokanee population in Yale annually and impacts of anadromous fish introduction on resident fish species.	As Required
		9.8 Monitoring of Flows. PacifiCorp to fund monitoring of Merwin flows and flows in the bypass reach.	Report Annually
Terrestrial Section 10	Land Acquisition	10.1 Yale Land Acquisition and Habitat Protection Fund. Provide \$2.5 million to purchase wildlife mitigation lands near the Yale Project.	In Years 1 and 2 of Effective Date

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		10.2 Swift No. 1 and Swift No. 2 Land Acquisition and Habitat Protection Fund. Provide \$7.5 million to purchase wildlife mitigation lands for the Swift No. 1 and Swift No. 2 projects.	Initiated within 18 months of Swift licenses
		10.3 Lewis River Land Acquisition and Habitat Protection Fund. Provide \$2.2 million total and matching contributions annually not to exceed \$100,000 or \$500,000 in any ten consecutive years, to purchase wildlife mitigation lands in the Lewis River basin.	Initiate in Year 4.5 of Yale License
		10.8 Wildlife Habitat Management Plan. Develop the Wildlife Habitat Management Plan to direct habitat conservation funds and provide effectiveness monitoring.	Start in Year 1
		10.8.4 Habitat Evaluation Procedures. Update HEP study of all WHMP lands.	Year 17
Recreation Section 11	RRMP	Implement the RRMP that will include all of PacifiCorp's recreation measures.	In 3 phases beginning in Year 1
PacifiCorp Recreation Measures	Swift Creek Reservoir Measures	11.2.1.1 Swift Dispersed Shoreline Use Sites. Manage and maintain dispersed use sites on PacifiCorp and USFS land and within the FERC project boundary.	Start in Year 1
		11.2.1.2 Eagle Cliff Trail. Develop trail from Eagle Cliff Park to USFS boundary.	Year 4
		11.2.1.3 Control of Swift Forest Camp. Acquire campground from WDNR or negotiate management agreement.	End of Year 1
		11.2.1.4 Swift ADA Accessibility Improvements. Evaluate ADA compliance at developed facilities at Swift Creek Reservoir and renovate as needed.	Years 1 through 7
		11.2.1.5 Swift Day Use Facilities. Provide a new picnic shelter at Swift Forest Camp; toilets, picnic area and day use renovations at Eagle Cliff Park.	Year 5 for Swift Camp; Year 11 for Eagle Cliff Park
		11.2.1.6 Swift Campground and Group Camp Expansion. Expand campground and improve facilities.	When needed
		11.2.1.7 Swift O&M. Operate and maintain Eagle Cliff Park and Swift Forest Camp.	Year 1
	Yale Lake Measures	11.2.2.1 Yale Dispersed Shoreline Use Sites. Maintain and manage dispersed shoreline use sites.	Start in Year 1
		11.2.2.2 Yale/IP Road Phase I. Attempt to secure access to road and bridge.	By Year 4
		11.2.2.3 Yale/IP Road Phase II. Develop trail, parking, reservoir access and day use facilities.	When Phase I is complete.

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		11.2.2.4 Yale/IP Road Phase III. Resurface trail.	Year 15 -16
		11.2.2.5 Yale Trails. Develop Saddle Dam trail segment, parking at Saddle Dam Park, management approach for Saddle Dam Park, trail from Cougar Park to Beaver Bay, and loop trail in Cougar.	Year 5
		11.2.2.6 ADA Accessibility Improvements. Evaluate ADA compliance at developed facilities at Yale Lake and renovate as needed.	Year 1 - 7
		11.2.2.7 Yale Park Boat Launch. Extend the ramp and replace the docks.	Year 4
		11.2.2.8 Beaver Bay Boat Launch. Replace the dock and repair bank erosion.	Year 4
		11.2.2.9 Beaver Bay Day Use Parking. Isolate parking area from wetland.	Year 4
		11.2.2.10 Yale Lake Day Use Facilities. Improve facilities at Yale Park, Beaver Bay and Cougar Park.	Year 7
		11.2.2.11 Cougar Day Use Restroom. Replace or renovate to meet ADA standards.	Year 6
		11.2.2.12 Beaver Bay Campground and Group Camps. Redesign campground and replace restrooms.	Year 13
		11.2.2.13 Cougar Campground. Renovate tent only camping area.	Year 14
		11.2.2.14 Cougar Campground and Group Camp. Expand facilities.	When needed
	Lake Merwin Measures	11.2.3.1 Merwin Dispersed Shoreline Use Areas. Maintain dispersed shoreline use sites.	Year 1
		11.2.3.2 Merwin Trails. Provide information about area trails.	Year 5
		11.2.3.3 Marble Creek Trail. Improve trail and ADA accessibility.	Year 4
		11.2.3.4 South Shore Merwin Trail Access. Evaluate potential trail easement from County land to lake.	When needed
		11.2.3.5 Merwin ADA Accessibility Improvements. Renovate Lake Merwin facilities.	Years 1-7
		11.2.3.6 Boat Launches. Extend ramp at Speelyai Bay Park.	11/30/04
		11.2.3.7 Yale Bridge Boating Access. Develop access for launching non-motorized watercraft.	Year 6
		11.2.3.8 Merwin Park Day Use Facilities. Provide new day use features.	Year 4

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		11.2.3.9 Merwin Park Picnic Shelters. Construct new shelters and move tables.	Year 4
		11.2.3.10 Speelyai Park Restroom. Upgrade to meet ADA requirements.	Year 6
		11.2.3.11 Day Use Parking. Improve parking at Speelyai Bay Park.	Year 12
		11.2.3.12 Merwin O & M. Keep Cresap Bay Campground open through September. Maintain existing sites and shoreline day use sites.	Year 1
	Lower River Measures	11.2.4.1 Lower Lewis River Vault Toilets. Provide new toilets at Cedar Creek, Merwin Hatchery, Johnson Creek, Lewis River Hatchery, and Island River access points.	Year 1 and by 2007 for Island River.
		11.2.4.2 Lower Lewis River Day Use Improvements. Provide picnic tables at 5 sites.	Year 11
	Project Area Measures	11.2.5 I & E Program. Utilities to collaborate on a single project-wide I&E program.	Years 1-4
		11.2.6 Visitor Management Controls. PacifiCorp to implement controls to enhance safety and visitor enjoyment.	Year 1
		11.2.7 Communications on Recreation Facility Availability. PacifiCorp will inform public when recreation sites are at capacity.	Year 1
		11.2.8 Recreation Access to Project Lands. Non-motorized day use allowed on PacifiCorp lands.	Year 1
		11.2.9 Land Ownership Retention for Recreation. PacifiCorp retains Switchback property for future recreation development when needed.	Year 1
		11.2.10 Parking and Dispersed Shoreline Use at Yale and Swift Creek reservoirs. Overnight parking allowed at boat launches.	Year 1
		11.2.11 Campground Gate Access and Schedule. Close but not lock gates at campgrounds at night.	Year 1
		11.2.12 Dispersed Camping Funds to USFS. PacifiCorp provides \$5,220 annually to USFS to manage dispersed camping on USFS land.	Year 1
		11.2.13 Vehicle Access and Use. Work to restrict dispersed upland camping and motorized use.	Year 1
		11.2.14 ADA-Accessible Fishing Sites. Assess feasibility of ADA-accessible bank fishing sites.	Year 7: Study Year 10: Implement
	11.2.15 Public Use of RV Dump Sites. Use of PacifiCorp's RV dump sites to be allowed.	Year 1	

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Resource Area and Section	Resource Component	Proposed Measure	Timing
Cowlitz PUD Recreation Measures		11.3.1 Swift No. 2 Power Canal Bank Fishing Facility. Construct ADA-compliant bank fishing facility at canal bridge, with parking and portable toilets.	9/30/05
		11.3.3 I & E Program. Collaborate with PacifiCorp on a single project-wide I&E program.	Years 1 - 4
		11.3.4 Recreation Access to Project Lands. Non-motorized day use allowed on lands within the Swift No. 2 project boundary.	Year 1
		11.3.5 Dispersed Camping Funds to USFS. Cowlitz PUD provides \$780 annually to USFS to manage dispersed camping on USFS land.	Year 1
Flood Management Section 12	Notification	12.4 Emergency Notification. PacifiCorp will contribute to County-developed installation and maintenance of emergency phone system for flood notification.	When installed
	Communications	12.6 NOAA Communications Transmitter. Fund NOAA weather radio transmitter installation and maintenance.	8/23/03
	High Runoff	12.8 High Runoff Procedure. Implement revised high runoff procedures for all 3 project reservoirs.	Year 1
Cultural Section 13.1	Resource Management	13.1 Cultural Resources. Finalize and Implement Historic Properties Management Plan for Merwin, Yale and Swift No. 1.	Year 1
		13.1(1) Curate artifacts in a secure location in the basin.	As defined in HPMP
		13.1 (2) Protect integrity of properties listed in the National Register of Historic Places (NRHP).	Year 1
		13.1 (3) Preserve tribal access for traditional uses.	Year 1
		13.1 (4) Monitor and protect cultural resources	Year 1
		13.1.2 Cowlitz PUD Obligation for Cultural Resources. PUD will follow Unanticipated Discovery Plan and consult as needed for Section 106 compliance.	Year 1
Socioeconomics Section 13.2		13.2.1 Fund 2 full time law enforcement officers and one full-time fish and wildlife officer to patrol in the North Fork Lewis River basin.	Within 1.5 years
		13.2.2 Provide annual funding for the maintenance of Forest Road 90.	Begin in April 2005
		13.2.3 Pine Creek Work Center Communication Link. Continue funding support.	Ongoing

Resource Area and Section	Resource Component	Proposed Measure	Timing
		13.2.4 Partially fund development of the Visitor Information Center or perform maintenance for the term of the new licenses.	As determined by USFS
Coordination and Decision Making Section 14		14.2 Technical Coordination Committees. Form one technical committee for terrestrial implementation and one for aquatic implementation.	Within 60 days

1.4.2.1 Fish Passage and Reintroduction Measures

Merwin Trap – From and after the effective date of the Lewis River Settlement Agreement, PacifiCorp will modify the existing fish trap located at the base of Merwin Dam as needed to improve worker safety and increase fish handling efficiency without introducing additional risk to fish¹. Until construction of the Merwin Upstream Collection and Transport Facility is complete (described below), the upgraded Merwin Trap will be operated to collect hatchery fish returning from the ocean and to transport any bull trout to Yale Lake unless otherwise directed by the USFWS. Fish other than hatchery fish, anadromous fish destined for transport, and bull trout will be returned to the river below Merwin Dam.

Reintroduction Above Swift No. 1 Dam – Beginning one year prior to completion of a Swift downstream passage facility, the Licensees will begin a supplementation program to introduce adult salmon and steelhead into the basin upstream of Swift No. 1 Dam. This early supplementation effort provides natural progeny to initiate the reintroduction effort, which is aimed at reestablishing natural runs. Collection and transport of natural juvenile outmigrants will coincide with completion of downstream collection facilities at Swift No. 1 Dam (described below). An added benefit of these measures is the addition of marine derived nutrients into the system and preparation of habitat for future spawning and full-scale reintroduction.

Concurrent with implementing the supplementation program, PacifiCorp will begin a design, permitting and construction phase for upstream passage at Merwin Dam and downstream passage at Swift No. 1 Dam. By six months after the fourth anniversary of the issuance of the new license for the Merwin Project, PacifiCorp will construct and begin operating an upstream trapping, sorting and hauling facility at Merwin Dam², and PacifiCorp and Cowlitz PUD would construct and begin operating a downstream modular surface fish collector at Swift No. 1 Dam with sorting and hauling capabilities. PacifiCorp will also construct a stress release pond below Merwin Dam. All downstream

¹ PacifiCorp will repair the fyke portion of the Merwin Trap or install another fyke to decrease the risk of injury to fish in the facility. PacifiCorp will also, to the extent feasible, limit the discharge from the generation facilities at Merwin Dam for safety purposes to a maximum flow to be determined by PacifiCorp and WDFW when personnel are working in the existing fish trap until such time as upgrades to the Merwin Trap are effective in providing a greater margin of safety for personnel.

² When designing the facility, engineers would look at the full suite of possible options, including without limitation (a) a complete new facility and (b) incorporation of the Merwin Trap (as upgraded) into the new design.

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migrating anadromous salmonids collected in the surface collector will be transported to that stress release pond. These facilities will result in up and downstream passage of spring Chinook, winter steelhead, late-run coho, bull trout and sea-run cutthroat to and from natural spawning and rearing habitat above Swift Dam. A monitoring and evaluation program will be put in place at that time to allow for measurement of performance standards.

Beginning upon completion of the Swift downstream facility, the supplementation program described above will be expanded to include juvenile salmon and steelhead and will continue for a minimum of 15 years for spring Chinook and winter steelhead and 9 years for late-run coho.

Reintroduction Above Yale Dam –In addition to hauling adult salmon and steelhead collected below Merwin Dam to above Swift No. 1 Dam, PacifiCorp will haul a portion of collected fish to Yale Lake to prepare the habitat for future fish and to seed the tributaries to Yale Lake. PacifiCorp will commence this supplementation as directed by the ACC.

Concurrent with implementing the Yale supplementation program, PacifiCorp will begin a design, permitting and construction phase for downstream passage at Yale Dam. On the thirteenth anniversary of the issuance of the new license for the Yale Project, PacifiCorp will begin operating a Yale downstream passage facility. All downstream migrating anadromous salmonids collected at Yale Dam will be transported to the stress release ponds below Merwin Dam. A monitoring and evaluation program will be added for downstream passage at Yale Dam at that time to allow for measurement of performance standards.

Upon completion of the Yale downstream facility, the supplementation program described above will be expanded to include placing juvenile salmon and steelhead into Yale Lake and will continue for a minimum of 15 years for spring Chinook and winter steelhead and 9 years for late-run coho.

Full Reintroduction and Connectivity Throughout the Lewis River Projects –PacifiCorp will haul adult salmon and steelhead to Lake Merwin to prepare the habitat for future fish and to seed the tributaries. PacifiCorp will commence this supplementation as directed by the Services.

Concurrent with implementing the supplementation program, the Licensees will begin a design, permitting and construction phase that will include downstream passage at Merwin and upstream passage at Yale and the Swift Projects. On the seventeenth anniversary of the issuance of the new license for the Merwin Project, PacifiCorp will begin operating a Merwin downstream collection facility (which will include sorting and hauling capabilities) On the seventeenth anniversary of the issuance of the new license for the Yale Project, PacifiCorp will begin operating a Yale upstream passage facility. On the seventeenth anniversary of the issuance of the new license for the Swift No. 1 or Swift No. 2 Project, whichever is later, PacifiCorp will begin operating a Swift upstream passage facility. All downstream migrating anadromous salmonids will be transported to the stress release pond. Adding these facilities to the existing upstream facility at

Merwin Dam and downstream facilities at the Swift Projects and Yale Dam will result in up and downstream passage of spring Chinook, winter steelhead, late-run coho, bull trout and sea-run cutthroat to and from natural spawning and rearing habitat throughout and above the Lewis River Projects. A monitoring and evaluation program will be added for the new facilities at that time to allow for measurement of performance standards.

Beginning upon completion of the Merwin downstream facility, the adult supplementation program described above will be expanded to include placing juvenile salmon and steelhead into Lake Merwin and will continue for a minimum of 15 years for spring Chinook and winter steelhead and 9 years for late-run coho.

Spring Chinook Satellite Collection Facility – If NOAA Fisheries concludes at any time that downstream passage at the Swift No. 1 Dam is not effective for collecting spring Chinook because of that species' unique behavior issues, and that a satellite collection facility has a reasonable likelihood of more effectively collecting spring Chinook, then PacifiCorp will design and install such a facility.

Species Transported – Initially, for purposes of fish passage, the Licensees will only transport spring Chinook, winter steelhead, coho, bull trout and sea-run cutthroat. Any other species inadvertently collected will be returned to the river and not transported. Notwithstanding the preceding sentence, the Licensees, after consultation with the ACC (Aquatics Coordinating Committee)³, and if directed by the Services, shall also transport fall Chinook or summer steelhead that enter the passage facilities.

Mode of Upstream Transport –

- a. Upstream Transport Before Full Adult Fish Passage – Unless and until alternative technologies are implemented (see paragraph b, below), the Licensees will provide for the transport by truck of species collected at an upstream transport facility. Once the Merwin Upstream Transport Facility is completed, and for so long as trucks are used, the Licensees will provide for transport according to the Upstream Transport Plan described below.
- b. Upstream Transport After Full Adult Fish Passage – On or before the thirteenth anniversary of the issuance of all new licenses, the Licensee responsible for each upstream transport facility (PacifiCorp for the Merwin Upstream Transport Facility and Yale Upstream Facility and PacifiCorp and Cowlitz PUD for the Swift Upstream Facility) shall evaluate whether alternative adult fish transport technologies (such as fish trams, cable lifts or other new technologies) at the facility will allow transportation of the fish with the least practicable amount of handling or other stress inducing actions, considering the need for sorting fish. If certain conditions are met, and if the Services determine that alternative transport technologies are suitable for meeting the Services' fish passage goals and the biological benefits are expected to be equal to or greater than the benefits of trap-and-transport by truck, then the Licensees will implement such alternative

³ The ACC is composed of representatives of the parties to the Settlement Agreement, including NOAA Fisheries.

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transport technologies for upstream transport. If alternative technologies are not used, the Licensees will continue to transport collected fish by truck

- c. **Upstream Transport Plan.** The Licensees will develop, in Consultation with the ACC and with the approval of the Services, a plan that shall describe the frequency and procedures for upstream fish passage. The Licensees will provide for the transport of fish at a minimum frequency of once daily, or more if necessary to achieve safe, timely and effective passage.
- d. **Downstream Transport.** PacifiCorp shall provide for the downstream transport of migrating transported species collected in the Swift Downstream Facility, the Yale Downstream Facility and the Merwin Downstream Facility by truck.
- e. **Downstream Transport Plan.** PacifiCorp shall develop, in Consultation with the ACC and with the approval of the Services, a plan which shall describe the frequency and procedures to achieve safe, timely and effective downstream transport.

Passage Design –

Subject to the final approval of the Services, PacifiCorp will develop and implement studies to inform the design of the fish passage facilities with the goal of improving the likelihood that the passage facilities will be successful as initially constructed. Needed information may include the hydraulic characteristics of the Swift No. 1, Yale, and Merwin forebays (e.g., a three-dimensional 3D numerical flow-field analysis) and the behavior of juvenile salmonids.

The Licensees will design the fish passage facilities to meet the defined performance standard targets (described below). The Licensees will use the best available technology for the type of passage facility being constructed, and design the facility to provide flexibility for subsequent adjustments or modifications⁴, if needed, to meet performance standards.

Overall Performance Standards for Salmonids – The Licensees will achieve the following overall performance standards for fish passage: Overall Downstream Survival (ODS) of greater than or equal to 80% until such time as the Yale Downstream Facility is built or the In Lieu Fund in lieu of Yale Downstream Facility becomes available to the Services, after which time the ODS will be greater than or equal to 75%, Upstream Passage Survival (UPS) of greater than or equal to 99.5%, and Adult Trap Efficiency (ATE) to be established as described below. The ODS of 80% or 75% are aggressive standards and it is likely that they will take some time to achieve. If these performance standards are not achieved, the Licensees will take the actions set forth in Section 4.1.6 of the Settlement Agreement and described below.

⁴ For purposes of the Settlement Agreement, a Facility Adjustment is a physical passage facility upgrade, improvement or addition that was part of the original design of the passage facility, or an adjustment to the fish passage facility or its operations. A Facility Modification is a physical alteration or addition to a physical passage facility that requires a new design.

Passage Facility Design Performance Standards for Salmonids – PacifiCorp shall design and construct downstream fish passage facilities to achieve (i) a Collection Efficiency (CE) of equal to or greater than 95% and (ii) a Collection Survival (CS) of equal to or greater than 99.5% for smolts and 98% for fry, and (iii) adult bull trout survival of equal to or greater than 99.5%. Design performance objectives for injury are less than or equal to 2%. The Licensees shall design and construct upstream fish passage facilities to achieve the UPS equal to or greater than 99.5% and the ATE as described below.

Adult Trap Efficiency for Anadromous Salmonid and Bull Trout – The Licensees, together with the Services, WDFW, Yakama Nation, and the Cowlitz Tribe, and in consultation with the ACC, will develop an ATE performance standard target for the terms of each new license to ensure the safe, timely, and effective passage of adult anadromous salmonids. Until such time as the standard has been developed, the Licensees will use NOAA Fisheries' existing fish passage guidelines (NOAA Fisheries 2004).

Adjustments or Modifications to Passage Facilities – If the ODS is not being met, then the Licensees will make facility adjustments or facility modifications to downstream passage facilities as follows:

- (1) If the CE is less than 95% and greater than or equal to 75%, or the CS for smolts is less than 99.5% and greater than or equal to 98%, or if the CS for fry is less than 98%, and greater than or equal to 96%, or injuries to juvenile transported anadromous species caused by downstream collection and transport are greater than 2% but less than 4%, PacifiCorp will make facility adjustments directed by the Services to achieve the performance standard or standards that are not being met, but will not be required to make facility modifications; or
- (2) If the CE is less than 75%, or the CS for smolts is less than 98%, or the CS for fry is less than 96%, or injuries to juvenile transported anadromous species caused by downstream transport are greater than or equal to 4%, PacifiCorp shall make the facility modifications⁵ directed by the Services to achieve the performance standard or standards that are not being met; provided that if the Services believe a facility adjustment will likely achieve the performance standard or standards that are not being met then PacifiCorp shall first make facility adjustments as directed by the Services.
- (3) If the ODS is being met but CE is less than 95%, the CS for smolts is less than 99.5%, the CS for fry is less than 98%, or injury to juvenile transported anadromous species caused by downstream transport is greater than 2%, PacifiCorp will make facility adjustments directed by the Services to downstream facilities but shall not be required to make facility modifications to achieve the performance standard or standards that are not being met.

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(4) For bull trout, PacifiCorp shall make facility adjustments or facility modifications to downstream passage facilities as follows:

(a) If the survival of bull trout is less than 99.5% and the survival is greater than or equal to 98%, or injuries caused by downstream collection and transport are greater than 2% but less than 4%, PacifiCorp shall make facility adjustments directed by the Services to achieve the performance standard or standards that are not being met, but shall not be required to make facility modifications; or

(b) If the survival of bull trout is less than 98%, or injuries caused by downstream collection and transport are greater than or equal to 4%, PacifiCorp shall make the facility modifications directed by the Services to achieve the performance standard or standards that are not being met; provided that if the Services believe a facility adjustment will likely achieve the performance standard or standards that are not being met then Licensees shall make facility adjustments as directed by the Services.

(5) For transported species, if UPS and/or ATE are not being met, then the Licensees (PacifiCorp for the Merwin Upstream Transport Facility and Yale Upstream Facility, and PacifiCorp and Cowlitz PUD for the Swift Upstream Facility) will make facility adjustments or facility modifications to upstream passage facilities as directed by the Services.

Except as otherwise provided in the Lewis River Settlement Agreement, the Licensees (PacifiCorp for Merwin, Yale and Swift No. 1 and Cowlitz PUD for Swift No. 2) will not be required to: (a) make structural or operational changes with respect to their generating facilities or Project reservoirs to achieve performance standards, (b) replace any fish passage facility with another passage facility, or (c) install additional collection and transport facilities or alternative fish passage facilities beyond those required by the Lewis River Settlement Agreement.

In Lieu Fund – The Licensees will construct and operate the Yale and Merwin downstream facilities and the Yale and Swift upstream facilities as described above unless the Services, upon a review of new information relevant to reintroduction of fish passage into Yale Lake and Lake Merwin, determine at least four and a half years prior to the operation date for a passage facility that the facility should not be constructed. In lieu of construction of a passage facility, PacifiCorp will contribute to an In Lieu Fund as follows: \$10 million in lieu of a juvenile surface collector at Yale Dam; \$10 million in lieu of a juvenile surface collector at Merwin Dam; \$5 million in lieu of an upstream adult fish passage facility at Yale Dam; and \$5 million in lieu of an upstream adult fish passage facility in the vicinity of the Swift Projects. The In Lieu Fund will be used for Services-approved mitigation measures that collectively contribute to meeting the objective of achieving equivalent or greater benefits to anadromous fish populations as will have occurred if passage through Yale Lake and/or Lake Merwin had been provided. Measures may include additional habitat enhancement in the basin; habitat protection, additional

research or other appropriate actions that will benefit listed species. The Settlement Agreement includes a list of possible mitigation measures to be implemented with the In Lieu Fund (Schedule 7.6.2 to the Settlement Agreement). Examples of mitigation measures that PacifiCorp may implement with the In Lieu Fund include:

North Fork

- Assess and repair the highest priority culvert passage problems on Ross, Johnson, Colvin, Cedar, Beaver, John, and Brush creeks and an unnamed tributary to Cedar Creek
- Improve passage at the Grist Mill dam on Cedar Creek including a sorting and handling facility and fund the monitoring program
- Remove dam on Bitter Creek or provide passage
- Remove dam on Colvin Creek including sediments and repair damage from slide
- Reconnect and enhance off-channel habitat along the lower reaches of the Lewis River where diking occurs
- Enhance floodplain habitat surrounding Eagle Island
- Identify and repair roads that are contributing excess sediments to streams in the basin
- Restore degraded riparian conditions along tributaries to the lower Lewis River
- Identify sources and reduce inputs of fine sediments to Cedar Creek
- Increase functional LWD structures in appropriate stream reaches
- Accelerate recruitment of conifers along stream reaches to provide future inputs of LWD
- Enhance pool habitat in Cedar Creek and other tributaries in the basin
- Fence livestock away from streams especially Cedar, Pup and Chelatchie creeks
- Repair slide upstream on Lewis River hatchery on the mainstem that buried chum spawning habitat
- Control farm run-off and biowaste streams
- Restore and enhance wetlands and springs
- Identify contributing causes and develop solutions to summer low flow conditions in Cedar Creek and other tributaries
- Identify and remove unauthorized diversions in Cedar Creek basin

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- Remove invasive non-native vegetation along riparian corridors

East Fork

- Remove culverts from Brezee, McCormick, Mason, and Dean creeks
- Restore upper East Fork spawning and rearing habitat
- Create funding partnership to restore Stordahl gravel pits and potentially create chum spawning habitat
- Fund an East Fork Monitoring program
- Restore and enhance off-channel and floodplain habitat in the lower 10 miles of the mainstem East Fork
- Reconnect and enhance side channels and areas with upwelling to provide chum spawning habitat
- Stabilize erosion problems in the mainstem East Fork and tributaries
- Reduce turbidity caused by gravel mining operations
- Increase functional LWD structures in appropriate stream reaches
- Restore riparian corridors and forested wetlands
- Reduce livestock access to the river and its tributaries
- Restore and enhance wetlands and springs
- Enhance pool habitat for thermal refuge
- Identify unauthorized private diversions and/or withdrawals within the basin
- Control invasive non-native plant species along riparian corridors

The lists above are examples of the types of measures that would be funded and implemented with the In Lieu Fund. Any mitigation measures that are implemented will be reviewed and approved by the Services.

Reintroduction Outcome Goal Status Checks –

The reintroduction outcome goal of the comprehensive aquatics program contained in Sections 4 through 9 of the Lewis River Settlement Agreement is to achieve genetically viable, self-sustaining, naturally-reproducing, harvestable populations of spring Chinook, winter steelhead and late-run coho above Merwin Dam greater than minimum viable populations. The Licensees are not responsible for limiting factors that are not related to project effects (e.g., harvest). The reintroduction outcome goals are separate from the targets relating to numbers of returning hatchery fish (described below).

Phase I Status Check – Year 27

It is anticipated that it will take at least 10 years following the last step in fish passage implementation to allow all facilities to achieve their best possible performance and for supplementation to be completed. In addition, the full passage scenario needs time to allow for supplementation actions to have an effect and for adequate seeding to occur in the available habitat. This brings the program to what is known in the Lewis River Settlement Agreement as the Phase I Status Check. It is at this point that the Reintroduction Outcome Goals are evaluated.

On or after the later of the following (a) the 27th anniversary of issuance of the new licenses, or (b) the 12th year after reintroduction of anadromous fish above Swift No. 1 Dam together with the operation of both the Merwin Upstream Transport Facility and the Swift Downstream Facility, the Services will determine whether the reintroduction outcome goal has been achieved for each North Fork Lewis River anadromous fish population that is being transported pursuant to the Lewis River Settlement Agreement ("Phase I Status Check"). The Services will consider the variability of the factors influencing the success of the program over time, such as cycles of ocean conditions, and will include an appropriate temporal component in developing and applying their evaluation methodology. If the reintroduction outcome goals are being met, then the Licensees will continue to operate the passage facilities and to seek improvements towards performance standards. If reintroduction outcome goals are not being met, PacifiCorp will conduct a limiting factors analysis (LFA) to determine the root causes for sub-optimum reintroduction outcome goal numbers. If it is determined that the primary limiting factor is attributable to the projects, the Licensees will implement measures that will provide biological benefits substantially equivalent to the impact of the project-related limiting factor (e.g., habitat enhancement projects, continuing juvenile supplementation, etc.). Examples of factors unrelated to Project effects include, but are not limited to, harvest, upstream of Merwin off-Project habitat conditions (e.g., degradations in habitat due to forest management practices and natural catastrophic events), and ocean conditions. The suite of possible remedies at the Phase I Status Check does not include: (1) structural or operational changes with respect to generating facilities or Project reservoirs to achieve standards, (2) replacement of any fish passage facility with another passage facility, or (3) installation of additional collection and transport facilities or alternative fish passage facilities.

Phase II Status Check – Year 37

After the Phase I Status Check, the Lewis River Settlement Agreement provides for an additional 10 years to evaluate whether any new remedies have had an impact on the outcome goal and to allow time for the fish populations to react to those remedies.

On or after the later of the following: (a) the 37th anniversary of issuance of the new licenses, or (b) the seventh year after the Phase I Status Check, the Services, using the approach developed pursuant to Section 3.1.2 above, shall determine whether the reintroduction outcome goals have been achieved ("Phase II Status Check"). If the reintroduction outcome goals have been met, the Licensees will continue to implement the measures provided in Sections 4 through 9 of the Lewis River Settlement Agreement

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for the remainder of the new licenses' terms, including adjusting and modifying fish passage facilities as needed to meet performance standards as described above. If any of the reintroduction outcome goals have not been met, PacifiCorp will perform a limiting factors analysis to determine the root causes for sub-optimum reintroduction outcome goal numbers. If the limiting factors analysis concludes, for all reintroduction outcome goals not being met, that all significant limiting factors contributing to the failure to meet such goals are unrelated to project effects, the Licensees will continue implementation of the measures contained in Sections 4 through 9 of the Lewis River Settlement Agreement, including adjusting and modifying fish passage facilities as described above, but will not be obligated to implement any additional measures.

If the limiting factors analysis concludes that a project effect is a significant limiting factor in any reintroduction outcome goal not being met, in addition to continuing implementation of the measures contained in Sections 4 through 9 of the Lewis River Settlement Agreement, including facility adjustment and facility modifications, the Licensees will consult with the Services and determine what further actions would be necessary to meet the reintroduction outcome goals. Such actions may include, without limitation, consideration of structural or operational changes with respect to the generating facilities or Project reservoirs or construction of new or replacement passage facilities. In the event that the Services and the Licensees cannot reach agreement, the Services may exercise their applicable authorities and direct what actions should be implemented.

Rationale for Phased Approach to Passage – As described above, the Settlement Agreement provides for a phased approach to providing for and evaluating the success of fish passage above Merwin Dam. The primary purposes of this phased approach are to allow time for habitat to become adequately seeded prior to reintroducing fish to certain areas, and to allow the Licensees and fish management agencies to learn from initial fish passage results prior to designing and constructing additional passage facilities. For example, after reintroduction begins above Swift No. 1 Dam, the Merwin upstream and Swift downstream passage facilities will be allowed to operate for approximately 5 years to allow for at least one complete life-cycle to be reached for each species and to allow adequate time for the habitat to become adequately seeded. This also allows time for assessment of the first returns from ocean recruits. The end of that 5 year period will coincide with the beginning of the design process for the Yale downstream facility, which will incorporate any information learned in the previous reintroduction phase. Once the Yale downstream facility is operating, it will be allowed to operate for 2 years, during which time PacifiCorp and fish management agencies will evaluate its success prior to designing or constructing remaining fish passage facilities. Since the Yale and Merwin downstream facilities are expected to be configured differently than the Swift downstream collector, this evaluation is critical because it will allow PacifiCorp and fish management agencies time to develop the Yale downstream facility and establish the best operating conditions for fish collection before considering passage at Merwin.

The Phase I Status Check is set for the 27th anniversary after issuance of the new licenses because, once fish are introduced into Lake Merwin, it is anticipated that it will take at least 10 years following the last phase in fish passage implementation for all facilities to

be working at their best possible performance and for supplementation to be completed. In addition, the full passage scenario needs time to allow for supplementation actions to have an affect and for adequate seeding to occur in the available habitat. Once these actions have had an opportunity to occur, the success of the reintroduction program can be accurately evaluated.

1.4.2.2 Additional Aquatic Resources Measures

Yale Spillway Modifications – PacifiCorp will design, permit, and construct improvements to the Yale spillway by six months after the fourth anniversary of the issuance of the new license for Yale to improve fish survival over the spillway during spill events.

Bull Trout Habitat Enhancement Measures – PacifiCorp and Cowlitz PUD will maintain conservation easements for the protection of bull trout habitat.

TDG Testing – PacifiCorp will monitor TDG at Swift No. 1 and Yale to determine compliance with state water quality standards, and implement measures to minimize take of bull trout if standards cannot be met.

Bull Trout Limiting Factors Analysis – By the second anniversary of the Effective Date of the Settlement Agreement, and in consultation with the ACC, PacifiCorp will provide a limiting factors analysis for bull trout occurring in Lake Merwin and Swift Creek Reservoir tributary streams. The ACC may implement enhancement measures through the use of the Aquatics Fund (see Section 1.4.2.4 below) if warranted by the study results.

Signage – PacifiCorp will provide information signs at established angler access areas on land that PacifiCorp owns or leases, describing bull trout and the need to protect this species. Flyers with the same information will be provided at each of PacifiCorp's park entrance booths; such will also be provided to WDFW and USFWS enforcement personnel for distribution.

1.4.2.3 Flow Releases for Fish and Other Aquatic Species

Flow Releases in the Bypass Reach; Constructed Channel – PacifiCorp and Cowlitz PUD will release flow into the reach of the Lewis River downstream of Swift No. 1 ending at Yale Lake, which parallels the Swift No. 2 canal (the "bypass reach"), for the duration of the license terms. Releases will be subject to the terms and limitations in Section 6.1 of the Lewis River Settlement Agreement and in accordance with a schedule established by the ACC pursuant to Section 6.1.2 of the Settlement Agreement. The total annual amount of water that may be scheduled for release in any one year will not exceed 55,200 acre-feet (55,349 acre feet in each leap year). The annual release quantity will be allocated between two release points: (a) released from and as measured at the outflow from a water delivery structure to be constructed at the upstream end of the bypass reach; and (b) released to a constructed channel (described below) from and as measured at the existing canal drain that is located approximately one third of the length of the canal downstream of the Swift No. 1 tailrace. The monthly schedule of flow releases from these two release points is together referred to as the "combined flow schedule."

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The existing Swift No. 2 canal wasteway may also be use to release water, up to the capacity of the canal, into the bypass reach.

Constructed Channel - The Licensees commissioned a study, conducted by Northwest Hydraulic Consultants, Inc., dated December 9, 2003, entitled "Swift Bypass Habitat Channel Reconnaissance Study", concerning the biological and technical feasibility of developing a constructed channel in the Bypass Reach downstream of the Swift No. 2 Canal Drain. The constructed channel is an existing, protected channel that runs parallel to the Swift No. 2 canal and receives water from an existing canal drain. This channel will be enhanced with instream structure and channel changes to create quality habitat that is hydraulically matched to the available flows. Unless the ACC determines that the constructed channel should not be built, the Licensees will construct and maintain a channel in the Bypass Reach to maximize the biological benefits of Canal Drain flows and to enhance connectivity with Yale Lake.

The combined flow schedule in the constructed channel and the Bypass Reach will be determined by the ACC, will not exceed 55,200 acre-feet (55,349 acre feet in each leap year) and will be consistent with the constraints outlined in Section 6.1.5 of the Settlement Agreement. For analysis purposes thses flows can be considered to be approximately 100 cfs in each November, December and January; 75 cfs in each February, March, April, May and June; and 60 cfs in each July, August, September and October. The maximum flow that may be scheduled for release from the canal drain to the constructed channel will be the maximum discharge capacity of the Canal Drain, without modification, estimated to be 47 cfs.

Minimum Flows Below Merwin Dam – Minimum flows below Merwin Dam will be set at (1) July 31 through October 15, 1,200 cfs; (2) October 16 through October 31, 2,500 cfs; (3) November 1 through December 15, 4,200 cfs; (4) December 16 through March 1, 2,000 cfs; (5) March 2 through March 15, 2,200 cfs; (6) March 16 through March 30, 2,500 cfs; (7) March 31 through June 30, 2,700 cfs; (8) July 1 through July 10, 2,300 cfs; (9) July 11, through July 20, 1,900 cfs; (10) July 21 through July 30, 1,500 cfs.

Low Flow Procedures – During dry years, PacifiCorp will convene a Flow Coordination Committee (FCC) in order to develop adaptive management measures for the particular circumstance. The FCC will consider fish needs (priority on ESA-listed species), flood control needs, and reservoir recreational pool levels when developing adaptive management measures.

Flow Fluctuations Below Merwin Dam – Commencing with the issuance of the new licenses, PacifiCorp will implement the following operational regime at Merwin Dam.

Plateau Operations at Merwin Dam – PacifiCorp will restrict daily fluctuation in flows below Merwin during the period of February 16 through August 15 of each year by maintaining flow plateaus (periods of near-steady discharge). Once a flow plateau is established, PacifiCorp will maintain the flow plateau for as long a duration as practicable, but flow plateaus may be altered to a new level as a result of changes in natural flow or operational demands on the Lewis River power system.

Plateau Steps – A “Plateau Step” is defined as a down ramping in flow below Merwin Dam that will result in a change in river elevation of more than 0.2 foot at the Ariel Gage. A single Plateau Step event will begin when the elevation drops by more than 0.2 foot and be deemed complete when, (i) the elevation rises by more than 0.2 foot or (ii) does not change by more than plus or minus 0.2 foot for more than 6 hours. Plateau Steps will be limited to no more than one change in any 24-hour period, no more than 4 in any seven-day period, or six in any calendar month. If PacifiCorp is required to release flows from Merwin Dam pursuant to the high runoff procedure, then down ramping to return to prior river levels will not be counted as a Plateau Step. During flood season, if there is less than 5 feet of storage capacity in addition to the required 17 feet of storage capacity under the high runoff procedure, then flow releases to restore the storage capacity will not count as Plateau Steps. Finally, if PacifiCorp is asked to lower flows below Merwin Dam for public safety reasons or to facilitate aquatics studies, such changes in river level will not be counted as Plateau Steps.

Plateau Changes – An accumulation of Plateau Steps will result in a “Plateau Change”. PacifiCorp will limit Plateau Changes to no more than 20 during the period February 16 through August 15. When flows are greater than or equal to 3,500 cfs below Merwin Dam, a Plateau Change will occur when any series of consecutive Plateau Steps totals 1 foot of down ramping. Any periods of up ramping during such period will be ignored in such calculations. When flows are less than 3,500 cfs below Merwin, a Plateau Change means a series of consecutive Plateau Steps totaling 0.5 foot. If a single Plateau Step in a series will cause the total to exceed one foot or one half foot, respectively, the excess will be counted toward the next Plateau Changes. If a Plateau Steps begins when flows are greater than 3,500 cfs and ends when flows are less than 3,500 cfs, the Plateau Change will be determined by adding the fractions of a Plateau Change occurring before and after the river discharge below Merwin Dam passes 3,500 cfs. For example, if a Plateau Step begins when flows are at 5,000 cfs and has measured 6 inches when flows reach 3,500 cfs (one half of a Plateau Change for flows above 3,500 cfs) and continues to decline an additional 3 inches ending at 3,000 cfs (one half of a Plateau Change for flows below 3,500 cfs), it will count as one full Plateau Change.

Ramping Rates Below Merwin Dam – PacifiCorp will limit the up-ramping rate to 1.5 feet per hour. The down-ramping rate will not exceed 2 inches per hour, as measured at the Ariel gage, when flows below Merwin Dam are at or less than 8,000 cfs, except, between February 16 through June 15, when no down-ramping will occur (1) commencing one hour before sunrise until one hour after sunrise and (2) commencing one hour before sunset until one hour after sunset.

Stranding Study and Habitat Evaluation – By the third anniversary of the issuance of the new license for Merwin Project, PacifiCorp (in consultation with the ACC and approval by the Services) will complete a stranding study and a habitat evaluation study below Merwin Dam to assess the potential effects of project operations on steelhead, coho, Chinook, and chum salmon, and their habitats. The ACC may recommend measures to

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be taken to minimize stranding or enhance habitat based on study results. The ACC may then choose to implement recommended measures using the Aquatics Fund (see below)

1.4.2.4 Aquatic Habitat Enhancement Actions

Large Woody Debris – After issuance of the new license for the Swift No. 1 Project and under direction of the ACC, PacifiCorp will stockpile LWD collected from Swift Creek Reservoir for use by other entities for LWD projects.

Funding – Within 180 days after issuance of the new license for the Merwin Project, PacifiCorp will provide \$2,000 annually, which may be disbursed to qualified entities for costs of LWD transportation and placement (the “LWD Fund”), with the unspent balance carrying over to subsequent years. PacifiCorp will also contribute \$10,000 per year to the Aquatics Fund (described below) that will be earmarked for LWD projects in the mainstem of the Lewis River below Merwin Dam to benefit anadromous fish. If there are not sufficient LWD projects, or if the LWD program is suspended, PacifiCorp, at the request of the ACC, will use the funds for other aquatic enhancement fund projects that benefit anadromous fish in the mainstem of the Lewis River below Merwin Dam and then for other projects in the basin below Merwin Dam.

LWD Study – PacifiCorp will hire a consultant, in consultation with the ACC, to develop and implement a LWD study to identify and assess the potential benefits of LWD projects below Merwin Dam. The final study plan will be completed 270 days after issuance of the new license for the Merwin Project. The results of the study will guide implementation of programs using the LWD Fund.

Spawning Gravel Program – Within six months after the effective date of the Settlement Agreement, PacifiCorp will hire a consultant, selected in consultation with the ACC, to develop and implement a spawning gravel study and, on the basis of the study results, develop a gravel monitoring and augmentation plan that maintains existing levels of gravel and includes a “trigger” for initiation of gravel augmentation. Pursuant to that plan, PacifiCorp will implement gravel augmentation if the consultant-established trigger is realized.

Predator Study – By the tenth anniversary of issuance of the new license for the Merwin Project, PacifiCorp will conduct (in consultation with the ACC and Services) a one-time study of whether predation in Lake Merwin is likely to be a limiting factor to the success of the anadromous salmonid reintroduction.

Habitat Preparation Plan – Within six months after the effective date of the Settlement Agreement, PacifiCorp will develop the “Habitat Preparation Plan” in consultation with the ACC to release live adult hatchery anadromous salmonids to “fertilize” the stream habitat in preparation for the reintroduction of anadromous salmonids. Fish will be released for 5 years in each reservoir commencing five years prior to expected completion of the downstream fish passage facility from that reservoir.

Aquatics Fund – PacifiCorp and Cowlitz PUD will establish the Lewis River Aquatics Fund (“Aquatics Fund”) to support resource protection measures and habitat projects.

PacifiCorp will provide funds over a period of years totaling \$5.2 million and Cowlitz PUD will provide funds over a period of years totaling \$520,000. PacifiCorp's contributions will begin in 2005 and Cowlitz PUD's contributions will begin after the first anniversary of the issuance of the new license for the Swift No. 2 Project. Projects goals will be to benefit the Lewis River basin and will be reviewed and approved by the ACC. The Licensees will submit annual reports regarding project review, implementation, and monitoring.

1.4.2.5 Hatchery Programs; Supplementation

As a component of the anadromous fish reintroduction program (Section 1.4.2.1), PacifiCorp and Cowlitz PUD, in consultation with the ACC and subject to the approval of NOAA Fisheries, will undertake a hatchery and supplementation program. The goals of the program are to support (i) self-sustaining, naturally-producing, harvestable native anadromous salmonid populations throughout their historical range in the North Fork Lewis River basin; and (ii) the continued harvest of resident and anadromous fish. The supplementation portion of the program will be limited to spring Chinook, steelhead and coho. The hatchery and supplementation program will be consistent with the ESA, applicable state and federal fisheries policies, and regional recovery plans, and will address both anadromous and resident fish.

To ensure that the hatchery and supplementation program is meeting its goals, PacifiCorp and Cowlitz PUD, in consultation with the ACC and subject to the approval of NOAA Fisheries, will develop and implement a hatchery and supplementation plan to adaptively manage the program and guide its management. The hatchery and supplementation plan (H&S Plan) will be designed to achieve the numeric hatchery targets provided in Table 1.4-2, and will be calculated in terms of returning ocean recruits taking into account harvest and escapement. PacifiCorp and Cowlitz PUD will use the existing Lewis River, Merwin, and Speelyai hatchery facilities to meet production obligations.

Table 1.4-2. Lewis River Hatchery Complex Targets.

	Spring Chinook	Steelhead	Coho	Total
Hatchery Target (adult ocean recruits)	12,800	13,200	60,000	86,000

When the number of natural returning ocean recruits of any species exceeds the relevant natural production threshold(s) for that species (Table 1.4-3), then PacifiCorp and Cowlitz PUD will decrease the appropriate hatchery target(s) identified in Table 1.4-2 on a fish for fish (1:1) basis; however, PacifiCorp and Cowlitz PUD will not decrease the hatchery targets below the hatchery target floor specified in Table 1.4-3. If PacifiCorp and Cowlitz PUD reduce hatchery targets based on the number of returning natural ocean recruits, but the number of returning ocean recruits subsequently decline under such methodology, the PacifiCorp and Cowlitz PUD will increase the hatchery targets on a fish for fish (1:1) basis provided that the increased hatchery targets will not exceed the hatchery targets in Table 1.4-2.

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Table 1.4-3. Numbers Governing Modifications to Hatchery Targets

	Spring Chinook	Steelhead	Coho	Total
Natural Production Threshold for Hatchery Reduction	2,977	3,070	13,953	20,000
Hatchery Target Floor	2,679	2,763	12,558	18,000

To meet their obligation, each year, PacifiCorp and Cowlitz PUD will produce spring Chinook salmon smolts, steelhead smolts, and coho salmon smolts at the levels specified in Table 1.4-4. PacifiCorp and Cowlitz PUD, in consultation with the ACC, may adjust the juvenile production as needed to achieve the hatchery target subject to the hatcheries capacity cap.

Table 1.4-4. Juvenile Production Targets.

Smolt Production	Spring Chinook	Steelhead	Coho
Years 1 through 3 of the H&S Plan (or "H&S Plan Years 1 - 3")	1.35 million	275,000	1.8 million
H&S Plan Years 4 - 5	1.35 million	275,000	1.9 million
H&S Plan Years 6 - 50	1.35 million	275,000	2.0 million

Anadromous fish stocks used in the reintroduction program will be the most appropriate for the basin and will include a mixture of indigenous and hatchery stocks (Table 1.4-5). These stocks will be used unless modified by the Licensees as part of the Hatchery and Supplementation Plan.

Table 1.4-5. Broodstock sources used for supplementation above and below Merwin Dam.

Program	Stock Source		
	Spring Chinook	Steelhead	Coho
Juveniles for Supplementation (release above Merwin)	Lewis River hatchery stock with Cowlitz River hatchery stock as contingency	Lewis River wild winter stock with Kalama hatchery stock as contingency	Lewis River hatchery early (type S) stock
Juveniles for Harvest (release below Merwin)	Same as for supplementation	Same as for supplementation and existing Lewis River hatchery summer and winter stock	Same as for supplementation and Lewis River hatchery late (type N) stock

Juvenile Salmonids Above Swift Dam

Subject to modification in the hatchery and supplementation plan, PacifiCorp and Cowlitz PUD will transport juvenile anadromous salmonids to acclimation sites located above Swift Dam for the following periods of time:

- (1) Spring Chinook and Steelhead. PacifiCorp and Cowlitz PUD will transport juvenile spring Chinook and steelhead for a period of 15 years commencing upon completion of the Swift downstream fish collection facility; and
- (2) Coho. PacifiCorp and Cowlitz PUD will supplement juvenile coho salmon for a period of 9 years commencing upon completion of the Swift downstream fish collection facility.

At the end of these time periods, the ACC will assess on a year-by-year basis whether to extend the transportation of juvenile salmonids. Upon ACC agreement and subject to NOAA Fisheries approval, PacifiCorp and Cowlitz PUD will continue to transport juvenile salmonids. However, PacifiCorp and Cowlitz PUD will not be required to (i) transport juvenile spring Chinook and steelhead for a period exceeding 15 years after completion of the Swift Downstream Facility or (ii) transport juvenile coho salmon for a period exceeding 9 years after completion of the Swift downstream fish collection facility.

Juvenile Salmonids to Yale Lake and Lake Merwin

PacifiCorp will, for the purposes of supplementation, transport juvenile salmonids to appropriate release sites in Yale Lake and Lake Merwin for the following periods of time:

- (1) Spring Chinook and Steelhead. PacifiCorp will transport juvenile spring Chinook and steelhead for a period of 15 years in Yale Lake after completion of the Yale Downstream fish collection facility; and for a period of 15 years in Lake Merwin after completion of the Merwin downstream fish collection facility.
- (2) Coho. PacifiCorp will transport juvenile coho salmon into Yale Lake for a period of 9 years after completion of the Yale downstream fish collection facility and into Lake Merwin for a period of 9 years commencing upon completion of the Merwin downstream fish collection facility.

At the end of these time periods, the ACC shall assess on a year-by-year basis whether to extend the transportation of juvenile salmonids. Upon ACC agreement and subject to NOAA Fisheries approval, PacifiCorp will continue to transport juvenile salmonids. PacifiCorp will provide short term, temporary in-stream enclosures to confine juvenile salmonids in tributaries to Yale Lake and Lake Merwin after they are released for the purpose of allowing juveniles to adjust to the natural environment prior to being exposed to natural mortality factors such as predators.

Adult Anadromous Salmonids above Merwin Dam

As discussed in Section 1.4.2.1, PacifiCorp and Cowlitz PUD will commence the supplementation of adult fish beginning one year prior to completion of the Swift downstream facility. Throughout the terms of the new licenses, the PacifiCorp and Cowlitz PUD will transport and release supplementation stocks of adult spring Chinook, coho, and steelhead above Swift No. 1 as directed by the ACC. Throughout the terms of the new licenses, PacifiCorp shall transport and release supplementation stocks of adult spring Chinook, coho, and steelhead into Yale Lake and Lake Merwin as directed by the

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ACC. The ACC shall determine the timing for initiating supplementation into Yale Lake and Lake Merwin. The ACC, subject to the approval of NOAA Fisheries, may recommend discontinuing or recommencing the transportation of such supplementation stocks provided that any such recommendations are biologically based, and not contrary to the goals of the ESA.

Resident Fish Production

Each year, for the life of the licenses, PacifiCorp and Cowlitz PUD will produce no more than 20,000 pounds of resident rainbow trout (800,000 juveniles with an estimated weight of 40 juvenile fish per pound). PacifiCorp and Cowlitz PUD will stock such rainbow trout in Swift Creek Reservoir. PacifiCorp will also produce no more than 12,500 pounds of resident kokanee (93,000 juveniles). PacifiCorp will plant such resident kokanee in Lake Merwin. The Licensees will modify resident rainbow trout and kokanee production in consultation with the ACC, and with approval of WDFW to address other management goals.

1.4.2.6 Aquatic Monitoring And Evaluation

Monitoring and Evaluation Plans – By the second anniversary of the issuance of the new licenses, PacifiCorp and Cowlitz PUD will develop plans and methods in consultation with the ACC and approved by Services to monitor and evaluate the effectiveness of various aquatic measures including monitoring of fish passage; adult anadromous salmonid migration, spawning, distribution, and abundance; water quality; hatchery supplementation programs; bull trout populations; and resident fish species. PacifiCorp and Cowlitz PUD will prepare annual monitoring reports.

1.4.2.7 Terrestrial Measures

Yale Habitat Fund – PacifiCorp will establish and maintain a fund for land acquisition to protect wildlife habitat in the vicinity of the Yale Project, with a total contribution of \$2.5 million. The total of \$2.5 million will be provided within two years of the effective date of the settlement agreement. Guidelines of the "Yale Fund" are to provide movement corridors for elk, acquire 660 acres of low elevation winter range, and 100 acres of elk forage land within the vicinity of the Yale Project.

Swift No. 1 and Swift No. 2 Land Acquisition and Habitat Fund – PacifiCorp and Cowlitz PUD will establish and maintain a fund with a total contribution by PacifiCorp of \$7.5 million over several years. The purpose of the "Swift Fund" is to acquire land to protect wildlife habitat within 5 miles of the Swift project boundaries or lands owned and managed by the licensees that are associated with the Swift Projects (laterally and upstream, but not downstream).

Lewis River Habitat Fund – PacifiCorp will establish and maintain a fund to acquire or enhance wildlife habitat anywhere in the Lewis River basin in the vicinity of the Projects, with a total contribution of \$2.2 million over several years. In addition to the \$2.2 million contribution, PacifiCorp will match the contributions of other entities for

habitat projects in an amount not to exceed \$100,000 per year, and not more than \$500,000 in any ten consecutive years.

Wildlife Habitat Management Plans – PacifiCorp and Cowlitz PUD, in consultation with the TCC, will develop Wildlife Habitat Management Plans (WHMPs) for their respective properties. The purpose of the WHMPs will be to benefit a broad range of fish, wildlife and native plant species, including, but not limited to, large and small game, amphibians, bats, forest raptors, neo-tropical birds, and culturally significant native plants. The WHMPs will include an effectiveness-monitoring component to measure progress toward reaching management objectives.

1.4.2.8 Recreation Measures

PacifiCorp Measures

Recreation Resources Management Plan – PacifiCorp submitted a draft Recreation Resources Management Plan (RRMP) to the Commission as part of its Final Application for New License for the Swift No. 1, Yale and Merwin projects. The RRMP includes measures set forth in Section 11.2 of the Settlement Agreement. PacifiCorp will implement measures specified in the Settlement.

Swift Creek Reservoir Measures – PacifiCorp will maintain and manage dispersed shoreline use sites on its lands and those under USFS jurisdiction within the FERC project boundary. Facility improvements will be made at Eagle Cliff Park, and a trail will be developed that extends from the park to the USFS boundary. PacifiCorp will acquire or manage WDNR's Swift Forest Campground, with improvements to the day use area, campsites, boat ramp and parking areas. ADA accessibility will be an important component of all recreation improvements at Swift Creek Reservoir.

Yale Lake Measures – PacifiCorp will maintain and manage dispersed shoreline use sites on its lands, and where landowner agreement is obtained, on lands owned by other parties. Use sites will be hardened, waste collection and disposal performed, and inappropriate sites signed for closure. Recreation improvements to the Yale/IP Road will be pursued, including securing access rights, completing bridge safety improvements, developing trailheads, formalizing reservoir access points, and installing toilets. Ultimately, a 12-mile segment of the road will be surfaced. Other multi-use trails in the Yale Lake area will be developed or improved, including a segment extending from the Saddle Dam parking area to the existing Saddle Dam trail, from Cougar Campground to Beaver Bay, and a new loop trail from Cougar to a reservoir overlook. Existing boat launches will be improved at Yale Park and Beaver Bay. Facility improvements at the Yale Park, Cougar, and Beaver Bay day use areas will be implemented, as will improvements to campgrounds at Cougar and Beaver Bay. ADA accessibility will be a component of all recreation improvements at Yale Lake.

Lake Merwin Measures – PacifiCorp will maintain and manage dispersed shoreline use sites on its lands, and where landowner agreement is obtained, on lands owned by other parties. Trail development in the Lake Merwin area will include improvements to the existing Marble Creek trail and evaluating a potential easement for a Clark County trail

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on the south shore of the lake. Boating facility improvements will be made at Speelyai Bay Park (ramp extension) and at Yale Bridge, where a launch site for non-motorized craft will be developed. At Merwin Park, day use facilities will be upgraded and new picnic shelters developed. At Speelyai Bay Park, the restroom will be upgraded to ADA standards and the parking area improved. At Cresap Bay Park, the use season will be extended through September. ADA accessibility will be a component of all recreation improvements at Lake Merwin.

Lower Lewis River Measures – PacifiCorp will install ADA-accessible vault toilets at the five Lewis River access sites (Cedar Creek, Merwin Hatchery, Johnson Creek, Lewis River Hatchery, and Island River). PacifiCorp also will be responsible for maintenance of these sites.

Basin-wide Measures – An Interpretation and Education program (I&E) will be developed in collaboration with Cowlitz PUD for developed sites throughout the project area. A range of visitor management measures will be implemented to improve public safety and improve the quality of visitor’s experiences. Measures include enforcing non-motorized access restrictions, regulating overnight parking, funding dispersed camping management by the USFS, allowing public use of RV dump stations, and assessing the feasibility of ADA-accessible bank fishing sites.

Cowlitz PUD Measures – Cowlitz PUD will develop an ADA-accessible bank fishing site (including parking and portable toilets) at Swift No. 2 Canal. Non-motorized recreation access will be allowed on lands within the Swift No. 2 project boundary and Cowlitz PUD will develop and implement an I&E program for the Swift No. 2 Project. Cowlitz PUD will also provide \$780 annually to the USDA-FS to manage project-related dispersed camping on National Forest System lands.

1.4.2.9 Cultural Measures

Cultural Resources – PacifiCorp will finalize and implement the Historic Properties Management Plan (HPMP) for the Merwin, Yale, and Swift No. 1 projects. This plan will guide the treatment of known and yet to be discovered cultural and historic resources through the period of the new licenses. In addition, PacifiCorp will curate and interpret artifacts at a new Visitor Information Center in Cougar; protect the integrity of properties listed in the National Register of Historic Places; preserve tribal access for traditional uses; and monitor and protect cultural resources.

Cowlitz PUD will follow a previously established Unanticipated Discovery Plan and will consult with the CIT and YN about development actions, land acquisitions or emergency response activities that would disturb areas greater than 0.1 acre. Cowlitz PUD will also allow tribal access to lands, not excluded for safety reasons, within the Swift No. 2 project boundary.

1.4.2.10 Socioeconomic Measures

Law Enforcement – PacifiCorp will provide funding for three full-time-equivalent law enforcement officers to augment land and marine-based traditional law enforcement

activities and patrols in the North Fork Lewis River basin, provided by state and local government, as part of their responsibilities to protect public health, safety and welfare in the North Fork Lewis River basin.

Forest Road 90 – PacifiCorp will pay \$7,474 and Cowlitz PUD will pay \$2,626 to the USDA-FS to assist in the repair of the Canal Bridge on Forest Road 90. PacifiCorp will pay \$19,980 per year beginning in April 2005 to the USDA-FS specifically for the maintenance of Forest Road 90. Cowlitz PUD will pay \$7,020 annually to the USDA-FS specifically for the maintenance of Forest Road 90 beginning in April of 2005. Each Licensee will pay appropriate use fees to the USDA-FS for hauling heavy loads on Forest Road 90 on a case-by-case basis when that Licensee uses Forest Road 90 for heavy hauls.

Visitor Information Facility – PacifiCorp will allow the construction of a 1,000 to 1,200-square-foot Visitor's Information Facility on its property in Cougar, and the Licensees will provide matching funds, or the Licensees will perform periodic maintenance of the facility for the term of the new licenses. PacifiCorp's portion of matching contributions contribution will be \$65,250 and Cowlitz PUD's portion will be \$9,750.

Pine Creek Communication Works Center Link – PacifiCorp will provide support for the USDA-FS radio-telephone link between Swift Dam and the Pine Creek Work Center.

2.0 PROJECT DESCRIPTION

2.1 BASIN DESCRIPTION

The North Fork Lewis River basin lies on the flanks of the southern Cascade Mountains of Washington State (Figure 1.1-1). The river flows in a general southwesterly direction from its source on the slopes of Mount Adams and Mount St. Helens to the Columbia River 19 miles downstream of Vancouver, Washington. The river is 93 miles long and has a total drop of 7,900 feet, the greater part of which is in the upper reaches. At its mouth and up to the Lewis River Hatchery, the river stage is influenced by tides and subsequent backflow from the Columbia River. The area of the drainage basin is 1,050 square miles with a mean elevation of 2,550 ft. mean sea level (msl). Slopes in the upper portions of the basin are generally steep, resulting from the incision of numerous streams and rivers into the geologically young landscape. Most of the tributaries have natural barrier falls or are too precipitous for spawning (Chambers 1957; Kray 1957). Areas to the south of the Merwin Project and downstream along the river are less steep, represented by rolling hills and flat woodland bottomlands. A general overview of major stream segments present in the basin along with a very general habitat characterization is presented in Figure 2.1-1.

The basin has a complex geologic history, having undergone Tertiary volcanism, several glaciations, and interglacial erosion and deposition. Soils in the basin are predominantly well drained and medium-textured, and were derived from volcanic ash or were formed in sediments derived from mixed volcanic rocks and ash. Slopes, which are variable from gentle to steep, range from flat to more than 70 percent. Soil erosion hazard is dependent on slope and vegetation cover; the erosion hazard increases with increasing

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slope and extent of bare soil. Many areas in the upper reaches of streams flowing from Mount St. Helens have actively eroding hill slopes, which contributes fine sediment to the stream channels.

The Lewis River basin has been subject to major natural landscape altering processes in the recent past. Debris avalanches, mudflows, and lahars, common on Mount St. Helens and Mount Adams, are rapidly moving slurries of water, rock, soil, and debris. Mudflows swept down Swift Creek, Pine Creek, and the Muddy River during the May 18, 1980 eruption of Mount St. Helens, carrying nearly 18 million cubic yards of water, mud, and debris into Swift Creek Reservoir (Tilling et al. 1990). These events altered the streambed and valley characteristics of affected drainages in a matter of hours, and have long-term effects of very high sediment load and altered channel characteristics. Streams affected by recent mudflows are continuing to process the sediment and woody debris and have changed from narrow channels into wide, braided, unstable channels with high sediment and wood loads. Riparian vegetation along these channels was lost, and is slowly recovering as sediment loads decrease with time.

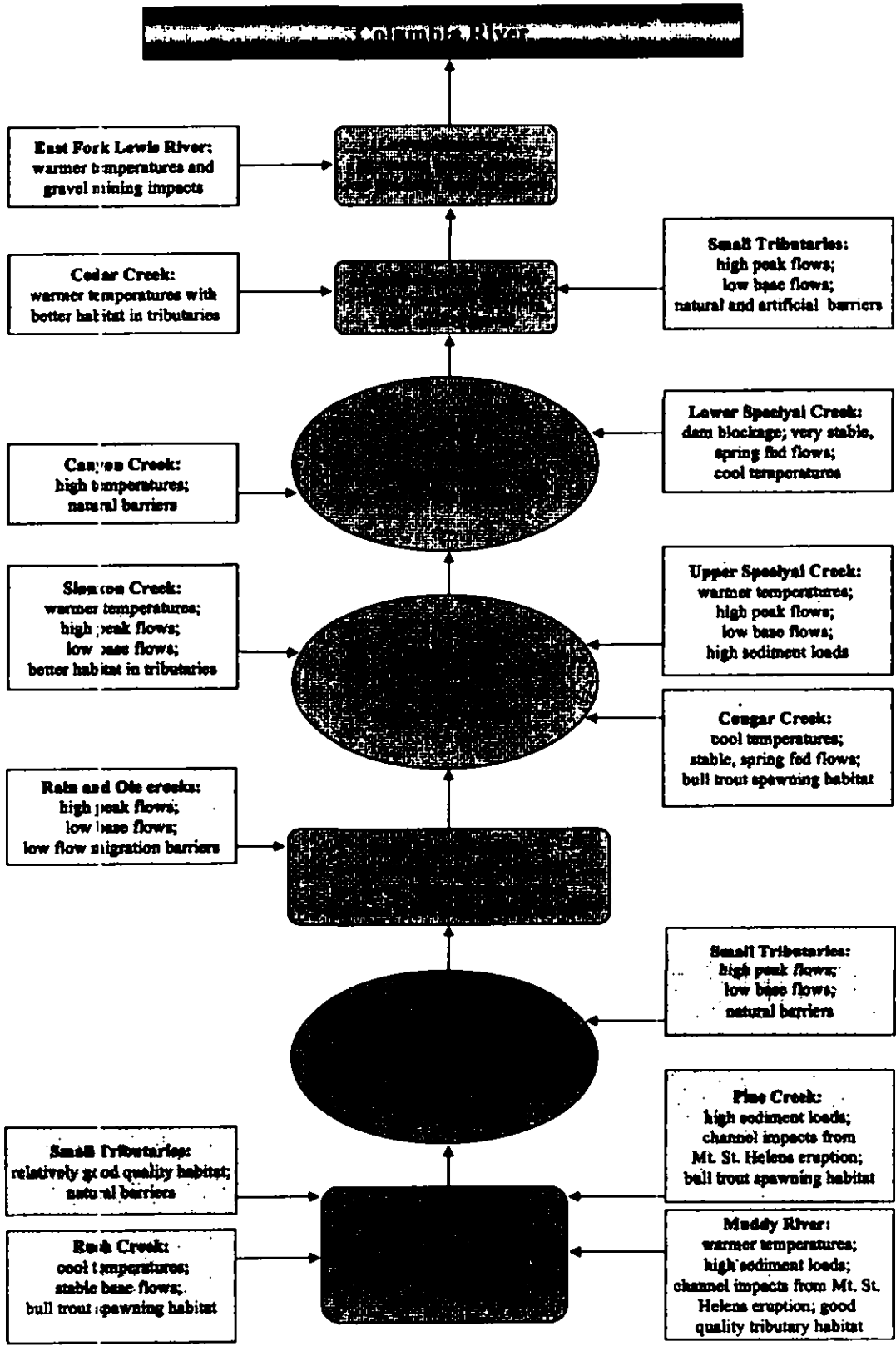


Figure 2.1-1. Schematic diagram of the Lewis River watershed environmental gradients.

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The climate in the North Fork Lewis River basin is influenced by the Pacific Ocean to the west and the Cascade Range to the east. Average annual precipitation varies from 45 inches near Woodland to over 140 inches on Mount Adams. The majority of the precipitation occurs during the rainy fall and winter months, with snow falling at higher elevations of the basin. Summers (July through mid-October) are generally drier. Snowfall is minimal at lower elevations, but exceeds 200 inches per year at elevations over 3,000 feet. In the warmest summer months, afternoon temperatures range from the middle seventies to the lower eighties, with nighttime temperatures in the fifties. Maximum temperatures exceed 90°F on 5 to 15 days each summer. Temperatures in the foothills and higher elevations are slightly lower than those recorded in the valleys.

Basin lands provide winter range for deer and elk; mink and beaver are common in wetlands. Large numbers of amphibians have been observed in the basin, primarily in wetland and riparian/riverine habitats. Over 100 species of birds have also been observed, including waterfowl, raptors, and numerous species of passerines. The watershed also provides habitat for several salmonid species, including bull trout, cutthroat, and steelhead trout, Chinook, coho, and chum salmon, and whitefish. Other fish, such as sculpin and suckers are also common. Several exotic non-native fish species are also present and include brook trout, tiger muskellunge, and bass Tiger muskellunge a non-native sterile hybrid known to prey heavily on soft-rayed fishes (including salmonids), were introduced into Lake Merwin by WDFW in 1995. The goal of the program is to reduce the abundance of salmonid-eating northern pikeminnow and to provide a sport fishery for anglers. Northern pikeminnow are known to be one of the main predators on emigrating salmonids in the Columbia River basin. Brook trout, a non-native char species, is known to hybridize and compete with bull trout (USFWS 2002). Hybridization with brook trout is one of the major factors contributing to the decline and lack of recovery of bull trout throughout its range (USFWS 2002).

The Lewis River watershed is located in an area dominated by natural resources based land uses such as forestry, recreation, and agriculture. As a result, population densities are generally low within the basin. The largest urban center, the City of Woodland, is located near the mouth of the Lewis River, approximately 20 miles north of Vancouver, Washington. Woodland was originally established by settlers in the mid-1850s. Today, it has a population of about 3,875, although the number of people living in the greater Woodland area approaches 10,000 residents. In recent years, the community has experienced substantial growth, with an economy driven by industries such as fishing gear manufacturing, manufactured home production, and agriculture. Development in the Woodland area has adversely affected aquatic habitat in the lower Lewis River basin. Residential and agricultural land uses have eliminated most of the riparian vegetation in the lower reaches, and the lower 7 miles of the Lewis River floodplain is almost entirely disconnected from the river due to extensive diking (Wade 2000). In the East Fork Lewis River, over 50 percent of the off-channel habitat and associated wetlands within the floodplains have been disconnected from the river.

Other towns in the Lewis River basin include Cougar, Ariel, Yale, Chelatchie, Amboy, Yacolt and La Center (Wade 2000). None of these settlements have populations exceeding 2,000 and their economies are primarily dependent upon logging, agriculture,

and recreation (Lowe 2002). The small town of Cougar, located along the north shore of Yale Lake, was originally established to serve as a staging point for timber harvest activities. However, after hydroelectric development and the creation of the Mount St. Helens National Volcanic Monument, recreation services became the primary industry. The current population of Cougar is under 200. Because these towns were/are largely supported by natural resource extraction (logging), their ecological footprint or impact is much larger than the size of the town would indicate.

There are 3 private communities located around Swift Creek Reservoir. The largest of these is the 206-home Northwoods community on the eastern shore. Yale Lake has private development clustered primarily around the Beaver Bay area, the Town of Cougar, and near Speelyai Canal. Private land ownership is more common around Lake Merwin, where there are several large communities along the shoreline, including a 1,600-lot home/trailer development along the south shore. Scattered private lands are found along the Lewis River adjacent to SR 503, increasing in number as one heads west to the City of Woodland.

2.2 THE UTILITIES' NORTH FORK LEWIS RIVER HYDRO FACILITIES

The following section describes all four hydroelectric projects in the North Fork Lewis River basin. The projects begin approximately 10 miles east of Woodland, Washington. The upstream sequence of the projects from the confluence of the Lewis and Columbia Rivers is as follows: Merwin, Yale, Swift No. 2, and Swift No.1. The Merwin, Yale, and Swift No.1 projects represent a linked reservoir/powerhouse system covering over 30 miles of the Lewis. The Swift No. 2 project does not include a dam and reservoir. It utilizes water directly from the tailrace of Swift No.1, which flows into a 3-mile-long canal that discharges through the Swift No. 2 powerhouse into Yale Lake.

The three-reservoir four-project system is operated in a coordinated fashion to achieve optimum benefits for power production, flood management, and to provide for natural resources in the basin such as fish, wildlife and recreation. The four projects utilize the water resources within the North Fork Lewis River basin from elevation 50 ft msl (Merwin Project tailwater) to 1,000 ft msl (Swift No. 1 normal pool). The total usable storage in the reservoirs is 814,000 acre-ft. The total installed capacity for the four projects is 580 MW.

2.2.1 Merwin Dam and Reservoir

The Merwin Hydroelectric Project is a 136 MW plant owned and operated by PacifiCorp. It is the furthestmost downstream project of the four operating on the North Fork Lewis River. Construction of the Merwin Project began in 1929 and was completed with a single unit in 1931. Two additional units were added in 1949 and 1958.

Merwin Dam spans the North Fork Lewis River 21 miles upstream from the confluence with the Columbia River. It is a concrete arch structure with a total crest length of 1,300 feet and a maximum height above its lowest foundation of 314 feet. The dam consists of an arch section 752 feet in crest length, a 75-foot-long gravity thrust block, a 206-foot-long spillway section, a non-overflow gravity section 242 feet long, followed by a

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concrete core wall section 20 feet high and extending 25 feet into the bank. The spillway is equipped with four taintor gates 39 feet wide and 30 feet high, and one taintor gate 10 feet wide and 30 feet high. The taintor gates have been extended to an elevation of 240 ft above msl by the addition of 5-foot flashboards.

The reservoir formed by Merwin Dam is about 14.5 miles long with a surface area of approximately 4,000 acres at elevation 239.6 feet msl (full pool). At full pool, the reservoir has a gross storage capacity of approximately 422,800 acre-ft. Of this amount, 182,600 acre-ft of usable storage is available between elevation 190 and 239.6 ft msl, with an additional 81,100 acre-ft of usable storage available if the reservoir is lowered to its allowable minimum level of 165 ft msl.

2.2.1.1 Penstocks and Powerhouse

Three penstocks lead from Merwin Dam to the powerhouse, via separate intakes. The Merwin intakes are relatively deep (approx. 187 ft. below full pool), high-head intakes with design velocities ranging from between 10 and 20 fps. The intakes are protected from large debris by steel trash racks on approximately 4-inch spacing. The capacity of the three penstocks is different, with Unit Nos. 1 and 2 capable of carrying 3,790 cfs, and Unit No. 3 carrying of 3,890 cfs. The penstock inlet diameters and the minimum water surface elevation in Merwin Lake allow the intake system to pass more than 150 percent of the existing plant hydraulic capacity. A fourth penstock was originally constructed but is currently not utilized by the project.

The powerhouse contains 3 semi-outdoor-type Francis turbine generator units, each with an installed capacity of 45,000kW, and one 1,000 kW house unit, for a total installed capacity of 136,000 kW.

2.2.1.2 Transmission and Auxiliary Equipment

Power is transported from the Merwin Project by two 115 kV transmission lines. One of these extends in a westerly direction a distance of approximately 15.9 miles from the project to the Bonneville Power Administration (BPA) Cardwell substation near Kalama, Washington. The other line runs in a southerly direction for 26.7 miles to the Clark County PUD View substation near Battleground, Washington and then into Portland, Oregon.

2.2.2 Yale Dam and Reservoir

The Yale Hydroelectric Project is a 134 MW plant owned and operated by PacifiCorp that lies directly upstream of the Merwin Project. Construction of the Yale Project began in 1951 and was complete by 1953. The project consists of a main embankment dam, saddle dam, reservoir, penstocks, powerhouse, and transmission line. The project is operated in coordination with the other three hydroelectric facilities on the North Fork Lewis River.

Yale Dam is located on the North Fork Lewis River approximately 30 miles upstream from the confluence with the Columbia River. Yale Dam is a rolled earthen fill

embankment type dam with a crest length of 1,305 feet and a height of 323 feet above its lowest foundation point. Its crest elevation is 503-ft msl. The saddle dam is located 1/4 mile west of the main dam and is approximately 1,600 feet long and 40 feet high with a crest elevation of 503 feet msl. The main dam has a chute-type spillway, located in the right abutment (looking downstream), with a capacity of 120,000 cfs through five 30-foot by 39-foot taintor gates at reservoir elevation 490 ft msl.

Yale Lake is approximately 10.5 miles long with a surface area of approximately 3,800 acres at elevation 490-ft msl (full pool). At full pool, the reservoir has a gross storage capacity of approximately 401,000 acre-ft. At the minimum pool elevation of 430-ft msl, the reservoir has a capacity of approximately 190,000 acre-ft.

2.2.2.1 Tunnels/Penstocks and Powerhouse

The Yale Project consists of two tunnels/penstocks leading from Yale Dam to the powerhouse. Water is delivered to the tunnels/penstocks via a common intake. The Yale intake is a relatively deep (approximately 90 ft. below full pool), high-head intake with design velocities ranging from between 10 and 20 fps. The intakes are protected from large debris by steel trash racks on approximately 4-inch spacing. The maximum diameter of each of the Yale tunnels/penstocks is 18.5 feet; the minimum diameter is 16 feet. Penstock velocities range from 18.2 fps in the tunnel to 24.3 fps in the penstocks' smallest sections. The Yale penstocks are each capable of passing a maximum of 4,880 cfs.

The Yale powerhouse contains 2 Francis-type generator units with a total installed capacity of 108,000 kW (nameplate). The powerhouse is located at the base of the earth embankment on the left side (facing downstream) of the old river channel. The generator units were originally installed in 1952. The turbines were rehabilitated coincident with generator rewinds in 1987 and 1988, respectively. In 1995, PacifiCorp installed a new runner in Yale Unit No. 2. A similar runner was installed in Unit No. 1 in 1996. The new runners increased Yale capacity to 134 MW.

2.2.2.2 Transmission and Auxiliary Equipment

Power generated at the Yale Project is transmitted 11.5 miles over a 115kV-transmission line (Lake Line) to a substation adjacent to the Merwin Project.

2.2.3 Swift Dam and Reservoir

The Swift No. 1 Hydroelectric Project is a 240 MW plant owned and operated by PacifiCorp. The project is the furthestmost upstream hydroelectric facility on the North Fork Lewis River, lying directly upstream of the Swift No 2 Hydroelectric Project. Construction of the Swift No. 1 Project began in 1956 and was completed in 1958. It consists of a main embankment dam, reservoir, penstocks, powerhouse, and transmission line, and is operated in coordination with the other three hydroelectric facilities on the North Fork Lewis River.

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Swift Dam spans the North Fork Lewis River approximately 40 miles upstream from the confluence with the Columbia River and 10.5 miles upstream of Yale Dam. It is an earthen fill embankment type dam with a crest length of 2,100 feet and a height of 512 feet. At the time of its construction, Swift Dam was the tallest earthen fill dam in the world. Its overflow spillway, located in the left abutment (looking downstream), has a capacity of 120,000 cfs (at reservoir elevation 1000 feet msl) through two 50-foot by 51-foot taintor gates. The elevation at the top of the taintor gates is 1,001.6-ft msl.

The reservoir formed by Swift Dam is approximately 11.5 miles long with a surface area of approximately 4,680 acres at elevation 1,000-ft msl (full pool). At maximum pool, the reservoir has a gross storage capacity of approximately 755,000 acre-ft. At the minimum pool elevation of 878-ft msl, the reservoir has a capacity of approximately 447,000 acre-ft.

2.2.3.1 Tunnels/Penstocks and Powerhouse

Water is delivered from Swift Creek Reservoir to the powerhouse through a system containing a tunnel, a surge tank, and an outlet, which branches into three penstocks. The Swift No. 1 intake is a relatively deep (approximately 75 ft. deep at full pool), high-head intake with design velocities ranging from between 10 and 20 fps. The intakes are protected from large debris by steel trash racks on approximately 4-inch spacing. The Swift No. 1 surge tank is located approximately 1,196 feet downstream of the tunnel intake and about 482 feet upstream of the powerhouse. This surge tank is of the restricted orifice, non-overflow style, with a diameter of 55 feet and a top elevation of 1,035-ft msl. Downstream of the tank, individual penstocks for each generating unit branch from the main tunnel. Each of the Swift No. 1 penstocks is 13 feet in diameter. At maximum turbine flows, water in the penstocks reaches velocities of up to 23 fps. The Swift No. 1 penstocks are capable of passing a maximum of 9,120 cfs, combined.

The Swift No. 1 Powerhouse contains 3 Francis-type generator units with a total installed capacity of 240,000 kW (nameplate). The turbines were rewound in 1987 (unit No. 12), 1990 (unit No. 11) and 1991 (unit No. 13) resulting in a capacity upgrade from 204 MW to 240 MW. The powerhouse is located at the base of the dam on the left side (facing downstream) of the old river channel. The powerhouse is operated by remote control from the Hydro Control Center at Merwin Headquarters.

2.2.3.2 Transmission and Auxiliary Equipment

The project is served by the 230kV Speelyai transmission line which extends from Swift No.1 to the Swift No. 2 switchyard and then to a BPA switching station near Woodland, Washington.

2.2.4 Swift No. 2 Hydroelectric Project

The Swift No. 2 Hydroelectric Project is a 70 MW development owned by Cowlitz PUD. The project lies between the Swift No. 1 and Yale hydroelectric projects on the North Fork Lewis River. The Swift No. 2 Project consists of a power canal, intake structure, penstocks, powerhouse, tailrace discharge channel, substation, and transmission line.

The powerhouse is located 3 miles downstream from Swift No. 1. Construction of the Swift No. 2 Project began in 1956 and was completed in 1958. It is operated in coordination with the other three hydroelectric facilities on the North Fork Lewis River.

2.2.4.1 Power Canal

The Swift No. 2 Power Canal begins at the tailrace of the Swift No. 1 Powerhouse and consists of an earthen-lined upper section (approximately 11,000 feet long) and a concrete-lined lower section (approximately 5,900 feet long). Water released from the Swift No. 1 Powerhouse immediately enters the 3-mile power canal and is conveyed to the Swift No. 2 Powerhouse. A gated check structure and ungated side-channel spillway/wasteway exist as part of the canal facilities. The purpose of the check structure is to allow isolation of the canal for operation of Swift No. 1 when Swift No. 2 is out of service. The gates in the check structure immediately downstream of the wasteway can be closed, to block flow, when, for example, the downstream section of the canal needs to be dewatered for maintenance activities including inspection. During normal operations, the wasteway prevents canal flows from exceeding the Swift No. 2 hydraulic capacity and maintains the maximum level in the canal. Water may be released to the bypass reach over the wasteway if flows in the canal exceed the Swift No. 2 hydraulic capacity or if the check structure gates are closed. A drain on the downstream side of the check structure may also be used to release water from the canal if needed. As a FERC Part 12 safety requirement for the project, a surge arresting structure (SAS) is located adjacent to the intake structure to release water from the canal in the event there is a surge from a turbine generator trip at Swift No. 2 and excess flow must be released from the canal. The release valve at the terminus of the SAS consists of two cone valves. The Interim Operation of the Lewis River Hydroelectric Projects consultation (June 27, 2002) currently provides incidental take coverage for existing operations but does not describe this operation of the SAS. For this potential circumstance when the SAS may operate prior to FERC issuing a new license but after the USFWS has issued its final biological opinion pursuant to the SA, the incidental take associated with the SAS will be covered by consultation associated with reconstruction of the canal and its appurtenances. Under the new license terms, the SAS will continue to be available and will operate for the same purpose.

Under normal operating conditions, the elevation of the canal waters at the Swift No. 2 intake structure range from 601 to 604 ft msl. The canal surface area is approximately 56 acres, and the canal holds approximately 922 acre-feet of water. The operating capacity of the power canal is 9,000 cfs.

2.2.4.2 Penstocks and Powerhouse

Water is delivered from the Swift No. 2 intake structure to the powerhouse via two penstocks, one for each of two turbine generator units. The intakes to the penstocks are protected from large debris by steel trash racks with approximately 4-inch spacing. The Swift No. 2 Powerhouse has two Francis-type turbines; each rated at 35,000 kW. Under contract with Cowlitz PUD, PacifiCorp currently operates the powerhouse via remote control from the Hydro Control Center at Merwin headquarters.

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2.2.4.3 Transmission

The project is served by the same 230 kV Speelyai transmission line that serves Swift No. 1 and that extends from the Swift No. 2 switchyard to a BPA switching station near Woodland, Washington.

3.0 STATUS OF THE SPECIES AND CRITICAL HABITAT

This BE was prepared to analyze potential impacts to threatened, endangered, proposed, and candidate species under USFWS jurisdiction. This BE analyzes the potential impacts to bull trout and designated bull trout critical habitat, golden paintbrush, water howellia, Bradshaw's lomatium, Nelson's checker-mallow, Mardon skipper, Oregon spotted frog, Columbian white-tailed deer, grizzly bear, Canada lynx, Pacific fisher, gray wolf, marbled murrelet, bald eagle, and northern spotted owl. The official list of threatened, endangered, proposed, and candidate species was provided to the Utilities by USFWS (Appendix B). In the Lewis River basin, cutthroat trout and Pacific lamprey have been identified as species of concern by the USFWS and have, therefore, been included in this analysis even though neither species has a formal ESA status. The status, distribution, life history, population dynamics, and critical habitat are described in the following section for bull trout. While general information is provided on the Columbia River bull trout distinct population segment (DPS), the main focus is on the local populations, which may be impacted in the Lewis River basin. This discussion is followed by an analysis of potential project effects on terrestrial species and other aquatic species.

3.1 BULL TROUT STATUS AND DISTRIBUTION

Bull trout (*Salvelinus confluentus*) are char, native to the Pacific Northwest and western Canada. Historical distribution occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in Northwest Territories in Canada (63 FR 31647). To the west, the bull trout range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska. Bull trout are widespread throughout tributaries of the Columbia River basin, but are patchily distributed (Whitesel et al. 2004).

Bull trout are estimated to have occupied about 60 percent of the Columbia River basin, and presently occur in 45 percent of their historical range (63 FR 31647). The USFWS listed the Columbia River bull trout DPS as threatened on June 10, 1998. Factors for bull trout decline in the Columbia River DPS include the fragmentation and isolation of local populations due to anthropogenic factors such as dams, diversions, and other land uses; degradation of spawning and rearing habitat; introduction of nonnative fish species; and historical over-harvest. In addition to these factors, a drastic reduction of the prey base, such as juvenile anadromous salmonids, may have contributed to the decline of the Columbia River DPS.

The Columbia River DPS is comprised of 141 subpopulations. As stated in the listing document, the North Fork Lewis River basin contains 2 of the 20 subpopulations in

watersheds of nine major tributaries of the lower Columbia River. The subpopulations identified at that time were the Swift Creek Reservoir subpopulation (Pine and Rush creeks) and the Yale Lake subpopulation (Cougar Creek). This decision was based on genetic information that has since been updated. Neraas and Spruell (2004) indicates that there are two distinct subpopulations, the Pine Creek and Rush Creek subpopulations in Swift Creek Reservoir, and a third spawning aggregate from Cougar Creek, which is a mixture of Pine and Rush Creek fish along with some level of natural production from the Cougar Creek system. The Cougar Creek spawning aggregate may or may not be a distinct subpopulation. The number of bull trout inhabiting the North Fork Lewis River basin is believed to be comparatively low, and the populations in the North Fork Lewis River basin are considered as having a "moderate" risk of extinction (WDFW 1998).

As described, bull trout populations within the North Fork Lewis River basin are found in Lake Merwin, Yale Lake, and Swift Creek Reservoir. The primary spawning tributaries to Swift Creek Reservoir include Pine and Rush creeks. Cougar Creek is the only tributary to Yale Lake that is believed to have appreciable bull trout spawning habitat. It is thought that there is no spawning habitat in tributaries to Lake Merwin.

Although bull trout have been found downstream of Yale Lake, it is thought these fish originated from the Yale or Swift Creek reservoirs. Adfluvial bull trout have been observed in the Yale tailrace annually in the late summer and fall. Bull trout captured at the Yale tailrace from 1995 through 1998 ranged in length from 381 to 820 mm (fork length) (PacifiCorp 1999). As a measure to assist bull trout with an apparent upstream movement, PacifiCorp and WDFW have been capturing adults in the late summer and fall and transporting them upstream to Cougar Creek. Bull trout were also present in the Swift No. 2 Power Canal prior to the canal embankment failure in April 2002. During fish rescue efforts in 2002 following the embankment failure, 42 bull trout were recovered, 14 of which were over 400 mm (maximum 635 mm) in length.

An occasional Dolly Varden or bull trout (identification is unclear) is captured in the ladder at the North Fork Lewis River Hatchery or the trap at Merwin Dam. The last documented Dolly Varden or bull trout in the lower North Fork Lewis River downstream of Lake Merwin was captured at the Lewis River Hatchery ladder in 1994 (Pers. comm. J. Byrnes, WDFW 2004).

3.2 BULL TROUT LIFE HISTORY

Bull trout exhibit resident and migratory life-history strategies through much of their current range (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile trout rear from 1 to 4 years before migrating to one of 3 habitats: (1) lake (adfluvial); (2) river (fluvial); or (3) in certain coastal areas, to saltwater (anadromous). Resident and migratory forms may be found together, but it is not known if resident and migratory fish interbreed, or if resident fish may produce migratory offspring and vice versa. Length at age data from scale analysis of bull trout from the Skagit River suggests that bull trout may be able to change life histories (Kraemer 2003).

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Found primarily in colder streams (although some adult fish are found in large river systems like the Columbia River), water temperatures above 15°C are believed to limit bull trout distribution, which may partially explain the patchy distribution of bull trout within a watershed (Rieman and McIntyre 1995). Although, recent information has documented bull trout use of waters over 17°C for short periods (ScCS 2002). Rieman and McIntyre (1993) stated that bull trout have more specific habitat requirements compared to other salmonids. Habitat components that appear to influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors. Dambacher and Jones (1997) found that seven habitat variables were significant descriptors of the presence of juvenile bull trout: (1) high levels of shade; (2) high levels of undercut banks; (3) large woody debris volume; (4) high level of gravel in riffles; (5) large woody debris pieces; (6) low level of fine sediments in riffles; and (7) low levels of bank erosion. Although these habitat variables are thought to be important for spawning and juvenile rearing in headwater areas, these variables are not always found with existing populations of bull trout and may not describe habitats used as migratory corridors by adult and subadult migratory bull trout or for overwintering habitat used by migratory bull trout.

The size and age of bull trout maturity depends on the life-history strategy; growth of resident fish is typically slower than migratory forms. Resident adults' range from 150 to 300 mm (total length), and migratory adults commonly reach 600 mm or more (Pratt 1984). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Repeat and alternate year spawning has been reported, although repeat spawning frequency and post-spawning mortality are not well known (Fraley and Shepard 1989).

Bull trout generally spawn from August to November during periods of decreasing water temperatures. However, migratory bull trout can begin spawning migrations as early as April (Fraley and Shepard 1989). Temperatures during spawning generally range from 4 to 10 C, with redds often constructed in stream reaches fed by springs or other sources of cold groundwater. Ideal incubation temperatures range from 2 to 4°C (McPhail and Murray 1979). The time from incubation to emergence can exceed 350 Celsius temperature units (Gould 1989). Fry normally emerge from early April through May depending on water temperatures and increasing stream flows (Ratliff and Howell 1992).

Little information is available on the migration timing and spawn timing of Lewis River bull trout. Spawning is thought to occur from August through early October. However, it appears that adfluvial spawners move into Pine and Rush creeks in late July and early August to stage for spawning (Lesko 2004). Upstream and downstream migration timing is unknown, since volitional fish trapping does not occur at the project dams, and only 9 bull trout have been sonic tagged. Bull trout apparently migrate out of Rush Creek as yearlings or young-of-the-year (Pers. comm. J. Byrnes, WDFW 2004). One, two and three-year old bull trout were captured in a screw trap at the confluence of the Lewis River and Swift Creek reservoir (PacifiCorp and Cowlitz PUD 2004). In other systems, downstream migration of juvenile bill trout from spawning and rearing areas has been documented during every month of the year (Hemmingsen et al. 2002).

3.3 BULL TROUT POPULATION DYNAMICS

Bull trout populations are patchily distributed at multiple spatial scales, such as throughout their range, within the Columbia River DPS, and at the local level of the Lewis River basin. This patchy distribution even occurs in watersheds with pristine wilderness characteristics (Rieman and McIntyre 1995). It is thought that groups of local populations of bull trout may function as a metapopulation of some form at the core area level or local level. In general, a true metapopulation is a collection of relatively isolated, spatially distributed, local populations bound together by the potential for dispersal between populations to the extent that if one local population was extirpated, the habitat could potentially be recolonized by dispersal of individuals from another local population. A less rigorous definition of a metapopulation requires that the extent of dispersal between local populations only be enough to sustain some level of genetic interaction over time. The evidence of whether or not local populations of bull trout actually function as a true metapopulation is equivocal (Whitesel et al. 2004).

The determination of whether or not a metapopulation exists in the Lewis River basin has management implications. There are potential serious and detrimental consequences to management and monitoring of incorrect assumptions about metapopulation structure. Ignoring metapopulation structure, if it exists, has several potential risks (Cooper and Mangel 1999). For example, when metapopulation structure exists (especially source-sink dynamics), the abundance of a species in an area can be disconnected from the specific survivorship or habitat availability of that particular area (owing to the effects of immigration from another nearby local population). This could lead to lack of detection of detrimental impacts in the sink areas until the sink areas go extinct. In addition, if abundance is no longer a good indicator of habitat quality because abundance is driven by immigration and not production within the deme, then managers may waste resources by conserving the wrong type of habitat (Whitesel et al. 2004). Conversely, if metapopulation structure is assumed where it does not actually exist, it could result in insufficient attention to the fate of relatively distinct local populations, under the assumption that they will be rescued by migrants from healthier, nearby populations (Whitesel et al. 2004).

Another approach is to focus on conserving key processes (for example: dispersal and linkages between landscapes, life history, phenotypic diversity, and patch size requirements) that likely contribute to persistence whether metapopulations exist or not, rather than designing minimal linkage networks based on a perceived, underlying metapopulation dynamic (Rieman and Dunham 2000).

Although, local populations may not act as true metapopulations, there may be substantial interactions between local populations, especially within the Lewis River basin. Based on recent studies, North Fork Lewis River bull trout appear to be functioning in some type of source-sink dynamic, where the fish spawning in tributaries to Swift Creek Reservoir may be contributing substantially to individuals located downstream in Yale Lake and Lake Merwin. Neraas and Spruell (2004) conducted genetic analysis on bull trout collected in 1998 and 2003 from known bull trout spawning tributaries in the North Fork Lewis River and from Lake Merwin, Yale Lake, and Swift Creek Reservoir. They found significant genetic differentiation among bull trout collected in the Lewis River.

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Surprisingly, Pine Creek and Rush Creek were the most highly differentiated sites even though there are no physical passage barriers between these two streams, which are located relatively close together. Both Pine and Rush creeks are tributaries to Swift Creek Reservoir.

Conversely, individuals collected in Yale Lake and Lake Merwin, and Cougar Creek (spawning tributary to Yale Lake) had no statistically significant differences in allele frequencies. The allele frequencies in the areas downstream of Swift Creek Reservoir were also consistently intermediate to those estimated in Pine and Rush creeks. Based on this data, Neraas and Spruell (2004) suggests that sites downstream of Swift Creek Reservoir are comprised of a mixture of individuals from both creeks.

Another consideration of bull trout population dynamics are guidelines for effective population size that will be required to sustain the Lewis River population through time. The number of spawners per year is a good measure of the effective population size (Whitesel et al. 2004). From 1979 through 2003, the number of adult bull trout observed spawning in Cougar Creek, the only spawning tributary to Yale Lake, has ranged from 0 in 1981 and 1982 to 40 in 1979 (based on annual peak counts) (Figure 3.3-1). The low number of spawners observed in the early 1980s may be related to impacts associated with the May 1980 eruption of Mount St. Helens.

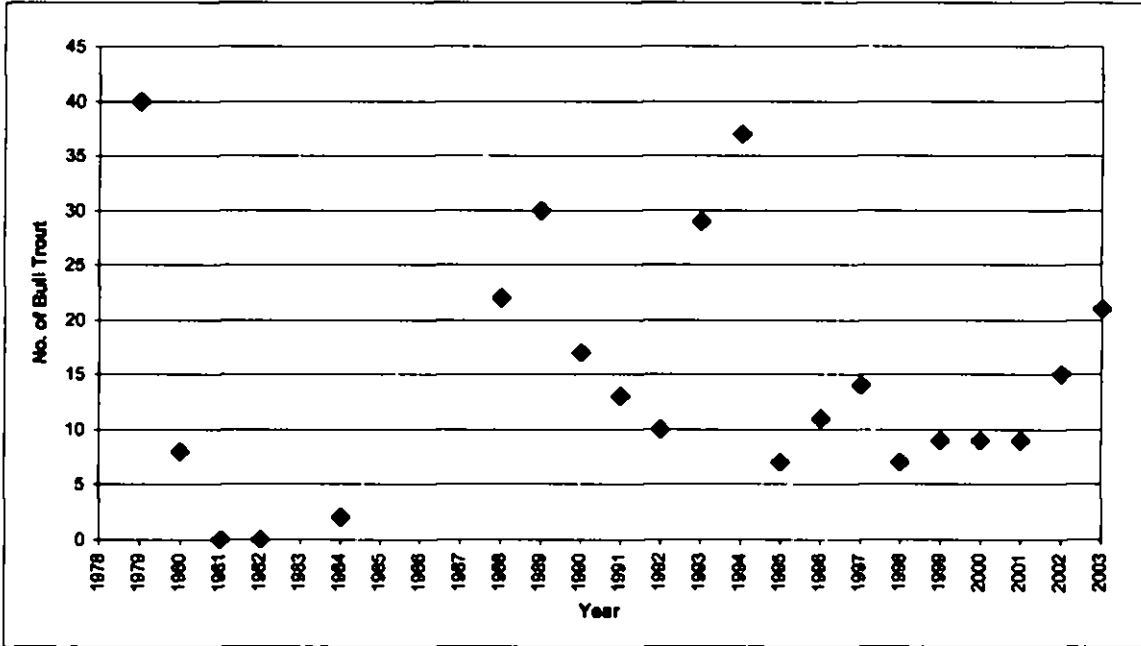


Figure 3.3-1. Annual peak counts of bull trout spawners observed in Cougar Creek 1979 through 2003 (Lesko 2004).

Spawners were counted using snorkel and foot surveys. Neither of these surveys were conducted in a manner that will allow an estimate of total spawners per year with an associated confidence level. Of note is that estimating bull trout spawning population size is notoriously difficult (Sankovich et al. 2003 and 2004; Maxell 1999; Dunham et al. 2001; Rieman and McIntyre 1996; Shappart 1998; Howell 1999). Therefore, the data should be considered preliminary, although it does provide an order-of-magnitude

estimate of the number of spawners per year in Cougar Creek (i.e., the true spawning population is likely somewhere between zero and 100). The data also indicate that in some years a large percentage of spawners in Cougar Creek may be from fish captured in the Yale Lake tailrace. In some years, over 28 percent of spawners in Cougar Creek were derived from fish captured in the Yale Lake tailrace and transported to the mouth of Cougar Creek (Lesko 2004). Because these surveys are not thought to have covered the entire spawning period, WDFW believes that bull trout spawners in Cougar Creek may be undercounted.

In addition to the survey work conducted in Cougar Creek, the USFS, WDFW, and PacifiCorp have been collecting distribution and abundance data about bull trout in Rush and Pine creeks, the primary spawning tributaries for bull trout in Swift Creek Reservoir (Faler and Bair 1992; Lesko 2002). In Swift Creek Reservoir, spawner abundance has increased since the early 1990s. Between 1994 and 2003, the annual spawner population estimated in Swift Creek Reservoir has ranged from 101 to 911 fish (Figure 3.3-2) (Lesko 2004).

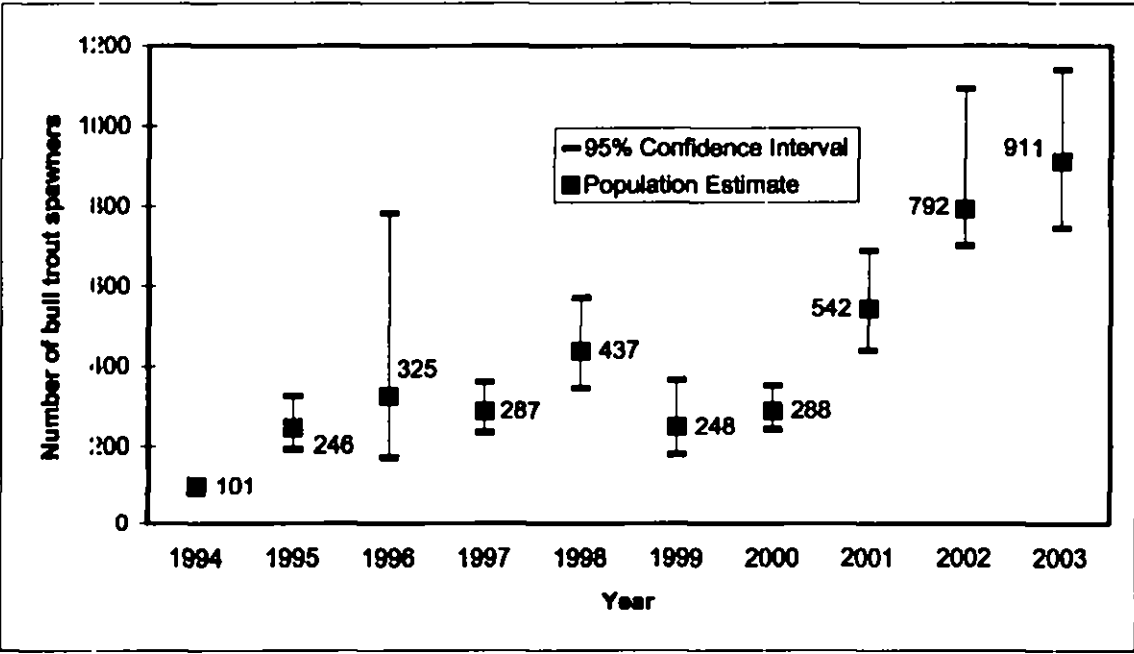


Figure 3.3-2. Spawning population estimate of bull trout in Swift Creek Reservoir for the years 1994 through 2003 (WDFW graph excerpted from Lesko 2004).

Assuming that snorkel efficiencies are similar in Pine and Rush creeks, approximately 22 percent of the fish spawned in Pine Creek and 78 percent spawned in Rush Creek in 2003. However, the physical attributes of each stream suggest that snorkel visibility may be better in Pine Creek, which is less steep (average gradient of 4 percent in the lower 8 miles) compared to Rush Creek (average of 8 percent in the bull trout zone), and has more sunlight penetration due to the broad valley form and limited overhanging vegetation (Kinney and Lampo 2002). Rush Creek is steep with many cascades and rapids that cannot be snorkeled, and the valley is relatively narrow. The steep valley

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walls and dense overhanging vegetation also limit light penetration in Rush Creek, which diminishes snorkel visibility.

Guidelines on effective population size appear to apply reasonably well to bull trout (see Rieman and Allendorf 2001 for review). Generally, it is recommended that a spawning population (N_e) should exceed 50 to avoid inbreeding depression and that the population should exceed 500 to avoid the loss of genetic and phenotypic variation through drift (Whitesel et al. 2004). The $N_e > 50$ rule applies to the short term viability of a population and the $N_e > 500$ rule applies to long term population persistence and viability. Since few local populations may support spawning numbers greater than 500 (see Rieman and Allendorf 2001), effective populations of this size may often require the possibility of gene flow between local populations (i.e. metapopulation) (Whitesel et al. 2004). When detailed information is lacking, Whitesel et al. (2004) suggest that these guidelines will be the most useful tool for managers to apply for avoiding loss of genetic variation and trying to ensure population persistence. However, detailed information for a population may allow the justification of effective population sizes larger or smaller than 50 or 500. If possible, when estimating the population size necessary for persistence, managers should consider, for example, demographic risks and selective pressures as well as stochastic and historical events in addition to genetic risks (Whitesel et al. 2004).

In the North Fork Lewis River basin, the population dynamic appears to approximate a source-sink relationship, where bull trout produced in Swift Creek Reservoir tributaries contributed substantially to individuals found downstream of Swift Creek Reservoir, and function as some form of metapopulation (although not a true metapopulation due to upstream passage constraints). Therefore, it is reasonable to apply the above effective populations size criteria to the metapopulation of North Fork Lewis River bull trout as a whole. Based on spawner abundance estimates presented in Figures 3.3-1 and 3.3-2, the North Fork Lewis River population appears to exceed the N_e greater than 50 criteria, and therefore, inbreeding depression and short-term genetic viability are not likely a concern. In addition, based on the trends in Figure 3.3-2, N_e may be greater than 500. If annual spawner abundance continues to remain above 500, then loss of genetic or phenotypic variation through drift may not be of major concern. Although genetic issues may not be a concern for North Fork Lewis River bull trout if the effective population size remains well above 500 spawners per year, stochastic and historical events may pose additional risk to the population above genetic risks, evidenced by the range of variation in yearly spawner abundance exhibited in the long term record presented in Figures 3.3-1 and 3.3-2.

3.4 BULL TROUT CRITICAL HABITAT

On September 21, 2004, the USFWS designated 1,748 miles of streams and 61,235 acres of lakes in Oregon, Idaho and Washington as critical habitat for bull trout, a threatened species, in the Columbia and Klamath river basins (50 CFR Part 17, RIN 1018 AI52). Designated critical habitat in the Lewis River basin includes the lower Lewis River downstream of Merwin Dam; the upper Lewis River up to the barrier falls; a portion of Pine Creek and one tributary; and an un-named tributary (referred to as S15) to Swift Creek Reservoir (Figure 3.4-1).

Bull trout are known to use other habitats in the Lewis River basin including Lake Merwin, Yale Lake, Swift Creek reservoir, Rush Creek, and Cougar Creek, and the Swift bypass reach; however, the USFWS did not designate these areas as critical habitat.

The USFWS believes that the benefits of exclusion of these areas as designated critical habitat outweigh the benefits of inclusion of these areas (50 CFR Part 17, RIN 1018 AI52). The primary reason for exclusion of the reservoirs was due to human health and safety concerns from flood management operations.

The USFWS also excluded other habitats, such as Swift Creek arm and Cougar Creek, based on the establishment of conservation covenants for these streams. A detailed rationale for the designation of bull trout habitat in the Lewis River basin is given in *Lower Columbia Recovery Unit Designated Critical Habitat (Final) Justification Narrative* (USFWS unpublished) and (50 CFR Part 17, RIN 1018 AI52). Some stream reaches included in the proposed critical habitat designation have been excluded from the final designation (Speelyai, Rain, and Ole Creeks, a portion of the Swift bypass reach, the upper Lewis River above the lower falls, and Pine Creek tributaries P8 and P10) based on the lack of historical documentation of occupancy by bull trout or for biological reasons, primarily due to habitat degradation and high water temperature.

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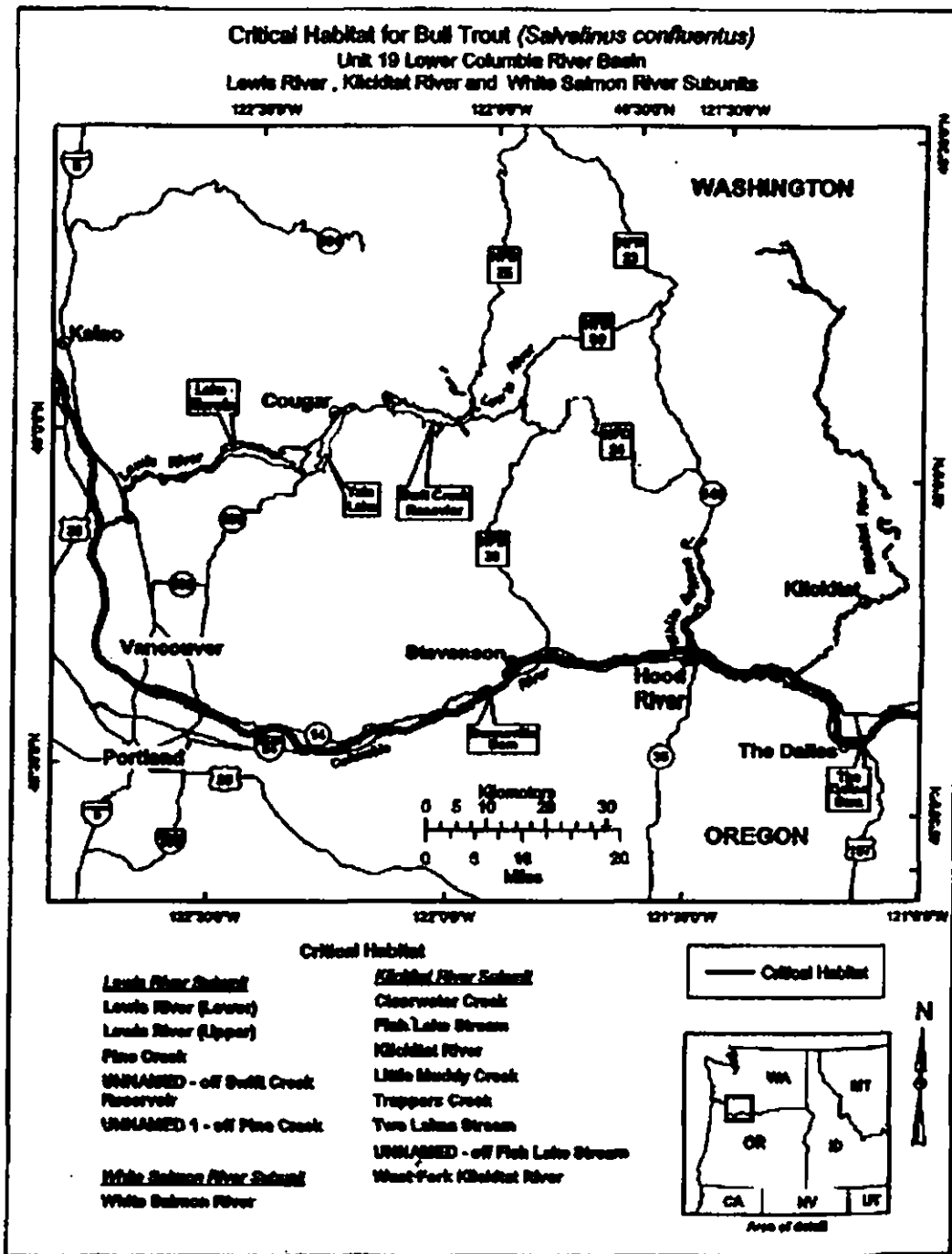


Figure 3.4-1. Designated bull trout critical habitat in the Lewis River basin (50 CFR Part 17, RIN 1018 AI52).

3.5 OTHER FEDERAL LISTED, PROPOSED, OR CANDIDATE SPECIES

The USFWS has provided a list of all endangered, threatened, and candidate species of animals and plants that are known to occur or that may occur in the North Fork Lewis River basin (Appendix B). This section provides a brief description of terrestrial surveys

conducted on the North Fork Lewis River associated with relicensing of the 4 hydropower projects, as well as additional surveys for some species.

Specific surveys were conducted during Yale relicensing studies for species that either have standard survey protocols or are closely associated with specific habitats with well-defined boundaries (e.g., streams, wetlands, and caves) (see PacifiCorp 1999). Other listed species, mostly birds, which are very mobile and more wide-ranging, were covered during seasonal surveys. No specific surveys were conducted for the gray wolf and grizzly bear, and it is unlikely that these species occur in the study area due to lack of suitable habitat.

Two federally listed species, the bald eagle and the spotted owl, were documented in the study area during the 1996-1997 field studies. There were no observations of wolves during the 1996-1997 field studies and the WDFW PHS has no records for this species in or near the study area. In general, it is unlikely that the North Fork Lewis River Valley in the vicinity of the Yale Project provides the isolation from human activity that the wolf needs for long-term survival; this species may, however, occasionally move through the study area.

3.5.1 Golden Paintbrush (threatened)

Golden paintbrush (*Castilleja levisecta*) is a perennial herb with showy yellow bracts. The flowers themselves are fairly inconspicuous, and hidden by the bracts. Golden paintbrush is strongly associated with open grasslands. The plants tend to grow on gravelly glacial outwash or depositional substrates in full sun, at elevations from 10 to 300 feet (WNHP and BLM 1997).

Golden paintbrush was federally listed as a threatened species in 1997 (62 FR 112). Its historic range extended from British Columbia to Linn County, Oregon, west of the Cascades. At the current time, only ten populations are known to exist in Washington. The population closest to the project area is located in Thurston County, about 60 miles to the north.

Consultation by PacifiCorp and Cowlitz PUD with the resource management agencies indicated that golden paintbrush will not be likely to occur in the area, although there are historic occurrences in Clark County. Botanists did not observe this species during rare plant surveys conducted in 2000 or 2001. For these reasons, we do not discuss this species further in this document.

3.5.2 Water Howellia (threatened)

Water howellia (*Howellia aquatilis*) is an annual herb with small white flowers. Although it is an aquatic plant, the seeds require exposure to air for germination. It grows in vernal ponds, shallow lake margins, and wetlands where soils dry out in late summer or early fall.

The USFWS listed water howellia as a threatened species in 1994 (59 FR 134). It is considered a regional endemic species and is thought to be extirpated from California and

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Oregon, but populations have recently been documented in Montana, Idaho and Washington. A site near Vancouver, Washington, contains two small populations in close proximity to one another (Gamon, 1992).

Consultation by PacifiCorp and Cowlitz PUD with the resource management agencies indicated that water howellia will not likely be present in the project area. Botanists did not observe this species during rare plant surveys conducted in 2000 or 2001; therefore, we do not discuss this species further in this document.

3.5.3 Bradshaw's Lomatium (endangered)

Bradshaw's lomatium (*Lomatium bradshawii*) is a tap rooted perennial herb with small, yellow flowers. It grows in seasonally flooded low-elevation grasslands along creeks and small rivers.

The USFWS listed Bradshaw's lomatium as an endangered species in 1988 (53 FR 190) and completed a draft recovery plan in 1993. The species' range includes the Puget Trough of western Washington and the central and southern portions of the Willamette Valley in Oregon. Most occurrences (38, as of 1992) are in Oregon. The only known occurrences in Washington (two, as of 1994) are located on private land in Clark County (CPC, undated).

Consultation by PacifiCorp and Cowlitz PUD with the resource management agencies indicated that Bradshaw's lomatium will not be likely to occur in the project area. Botanists did not observe this species during rare plant surveys conducted in 2000 or 2001. For these reasons, we do not discuss Bradshaw's lomatium further in this document.

3.5.4 Nelson's Checker-mallow (threatened)

Nelson's checker-mallow (*Sidalcea nelsoniana*) is a perennial herb that grows up to 40 inches tall. It produces pink-to-purple flower spikes from mid-May through September, depending on site-specific conditions. It is found in grasslands and wet meadows, or in relatively open areas along streams, roadsides, and fence lines where some remnants of prairie habitat persist.

Nelson's checker-mallow was listed as threatened in 1993 (58 FR 28). The species is a regional endemic, growing from southern Benton County, Oregon north to Lewis County, Washington (WNHP and BLM 1997). Nelson's checker-mallow has been documented at one site in Cowlitz County, northwest of the project area, near Longview.

Consultation by PacifiCorp and Cowlitz PUD with the resource management agencies indicated that Nelson's checker-mallow will not be likely to occur in the project area. Botanists did not observe this species during rare plant surveys conducted in 2000 or 2001; therefore, Nelson's checker-mallow is not discussed further in this document.

3.5.5 Mardon Skipper (candidate)

The Mardon skipper (*Polites mardon*) is a small, tawny-orange butterfly. The adults feed on nectar from several herbaceous plants, including common vetch, strawberry, penstemon, hawkweed, geranium, and yarrow. Occupied sites can be characterized as open grasslands within ponderosa pine savanna or grassy openings in the grand fir zone at elevations ranging from 1,800 feet to 5,500 feet. Mardon skippers are non-migratory, and dispersal is thought to be limited.

As of 2003, Mardon skippers were known from 4 separate areas in the Pacific Northwest: the northern coast of California, the Siskiyou Mountains of southern Oregon, the south Puget Sound prairie, and the Washington Cascades in the vicinity of Mt. Adams (USFWS 2004). Mardon skippers have been documented at 43 sites in the southern Washington Cascades, including 6 sites in the upper Cispus watershed and 2 sites in the Little White Salmon watershed on the Gifford Pinchot National Forest (GPNF).

The Lewis River projects do not support any ponderosa pine or grand fir plant associations, and are situated at lower elevations than sites that are so far known to support Mardon skippers. For these reasons, we do not expect the species to occur in the project area and do not discuss it further in this document.

3.5.6 Oregon Spotted Frog (candidate)

The Oregon spotted frog (*Rana pretiosa*) is highly aquatic year-round, never moving far from permanent water. This species inhabits the margins of streams, ponds, and shallow or slow-moving water where emergent vegetation is abundant, and where the substrate is covered with thick layers of organic debris that can provide refuge (Leonard et al. 1993).

The Oregon spotted frog is endemic to the Pacific Northwest. Its historic range extended from the lower Fraser River Valley in British Columbia through the Puget Trough and Willamette Valley to northeastern California. In Washington, the species is now known from only three locations, in Thurston and Klickitat counties (McAllister and Leonard, 1997).

Several factors have likely contributed to the decline of Oregon spotted frog populations. These include habitat loss and alteration, poor water quality, disease, and predation. Predation by introduced, non-native fish and bullfrogs may be especially important. At two of the three sites where the frogs currently exist in Washington, bullfrogs and non-native fish are absent. At the third site, stomach contents analysis indicates that bullfrogs prey heavily on Oregon spotted frogs. The presence of bullfrogs in many project-area wetlands, together with the scarcity of well-distributed non-woody wetland communities, will likely preclude Oregon spotted frog occurrence.

PacifiCorp conducted surveys for amphibians, targeting the northern red-legged frog, in 26 wetlands associated with the Lewis River projects. In addition to northern red-legged frogs, surveyors identified Pacific tree frogs and bullfrogs, and at four locations, observed egg masses (3), larvae (1) or adults (2), that could not be identified with certainty. No Oregon spotted frogs were observed. We conclude it is unlikely that Oregon spotted

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frogs are present in the project area, and for this reason, will not be affected by continued operation of the hydropower projects. We do not discuss the Oregon spotted frog further in this document.

3.5.7 Columbian White-tailed Deer (endangered)

The Columbian white-tailed deer (*Odocoileus virginianus leucurus*) was listed as endangered in 1967. Based on genetic differences between two geographically isolated populations, USFWS has classified the species into two DPSs. The Douglas County (Oregon) DPS has shown steady upward trends in numbers since 1975, and was delisted in 2003 (68 FR 142). The Columbia River DPS is still considered endangered.

The Columbian white-tailed deer was once locally abundant throughout the grasslands and woodlands of the lower Columbia River and the lower reaches of its tributaries in Oregon and Washington. The remaining population in Washington is restricted to portions of Cowlitz and Wahkiakum counties lying along the Columbia River. The Columbian white-tailed deer is not migratory, and home ranges are relatively small. For these reasons, the Columbian white-tailed deer will not be expected to occur in the Lewis River Project area, and will not be affected by continued operation of the projects. We do not discuss the Columbian white-tailed deer further in this document.

3.5.8 Grizzly Bear (threatened)

The USFWS listed the grizzly bear (*Ursus arctos horribilis*) as a threatened species in 1975 and developed a Grizzly Bear Recovery Plan in 1982. The Interagency Grizzly Bear Committee (IGBC) provides guidance and coordination for recovery actions. The IGBC has identified 6 recovery ecosystems that contain habitat capable of supporting self-sustaining grizzly bear populations. The closest of these (North Cascades recovery ecosystem) is located over 140 miles from the Lewis River Project area, and is thought to be occupied by less than five bears (USFWS 2003).

GPNP contains suitable habitat (GPNP 1999b), but no grizzly bears are known to occur in the vicinity at this time, and the project will not affect them. For this reason, we do not discuss grizzly bears further in this document.

3.5.9 Canada Lynx (threatened)

The Canada lynx was listed as a threatened species in 2000 (65 FR 58). The historic range for the species included both sides of the Cascades in Washington, but very few observations have ever been documented from the west side of the crest (Stinson 2001).

WDFW has designated 6 lynx management zones (LMZs) in Washington. The nearest LMZ (Southwest Okanogan) is located over 150 miles from the project area. Although potential habitat has been mapped at high elevations in the vicinity of Mt. Adams (GPNP 1999c), habitat capability has not been verified on the ground and WDFW's recovery plan notes it is uncertain whether habitat in the south Cascades will actually be capable of supporting reproductive populations (Stinson 2001).

At the current time, populations in Washington are found primarily in high-elevation forests in the north-central Cascades. Most dens that have been documented in the state have been located in mature or older lodgepole pine, spruce or subalpine fir stands. Lynx forage in younger stands, where greater understory structure supports higher populations of their primary prey, snowshoe hare.

The Lewis River Project area is situated at elevations below those typically occupied by Canada lynx, and is not characterized by the habitat types or prey populations that will be considered suitable for this species. Therefore, we do not discuss the Canada lynx further in this document.

3.5.10 Pacific Fisher (candidate)

In April, 2004, the USFWS found that listing of the West Coast DPS of the fisher (*Martes pennanti*) was warranted but precluded by higher priority actions (69 FR 68). While the Pacific fisher's historic range extends throughout most forested areas of Washington, WDFW's 1998 status report indicates the species is currently very rare in the state (Lewis and Stinson 1998). The status report documents one museum record of a fisher taken in Skamania County in 1923, and two sightings from the GPNP (in 1975 and 1984) that are of unknown reliability or were of tracks only.

Fishers are found in closed-canopy forests that are interspersed with small openings and wetlands or riparian habitat, and appear to prefer areas with abundant standing snags and large woody debris on the forest floor. WDFW has mapped potential habitat for fisher in the Cascades (Jacobsen et al. 2003), including Skamania County, and PacifiCorp and Cowlitz PUD mapped potential habitat in the project area, based on the occurrence of mature to old-growth conifer forest. No fishers were observed during the 1996-1997 or 2000-2001 field studies. Due to their rarity in the state and the high degree of forest fragmentation in the Lewis River watershed, it is unlikely that fishers occur in the project area. For this reason, we do not discuss the fisher further in this document.

3.5.11 Gray Wolf (threatened)

The USFWS listed the gray wolf (*Canis lupus*) as an endangered species in 1978 (43 FR 9607). Based on the expansion of naturally establishing packs in Glacier National Park and the success of reintroductions in central Idaho and the Greater Yellowstone area, USFWS downlisted the western DPS, which includes wolves in Washington, to a threatened status in 2003 (68 FR 15804).

The gray wolf was almost totally eradicated from Washington in the 1930s, and species occurrence was restricted to remote forests. However, the gray wolf is highly adaptable in its use of habitat, and populations in the Pacific Northwest are currently expanding into areas characterized by a mix of forests, agricultural lands, and rural residential development (68 FR 15804). Habitat requirements appear to center around availability of unoccupied territory with a sufficient prey base (primarily elk and deer), and human tolerance of their presence.

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Several wolf sightings have been confirmed in Washington since 1990 (Almack and Fitkin 1998). Most of these were documented in the north Cascades and northeastern Washington (Palmquist 2002). Unconfirmed sightings have also been reported from the GPNP, but no wolves were observed during track and camera surveys conducted by the USFS in 2000 (Foster undated). The USFS has mapped potential habitat on the GPNP using GIS to overlay areas of high ungulate populations with areas of low road density (GPNP 1999a).

Wolves are known to disperse as far as 500 miles from their natal packs (68 FR 15804), and it is possible that animals dispersing from established territories in British Columbia, Montana, and Idaho could move through the project area from time to time. However, there is no evidence that wolves are currently established in southwestern Washington. For this reason, we do not anticipate any project effects on the gray wolf, and do not discuss the gray wolf further in this document.

3.5.12 Marbled Murrelet (threatened)

The marbled murrelet (*Brachyramphus marmoratus*), a seabird that nests as much as 50 miles inland from the Washington coast, was listed as a threatened species in 1992 (57 FR 191). The marbled murrelet is typically associated with old-growth conifer forests, but nests have also been documented in younger, mixed stands. The species is known to occur in western Cowlitz County, and critical habitat is designated along the border with Wahkiakum County (61 FR 102). Presence in the project area will be very unlikely, however, due to the distance of the project from saltwater. For this reason, we do not discuss this species further in this document.

3.5.13 Bald Eagle (threatened, proposed for de-listing)

In western Washington, the bald eagle (*Haliaeetus leucocephalus*) is strongly associated with large bodies of water that provide abundant and concentrated forage resources. For nesting, bald eagles typically select large-diameter, open-crowned trees within close proximity to lakes, rivers, reservoirs or saltwater. Preferred perch trees are also located close to shorelines. Roost trees may be found farther from the water, in dense conifer stands that provide thermal cover.

In western Washington, bald eagles prey primarily on fish, but they are opportunistic and their diet varies, to some degree, depending on what is available. When fish are not abundant, bald eagles rely more heavily on waterfowl, small mammals, and carrion.

In 1999, the USFWS proposed to remove the bald eagle from the list of threatened and endangered species, due to the success of recovery efforts throughout the United States (64 FR 128). In the Pacific Recovery Region (in which the Lewis River Projects are located), the number of occupied breeding areas exceeded the recovery goal of 800 in 1990, and by 1998 had increased to 1,480. The productivity goal set for the region (1.0 young produced per nesting area) has also been met or exceeded in Washington.

PacifiCorp has observed bald eagle use in the project vicinity since 1984. PacifiCorp conducts helicopter surveys twice yearly; once between January and March to document

winter use, and once in May or June to record nesting activity. PacifiCorp (Anderson and Ichisaka 1986) and the WDFW PHS have also documented several roost sites and perch trees used by bald eagles in the project area.

Results of past studies and on-going survey efforts suggest that bald eagles use portions of the study area year-round for breeding, foraging, perching, and roosting. Bald eagles are regularly observed flying over the reservoirs or perched in trees along the shorelines below the project dams. Active bald eagle nests are located along all three project reservoirs. Table 3.5-1 shows the results of productivity surveys between 1993 and 2002. PacifiCorp has also monitored a nest downstream of the project, near Woodland. The nest has been active since 1997, and has produced young each year except 1997.

Table 3.5-1. Productivity of bald eagle nests in the vicinity of the Lewis River hydroelectric projects, based on data from aerial surveys conducted by PacifiCorp.

Year	Drift Creek	Swift Dam	Yale Dam	South Merwin	Total Young	Number of Successful/Occupied Territories	Number of Young/Occupied Territory
1993	UNK	-	F	-	0	0%	0
1994	A/1	-	A/1	-	2	100%	1.0
1995	A/2	F	F	F	2	25%	0.5
1996	A/2	A/1	A/1	UO	4	100%	1.33
1997	F	A/2	A/1	UNK	3	66%	1.0
1998	A/2	O	UO	A/2	4	66%	1.33
1999	UO	UO	A/1	A/1	2	100%	1.0
2000	O	A/2	UO	UO	2	50%	1.0
2001	A/2	O	O	A/1	3	50%	0.75
2002	O	UNK	A/2	F	2	66%	0.66
2003	A	UNK	A	A		---	---
Total	9	5	6	4	24	x = 62%	x = 0.86

A/# = Active (incubation observed)/# produced; O = Occupied (adults present but no incubation observed); UO = Unoccupied; UNK = Unknown; F = Active, failure (incubation observed but no young produced).

Between 1993 and 2002, the annual success rate for nests located within the project area has averaged 62 percent. The mean productivity between 1993 and 2002 has averaged 0.86, slightly less than the recovery objective of 1.0 young per occupied territory.

PacifiCorp has conducted winter surveys since 1991. The results have varied considerably from year to year. The lowest number of bald eagles recorded was 5 in 2001, while 80 birds were observed during the 1996 survey. Currently, PacifiCorp reports 6 communal roost sites at Swift Reservoir, 7 at Yale, and 4 at Merwin.

3.5.14 Northern Spotted Owl (threatened)

The northern spotted owl (*Strix occidentalis*) was listed as a threatened species in 1990 (55 FR 123). The northern spotted owl generally nests in old-growth or mature conifer forests, but may use younger stands for roosting, foraging and dispersal.

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An interagency team completed a draft recovery plan for the northern spotted owl in 1992, but the plan has not been finalized. Critical habitat was designated on federal land in 1992 (47 FR 10). In the project vicinity, this includes NFS lands to the north and south of Swift Creek Reservoir. Federal 4(d) rules and state Forest Practice Rules apply to management of the species on non-federal lands in Washington.

Northern spotted owls are known to nest in Clark, Cowlitz, and Skamania counties. WDFW has documented more than 20 breeding pairs in the project vicinity. Territories of 15 pairs are contiguous with the project area. The highest density of breeding territories is south of Swift Creek Reservoir and east of Yale Lake. Territories are also located along Range and Drift creeks, the south side of the Lewis River bypass reach, the east and west shores of Yale Lake, and the north shore of Lake Merwin.

No activity centers have been identified within the study area, most likely due to the lack of old-growth and mature forest. During a seasonal wildlife survey conducted in June of 1996, one spotted owl was observed in a stand of old-growth conifer on GPNF lands in the northeastern portion of the study area, just off USFS Road 90. The owl was not resighted on a follow-up visit to the stand or during subsequent seasonal surveys.

3.6 OTHER IMPORTANT SPECIES OF RECORD

Coastal cutthroat trout and lamprey have received increasing attention from resource managers, tribes, and other environmentally concerned entities. In the Lewis River basin, cutthroat trout and Pacific lamprey have been identified as species of concern by the USFWS and have, therefore, been included in this analysis even though neither species has a formal ESA status.

3.6.1 Pacific Lamprey

On January 23, 2003, a group of 11 non-governmental organizations petitioned the USFWS to list four species of lamprey in California, Oregon, Washington, and Idaho as threatened or endangered species under the ESA. These four species include Pacific lamprey (*Lampetra tridentate*), river lamprey (*L. ayresi*), Western brook lamprey (*L. richardsoni*), and Kern brook lamprey (*L. hubbsi*). In December 2004, the USFWS found that the petition and additional information in its files does not present substantial scientific or commercial information indicating that listing these species may be warranted (69 FR 77158).

Like Pacific salmon, Pacific lamprey are anadromous. They hatch and rear in freshwater streams, migrate out to the ocean, and return to freshwater as mature adults to spawn. Pacific lamprey belong to a very unique class of fish known as agnathans, or "jawless fishes." As the name implies, transformed individuals (non-larval lamprey) are jawless, with a nearly circular buccal funnel (oral suction disk) on the underside of the head. This funnel, the point of attachment for parasitic feeding, contains a raspy tongue and sharp teeth (Scott and Crossman 1973). The size of adult Pacific lamprey is variable. Adults can reach a length of 76 cm (30 in) and weigh over half a kilogram (1 lb.). In freshwater,

larval Pacific lamprey (ammocoetes) spend their larval years as sedentary, blind filter feeders (Moore and Mallat 1980).

The distribution of Pacific lamprey is similar to that of Pacific salmon. They are found in coastal streams along the Pacific coast, from Baja California to the Bering Sea in Alaska and Asia. The species is rare north of the Alaska Peninsula. In Washington, Pacific lamprey are found in most large coastal rivers including the Columbia, Snake, and Yakima river systems (Wydoski and Whitney 1979). Little is known about the marine distribution of the species.

The spawning migration of adult Pacific lamprey usually extends from July to October (Scott and Crossman 1973). They ascend rivers by swimming upstream briefly, then attaching to rocks and resting. Feeding appears to cease during the early stages of upstream migration. Upon entering freshwater, the sexually immature lampreys overwinter attached to stones or other structures. Starting in early spring the lamprey continue their voyage to the spawning grounds in the headwaters (Scott and Crossman 1973). Migrating lamprey may travel up to several hundred miles to their spawning grounds where both sexes will build a nest through sinuous body movement and suction. In the Columbia River system, the Pacific lamprey has been estimated to move 4.5 km (2.8 miles) per day (Kan 1975). A moderately strong swimming ability and the capacity to cling to rocks, dams, and fishways enable them to surmount most obstacles (Scott and Crossman 1973). During this freshwater migration the Pacific lamprey does not eat, and shrinkage in body size has been measured around 20 percent (Beamish 1980).

Pacific lamprey spawn in the headwaters of both large and small streams in low gradient, sandy gravel areas located at the upstream end of riffles (Kan 1975, Scott and Crossman 1973). Spawning takes place in spring (from April to July) when water temperatures are between (10 and 16°C) (50 and 60°F). Males will spawn with more than one female in different nests. Adults die within 4 days of spawning, after depositing about 10,000 to 100,000 extremely small eggs in their nest (Scott and Crossman 1973). Lower fecundity may be associated with those lampreys spawning further inland due to the higher bioenergetic cost of migration. Upon initial spawning, the eggs are adhesive and will stick to the substrate for 2 hours, during which they are covered by substrate material stirred up by additional spawning activity.

Lamprey eggs hatch within 2 to 4 weeks, depending on water temperature. At 15°C (59°F), hatching time is 19 days (Pletcher 1963). After hatching, the larvae remain in the gravel for approximately 2 or 3 weeks before emerging and drifting to backwater or eddy areas with low water velocities and soft substrate. The juvenile lamprey then burrow into the substrate (typically silt/mud) and stay burrowed for 4 to 6 years, moving only rarely to new areas. During this period, the ammocoetes are blind, sedentary filter feeders (Richards 1980; Kan 1975; Pletcher 1963). Before emerging from the substrate, the ammocoetes undergo a metamorphosis lasting approximately 2 months where morphological and physiological changes prepare them for a parasitic life at sea. This metamorphosis is triggered by unknown factors, but is generally complete by October or November (Beamish and Levings 1991). Larvae emerge from the substrate at this time as young adults and burrow themselves into cobble and gravel substrate while continuing to develop (Pletcher 1963). In the late fall or early spring, the juveniles emerge and take

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advantage of high flows to migrate to the ocean (Beamish and Levings 1991). During its ocean phase, Pacific lamprey are scavengers, parasites, or predators on larger prey such as salmon and marine mammals. After 2 to 3 years in the ocean they return to freshwater to spawn.

Based on our review of existing literature, no information currently exists describing the abundance and distribution of Pacific lamprey in the Lewis River basin. However, lamprey ammocoetes have been observed in Siouxon Creek and in the bypass reach (Pers. comm. J. Byrnes, WDFW 2004; F. Shrier, PacifiCorp 2004). Current stocks of the Pacific lamprey in the Columbia and Snake river systems are in a steep decline (Close et al. 1995). Due to their role in the food web of North Pacific ecosystems as predator and prey, and their status as a food and cultural resource for the Pacific Northwest Indian Tribes, plans for restoration of the stock are currently being developed (Close and Aronsuu 2003).

3.6.2 Coastal Cutthroat Trout

A NOAA-Fisheries status report on sea-run cutthroat trout in the lower Columbia River (NMFS 1999) indicates that returns of both naturally spawned and hatchery produced fish have declined in almost all lower Columbia river tributaries over the past 10 to 15 years. One of the key concerns is the potential reduction in life-history diversity. In many streams, freshwater forms are well distributed with relatively high abundance in comparison to the anadromous forms in the same streams. NOAA-Fisheries concluded that habitat degradation and poor ocean and estuarine conditions are the likely causes of the severe depletion of anadromous forms of sea-run cutthroat trout. Therefore, on April 5, 1999, NOAA-Fisheries and the USFWS jointly issued a proposed rule for the listing of the southwestern Washington/Columbia River sea-run cutthroat trout ESU as threatened under the ESA (Federal Register, Vol. 64, No. 64, April 5, 1999). The ESU includes populations of coastal cutthroat trout in the Columbia River and its tributaries downstream from the Klickitat River in Washington and Fifteen Mile Creek in Oregon (inclusive) and the Willamette River and its tributaries downstream from Willamette Falls. Cutthroat trout found in the Lewis River are included in this ESU, although the status of Lewis River coastal cutthroat trout is currently unknown because of "insufficient quantitative information to identify a trend in abundance or survival" (WDFW 2000). NOAA-Fisheries no longer manages coastal cutthroat trout. This responsibility was assigned to the USFWS. The Washington/Columbia River sea-run cutthroat trout is no longer proposed for listing.

Coastal cutthroat trout are native to the Pacific Northwest, western Canada, and southwestern Alaska. Their distribution extends from the Eel River in northern California to Prince William Sound in Alaska, extending to Gore Point on the Kenai Peninsula (Scott and Crossman 1973). The eastern range is bounded by the Cascade Mountain Range in California, Oregon, and Washington and by the Coast Range in British Columbia and southeastern Alaska (Johnson et al. 1999).

The life history of coastal cutthroat trout is extremely complex (Johnson et al. 1999, Trotter 1991). Both migratory and non-migratory (anadromous, adfluvial, fluvial, and resident) forms may be present within the same population. These variations in life

history may be related to environmental conditions, particularly those affecting growth rates. The Lewis River basin contains both migratory and non-migratory life history types.

Although sea-run coastal cutthroat trout belong to the same genus as Pacific salmon and steelhead, they are generally smaller, rarely over-winter at sea, and do not usually make extensive ocean migrations (Johnson et al. 1999). Like steelhead, coastal cutthroat trout are capable of spawning more than once, and adults have been known to spawn each year for more than 6 years (Johnson et al. 1999). Although relatively small, growth and potential maximum size are highly variable. Most adult anadromous coastal cutthroat trout range from about 0.7 to 1.8 kg (1.5 to 4 lbs.) (Scott and Crossman 1973).

All cutthroat trout, regardless of their life history type, are spring spawners. Actual spawning time depends on latitude, altitude, water temperature, and flow conditions (Trotter 1991). Depending on their time of freshwater entry, anadromous coastal cutthroat trout (sea-run cutthroat trout) in Washington, Oregon, and British Columbia are referred to as either "early entering" or "late entering." Early entering stocks migrate to freshwater from late June through October, reaching a peak in September and October. Late entering stocks return to freshwater from December through March (Trotter 1991). Early entering fish are typically found in larger streams with summer low flows greater than 45 cubic feet per second (cfs). Late entering stocks utilize smaller streams that often flow directly into salt water (i.e., Puget Sound). In both cases, run timing is fairly consistent from year to year for specific streams, but can be highly variable between streams in different geographic regions (Johnston 1982). In the Lewis River basin, sea-run cutthroat trout enter freshwater from early October through mid-December (WDFW 2000).

Coastal cutthroat trout spawning in the Lewis River basin typically starts in early February and continues through late April, with a peak in February (PacifiCorp and Cowlitz PUD 2004a). Spawning takes place in the upper reaches of small, low gradient streams and in the upper reaches of small tributaries of moderate-size streams. Often these relatively small systems contain low gradient sloughs or wetlands in their lower reaches. The volume of water in sea-run cutthroat trout spawning streams seldom exceeds 10 cfs during the low flow period, with most averaging less than 5 cfs (Johnston 1982, Trotter 1991). Population genetics studies have shown that homing in sexually mature sea-run cutthroat trout is relatively precise; however, immature fish do not always return to their home stream (Trotter 1991).

In Oregon, sea-run coastal cutthroat trout were reported to lose between 29 and 38 percent of their body weight during spawning. Despite this substantial weight loss, an average of 41 percent of the spawned out adults in Washington and Oregon survive and return to saltwater in late March or early April. Typically, this occurs about one month before the peak out-migration of sea-run cutthroat trout smolts (Trotter 1989).

Sea-run cutthroat trout eggs hatch in approximately 6 to 7 weeks, and alevins remain in the gravel for another 1 or 2 weeks prior to emergence. Peak emergence of fry typically occurs from March through June (Trotter 1991). In the Lewis River basin, emergence extends from mid-March through late June (PacifiCorp and Cowlitz PUD 2004a).

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While rearing in freshwater, young sea-run coastal cutthroat trout are opportunistic feeders. Fry begin feeding on small invertebrates between 14 to 23 days after hatching (Scott and Crossman 1973). As they increase in size, they begin to feed on larger aquatic and terrestrial insects, salmon eggs, and small fish. Food availability is very important in determining microhabitat distribution, and often sea-run cutthroat trout are in direct competition with coho salmon and steelhead (Pauley et al. 1989). This competition can lead to the displacement of cutthroat fry from their preferred habitat.

After surviving their first winter in freshwater, non-smolting juvenile coastal cutthroat trout range more widely than young-of-the-year fish. Many begin to move downstream into mainstem reaches; however, this net downstream movement lasts only until the onset of higher winter flows (November through January). Winter freshets trigger an upstream movement that often takes the fish back into the smaller tributaries. This movement may be in response to seasonal physiological changes, changing stream flows, food availability, or crowding due to recruitment (Trotter 1989).

Juvenile sea-run coastal cutthroat trout migrate to sea between the ages of 1 and 6; however, the majority are reported to migrate at age 2, 3, or 4 depending on their geographic location (Trotter 1987). Data have shown that the age at which sea-run cutthroat trout smolting first occurs is somewhat size-dependent. Fish that spend more time in freshwater prior to outmigration (i.e., age 3 and 4 fish) tend to grow slower, and are only slightly larger than age 2 outmigrants. Throughout Washington, Oregon, and British Columbia the average age of sea-run cutthroat trout outmigrants is 3 or 4. Fish in these age groups have an average length of 20 to 25 cm (7.9 to 9.8 in) (Pauley et al. 1989). In most of Washington and Oregon, the juvenile outmigration begins as early as March and peaks in mid-May. In the Lewis River basin, outmigration extends from early April through late June (PacifiCorp and Cowlitz PUD 2004a).

Throughout most of Washington State, sea-run cutthroat trout reach sexual maturity at age 4 and 5, following their first year in the marine environment (Johnston 1982). However, a small percentage of Columbia River and Puget Sound sea-run cutthroat will not reach sexual maturity until they spend a second year at sea. In the Cowlitz River, 85 percent of the male and 69 percent of the female fish (hatchery returns) were reported to be sexually mature on their initial return to the river (Tipping 1986). The remaining sexually immature 1-salt fish return to freshwater to simply feed and over-winter. These fish will not spawn until the following year.

Anadromous, fluvial, adfluvial, and resident forms of coastal cutthroat trout are found throughout the Lewis River watershed (WDFW 2000, PacifiCorp 1999). The anadromous form (sea-run cutthroat trout) is currently found in the North Fork Lewis River and its tributaries up to Merwin Dam (RM 19.4) and in the East Fork Lewis River up to Lucia Falls. Fluvial and resident coastal cutthroat trout are found throughout the upper and lower watershed (upstream and downstream of Merwin Dam), and adfluvial fish have been observed in Lake Merwin, Yale Lake, and Swift Creek Reservoir (WDFW 2000). Although hatchery-origin anadromous cutthroat trout have been released as smolts into the mainstem North Fork Lewis annually (Cowlitz River and Skamania River stocks), the existing Lewis River coastal cutthroat trout stock is considered native with wild production (WDFW 2000). WDFW staff believes that few genetic interactions have

occurred between wild and hatchery populations, although recently, WDFW has elected to discontinue cutthroat trout production at the Merwin Hatchery (PacifiCorp and Cowlitz PUD 2004a). The existing Merwin FERC license requires the production of approximately 25,000 juvenile sea-run cutthroat trout (up to 6,250 pounds). An amendment to the Merwin license in 2000 eliminated the sea-run cutthroat requirement and added 25,000 steelhead.

Information describing the abundance of coastal cutthroat trout in the Lewis River basin is extremely limited. According to WDFW (2000) there are no data available describing average run size distribution in the basin. In 1998, sea-run cutthroat trout creel survey results on the Lewis River showed a catch of only 20 fish (Hillson and Tipping 1999).

Resident cutthroat trout were the most abundant salmonid species captured during PacifiCorp's 1996-1997 fish population surveys in Yale Lake tributaries. In September 1996, the Swift bypass reach contained an estimated 924 cutthroat trout greater than 65 mm (2.5 in) in length (254 cutthroat trout per mile) (PacifiCorp 1999). Cutthroat trout fry and adults were also captured in Ole Creek, Dog Creek, Speelyai Creek, and Panamaker Creek in 1996 and 1997. No other salmonids were observed during sampling in these smaller tributaries. In 1995, the USFS observed low numbers of cutthroat trout in Cougar Creek (USFS 1995).

4.0 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. These include the anticipated impacts of proposed federal projects in the action area that have undergone Section 7 consultation and the impacts of state and private actions undergoing consultation pursuant to 50 CFR § 402.02(d). PacifiCorp and Cowlitz PUD have previously consulted on ongoing operations of the Lewis River Hydroelectric Projects. See FERC RIMS DOC No. 2293041 *Endangered Species Act – Section 7 Consultation Biological Opinion for the Interim Operation of the Lewis River Hydroelectric Projects, June 27, 2002*. The baseline provides a reference for the USFWS to evaluate the species current status in relationship to the proposed action. The Lewis River Hydroelectric facilities are currently in place and are part of the existing baseline. This consultation is not on the existence of the facilities, but the implementation of the new licenses for their continued operation. Additionally, the Lewis River Hydroelectric Projects have blocked passage of anadromous species that now are extirpated in this part of their range.

4.1 HABITAT FACTORS AFFECTING LISTED SPECIES WITHIN THE ACTION AREA

The environmental baseline encompasses the effects of both human and natural factors leading to the current status of the species. Effects from the future operation of the Projects and other activities authorized pursuant to the proposed action are not part of the

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environmental baseline. Rather, the environmental baseline describes the status of the environment currently affecting the species within the action area.

The Lewis River is a natural-cultural ecosystem that has undergone considerable change since the arrival of Euro-Americans. The three Project dams (Merwin, Yale and Swift) and the Lewis River bypass reach located in the North Fork Lewis River between RM 19 and RM 45 represent a major modification of the river's salmonid habitat and the ecological processes that form and maintain salmonid habitat. The Projects are part of the current environmental baseline. The historical and ongoing effects of the Projects include:

- Diverted all river flow (except during spill events) from a 3.3-mile-long reach of the Lewis River above Yale Lake.
- Reduced or eliminated habitat connectivity for resident and adfluvial fish, such as bull trout.
- Limited the downstream transport of habitat building materials.
- Eliminated marine derived nutrients (from salmon carcasses) above Merwin Dam for 70+ years.
- Shifted the natural salmonid production system to a heavy reliance on artificial propagation (with the exception of fall Chinook).

It is important to keep in mind that other land uses, such as residential, commercial, and industrial development; agriculture; and natural resource extraction industries, such as gravel mining and timber harvest, have also had significant historical effects on the Lewis River basin and continue to affect the environment today. These land uses have:

- Drastically reduced floodplain and off-channel habitat connectivity in the Lower Lewis River, primarily due to extensive diking.
- Degraded riparian habitats throughout the basin, which increased sedimentation, erosion, and increased water temperatures, and affected large woody debris (LWD) recruitment potential.
- Increased road density and drainage network patterns, which likely have altered hydrology and blocked fish passage due to impassable culverts.

The environmental baseline description focuses on habitat elements, the alteration of which affects listed salmonid population viability, frequently in a negative manner. For actions that affect freshwater habitat, biological requirements are defined in terms of a concept called properly functioning condition. Properly functioning condition is the sustained presence of natural habitat forming processes in a watershed that are necessary for the long-term survival of the species through the full range of environmental variation. In this framework, based on NMFS (1996) and USFWS (1998), baseline environmental conditions are described as "functioning appropriately" (FA), "functioning

at risk” (AR), or “functioning at unacceptable risk” (UR). In this matrix “properly functioning condition” is equivalent to “functioning appropriately.” This concept includes a recognition that natural patterns of habitat disturbance will continue to occur. For example, floods, landslides, wind damage, and wildfires result in spatial and temporal variability in habitat characteristics, as will anthropogenic perturbations.

Table 4.1-1 is based on Matrix of Pathways and Indicators (NMFS 1996; USFWS 1998) and is designed to summarize existing environmental conditions and parameters for the action area. Criteria for the status of each indicator as FA, AR, or UR are derived from USFWS (1998). It is important to note that the status of a particular environmental indicator can be independent of current Project operations. For example, road density in the lower Lewis River watershed may rate as “functioning at unacceptable risk” under existing conditions even though the Project may have no influence on this indicator. Detailed rationale for the status determination of each environmental indicator follows Table 4.1-1. It should be noted that the term “upper watershed” refers to the Lewis River watershed upstream of Swift Creek Reservoir. The term “middle watershed” refers to the portion between Swift Creek Reservoir and Merwin Dam. The term “lower watershed” refers to the Lewis River downstream of Merwin Dam.

Table 4.1-1. Matrix of diagnostics for documenting the environmental baseline and effects of the proposed action on relevant indicators for Bull Trout (USFWS 1998).

Pathway Indicators	Baseline Environmental Conditions	
	Function	Description
<i>Local Population Characteristics</i>		
Population Size	FA	>50 adults, long term average <500, population appears to be increasing, need more long term data to support trends.
Growth and Survival	FA	Population rebounded from Mount St. Helens eruption and appears to be increasing, need more long term data to support trends.
Life History Diversity and Isolation	AR	Migratory form exists, but dams inhibit volitional migration, no other populations nearby Lewis River basin.
Persistence and Genetic Integrity	AR	Connectivity among local subpopulations in Swift Creek Reservoir is good, mixing is apparently naturally infrequent, and connection with Cougar Creek is inhibited due to dam passage, but does occur in the downstream direction.
<i>Water Quality</i>		
Temperature	AR	Temperature conditions meet State standards in project waters, but warm surface waters in Yale tailrace are present during adult upstream migration and in some tributaries. Temperatures in known spawning and rearing areas appear to be FA.
Sediment/Turbidity	UR	Vast areas of the upper river landscape were devastated by the Mount St. Helens eruption. Heavy rain and high runoff conditions create high turbidity in the streams and reservoirs from this natural event
Chemical Contamination /Nutrients	AR	No 303(d) listed reaches in the action area.
<i>Habitat Access</i>		
Physical Barriers	UR	Upstream and downstream migration impeded by dams.
<i>Habitat Elements</i>		
Substrate	UR	Substrate transportation from the upper basin blocked, but gravel supply stable and supports anadromous spawning populations downstream of Merwin; Project retained heavy sediment loads from Mount St. Helens eruption.

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Baseline Environmental Conditions		
Pathway Indicators	Function	Description
Large Woody Debris	UR	LWD transport from upper basin blocked, low levels of LWD in upper basin.
Pool Frequency and Quality	UR	Pools reduced in streams draining Mount St. Helens (Pine Creek, Muddy River) due to sediment input, other streams have few pools due to natural high gradient (Rush Creek).
Large Pools	AR	Few pools in general, same as pool frequency and quality indicator.
Off-Channel Habitat	UR	Poor connectivity to off-channel habitat in lower river downstream of Merwin Dam due to diking and development.
Refugia	AR	Rush Creek habitat supports the strongest subpopulation, but other habitats have been degraded by Mount St. Helens eruption and will take a long time to recover. Land uses such as logging occur.
Channel Conditions and Dynamics		
Width/Depth Ratio for Scour Pools	AR	Scour pools likely degraded by sediment input due to Mount St. Helens eruption.
Streambank Condition	UR	Streambanks do not support natural floodplain function in the lower river, and are actively eroding in upstream areas affected by Mount St. Helens eruption.
Floodplain Connectivity	UR	Dikes prevent connection to lower river floodplain, but downstream migration to these areas from the upper watershed is impeded by dams.
Flow/Hydrology		
Change in Peak/Base Flow	UR	Lower Lewis River hydrology affected by seasonal reservoir drafting and refilling, and flood control operations, peaks are lower and summer base flow is higher.
Increase in Drainage Network	UR	Increase in drainage network density due to forest road density.
Watershed Conditions		
Road Density and Location	UR	Large network of logging roads in upper basin. Road network in lower basin associated with urban, agricultural, and industrial development, and many roads in valley bottoms.
Disturbance History/Regime	UR	Intensive industrial logging, fires, and Mount St. Helens eruption.
Riparian Conservation Areas	UR	>40 percent late-successional forests upstream of the projects (USDA-FS 1995), very little in the watershed downstream of the projects.
Species and Habitat		
Integration of Species and Habitat Conditions	AR	Fine sediment and suitable habitats have been altered and will not recover to predisturbance conditions within 5 years. The population has likely been reduced from the historical size, but appears to be increasing. Connectivity among subpopulations occurs but is inhibited by dams.

AR: At risk; UR: unacceptable risk; FA: Functioning appropriately.

4.2 BULL TROUT LOCAL POPULATION CHARACTERISTICS

4.2.1 Population Size

USFWS (1998) defines FA as the mean subpopulation size or a local habitat capacity of more than several thousand individuals and all life stages evenly represented in the subpopulation. AR is defined as fewer than 500 adults in subpopulation but more than 50.

4.2.1.1 Conclusion

Based on spawner population estimates presented in Section 3.3, there have been 500 or more spawners since 2001 and preliminary data indicates the trend seems to be on the same track for 2004. However, additional data are needed to confirm a long term trend. For this reason, this indicator rates as Functioning Appropriately.

4.2.2 Growth and Survival

USFWS (1998) defines FA as the subpopulation has the resilience to recover from short-term disturbances in 5 to 10 years. Additionally, the subpopulation is increasing or stable, with at least 10 years of data to support such a trend.

4.2.2.1 Conclusion

The Lewis River bull trout population appears to be rebounding, but this apparent rebound has been over several generations. As with the "population size" indicator, additional data are needed to confirm a long-term increase in spawner abundance. Therefore, this indicator rates as Functioning Appropriately.

4.2.3 Life History Diversity and Isolation

USFWS (1998) defines FA as the migratory form being present with subpopulations in close proximity to other spawning and rearing groups. There is high likelihood of neighboring subpopulations straying and adults mixing with other groups. UR is defined as when the migratory form does not exist and the subpopulation is isolated to a local stream, not likely to support more than 2,000 fish.

4.2.3.1 Conclusion

Based on genetic data presented in Section 3.3, bull trout in Rush and Pine Creeks appear to be distinct subpopulations with little mixing. The Cougar Creek spawning subpopulations appears to be an aggregate of Pine and Rush Creek fish, and may not actually represent distinct subpopulations. The migratory form exists in all project reservoirs although the dams block volitional migration between the Project reservoirs. Passage is not hindered between Pine and Rush creeks. Therefore, this indicator rates as At Risk.

4.2.4 Persistence and Genetic Integrity

USFWS (1998) defines FA as possessing high connectivity among more than 5 subpopulations with at least several thousand fish each. UR is defined as having little or no connectivity and subpopulations that are in low numbers or in decline. Additionally, there is only a single subpopulation or several small, isolated local populations with competitive species that readily displace bull trout. Finally, hybridization potential with brook trout is high. A single brook trout was observed while snorkeling Pine Creek (F. Shrier, PacifiCorp 2004) and several brook trout have been captured while electrofishing the constructed channel area (E. Lesko, PacifiCorp 2004).

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4.2.4.1 Conclusion

Under existing conditions, Merwin, Yale and Swift dams hinder connectivity, but the Pine and Rush Creek subpopulations have full connectivity. In addition, spawner abundance appears to be increasing, although additional data are needed to confirm long-term trends. Brook trout are sympatric with bull trout and some hybridization may have occurred. Therefore, this indicator rates as At Risk.

4.3 WATER QUALITY

4.3.1 Water Temperature

USFWS (1998) defines FA as water temperatures 2 to 5°C for incubation, 4 to 12°C for rearing, and spawning temperatures of 4 to 9°C. UR is defined as temperatures outside the above criteria, with rearing areas and migration corridor temperatures over 15°C.

Water temperature in the lower portion of the Lewis River bypass reach have been recorded as occasionally exceeding the WDOE temperature standards (PacifiCorp and Cowlitz PUD 2002; PacifiCorp and Cowlitz PUD 2003). However, in accordance with WDOE's 7-day average maximum standard, there are no temperature violations in the Lewis River project area. Water temperature in the lower portion of Speelyai Creek is up to 5°C cooler than that observed upstream of the PacifiCorp diversion (PacifiCorp and Cowlitz PUD 2002). Water temperature in the Merwin tailrace is consistently higher than that observed at the upstream end of Swift Creek Reservoir on an instantaneous basis. The largest differences in daily mean temperature occur from September through December, when the Merwin tailrace is generally between 4 and 10°C warmer than the inflow to Swift Creek Reservoir (PacifiCorp and Cowlitz PUD 2002; PacifiCorp and Cowlitz PUD 2003). However, with retention times in each reservoir exceeding several months, it is inappropriate to make direct instantaneous temperature comparisons. Changes in generation at the Yale powerhouse cause fluctuations in water temperature in the upper portion of Lake Merwin; surface water temperature can fluctuate as much as 10°C in a 24-hour period (PacifiCorp and Cowlitz PUD 2002, WAQ 1; PacifiCorp and Cowlitz PUD 2003). However, the fluctuations are minimal to the extent that the 7-day average maximum temperature does not exceed WDOE standards.

USFS water quality monitoring data (USFS 1997, USFS 1998, USFS 1999, USFS 2000, USFS 2001 and USFS 2002) show that water temperatures in the upper mainstem Lewis River (upstream of the Lewis River projects), Quartz Creek, Clearwater Creek, Muddy River, Clear Creek, Siouxon Creek, Canyon Creek, and the East Fork Lewis River regularly exceed 16°C. Water temperatures above 20°C have been recorded in the Muddy River, Clear Creek, Clearwater Creek, East Fork Lewis River, and Siouxon Creek.

4.3.1.1 Conclusion

Some rearing and migration areas exceed 15°C; and many streams do not support spawning, which may be due to inadequate water temperatures. Temperatures in known

spawning tributaries (Rush, Pine, and Cougar creeks) appears to be FA. This indicator should be considered AR for the basin as a whole and may rate as UR locally.

4.3.2 Sediment/Turbidity

USFWS (1998) defines FA containing as less than 12 percent fines in gravel, and UR is defined as having greater than 20 percent surface fines.

Historically, input of sediment to the Lewis River upstream of Swift Dam included periodic large inputs from lahars and ash fall associated with volcanic activity at Mount St. Helens, Mt. Hood, and the Indian Heaven volcanic field. This sediment has been transported through the watershed into the lower Lewis River and Columbia River. Current sediment inputs to streams in the watershed are due to natural processes and land management practices that have increased the erosion potential of managed areas, and to the construction of dams or barriers that block downstream transport of sediment (PacifiCorp and Cowlitz PUD 2003).

The eruption of Mount St. Helens provided a recent and overwhelming source of sediment to several streams in the upper watershed, instantaneously contributing large amounts of sediment and fine ash via mudflows, and providing a source of easily erodible ash to streams in portions of the upper watershed. Mudflows during the initial eruptions swept nearly 18 million cubic yards of water, wood, and debris down these streams and into Swift Creek Reservoir (Tilling et al. 1990). The Muddy River, Pine Creek, and Swift Creek still carry large volumes of sediment into the reservoir; over 15 million tons of sediment were transported from 1982 through 1990 (Dinehart 1997). Thick deposits of tephra covered the upper portions of Smith Creek and Clearwater Creek, reducing infiltration rates and increasing erosion following the 1980 eruption (Dinehart 1997).

Several large fires burned in the East Fork Lewis River watershed in the past century (Wade 2000). The Yacolt Fire of 1902 covered 238,900 acres and was a particularly hot burn, leaving little live vegetation. Portions of the area were re-burned in subsequent fires in 1927, 1929, and the 1950s. These fires likely increased fine sediment inputs for several years until vegetation was re-established. Associated timber salvage operations also likely greatly increased sediment inputs as wood was pulled from riparian areas and stream channels. Road building, timber harvest, farming/grazing, or urbanization have taken place in nearly all portions of the Lewis River watershed. These activities have the potential to increase the fine sediment supply to streams through associated mass wasting, surface erosion, or bank erosion.

4.3.2.1 Conclusion

Due to high levels of fine sediment, the majority of which is likely derived from the Mount St. Helens eruption, logging, and road building, this indicator rates as UR.

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4.3.3 Chemical Contamination/Nutrients

USFWS (1998) defines FA as characterized by low levels of contamination with no 303(d) designated reaches, and UR is defined as high levels of chemical contamination and nutrients and more than one 303(d) listed reach.

The WDOE has not listed any 303(d) reaches for contamination in the North Fork Lewis River basin or the mainstem Lewis River downstream to the confluence with the Columbia River (WDOE 1998). The lack of anadromous fish access to habitats above the dams has eliminated the input of marine derived nutrients (PacifiCorp and Cowlitz PUD 2003). In this case, instead of a problem with nutrient enrichment, the lack of nutrients likely represents a departure from properly functioning conditions. It is likely that several hundred tons of marine derived nutrients, in the form of salmon and steelhead carcasses, entered the upper Lewis River basin prior to the completion of Merwin, Yale, and Swift dams (PacifiCorp and Cowlitz PUD 2003).

4.3.3.1 Conclusion

Although there are no listed 303(d) reaches in the action area, this indicator rates as At Risk due to the lack of marine derived nutrients.

4.4 HABITAT ACCESS

4.4.1 Physical Barriers

USFWS (1998) defines FA as a system in which, when present, man-made barriers allow upstream and downstream passage at all flows without significant levels of mortality or delay. The system is classified as UR when man-made barriers present do not allow upstream and downstream fish passage at a range of flows.

Merwin, Yale, and Swift dams block access to as much as 174 miles of potential anadromous fish habitat in the upper Lewis River basin. They prevent the normal migration of bull trout into, out of, and between river reaches from the lower Lewis River to Swift Creek Reservoir. Downstream migrating fish are subject to both spillway and intake entrainment, both of which have the potential to injure or kill migrating fish (PacifiCorp and Cowlitz PUD 2003).

A small dam in Colvin Creek created an impoundment that was originally used as a holding pond for the Lewis River Hatchery, but is not used any longer, blocks fish migration. Two diversion dams are currently located on Speelyai Creek. Both the upper and lower diversions are total barriers to fish migration; however, fish do have access to upper Speelyai Creek via the canal from Yale Lake. It should be noted that prior to the completion of Merwin Dam, a natural anadromous fish migration barrier existed at the mouth of Speelyai Creek (Hamilton et al. 1970). Reservoir operations (annual reservoir drawdowns) do not appear to limit access into Cougar Creek, Swift Creek, the Lewis River above Swift Creek Reservoir, Pine Creek, S15, or other streams potentially used by bull trout. All reservoir tributaries remain continually accessible at the lowest reservoir elevations (pers comm. Frank Shrier, PacifiCorp).

4.4.1.1 Conclusion

Because of the impacts to passage in the basin, this indicator rates as UR.

4.5 HABITAT ELEMENTS

4.5.1 Substrate

USFWS (1998) defines FA conditions for substrate as embeddedness of less than 20 percent and UR as embeddedness greater than 30 percent.

Sediment from reaches upstream of project dams is blocked from being transported to downstream reaches. As a result, the Lewis River bypass reach, lower Speelyai Creek, the Lewis River downstream from Merwin Dam, and the Columbia River and estuary have a much lower rate of sediment movement than will have occurred if the dams were not in place. The high peak flows in the Lewis River bypass reach result in a cobble-boulder bed, with little gravel except downstream from Rain and Ole creeks. Lower Speelyai Creek has a stable channel with a variety of grain sizes; if the upper Speelyai diversion were not in place, the channel will be very wide and active, with a dynamic cobble bed similar to conditions upstream of the diversion structure. The Lewis River downstream from Merwin Dam has a mix of substrate sizes, and has retained spawning-sized gravel, likely as a result of the very low gradient. If the project facilities were not in place, this reach would be much different, with a very active channel and abundant sediment and large woody debris as a result of the huge influx of such material following the Mount St. Helens eruptions.

Quantitative estimates of the amount of sediment input to streams from management-related sources have been made for a few portions of the watershed. In these sub-basins, sediment input ranged from very little in Lower Speelyai, Cedar Creek, and the Lewis River bypass reach, to several hundred tons per square mile per year in Upper Speelyai, Ole Creek, and the Lewis River downstream of Merwin Dam (PacifiCorp and Cowlitz PUD 2003).

Other disturbances in the watershed that affect the movement of sediment through the river system included gravel mining, forest practices, and road construction. In the past, gravel mining activities have occurred in the Lewis River downstream of Merwin Dam and in the East Fork Lewis River. Gravel was also mined in the Lewis River bypass reach to provide materials for dam construction. Gravel mining operations reduce the in-channel amount of gravel, and often results in reduced spawning habitat availability (PacifiCorp and Cowlitz PUD 2003).

4.5.1.1 Conclusion

Due to high levels of fine sediment upstream of Swift Creek Reservoir, the majority of which is likely derived from the Mount St. Helens eruption, logging, and road building, and the blockage of sediment transport downstream by the dams, this indicator rates as UR.

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4.5.2 Large Woody Debris

USFWS (1998) defines a FA stream as one with greater than 80 pieces of wood per mile, which are greater than 24 inches in diameter and greater than 50 feet long. UR is defined as wood abundance that does not meet the criteria of FA and sources of LWD recruitment are lacking.

Current levels of large woody debris were measured during field surveys of the Lewis River in the Lewis River bypass reach, downstream of Merwin Dam, and Speelyai Creek. Lower Speelyai Creek had the highest density of large wood, with 108 pieces/mile; upper Speelyai had 77 pieces/mile. The Lewis River bypass reach had an average of 21 pieces/mile with most of the wood in the lower end of the reach downstream from Ole Creek. The Lewis River downstream of Merwin Dam had 15 pieces/mile. Rating of large woody debris in the rest of the watershed was considered "poor" in the WRIA 27 limiting factors report (Wade 2000). The USFS rated 26 streams above Swift Dam as "functioning at unacceptable risk." The lack of wood downstream of Merwin Dam is the result of cumulative effects of project and non-project actions: removal of wood from the channel long before the projects were constructed, the lack of input from upstream sources (project effect), and low recruitment of large wood from within the reach due to previous harvest of the riparian areas (non-project effect), and the more stable channel and peak flow regime (project effect).

4.5.2.1 Conclusion

Because recruitment of LWD is limited, this indicator rates as UR.

4.5.3 Pool Frequency/Quality

USFWS (1998) defines FA for pool frequency based on channel width; the standard for the lower portion of the action area is 4 to 9 pools/mile, and the upper reach is approximately 39 to 60 per mile. Pool quality for FA is defined as pools with good cover with only minor reduction of pool volume caused by fine sediments. UR is defined as pool frequency that is considerably less than under FA, cover and temperature that is inadequate, with high fine sediment loads.

The USFS rated 26 streams upstream of Swift Dam for pool frequency. In order to be rated as FA there will have to be approximately 39 pools per mile. According to USFS (2002a), the average pool frequency for these streams was 17.5 pools per mile, which the USFS rated as UR. In addition, lack of habitat forming LWD in the basin, diking in the lower river, and high sediment loads in the upper basin due primarily to the Mount St. Helens eruption, have likely impacted pool frequency and quality.

4.5.3.1 Conclusion

Based on the observed lack of pools, impairment of pool-forming process, and high sediment loads this indicator rates as UR.

4.5.4 Large Pools

USFWS (1998) defines FA for large pools as conditions where each reach has many large pools greater than 1 meter deep and UR is defined as possessing no pools greater than 1 meter deep.

No specific data were reviewed for this indicator that quantifies the exact number of large pools in the action area; however, many pools are known to be present that are greater than 1 meter deep throughout the Lewis River basin. The frequency of these pools is likely impaired by the same processes as listed for the "pool frequency/quantity" indicator. In two of the three bull trout spawning tributaries, there are only 16 and 14 total pools per mile for Cougar and Rush creeks, respectively (Kinney and Lampo 2002), while Pine Creek had nearly double these pool densities at 28 pools per mile.

4.5.4.1 Conclusion

Based on information presented for the "pool frequency/quantity" indicator, this indicator is likely functioning AR, but is not UR as there are pools present that are greater than 1 meter deep.

4.5.5 Off-channel Habitat

USFWS defines FA for off-channel habitat as many backwaters with cover and low energy, off-channel areas, including ponds and oxbows. UR is defined as the watershed with few or none of these habitat types.

The lower Lewis River is characterized as a simple channel which has been subject to dredging and diking. Connectivity to off-channel habitat is generally absent or extremely limited, although bull trout use of this area is hindered by dam passage.

4.5.5.1 Conclusion

Because of reduced connection of off-channel habitat areas to the Lewis River downstream from Merwin Dam, this indicator rates as UR.

4.5.6 Refugia

USFWS (1998) defines FA for refugia as habitats capable of supporting strong and significant populations of bull trout that are protected, well distributed, and connected for all life stages and forms. UR is defined as habitat and refugia that do not exist.

At least three spawning tributaries (Rush, Pine, and Cougar creeks) support an aggregate of several hundred spawners per year and spawner abundance appears to be increasing (see Section 3.3). However, additional data are needed to confirm long-term trends.

4.5.6.1 Conclusion

Existing habitat supports several hundred spawners per year and the spawner abundance appears to be increasing. Therefore, bull trout habitat refugia are present, but this

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indicator should be rated as AR due to ongoing land uses, such as timber harvest, that may continue to affect bull trout refugia.

4.6 CHANNEL CONDITION AND DYNAMICS

4.6.1 Width/Depth Ratio for Scour Pools

USFWS (1998) defines FA for the average width/depth ratio of scour pools as less than or equal to 10, and for UR, as greater than 20.

No specific data were reviewed for this indicator that quantifies the average width/depth ratio for scour pools in the action area; however, the average width/depth ratio for pools is likely impaired by the same processes as listed for the "pool frequency/quantity" indicator.

4.6.1.1 Conclusion

Based on the observed lack of pools, impairment of pool-forming processes, and high sediment loads, this indicator is AR and may be UR.

4.6.2 Streambank Condition

USFWS (1998) defines FA as greater than 80 percent of any stream reach of which 90 percent or more is stable. UR is defined as less than 50 percent of any stream reach that is characterized by greater than or equal to 90 percent stability.

Residential and agricultural land uses have eliminated most of the riparian vegetation in the lower reaches, and the lower 7 miles of the Lewis River floodplain is almost entirely disconnected from the river due to extensive diking (Wade 2000). In the East Fork Lewis River, over 50 percent of the off-channel habitat and associated wetlands within the floodplains have been disconnected from the river. Many slopes in the upper basin are actively eroding, primarily due to impacts from the Mount St. Helens eruption.

4.6.2.1 Conclusion

This indicator rates as UR due to ongoing affects from diking and the Mount St. Helens eruption.

4.6.3 Floodplain Connectivity

USFWS (1998) defines FA as well-connected, off-channel areas with overbank flows of sufficient frequency to maintain function. UR is defined as a severe reduction in hydrologic connection with off-channel habitats.

4.6.3.1 Conclusion

Flood management operations have reduced peak flows and diking in the lower basin has disconnected the majority of the historical Lewis River floodplain from the main channel. Therefore, this indicator rates as UR.

4.7 FLOW/HYDROLOGY

4.7.1 Change in Peak/Base Flows

USFWS (1998) defines FA for the watershed hydrograph as being similar in terms of peak flow, base flow, and timing characteristics to an undisturbed watershed with similar geology and geography. UR is defined as pronounced changes in various hydrologic parameters.

Streamflow patterns of upper basin reaches show a marked spring runoff peak, very low flows in summer and early fall, and a secondary peak resulting from fall and early winter rainstorms. Streams in the lower elevations of the watershed, where a snow pack does not develop, have a fall/winter rainfall peak and low summer flows. Smaller tributaries in the watershed often show a "flashier" runoff pattern than larger streams. They are more responsive to changes in precipitation, with relatively higher peak to mean flow ratios and lower baseflow to mean flow ratios, as shown by analysis of the Speelyai Creek gage data. Baseflows for most streams in the watershed occur during August, September, and October when little rain falls in the area. Baseflows vary with stream size, but are generally 1/3 to 1/4 of the average annual flow. The exception to this is Speelyai Creek, a small tributary to the Lewis River that has very low baseflows (about 14 times lower than average annual flow). However, the stream gauge is located downstream of the Speelyai diversion that directs surface flow into Yale Lake.

Currently, the 3-mile-long Lewis River bypass reach (North Fork Lewis River) has no minimum flow requirement; surface flow at the downstream end of the bypass reach is estimated to be about 21 cfs (during summer low flows). Flows in the Lewis River bypass reach are normally limited to inflow from groundwater/seepage and tributaries except during spill events when large quantities of water are released into the reach. Normal daily flows between Swift Dam and Ole Creek average 5-10 cfs (See PacifiCorp and Cowlitz PUD 2002, WTS2) and more recently have been measured at 21 cfs (pers comm. Frank Shrier, PacifiCorp). The low daily flows limit the area of available aquatic habitat in this 3-mile long reach.

Flows downstream of the upper diversion on Speelyai Creek are currently limited to groundwater and tributary inflow. The water right for the upper Speelyai diversion includes the provision for 15 cfs (or inflow if less than 15 cfs) to be diverted into lower Speelyai Creek. As a result of concerns for fish health at the hatchery, the upper diversion has only been opened 3 times since 1979 to allow water to flow into lower Speelyai Creek (during extremely dry years). Due to a shift in the upper Speelyai channel away from the diversion structure, water is not currently able to flow from upper to lower Speelyai Creek. Instead, this flow enters Yale Lake. Normal daily flows downstream of the upper diversion increase to an average of 15-20 cfs at the hatchery intake near the mouth and are fairly constant throughout the year as a result of constant groundwater input (see PacifiCorp and Cowlitz PUD 2002, AQU 9).

Flows in the Lewis River downstream from Merwin Dam are altered as a result of project operations to manage floods, produce power, and augment late summer flows (Figure 4.7-1). Normal daily flows downstream from Merwin Dam are higher during the late

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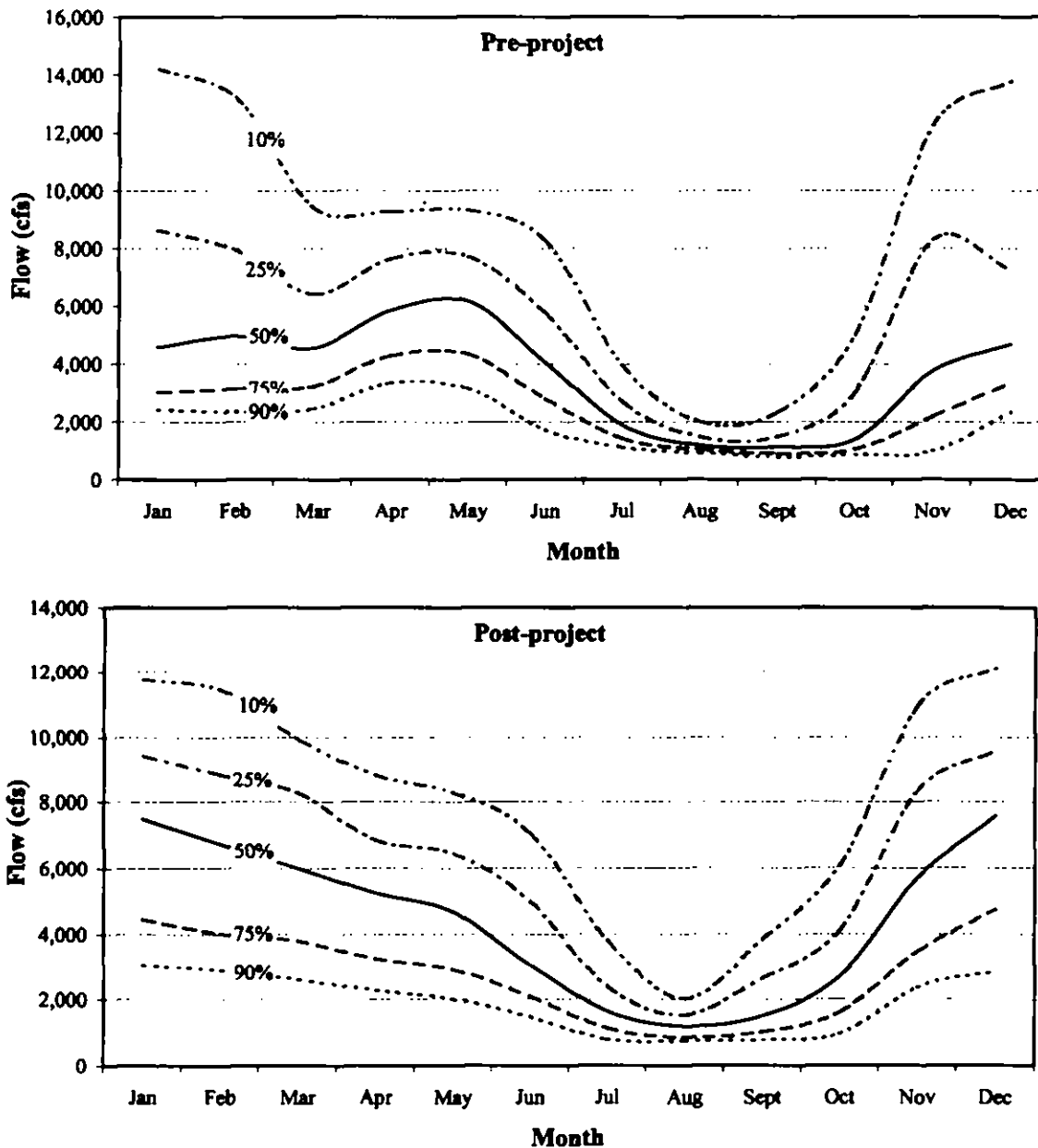


Figure 4.7-1. Daily flow exceedence curve for the Lewis River at Ariel (below Merwin Dam).

USGS Gage 14220500: pre-project data are from 1909 through 1930 and post-project data are from 1932 through 1998. Daily flow from 1910 through 1923 was estimated based on Lewis River flow at USGS Gage 14219500 near Amboy.

summer, fall, and winter due to flow augmentation (for fish) and reservoir level reductions for peak flow storage. Normal daily flows are lower during the spring as reservoirs are re-filled for the summer recreation season (see PacifiCorp and Cowlitz PUD 2002, WTS2). Operation of the projects reduces the frequency of flows in the 10,000-20,000 cfs range and results in a “stepped” pattern of flows (see PacifiCorp and Cowlitz PUD Final 2001 Technical Report [PacifiCorp and Cowlitz PUD 2004b], WTS

2). The more stable flow regime provides additional area of aquatic habitat in the summer months and reduces the frequency of scouring flows during the winter months.

An analysis of changes in flow patterns downstream from Merwin Dam using the Indicators of Hydrologic Alteration (IHA) method (Richter et al. 1996) was completed to compare pre-project and with-project conditions (Kaje 2002). The results were similar to those reported in the Streamflow Study (PacifiCorp and Cowlitz PUD 2002a: WTS 2). The project storage and flood control operations result in higher median flows during fall and winter months (September-March) as the reservoirs are drawn down to regulate winter peak flow events. Median flows are lower between April and July as the reservoirs are refilled for the summer recreation season. Project operations have slightly lowered minimum flows (2 to 9 percent lower) and daily maximum flows (13 to 14 percent lower) and shifted the timing of low flows from September to August. The timing of the one-day maximum daily flow has shifted from December to January. Flows rise and fall more frequently under regulated conditions, with more gradual flow increases and more rapid flow decreases.

These flow changes have resulted in more wetted area in the Lewis River downstream from Merwin Dam during the summer and early fall months than prior to construction of the projects, inundating more potential aquatic habitat and likely more side channel habitat. The reduction in peak flows has resulted in a more stable channel with less scour of redds and less sediment transport than prior to project operation. These conditions are different than a "natural" system that is often quite dynamic.

4.7.1.1 Flow Fluctuation/Ramping

As water rapidly recedes (faster than what will occur naturally) potential impacts can include the stranding of fish in shallow low gradient areas and off-channel habitat (resulting in immediate or delayed mortality); temporary loss of habitat or loss of habitat access; and the dewatering of fish redds, aquatic insects, and plant life. Relatively rapid changes in streamflow can also affect fish behavior, which could reduce survival or growth. In 1993, PacifiCorp implemented a voluntary 2-inch per hour down-ramping rate below Merwin Dam to protect aquatic resources. While this ramping rate partially meets WDFW criteria, project related flow fluctuations still have the potential to affect aquatic resources (see PacifiCorp and Cowlitz PUD 2002, AQU3 and PacifiCorp and Cowlitz PUD 2004b). Of note is that even the WDFW interim ramping guidelines have the potential to strand fish, and fish stranding has been documented resulting from natural flow fluctuations (Hunter 1992). In the past, multiple fish losses have occurred in the Lewis River as a result of project-induced changes in river stage. PacifiCorp and Cowlitz PUD (2000) document 5 separate incidents of rapid flow reductions in a 2-year period.

4.7.1.2 Conclusion

Lewis River hydrology downstream of Merwin Dam is affected by seasonal reservoir drafting and refilling; peaks are lower and summer base flow is higher. Therefore, this indicator rates as UR.

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4.7.2 Increase in Drainage Network

USFWS (1998) defines FA as zero to minimal increases in the drainage network due to roads. That is, the construction of roads and their companion drainage systems have not increased the total number of drainage routes to the river, potentially increasing input of sediment and contaminants, and altering hydrology.

Extensive networks of logging roads are present in the upper basin, many of which are subject to erosion or failure (WSCC 2003).

4.7.2.1 Conclusion

Because of the extensive network of roads throughout the Lewis River basin, this indicator rates as UR.

4.7.3 Road Density and Location

USFWS (1998) defines FA as less than 1 mile of road per square mile with no valley bottom roads and UR as greater than 2.4 miles of road per square mile with many valley bottom roads.

Extensive networks of logging roads are present in the upper basin, many of which are subject to erosion or failure (WSCC 2003). The lower basin has large networks of roads associated with agricultural, urban, and industrial development.

Since about 1940, approximately 31 percent of the National Forest land within the agency's 166,000-acre Lower Lewis River Watershed Analysis area has been subject to intensive timber harvest (USFS 1996). This area includes lands drained by Panamaker, Cougar, Swift, Marble, Pine, Drift, Siouxon, and Canyon creeks, and several smaller streams (Figure 4.1.1-1). All of these streams are located above Merwin Dam. Overall harvest rates for the Pine Creek drainage, a major tributary to the North Fork Lewis River above Swift Dam, were calculated at 75 percent for the upper basin, 69 percent for the middle basin, and 52 percent for the lower basin (USFS 1996). Approximately 28 percent of the land in the USFS's "Middle Lewis River Watershed Analysis" area has been harvested since 1950, with a much higher proportion of that harvest occurring on privately owned lands (USFS 1995). The 102,000-acre "Middle Lewis River Watershed Analysis Area" begins at the confluence of the Muddy River and includes lands drained by Alec Creek, Chickoon Creek, Crab Creek, Big Creek, Little Creek, Meadow Creek, Rush Creek, Curley Creek, Outlaw Creek, Hardtime Creek, Miller Creek, Drift Creek, Range Creek and several smaller streams. All of these streams are located upstream of Swift Dam.

As mentioned previously, much of the Lewis River basin is managed as commercial forest, and as a result, it contains numerous logging roads managed by the counties, DNR, USFS, and private landowners. According to Wade (2000), road densities in the Lewis River basin (up to Merwin Dam) average 4.48 miles per square mile. In the East Fork Lewis River basin, road densities average 4.13 miles per square mile (WDFW 1998). The average road density within the Lower Lewis River Watershed Analysis Area

(between the upper portions of Yale Lake [RM 42.4] to just above Pine Creek [RM 59.5]) is 3.41 miles per square mile (USFS 1995). Pine Creek is one of the most densely roaded subbasins within the analysis area with 6.44 miles of road per square mile. In the Middle Lewis River Watershed Analysis area (from above Pine Creek [RM 59.5] to just above Alec Creek [RM 74.7]) the average road density is 2.53 miles per square mile. These road densities on National Forest System lands are significant, as areas exceeding 3.0 miles of road per square mile are thought to have high potential for road-related environmental degradation (USFS 1996).

4.7.3.1 Conclusion

Because of the high road density throughout the North Fork Lewis River basin, this indicator rates as UR.

4.7.4 Disturbance History/Regime

USFWS (1998) defines FA as having less than 15 percent equivalent clear-cut area (entire watershed) with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for Northwest Forest Plan area (except adaptive management areas), 15 percent retention of late successional old growth timber in the watershed.

Historically, fire was the strongest natural disturbance influencing vegetation structure and composition within these different plant communities. However, the eruption of Mount St. Helens has shown the potential influence that volcanism can also exert on vegetation composition and riparian structure within the watershed. Logging and grazing have also had substantial impacts on vegetation structure and composition in riparian areas throughout the Lewis River basin. Since about 1940, approximately 31 percent of the National Forest land within the agency's 166,000-acre Lower Lewis River Watershed Analysis area has been subject to intensive timber harvest (USFS 1996). This area includes lands drained by Panamaker, Cougar, Swift, Marble, Pine, Drift, Siouxon, and Canyon creeks, and several smaller streams. Overall harvest rates for the Pine Creek drainage, a major tributary to the North Fork Lewis River above Swift Dam, were calculated at 75 percent for the upper basin, 69 percent for the middle basin, and 52 percent for the lower basin (USFS 1996). Approximately 28 percent of the land in the USFS's Middle Lewis River Watershed Analysis area (102,000 acres) has been harvested since 1950, with a much higher proportion of that harvest occurring on privately owned lands (USFS 1995); the area extends from the Muddy River downstream to Swift Dam.

4.7.4.1 Conclusion

Because of large-scale disturbances in the basin, this indicator rates as UR.

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4.7.5 Riparian Conservation Areas

USFWS (1998) defines FA as a riparian reserve system which provides adequate shade, LWD recruitment, habitat protection, and connectivity to all subwatersheds. This reserve must be greater than 80 percent intact and the vegetation must be greater than 50 percent similar to the potential natural community composition.

Historically, the Lewis River basin has been subject to extensive industrial logging, and riparian reserves in the upper North Fork Lewis River basin were damaged by the eruption of Mount St. Helens in 1980. Timber harvest, farming, and urbanization along the lower river have also affected riparian communities.

Timber harvesting is one of the most important industries in southwestern Washington, and the majority of the land in the Lewis River basin is devoted to this use. Overall harvest rates for the Pine Creek drainage, a major tributary to the North Fork Lewis River above Swift Dam, were calculated at 75 percent for the upper basin, 69 percent for the middle basin, and 52 percent for the lower basin (USFS 1996). The riparian areas or "riparian reserves" surrounding the vast majority of the tributaries in the USFS Lower Lewis River Watershed Analysis Area are impaired and have been severely affected by timber harvest, volcanism, fire and floods. According to this same USFS analysis, it could take "a century or more before historic levels are reached." It is important to note that the Pine Creek and Swift Creek drainages previously were privately owned and were acquired by the USFS in an effort to consolidate its ownership south of Mount St. Helens.

4.7.5.1 Conclusion

Because of depletion of riparian reserves by high levels of logging and other disturbances in the Lewis River basin, this indicator rates as UR.

4.8 INTEGRATION OF SPECIES AND HABITAT CONDITIONS

USFWS (1998) rates the integration of species and habitat information. The North Fork Lewis River basin meets the criteria for AR. The criteria that apply to Lewis River bull trout are: fine sediment; stream temperatures; or that available suitable habitats have been altered and will not recover to predisturbance conditions within 5 years; the subpopulations are reduced in size, but the reduction does not represent a long-term trend; and connectivity among subpopulations occurs but habitats are fragmented.

5.0 EFFECTS OF THE ACTION ON LISTED, PROPOSED AND CANDIDATE SPECIES

FACTORS TO BE CONSIDERED

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50

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

Table 1.4-1 (presented in section 1.4-2) summarizes the measures proposed by PacifiCorp and Cowlitz PUD that will be implemented upon issuance of new licenses by FERC, consultation with NOAA-Fisheries and USFWS, and subsequent issuance of a Biological Opinion (BO) and Incidental Take Statement (ITS). In the following sections we analyze the effects of these measures on listed species.

5.1 EFFECTS ON BULL TROUT

5.1.1 Direct Effects

5.1.1.1 Fish Passage Measures

Direct effects are the direct or immediate effects of the Project on the species or its habitat. Direct effects result from agency action, including the effects of interrelated actions and interdependent actions. Future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not considered in this analysis.

The primary limiting factors to salmonid populations associated with past Project operations (as summarized in Table 4.1-1 of the Environmental Baseline description) include:

1. Barriers to upstream and downstream migration of salmonids resulting in the loss of spawning and rearing habitat.
2. Reservoir inundation and passage blockage.
3. Modified flow regimes in the Lewis River below the projects.
4. Blocked downstream movement of substrate and LWD.

Unless identified herein, effects from past Project operations which were defined in the Environmental Baseline section of this Opinion are expected to continue. In other words, USFWS expects past impacts to continue into the future if they are not explicitly modified by the new license. As noted above, under the licensees' interpretation of the ESA and its implementing regulations, such effects would be considered as part of the environmental baseline and not as an effect of relicensing the projects.

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Under existing conditions, the only fish passage facility in the Lewis River basin is the upstream fish collection facility at the base of Merwin Dam. This collect-and-transport system operates year-round. The system consists of a fish entrance located on the right bank (looking upstream) below the dam, a fish elevator, and truck transport loading facility. Collected fish are loaded into tanker trucks and transported to hatchery facilities, or released in the lower Lewis River to support angler harvest. This facility has not been used to transport anadromous fish upstream of Merwin Dam since 1957 because a lack of downstream fish passage facilities at Yale and Merwin made this measure impractical. Bull trout have not been observed in the Merwin trap since 1992. Traps designed to capture Chinook and steelhead have been shown to be ineffective for capturing upstream migrating bull trout (Bellerud and Shappart 1998). Although the Merwin Trap was not specifically designed for bull trout, lack of capture may be more related to numbers of bull trout present in the lower river rather than trap design.

Under existing conditions, no project structures are equipped with downstream fish passage facilities. Juvenile and adult bull trout can, however, pass downstream of Merwin, Yale and Swift dams through the project turbines and spillways. Both turbine and spillway entrainment have the potential to injure or kill downstream migrating fish; however, survival rates associated with entrainment are currently unknown. Merwin, Yale and Swift dams also block bull trout migration between the Project reservoirs and lower Lewis River. The existing bull trout collect and transport program at the base of Yale Dam and at the upstream end of Yale Lake provides upstream passage for some adult bull trout, but has resulted in incidence of adult bull trout loss through handling (Lesko 2004). Without the bull trout collect and transport program, fish entrained into Lake Merwin are effectively lost to the population since there is no spawning habitat downstream of Yale Dam. Bull trout maybe present downstream of Merwin Dam, but the current program does not attempt to capture these fish unless they enter the Merwin trap. Overall, the collect and transport program should be considered beneficial as it allows passage for some bull trout that would otherwise be reproductively lost.

Under the proposed action, upstream and downstream passage facilities will be installed and/or upgraded at all three dams and the Yale spillway will be modified to reduce mortality of downstream migrant fish during spill events. Bull trout upstream and downstream passage will be provided by these new facilities or by other methods, such as collect and transport (as directed by the Services). If some fish passage facilities are not built, at the direction of the Services, then funds would be made available through the In Lieu Fund to be used for mitigation measures that collectively contribute to meeting the objective of achieving equivalent or greater benefits to anadromous fish populations as will have occurred if passage through Yale Lake and/or Lake Merwin had been provided.

Analysis

Currently, the project reservoirs provide bull trout foraging, migration, and overwintering habitat (FMO). However, the reservoirs are disconnected from one-another and FMO habitat is only connected to spawning and rearing habitat in Yale Lake and Swift Creek Reservoir. Yale Lake and Swift Creek Reservoir are also isolated from each other. Bull trout foraging and overwintering habitat in Lake Merwin is not connected to any spawning and rearing habitat. Under the proposed action bull trout FMO habitats in all

three reservoirs will be connected to each other and to spawning and rearing habitats by operating upstream and downstream passage facilities, or by other collect and transport methods. Providing upstream and downstream passage at the project dams will achieve two recovery goals identified in the draft Lower Columbia River bull trout recovery plan (USFWS 2002). Recovery plan goals and objectives addressed by the proposed action's bull trout passage measures include:

- Maintain current distribution of bull trout and restore distribution in previously occupied areas within the Lower Columbia Recovery Unit.

Bull trout are currently present in all project reservoirs; however, bull trout may not be currently present downstream of Merwin Dam. Under the proposed action, bull trout will have access to the lower Lewis River for foraging, migration, and overwinter, depending where the USFWS directs the Licensees to release downstream migrating bull trout. If bull trout are released downstream of Merwin Dam, this would represent a restoration of bull trout distribution in previously occupied areas.

- Conserve genetic diversity and provide opportunity for genetic exchange.

Under the proposed action, bull trout passage measures will provide for the opportunity of two-way genetic exchange between bull trout spawning populations from Pine, Rush and Cougar creeks, which cannot occur under existing conditions due to the lack of fish passage. Establishing connectivity between isolated spawning populations has been a fundamental goal in development of all of the draft bull trout recovery plans throughout the bull trout range.

New and upgraded upstream and downstream fish passage facilities would substantially decrease bull trout entrainment through the turbines at all three dams; decrease entrainment into the Swift No. 2 Power Canal; increase bull trout survival during collect and transport operations; increase survival of bull trout passing over Yale Dam during spill events; and increase genetic interactions among local bull trout populations. All of these actions will incorporate long-term monitoring, which will facilitate adaptive management to ensure that bull trout passage is effective and that entrainment and mortality are minimized over the long term.

The fish passage program will be subject to rigorous fish passage facility performance standards including overall quantitative survival standards, specific life stage standards, and facility design standards. These will help gauge program success and determine if there is need for facility adjustments or ultimately, facility modifications. The program will also include two "status checks" in years 27 and 37 to allow a detailed review of program measures and to track progress toward the program goals for the reintroduction of anadromous fish species. If the reintroduction goals have not been met in years 27 and 37, "limiting factors analyses" will be undertaken to more precisely determine whether performance standards and species goals have been met. While these status checks do not specifically apply to bull trout, assessing the anadromous fish reintroduction goals would benefit bull trout to the extent that the salmon reintroduction program provides benefits to bull trout as previously described, such as increased MDN to bull trout rearing habitats and increases to bull trout forage.

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If some fish passage facilities were not build, at the direction of the Services, then the In Lieu Fund will be used for mitigation measures such as repairing the highest priority culvert passage problems on Ross, Johnson, Colvin, Cedar, Beaver, John, Brush creeks; restoring and enhancing Johnson Creek to eliminate passage problems; reconnecting and enhancing off-channel and floodplain habitats along the lower reaches of the mainstem Lewis River; enhancing floodplain and side channel habitat around Eagle Island; restoring degraded riparian conditions along the tributaries to the lower Lewis River; increasing functional LWD structures, or similar natural structures, in appropriate stream reaches; and restoring and enhancing wetlands, springs, and seeps in the sub basin. These types of projects should also benefit bull trout; however, since no specific projects or plans have been reported, the actual effects of this fund are not possible to determine.

Construction of fish passage facilities has the potential to cause short-term adverse effects, such as increased turbidity in adjacent waters. Although water quality may be affected temporarily during construction through increased erosion and sedimentation, these effects can be minimized and avoided by implementing best management practices (e.g., installing silt fencing and other sediment trapping devices on land and silt curtains in water) and covering exposed soil until permanently stabilized. PacifiCorp and Cowlitz PUD will be required by federal, state, and county regulations to develop sediment and erosion control plans as part of the construction process. Chemical spills could also occur during construction, but development of a pollution prevention plan in accordance with appropriate federal, state, and county requirements will minimize the effects of such an occurrence. Typically, a pollution prevention plan will specify areas for equipment maintenance and refueling, spill prevention and emergency response strategies, and requirements for keeping emergency response spill containment kits onsite and for having trained personnel be onsite during construction. PacifiCorp and Cowlitz PUD currently have Spill Prevention, Control and Countermeasure (SPCC) programs in place.

Through the construction permitting process, plans will be developed to minimize and avoid temporary construction-related effects to the extent feasible using best management practices that are similar, but not limited to, the previously mentioned actions. No long-term negative effects on aquatic resources are anticipated from construction of new fish passage facilities. Overall, it is anticipated that construction of new fish passage facilities will benefit bull trout by increasing the opportunity for two way genetic exchange between spawning tributaries, and by increasing the amount of interconnected spawning and rearing habitat with foraging, migration, and overwintering habitats.

5.1.1.2 Anadromous Fish Reintroduction

The proposed action will make available 174 miles of spawning, rearing and migration habitat for Chinook, coho, steelhead, and chum salmon. According to the draft Salmon recovery plan NPCC (2004), making this upstream habitat available in the North Fork Lewis River is one of the most substantial salmon recovery measures in the lower Columbia region. This is especially true since Lewis River spring Chinook and steelhead are considered core populations in the draft recovery plan. The subsequent increase in juvenile anadromous fish production will likely improve the forage base for adult and subadult bull trout.

Analysis

Under the proposed action, PacifiCorp and Cowlitz PUD will reintroduce spring Chinook, coho, and late-winter steelhead into the upper Lewis River basin above Merwin, Yale and Swift dams. The goal of the reintroduction program is to achieve "genetically viable, self-sustaining naturally reproducing, harvestable populations above Merwin Dam that are greater than minimum viable populations." Adult and juvenile Chinook, coho and steelhead will be transported and released above the dams, with the adults spawning and the juveniles rearing before migrating downstream. The establishment of naturally spawning anadromous salmonids will benefit bull trout by increasing primary productivity through the addition of MDN. The addition of MDN will likely increase the aquatic invertebrate biomass, which will increase the forage base for juvenile bull trout. In addition, the production of juvenile salmon will increase the forage base for adult and subadult bull trout.

Negative effects of anadromous salmonid reintroduction into areas currently occupied by bull trout will include interspecific competition between juvenile salmon and bull trout for food and space, and competition for spawning sites and potential redd superimposition of bull trout redds by spawning coho salmon. However, bull trout and Chinook and steelhead have co-existed and evolved sympatrically in the Lewis River and throughout most of the bull trout range. In addition, spawn timing and habitat preference differ substantially, which will diminish the possibility of negative interaction between bull trout and these two species.

As described in the PDEA (PacifiCorp and Cowlitz PUD April 2004), introduction of coho has the greatest chance of negatively affecting bull trout since coho spawn in similar habitats as large migratory bull trout. Coho spawn later in the fall and winter, which could lead to redd superimposition. Coho juveniles also rear in similar habitats to juvenile bull trout, and are considered to be aggressive and territorial (Chapman 1962). Despite the potential for negative interactions, coho and bull trout have co-evolved in sympatry in the Lewis River and in many other river basins, such as the Skagit and Snohomish rivers where they currently exist together. Bull trout and coho likely co-existed in the Wenaha and Wallowa River watersheds prior to coho's extirpation from the Snake River basin (Thompson and Haas 1960). Therefore, natural coho production will not likely limit bull trout production, but it is possible that bull trout could be overwhelmed by hatchery coho if stocking densities were too high. Under the proposed action, monitoring will be implemented to determine impacts on bull trout, if any, that the anadromous salmon reintroduction program has on bull trout. The monitoring program will provide a mechanism to implement adaptive management as new information arises to limit impacts to bull trout. Overall, the anadromous fish reintroduction program will be beneficial by providing MDN and increasing the forage base for bull trout.

5.1.1.3 Resident Trout and Kokanee Supplementation

WDFW's management of the recreation fishery in the Lewis River reservoirs has resulted in the introduction of several nonnative species including kokanee, tiger musky, and a nonnative stock of rainbow trout. Under existing conditions, PacifiCorp funds the production of 800,000 juvenile hatchery rainbow and 93,000 juvenile kokanee each year

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for release into Swift Creek Reservoir and Lake Merwin, respectively. Hatchery kokanee and rainbow trout can also pass over the spillway into Yale Lake. Under the proposed action these programs will continue at the same production levels, continuing to provide sport harvest opportunities. The hatchery program will be guided by the ACC through the Hatchery and Supplementation Plan.

Analysis

Presumably, the ACC will recommend rainbow trout and kokanee supplementation programs that will incorporate current scientific information in order to reduce or eliminate hatchery impacts on wild fish populations to the extent practicable. However, this is not assured, since specific programs and program attributes, such as number released, stock origin, release location, fish marking, etc. are not specified in any measures.

Recreational fishing associated with the release of hatchery rainbow trout in Swift Creek Reservoir will likely result in fishing pressure on native fish stocks, such as bull trout, which will result in incidental take of bull trout. The presence of hatchery trout may also increase the risk of disease. Non-native kokanee could compete with native fish stocks and inhibit production of native fish. Studies have found that adverse species interactions are more likely with fish that were not historically present in an area compared with the reintroduction of fish that were once native (Hearn 1987).

It is not known what affect the hatchery rainbow and kokanee programs may have on bull trout. Although hatchery rainbow and kokanee may compete with juvenile bull trout for food and habitat resources, these species will provide forage for large migratory bull trout in Swift Creek Reservoir, Yale Lake and Lake Merwin. The proposed surface collector guide nets likely will reduce passage of hatchery rainbow trout from Swift Creek Reservoir into Yale Lake.

5.1.1.4 Aquatic Habitat Enhancement and Monitoring Measures

Under the proposed action, several measures will be implemented to protect and enhance aquatic habitat and water quality. Bull trout conservation covenants will be maintained; a bull trout limiting factors analysis will be conducted for the three reservoirs similar to that conducted by Pratt (2003) for the Lewis River bypass reach; large woody debris (LWD) will be stockpiled for habitat projects; a spawning gravel monitoring and augmentation plan will be developed; and several funds will be setup in order to support stream and riparian habitat protection and enhancement project.

TDG Testing

Elevated TDG levels resulting from power generation in the Swift No. 1 and Yale tailraces have the potential to adversely affect fish rearing or migrating in Yale Lake and Lake Merwin. As a component of the Lewis River Settlement Agreement, PacifiCorp will monitor TDG at the Swift No. 1 and Yale tailraces to determine compliance with state water quality standards (120 percent TDG), and implement measures to minimize effects on ESA listed species if standards cannot be met. Although this measure is

designed primarily to benefit bull trout, it will also benefit Chinook, coho, and steelhead rearing or migrating in these reservoirs and other species present in the reservoirs.

Monitoring plans will be developed and implemented to evaluate the effectiveness of aquatic measures, primarily to determine the success of the anadromous fish reintroduction program; assess the effectiveness of passage measures; to determine compliance with 401 water quality criteria; and to assess the impact of predation on bull trout population trends in the North Fork Lewis River basin.

Analysis

With the exception of conservation covenants, none of the habitat measures listed above are currently being implemented. Their implementation will improve bull trout spawning and rearing habitat and provide long-term protection of critical habitat for bull trout in the Lewis River basin. Furthermore, the proposed monitoring programs will ensure that managers have information to determine the effectiveness of the proposed aquatic measures. This monitoring information will also allow adaptive management decisions to be made to ensure the long-term persistence of bull trout in the Lewis River basin.

5.1.1.5 Flow and Reservoir Level Management Measures

Minimum Flows and Plateau Operations

Under current conditions, project flow releases have resulted in more wetted area in the Lewis River downstream from Merwin Dam during the summer and early fall months than prior to their construction, inundating more potential aquatic habitat and likely more side channel habitat. The reduction in peak flows has resulted in a more stable channel with less scour of redds and less sediment transport than prior to project operation. These conditions are different than a "natural" system that is often quite dynamic.

Currently, the 3-mile-long Lewis River bypass reach has no minimum flow requirement; surface flow at the downstream end of the bypass reach was estimated to be about 10 cfs (during summer low flows). Under the proposed action, minimum flows will vary by season and will range from 60 to 100 cfs.

Current minimum flows downstream of Merwin Dam are managed on a seasonal basis and minimum flows are adjusted based on runoff volume forecasts. Minimum flows in the spring range from 1,000 to 2,700 cfs; in summer from 2,700 to 1,200 cfs; fall low flows are 1,200 cfs; late fall minimum flows range from 2,700 to 5,400 cfs; and the winter minimum flow is 1,500 cfs. Under the proposed action, minimum flows in the spring will range from 2,200 to 2,700 cfs; summer minimum flows will range from 2,700 to 1,200 cfs; fall low flows will be 1,200 cfs; late fall minimum flows will range from 2,500 to 4,200 cfs; and the winter minimum flow will be 2,000 cfs.

Under the proposed action, PacifiCorp will further restrict daily flow fluctuations below Merwin from February 16 through August 15 of each year by maintaining flow plateaus (periods of near-steady discharge). Once a flow plateau is established, the plateau will be maintained for as long a duration as practicable, but flow plateaus may be altered to a

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new level as a result of changes in natural flow or operational demands on the Lewis River power system subject to the limitations of the ramping restrictions.

Minimum Flow Analysis

Downstream of Merwin Dam – Minimum flows downstream of Merwin Dam affect several stream habitat parameters, such as fish spawning and rearing habitat quantity and quality; off-channel and side channel habitat availability; and can influence redd dewatering. Bull trout are not known to spawn downstream of Merwin Dam, and spawning will not be expected due to unfavorable water temperatures during their spawning season. Although water temperatures are undoubtedly affected by the existence and operation of the Lewis River Projects, temperatures in the Lewis River at the Merwin tailrace did not exceed the State’s proposed criteria (18°C for the 7-day running mean of daily maximum water temperatures) during the water quality study conducted for the relicensing (PacifiCorp and Cowlitz PUD 2004b). In addition, the 7-day running mean of daily maximum water temperatures at the Swift Reservoir inflow was calculated to be 14.6°C, but only 15.5°C at the Merwin tailrace, which is more than 35 miles downstream from the Swift Creek Reservoir inflow (PacifiCorp and Cowlitz PUD 2004, WAQ1).

Bull trout likely did not spawn downstream of Merwin Dam historically, as the majority of bull trout spawning in western Washington occurs above the winter snowline or in very cold spring-fed systems (Kraemer 1994). Therefore, minimum flows downstream of the Merwin Dam will not likely affect bull trout spawning. Although, adult and subadult bull trout may be present downstream of Merwin Dam, it is unknown what habitats they use and how the proposed minimum instream flows will impact these habitats, since the flows were designed to maximize anadromous salmonid spawning habitat, while minimizing redd dewatering.

However, designing a flow regime to maximize juvenile anadromous fish survival would benefit bull trout by increasing the forage base in the lower Lewis River, which could be used by bull trout for foraging and overwintering habitat. Although specific habitat impacts are unknown, the flow regime would most likely be beneficial to bull trout by maximizing habitat for one of the bull trout’s primary forage species, juvenile anadromous salmonids.

Lewis River Bypass Reach – The Lewis River bypass reach extends from Swift No. 1 dam to Yale Lake parallel to the Swift No. 2 canal. Flow in this reach is currently made up of groundwater seepage and the combined flow from Rain and Ole creeks. Under the proposed action, minimum flows in the bypass reach will increase over five times compared to existing conditions. The minimum flow increase will maintain additional foraging habitat for bull trout during the winter and spring; however, relatively warm summer and fall water temperature (>9°C) will likely preclude bull trout spawning in the reach (Pratt 2003, published as AQU 20 in PacifiCorp and Cowlitz PUD 2004b). Pratt (2003) noted that predicted fall water temperatures in excess of 11°C might delay or abort bull trout spawning, as appropriate spawning temperatures (<9°C) will not occur until November or December under minimum flow releases modeled up to 400 cfs (Figure 5.1-1). This is well beyond the observed spawning time for bull trout in the Lewis River

basin. In September, the median water temperature in Cougar Creek (a known bull trout spawning site) is 6.7°C, approximately 5 to 6°C cooler than the water temperature predicted in the bypass reach during that same period (with a 60 cfs flow under the proposed action). Currently, bull trout residing in Yale Lake spawn from early August through late October (PacifiCorp and Cowlitz PUD 2003a). If bull trout spawning is not delayed until at least November, eggs in the redds will be exposed to bypass reach temperatures in excess of 10°C and egg mortality will likely be complete (Pratt 2003). As a result, augmenting the flows in the bypass reach with the coldest water available will not likely provide additional spawning habitat for bull trout residing in Yale Lake.

Pratt (2003) also determined that recovery of bull trout in Yale Lake was not dependent on the Lewis River bypass reach and believed that any attempts to provide habitat there could result in a detriment to the small, critical population residing in Yale Lake. Brook trout pose a threat to bull trout and are present in the bypass reach. Brook trout have been shown to out-compete bull trout (Gunckel et al. 2002). Increasing the minimum flow may increase brook trout production, which may lead to increased competitive interactions between brook trout and bull trout.

As stated previously, increasing minimum flows up to 400 cfs in the bypass reach will not likely support successful bull trout egg incubation due to high water temperatures. Recent geomorphological and biological investigation have shown that Rain and Ole creeks will also not support successful bull trout spawning and incubation due to similar water temperature problems as described for the bypass reach (PacifiCorp and Cowlitz PUD 2004, WTS 4). The intermittent nature of surface flow at the mouth and high bedload transport (>11,000 tons per year) also make it unlikely that Rain or Ole creeks will provide bull trout spawning habitat in the future (PacifiCorp and Cowlitz PUD 2004, WTS 4). Therefore, the bypass reach and tributaries to the bypass reach were not included in the final critical habitat designation (50 CFR Part 17, RIN 1018 A152). Although successful spawning would not be expected in the bypass reach and bypass reach tributaries under current conditions and under the proposed action, increasing the minimum flow under the proposed action may increase forage fish species abundance and foraging and support overwintering habitat area for bull trout in the bypass reach.

PacifiCorp and Cowlitz PUD will also design and construct an "improved habitat channel" between the lower release point and Yale Lake. Conceptual design of this approximately 1,500-foot-long channel incorporates placement of large woody debris and boulders to increase velocity and depth in the reach. Focusing habitat improvement efforts in this off-channel area will maximize the benefits of the engineered channel and reduce adverse impacts associated with spill events in the main bypass reach. The objective of also providing flow releases at the upper release point is to maintain some level of connectivity between large pools that exist in the upper bypass reach (upstream from the canal drain). Construction of the "improved habitat channel" may further increase forage fish species abundance and foraging and overwintering habitat area for bull trout in the bypass reach.

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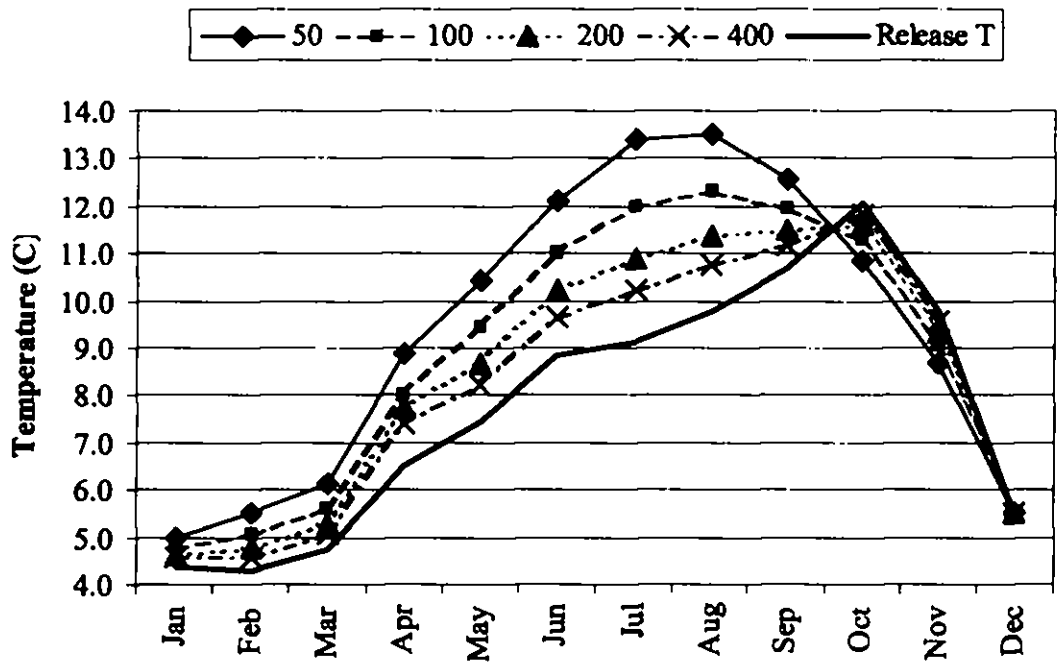


Figure 5.1-1. Observed Swift Dam release temperature and modeled water temperature at downstream end of Lewis River bypass reach for four release flows under average temperature conditions.

Swift No. 2 Canal Surge Arresting Structure

Surge Arresting Structure- In the event that the SAS were to operate, it would be doubtful that, if any fish were present in the canal, they would survive passage through the cone valves. Therefore, there is a potential for the SAS to impact bull trout.

Canal Inspections - Starting shortly after the canal returns to full operation, Cowlitz PUD will be required to examine the integrity of the canal on a periodic basis. This examination would require dewatering the canal. During the dewatering if any bull trout were present in the canal, they would be recovered and released into Yale Lake in coordination with the USFWS and WDFW. The "improved habitat channel" in the bypass reach could also potentially be affected by dewatering the canal because the intake for the existing water source (canal drain) is currently located in the portion of the canal to be dewatered and inspected. The proposed action provides for development and implementation of plans for expeditious installation and operation of temporary replacement facilities for delivery of flows from the canal drain in the event maintenance activities (e.g. dewatering of the canal for inspection) reduce or interrupt flows to the habitat channel. In addition, a second canal drain is being evaluated for installation in the canal above the check structure. If needed, this canal drain would be used to dewater the canal above the check structure to examine the upper section of the canal. Operation of this drain is intended to be covered as part of the proposed action, contingent only on a decision by Cowlitz PUD that construction of the second canal drain is necessary and obtaining any required approvals. If this additional canal drain is installed, it could

potentially be used to provide water to the habitat channel if the canal below the check structure were to be dewatered.

Fish, and bull trout in particular, with the exception of trout that may be planted in the canal prior to fishing season, are not expected to be present in the Swift No. 2 canal after installation of the floating surface collector and guide net system in Swift Creek Reservoir. The floating surface collector at Swift No. 1 will be designed to preclude entrainment of fish into the Swift No. 2 canal, but some fish would likely be able to migrate past the floating surface collector and guide net system, because these facilities cannot be designed to be 100 percent effective. Thus, there is potential to entrain some fish into the Swift No. 2 Canal. However, entrainment potential would be substantially reduced under the proposed action compared to the current conditions where no system is in place to limit entrainment into the canal. Also, bull trout that do enter the canal will be rescued during scheduled canal dewatering and released into Yale Lake. This action provides an opportunity for those bull trout surviving turbine entrainment at Swift No. 1 and entering the Swift No. 2 canal to be reinstated to the gene pool in Yale Lake. Because of the nature of the Yale Lake local population (Neraas and Spruell 2004), this action will not compromise the current local population genetics. Through monitoring of the downstream passage system, along with any facility adjustments deemed necessary through the monitoring process (as specified in the Lewis River Settlement Agreement), entrainment into the Swift No. 2 canal would likely be minimized. Any on-going entrainment and subsequent rescue would represent a positive local population level effect. Of particular note is the fact that bull trout spawner abundance in Swift Creek Reservoir has been increasing even with no entrainment reduction structures present (Figure 3.3-2). The effect of placing bull trout from the Swift No. 2 canal into Yale Lake enhances the ability of the small local population in Yale Lake to increase toward a more viable population level.

Plateau Operation Analysis

Plateau operations have been designed to limit flow fluctuations on a daily to weekly basis, as opposed to ramping rates which are designed to limit flow fluctuations on an hourly basis. Daily to monthly flow fluctuations have been shown to reduce benthic macroinvertebrate diversity and total biomass and can change invertebrate species composition. A study on the Skagit River found that flow fluctuations had a greater adverse effect on the aquatic invertebrate community than a substantial reduction in average flow (Gislason 1985). Cushman (1985) cited several sources that found some macroinvertebrate taxa increased with fluctuating flows while other taxa decreased. Macroinvertebrates that are adapted to inhabit the hyporheic zone (the zone where surface water and groundwater intermix) may be somewhat more resistant to fluctuating flows. Alterations in the annual hydrograph of rivers may also contribute to disruptions in aquatic food webs as documented in several northern California river systems (Power et. al., 1996). Shifts in the composition of benthic fauna to more predator resistant taxa have been found to occur in regulated river systems, which potentially results in decreasing the energy transfer from algae to fish (Power et. al. 1996).

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A reduction in the aquatic invertebrate forage base can negatively affect fish production potential. Flow fluctuations can affect aquatic invertebrates through stranding (similar to fish stranding), increase drift response, and may reduce aquatic invertebrate forage. It is anticipated that by implementing plateau operations under the proposed action will reduce macroinvertebrate impacts caused by flow fluctuations. Therefore, the proposed action may increase macroinvertebrate production in the Lewis River downstream of Merwin Dam. This will represent an increase in bull trout forage to the extent that bull trout may use this reach.

Ramping

Under Article 49 of the existing Merwin license, PacifiCorp is required to limit down-ramping below Merwin Dam to 1.5 feet (18 inches) per hour from August 1 through February 18. For the remainder of the year, required ramping rates range from 300 to 750 cfs per hour at Ariel gage. Depending on river flow, ramping measured in cfs can have a widely varying influence on changes in river stage (i.e. at high flows, a change in 750 cfs may only result in a change in stage of less than one inch, but at low flows may result in a change of several inches). Phinney et al. (1973) conducted studies in 1971 and estimated that Project ramping resulted in stage changes of 5 to 11 inches per hour. These ramping rates represent fairly rapid changes in river stage and consequently could strand large numbers of juvenile fish. Since 1993, PacifiCorp has implemented a voluntary two-inch per hour down-ramping rate at all release levels to protect aquatic resources below Merwin Dam and to reduce juvenile fish stranding. In their Biological Opinion for the Interim Operation of the Lewis River Hydroelectric Projects (USFWS and NMFS 2002), the USFWS and NOAA-Fisheries recently required PacifiCorp to alter their Article 49 ramping rates to meet a limit of (1) 0.5 feet per three-hour period; (2) 2 inches per hour for down-ramping; and (3) 1.5 feet per hour for up-ramping.

Ramping restrictions under the proposed action will be similar to those recommended by the Services in the 2002 Interim Operations Biological Opinion, except that no down-ramping will be allowed from February 16 through June 15, between one hour before and one hour after sunset and one hour before and one hour after sunrise each day. A critical ramping flow will be set at 8,000 cfs (measured at the Ariel gage). Ramping criteria will be imposed at flows less than the critical flow, and no ramping restrictions will be required when flows were equal to or greater than the critical flow.

The most widely studied biological impact associated with down-ramping is stranding, primarily of fish. Stranding is the separation of aquatic organisms from flowing surface water as a result of declining river stage. Stranding can occur during any drop in stage. It is not exclusively associated with substantial dewatering of a river and can occur in unregulated as well as regulated river systems. In addition to hydropower operations, stranding can occur as a result of other events, including natural declines in flow, ship wash, municipal water withdrawals, and irrigation withdrawals.

Fish stranding associated with hydropower operations has been widely documented in the Pacific Northwest and has been documented in the Lewis River downstream of Merwin Dam. PacifiCorp and Cowlitz PUD (2000) documented 5 separate incidents of rapid flow reductions in a 2-year period. Stranding mortality can occur many miles

downstream of a powerhouse, and stranding mortality is difficult or impossible to estimate. The fish species and life stage, substrate type, channel morphology, ramping rate and range, critical flow, ramping frequency, season, and time of day all affect the incidence of stranding. Of particular importance are ramping season, time of day, and ramping range and rate, and the critical ramping flow (Hunter 1992).

Ramping Analysis

Juvenile and adult listed salmonids will be subject to down-ramping flow impacts under the proposed action, which also occurs under existing conditions. Down-ramping at any rate has the potential to strand fish, especially juvenile salmonids using gravel and cobble substrates along the river margin (Hunter 1992). However, minimizing the down-ramping rate will reduce the stranding potential.

Under the proposed action, PacifiCorp will incorporate the ramping regime approved by the Services in the Interim Operations Biological Opinion. In addition to these measures, no down-ramping will be allowed one hour before to one hour after the sunrise and sunset as recommended by WDFW through the collaborative process. According to WDFW limiting down-ramping during this time period will provide substantial stranding protection for anadromous salmonids.

At flows above 8,000 cfs, (as measured at the Ariel gage), gravel bars and substrate with high stranding potential are fully wetted (see PacifiCorp and Cowlitz PUD 2002, AQU 3). Therefore, ramping at flows above 8,000 cfs will have a negligible stranding potential. However, gravel bars can become exposed during ramping at flows below 8,000 cfs (see PacifiCorp and Cowlitz PUD 2002, AQU 3). Therefore, adopting the critical flow of 8,000 cfs will ensure that ramping restrictions will be in effect during periods of high stranding potential (i.e. at flows below 8,000 cfs).

In addition to the above measures, PacifiCorp has finished mechanical upgrades to provide back-up power and additional alarms to prevent future losses of anadromous salmonids from mechanical failures. Past emergency shutdowns have de-watered the adult fish trap at Merwin Dam and a portion of downstream river channels. It was estimated that the June 1999 shutdown killed 101 adult salmonids in the Merwin trap and that the loss of juvenile salmonids downstream, due to stranding, was equivalent to 1,500 adult fall Chinook. To prevent this type of catastrophic event in the future, a series of alarms and a video system to observe the tailrace area have been installed to aid the operator to manage shutdowns. In addition, secondary and tertiary power back-up systems have been installed to allow automatic gate openings to maintain river flows.

The proposed action will benefit anadromous salmonids by reducing stranding potential compared to existing conditions. By implementing the Service's recommended ramping rates, the critical flow, and sunset/sunrise ramping restrictions recommended by WDFW, in addition to the upgrades to the physical facilities to prevent emergency shutdowns, the proposed action will provide a substantial reduction in fish stranding potential compared to the existing Project License Article 49. The proposed action will provide additional stranding protection over the Interim Operations Biological Opinion ramping requirements by implementing the sunrise/sunset ramping restriction and by

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implementing the stranding study. The stranding study will provide information for adaptive management purposes to further reduce stranding potential if warranted.

As upstream and downstream fish passage facilities are upgraded it is reasonable to assume that bull trout will migrate past Merwin Dam and will be subject to Project induced down-ramping. In this reach, bull trout will likely be adults and sub-adults. Based on stranding studies for anadromous salmonids, fry are most susceptible to stranding (Hunter 1992), although no studies were found regarding bull trout. Bull trout fry will not be expected to migrate downstream of Merwin Dam because they are found in close proximity to spawning areas that are located far upstream of Merwin Dam. Therefore, bull trout fry stranding will not likely occur. However, larger fish are also susceptible to stranding, but given the proposed measures listed above, migratory adult and subadult bull trout stranding will be minimized. Reducing stranding of juvenile salmonids would also increase the forage base in the lower Lewis River, which could be used by bull trout for foraging and overwintering habitat.

5.1.1.6 Effects of Terrestrial Measures

The proposed terrestrial measures consist of providing funds to purchase and enhance wildlife mitigation lands and to develop wildlife management plans, along with effectiveness monitoring. These measures will benefit aquatic habitats to the extent that protecting upland habitat preserves the watershed processes that influence the aquatic environment, such as preserving natural storm water runoff patterns and reducing hill slope erosion. Therefore, the proposed terrestrial measures will likely benefit bull trout habitat in the Lewis River basin.

5.1.1.7 Effects of Recreational Measures

Expansion and improvement of recreation facilities under the proposed action, such as campground expansion and boat launch facility improvements, may provide for increased human presence in several locations, thereby increasing angling pressure in specific areas of the reservoir and tributary streams. However, recreational use may increase independent of the construction of new facilities, due to expected population growth in nearby urban areas. Effects of increased in recreational users are subsequently addressed under the indirect effects.

Construction of new recreational facilities under the proposed action, such as boat launch facility improvements, has the potential to cause short-term adverse effects, such as increased turbidity. Although water quality may be affected temporarily during construction (primarily through increased erosion and sedimentation), these effects can be minimized and avoided by implementing best management practices (e.g., installing silt fencing and other sediment trapping devices on land and silt curtains in water) and covering exposed soil until permanently stabilized. PacifiCorp and Cowlitz PUD will be required by federal, state, and county regulations to develop sediment and erosion control plans as part of the construction process. Chemical spills could also occur during construction, but development of a pollution prevention plan in accordance with appropriate federal, state, and county requirements will minimize the effects of such an occurrence. Typically, a pollution prevention plan will specify areas for equipment

maintenance and refueling, spill prevention and emergency response strategies, and requirements for keeping emergency response spill containment kits onsite and for having trained personnel be onsite during construction. Effects of construction of recreational facilities under the proposed action are anticipated to be negligible.

Through the construction permitting process, plans will be developed to minimize and avoid temporary construction-related effects to the extent feasible using best management practices that are similar, but not limited to, the previously mentioned actions. No long-term negative effects on aquatic resources are anticipated to result from construction of new recreational facilities. However, no benefits to bull trout are anticipated through construction of new recreational facilities.

5.1.1.8 Effects of Cultural Resource Measures

Under the proposed action, cultural resource measures include the management and protection of historic properties and cultural resources; preserving tribal access to cultural sites; monitoring; and construction of a new visitor's center in Cougar. None of these measures are anticipated to have a negative effect on bull trout or bull trout habitat. New facility construction of any type will avoid impacts to surface waters and habitats as listed above. Effects of cultural measures on bull trout are anticipated to be negligible.

5.1.1.9 Effects of Socioeconomic Measures

Under the proposed action, socioeconomic measures include funding three full time law enforcement officers, one of which will be dedicated to fish and wildlife law enforcement; providing funding for the maintenance of Forest Road 90; and funding development of a visitor's center in Cougar. Potential benefits to bull trout resulting from the funding of the fish and wildlife officer are discussed under the effects of recreational measures below. Providing funding for the maintenance of Forest Road 90 will likely reduce impacts to the aquatic environment by maintaining the road in good working order, which will limit sedimentation and erosion into streams. Construction-related impacts resulting from the new visitor's center in Cougar will be minimized or avoided by following best management practices as listed previously. Effects of socioeconomic measures on bull trout are anticipated to be beneficial with respect to additional fish and wildlife enforcement.

5.1.1.10 Effects on Designated Critical Habitat

Pine Creek and the Lewis River upstream of the Swift Creek Reservoir are not affected by project operations; therefore, the continued operation of the projects would not destroy or adversely modify designated bull trout critical habitat in these areas.

Although 1.3 miles of an unnamed tributary to Swift Creek Reservoir (referred to as S15 in PacifiCorp and Cowlitz PUD 2000) is designated as critical habitat, it is unlikely that this stream supports substantial numbers of bull trout. Past timber harvest activities have severely impacted the stream's riparian area and high summer and fall water temperatures (PacifiCorp and Cowlitz PUD 2004) may preclude successful bull trout spawning and juvenile rearing. As a result, PacifiCorp and Cowlitz PUD feel that it may be premature

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to designate S15 as critical habitat. Therefore, as part of their bull trout limiting factors analyses, PacifiCorp and Cowlitz PUD will evaluate the quality of the habitat in S15 and its potential to support bull trout.

Project operations do affect designated bull trout critical habitat in the lower Lewis River downstream of Merwin Dam due to flow regulation. Bull trout could use the lower Lewis River for foraging, migration, and overwintering (FMO) habitat from winter to summer before migrating upstream to spawn or to avoid high water temperatures in late summer. As upstream and downstream passage facilities are provided under the proposed action, there could be greater use of the lower Lewis River by bull trout depending where the USFWS directs the Licensees to release downstream migrating bull trout. Although project operations alter natural stream flow patterns, sediment transport, and LWD movement, implementation of a minimum flow regime, flow plateau operations, LWD assessment, gravel monitoring and augmentation, monitoring and maintaining water quality, and providing habitat enhancement funding under the proposed action will maintain the lower Lewis River as functional FMO habitat for migratory bull trout. Therefore, the proposed action will not destroy or adversely modify designated bull trout critical habitat in the lower Lewis River.

5.1.2 Indirect Effects

Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR § 402.02). Indirect effects are effects that are caused by the action but are later in time. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. These indirect effects, interrelated and interdependent actions include hatchery and harvest practices, recreation in the basin, and roads in the upper basin. Factors such as hatchery practices and fish management influence the listed, proposed and candidate species. Introduction of non-native fish can negatively affect listed species by increasing competition for food, hybridization, loss of genetic fitness, and increased predation on listed species. Impacts to all listed species are being addressed through separate consultations during the development and evaluation of specific Hatchery Genetic Management Plans.

There may be beneficial effects on bull trout if the introduced fish become a significant prey base. Fishing regulations, such as size and gear restrictions and possession limits, can affect listed species. The section 4(d) rule published with the listing of bull trout allows incidental catch of bull trout when legally fishing for other fish species.

Currently, it is illegal to catch and keep bull trout in the Lewis River basin and the incidental harvest rates appear to be in decline. PacifiCorp (1999) reported 16 bull trout caught of which 15 were released during a 1996-97 creel census conducted as part of the Yale relicensing. The 1999 creel survey report (Hillson and Tipping 2000) indicates that in over 10,000 angler-hours, 7 out of 2,151 fish captured were bull trout (PacifiCorp and Cowlitz PUD 2000a). Unfortunately, Hillson and Tipping (2000) reported that less than half of the anglers interviewed could correctly identify bull trout. The large size of Yale Lake and Swift Creek Reservoir and the limited sampling make it likely that the recent creel census underestimated the actual catch and/or possession of bull trout.

Hooking a fish, even if it is released, can result in acute or chronic injuries, increased susceptibility to diseases, and potentially mortality. Handling hooked fish before releasing them also contributes to mortality. Catch and release fishing can cause mortality ranging from 3.9 percent for fly-caught fish up to 58 percent for bait caught fish (Schisler and Bergersen 1996; Warner et al. 1978). Using the two creel surveys discussed above, and the bait caught estimates of mortality, at least 8 bull trout died in 1996 and more than 3 bull trout died in 1999-2000 as a result of angling.

Poaching and directed targeting of bull trout has occurred in the upper Swift Creek Reservoir area. This resulted in a proposal to completely close a reach of the North Fork Lewis River just above the reservoir to fishing. The proposal was rejected by the Washington Fish and Wildlife Commission, but a change to non-bait gear (with single barbless hooks) was approved. This change may reduce the mortality of bull trout from angling but will need to be monitored closely.

Improvement of recreational facilities, such as campgrounds and boat ramps, may increase recreational use of the reservoirs. However, recreational use increases may increase independent of the construction of new facilities, due to expected population increases in nearby urban areas, such as Portland and Vancouver. Incidental take of bull trout will likely increase as fishing pressure increases resulting from additional recreational use of the Project waters. Additional bull trout take may negatively affect bull trout populations to an unknown degree.

However, under the proposed action, a public information program will be implemented to protect bull trout by installing signage and distributing flyers to inform the public about bull trout in the project area. In addition, providing three full time law enforcement officers, one of which will be a full time wildlife officer under measure 13.2.1.1, may lead to the reduction of incidental bull trout take. The officer may be able to educate anglers regarding bull trout protection, and may be able to address bull trout poaching problems that have been documented in Swift Creek Reservoir.

Localized and dispersed recreational use within the Lewis River sub-basin has the potential to affect bull trout. People that use this recreational area are drawn to water and engage in activities that may adversely affect bull trout populations and habitat. Recreationists take part in a variety of activities, including camping, hiking, boating, fishing, and swimming in areas that may affect bull trout. The effects include large wood removal by recreationists for firewood, and changes in streambank conditions due to trampling along bull trout streams. The only recreational area managed by PacifiCorp near bull trout habitat is the campground at the mouth of Cougar Creek. The effects on bull trout within the project boundaries are believed to be minimal because most of the recreational focus is on the reservoir and not on Cougar Creek. In addition, the Cougar Creek campground is closed before adult bull trout begin their spawning run into Cougar Creek.

Roads contribute more sediment to streams than any other land management activity (Gibbons and Salo 1973; Meehan 1991), and most of the land management activities are dependent on roads. Road-related mass soil movements can continue for decades after roads have been constructed (Furniss et al. 1991). Roads are recognized as a long term

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source of sediment even after erosion control measures have been implemented (Furniss et al. 1991, Belt et al. 1992). Removing vegetation and ditch rock can increase downstream sedimentation. Lack of adequate culvert cleaning before winter storms can result in major mass wasting and extreme sedimentation for miles downstream. Such habitat alterations can adversely affect all life-stages of fishes, including migration, spawning, incubation, emergence, and rearing (Furniss et al. 1991; Henjum et al. 1994; Rhodes et al. 1994).

The land along Cougar Creek that PacifiCorp recently purchased has several miles of old logging roads. These roads could cause habitat degradation in Cougar and Panamaker Creeks as discussed above. PacifiCorp is currently working on a road management plan to minimize the potential for detrimental effects to Cougar Creek bull trout habitat. The land purchased by Cowlitz PUD along the Swift Creek Arm of Swift Creek Reservoir has several miles of logging roads. While most are located above the steep section adjacent to the reservoir, and may have the potential to cause effects downstream, the main access road is owned by and gated by the neighboring landowner and the majority of Cowlitz PUD's roads are closed to vehicular traffic.

5.1.3 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered in this BE. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

Above Yale Dam there are several thousand acres of non-federal lands. Most of these lands are used for timber production. The non-federal lands surrounding Cougar and Pine Creeks are of critical importance due to the presence of spawning and rearing bull trout. The lands immediately adjacent to Cougar Creek are primarily owned by PacifiCorp, but the upper watershed of Panamaker Creek, a major tributary of Cougar Creek, is owned by private timber companies. Timber harvest and road building in the upper Panamaker Creek basin could have a downstream effect on bull trout habitat in Cougar Creek, but activity in this drainage is not anticipated between now and when the relicensing consultation is completed.

The town of Cougar, a highway, and several campgrounds occur along or have the potential to affect Cougar Creek. Management of these lands and facilities are not expected to appreciably change in the near future; therefore, impacts on bull trout and their habitat have already occurred and will likely maintain the status quo with the exception of potential poaching of bull trout at one of the campgrounds. The current State of Washington fishing regulations prohibit keeping bull trout if captured while fishing for other species.

Land management activities along Pine Creek pose the most serious cumulative threat to bull trout in the Lewis River watershed. Pine Creek is one of only two known bull trout spawning and rearing tributaries to Swift Creek Reservoir. Most of the Pine Creek watershed is owned by Plum Creek Timber Company and the effects of their actions have been covered in an amendment to their HCP (USDI 1998). Several private vacation

homes and lots also occur in the headwaters of several tributaries to Pine Creek. The activities associated with the vacation homes do not appear to be affecting bull trout habitat. Expansion of the summer homes or activities associated with the existing homes is not anticipated.

There are no other known bull trout streams on non-federal lands in this area. Therefore, current and expected future management actions on non-federal lands not associated with Cougar or Pine creeks are not anticipated to cumulatively affect bull trout because no suitable or accessible habitat exists on those lands. No downstream effects on known or potential bull trout habitat from actions on non-federal lands are expected outside Pine and Cougar Creeks.

Past and future timber harvest activities on non-federal lands surrounding Swift Creek may increase sedimentation into nearby streams, potentially degrading habitat quality in Swift Creek. Sediment entering Swift Creek Reservoir from these actions will likely have minimal effects on adult bull trout in Swift Creek Reservoir unless landslides or road failures occur. The persistence of bull trout in Swift Creek Reservoir appears to hinge on Pine Creek, which is unstable due to the Mount St. Helens eruption, and Rush Creek, which provides limited habitat due to the naturally steep gradient, averaging 8 percent in the bull trout zone (Kinney and Lampo 2002). It is not known to what degree the Rush Creek bull trout could sustain the subpopulation if the Pine Creek population is adversely affected. However, after the eruption of Mount St. Helens in 1980, when bull trout habitat throughout the Pine Creek drainage was severely altered (Faler and Bair 1996), it was assumed that migratory bull trout from Rush Creek subsequently recolonized Pine Creek. However, genetic analysis by Neraas and Spruell (2004) shows this not to be the case, since Pine and Rush Creek fish are genetically distinct. Population trends in Pine and Rush creeks appear to be increasing, although additional data are needed to confirm a long term trend.

5.1.4 Conservation Measures

Under the Proposed Action, the Licensees will implement the following measures that will directly benefit bull trout.

- Provide upstream and downstream passage for bull trout at Project dams.
- Monitor upstream and downstream passage to ensure that passage is adequately facilitated.
- Monitor bull trout population dynamics and determine limiting factors.
- Test alternatives to limit bull trout entrainment and implement a preferred alternative.
- Install signage and distribute flyers to inform public about bull trout in the project area.
- Manage existing conservation covenants to protect bull trout habitat in perpetuity.

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- Modify the Yale spillway to improve downstream resident fish survival (including bull trout) during spill events.
- Reintroduce anadromous salmonids upstream of Merwin Dam; this action will increase primary production and the bull trout forage base.
- Monitor the anadromous salmonid reintroduction program to ensure that any potential negative effects on bull trout are minimized or avoided.
- Increase flow in the bypass reach to increase habitat.

5.1.5 Bull Trout Recovery

The draft Lower Columbia River bull trout recovery plan (USFWS 2002) specifies several key information gaps that need to be addressed in the Lower Columbia Recovery Unit including: (1) specific information on the suitability of potential spawning and rearing areas in each basin; (2) increased inventory in each basin to establish the current distribution; and (3) a complete limiting factors analysis to identify site specific actions needed to recover bull trout within each system. Under the proposed action a bull trout limiting factors analysis will be completed to address these information gaps for the North Fork Lewis River basin upstream of Merwin Dam.

The draft recovery plan also states that dams have fragmented bull trout habitat, isolated local populations, and prevented access to historical foraging and overwintering habitat. The proposed action addresses this concern by implementing upstream and downstream passage for bull trout at Merwin, Yale, and Swift Creek dams. As stated previously, facilitating passage will address the following recovery goals:

- Maintain current distribution of bull trout and restore distribution in previously occupied areas within the Lower Columbia Recovery Unit.
- Conserve genetic diversity and provide opportunity for genetic exchange.

By maintaining conservation covenants for important bull trout habitats; identifying bull trout limiting factors and monitoring bull trout abundance over time; and implementing habitat projects under the Aquatic Habitat Fund to address potential habitat limiting factors the proposed action will address additional recovery goals including:

- Maintain stable or increasing trends in abundance of bull trout.
- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.

By addressing the four primary recovery goals in the North Fork Lewis River basin, the proposed action will benefit the Lower Columbia River bull trout recovery unit, and will improve the chance for the recovery of the Columbia River bull trout DPS.

5.1.6 Effect Determination

Implementation of the conservation measures listed above will likely result in an overall net benefit to bull trout populations of the North Fork Lewis River by increasing connectivity between spawning tributaries, decreasing entrainment, increasing primary production and the forage base, and increasing habitat protection and enhancement over existing conditions. However, entrainment cannot be completely eliminated and some small level of bull trout handling mortality is unavoidable under any collect and transport scenario. Other occasional potential adverse effects to bull trout, such as via stranding cannot be avoided entirely during either some scheduled down ramp events or during some unscheduled emergency plant shutdowns.

While the overall effect of the proposed action will be beneficial to listed bull trout and habitat in the North Fork Lewis River basin and addresses all four primary recovery goals for the lower Columbia River bull trout recovery unit, the risk of incidental adverse effect to individual fish cannot be entirely eliminated. Therefore, in accordance with definitions contained in the NOAA Fisheries and USFWS Guide to Biological Assessments (1998), Project operations under the proposed action are "likely to adversely affect" listed bull trout. This determination requires formal Section 7 consultation between FERC and USFWS to determine whether the proposed action will jeopardize the continued existence of the Columbia River bull trout DPS.

Critical habitat is designated for the Columbia River bull trout DPS. In previous sections, we examined the existing conditions of bull trout critical habitat in the Lewis River project area and those measures of the proposed action that have the potential to affect this habitat. We conclude that relicensing the projects under the proposed action will improve existing habitat conditions for bull trout providing for habitat enhancement funding, implementing minimum instream flows and flow plateau operations, maintain habitat conservation covenants, monitoring and improving water quality, developing habitat management plans, enforcing harvest regulations, and improving fish passage. Therefore, the proposed action is not likely to destroy or adversely modify designated bull trout critical habitat.

5.1.7 Take Analysis

Direct take cause by project operations will result from entrainment and handling. Take may also occur through stranding caused by downramping. Take will be minimized by implementing the conservation measures listed above. While it is expected that take will be substantially reduced under the proposed action, a precise estimate of the numbers of fish that may be injured cannot be made, but will be assessed and minimized through bull trout monitoring activities and the adaptive management framework that are part of the proposed action.

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5.2 EFFECTS ON COASTAL CUTTHROAT TROUT

5.2.1 Direct Effects

5.2.1.1 Fish Passage Measures

New and upgraded passage facilities will likely substantially decrease cutthroat trout entrainment through turbines at all four projects; decrease entrainment into the Swift No. 2 Power Canal; increase survival of cutthroat trout passing over Yale Dam during spill events; and increase genetic interactions among local cutthroat trout populations. All of these actions will incorporate long-term monitoring, which will facilitate adaptive management to ensure that cutthroat trout passage is facilitated and that entrainment and mortality are minimized.

Construction of fish passage facilities has the potential to cause short-term adverse effects, such as by increasing turbidity. Although water quality may be affected temporarily during construction (primarily through increased erosion and sedimentation), these effects can be minimized and avoided by implementing best management practices as described in Section 5.1.1.1. No long-term negative effects on aquatic resources are anticipated to result from construction of new fish passage facilities. Overall, it is anticipated that construction of new fish passage facilities will benefit cutthroat trout and aquatic species.

5.2.1.2 Anadromous Fish Reintroduction

Similar to the analysis for bull trout, the re-establishment of naturally spawning anadromous salmonids will benefit cutthroat trout by increasing primary productivity through the addition of MDN. The addition of MDN will likely increase aquatic invertebrate biomass, which will increase the forage base for juvenile cutthroat trout. In addition, the production of juvenile salmon will increase the forage base for adult and subadult cutthroat trout.

Negative effects of anadromous salmonid reintroduction into areas currently occupied by cutthroat trout will include interspecific competition between juvenile salmon and cutthroat trout for food and space. However, cutthroat trout, Chinook, steelhead, and coho have co-existed and evolved sympatrically in the Lewis River and throughout most of the cutthroat trout range. In addition, spawn timing and spawning habitat preference differ substantially, which will diminish the possibility of negative interaction between cutthroat trout and these three species. Overall, the anadromous fish reintroduction program will be beneficial by providing MDN and increasing the forage base for cutthroat trout.

5.2.1.3 Resident Trout and Kokanee Supplementation

Presumably, the ACC will recommend rainbow trout and kokanee supplementation programs that will incorporate current scientific information in order to reduce or eliminate hatchery impacts on wild fish populations to the extent practicable. However, this is not assured, since specific programs and program attributes, such as number

released, stock origin, release location, fish marking, etc. are not specified in any measures.

Releasing 800,000 hatchery rainbow trout into Swift Creek Reservoir does not minimize the potential for adverse species interactions between the hatchery rainbow trout and wild fish in the Lewis River basin. The rainbow trout supplementation program will likely only have negative effects on the local native rainbow and cutthroat trout populations, even if local brood stock was used. The local cutthroat and rainbow trout populations likely have reached an equilibrium state since the construction of the dams, and have more than likely adopted adfluvial and resident life histories. Additional hatchery trout introduced into the reservoirs and tributaries will likely interbreed with naturally reproduced fish, and will compete for habitat and food resources. Hatchery rainbow introductions also may increase hybridization rates with native cutthroat trout. However, WDFW has used the Goldendale rainbow trout stock in the Lewis River basin, which is a fall spawning strain. The local rainbow and cutthroat populations are winter and spring spawners. Therefore, stocking Goldendale rainbow will limit hybridization; however, competition for food and habitat resources will continue to occur. Of note is that the rainbow trout stock to be used under the proposed action is not specified, and WDFW has used other hatchery rainbow stocks in the Lewis River basin that are winter and spring spawners. The Hatchery Scientific Review Group (HSRG) consistently recommends that hatchery trout only be released into the closed systems to minimize interactions with naturally produced fish (HSRG 2002, 2003).

Recreational fishing associated with the release of hatchery rainbow trout in Swift Creek Reservoir will likely result in fishing pressure on native fish stocks, such as cutthroat. Hatchery trout may increase the risk of disease. Non-native kokanee could compete with native fish stocks and inhibit production of native fish. Studies have found that adverse species interactions are more likely with fish that were not historically present in an area compared with the reintroduction of fish that were once native (Hearn 1987).

Although, hatchery rainbow and kokanee may compete with juvenile cutthroat trout for food and habitat resources, these species will provide forage for adfluvial cutthroat trout in Swift Creek Reservoir and Lake Merwin. Hatchery rainbow trout will also move into Yale Lake during spill events and will have a similar effect on cutthroat trout in Yale Lake as described above.

5.2.1.4 Aquatic Habitat Enhancement and Monitoring Measures

The implementation of all of the aquatic habitat enhancement and monitoring measures are expected to improve cutthroat trout spawning and rearing habitat in the Lewis River basin, similar to that described for bull trout in Section 5.1.1.4.

5.2.1.5 Flow and Reservoir Level Management Measures

Minimum Flow Analysis

Under the proposed action, minimum flows in the Lewis River bypass reach will increase over six times compared to existing conditions, creating additional spawning, rearing, and

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foraging habitat for cutthroat trout. However, overall aquatic habitat quality will continue to be poor in the bypass reach; limited by a lack of gravel and instream cover (PacifiCorp and Cowlitz PUD 2004).

Plateau Operation Analysis

The proposed action may increase macroinvertebrate production in the Lewis River downstream of Merwin Dam, as described for bull trout in Section 5.1.1.5. This will represent an increase in cutthroat trout forage downstream of Merwin Dam.

Ramping Analysis

As described for bull trout in Section 5.1.1.5, the implementation of ramping restrictions will reduce stranding potential for cutthroat trout downstream of Merwin dam to an unknown degree.

5.2.1.6 Effects of Terrestrial Measures

Proposed terrestrial measures will have the same benefit on the aquatic environment as described for bull trout in section 5.1.1.6.

5.2.1.7 Effects of Recreational Measures

Impacts resulting from an increase in recreational users are subsequently addressed under the indirect effects. Construction of new recreational facilities under the proposed action may have the potential to cause short-term adverse effects, such as by increasing turbidity. Although, water quality may be affected temporarily during construction, primarily through increased erosion and sedimentation, these effects can be minimized and avoided by implementing best management practices. No long-term negative effects on aquatic resources are anticipated to result from construction of new recreational facilities. However, no benefits to cutthroat trout are anticipated through construction of new recreational facilities.

5.2.1.8 Effects of Cultural Resource Measures

Under the proposed action, cultural resource measures include managing and protecting historic properties and cultural resources; preserving tribal access to cultural sites; monitoring; and constructing of a new visitors center in Cougar. None of these measures are anticipated to have a negative effect on cutthroat trout habitat. New facility construction of any type will avoid impacts to surface waters and habitats as listed above. Effects of cultural measures on cutthroat trout are anticipated to be negligible.

5.2.1.9 Effects of Socioeconomic Measures

Under the proposed action, socioeconomic measures include funding three full time law enforcement officers, one of which will be dedicated to wildlife law enforcement; providing funding for the maintenance of Forest Road 90; and funding development of the visitor's center in Cougar. Effects of socioeconomic measures on cutthroat trout are anticipated to be beneficial and similar to those described for bull trout in Section 5.1.1.9.

5.2.2 Indirect Effects

Introduction of non-native fish can negatively affect listed species by increasing competition for food, hybridization, loss of genetic fitness, and increased predation on species of concern. Impacts to all listed species are being addressed through separate consultations during the development and evaluation of specific Hatchery Genetic Management Plans. However, cutthroat are not a listed species and may not be addressed through the HGMP process for the WDFW Lewis River rainbow trout stocking program, funded by PacifiCorp and Cowlitz PUD.

Improvement of recreational facilities, such as campgrounds and boat ramps, may increase recreational use of the reservoirs. However, recreational use may increase independent of the construction of new facilities, due to expected population increases in nearby urban areas, such as Portland and Vancouver. Harvest of cutthroat trout will increase as fishing pressure increases resulting from additional recreational use of the Project waters. Additional harvest may negatively affect cutthroat trout populations to an unknown degree.

5.2.3 Cumulative Effects

Land use upstream and downstream of the Lewis River Projects will have similar negative cumulative effects on cutthroat trout, as described in Section 5.1.3 for bull trout.

5.2.4 Conservation Measures

Under the Proposed Action, the Licensees will implement the following measures that will directly benefit cutthroat trout.

- Provide upstream and downstream passage for cutthroat trout at Project dams.
- Monitor upstream and downstream passage to ensure that passage is adequately facilitated.
- Test alternatives to limit entrainment and implement a preferred alternative.
- Modify the Yale spillway to improve downstream resident fish survival during spill events.
- Reintroduce anadromous salmonids upstream of Merwin Dam; this action will increase primary production and the cutthroat trout forage base.
- Increase minimum flow in the bypass reach to increase habitat.

5.2.5 Effect Determination

By implementing the conservation measures listed above, the proposed action will have a net beneficial effect on cutthroat trout by increasing primary productivity through the reintroduction of anadromous salmonids upstream of Merwin Dam; by facilitating upstream and downstream passage, and reducing entrainment of cutthroat trout a Project

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facilities; and by protecting and improving aquatic habitat through the various habitat enhancement funds.

5.2.6 Take Analysis

"Take" does not apply to non-listed species, such as cutthroat trout.

5.3 EFFECTS ON LAMPREY

No systematic survey of Pacific lamprey distribution or abundance has been conducted in the Lewis River basin, nor is their historic distribution known; however, current stocks in the Columbia and Snake river systems are in a steep decline (Close et al. 1995). Limited available data suggest that Pacific lamprey populations in the Columbia River basin have been declining since the construction of the network of dams on the mainstem Columbia River. Adult lamprey counts at each of these dams are markedly lower than counts during the mid-1900s, and growing evidence indicates that Pacific lamprey have great difficulty surviving downstream passage at dams and migrating upstream past dams.

Due to the lack of information regarding Pacific lamprey distribution and abundance in the Lewis River basin, no specific analysis of effects of the proposed action can be made. However, it is suspected that by implementing the conservation measures listed above, the proposed action will have a net beneficial effect on Pacific lamprey that may currently inhabit the North Fork Lewis River basin by increasing primary productivity through the reintroduction of anadromous salmonids upstream of Merwin Dam; by facilitating upstream and downstream passage, and reducing entrainment at Project facilities; and by protecting and improving aquatic habitat through the various habitat enhancement funds. In addition, the reintroduction of anadromous salmonids will provide an incremental increase in the lamprey forage base for the lamprey marine life stage in the Pacific Ocean. The proposed action will likely have a net beneficial effect on Pacific lamprey when compared to existing conditions.

5.4 EFFECTS ON BALD EAGLE

The proposed action includes a number of measures that are intended to improve habitat for fish, wildlife, and recreation resources. Many of these measures have the potential to directly or indirectly affect the bald eagle.

5.4.1 Direct Effects

5.4.1.1 Effects of Aquatic Measures

Aquatic resource measures that will require construction (e.g., upstream and downstream collection and transport facilities; acclimation ponds) will be located at existing project facilities. No potential bald eagle habitat will be removed or altered.

Construction activities will have the potential to cause disturbance to bald eagles, if they were to occur in close proximity to bald eagle nests. Numerous studies show that traffic and noise near nest sites can cause temporary or permanent nest abandonment; increase

the risk of over-cooling, over-heating, and predation on eggs and young; or cause injury or mortality to juveniles through premature fledging (Fyfe and Oldendorff 1976; Knight and Skagen 1988; Richardson and Miller 1997). Bald eagles are most sensitive to disturbance early in the breeding season, during courtship (e.g., mid-January through late February) and incubation (mid-February through late May). They tend to become less sensitive through the summer, as eaglets develop and fledge.

Bald eagles are also sensitive to disturbance during the winter. Disturbance can adversely affect birds during the winter by increasing their energy demands and causing physiological stress (Stalmaster and Kaiser 1998).

Timing restrictions are often applied to construction activities in order to minimize the potential for disturbance to breeding or wintering eagles, and buffer zones are typically established around nest sites. The timing of restricted activities and the size of buffer zones around nest sites may be modified depending on the type, frequency, and duration of the activity and the presence or absence of visual screening between the activity and the nest. Restrictions may also depend on raptor responses to disturbance. Responses to disturbance vary from pair to pair (Stalmaster and Kaiser 1998; Watson and Pierce 1998; Grubb et al. 1992). Differences may be due to the inherent or learned tolerance of individual pairs, as well as to site-specific conditions.

Construction of fish collection and transport facilities will take place over a mile from existing bald eagle nests at Merwin, Yale and Swift Creek reservoirs. Because of the distance between proposed activities and existing nests, construction will be unlikely to affect birds at the nests. Bald eagle winter foraging patterns and roost and perch preferences should also be evaluated, if construction is planned during the winter (i.e., November through March). Bald eagles often take advantage of foraging opportunities below dams, where adult or juvenile salmonids are concentrated. Identification of core foraging areas may be needed to ensure that adequate buffer zones can be established.

Positive benefits to eagles include an increased prey base and foraging opportunities closer to existing nesting and perch sites and indirect benefits accrued from reintroduction of marine derived nutrients.

5.4.1.2 Effects of Terrestrial Measures

Under the Lewis River Settlement Agreement, PacifiCorp and Cowlitz PUD will provide funding to acquire and manage land to benefit a broad range of fish, wildlife, and native plants in the project area. As part of the Wildlife Habitat Management Plans, PacifiCorp and Cowlitz PUD will maintain and/or increase the area of late-successional forest, increase snag densities, establish and preserve riparian buffers, restrict harvest of cottonwood trees, and conduct surveys for raptors prior to any timber harvest. PacifiCorp will continue to conduct annual surveys to monitor bald eagle breeding, productivity, and winter use. Road closures will also be implemented to prevent disturbance.

Under the proposed action a number of terrestrial resource protection and enhancement measures are focused on forest management. Measures to increase the area of mature and old-growth forest and protect riparian habitat (including cottonwoods) will benefit

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bald eagles by helping to ensure that adequate roost, perch and nesting habitat is available through any new license periods. Raptor surveys prior to timber harvest and annual breeding, productivity, and winter use surveys will provide the information needed to establish buffer zones or timing restrictions when necessary.

5.4.1.3 Effects of Recreation Measures

As discussed above, construction activities have the potential to cause disturbance to bald eagles. Several of PacifiCorp's proposed recreation measures will require construction.

Under the proposed action, PacifiCorp will improve or expand facilities at some day use areas and boat launches. At Speelyai Bay Park, PacifiCorp will extend the boat ramp and replace the docks. Boat launches at Yale Park and Beaver Bay will also be improved. PacifiCorp proposes to provide non-motorized boat access to the river downstream of Yale Dam.

Trails will be developed on the Yale IP Road; from Saddle Dam Park to Saddle Dam Trail; between Cougar Campground and Beaver Bay Campground; and at the town of Cougar. If easements can be obtained, PacifiCorp will develop a trail between Eagle Cliff Park and the USFS boundary.

Depending on the results of future recreation needs assessments, camping facilities at Yale Lake and Swift Forest Campground could be expanded. PacifiCorp proposes to prohibit dispersed camping along the Lake Merwin shoreline and limit it along the Yale Lake and Swift Creek Reservoir shorelines. PacifiCorp will also assist USFS in managing dispersed camping on NFS lands along the Swift Creek Reservoir shoreline.

None of the proposed recreation measures at day use areas, boat launches, trails, or campgrounds will be likely to cause disturbance to bald eagles, due to the distance of the recreation sites from existing bald eagle nests, which measures over half a mile at the Speelyai Bay Park and over a mile at all other sites.

The locations of dispersed camping sites that will be converted to day use only sites are unknown at this time. If review of PacifiCorp's GIS database shows that the selected camp sites are located less than half a mile from any existing bald eagle nests, PacifiCorp may need to implement timing restrictions to prevent disturbance. An overall reduction of dispersed camping, however, will be expected to reduce disturbance to bald eagles along the shoreline.

5.4.2 Indirect Effects

5.4.2.1 Effects of Aquatic Measures

The Lewis River Settlement Agreement outlines several aquatic resource enhancement measures that will not cause disturbance to bald eagles, but could indirectly affect eagles as a result of their impacts on fish. To improve fish habitat, PacifiCorp and Cowlitz PUD will modify flow releases, reservoir operations, and ramping rates. PacifiCorp and Cowlitz PUD will reintroduce anadromous fish into all three reservoirs and into the upper

watershed, as well as continuing the annual kokanee and rainbow trout stocking programs in Lake Merwin and Swift Creek Reservoir, respectively. Large woody debris placement and spawning gravel augmentation will be implemented in the lower river.

Each of the measures described above is intended to eventually result in a greater abundance and wider distribution of salmonids in the Project area. Reintroduction of anadromous fish will improve foraging opportunities for bald eagles in each of the reservoirs, in reservoir tributaries, and in the upper watershed, beginning approximately 5 years from the issuance of new licenses. Species that will be re-introduced include fall Chinook, coho, and winter steelhead. Fall Chinook spawn in September and October, while coho spawn from October through December. Winter steelhead spawn from mid-March through mid-June. This mix of run timing will provide carcasses for both breeding and wintering bald eagles. Juvenile fall Chinook will not remain in the system for long, but juvenile coho and steelhead could provide some year-round forage opportunities.

5.4.2.2 Effects of Recreation Measures

PacifiCorp estimates that the demand for boating-related activities will increase by at least 100 percent during the term of any new licenses; that the demand for trail-related activities will increase by well over 100 percent; and that peak season camping will exceed capacity by or before 2015. Improving campgrounds, day use sites, trails, boat launches and docks will likely contribute to long-term increases in recreational use of all three reservoirs. Higher levels of recreational activity on the water and along the shorelines will increase the potential for disturbance to bald eagles during the breeding season. However, camping, hiking, boating and angling activity is highest from June through August, when eagles are typically less sensitive to disturbance than is the case earlier in the breeding season. Positive effects will also accrue to bald eagles and other wildlife due to the increase in the prey base and foraging opportunities related to salmon and steelhead reintroduction.

5.4.3 Cumulative Effects

As human populations expand in western Washington and northwestern Oregon, the demand for outdoor recreation opportunities is expected to increase. Recreation measures that will be implemented under the Lewis River Settlement Agreement will enhance recreation facilities in the project area, and improve access for fishing, boating, and hiking. Each of these activities has the potential to cause disturbance to bald eagles that nest along the reservoir shorelines and forage on the reservoirs.

Proposed aquatic resource measures are anticipated to benefit bald eagles by increasing the abundance of prey in project reservoirs, tributaries, and in the upper watershed. Measures implemented in the Lewis River will contribute to salmon recovery efforts that are being implemented throughout the region. Because of their strong reliance on salmon as the mainstay of their diet, the success of regional salmon recovery will also contribute to bald eagle population stability.

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5.4.4 Conservation Measures

Similar to the existing Merwin Wildlife Habitat Management Plan, PacifiCorp's and Cowlitz PUD's proposed Wildlife Habitat Management Plans will include measures to protect bald eagle nests and communal roosts. The measures include the following key features:

- Conduct pre-cut surveys to search for new raptor nests and determine the status of known nests. Where nests are documented, restrict activities within 1,500 feet between January 1 and August 31. Outside the winter season, buffer zones are maintained to provide thermal protection and vegetative screening from disturbance, and to ensure adequate replacement trees are available in the future
- When planning forest management activities near nest sites, consider alternative and potential nest trees, perch trees, vegetative screening, foraging areas, flight paths, and sources of disturbance.
- Implement road closures, as needed, to protect bald eagles.

PacifiCorp will continue to conduct annual surveys to document nesting, productivity, and winter use, and will continue to implement bald eagle protection measures through any new license periods.

5.4.5 Effect Determination

Implementation of measures proposed under the Lewis River Settlement Agreement may affect, but with conservation measures in place, benefits will accrue to bald eagles and other raptors and will not likely adversely affect them.

5.5 NORTHERN SPOTTED OWL

5.5.1 Direct Effects

5.5.1.1 Effects of Aquatic Resource Measures

Aquatic resource measures that will require construction will be located at existing project facilities; no spotted owl habitat will be removed or altered. Construction could cause noise disturbance during the breeding season, if located within 0.25 miles of spotted owl nest sites.

5.5.1.2 Effects of Terrestrial Resource Measures

Several of the terrestrial resource measures proposed under the proposed action are focused on forest management. PacifiCorp and Cowlitz PUD will protect existing old-growth and mature forest and increase snag densities, thin dense stands to improve wildlife access, and may convert alder-dominated stands to conifer where possible. Because of their strong association with mature and old-growth conifer forest, these measures will likely improve habitat for the northern spotted owl in the project area over the long-term. PacifiCorp's proposal to provide funding for the acquisition of additional

wildlife mitigation lands will result in expansion of the area of forest that could be managed to improve habitat for owls.

PacifiCorp will continue to conduct raptor surveys prior to timber harvest, and will schedule management activities to prevent disturbance during the nesting season. Although specifically intended to reduce disturbance to big game species, PacifiCorp's proposals to maintain road closures and close additional roads, where possible, will also reduce the potential for disturbance to spotted owls.

5.5.1.3 Effects of Recreation Resource Measures

Most recreation enhancement measures will be implemented at existing recreation facilities, and spotted owl habitat will not be removed or altered. Noise during construction could cause disturbance if implemented during the breeding season at locations within 0.25 miles of nest sites.

None of the proposed trails will be constructed in areas known to be used by spotted owls. Again, construction noise could cause disturbance to nesting birds, depending on the proximity of trails to nest sites.

5.5.2 Indirect Effects

Recreational use in the project area is likely to increase through any new license periods, as human populations in western Washington and northwestern Oregon continue to expand. Recreation measures proposed under the Lewis River Settlement Agreement will enhance recreation opportunity. Most increases will likely occur at day use areas, boat launches and campgrounds along the shoreline. Because spotted owls generally prefer forest interior habitat and avoid edge habitat, it is unlikely that long-term increases in human activity along the shorelines will affect this species.

Construction of new trails could introduce disturbance into forested areas that are currently not accessible to hikers, cyclists, or equestrians. However, effects on northern spotted owls are unlikely because no trails are proposed for construction through late-successional forest cover types.

5.5.3 Cumulative Effects

No cumulative effects on the northern spotted owl have been identified.

5.5.4 Conservation Measures

No northern spotted owl nests have been documented to date on project lands. Under their respective Wildlife Habitat Management Plans, PacifiCorp and Cowlitz PUD conduct pre-cut surveys to search for new nests and will monitor annual nest activity, should nests be documented, restrict activities within 1,500 feet of nest trees between February 1 and June 30, and will prepare site-specific plans to protect alternative and potential nest trees, retain vegetative screening, and minimize disturbance.

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PacifiCorp and Cowlitz PUD will implement northern spotted owl protection measures, as needed, through any new license periods. Adequate protection will require close coordination with adjacent landowners, since several spotted owl activity centers are contiguous with project lands.

5.5.5 Effects Determination

Measures to be implemented under the Lewis River Settlement Agreement may affect, but will not be likely to adversely affect, the northern spotted owl. No suitable habitat will be removed or altered, but timing restriction may be needed to prevent disturbance if proposed construction activities are located within 0.25 miles of nest sites.

6.0 CONCLUSION

Section 7 of the ESA directs federal departments and agencies to ensure that actions authorized, funded, and/or conducted by them are not likely to jeopardize the continued existence of any federally proposed or listed species, or result in destruction or adverse modification of critical habitat for such species. The objective of this BE was to review all pertinent and available information on the potential direct, indirect, and cumulative effects of the proposed action on ESA listed threatened and endangered species and associated critical habitats under USFWS jurisdiction. Proposed, candidate, and other important species of record that could potentially be affected by this project were also considered in the event that they become listed before the project is complete.

Based on the information presented in this BE, the following determinations have been made (Table 6.0-1).

Table 6.0-1. Summary of Effect Determinations.

Species unit (status), critical habitat unit	Effects Determination	Rationale
Columbia River bull trout DPS (Threatened)	Likely to adversely affect	Although the proposed action will have a net benefit to bull trout by increasing connectivity, reducing entrainment, increasing the forage base, and protecting and enhancing habitat, some level of handling mortality and entrainment is unavoidable.
Designated critical habitat	Not likely to destroy or adversely modify	Critical habitat will be improved over existing conditions by implementing minimum flows and flow plateau operations, evaluating LWD, monitoring and augmenting gravel, funding habitat enhancement, monitoring and improving water quality, and developing habitat management plans.

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Species unit (status), critical habitat unit	Effects Determination	Rationale
Pacific Lamprey (No ESA status, but important species of record in the Columbia River basin) ESA critical habitat does not apply	Net beneficial effect	Increased primary productivity, improved upstream and downstream passage, reduced entrainment, and protection and enhancement of habitat will benefit lamprey in the Lewis River basin.
Washington/Columbia River sea-run cutthroat trout ESU (No ESA status, but important species of record in the Columbia River basin) ESA critical habitat does not apply	Net beneficial effect	Increased primary productivity, improved upstream and downstream passage, reduced entrainment, and protection and enhancement of habitat will benefit cutthroat trout in the Lewis River basin.
Golden paintbrush (Threatened)	No effect	Unlikely to occur in project area; not observed during field surveys.
Water howellia (Threatened)	No effect	Unlikely to occur in project area; not observed during field surveys.
Bradshaw's lomatium (Endangered)	No effect	Unlikely to occur in project area; not observed during field surveys.
Nelson's checker-mallow (Threatened)	No effect	Unlikely to occur in project area; not observed during field surveys.
Mardon skipper (Candidate)	No effect	Unlikely to occur in project area.
Oregon spotted frog (Candidate)	No effect	Unlikely to occur in project area; not observed during field surveys.
Columbian white-tailed deer (Endangered)	No effect	Does not occur in project area
Grizzly bear (Threatened)	No effect	Does not occur in project area.
Canada lynx (Threatened)	No effect	Unlikely to occur in project area; not observed during field surveys.
Pacific fisher (Candidate)	No effect	Unlikely to occur in project area; not observed during field surveys.
Gray wolf (Threatened)	May affect, not likely to adversely affect	May occur as transient.
Marbled murrelet (Threatened)	No effect	Unlikely to occur in project area; not observed during field surveys.

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Species unit (status), critical habitat unit	Effects Determination	Rationale
<p>Bald eagle (Threatened, proposed for de-listing)</p>	<p>May affect, not likely to adversely affect</p>	<p>Although there will be a potential for short-term disturbance during construction and long-term disturbance due to project-related recreation through the new license periods, implementation of the LRWHMPs and conservation measures should be adequate to prevent measurable adverse effects. Long-term indirect benefits will be anticipated as a result of reintroduction of anadromous salmonids, which will increase the eagle forage base.</p>
<p>Northern spotted owl (Threatened)</p>	<p>May affect, not likely to adversely affect</p>	<p>Although there will be a potential for short-term disturbance during construction and long-term disturbance due to project-related recreation through the new license periods, implementation of the LRWHMP and conservation measures should be adequate to prevent measurable adverse impacts.</p>

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8.0 COMMUNICATION RECORD

Jim Byrnes - Washington Department of Fish and Wildlife, Vancouver

PacifiCorp and Cowlitz PUD
Lewis River Hydroelectric Projects
FERC Project Nos. 935, 2071, 2111, 2213

APPENDIX A

Species Lists Provided by
U.S. Fish and Wildlife Service
United States Department of the Interior

FISH AND WILDLIFE SERVICE

Western Washington Fish and Wildlife Office
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503
Phone: (360) 753-9440 Fax: (360) 534-9331

Jun 8 2004

Dear Species List Requester:

We (U.S. Fish and Wildlife Service) are providing the information you requested to assist your determination of possible impacts of a proposed project to species of Federal concern. Attachment A includes the listed threatened and endangered species, species proposed for listing, candidate species, and/or species of concern that may be within the area of your proposed project.

Any Federal agency, currently or in the future, that provides funding, permitting, licensing, or other authorization for this project must assure that its responsibilities under section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act), are met. Attachment B outlines the responsibilities of Federal agencies for consulting or conferencing with us.

If both listed and proposed species occur in the vicinity of a project that meets the requirements of a major Federal action (i.e., "major construction activity"), impacts to both listed and proposed species must be considered in a Biological Evaluation (BE) (section 7(c); see Attachment B). Although the Federal agency is not required, under section 7(c), to address impacts to proposed species if listed species are not known to occur in the project area, it may be in the Federal agency's best interest to address impacts to proposed species. The listing process may be completed within a year, and information gathered on a proposed species could be used to address consultation needs should the species be listed. However, if the proposed action is likely to jeopardize the continued existence of a proposed species, or result in the destruction or adverse modification of critical habitat, a formal conference with us is required by the Act (section 7(a)(4)). The results of the BE will determine if conferencing is required.

The Federal agency is responsible for making a determination of the effects of the project on listed species and/or critical habitat. For a Federal agency determination that a listed species or critical habitat is likely to be affected (adversely or beneficially) by the project, you should request section 7 consultation through this office. For a "not likely to

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Lewis River Hydroelectric Projects
FERC Project Nos. 935, 2071, 2111, 2213

adversely affect" determination, you should request our concurrence through the informal consultation process.

Candidate species and species of concern are those species whose conservation status is of concern to us, but for which additional information is needed. Candidate species are included as an advance notice to Federal agencies of species that may be proposed and listed in the future. Conservation measures for candidate species and species of concern are voluntary but recommended. Protection provided to these species now may preclude possible listing in the future.

For other federally listed species that may occur in the vicinity of your project, contact the National Marine Fisheries Service (NOAA Fisheries) at (360) 753 to request a list of species under their jurisdiction. For wetland permit requirements, contact the Seattle District of the U.S. Army Corps of Engineers for Federal permit requirements and the Washington State Department of Ecology for State permit requirements.

Thank you for your assistance in protecting listed threatened and endangered species and other species of Federal concern. If you have additional questions, please contact Tami Black at (360) 753-4322 or Yvonne Dettlaff at (360) 753-9582.

Sincerely,

Ken S. Berg

Western Washington Fish and Wildlife Office

Enclosure(s)

PacifiCorp and Cowlitz PUD
Lewis River Hydroelectric Projects
FERC Project Nos. 935, 2071, 2111, 2213

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Western Washington Office
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503
Phone: (360) 753-9440 Fax: (360) 534-9331

SEP 3 2003

Dear Species List Requester:

Enclosed is a list of threatened and endangered species, species proposed for listing, candidate species, and species of concern within the western Washington county(s) for your proposed project. Due to our current workload and budget constraints, we are no longer providing site-specific species lists. For site-specific species information, please contact the Washington Department of Fish and Wildlife Priority Habitats and Species at (360) 902-2543 or access their website at [p://www.wa.gov/wdfw/hab/phspage.htm](http://www.wa.gov/wdfw/hab/phspage.htm), and the Washington Department of Natural Resources Natural Heritage Program at (360) 902-1667 or access their website at <http://www.dnr.wa.gov/nhp/>

If you have any questions, please contact Tami Black at (360) 753-4322.

Sincerely,

Ken S. Eerg, Manager

Western Washington Fish and Wildlife Office

Enclosure(s)

PacifiCorp and Cowlitz PUD
Lewis River Hydroelectric Projects
FERC Project Nos. 935, 2071, 2111, 2213

ATTACHMENT A

June 3, 2004

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES,
CRITICAL HABITAT, CANDIDATE SPECIES, AND SPECIES OF CONCERN
THAT MAY OCCUR IN WESTERN WASHINGTON

PREPARED BY

THE U.S. FISH AND WILDLIFE SERVICE

WESTERN WASHINGTON FISH AND WILDLIFE OFFICE

(Revised May 5, 2004)

FWS REF: 1-3-04-SP-0991

FERC LICENSES P-934, P-2071, LEWIS RIVER PROJECT

CLARK COUNTY

LISTED

Wintering bald eagles (*Haliaeetus leucocephalus*) occur in the county from about October 31 through March 31.

There are four bald eagle winter communal night roosts located in the county.

There are five bald eagle nesting territories located in the county. Nesting activities occur from about January 1 through August 15.

Bull trout (*Salvelinus confluentus*) occur in the county.

Northern spotted owls (*Strix occidentalis caurina*) occur in the county throughout the year.

Gray wolves (*Canis lupus*) may occur in the county.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species include:

1. Level of use of the project area by listed species.
2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.
3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) that may result in disturbance to listed species and/or their avoidance of the project area.

Castilleja levisecta (golden paintbrush) may occur in the county. *Howellia aquatilis* (water howellia) occurs in the county.

Howellia aquatilis (water howellia) occurs in the county.

Lomatium bradshawii (Bradshaw lomatium) occurs in the county.

Major concerns that should be addressed in a biological assessment for a listed plant species include:

1. Distribution of the taxon in the project vicinity.
2. Disturbance (trampling, uprooting, collecting, etc.) of individual plants and loss of habitat.
3. Changes in hydrology where the taxon is found.

CRITICAL HABITAT

None

PROPOSED

Critical habitat for bull trout (Columbia River distinct population segment) has been proposed in Clark County.

CANDIDATE

Oregon spotted frog (*Rana pretiosa*)

SPECIES OF CONCERN

California wolverine (*Gulo gulo luteus*)

Cascades frog (*Rana cascadae*)

Coastal cutthroat trout (*Oncorhynchus clarki clarki*)

Larch Mountain salamander (*Plethodon larselli*)

Long-eared myotis (*Myotis evotis*)

Long-legged myotis (*Myotis volans*)

Northern goshawk (*Accipiter gentilis*)

Northwestern pond turtle (*Emys* (= *Clemmys*) *marmorata marmorata*)

Olive-sided flycatcher (*Contopus cooperi*)

Pacific lamprey (*Lampetra tridentata*)

Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)

PacifiCorp and Cowlitz PUD
Lewis River Hydroelectric Projects
FERC Project Nos. 935, 2071, 2111, 2213

Peregrine falcon (*Falco peregrinus*)

River lamprey (*Lampetra ayresi*)

Slender-billed white-breasted nuthatch (*Sitta carolinensis aculeata*)

Tailed frog (*Ascaphus truei*)

Van Dyke's salamander (*Plethodon vandykei*)

Western gray squirrel (*Sciurus griseus griseus*)

Western toad (*Bufo boreas*)

Cimicifuga elata (tall bugbane)

Lathyrus torreyi (Toney's peavine)

ATTACHMENT A

June 3, 2004

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES,
CRITICAL HABITAT, CANDIDATE SPECIES, AND SPECIES OF CONCERN
THAT MAY OCCUR IN WESTERN WASHINGTON

PREPARED BY

U.S. FISH AND WILDLIFE SERVICE

WESTERN WASHINGTON OFFICE

(Revised April 12, 2004)

FWS REF: 1-3-04-SP-0991

FERC LICENSES P-934, P-2071, LEWIS RIVER PROJECT

COWLITZ COUNTY

LISTED

Wintering bald eagles (*Haliaeetus leucocephalus*) occur in the county from about October 31 through March 31.

There is one bald eagle winter communal night roost located in the county.

There is one bald eagle winter concentration area located in the county at Lake Merwin.

There are 21 bald eagle nesting territories located in the county. Nesting activities occur from about January 1 through August 15.

Bull trout (*Salvelinus confluentus*) occur in the county.

Columbian white-tailed deer (*Odocoileus virginianus leucurus*) occur along the Columbia River in the county.

Marbled murrelets (*Brachyramphus marmoratus*) occur in the county. Nesting murrelets occur from April 1 through September 15.

Northern spotted owls (*Strix occidentalis caurina*) occur in the county throughout the year.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species include:

1. Level of use of the project area by listed species.
2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

PacifiCorp and Cowlitz PUD
Lewis River Hydroelectric Projects
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3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) that may result in disturbance to listed species and/or their avoidance of the project area.

Sidalcea nelsoniana (Nelson checker-mallow) occurs in the county.

Major concerns that should be addressed in a biological assessment for a listed plant species include:

1. Distribution of the taxon in the project vicinity.
2. Disturbance (trampling, uprooting, collecting, etc.) of individual plants and loss of habitat.
3. Changes in hydrology where the taxon is found.

CRITICAL HABITAT

Critical habitat for the northern spotted owl has been designated in Cowlitz County.

Critical habitat for the marbled murrelet has been designated in Cowlitz County.

PROPOSED

Critical habitat for bull trout (Columbia River distinct population segment) has been proposed in Cowlitz County.

CANDIDATE

Oregon spotted frog (*Rana pretiosa*)

SPECIES OF CONCERN

Cascades frog (*Rana cascadae*)

California wolverine (*Gulo gulo luteus*)

Coastal cutthroat trout (*Oncorhynchus clarki clarki*)

Columbia torrent salamander (*Rhyacotriton kezeri*)

Larch Mountain salamander (*Plethodon larselli*)

Long-eared myotis (*Myotis evotis*)

Long-legged myotis (*Myotis volans*)

Northern goshawk (*Accipiter gentilis*)

Northwestern pond turtle (*Emys* (= *Clemmys*) *marmorata marmorata*)

Olive-sided flycatcher (*Contopus cooperi*)

Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)

Pacific lamprey (*Lampetra tridentata*)

Peregrine falcon (*Falco peregrinus*)

River lamprey (*Lampetra ayresi*)

Tailed frog (*Ascaphus truei*)

Valley silverspot (butterfly) (*Speyeria zerene bremeri*)

Van Dyke's salamander (*Plethodon vandykei*)

Western toad (*Bufo boreas*)

Cimicifuga elata (tall bugbane)

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Lewis River Hydroelectric Projects
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ATTACHMENT A

June 3, 2004

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES,
CRITICAL HABITAT, CANDIDATE SPECIES, AND SPECIES OF CONCERN
THAT MAY OCCUR IN WESTERN WASHINGTON

PREPARED BY

U.S. FISH AND WILDLIFE SERVICE

WESTERN WASHINGTON OFFICE

(Revised April 12, 2004)

FWS REF: 1-3-04-SP-0991

FERC LICENSES P-934, P-2071, LEWIS RIVER PROJECT
SKAMANIA COUNTY

LISTED

Wintering bald eagles (*Haliaeetus leucocephalus*) occur in the county from about October 31 through March 31.

There are six bald eagle winter communal night roosts located in the county.

There are four bald eagle nesting territories located in the county. Nesting activities occur from about January 1 through August 15.

Bull trout (*Salvelinus confluentus*) may occur in the county.

Canada lynx (*Lynx canadensis*) may occur in the county.

Gray wolves (*Canis lupus*) may occur in the county.

Northern spotted owls (*Strix occidentalis caurina*) occur in the county throughout the year.

Grizzly bears (*Ursus arctos* = *U. a. horribilis*) may occur in the county.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species include:

1. Level of use of the project area by listed species.
2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) that may result in disturbance to listed species and/or their avoidance of the project area.

CRITICAL HABITAT

Critical habitat for the northern spotted owl has been designated in Skamania County.

PROPOSED

Critical habitat for bull trout (Columbia River distinct population segment) has been proposed in Skamania County.

CANDIDATE

Fisher (*Martes pennanti*) (West Coast distinct population segment)

Mardon skipper (*Polites mardon*)

Oregon spotted frog (*Rana pretiosa*)

SPECIES OF CONCERN

Coastal cutthroat trout (*Oncorhynchus clarki clarki*)

Larch Mountain salamander (*Plethodon larselli*)

Long-eared myotis (*Myotis evotis*)

Long-legged myotis (*Myotis volans*)

Northern goshawk (*Accipiter gentilis*)

Northwestern pond turtle (*Emys* (= *Clemmys*) *marmorata marmorata*)

Olive-sided flycatcher (*Contopus cooperi*)

Pacific lamprey (*Lampetra tridentata*)

Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)

Peregrine falcon (*Falco peregrinus*)

River lamprey (*Lampetra ayresi*)

Tailed frog (*Ascaphus truei*)

Van Dyke's salamander (*Plethodon vandykei*)

Western gray squirrel (*Sciurus griseus griseus*)

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Western toad (Bufo boreas)

Cimicifuga data (tall bugbane)

Corydalis aquae-gelidae (Clackamas corydalis)

Cypripedium fasciculatum (clustered lady's slipper)

Erigeron howellii (Howell's daisy)

Penstemon barrettiae (Barrett's beardtongue)

Rorippa columbiae (Columbia yellowcress)

Sisyrinchium sarmentosum (pale blue-eyed grass)

Sullivantia oregana (Oregon sullivantia)

ORIGINAL

**Biological Evaluation of Listed, Proposed, and Candidate
Salmon and Steelhead Species**

**As Related to PacifiCorp and Cowlitz PUD's
Lewis River Hydroelectric Projects**

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REGULATORY COMMISSION

Prepared by

PacifiCorp

Meridian Environmental, Inc.

and

**Public Utility District No. 1 of Cowlitz County,
Washington**

January 15, 2005

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1.0 DESCRIPTION OF PROPOSED ACTION

1.1 HISTORY OF FERC RELICENSING

PacifiCorp and Public Utility District No. 1 of Cowlitz County (Cowlitz PUD) have completed a collaborative Federal Energy Regulatory Commission (FERC) relicensing process for the Yale, Swift No. 1, Swift No. 2, and Merwin hydroelectric projects located on the Lewis River, Washington (Figure 1.1-1). The Yale (Project No. 2071), Swift No. 1 (Project No. 2111), and Merwin (Project No. 935) Hydroelectric Projects are owned and operated by PacifiCorp. The Swift No. 2 (Project No. 2213) Hydroelectric Project is owned by Cowlitz PUD and currently operated by PacifiCorp under a contract with Cowlitz PUD. PacifiCorp and Cowlitz PUD initiated the collaborative relicensing process in response to comments from resource agencies and others that all four projects should be relicensed concurrently to better evaluate cumulative project effects in light of the fact the projects are operationally linked.

1.2 LEWIS RIVER COLLABORATIVE PROCESS

In January 1999, PacifiCorp and Cowlitz PUD filed a request with FERC for approval to use FERC's alternative licensing procedures (ALP) and for the simultaneous and coordinated processing of the license applications for all four projects. The purpose of ALP was to facilitate communication and collaboration among parties during the relicensing proceeding. On April 1, 1999, FERC approved the requested use of ALP and issued an order accelerating the expiration of the Merwin license to coincide with the other projects (letter from J. Mark Robinson, Director of Licensing and Compliance, FERC to Dave Leonhardt, PacifiCorp and Dennis Robinson, Cowlitz PUD; Order Accelerating License Expiration Date, issued April 8, 1999).

Upon securing FERC's approval for the use of ALP, PacifiCorp and Cowlitz PUD convened meetings on April 29-30, 1999, to initiate the collaborative process. Since this initial meeting, a series of public meetings have been held to establish the structure and ground rules of the process, and goals and objectives of the participants. Through these meetings, the participants established the Lewis River Hydroelectric Project Relicensing Steering Committee and Resource Workgroups.

The Steering Committee was responsible for overseeing the collaborative process and establishing work group goals and objectives. The Steering Committee established the following Resource Groups to study and address particular resource issues: (1) Aquatics; (2) Terrestrial/Land Use; (3) Flood Management; (4) Recreation/Aesthetics; (5) Socioeconomics; and (6) Cultural. The Resource Groups defined resource goals and objectives, developed an approach to achieve those goals and objectives, and provided recommendations to the Steering Committee. The Steering Committee acted on Resource Group recommendations and resolved outstanding issues. Initially, the Resource Groups devised studies to evaluate resource issues; later, the Groups devised conservation measures to address identified resource issues. In March 2002, Negotiating, Policy, and Legal groups were formed to develop the Lewis River Settlement Agreement

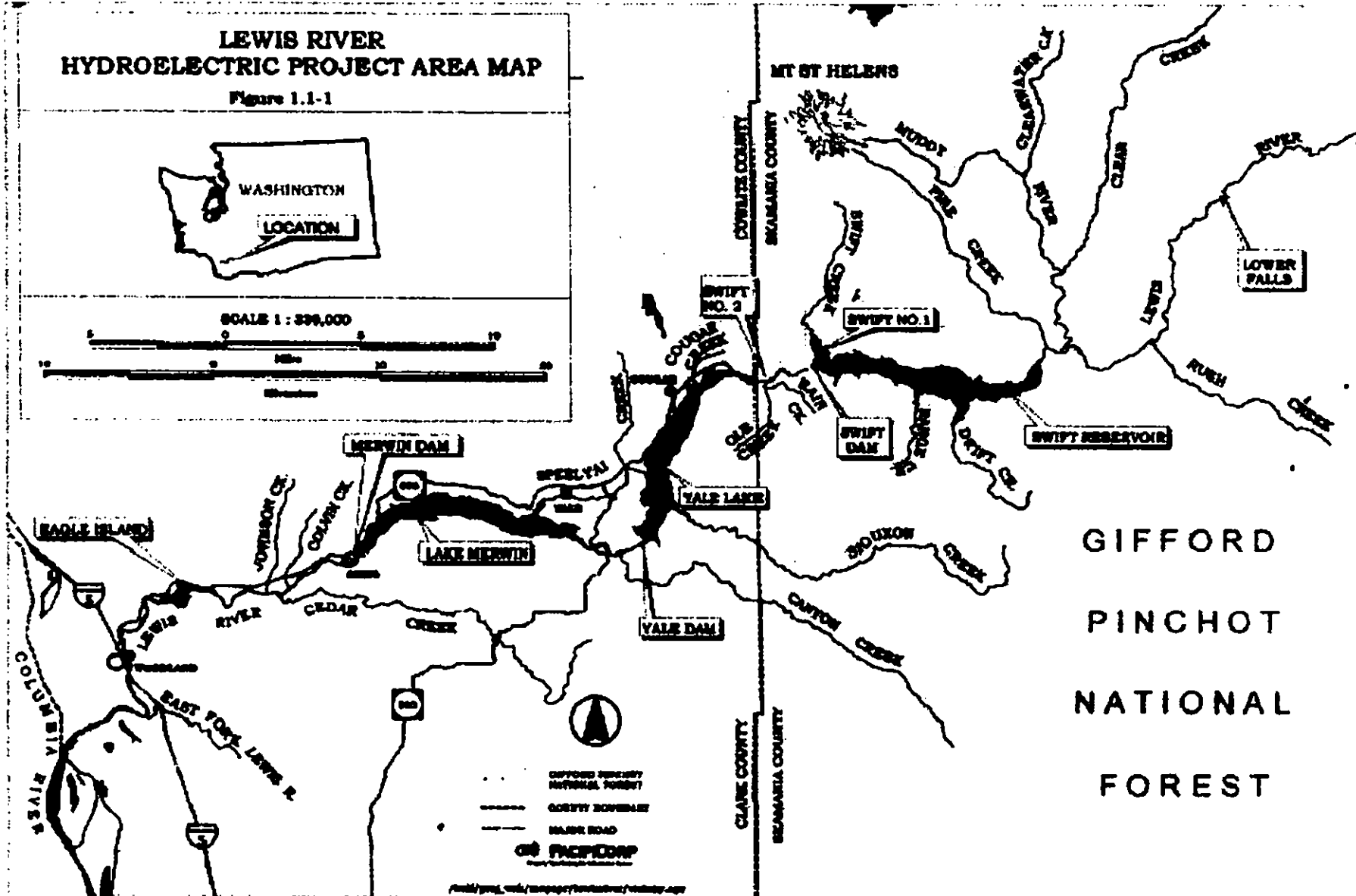


Figure 1.1-1. Lewis River Hydroelectric Project Area Map.

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for the implementation of long-term conservation measures for the Projects. The Settlement Agreement was signed on November 30, 2004. The signed Settlement Agreement along with an explanatory statement and supplemental Preliminary Draft Environmental Assessment (PDEA) were conveyed to FERC by PacifiCorp on December 1, 2004 and December 3, 2004 by Cowlitz PUD. The Lewis River Settlement Agreement measures form the basis for the FERC actions that this BE analyzes.

1.3 RELATIONSHIP OF PROPOSED ACTION TO NEW LEWIS RIVER LICENSES

In March 1998, NOAA Fisheries listed the Lower Columbia River steelhead (*O. mykiss*) as a threatened species under the ESA (63 FR 13347). In March 1999, NOAA listed Lower Columbia River Chinook salmon (*O. tshawytscha*) and Columbia River chum salmon (*O. keta*) as threatened species under the ESA (64 FR 14308; 64 FR 14508).

In September 2001, the U.S. District Court set aside NOAA's 1998 ESA listing of Oregon Coast coho salmon, finding that the ESA does not allow NOAA to list a subset of an Evolutionarily Significant Unit (ESU), and that NOAA had improperly excluded stocks from the listing once it decided that certain hatchery stocks were not part of the ESU (*A'sea Valley Alliance v. Evans*, 161 F Supp 2nd 1154 [2001]). Although the Court's ruling affected only one ESU, the interpretive issue raised by the ruling called into question nearly all of NOAA Fisheries' Pacific salmonid listing determinations. On remand, NOAA Fisheries voluntarily reviewed all of its previous listing decisions as well as additional petitions filed by others. In June 2004, NOAA Fisheries issued a new proposed rule evaluating 27 ESUs (69 FR 33102). NOAA has now proposed that the Lower Columbia River Chinook ESU, the Columbia River chum and the Lower Columbia River *O. mykiss* ESU remain listed under the ESA as threatened species (69 FR 33102). In addition, NOAA proposed that the Lower Columbia River coho ESU be listed under the ESA as threatened (69 FR 33102). All of these species occur in the Lewis River below Merwin Dam.

Section 7(a) (2) of the ESA requires federal agencies to ensure their actions do not jeopardize listed species. Each of the Lewis River Projects is licensed by the FERC, and PacifiCorp and Cowlitz PUD must comply with license articles that direct project operations and natural resource protection. FERC's issuance of new licenses for the Lewis River Hydroelectric Projects constitutes a federal action triggering the need for section 7 consultation. On October 14, 2004, FERC designated PacifiCorp and Cowlitz PUD as its non-federal representatives under U.S. Fish and Wildlife Service/National Marine Fisheries Service ESA section 7 regulations. PacifiCorp and Cowlitz PUD have prepared this BE in accordance with their designated ESA authority (see 50 CFR § 402.08). It addresses impacts from PacifiCorp's ownership and operation of the Merwin, Yale and Swift No. 1 projects; and Cowlitz PUD's ownership and operation of Swift No. 2. Cowlitz PUD has contracted with a third party (currently PacifiCorp) to perform certain operation functions. This BE addresses the effects on listed species as well as the new proposed listing decisions for the Lower Columbia River coho as well as the Lower Columbia River Chinook ESU, the Columbia River chum and the Lower Columbia River *O. mykiss* ESU. If necessary, PacifiCorp and Cowlitz PUD anticipate that NOAA will issue both a biological opinion and a conference opinion. However, it is likely that a final

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listing decision may occur for the species of concern before NOAA finalizes its biological opinion. The BE has incorporated the best available scientific information from the proposed listing decisions in the most recent federal register notice.

This BE identifies conservation measures that PacifiCorp and Cowlitz PUD propose to implement under the new FERC licenses. The primary goals of these proposed conservation measures are to provide PacifiCorp and Cowlitz PUD with ESA coverage. This BE addresses impacts from PacifiCorp's ownership and role as licensee and operations of the Merwin, Yale and Swift No. 1 projects; and Cowlitz PUD's ownership and role as licensee and operations of the Swift No. 2 project; and the designated operation functions PacifiCorp or another contractor performs pursuant to agreements with Cowlitz PUD for Swift No. 2.

1.4 PROPOSED ACTION

The proposed action for this consultation is the continued operation of the Lewis River Hydroelectric Projects (Yale Project FERC No. 2071, Swift No. 1 Project FERC No. 2111, Merwin Project FERC No. 935 and Swift No. 2 Project FERC No. 2213), operated under four new licenses for terms of 50 years consistent with the Lewis River Settlement Agreement.

The proposed action includes a comprehensive suite of salmon protection and restoration measures and actions that will be implemented in a phased approach over the terms of the licenses to primarily benefit spring Chinook, winter steelhead, and late-run coho. The fish passage elements of the program will be subject to rigorous performance standards. These include overall quantitative survival standards, specific salmon life stage standards and facility design standards. These will assist in gauging program success and whether there is need for potential facility adjustments or ultimately, facility modifications.

The overarching goal of the comprehensive program is to achieve genetically viable, self-sustaining naturally, reproducing, harvestable populations of these species above Merwin Dam at greater than minimum viable populations. There is recognition that commercial and tribal harvest and ocean conditions may dramatically affect program results but are not within the Licensees' control. Status checks are built into the program over time to monitor progress and adaptively manage the program as needed to maximize the expected benefits.

A central, significant feature of the comprehensive program involves reintroduction of extirpated salmon species into their historical range upstream of Merwin Dam. The program takes a comprehensive approach to salmon protection and reintroduction given the experimental nature of reintroducing extirpated anadromous species into their native range after many decades have passed. A key premise of the program is that it will provide an estimated 174 miles of potential anadromous fish habitat above Merwin Dam. Of this, 117 miles of habitat above Swift No. 1 Dam will become available in the fourth year of the reintroduction program as fish are trapped at Merwin Dam and transported upstream to above Swift Creek Reservoir. Over the next seventeen years, unless

otherwise directed by NOAA Fisheries and the United States Fish and Wildlife Service (the "Services"), each species will be reintroduced to Lake Merwin and Yale Lake via newly constructed upstream fish passage facilities at the Merwin, Yale and Swift Projects and downstream passage at Yale and Merwin Projects. Ultimately, this program will result in uninterrupted upstream fish passage for steelhead, salmon, cutthroat, and bull trout through each of the reservoirs associated with the Lewis River Projects.

The Lewis Projects are high-head projects that pose technological and behavioral challenges with respect to fish passage. As a result, the program includes many other important and complementary measures to underpin and strengthen the reintroduction effort. These include habitat preparation activities in the tributaries to the project reservoirs prior to species reintroduction, funding for habitat protection and restoration projects on key tributary streams to the reservoirs, and supplementation using hatchery fish over a period of years both to launch the reintroduction effort and provide support over time. The trap and transport effort will include the best available technology and designs to address the specific characteristics of the Lewis projects as high-head, high flow projects. Project operational changes also will be implemented to address impacts on species downstream.

Under the proposed action, it will likely take many years to reap the full benefits of all the measures and activities that will be undertaken and for the program to fully succeed:

- Habitat restoration activities need to occur over a period of several years to make the habitat fully functioning and productive;
- It will take several life cycles of salmon to determine whether the program is delivering anticipated benefits and to better understand potential outside impacts on the program such as harvest;
- The program contemplates phasing in reintroduction into the three reservoirs so that experience and knowledge gained from reintroduction above Swift No. 1 Dam can be applied to reintroduction into Yale Lake and Lake Merwin subsequent efforts;
- It will take time to construct fish passage facilities and time to determine what is working or what needs to be modified based on established performance standards;
- An aggressive monitoring and evaluation program, overseen by a multi-party committee, will be undertaken over many years to collect new information and scientific data to implement an adaptive management approach to species restoration and protection.

As noted, the proposed action includes rigorous facility and fish survival performance standards and a monitoring and evaluation program to track progress. The program also includes built-in, major "status checks" in years 27 and 37 to provide for a detailed review of program measures and activities and to track progress. If reintroduction outcome goals are not being met in years 27 and 37, "limiting factors analyses" will be undertaken to more precisely determine whether performance and species goals have been met, whether other factors are undermining program performance, and whether

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other actions could be undertaken to provide biological benefits equivalent to any project-related limiting factor.

In addition to the phased reintroduction of extirpated anadromous species and construction of fish passage facilities, the proposed action also includes hatchery and supplementation programs; flows in the Lewis River bypass reach; construction of an aquatic habitat channel; minimum flows below the Merwin Dam; plateau operation and ramping procedures; wildlife habitat acquisition, protection, and management; recreation upgrades and maintenance; cultural and historic resources protection measures; funding of law enforcement; and a visitor's center. All of these may provide indirect benefits to aquatic species. The discussion below in this Section 1.4 provides additional details regarding the proposed action to assist in the reader's understanding of its analysis in this BE; however, the Settlement Agreement is considered the best and most accurate description of the proposed action, and has been relied upon by PacifiCorp and Cowlitz PUD in preparing this BE.

1.4.1 Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action 50 CFR § 402.02(d). The action area for the purposes of this evaluation is the Lewis River basin from its confluence with the Columbia River to the headwaters of the North Fork Lewis River. This area encompasses all direct and indirect effects to listed species.

1.4.2 Lewis River Settlement Agreement Terms

A summary of the measures included in the Lewis River Settlement Agreement is presented in Table 1.4-1. More detailed information describing these measures is provided in the subsequent sections. The section numbers referred to in Table 1.4-1 correspond to sections of the Lewis River Settlement Agreement.

Table 1.4-1 Measures proposed under the Lewis River Settlement Agreement with the Potential to Affect ESA Listed Species.

Resource Area and Section	Resource Component	Proposed Measure	Timing
Section 3	Anadromous Fish Reintroduction Outcome Goals	3.1 Work to achieve genetically viable, naturally spawning, harvestable populations of Chinook, steelhead and coho above Merwin Dam. Check status of goals in Years 27 and 37 of new licenses.	Terms of the New Licenses
Aquatics Section 4	Upstream Fish Passage	4.2 Merwin Trap. Repair the fyke net. Reduce generation when personnel are working the trap. Improve efficiency and human safety of existing Merwin trap and add a new sorting and truck loading facility. Truck spring Chinook, coho & steelhead from the Merwin sorting facility to Swift Creek Reservoir or Yale Lake, per Upstream Transport Plan. Truck bull trout to Yale Lake.	By Year 2, modify trap By Year 4, operate new collection and transport facility

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		4.7 Upstream Passage at Yale Dam. Construct an upstream adult trap and sorting/trucking facility.	By Year 17
		4.8 Upstream Passage at the Swift Projects. Construct an upstream adult trap and sorting/trucking facility.	By Year 17
		4.9.1 Collect-and-Haul Programs. Net bull trout in Yale and Swift No. 2 tailraces and transport to Yale Lake or as directed by USFWS. Investigate alternative trapping methods.	Ongoing
		4.10.2 Bull Trout Passage in the Absence of Anadromous Fish Facilities. If 4.7 and/or 4.8 are not constructed, develop facility to collect bull trout at Yale and at Swift.	By Year 17 at Swift and Yale
	Downstream Fish Passage	4.4 Downstream Transport at Swift No. 1 Dam. Install a floating surface collector system with guide walls and nets at Swift Dam. Collect anadromous fish, sort, mark a sub-sample, and truck to release pond below Lake Merwin. Release bull trout in Yale Lake or below Merwin, depending on developmental stage.	By Year 4.5
		4.4.2 Spring Chinook Satellite Collection Facility. If directed by NOAA-Fisheries, evaluate, design and install a satellite passage facility in Swift Creek Reservoir.	If Required
		4.4.3 Release Ponds. Construct release pond below Merwin Dam for downstream migrants.	By Year 4.5
		4.5 Downstream Passage at Yale Dam. Install a floating surface similar to Swift. Collect fish, sort, mark a sub-sample, and truck to release pond below Lake Merwin. Bull trout will be returned to Yale Lake or transported to the downstream release pond, depending on development stage.	By Year 13
		4.6 Downstream Passage at Merwin Dam. Install a floating surface similar to Swift. Collect fish, sort, mark a sub-sample, and truck to a release site below Lake Merwin. Release bull trout in Lake Merwin or as directed by USFWS.	By Year 17
		4.9.3 Yale and Merwin Bull Trout Entrainment Reduction. Evaluate and implement measures to reduce entrainment up to and until downstream floating collector is constructed.	By Year 1 at Yale, when directed by USFWS at Merwin

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		4.10.1 Bull Trout Passage in the Absence of Anadromous Fish Facilities. If 4.5 and/or 4.6 not built, develop downstream facility to collect/transport bull trout.	By Year 13 at Yale; after Year 17 at Merwin
Aquatics Section 5	Additional Aquatic Measures	5.1 Yale Spillway modifications. Modify Yale spillway to improve downstream resident fish survival (including bull trout) during spill events.	By Year 4.5 of the Yale License
		5.2 Bull Trout Habitat Enhancement Measures. Manage existing conservation covenants to protect bull trout habitat in perpetuity.	Complete
		5.5 Bull Trout Limiting Factors Analysis. Conduct LFA on Merwin and Swift Creek Reservoir tributaries.	By 2 nd anniversary of Effective Date
		5.6 Public Information Program to Protect Listed Anadromous Species. Provide signage and educational materials to inform the public of efforts to reintroduce and protect listed anadromous fish to the Lewis River above Merwin Dam.	When Requested
		5.7 Public Information Program to Protect Bull trout. Install signage and distribute flyers to inform public about bull trout in the project area.	Within 6 months
Aquatics Section 6	Bypass Flow	6.1 Bypass Reach. Release flows to the reach of the Lewis River downstream of Swift No. 1 ending at Yale Lake.	Year 1
		6.1.1 Flow releases from canal drain. Release up to 47 cfs.	Upon completion of Swift No. 2 reconstruction
		6.1.2 Construct upper release point. Design and construct upper water release point.	Year 1
		6.1.3 Determine feasibility of constructed channel in bypass reach and fund construction. Interim flow schedule: 60 cfs, July 1 through Oct. 31; 100 cfs, Nov. 1 through Jan, 31; 75 cfs, Feb. 1 through June 30.	Upon completion of upper release structure
		6.1.4 Flow Schedule. Develop an interim and final flow release schedule for the bypass reach	Start Year 1
	Merwin Flow	6.2.1. Ramping Rates Below Merwin Dam. Up ramping rates limited to 1.5 feet per hour, down ramping limited to 2 inches per hour, with critical flow set at 8,000 cfs; no ramping from February 16 through June 15, one hour before/after sunrise or one hour before/after sunset.	Start Year 1

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		6.2.2 Plateau Operations at Merwin Dam. Follow Plateau Operation procedures between February 16 and August 15. Changes in flow will be consistent with ramping restriction of 6.2.1 at or below flows of 8,000 cfs, and flow changes will be limited to no more than one change in any 24-hour period, and 4 times in any 7-day period, or 6 times/month.	Start Year 1
		6.2.3 Stranding Study and Habitat Evaluation. Conduct stranding study and habitat evaluation below Merwin Dam to evaluate operation effects on anadromous salmonids and their habitats.	Complete by Year 3
		6.2.4 Minimum Flows Below Merwin Dam. Minimum flows range from a high of 4,200 cfs (Nov 1 to Dec 15) to 1,200 cfs (July 31 to Oct 12)	Start Year 1
		6.2.5 Low Flow Procedures. During dry years convene Flow Coordination Committee to implement adaptive management; focused on fish needs, flood management, and reservoir recreational pool levels.	As Needed
Aquatic Habitat Section 7	Habitat Enhancement Actions	7.1 Large Woody Debris Program. Stockpile Large Woody Debris under direction of ACC for use by other entities for habitat projects.	Start Year 1 of Merwin License
		7.1.1 Funding. Provide \$2,000 annually for qualified entities to use for LWD projects and \$10,000 annually for the Aquatics Fund earmarked for habitat projects.	Within 6 months of Merwin License
		7.1.2 LWD Study. Conduct a LWD study to identify issues and opportunities for LWD projects below Merwin Dam	Within 1 st year of Merwin License
		7.2 Spawning Gravel Program. Develop spawning gravel monitoring and augmentation program below Merwin.	Start within 6 months of Effective Date
		7.3 Predator Study. Conduct one-time study of whether predation in Merwin is a limiting factor to anadromous salmonid survival.	Complete by Year 10
		7.4 Habitat Preparation Plan. Release adult salmon for five years into the reservoirs prior to passage to begin preparing the spawning habitat and to enhance nutrients.	Within 6 months of Effective Date
		7.5 Aquatic Enhancement Fund. Provide funding for aquatic enhancement projects; PacifiCorp to provide \$5.2 million over 14 years, and Cowlitz PUD to provide \$520,000 over 20 years.	PacifiCorp starts in 2005; Cowlitz PUD starts at end of Year 1

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		7.6 In Lieu Fund. Establish In Lieu Fund if the Services determine salmonid introduction to Yale or Merwin is not required and passage facilities not built; PacifiCorp to provide up to a total of \$30 million; funds to be spent on aquatic enhancement measures.	Contributions in Years 11-13 and 14-17 of Yale; Years 14-17 of Merwin; Years 14-17 of Swift No. 1
Hatchery Program and Supplementation Section 8	Hatcheries	8.2 Anadromous Fish Hatchery Adult Ocean Recruit Target by Species. Anadromous Fish Hatchery Production. Licensees will produce 86,000 adult ocean recruits according to allocation in Section 8.2.1.	Start in Year 1
		8.3 Anadromous Fish Hatchery Juvenile Production. Juvenile production targets are defined in Table 8.3 for Years 1-3, 4-5, and 6-60.	Start in Year 1
		8.4 Supplementation Program. Licensees will supplement adult and juvenile salmon and steelhead according to allocation in sections 8.4.1, 8.4.2, and 8.4.3.	Varies by species and reservoir
		8.5 Resident Fish Production. Stock 20,000 lbs. of rainbow annually in Swift Creek Reservoir. Stock 12,500 lbs. of kokanee annually in Lake Merwin.	Start in Year 1
		8.6 Hatchery and Supplementation Plan. Develop a plan for hatchery production and supplementation according to Section 8.6.1 and 8.6.2.	Start between Years 1 and 3
		8.7 Hatchery and Supplementation Facilities, Upgrades, and Maintenances. Fund or undertake upgrades to existing hatcheries in collaboration with WDFW and the ACC.	Per Schedule 8.7
		8.8.1 Locate and install juvenile acclimation sites (if feasible) above Swift Creek Reservoir.	By Year 4
		8.8.2 Install juvenile acclimation sites in Yale Lake and Lake Merwin. Temporary sites in tributary streams.	By Year 13
		Monitoring Section 9	Aquatic Monitoring and Evaluation
9.2 Monitoring and Evaluation Related to Fish Passage. Monitor performance of upstream and downstream passage facilities according to performance criteria.	As Needed		
9.3 Wild Fall Chinook and Chum. Monitor spawners below Merwin.	Annually		
9.4 Water Quality Monitoring. Monitor water quality and fund NPDES compliance monitoring.	As Required		

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		9.5 Monitor Hatchery and Supplementation Program. Assess effects of supplementation efforts.	Report as Directed
		9.6 Bull Trout Monitoring. Monitor bull trout collection and test alternate passage facilities.	Start in Year 1
		9.7 Resident Fish Assessment. Monitor kokanee population in Yale annually and impacts of anadromous fish introduction on resident fish species.	As Required
		9.8 Monitoring of Flows. PacifiCorp to fund monitoring of Merwin flows and flows in the bypass reach.	Report Annually
Terrestrial Section 10	Land Acquisition	10.1 Yale Land Acquisition and Habitat Protection Fund. Provide \$2.5 million to purchase wildlife mitigation lands near the Yale Project.	In Years 1 and 2 of Effective Date
		10.2 Swift No. 1 and Swift No. 2 Land Acquisition and Habitat Protection Fund. Provide \$7.5 million to purchase wildlife mitigation lands for the Swift No. 1 and Swift No. 2 projects.	Initiated within 18 months of Swift licenses
		10.3 Lewis River Land Acquisition and Habitat Protection Fund. Provide \$2.2 million total and matching contributions annually not to exceed \$100,000 or \$500,000 in any ten consecutive years, to purchase wildlife mitigation lands in the Lewis River basin.	Initiate in Year 4.5 of Yale License
		10.8 Wildlife Habitat Management Plan. Develop the Wildlife Habitat Management Plan to direct habitat conservation funds and provide effectiveness monitoring.	Start in Year 1
		10.8.4 Habitat Evaluation Procedures. Update HEP study of all WHMP lands.	Year 17
Recreation Section 11	RRMP	Implement the RRMP that will include all of PacifiCorp's recreation measures.	In 3 phases beginning in Year 1
PacifiCorp Recreation Measures	Swift Creek Reservoir Measures	11.2.1.1 Swift Dispersed Shoreline Use Sites. Manage and maintain dispersed use sites on PacifiCorp and USFS land and within the FERC project boundary.	Start in Year 1
		11.2.1.2 Eagle Cliff Trail. Develop trail from Eagle Cliff Park to USFS boundary.	Year 4
		11.2.1.3 Control of Swift Forest Camp. Acquire campground from WDNR or negotiate management agreement.	End of Year 1
		11.2.1.4 Swift ADA Accessibility Improvements. Evaluate ADA compliance at developed facilities at Swift Creek Reservoir and renovate as needed.	Years 1 through 7

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		11.2.1.5 Swift Day Use Facilities. Provide a new picnic shelter at Swift Forest Camp; toilets, picnic area and day use renovations at Eagle Cliff Park.	Year 5 for Swift Camp; Year 11 for Eagle Cliff Park
		11.2.1.6 Swift Campground and Group Camp Expansion. Expand campground and improve facilities.	When needed
		11.2.1.7 Swift O&M. Operate and maintain Eagle Cliff Park and Swift Forest Camp.	Year 1
	Yale Lake Measures	11.2.2.1 Yale Dispersed Shoreline Use Sites. Maintain and manage dispersed shoreline use sites.	Start in Year 1
		11.2.2.2 Yale/IP Road Phase I. Attempt to secure access to road and bridge.	By Year 4
		11.2.2.3 Yale/IP Road Phase II. Develop trail, parking, reservoir access and day use facilities.	When Phase I is complete.
		11.2.2.4 Yale/IP Road Phase III. Resurface trail.	Year 15 -16
		11.2.2.5 Yale Trails. Develop Saddle Dam trail segment, parking at Saddle Dam Park, management approach for Saddle Dam Park, trail from Cougar Park to Beaver Bay, and loop trail in Cougar.	Year 5
		11.2.2.6 ADA Accessibility Improvements. Evaluate ADA compliance at developed facilities at Yale Lake and renovate as needed.	Year 1 - 7
		11.2.2.7 Yale Park Boat Launch. Extend the ramp and replace the docks.	Year 4
		11.2.2.8 Beaver Bay Boat Launch. Replace the dock and repair bank erosion.	Year 4
		11.2.2.9 Beaver Bay Day Use Parking. Isolate parking area from wetland.	Year 4
		11.2.2.10 Yale Lake Day Use Facilities. Improve facilities at Yale Park, Beaver Bay and Cougar Park.	Year 7
		11.2.2.11 Cougar Day Use Restroom. Replace or renovate to meet ADA standards.	Year 6
		11.2.2.12 Beaver Bay Campground and Group Camps. Redesign campground and replace restrooms.	Year 13
		11.2.2.13 Cougar Campground. Renovate tent only camping area.	Year 14
		11.2.2.14 Cougar Campground and Group Camp. Expand facilities.	When needed
		Lake Merwin Measures	11.2.3.1 Merwin Dispersed Shoreline Use Areas. Maintain dispersed shoreline use sites.
		11.2.3.2 Merwin Trails. Provide information about area trails.	Year 5

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		11.2.3.3 Marble Creek Trail. Improve trail and ADA accessibility.	Year 4
		11.2.3.4 South Shore Merwin Trail Access. Evaluate potential trail easement from County land to lake.	When needed
		11.2.3.5 Merwin ADA Accessibility Improvements. Renovate Lake Merwin facilities.	Years 1-7
		11.2.3.6 Boat Launches. Extend ramp at Speelyai Bay Park.	11/30/04
		11.2.3.7 Yale Bridge Boating Access. Develop access for launching non-motorized watercraft.	Year 6
		11.2.3.8 Merwin Park Day Use Facilities. Provide new day use features.	Year 4
		11.2.3.9 Merwin Park Picnic Shelters. Construct new shelters and move tables.	Year 4
		11.2.3.10 Speelyai Park Restroom. Upgrade to meet ADA requirements.	Year 6
		11.2.3.11 Day Use Parking. Improve parking at Speelyai Bay Park.	Year 12
		11.2.3.12 Merwin O & M. Keep Cresap Bay Campground open through September. Maintain existing sites and shoreline day use sites.	Year 1
	Lower River Measures	11.2.4.1 Lower Lewis River Vault Toilets. Provide new toilets at Cedar Creek, Merwin Hatchery, Johnson Creek, Lewis River Hatchery, and Island River access points.	Year 1 and by 2007 for Island River.
		11.2.4.2 Lower Lewis River Day Use Improvements. Provide picnic tables at 5 sites.	Year 11
	Project Area Measures	11.2.5 I & E Program. Utilities to collaborate on a single project-wide I&E program.	Years 1-4
		11.2.6 Visitor Management Controls. PacifiCorp to implement controls to enhance safety and visitor enjoyment.	Year 1
		11.2.7 Communications on Recreation Facility Availability. PacifiCorp will inform public when recreation sites are at capacity.	Year 1
		11.2.8 Recreation Access to Project Lands. Non-motorized day use allowed on PacifiCorp lands.	Year 1
11.2.9 Land Ownership Retention for Recreation. PacifiCorp retains Switchback property for future recreation development when needed.		Year 1	

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Resource Area and Section	Resource Component	Proposed Measure	Timing
		11.2.10 Parking and Dispersed Shoreline Use at Yale and Swift Creek reservoirs. Overnight parking allowed at boat launches.	Year 1
		11.2.11 Campground Gate Access and Schedule. Close but not lock gates at campgrounds at night.	Year 1
		11.2.12 Dispersed Camping Funds to USFS. PacifiCorp provides \$5,220 annually to USFS to manage dispersed camping on USFS land.	Year 1
		11.2.13 Vehicle Access and Use. Work to restrict dispersed upland camping and motorized use.	Year 1
		11.2.14 ADA-Accessible Fishing Sites. Assess feasibility of ADA-accessible bank fishing sites.	Year 7: Study Year 10: Implement
		11.2.15 Public Use of RV Dump Sites. Use of PacifiCorp's RV dump sites to be allowed.	Year 1
Cowlitz PUD Recreation Measures		11.3.1 Swift No. 2 Power Canal Bank Fishing Facility. Construct ADA-compliant bank fishing facility at canal bridge, with parking and portable toilets.	6/30/05
		11.3.3 I & E Program. Collaborate with PacifiCorp on a single project-wide I&E program.	Years 1 - 4
		11.3.4 Recreation Access to Project Lands. Non-motorized day use allowed on lands within the Swift No. 2 project boundary.	Year 1
		11.3.5 Dispersed Camping Funds to USFS. Cowlitz PUD provides \$780 annually to USFS to manage dispersed camping on USFS land.	Year 1
Flood Management Section 12	Notification	12.4 Emergency Notification. PacifiCorp will contribute to County-developed installation and maintenance of emergency phone system for flood notification.	When installed
	Communications	12.6 NOAA Communications Transmitter. Fund NOAA weather radio transmitter installation and maintenance.	8/23/03
	High Runoff	12.8 High Runoff Procedure. Implement revised high runoff procedures for all 3 project reservoirs.	Year 1
Cultural Section 13.1	Resource Management	13.1 Cultural Resources. Finalize and Implement Historic Properties Management Plan for Merwin, Yale and Swift No. 1.	Year 1
		13.1(1) Curate artifacts in a secure location in the basin.	As defined in HPMP
		13.1 (2) Protect integrity of properties listed in the National Register of Historic Places (NRHP).	Year 1

Resource Area and Section	Resource Component	Proposed Measure	Timing
		13.1 (3) Preserve tribal access for traditional uses.	Year 1
		13.1 (4) Monitor and protect cultural resources	Year 1
		13.1.2 Cowlitz PUD Obligation for Cultural Resources. PUD will follow Unanticipated Discovery Plan and consult as needed for Section 106 compliance.	Year 1
Socioeconomics Section 13.2		13.2.1 Fund 2 full time law enforcement officers and on full-time fish and wildlife officer to patrol in the North Fork Lewis River basin.	Within 1.5 years
		13.2.2 Provide annual funding for the maintenance of Forest Road 90.	Begin in April 2005
		13.2.3 Pine Creek Work Center Communication Link. Continue funding support.	Ongoing
		13.2.4 Partially fund development of the Visitor Information Center or perform maintenance for the term of the new licenses.	As determined by USFS
Coordination and Decision Making Section 14.		14.2 Technical Coordination Committees. Form one technical committee for terrestrial implementation and one for aquatic implementation.	Within 60 days

1.4.2.1 Fish Passage and Reintroduction Measures

Merwin Trap – From and after the effective date of the Lewis River Settlement Agreement, PacifiCorp will modify the existing fish trap located at the base of Merwin Dam as needed to improve worker safety and increase fish handling efficiency without introducing additional risk to fish¹. Until construction of the Merwin Upstream Collection and Transport Facility is complete (described below), the upgraded Merwin Trap will be operated to collect hatchery fish returning from the ocean and to transport any bull trout to Yale Lake unless otherwise directed by the USFWS. Fish other than hatchery fish, anadromous fish destined for transport, and bull trout will be returned to the river below Merwin Dam.

Reintroduction Above Swift No. 1 Dam – Beginning one year prior to completion of a Swift downstream passage facility, the Licensees will begin a supplementation program to introduce adult salmon and steelhead into the basin upstream of Swift No. 1 Dam. This early supplementation effort provides natural progeny to initiate the reintroduction effort, which is aimed at reestablishing natural runs. Collection and transport of natural

¹ PacifiCorp will repair the fyke portion of the Merwin Trap or install another fyke to decrease the risk of injury to fish in the facility. PacifiCorp will also, to the extent feasible, limit the discharge from the generation facilities at Merwin Dam for safety purposes to a maximum flow to be determined by PacifiCorp and WDFW when personnel are working in the existing fish trap until such time as upgrades to the Merwin Trap are effective in providing a greater margin of safety for personnel.

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juvenile outmigrants will coincide with completion of downstream collection facilities at Swift No. 1 Dam (described below). An added benefit of these measures is the addition of marine derived nutrients into the system and preparation of habitat for future spawning and full-scale reintroduction.

Concurrent with implementing the supplementation program, PacifiCorp will begin a design, permitting and construction phase for upstream passage at Merwin Dam and downstream passage at Swift No. 1 Dam. By six months after the fourth anniversary of the issuance of the new license for the Merwin Project, PacifiCorp will construct and begin operating an upstream trapping, sorting and hauling facility at Merwin Dam², and PacifiCorp and Cowlitz PUD would construct and begin operating a downstream modular surface fish collector at Swift No. 1 Dam with sorting and hauling capabilities. PacifiCorp will also construct a stress release pond below Merwin Dam. All downstream migrating anadromous salmonids collected in the surface collector will be transported to that stress release pond. These facilities will result in up and downstream passage of spring Chinook, winter steelhead, late-run coho, bull trout and sea-run cutthroat to and from natural spawning and rearing habitat above Swift Dam. A monitoring and evaluation program will be put in place at that time to allow for measurement of performance standards.

Beginning upon completion of the Swift downstream facility, the supplementation program described above will be expanded to include juvenile salmon and steelhead and will continue for a minimum of 15 years for spring Chinook and winter steelhead and 9 years for late-run coho.

Reintroduction Above Yale Dam –In addition to hauling adult salmon and steelhead collected below Merwin Dam to above Swift No. 1 Dam, PacifiCorp will haul a portion of collected fish to Yale Lake to prepare the habitat for future fish and to seed the tributaries to Yale Lake. PacifiCorp will commence this supplementation as directed by the ACC.

Concurrent with implementing the Yale supplementation program, PacifiCorp will begin a design, permitting and construction phase for downstream passage at Yale Dam. On the thirteenth anniversary of the issuance of the new license for the Yale Project, PacifiCorp will begin operating a Yale downstream passage facility. All downstream migrating anadromous salmonids collected at Yale Dam will be transported to the stress release ponds below Merwin Dam. A monitoring and evaluation program will be added for downstream passage at Yale Dam at that time to allow for measurement of performance standards.

Upon completion of the Yale downstream facility, the supplementation program described above will be expanded to include placing juvenile salmon and steelhead into Yale Lake and will continue for a minimum of 15 years for spring Chinook and winter steelhead and 9 years for late-run coho.

² When designing the facility, engineers would look at the full suite of possible options, including without limitation (a) a complete new facility and (b) incorporation of the Merwin Trap (as upgraded) into the new design.

Full Reintroduction and Connectivity Throughout the Lewis River Projects – PacifiCorp will haul adult salmon and steelhead to Lake Merwin to prepare the habitat for future fish and to seed the tributaries. PacifiCorp will commence this supplementation as directed by the Services.

Concurrent with implementing the supplementation program, the Licensees will begin a design, permitting and construction phase that will include downstream passage at Merwin and upstream passage at Yale and the Swift Projects. On the seventeenth anniversary of the issuance of the new license for the Merwin Project, PacifiCorp will begin operating a Merwin downstream collection facility (which will include sorting and hauling capabilities) On the seventeenth anniversary of the issuance of the new license for the Yale Project, PacifiCorp will begin operating a Yale upstream passage facility. On the seventeenth anniversary of the issuance of the new license for the Swift No. 1 or Swift No. 2 Project, whichever is later, PacifiCorp will begin operating a Swift upstream passage facility. All downstream migrating anadromous salmonids will be transported to the stress release pond. Adding these facilities to the existing upstream facility at Merwin Dam and downstream facilities at the Swift Projects and Yale Dam will result in up and downstream passage of spring Chinook, winter steelhead, late-run coho, bull trout and sea-run cutthroat to and from natural spawning and rearing habitat throughout and above the Lewis River Projects. A monitoring and evaluation program will be added for the new facilities at that time to allow for measurement of performance standards.

Beginning upon completion of the Merwin downstream facility, the adult supplementation program described above will be expanded to include placing juvenile salmon and steelhead into Lake Merwin and will continue for a minimum of 15 years for spring Chinook and winter steelhead and 9 years for late-run coho.

Spring Chinook Satellite Collection Facility – If NOAA Fisheries concludes at any time that downstream passage at the Swift No. 1 Dam is not effective for collecting spring Chinook because of that species' unique behavior issues, and that a satellite collection facility has a reasonable likelihood of more effectively collecting spring Chinook, then PacifiCorp will design and install such a facility.

Species Transported – Initially, for purposes of fish passage, the Licensees will only transport spring Chinook, winter steelhead, coho, bull trout and sea-run cutthroat. Any other species inadvertently collected will be returned to the river and not transported. Notwithstanding the preceding sentence, the Licensees, after consultation with the ACC (Aquatics Coordinating Committee)³, and if directed by the Services, shall also transport fall Chinook or summer steelhead that enter the passage facilities.

Mode of Upstream Transport –

- a. Upstream Transport Before Full Adult Fish Passage – Unless and until alternative technologies are implemented (see paragraph b, below), the Licensees will

³ The ACC is composed of representatives of the parties to the Settlement Agreement, including NOAA Fisheries.

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provide for the transport by truck of species collected at an upstream transport facility. Once the Merwin Upstream Transport Facility is completed, and for so long as trucks are used, the Licensees will provide for transport according to the Upstream Transport Plan described below.

- b. **Upstream Transport After Full Adult Fish Passage** – On or before the thirteenth anniversary of the issuance of all new licenses, the Licensee responsible for each upstream transport facility (PacifiCorp for the Merwin Upstream Transport Facility and Yale Upstream Facility and PacifiCorp and Cowlitz PUD for the Swift Upstream Facility) shall evaluate whether alternative adult fish transport technologies (such as fish trams, cable lifts or other new technologies) at the facility will allow transportation of the fish with the least practicable amount of handling or other stress inducing actions, considering the need for sorting fish. If certain conditions are met, and if the Services determine that alternative transport technologies are suitable for meeting the Services’ fish passage goals and the biological benefits are expected to be equal to or greater than the benefits of trap-and-transport by truck, then the Licensees will implement such alternative transport technologies for upstream transport. If alternative technologies are not used, the Licensees will continue to transport collected fish by truck
- c. **Upstream Transport Plan.** The Licensees will develop, in Consultation with the ACC and with the approval of the Services, a plan that shall describe the frequency and procedures for upstream fish passage. The Licensees will provide for the transport of fish at a minimum frequency of once daily, or more if necessary to achieve safe, timely and effective passage.
- d. **Downstream Transport.** PacifiCorp shall provide for the downstream transport of migrating transported species collected in the Swift Downstream Facility, the Yale Downstream Facility and the Merwin Downstream Facility by truck.
- e. **Downstream Transport Plan.** PacifiCorp shall develop, in Consultation with the ACC and with the approval of the Services, a plan which shall describe the frequency and procedures to achieve safe, timely and effective downstream transport.

Passage Design –

Subject to the final approval of the Services, PacifiCorp will develop and implement studies to inform the design of the fish passage facilities with the goal of improving the likelihood that the passage facilities will be successful as initially constructed. Needed information may include the hydraulic characteristics of the Swift No. 1, Yale, and Merwin forebays (e.g., a three-dimensional 3D numerical flow-field analysis) and the behavior of juvenile salmonids.

The Licensees will design the fish passage facilities to meet the defined performance standard targets (described below). The Licensees will use the best available technology for the type of passage facility being constructed, and design the facility to provide

flexibility for subsequent adjustments or modifications⁴, if needed, to meet performance standards.

Overall Performance Standards for Salmonids – The Licensees will achieve the following overall performance standards for fish passage: Overall Downstream Survival (ODS) of greater than or equal to 80% until such time as the Yale Downstream Facility is built or the In Lieu Fund in lieu of Yale Downstream Facility becomes available to the Services, after which time the ODS will be greater than or equal to 75%, Upstream Passage Survival (UPS) of greater than or equal to 99.5%, and Adult Trap Efficiency (ATE) to be established as described below. The ODS of 80% or 75% are aggressive standards and it is likely that they will take some time to achieve. If these performance standards are not achieved, the Licensees will take the actions set forth in Section 4.1.6 of the Settlement Agreement and described below.

Passage Facility Design Performance Standards for Salmonids – PacifiCorp shall design and construct downstream fish passage facilities to achieve (i) a Collection Efficiency (CE) of equal to or greater than 95% and (ii) a Collection Survival (CS) of equal to or greater than 99.5% for smolts and 98% for fry, and (iii) adult bull trout survival of equal to or greater than 99.5%. Design performance objectives for injury are less than or equal to 2%. The Licensees shall design and construct upstream fish passage facilities to achieve the UPS equal to or greater than 99.5% and the ATE as described below.

Adult Trap Efficiency for Anadromous Salmonid and Bull Trout – The Licensees, together with the Services, WDFW, Yakama Nation, and the Cowlitz Tribe, and in consultation with the ACC, will develop an ATE performance standard target for the terms of each new license to ensure the safe, timely, and effective passage of adult anadromous salmonids. Until such time as the standard has been developed, the Licensees will use NOAA Fisheries' existing fish passage guidelines (NOAA Fisheries 2004).

Adjustments or Modifications to Passage Facilities – If the ODS is not being met, then the Licensees will make facility adjustments or facility modifications to downstream passage facilities as follows:

- (1) If the CE is less than 95% and greater than or equal to 75%, or the CS for smolts is less than 99.5% and greater than or equal to 98%, or if the CS for fry is less than 98%, and greater than or equal to 96%, or injuries to juvenile transported anadromous species caused by downstream collection and transport are greater than 2% but less than 4%, PacifiCorp will make facility adjustments directed by the Services to achieve the performance standard or standards that are not being met, but will not be required to make facility modifications; or

⁴ For purposes of the Settlement Agreement, a Facility Adjustment is a physical passage facility upgrade, improvement or addition that was part of the original design of the passage facility, or an adjustment to the fish passage facility or its operations. A Facility Modification is a physical alteration or addition to a physical passage facility that requires a new design.

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- (2) If the CE is less than 75%, or the CS for smolts is less than 98%, or the CS for fry is less than 96%, or injuries to juvenile transported anadromous species caused by downstream transport are greater than or equal to 4%, PacifiCorp shall make the facility modifications⁵ directed by the Services to achieve the performance standard or standards that are not being met; provided that if the Services believe a facility adjustment will likely achieve the performance standard or standards that are not being met then PacifiCorp shall first make facility adjustments as directed by the Services.**
- (3) If the ODS is being met but CE is less than 95%, the CS for smolts is less than 99.5%, the CS for fry is less than 98%, or injury to juvenile transported anadromous species caused by downstream transport is greater than 2%, PacifiCorp will make facility adjustments directed by the Services to downstream facilities but shall not be required to make facility modifications to achieve the performance standard or standards that are not being met.**
- (4) For bull trout, PacifiCorp shall make facility adjustments or facility modifications to downstream passage facilities as follows:**
 - (a) If the survival of bull trout is less than 99.5% and the survival is greater than or equal to 98%, or injuries caused by downstream collection and transport are greater than 2% but less than 4%, PacifiCorp shall make facility adjustments directed by the Services to achieve the performance standard or standards that are not being met, but shall not be required to make facility modifications; or**
 - (b) If the survival of bull trout is less than 98%, or injuries caused by downstream collection and transport are greater than or equal to 4%, PacifiCorp shall make the facility modifications directed by the Services to achieve the performance standard or standards that are not being met; provided that if the Services believe a facility adjustment will likely achieve the performance standard or standards that are not being met then Licensees shall make facility adjustments as directed by the Services.**
- (5) For transported species, if UPS and/or ATE are not being met, then the Licensees (PacifiCorp for the Merwin Upstream Transport Facility and Yale Upstream Facility, and PacifiCorp and Cowlitz PUD for the Swift Upstream Facility) will make facility adjustments or facility modifications to upstream passage facilities as directed by the Services.**

Except as otherwise provided in the Lewis River Settlement Agreement, the Licensees (PacifiCorp for Merwin, Yale and Swift No. 1 and Cowlitz PUD for Swift No. 2) will not be required to: (a) make structural or operational changes with respect to their generating facilities or Project reservoirs to achieve performance standards, (b) replace any fish passage facility with another passage facility, or (c) install additional collection and

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transport facilities or alternative fish passage facilities beyond those required by the Lewis River Settlement Agreement.

In Lieu Fund –

The Licensees will construct and operate the Yale and Merwin downstream facilities and the Yale and Swift upstream facilities as described above unless the Services, upon a review of new information relevant to reintroduction of fish passage into Yale Lake and Lake Merwin, determine at least four and a half years prior to the operation date for a passage facility that the facility should not be constructed. In lieu of construction of a passage facility, PacifiCorp will contribute to an In Lieu Fund as follows: \$10 million in lieu of a juvenile surface collector at Yale Dam; \$10 million in lieu of a juvenile surface collector at Merwin Dam; \$5 million in lieu of an upstream adult fish passage facility at Yale Dam; and \$5 million in lieu of an upstream adult fish passage facility in the vicinity of the Swift Projects. The In Lieu Fund will be used for Services-approved mitigation measures that collectively contribute to meeting the objective of achieving equivalent or greater benefits to anadromous fish populations as will have occurred if passage through Yale Lake and/or Lake Merwin had been provided. Measures may include additional habitat enhancement in the basin; habitat protection, additional research or other appropriate actions that will benefit listed species. The Settlement Agreement includes a list of possible mitigation measures to be implemented with the In Lieu Fund (Schedule 7.6.2 to the Settlement Agreement). Examples of mitigation measures that PacifiCorp may implement with the In Lieu Fund include:

North Fork

- Assess and repair the highest priority culvert passage problems on Ross, Johnson, Colvin, Cedar, Beaver, John, and Brush creeks and an unnamed tributary to Cedar Creek
- Improve passage at the Grist Mill dam on Cedar Creek including a sorting and handling facility and fund the monitoring program
- Remove dam on Bitter Creek or provide passage
- Remove dam on Colvin Creek including sediments and repair damage from slide
- Reconnect and enhance off-channel habitat along the lower reaches of the Lewis River where diking occurs
- Enhance floodplain habitat surrounding Eagle Island
- Identify and repair roads that are contributing excess sediments to streams in the basin
- Restore degraded riparian conditions along tributaries to the lower Lewis River
- Identify sources and reduce inputs of fine sediments to Cedar Creek

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- **Increase functional LWD structures in appropriate stream reaches**
- **Accelerate recruitment of conifers along stream reaches to provide future inputs of LWD**
- **Enhance pool habitat in Cedar Creek and other tributaries in the basin**
- **Fence livestock away from streams especially Cedar, Pup and Chelatchie creeks**
- **Repair slide upstream on Lewis River hatchery on the mainstem that buried chum spawning habitat**
- **Control farm run-off and biowaste streams**
- **Restore and enhance wetlands and springs**
- **Identify contributing causes and develop solutions to summer low flow conditions in Cedar Creek and other tributaries**
- **Identify and remove unauthorized diversions in Cedar Creek basin**
- **Remove invasive non-native vegetation along riparian corridors**

East Fork

- **Remove culverts from Brezee, McCormick, Mason, and Dean creeks**
- **Restore upper East Fork spawning and rearing habitat**
- **Create funding partnership to restore Stordahl gravel pits and potentially create chum spawning habitat**
- **Fund an East Fork Monitoring program**
- **Restore and enhance off-channel and floodplain habitat in the lower 10 miles of the mainstem East Fork**
- **Reconnect and enhance side channels and areas with upwelling to provide chum spawning habitat**
- **Stabilize erosion problems in the mainstem East Fork and tributaries**
- **Reduce turbidity caused by gravel mining operations**
- **Increase functional LWD structures in appropriate stream reaches**
- **Restore riparian corridors and forested wetlands**
- **Reduce livestock access to the river and its tributaries**

- Restore and enhance wetlands and springs
- Enhance pool habitat for thermal refuge
- Identify unauthorized private diversions and/or withdrawals within the basin
- Control invasive non-native plant species along riparian corridors

The lists above are examples of the types of measures that will be funded and implemented with the In Lieu Fund. Any mitigation measures that are implemented will be reviewed and approved by the Services.

Reintroduction Outcome Goal Status Checks –

The reintroduction outcome goal of the comprehensive aquatics program contained in Sections 4 through 9 of the Lewis River Settlement Agreement is to achieve genetically viable, self-sustaining, naturally-reproducing, harvestable populations of spring Chinook, winter steelhead and late-run coho above Merwin Dam greater than minimum viable populations. The Licensees are not responsible for limiting factors that are not related to project effects (e.g., harvest). The reintroduction outcome goals are separate from the targets relating to numbers of returning hatchery fish (described below).

Phase I Status Check – Year 27

It is anticipated that it will take at least 10 years following the last step in fish passage implementation to allow all facilities to achieve their best possible performance and for supplementation to be completed. In addition, the full passage scenario needs time to allow for supplementation actions to have an effect and for adequate seeding to occur in the available habitat. This brings the program to what is known in the Lewis River Settlement Agreement as the Phase I Status Check. It is at this point that the Reintroduction Outcome Goals are evaluated.

On or after the later of the following (a) the 27th anniversary of issuance of the new licenses, or (b) the 12th year after reintroduction of anadromous fish above Swift No. 1 Dam together with the operation of both the Merwin Upstream Transport Facility and the Swift Downstream Facility, the Services will determine whether the reintroduction outcome goal has been achieved for each North Fork Lewis River anadromous fish population that is being transported pursuant to the Lewis River Settlement Agreement (“Phase I Status Check”). The Services will consider the variability of the factors influencing the success of the program over time, such as cycles of ocean conditions, and will include an appropriate temporal component in developing and applying their evaluation methodology. If the reintroduction outcome goals are being met, then the Licensees will continue to operate the passage facilities and to seek improvements towards performance standards. If reintroduction outcome goals are not being met, PacifiCorp will conduct a limiting factors analysis (LFA) to determine the root causes for sub-optimum reintroduction outcome goal numbers. If it is determined that the

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primary limiting factor is attributable to the projects, the Licensees will implement measures that will provide biological benefits substantially equivalent to the impact of the project-related limiting factor (e.g., habitat enhancement projects, continuing juvenile supplementation, etc.). Examples of factors unrelated to Project effects include, but are not limited to, harvest, upstream of Merwin, off-Project habitat conditions (e.g., degradations in habitat due to forest management practices and natural catastrophic events), and ocean conditions. The suite of possible remedies at the Phase I Status Check does not include: (1) structural or operational changes with respect to generating facilities or Project reservoirs to achieve standards, (2) replacement of any fish passage facility with another passage facility, or (3) installation of additional collection and transport facilities or alternative fish passage facilities.

Phase II Status Check – Year 37

After the Phase I Status Check, the Lewis River Settlement Agreement provides for an additional 10 years to evaluate whether any new remedies have had an impact on the outcome goal and to allow time for the fish populations to react to those remedies.

On or after the later of the following: (a) the 37th anniversary of issuance of the new licenses, or (b) the seventh year after the Phase I Status Check, the Services, using the approach developed pursuant to Section 3.1.2 above, shall determine whether the reintroduction outcome goals have been achieved (“Phase II Status Check”). If the reintroduction outcome goals have been met, the Licensees will continue to implement the measures provided in Sections 4 through 9 of the Lewis River Settlement Agreement for the remainder of the new licenses’ terms, including adjusting and modifying fish passage facilities as needed to meet performance standards as described above. If any of the reintroduction outcome goals have not been met, PacifiCorp will perform a limiting factors analysis to determine the root causes for sub-optimum reintroduction outcome goal numbers. If the limiting factors analysis concludes, for all reintroduction outcome goals not being met, that all significant limiting factors contributing to the failure to meet such goals are unrelated to project effects, the Licensees will continue implementation of the measures contained in Sections 4 through 9 of the Lewis River Settlement Agreement, including adjusting and modifying fish passage facilities as described above, but will not be obligated to implement any additional measures.

If the limiting factors analysis concludes that a project effect is a significant limiting factor in any reintroduction outcome goal not being met, in addition to continuing implementation of the measures contained in Sections 4 through 9 of the Lewis River Settlement Agreement, including facility adjustment and facility modifications, the Licensees will consult with the Services and determine what further actions would be necessary to meet the reintroduction outcome goals. Such actions may include, without limitation, consideration of structural or operational changes with respect to the generating facilities or Project reservoirs or construction of new or replacement passage facilities. In the event that the

Services and the Licensees cannot reach agreement, the Services may exercise their applicable authorities and direct what actions should be implemented.

Rationale for Phased Approach to Passage – As described above, the Settlement Agreement provides for a phased approach to providing for and evaluating the success of fish passage above Merwin Dam. The primary purposes of this phased approach are to allow time for habitat to become adequately seeded prior to reintroducing fish to certain areas, and to allow the Licensees and fish management agencies to learn from initial fish passage results prior to designing and constructing additional passage facilities. For example, after reintroduction begins above Swift No. 1 Dam, the Merwin upstream and Swift downstream passage facilities will be allowed to operate for approximately 5 years to allow for at least one complete life-cycle to be reached for each species and to allow adequate time for the habitat to become adequately seeded. This also allows time for assessment of the first returns from ocean recruits. The end of that 5 year period will coincide with the beginning of the design process for the Yale downstream facility, which will incorporate any information learned in the previous reintroduction phase. Once the Yale downstream facility is operating, it will be allowed to operate for 2 years, during which time PacifiCorp and fish management agencies will evaluate its success prior to designing or constructing remaining fish passage facilities. Since the Yale and Merwin downstream facilities are expected to be configured differently than the Swift downstream collector, this evaluation is critical because it will allow PacifiCorp and fish management agencies time to develop the Yale downstream facility and establish the best operating conditions for fish collection before considering passage at Merwin.

The Phase I Status Check is set for the 27th anniversary after issuance of the new licenses because once fish are introduced into Lake Merwin, it is anticipated that it will take at least 10 years following the last phase in fish passage implementation for all facilities to be working at their best possible performance and for supplementation to be completed. In addition, the full passage scenario needs time to allow for supplementation actions to have an effect and for adequate seeding to occur in the available habitat. Once these actions have had an opportunity to occur, the success of the reintroduction program can be accurately evaluated.

1.4.2.2 Additional Aquatic Resources Measures

Yale Spillway Modifications – PacifiCorp will design, permit, and construct improvements to the Yale spillway by six months after the fourth anniversary of the issuance of the new license for Yale to improve fish survival over the spillway during spill events.

Bull Trout Habitat Enhancement Measures – PacifiCorp and Cowlitz PUD will maintain conservation easements for the protection of bull trout habitat.

TDG Testing – PacifiCorp will monitor TDG at Swift No. 1 and Yale to determine compliance with state water quality standards, and implement measures to minimize take of bull trout if standards cannot be met.

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Bull Trout Limiting Factors Analysis – By the second anniversary of the Effective Date of the Settlement Agreement, and in consultation with the ACC, PacifiCorp will provide a limiting factors analysis for bull trout occurring in Lake Merwin and Swift Creek Reservoir tributary streams. The ACC may implement enhancement measures through the use of the Aquatics Fund (see Section 1.4.2.4 below) if warranted by the study results.

Signage – PacifiCorp will provide information signs at established angler access areas on land that PacifiCorp owns or leases, describing bull trout and the need to protect this species. Flyers with the same information will be provided at each of PacifiCorp’s park entrance booths; such will also be provided to WDFW and USFWS enforcement personnel for distribution.

1.4.2.3 Flow Releases for Fish and Other Aquatic Species

Flow Releases in the Bypass Reach; Constructed Channel – PacifiCorp and Cowlitz PUD will release flow into the reach of the Lewis River downstream of Swift No. 1 ending at Yale Lake, which parallels the Swift No. 2 canal (the “bypass reach”), for the duration of the license terms. Releases will be subject to the terms and limitations in Section 6.1 of the Lewis River Settlement Agreement and in accordance with a schedule established by the ACC pursuant to Section 6.1.2 of the Settlement Agreement. The total annual amount of water that may be scheduled for release in any one year will not exceed 55,200 acre-feet (55,349 acre feet in each leap year). The annual release quantity will be allocated between two release points: (a) released from and as measured at the outflow from a water delivery structure to be constructed at the upstream end of the bypass reach; and (b) released to a constructed channel (described below) from and as measured at the existing canal drain that is located approximately one third of the length of the canal downstream of the Swift No. 1 tailrace. The monthly schedule of flow releases from these two release points is together referred to as the “combined flow schedule.”

The existing Swift No. 2 canal wasteway may also be use to release water, up to the capacity of the canal, into the bypass reach.

Constructed Channel - The Licensees commissioned a study, conducted by Northwest Hydraulic Consultants, Inc., dated December 9, 2003, entitled “Swift Bypass Habitat Channel Reconnaissance Study”, concerning the biological and technical feasibility of developing a constructed channel in the Bypass Reach downstream of the Swift No. 2 Canal Drain. The constructed channel is an existing, protected channel that runs parallel to the Swift No. 2 canal and receives water from an existing canal drain. This channel will be enhanced with instream structure and channel changes to create quality habitat that is hydraulically matched to the available flows. Unless the ACC determines that the constructed channel should not be built, the Licensees will construct and maintain a channel in the Bypass Reach to maximize the biological benefits of Canal Drain flows and to enhance connectivity with Yale Lake.

The combined flow schedule in the constructed channel and the Bypass Reach will be determined by the ACC, will not exceed 55,200 acre-feet (55,349 acre feet in each leap year), and will be consistent with the constraints outlined in Section 6.1.5 of the Settlement Agreement. For analysis purposes flows can be considered to be

approximately 100 cfs in each November, December and January; 75 cfs in each February, March, April, May and June; and 60 cfs in each July, August, September and October. The maximum flow that may be scheduled for release from the canal drain to the constructed channel will be the maximum discharge capacity of the Canal Drain, without modification, estimated to be 47 cfs.

Minimum Flows Below Merwin Dam – Minimum flows below Merwin Dam will be set at (1) July 31 through October 15, 1,200 cfs; (2) October 16 through October 31, 2,500 cfs; (3) November 1 through December 15, 4,200 cfs; (4) December 16 through March 1, 2,000 cfs; (5) March 2 through March 15, 2,200 cfs; (6) March 16 through March 30, 2,500 cfs; (7) March 31 through June 30, 2,700 cfs; (8) July 1 through July 10, 2,300 cfs; (9) July 11, through July 20, 1,900 cfs; (10) July 21 through July 30, 1,500 cfs.

Low Flow Procedures – During dry years, PacifiCorp will convene a Flow Coordination Committee (FCC) in order to develop adaptive management measures for the particular circumstance. The FCC will consider fish needs (priority on ESA-listed species), flood control needs, and reservoir recreational pool levels when developing adaptive management measures.

Flow Fluctuations Below Merwin Dam – Commencing with the issuance of the new licenses, PacifiCorp will implement the following operational regime at Merwin Dam.

Plateau Operations at Merwin Dam – PacifiCorp will restrict daily fluctuation in flows below Merwin during the period of February 16 through August 15 of each year by maintaining flow plateaus (periods of near-steady discharge). Once a flow plateau is established, PacifiCorp will maintain the flow plateau for as long a duration as practicable, but flow plateaus may be altered to a new level as a result of changes in natural flow or operational demands on the Lewis River power system.

Plateau Steps – A “Plateau Step” is defined as a down ramping in flow below Merwin Dam that will result in a change in river elevation of more than 0.2 foot at the Ariel Gage. A single Plateau Step event will begin when the elevation drops by more than 0.2 foot and be deemed complete when, (i) the elevation rises by more than 0.2 foot or (ii) does not change by more than plus or minus 0.2 foot for more than 6 hours. Plateau Steps will be limited to no more than one change in any 24-hour period, no more than 4 in any seven-day period, or six in any calendar month. If PacifiCorp is required to release flows from Merwin Dam pursuant to the high runoff procedure, then down ramping to return to prior river levels will not be counted as a Plateau Step. During flood season, if there is less than 5 feet of storage capacity in addition to the required 17 feet of storage capacity under the high runoff procedure, then flow releases to restore the storage capacity will not count as Plateau Steps. Finally, if PacifiCorp is asked to lower flows below Merwin Dam for public safety reasons or to facilitate aquatics studies, such changes in river level will not be counted as Plateau Steps.

Plateau Changes – An accumulation of Plateau Steps will result in a “Plateau Change”. PacifiCorp will limit Plateau Changes to no more than 20 during the period February 16 through August 15. When flows are greater than or equal to

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3,500 cfs below Merwin Dam, a Plateau Change will occur when any series of consecutive Plateau Steps totals 1 foot of down ramping. Any periods of up ramping during such period will be ignored in such calculations. When flows are less than 3,500 cfs below Merwin, a Plateau Change means a series of consecutive Plateau Steps totaling 0.5 foot. If a single Plateau Step in a series will cause the total to exceed one foot or one half foot, respectively, the excess will be counted toward the next Plateau Changes. If a Plateau Steps begins when flows are greater than 3,500 cfs and ends when flows are less than 3,500 cfs, the Plateau Change will be determined by adding the fractions of a Plateau Change occurring before and after the river discharge below Merwin Dam passes 3,500 cfs. For example, if a Plateau Step begins when flows are at 5,000 cfs and has measured 6 inches when flows reach 3,500 cfs (one half of a Plateau Change for flows above 3,500 cfs) and continues to decline an additional 3 inches ending at 3,000 cfs (one half of a Plateau Change for flows below 3,500 cfs), it will count as one full Plateau Change.

Ramping Rates Below Merwin Dam – PacifiCorp will limit the up-ramping rate to 1.5 feet per hour. The down-ramping rate will not exceed 2 inches per hour, as measured at the Ariel gage, when flows below Merwin Dam are at or less than 8,000 cfs, except, between February 16 through June 15, when no down-ramping will occur (1) commencing one hour before sunrise until one hour after sunrise and (2) commencing one hour before sunset until one hour after sunset.

Stranding Study and Habitat Evaluation – By the third anniversary of the issuance of the new license for Merwin Project, PacifiCorp (in consultation with the ACC and approval by the Services) will complete a stranding study and a habitat evaluation study below Merwin Dam to assess the potential effects of project operations on steelhead, coho, Chinook, and chum salmon, and their habitats. The ACC may recommend measures to be taken to minimize stranding or enhance habitat based on study results. The ACC may then choose to implement recommended measures using the Aquatics Fund (see below)

1.4.2.4 Aquatic Habitat Enhancement Actions

Large Woody Debris – After issuance of the new license for the Swift No. 1 Project and under direction of the ACC, PacifiCorp will stockpile LWD collected from Swift Creek Reservoir for use by other entities for LWD projects.

Funding – Within 180 days after issuance of the new license for the Merwin Project, PacifiCorp will provide \$2,000 annually, which may be disbursed to qualified entities for costs of LWD transportation and placement (the “LWD Fund”), with the unspent balance carrying over to subsequent years. PacifiCorp will also contribute \$10,000 per year to the Aquatics Fund (described below) that will be earmarked for LWD projects in the mainstem of the Lewis River below Merwin Dam to benefit anadromous fish. If there are not sufficient LWD projects, or if the LWD program is suspended, PacifiCorp, at the request of the ACC, will use the funds for other aquatic enhancement fund projects that benefit anadromous fish in the mainstem of the Lewis River below Merwin Dam and then for other projects in the basin below Merwin Dam.

LWD Study – PacifiCorp will hire a consultant, in consultation with the ACC, to develop and implement a LWD study to identify and assess the potential benefits of LWD projects below Merwin Dam. The final study plan will be completed 270 days after issuance of the new license for the Merwin Project. The results of the study will guide implementation of programs using the LWD Fund.

Spawning Gravel Program – Within six months after the effective date of the Settlement Agreement, PacifiCorp will hire a consultant, selected in consultation with the ACC, to develop and implement a spawning gravel study and, on the basis of the study results, develop a gravel monitoring and augmentation plan that maintains existing levels of gravel and includes a “trigger” for initiation of gravel augmentation. Pursuant to that plan, PacifiCorp will implement gravel augmentation if the consultant-established trigger is realized.

Predator Study – By the tenth anniversary of issuance of the new license for the Merwin Project, PacifiCorp will conduct (in consultation with the ACC and Services) a one-time study of whether predation in Lake Merwin is likely to be a limiting factor to the success of the anadromous salmonid reintroduction.

Habitat Preparation Plan – Within six months after the effective date of the Settlement Agreement, PacifiCorp will develop the “Habitat Preparation Plan” in consultation with the ACC to release live adult hatchery anadromous salmonids to “fertilize” the stream habitat in preparation for the reintroduction of anadromous salmonids. Fish will be released for 5 years in each reservoir commencing five years prior to expected completion of the downstream fish passage facility from that reservoir.

Aquatics Fund – PacifiCorp and Cowlitz PUD will establish the Lewis River Aquatics Fund (“Aquatics Fund”) to support resource protection measures and habitat projects. PacifiCorp will provide funds over a period of years totaling \$5.2 million and Cowlitz PUD will provide funds over a period of years totaling \$520,000. PacifiCorp's contributions will begin in 2005 and Cowlitz PUD's contributions will begin after the first anniversary of the issuance of the new license for the Swift No. 2 Project. Projects goals will be to benefit the Lewis River basin and will be reviewed and approved by the ACC. The Licensees will submit annual reports regarding project review, implementation, and monitoring.

1.4.2.5 Hatchery Programs; Supplementation

As a component of the anadromous fish reintroduction program (Section 1.4.2.1), PacifiCorp and Cowlitz PUD, in consultation with the ACC and subject to the approval of NOAA Fisheries, will undertake a hatchery and supplementation program. The goals of the program are to support (i) self-sustaining, naturally-producing, harvestable native anadromous salmonid populations throughout their historical range in the North Fork Lewis River basin; and (ii) the continued harvest of resident and anadromous fish. The supplementation portion of the program will be limited to spring Chinook, steelhead and coho. The hatchery and supplementation program will be consistent with the ESA, applicable state and federal fisheries policies, and regional recovery plans, and will address both anadromous and resident fish.

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To ensure that the hatchery and supplementation program is meeting its goals, PacifiCorp and Cowlitz PUD, in consultation with the ACC and subject to the approval of NOAA Fisheries, will develop and implement a hatchery and supplementation plan to adaptively manage the program and guide its management. The hatchery and supplementation plan (H&S Plan) will be designed to achieve the numeric hatchery targets provided in Table 1.4-2, and will be calculated in terms of returning ocean recruits taking into account harvest and escapement. PacifiCorp and Cowlitz PUD will use the existing Lewis River, Merwin, and Speelyai hatchery facilities to meet production obligations.

Table 1.4-2. Lewis River Hatchery Complex Targets.

	Spring Chinook	Steelhead	Coho	Total
Hatchery Target (adult ocean recruits)	12,800	13,200	60,000	86,000

When the number of natural returning ocean recruits of any species exceeds the relevant natural production threshold(s) for that species (Table 1.4-3), then PacifiCorp and Cowlitz PUD will decrease the appropriate hatchery target(s) identified in Table 1.4-2 on a fish for fish (1:1) basis; however, PacifiCorp and Cowlitz PUD will not decrease the hatchery targets below the hatchery target floor specified in Table 1.4-3. If PacifiCorp and Cowlitz PUD reduce hatchery targets based on the number of returning natural ocean recruits, but the number of returning ocean recruits subsequently decline under such methodology, the PacifiCorp and Cowlitz PUD will increase the hatchery targets on a fish for fish (1:1) basis provided that the increased hatchery targets will not exceed the hatchery targets in Table 1.4-2.

Table 1.4-3. Numbers Governing Modifications to Hatchery Targets

	Spring Chinook	Steelhead	Coho	Total
Natural Production Threshold for Hatchery Reduction	2,977	3,070	13,953	20,000
Hatchery Target Floor	2,679	2,763	12,558	18,000

To meet their obligation, each year, PacifiCorp and Cowlitz PUD will produce spring Chinook salmon smolts, steelhead smolts, and coho salmon smolts at the levels specified in Table 1.4-4. PacifiCorp and Cowlitz PUD, in consultation with the ACC, may adjust the juvenile production as needed to achieve the hatchery target subject to the hatcheries capacity cap.

Table 1.4-4. Juvenile Production Targets.

Smolt Production	Spring Chinook	Steelhead	Coho
Years 1 through 3 of the H&S Plan (or "H&S Plan Years 1 - 3")	1.35 million	275,000	1.8 million
H&S Plan Years 4 - 5	1.35 million	275,000	1.9 million
H&S Plan Years 6 - 50	1.35 million	275,000	2.0 million

Anadromous fish stocks used in the reintroduction program will be the most appropriate for the basin and will include a mixture of indigenous and hatchery stocks (Table 1.4-5). These stocks will be used unless modified by the Licensees as part of the Hatchery and Supplementation Plan.

Table 1.4-5. Broodstock sources used for supplementation above and below Merwin Dam.

Program	Stock Source		
	Spring Chinook	Steelhead	Coho
Juveniles for Supplementation (release above Merwin)	Lewis River hatchery stock with Cowlitz River hatchery stock as contingency	Lewis River wild winter stock with Kalama hatchery stock as contingency	Lewis River hatchery early (type S) stock
Juveniles for Harvest (release below Merwin)	Same as for supplementation	Same as for supplementation and existing Lewis River hatchery summer and winter stock	Same as for supplementation and Lewis River hatchery late (type N) stock

Juvenile Salmonids Above Swift Dam

Subject to modification in the hatchery and supplementation plan, PacifiCorp and Cowlitz PUD will transport juvenile anadromous salmonids to acclimation sites located above Swift Dam for the following periods of time:

- (1) Spring Chinook and Steelhead. PacifiCorp and Cowlitz PUD will transport juvenile spring Chinook and steelhead for a period of 15 years commencing upon completion of the Swift downstream fish collection facility; and
- (2) Coho. PacifiCorp and Cowlitz PUD will supplement juvenile coho salmon for a period of 9 years commencing upon completion of the Swift downstream fish collection facility.

At the end of these time periods, the ACC will assess on a year-by-year basis whether to extend the transportation of juvenile salmonids. Upon ACC agreement and subject to NOAA Fisheries approval, PacifiCorp and Cowlitz PUD will continue to transport juvenile salmonids. However, PacifiCorp and Cowlitz PUD will not be required to (i) transport juvenile spring Chinook and steelhead for a period exceeding 15 years after completion of the Swift Downstream Facility or (ii) transport juvenile coho salmon for a period exceeding 9 years after completion of the Swift downstream fish collection facility.

Juvenile Salmonids to Yale Lake and Lake Merwin

PacifiCorp will, for the purposes of supplementation, transport juvenile salmonids to appropriate release sites in Yale Lake and Lake Merwin for the following periods of time:

- (1) Spring Chinook and Steelhead. PacifiCorp will transport juvenile spring Chinook and steelhead for a period of 15 years in Yale Lake after completion of the Yale

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Downstream fish collection facility; and for a period of 15 years in Lake Merwin after completion of the Merwin downstream fish collection facility.

- (2) Coho. PacifiCorp will transport juvenile coho salmon into Yale Lake for a period of 9 years after completion of the Yale downstream fish collection facility and into Lake Merwin for a period of 9 years commencing upon completion of the Merwin downstream fish collection facility.

At the end of these time periods, the ACC shall assess on a year-by-year basis whether to extend the transportation of juvenile salmonids. Upon ACC agreement and subject to NOAA Fisheries approval, PacifiCorp will continue to transport juvenile salmonids. PacifiCorp will provide short term, temporary in-stream enclosures to confine juvenile salmonids in tributaries to Yale Lake and Lake Merwin after they are released for the purpose of allowing juveniles to adjust to the natural environment prior to being exposed to natural mortality factors such as predators.

Adult Anadromous Salmonids above Merwin Dam

As discussed in Section 1.4.2.1, PacifiCorp and Cowlitz PUD will commence the supplementation of adult fish beginning one year prior to completion of the Swift downstream facility. Throughout the terms of the new licenses, the PacifiCorp and Cowlitz PUD will transport and release supplementation stocks of adult spring Chinook, coho, and steelhead above Swift No. 1 as directed by the ACC. Throughout the terms of the new licenses, PacifiCorp shall transport and release supplementation stocks of adult spring Chinook, coho, and steelhead into Yale Lake and Lake Merwin as directed by the ACC. The ACC shall determine the timing for initiating supplementation into Yale Lake and Lake Merwin. The ACC, subject to the approval of NOAA Fisheries, may recommend discontinuing or recommencing the transportation of such supplementation stocks provided that any such recommendations are biologically based, and not contrary to the goals of the ESA.

Resident Fish Production

Each year, for the life of the licenses, PacifiCorp and Cowlitz PUD will produce no more than 20,000 pounds of resident rainbow trout (800,000 juveniles with an estimated weight of 40 juvenile fish per pound). PacifiCorp and Cowlitz PUD will stock such rainbow trout in Swift Creek Reservoir. PacifiCorp will also produce no more than 12,500 pounds of resident kokanee (93,000 juveniles). PacifiCorp will plant such resident kokanee in Lake Merwin. The Licensees will modify resident rainbow trout and kokanee production in consultation with the ACC, and with approval of WDFW to address other management goals.

1.4.2.6 Aquatic Monitoring And Evaluation

Monitoring and Evaluation Plans – By the second anniversary of the issuance of the new licenses, PacifiCorp and Cowlitz PUD will develop plans and methods in consultation with the ACC and approved by Services to monitor and evaluate the effectiveness of various aquatic measures including monitoring of fish passage; adult anadromous salmonid migration, spawning, distribution, and abundance; water quality; hatchery

supplementation programs; bull trout populations; and resident fish species. PacifiCorp and Cowlitz PUD will prepare annual monitoring reports.

1.4.2.7 Terrestrial Measures

Yale Habitat Fund – PacifiCorp will establish and maintain a fund for land acquisition to protect wildlife habitat in the vicinity of the Yale Project, with a total contribution of \$2.5 million. The total of \$2.5 million will be provided within two years of the effective date of the settlement agreement. Guidelines of the "Yale Fund" are to provide movement corridors for elk, acquire 660 acres of low elevation winter range, and 100 acres of elk forage land within the vicinity of the Yale Project.

Swift No. 1 and Swift No. 2 Land Acquisition and Habitat Fund – PacifiCorp and Cowlitz PUD will establish and maintain a fund with a total contribution by PacifiCorp of \$7.5 million over several years. The purpose of the "Swift Fund" is to acquire land to protect wildlife habitat within 5 miles of the Swift project boundaries or lands owned and managed by the Licensees that are associated with the Swift Projects (laterally and upstream, but not downstream).

Lewis River Habitat Fund – PacifiCorp will establish and maintain a fund to acquire or enhance wildlife habitat anywhere in the Lewis River basin in the vicinity of the Projects, with a total contribution of \$2.2 million over several years. In addition to the \$2.2 million contribution, PacifiCorp will match the contributions of other entities for habitat projects in an amount not to exceed \$100,000 per year, nor more than \$500,000 in any ten consecutive years.

Wildlife Habitat Management Plans – PacifiCorp and Cowlitz PUD, in consultation with the TCC, will develop Wildlife Habitat Management Plans (WHMPs) for their respective properties. The purpose of the WHMPs will be to benefit a broad range of fish, wildlife and native plant species, including, but not limited to, large and small game, amphibians, bats, forest raptors, neo-tropical birds, and culturally significant native plants. The WHMPs will include an effectiveness-monitoring component to measure progress toward reaching management objectives.

1.4.2.8 Recreation Measures

PacifiCorp Measures

Recreation Resources Management Plan – PacifiCorp submitted a draft Recreation Resources Management Plan (RRMP) to the Commission as part of its Final Application for Nev' License for the Swift No. 1, Yale and Merwin projects. The RRMP includes measures set forth in Section 11.2 of the Settlement Agreement. PacifiCorp will implement measures specified in the Settlement.

Swift Creek Reservoir Measures – PacifiCorp will maintain and manage dispersed shoreline use sites on its lands and those under USFS jurisdiction within the FERC project boundary. Facility improvements will be made at Eagle Cliff Park, and a trail will be developed that extends from the park to the USFS boundary. PacifiCorp will

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acquire or manage WDNR's Swift Forest Campground, with improvements to the day use area, campsites, boat ramp and parking areas. ADA accessibility will be an important component of all recreation improvements at Swift Creek Reservoir.

Yale Lake Measures – PacifiCorp will maintain and manage dispersed shoreline use sites on its lands, and where landowner agreement is obtained, on lands owned by other parties. Use sites will be hardened, waste collection and disposal performed, and inappropriate sites signed for closure. Recreation improvements to the Yale/IP Road will be pursued, including securing access rights, completing bridge safety improvements, developing trailheads, formalizing reservoir access points, and installing toilets. Ultimately, a 12-mile segment of the road will be surfaced. Other multi-use trails in the Yale Lake area will be developed or improved, including a segment extending from the Saddle Dam parking area to the existing Saddle Dam trail, from Cougar Campground to Beaver Bay, and a new loop trail from Cougar to a reservoir overlook. Existing boat launches will be improved at Yale Park and Beaver Bay. Facility improvements at the Yale Park, Cougar, and Beaver Bay day use areas will be implemented, as will improvements to campgrounds at Cougar and Beaver Bay. ADA accessibility will be a component of all recreation improvements at Yale Lake.

Lake Merwin Measures – PacifiCorp will maintain and manage dispersed shoreline use sites on its lands, and where landowner agreement is obtained, on lands owned by other parties. Trail development in the Lake Merwin area will include improvements to the existing Marble Creek trail and evaluating a potential easement for a Clark County trail on the south shore of the lake. Boating facility improvements will be made at Speelyai Bay Park (ramp extension) and at Yale Bridge, where a launch site for non-motorized craft will be developed. At Merwin Park, day use facilities will be upgraded and new picnic shelters developed. At Speelyai Bay Park, the restroom will be upgraded to ADA standards and the parking area improved. At Cresap Bay Park, the use season will be extended through September. ADA accessibility will be a component of all recreation improvements at Lake Merwin.

Lower Lewis River Measures – PacifiCorp will install ADA-accessible vault toilets at the five Lewis River access sites (Cedar Creek, Merwin Hatchery, Johnson Creek, Lewis River Hatchery, and Island River). PacifiCorp also will be responsible for maintenance of these sites.

Basin-wide Measures – An Interpretation and Education program (I&E) will be developed in collaboration with Cowlitz PUD for developed sites throughout the project area. A range of visitor management measures will be implemented to improve public safety and improve the quality of visitor's experiences. Measures include enforcing non-motorized access restrictions, regulating overnight parking, funding dispersed camping management by the USFS, allowing public use of RV dump stations, and assessing the feasibility of ADA-accessible bank fishing sites.

Cowlitz PUD Measures – Cowlitz PUD will develop an ADA-accessible bank fishing site (including parking and portable toilets) at Swift No. 2 Canal.. Non-motorized recreation access will be allowed on lands within the Swift No. 2 project boundary. Cowlitz PUD will develop and implement an I&E program for the Swift No. 2 Project. Cowlitz PUD

will also provide \$780 annually to the USDA-FS to manage project-related dispersed camping on National Forest System lands.

1.4.2.9 Cultural Measures

Cultural Resources – PacifiCorp will finalize and implement the Historic Properties Management Plan (HPMP) for the Merwin, Yale, and Swift No. 1 projects. This plan will guide the treatment of known and yet to be discovered cultural and historic resources through the period of the new licenses. In addition, PacifiCorp will curate and interpret artifacts at a new Visitor Information Center in Cougar; protect the integrity of properties listed in the National Register of Historic Places; preserve tribal access for traditional uses; and monitor and protect cultural resources.

Cowlitz PUD will follow a previously established Unanticipated Discovery Plan and will consult with the CIT and YN about development actions, land acquisitions or emergency response activities that would disturb areas greater than 0.1 acre. Cowlitz PUD will also allow tribal access to lands, not excluded for safety reasons, within the Swift No. 2 project boundary.

1.4.2.10 Socioeconomic Measures

Law Enforcement – PacifiCorp will provide funding for three full-time-equivalent law enforcement officers to augment land and marine-based traditional law enforcement activities and patrols in the North Fork Lewis River basin, provided by state and local government, as part of their responsibilities to protect public health, safety and welfare in the North Fork Lewis River basin.

Forest Road 90 – PacifiCorp will pay \$7,474 and Cowlitz PUD will pay \$2,626 to the USDA-FS to assist in the repair of the Canal Bridge on Forest Road 90. PacifiCorp will pay \$19,980 per year beginning in April 2005 to the USDA-FS specifically for the maintenance of Forest Road 90. Cowlitz PUD will pay \$7,020 annually to the USDA-FS specifically for the maintenance of Forest Road 90 beginning in April of 2005. Each Licensee will pay appropriate use fees to the USDA-FS for hauling heavy loads on Forest Road 90 on a case-by-case basis when that Licensee uses Forest Road 90 for heavy hauls.

Visitor Information Facility – PacifiCorp will allow the construction of a 1,000 to 1,200-square-foot Visitor's Information Facility on its property in Cougar, and the Licensees will provide matching funds, or the Licensees will perform periodic maintenance of the facility for the term of the new licenses. PacifiCorp's portion of matching contributions contribution will be \$65,250 and Cowlitz PUD's portion will be \$9,750.

Pine Creek Communication Works Center Link – PacifiCorp will provide support for the USDA-FS radio-telephone link between Swift Dam and the Pine Creek Work Center.

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2.0 PROJECT DESCRIPTION

2.1 BASIN DESCRIPTION

The North Fork Lewis River basin lies on the flanks of the southern Cascade Mountains of Washington State (Figure 1.1-1). The river flows in a general southwesterly direction from its source on the slopes of Mount Adams and Mount St. Helens to the Columbia River 19 miles downstream of Vancouver, Washington. The river is 93 miles long and has a total drop of 7,900 feet, the greater part of which is in the upper reaches. At its mouth and up to the Lewis River Hatchery, the river stage is influenced by tides and subsequent backflow from the Columbia River. The area of the drainage basin is 1,050 square miles with a mean elevation of 2,550 ft. mean sea level (msl). Slopes in the upper portions of the basin are generally steep, resulting from the incision of numerous streams and rivers into the geologically young landscape. Most of the tributaries have natural barrier falls or are too precipitous for spawning (Chambers 1957; Kray 1957). Areas to the south of the Merwin Project and downstream along the river are less steep, represented by rolling hills and flat woodland bottomlands. A general overview of major stream segments present in the basin along with a very general habitat characterization is presented in Figure 2.1-1.

The basin has a complex geologic history, having undergone Tertiary volcanism, several glaciations, and interglacial erosion and deposition. Soils in the basin are predominantly well drained and medium-textured, and were derived from volcanic ash or were formed in sediments derived from mixed volcanic rocks and ash. Slopes, which are variable from gentle to steep, range from flat to more than 70 percent. Soil erosion hazard is dependent on slope and vegetation cover; the erosion hazard increases with increasing slope and extent of bare soil. Many areas in the upper reaches of streams flowing from Mount St. Helens have actively eroding hill slopes, which contributes fine sediment to the stream channels.

The Lewis River basin has been subject to major natural landscape altering processes in the recent past. Debris avalanches, mudflows, and lahars, common on Mount St. Helens and Mount Adams, are rapidly moving slurries of water, rock, soil, and debris. Mudflows swept down Swift Creek, Pine Creek, and the Muddy River during the May 18, 1980 eruption of Mount St. Helens, carrying nearly 18 million cubic yards of water, mud, and debris into Swift Creek Reservoir (Tilling et al. 1990). These events altered the streambed and valley characteristics of affected drainages in a matter of hours, and have long-term effects of very high sediment load and altered channel characteristics. Streams affected by recent mudflows are continuing to process the sediment and woody debris and have changed from narrow channels into wide, braided, unstable channels with high sediment and wood loads. Riparian vegetation along these channels was lost, and is slowly recovering as sediment loads decrease with time.

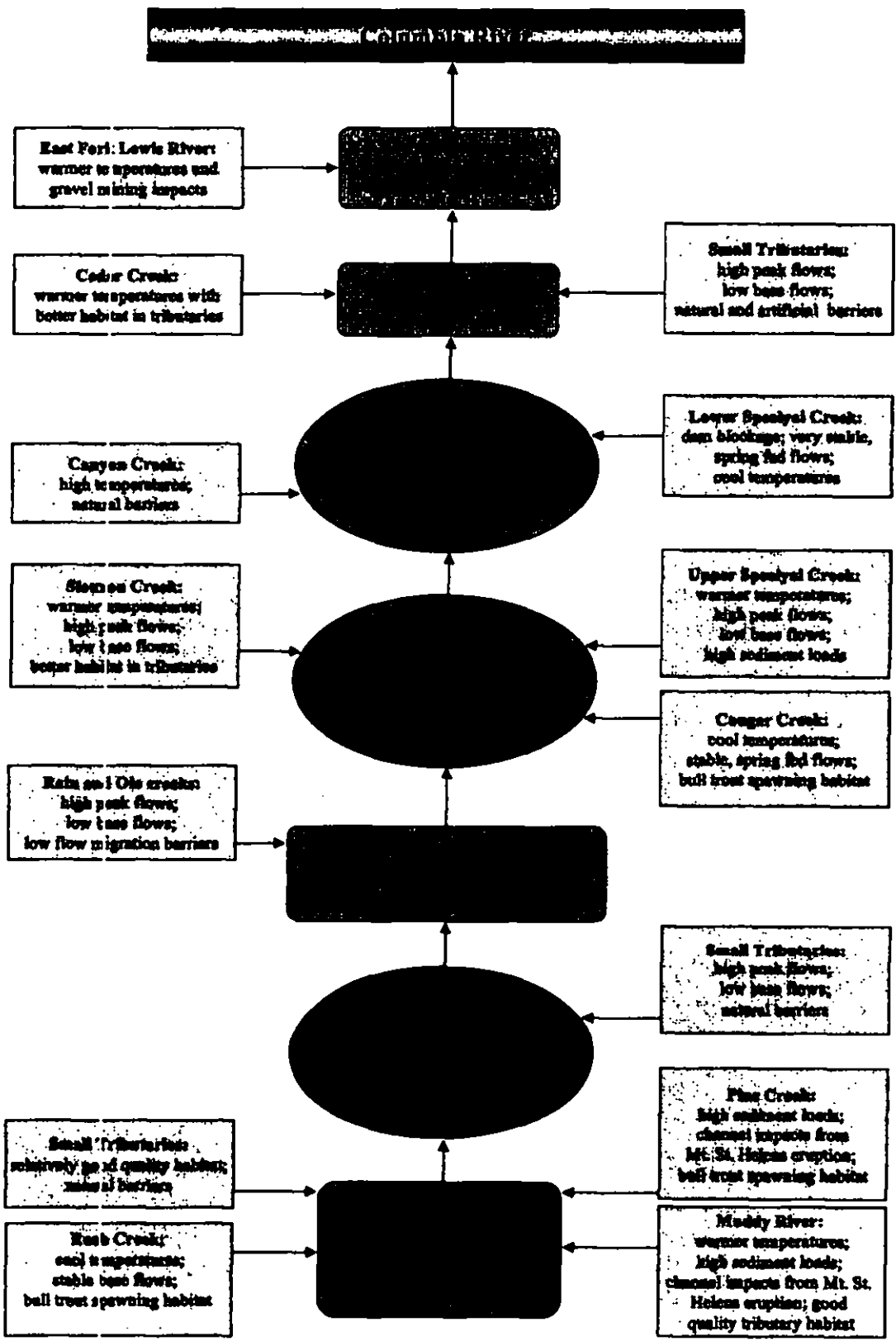


Figure 2.1-1. Schematic diagram of the Lewis River watershed environmental gradients.

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The climate in the North Fork Lewis River basin is influenced by the Pacific Ocean to the west and the Cascade Range to the east. Average annual precipitation varies from 45 inches near Woodland to over 140 inches on Mount Adams. The majority of the precipitation occurs during the rainy fall and winter months, with snow falling at higher elevations of the basin. Summers (July through mid-October) are generally drier. Snowfall is minimal at lower elevations, but exceeds 200 inches per year at elevations over 3,000 feet. In the warmest summer months, afternoon temperatures range from the middle seventies to the lower eighties, with nighttime temperatures in the fifties. Maximum temperatures exceed 90°F on 5 to 15 days each summer. Temperatures in the foothills and higher elevations are slightly lower than those recorded in the valleys.

Basin lands provide winter range for deer and elk; mink and beaver are common in wetlands. Large numbers of amphibians have been observed in the basin, primarily in wetland and riparian/riverine habitats. Over 100 species of birds have also been observed, including waterfowl, raptors, and numerous species of passerines. The watershed also provides habitat for several salmonid species, including bull trout, cutthroat, and steelhead trout, Chinook, coho, and chum salmon, and whitefish. Other fish, such as sculpin and suckers are also common. Several exotic non-native fish species are also present and include brook trout, tiger muskellunge, and bass. Tiger muskellunge, a non-native sterile hybrid known to prey heavily on soft-rayed fishes (including salmonids), were introduced into Lake Merwin by WDFW in 1995. The goal of the program is to reduce the abundance of salmonid-eating northern pikeminnow and to provide a sport fishery for anglers. Northern pikeminnow are known to be one of the main predators on emigrating salmonids in the Columbia River basin. Brook trout, a non-native char species, is known to hybridize and compete with bull trout (USFWS 2002). Hybridization with brook trout is one of the major factors contributing to the decline and lack of recovery of bull trout throughout its range (USFWS 2002).

The Lewis River watershed is located in an area dominated by natural resources based land uses such as forestry, recreation, and agriculture. As a result, population densities are generally low within the basin. The largest urban center, the City of Woodland, is located near the mouth of the Lewis River, approximately 20 miles north of Vancouver, Washington. Woodland was originally established by settlers in the mid-1850s. Today, it has a population of about 3,875, although the number of people living in the greater Woodland area approaches 10,000 residents. In recent years, the community has experienced substantial growth, with an economy driven by industries such as fishing gear manufacturing, manufactured home production, and agriculture. Development in the Woodland area has adversely affected aquatic habitat in the lower Lewis River basin. Residential and agricultural land uses have eliminated most of the riparian vegetation in the lower reaches, and the lower 7 miles of the Lewis River floodplain is almost entirely disconnected from the river due to extensive diking (Wade 2000). In the East Fork Lewis River, over 50 percent of the off-channel habitat and associated wetlands within the floodplains have been disconnected from the river.

Other towns in the Lewis River basin include Cougar, Ariel, Yale, Chelatchie, Amboy, Yacolt and La Center (Wade 2000). None of these settlements have populations exceeding 2,000 and their economies are primarily dependent upon logging, agriculture,

and recreation (Lowe 2002). The small town of Cougar, located along the north shore of Yale Lake, was originally established to serve as a staging point for timber harvest activities. However, after hydroelectric development and the creation of the Mount St. Helens National Volcanic Monument, recreation services became the primary industry. The current population of Cougar is under 200. Because these towns were/are largely supported by natural resource extraction (logging), their ecological footprint or impact is much larger than the size of the town would indicate.

There are 3 private communities located around Swift Creek Reservoir. The largest of these is the 206-home Northwoods community on the eastern shore. Yale Lake has private development clustered primarily around the Beaver Bay area, the Town of Cougar, and near Speelyai Canal. Private land ownership is more common around Lake Merwin, where there are several large communities along the shoreline, including a 1,600-lot home/trailer development along the south shore. Scattered private lands are found along the Lewis River adjacent to SR 503, increasing in number as one heads west to the City of Woodland.

2.2 THE UTILITIES' NORTH FORK LEWIS RIVER HYDRO FACILITIES

The following section describes all four hydroelectric projects in the North Fork Lewis River basin. The projects begin approximately 10 miles east of Woodland, Washington. The upstream sequence of the projects from the confluence of the Lewis and Columbia Rivers is as follows: Merwin, Yale, Swift No. 2, and Swift No.1. The Merwin, Yale, and Swift No.1 projects represent a linked reservoir/powerhouse system covering over 30 miles of the Lewis. The Swift No. 2 project does not include a dam and reservoir. It utilizes water directly from the tailrace of Swift No.1, which flows into a 3-mile-long canal that discharges through the Swift No. 2 powerhouse into Yale Lake.

The three-reservoir four-project system is operated in a coordinated fashion to achieve optimum benefits for power production, flood management, and to provide for natural resources in the basin such as fish, wildlife and recreation. The four projects utilize the water resources within the North Fork Lewis River basin from elevation 50 ft msl (Merwin Project tailwater) to 1,000 ft msl (Swift No. 1 normal pool). The total usable storage in the reservoirs is 814,000 acre-ft. The total installed capacity for the four projects is 580 MW.

2.2.1 Merwin Dam and Reservoir

The Merwin Hydroelectric Project is a 136 MW plant owned and operated by PacifiCorp. It is the furthestmost downstream project of the four operating on the North Fork Lewis River. Construction of the Merwin Project began in 1929 and was completed with a single unit in 1931. Two additional units were added in 1949 and 1958.

Merwin Dam spans the North Fork Lewis River 21 miles upstream from the confluence with the Columbia River. It is a concrete arch structure with a total crest length of 1,300 feet and a maximum height above its lowest foundation of 314 feet. The dam consists of an arch section 752 feet in crest length, a 75-foot-long gravity thrust block, a 206-foot-long spillway section, a non-overflow gravity section 242 feet long, followed by a

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concrete core wall section 20 feet high and extending 25 feet into the bank. The spillway is equipped with four taintor gates 39 feet wide and 30 feet high, and one taintor gate 10 feet wide and 30 feet high. The taintor gates have been extended to an elevation of 240 ft above msl by the addition of 5-foot flashboards.

The reservoir formed by Merwin Dam is about 14.5 miles long with a surface area of approximately 4,000 acres at elevation 239.6 feet msl (full pool). At full pool, the reservoir has a gross storage capacity of approximately 422,800 acre-ft. Of this amount, 182,600 acre-ft of usable storage is available between elevation 190 and 239.6 ft msl, with an additional 81,100 acre-ft of usable storage available if the reservoir is lowered to its allowable minimum level of 165 ft msl.

2.2.1.1 Penstocks and Powerhouse

Three penstocks lead from Merwin Dam to the powerhouse, via separate intakes. The Merwin intakes are relatively deep (approx. 187 ft. below full pool), high-head intakes with design velocities ranging from between 10 and 20 fps. The intakes are protected from large debris by steel trash racks on approximately 4-inch spacing. The capacity of the three penstocks is different, with Unit Nos. 1 and 2 capable of carrying 3,790 cfs, and Unit No. 3 carrying of 3,890 cfs. The penstock inlet diameters and the minimum water surface elevation in Merwin Lake allow the intake system to pass more than 150 percent of the existing plant hydraulic capacity. A fourth penstock was originally constructed but is currently not utilized by the project.

The powerhouse contains 3 semi-outdoor-type Francis turbine generator units, each with an installed capacity of 45,000kW, and one 1,000 kW house unit, for a total installed capacity of 136,000 kW.

2.2.1.2 Transmission and Auxiliary Equipment

Power is transported from the Merwin Project by two 115 kV transmission lines. One of these extends in a westerly direction a distance of approximately 15.9 miles from the project to the Bonneville Power Administration (BPA) Cardwell substation near Kalama, Washington. The other line runs in a southerly direction for 26.7 miles to the Clark County PUD View substation near Battleground, Washington and then into Portland, Oregon.

2.2.2 Yale Dam and Reservoir

The Yale Hydroelectric Project is a 134 MW plant owned and operated by PacifiCorp that lies directly upstream of the Merwin Project. Construction of the Yale Project began in 1951 and was complete by 1953. The project consists of a main embankment dam, saddle dam, reservoir, penstocks, powerhouse, and transmission line. The project is operated in coordination with the other three hydroelectric facilities on the North Fork Lewis River.

Yale Dam is located on the North Fork Lewis River approximately 30 miles upstream from the confluence with the Columbia River. Yale Dam is a rolled earthen fill

embankment type dam with a crest length of 1,305 feet and a height of 323 feet above its lowest foundation point. Its crest elevation is 503-ft msl. The saddle dam is located 1/4 mile west of the main dam and is approximately 1,600 feet long and 40 feet high with a crest elevation of 503 feet msl. The main dam has a chute-type spillway, located in the right abutment (looking downstream), with a capacity of 120,000 cfs through five 30-foot by 39-foot tainter gates at reservoir elevation 490 ft msl.

Yale Lake is approximately 10.5 miles long with a surface area of approximately 3,800 acres at elevation 490-ft msl (full pool). At full pool, the reservoir has a gross storage capacity of approximately 401,000 acre-ft. At the minimum pool elevation of 430-ft msl, the reservoir has a capacity of approximately 190,000 acre-ft.

2.2.2.1 Tunnels/Penstocks and Powerhouse

The Yale Project consists of two tunnels/penstocks leading from Yale Dam to the powerhouse. Water is delivered to the tunnels/penstocks via a common intake. The Yale intake is a relatively deep (approximately 90 ft. below full pool), high-head intake with design velocities ranging from between 10 and 20 fps. The intakes are protected from large debris by steel trash racks on approximately 4-inch spacing. The maximum diameter of each of the Yale tunnels/penstocks is 18.5 feet; the minimum diameter is 16 feet. Penstock velocities range from 18.2 fps in the tunnel to 24.3 fps in the penstocks' smallest sections. The Yale penstocks are each capable of passing a maximum of 4,880 cfs.

The Yale powerhouse contains 2 Francis-type generator units with a total installed capacity of 108,000 kW (nameplate). The powerhouse is located at the base of the earth embankment on the left side (facing downstream) of the old river channel. The generator units were originally installed in 1952. The turbines were rehabilitated coincident with generator rewinds in 1987 and 1988, respectively. In 1995, PacifiCorp installed a new runner in Yale Unit No. 2. A similar runner was installed in Unit No. 1 in 1996. The new runners increased Yale capacity to 134 MW.

2.2.2.2 Transmission and Auxiliary Equipment

Power generated at the Yale Project is transmitted 11.5 miles over a 115kV-transmission line (Lake Line) to a substation adjacent to the Merwin Project.

2.2.3 Swift Dam and Reservoir

The Swift No. 1 Hydroelectric Project is a 240 MW plant owned and operated by PacifiCorp. The project is the furthestmost upstream hydroelectric facility on the North Fork Lewis River, lying directly upstream of the Swift No 2 Hydroelectric Project. Construction of the Swift No. 1 Project began in 1956 and was completed in 1958. It consists of a main embankment dam, reservoir, penstocks, powerhouse, and transmission line, and is operated in coordination with the other three hydroelectric facilities on the North Fork Lewis River.

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Swift Dam spans the North Fork Lewis River approximately 40 miles upstream from the confluence with the Columbia River and 10.5 miles upstream of Yale Dam. It is an earthen fill embankment type dam with a crest length of 2,100 feet and a height of 512 feet. At the time of its construction, Swift Dam was the tallest earthen fill dam in the world. Its overflow spillway, located in the left abutment, has a capacity of 120,000 cfs (at reservoir elevation 1000 feet msl) through two 50-foot by 51-foot taintor gates. The elevation at the top of the taintor gates is 1,001.6-ft msl.

The reservoir formed by Swift Dam is approximately 11.5 miles long with a surface area of approximately 4,680 acres at elevation 1,000-ft msl (full pool). At maximum pool, the reservoir has a gross storage capacity of approximately 755,000 acre-ft. At the minimum pool elevation of 878-ft msl, the reservoir has a capacity of approximately 447,000 acre-ft.

2.2.3.1 Tunnels/Penstocks and Powerhouse

Water is delivered from Swift Creek Reservoir to the powerhouse through a system containing a tunnel, a surge tank, and an outlet, which branches into three penstocks. The Swift No. 1 intake is a relatively deep (approximately 75 ft. deep at full pool), high-head intake with design velocities ranging from between 10 and 20 fps. The intakes are protected from large debris by steel trash racks on approximately 4-inch spacing. The Swift No. 1 surge tank is located approximately 1,196 feet downstream of the tunnel intake and about 482 feet upstream of the powerhouse. This surge tank is of the restricted orifice, non-overflow style, with a diameter of 55 feet and a top elevation of 1,035-ft msl. Downstream of the tank, individual penstocks for each generating unit branch from the main tunnel. Each of the Swift No. 1 penstocks is 13 feet in diameter. At maximum turbine flows, water in the penstocks reaches velocities of up to 23 fps. The Swift No. 1 penstocks are capable of passing a maximum of 9,120 cfs, combined.

The Swift No. 1 Powerhouse contains 3 Francis-type generator units with a total installed capacity of 240,000 kW (nameplate). The turbines were rewound in 1987 (unit No. 12), 1990 (unit No. 11) and 1991 (unit No. 13) resulting in a capacity upgrade from 204 MW to 240 MW. The powerhouse is located at the base of the dam on the left side (facing downstream) of the old river channel. The powerhouse is operated by remote control from the Hydro Control Center at Merwin Headquarters.

2.2.3.2 Transmission and Auxiliary Equipment

The project is served by the 230kV Speelyai transmission line which extends from Swift No.1 to the Swift No. 2 switchyard and then to a BPA switching station near Woodland, Washington.

2.2.4 Swift No. 2 Hydroelectric Project

The Swift No. 2 Hydroelectric Project is a 70 MW development owned by Cowlitz PUD. The project lies between the Swift No. 1 and Yale hydroelectric projects on the North Fork Lewis River. The Swift No. 2 Project consists of a power canal, intake structure, penstocks, powerhouse, tailrace discharge channel, substation, and transmission line.

The powerhouse is located 3 miles downstream from Swift No. 1. Construction of the Swift No. 2 Project began in 1956 and was completed in 1958. It is operated in coordination with the other three hydroelectric facilities on the North Fork Lewis River.

2.2.4.1 Power Canal

The Swift No. 2 Power Canal begins at the tailrace of the Swift No. 1 Powerhouse and consists of an earthen-lined upper section (approximately 11,000 feet long) and a concrete-lined lower section (approximately 5,900 feet long). Water released from the Swift No. 1 Powerhouse immediately enters the 3-mile power canal and is conveyed to the Swift No. 2 Powerhouse. A gated check structure and ungated side-channel spillway/wasteway exist as part of the canal facilities. The purpose of the check structure is to allow isolation of the canal for operation of Swift No. 1 when Swift No. 2 is out of service. The gates in the check structure immediately downstream of the wasteway can be closed, to block flow, when, for example, the downstream section of the canal needs to be dewatered for maintenance activities including inspection. During normal operations, the wasteway prevents canal flows from exceeding the Swift No. 2 hydraulic capacity and maintains the maximum level in the canal. Water may be released to the bypass reach over the wasteway if flows in the canal exceed the Swift No. 2 hydraulic capacity or if the check structure gates are closed. A drain on the downstream side of the check structure may also be used to release water from the canal if needed. As a FERC Part 12 safety requirement for the project, a surge arresting structure (SAS) is located adjacent to the intake structure to release water from the canal in the event there is a surge from a turbine generator trip at Swift No. 2 and excess flow must be released from the canal. The release valve at the terminus of the SAS consists of two cone valves. The Interim Operation of the Lewis River Hydroelectric Projects consultation (June 27, 2002) currently provides incidental take coverage for existing operations but does not describe this operation of the SAS. For this potential circumstance when the SAS may operate prior to FERC issuing a new license but after NOAA Fisheries has issued its final biological opinion pursuant to the SA, the incidental take associated with the SAS will be covered by consultation associated with reconstruction of the canal and its appurtenances. Under the new license terms, the SAS will continue to be available and will operate for the same purpose.

Under normal operating conditions, the elevation of the canal waters at the Swift No. 2 intake structure range from 601 to 604 ft msl. The canal surface area is approximately 56 acres, and the canal holds approximately 922 acre-feet of water. The operating capacity of the power canal is 9,000 cfs.

2.2.4.2 Penstocks and Powerhouse

Water is delivered from the Swift No. 2 intake structure to the powerhouse via two penstocks, one for each of two turbine generator units. The intakes to the penstocks are protected from large debris by steel trash racks with approximately 4-inch spacing. The Swift No. 2 Powerhouse has two Francis-type turbines; each rated at 35,000 kW. Under contract with Cowlitz PUD, PacifiCorp currently operates the powerhouse via remote control from the Hydro Control Center at Merwin headquarters.

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2.2.4.3 Transmission

The project is served by the same 230 kV Speelyai transmission line that serves Swift No. 1 and that extends from the Swift No. 2 switchyard to a BPA switching station near Woodland, Washington.

3.0 STATUS OF THE SPECIES AND CRITICAL HABITAT

NOAA Fisheries issued the final rule to list Lower Columbia River steelhead as a threatened species under the ESA on May 18, 1998 (63 FR 13347). NOAA Fisheries also listed Lower Columbia River Chinook and Columbia River chum as threatened on March 16, 1999 (64 FR 14308; 64 FR 14508). In June 2004, NOAA Fisheries issued a new proposed rule evaluating 27 ESUs (69 FR 33102). NOAA has now proposed that the Lower Columbia River Chinook ESU, the Columbia River chum and the Lower Columbia River *O. mykiss* ESU remain listed under the ESA as threatened species (69 FR 33102). In addition, NOAA proposed that the Lower Columbia River coho ESU be listed under the ESA as threatened (69 FR 33102). All of these species occur in the Lewis River below Merwin Dam. NOAA Fisheries provided PacifiCorp and Cowlitz PUD with a complete list of threatened, endangered, proposed, and candidate species (Appendix B). General biology, distribution, life history, and recent biological data for Lower Columbia River coho, Chinook, and steelhead, and Columbia River chum in the vicinity of the four Lewis River hydroelectric projects are described in the following section. The BE has incorporated the best available scientific information from the proposed listing decisions in the most recent federal register notice.

3.1 CHUM SALMON

3.1.1 Chum Status and Distribution

The Columbia River chum ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon (64 FR 14508; March 25, 1999). Three artificial propagation programs are considered to be part of the ESU: the Chinook River (Sea Resources Hatchery), Grays River, and Washougal River/Duncan Creek chum hatchery programs. NOAA Fisheries has determined that these artificially propagated stocks are genetically no more than moderately divergent from the natural populations (NMFS, 2004b).

Chum salmon has the widest natural geographic and spawning distribution of any Pacific salmonid (Salo 1991). Chum salmon have been documented to spawn from Korea and the Japanese island of Honshu, east, around the rim of the North Pacific Ocean, to Monterey Bay in southern California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast. The species was abundant in the lower reaches of the Columbia River and spawning may have occurred as far upstream as the Walla Walla River (over 300 miles inland). Chum salmon may

historically have been the most abundant of all salmonids; prior to the 1940s, it is estimated that chum salmon contributed almost 50 percent of the total biomass of all salmonids in the Pacific Ocean (Neave 1961).

Today, only remnant chum salmon populations exist, all in the lower Columbia River. These populations are low in abundance and of uncertain stocking history. Presently, only three chum salmon populations, all relatively small and all in Washington are recognized and monitored in the Columbia River (Grays River, Hardy and Hamilton creeks). There are presently neither recreational nor directed commercial fisheries for chum salmon in the Columbia River, although some chum salmon are taken incidentally in the gillnet fisheries for coho and Chinook salmon, and there has been minor recreational harvest in some tributaries (WDF et al. 1993). WDF et al. (1993) monitored returns of chum salmon to three streams in the Columbia River and suggested that there may be a few thousand, perhaps up to 10,000, chum salmon spawning annually in the Columbia River basin. Kostow (1995) identified 23 spawning populations on the Oregon side of the Columbia River but provided no estimates of the number of spawners in these populations.

The question of the extent of the Columbia River ESU along the Washington and Oregon coasts prompted considerable debate within the biological review team (BRT). After evaluating patterns of abundance and other risk factors for chum salmon in the Columbia River, the BRT reached the following conclusions: the Columbia River historically contained large runs of chum salmon that supported a substantial commercial fishery in the first half of this century. These landings represented a harvest of more than 500,000 chum salmon in some years. An estimate of the minimal run size for chum salmon returning to both the Oregon and Washington sides of the Columbia River has been calculated by summing harvest, spawner surveys, Bonneville Dam counts, and returns to the Sea Resources Hatchery on the Chinook River in Washington (ODFW and WDFW 1995). This suggests that the chum salmon run size in the Columbia River has been relatively stable since the run collapsed in the mid-1950s, but only represents approximately 1 percent of historical abundance. Although current abundance is only a small fraction of historical levels and much of the original inter-population diversity has presumably been lost, total natural escapement for the ESU is probably at least several thousand fish per year. Taking all of these factors into consideration, about half of the BRT members concluded that this ESU was at significant risk of extinction; the remainder concluded that the short-term extinction risk was not as high, but that the ESU was at risk of becoming endangered.

3.1.1.1 North Fork Lewis River Chum

Very little is known about the life history of chum in the North Fork Lewis River. Smoker et al. (1951) confirmed the presence of chum in the North Fork Lewis River downstream of Merwin Dam. Chambers (1957) reported 96 chum spawning just downstream of Merwin Dam in mid-November of 1955. Chum were sighted occasionally during 1998 fall Chinook spawning surveys and 4 adult carcasses were observed in Cedar Creek. In addition, about 45 juvenile chum were captured during seining operations related to a smolt residual study in 1998 (pers. comm. S. Hawkins WDFW, 1999). Annually, about 3 or 4 adult chum have also been captured at the

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Merwin fish trap (pers. comm. R. Nicolay, WDFW, 1999). All of these fish were believed to be wild; hatchery supplementation has not occurred since 1940 (NPPC 1990).

3.1.2 Chum Life History

Chum salmon are semelparous and exhibit obligatory anadromy⁶. They also spend more of their life history in marine waters than other Pacific salmonids (Salo 1991). Mature adults enter freshwater at an advanced stage of sexual development and spawn in the lower reaches of coastal streams of various sizes (typically, just above tidal influence). Rarely do chum salmon penetrate rivers more than 100 miles (Scott and Crossman 1973).

During the spawning migration, adult chum salmon enter natal river systems from June to March, depending on characteristics of the population or geographic location (Salo 1991). In Washington, a variety of seasonal runs are recognized, including summer, fall, and winter populations. Fall-run fish predominate, but summer runs are found in Hood Canal, the Strait of Juan de Fuca, and in southern Puget Sound (WDF et al. 1993). Only two rivers have fish returning so late in the season that the fish are designated as winter-run fish, and both of these are in southern Puget Sound.

Chum salmon spawn most commonly in the lower reaches of rivers, with redds usually dug in the mainstem or in side channels from just above tidal influence. Some chum salmon spawn in intertidal zones of streams at low tide, especially in Alaska, where tidal fluctuation is extensive and upwelling of groundwater in intertidal areas may provide preferred spawning sites (Salo 1991). The peak of chum salmon migration usually occurs when water temperatures range between 7° and 11°C. Preferred water temperatures for spawning range from 7.2 to 12.8°C (Bell 1990). Subgravel flow (upwelled groundwater) may also be important in the choice of redd sites by chum salmon. Salo (1991) reported that "chum salmon prefer to spawn immediately above turbulent areas or where there was upwelling."

Typically, incubating eggs hatch in about 2 to 18 weeks (Wydoski and Whitney 1979, Salo 1991). Emergence typically occurs in April and May. Juvenile chum salmon outmigrate to saltwater almost immediately following emergence (Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, coho salmon, and most types of Chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions (Salo 1991). In Washington, chum salmon may reside in freshwater for as long as a month, migrating from late January through May (Salo 1991). Several cues influence the timing of fry migration. These include: time of spawning, water temperature during incubation, fry size and condition, population density, food availability, stream discharge volume and turbidity, tidal cycles, and day length (Salo 1991).

⁶ They die after spawning and only reach sexual maturity in salt water.

When chum salmon enter the estuary, some fry remain near the mouth of their natal river, but most disperse within a few hours into tidal creeks and sloughs up to several kilometers from the mouth of their natal river (Salo 1991). Chum salmon are second only to ocean-type Chinook in dependence upon estuaries. Observed residence times range from 4 to 32 days and extends from January to July (Salo 1991).

Chum salmon grow to be among the largest of Pacific salmon, second only to Chinook salmon in adult size. Average size for the species is around 3.6 to 6.8 kg (Salo 1991). Most chum salmon (95 percent) mature between 3 and 5 years of age, with 60 to 90 percent of the fish maturing at 4 years of age. In the Columbia River, 70.5 percent of the chum salmon mature at age 3, 28.7 percent mature at age 4, and 0.8 percent mature at age 5 (Salo 1991). A few populations of chum salmon show an alternation of dominance between 3 to 4 year-old fish, usually in the presence of dominant year classes of pink salmon (Gallagher 1979).

3.1.3 Chum Population Dynamics

Chum salmon are native to rivers and creeks near the mouth of the Columbia River. Chum salmon that currently enter the Lewis River have been considered strays from other Columbia River populations. However, recent genetic studies (Small 2003) have identified collections from the Lewis and Cowlitz Rivers as a group genetically distinct from Coastal and Columbia River Gorge populations of chum salmon.

3.2 CHINOOK SALMON

3.2.1 Chinook Status and Distribution

Chinook salmon is the largest of the Pacific salmon species. Spawning stocks are distributed from the Ventura River in central California to Kotzebue Sound, Alaska on the North American coast, and from northern Hokkaido, Japan to the Anadyr River, Russia on the Asian coast (Healey 1991, Myers et al. 1998). Along the coast of North America, there are well in excess of 1,000 spawning Chinook salmon populations. Fewer populations are known to occur along the Asian coast (Healey 1991).

Based on the best available scientific and commercial information, NOAA Fisheries has identified 15 ESUs of Chinook salmon from Washington, Oregon, Idaho, and California, including 11 new ESUs, and one redefined ESU. Genetic data (from studies of protein electrophoresis and DNA) were the primary evidence considered for the reproductive isolation criterion, supplemented by inferences about barriers to migration created by natural geographic features and human-induced changes resulting from artificial propagation and harvest. Of concern in the North Fork Lewis River is the Lower Columbia River ESU.

The Lower Columbia River Chinook ESU includes all naturally spawning populations of Chinook salmon from the Columbia River and its tributaries from the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, and includes the Willamette River to Willamette Falls, Oregon, exclusive of spring-run Chinook salmon in the Clackamas River (64 FR 14208).

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Seventeen artificial propagation programs are considered to be part of the ESU, including the Lewis River spring Chinook Program. NOAA Fisheries has determined that these artificially propagated stocks are genetically no more than moderately divergent from the natural populations.

3.2.1.1 North Fork Lewis River Chinook

Prior to the completion of Merwin Dam in 1932, the Lewis River basin supported self-sustaining populations of both spring and fall Chinook salmon. Early reports of Chinook abundance completed by the WDF and the WDG (Smoker et al. 1951) indicate that "at least 3,000" spring Chinook were believed to have entered the Lewis River above the Merwin Dam site. The "original" fall Chinook run past the dam site was believed to be "at least 1,300 adults." Unfortunately, these upper basin population estimates do not do not account for commercial or recreation harvest, nor do they reflect Chinook abundance before major freshwater habitat degradation.

Today, three Chinook salmon stocks are found in the Lewis River, but only two are listed as threatened species. The spring Chinook stock in the North Fork Lewis River has been supplemented with Cowlitz and Carson hatchery stocks since 1956 and current returns are thought to be solely hatchery origin (pers. comm. R. Nicolay, WDFW, 1999). As a result, it is a component of the Lower Columbia Chinook ESU, but is not considered a listed species (Table 2 of 64 FR 14308). However, NOAA Fisheries has proposed that these fish be considered listed. (69 FR 33102 at 33116). North Fork Lewis River bright fall Chinook are wild and a designated index stock used for monitoring purposes under the Pacific Salmon Treaty. The bright fall Chinook run is considered a wild run although the run has experienced intermittent supplementation from 1940 through 1986 (pers. comm. R. Nicolay, WDFW, 1999). Both the Lewis River bright and Lewis River Tule fall Chinook runs are components of the Lower Columbia River Chinook ESU, which is listed as a threatened species. The Tule fall Chinook run has also been supplemented with Kalama stock since 1940. Both fall Chinook stocks are currently self-sustaining.

In the last 20 years, adult spring Chinook returns to the Lewis River basin have been highly variable. From 1980 through 1997, the total adult spring Chinook return (including hatchery returns, natural escapement, and sport harvest) has ranged from a low of 1,600 in 1996 to nearly 17,000 in 1987, with an average of approximately 5,600 fish (Figure 3.2-1) (Pettit 1997; pers. comm., R. Pettit, WDFW, 2001; WDF, et al. 1993). Trends in annual abundance were similar to those observed in the Columbia River basin as a whole.

There is very little natural production of spring Chinook in the Lewis River basin. From 1980 through 1997, the natural escapement of adult spring Chinook, based on annual spawning ground counts, averaged about 1,700 fish, or approximately 15 to 20 percent of the total run size (Pettit 1997). All of these naturally spawning fish are considered a mixed stock of composite production (WDF, WDW and WWTTT 1993).

The distribution of naturally spawning spring Chinook is limited to the mainstem Lewis River up to RM 19.4 (Merwin Dam) and Cedar Creek up to RM 18.2. Few, if any, spring Chinook return to the East Fork Lewis River (WDF, WDW and WWTTT 1993). In the

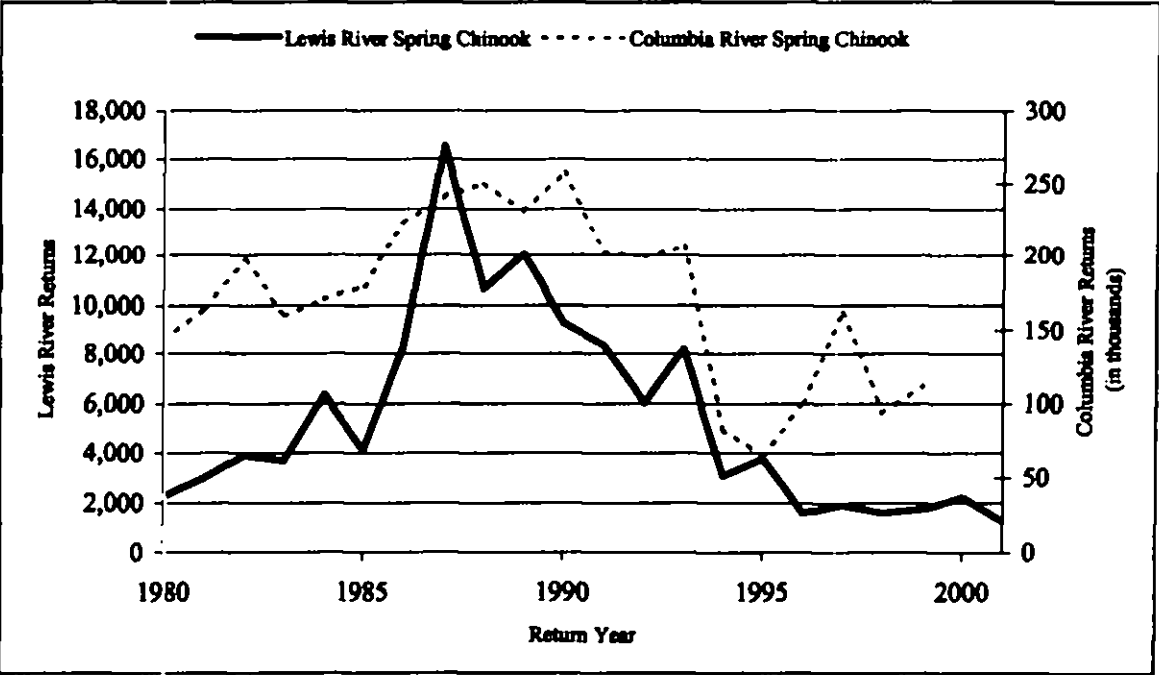
mainstem Lewis River, most natural spring Chinook spawning and rearing occurs between Merwin Dam and the Lewis River Hatchery (RM 15.6 to RM 19.4). Most spawning and rearing in Cedar Creek occurs between RM 11.0 and RM 18.2.

Today, naturally spawning Lewis River fall Chinook represent about 80 to 85 percent of the wild fall Chinook returning to the lower Columbia River (NPPC 1990). From 1980 through 1998, the total adult fall Chinook return to the Lewis River has been highly variable, ranging from 6,200 in 1998 to 21,200 in 1989 (Figure 3.2-1). The average over this period was 11,600 fish (Figure 3.2-1) (Hawkins 1998).

The distribution of Lewis River fall Chinook is limited to the mainstem Lewis River up to RM 19.4 (Merwin Dam), in the East Fork Lewis River up to RM 20.6, and in Cedar Creek up to RM 8.2. In the East Fork Lewis River, most fall Chinook spawning and rearing occurs between RM 0.0 and RM 13.9.

3.2.2 Chinook Life History

Chinook salmon are anadromous and semelparous (die after spawning once) and have a broad range of life history traits, including variation in age at seaward migration; variation in freshwater, estuarine, and ocean residence; variation in ocean distribution; and in age and season of spawning migration (Healey 1991, Myers et al. 1998). Most of this variation is exhibited in two distinct behavioral forms (races). These races are commonly referred to as spring (stream-type) and fall Chinook (ocean-type). Spring Chinook reside in freshwater for a year or more before migrating to sea and return to their natal river in



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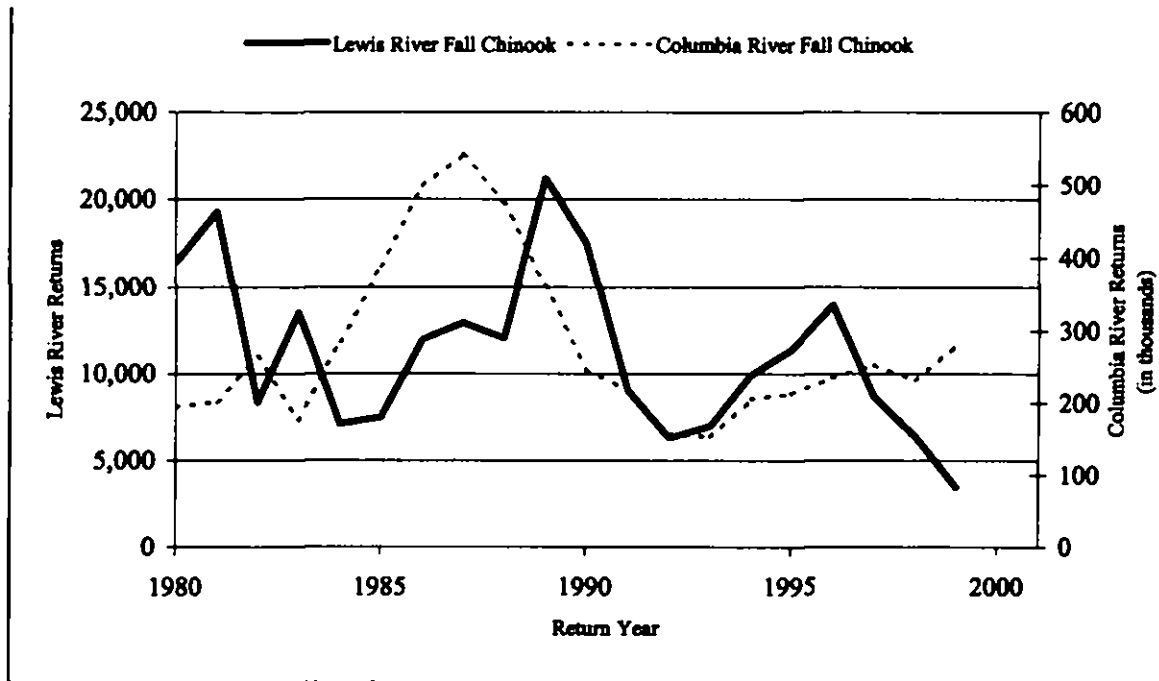


Figure 3.2-1. Adult spring Chinook and fall Chinook returns to the North Fork Lewis River compared with Columbia River basin returns (1980 to 2001).

spring or summer, several months prior to spawning. Fall Chinook migrate to sea in their first year of life, usually only a few months after emergence, and return to their natal river in the fall, a few days or weeks before spawning (Healey 1991). The timing of river entry varies among individual stocks and is generally related to local temperature and water flow regimes (Healey 1991) and ranges from summer to winter.

Chinook spawning typically occurs in the fall. They require clean gravel, 2.5-7.5 cm in diameter for spawning (USDI and BLM 1996). Chinook salmon eggs hatch, depending upon water temperatures, between 90 to 150 days after deposition. Stream flow, gravel quality, and silt load all significantly influence the survival of developing Chinook salmon eggs. After emergence, both ocean and stream-type Chinook salmon juveniles use a wide variety of freshwater habitats and depend on the quality of the entire watershed, from headwaters to the estuary. Chinook salmon are typically found in low-gradient streams dominated by gravel and cobble (Scott and Crossman 1973). Juvenile Chinook salmon are typically associated with low gradient, meandering, unconstrained stream reaches (Lee et al. 1996), and require abundant habitat complexity such as associated with accumulations of large wood and overhanging vegetation (USDI and BLM 1996). Juvenile Chinook salmon often move into side channels, beaver ponds, and sloughs for over-wintering habitat. The preferred temperature range for Chinook salmon fry ranges between 12 and 14°C. The upper lethal tolerance limit is 25°C (Scott and Crossman 1973).

Juvenile Chinook may spend from 3 months to 2 years in freshwater after emergence and before migrating to estuarine areas as smolts, and then into the ocean to feed and mature.

Out-migration typically peaks in the spring. Chinook salmon remain at sea for 1 to 6 years (more commonly 2 to 4 years), with the exception of a small proportion of yearling males (called jack salmon) which mature in freshwater or return after 2 or 3 months in salt water (Rutter 1904; Gilbert 1912; Rich 1920; Mullan et al. 1992). The average age of spawners is typically four years (Myers et al. 1998).

3.2.2.1 Age and Growth

Chinook salmon stocks exhibit considerable variability in size and age of maturation, and at least some portion of this variation is genetically determined. The relationship between size and length of migration may also reflect the earlier timing of river entry and the cessation of feeding for Chinook salmon stocks that migrate to the upper reaches of river systems. Body size, which is correlated with age, may be an important factor in migration and redd construction success. Roni and Quinn (1995) reported that under high-density conditions on the spawning ground, natural selection may produce stocks with exceptionally large-sized returning adults. Early researchers recorded the existence of different temporal "runs" or modes in the migration of Chinook salmon from the ocean to freshwater.

3.2.2.2 Hybridization and Genetics

The following sections describe the genetic, ecological, and life history characteristics, as well as human-induced genetic changes that NOAA Fisheries assessed to determine the number and geographic extent of Chinook salmon ESUs. Chinook salmon populations in the Columbia and Snake rivers appear to be separated into two large genetic groups: those producing ocean-type outmigrants and those producing stream-type outmigrants. The first group includes populations in lower Columbia River tributaries including the North Fork Lewis River, with both spring-run and fall-run (bright and Tule) life histories. The second major group of Chinook salmon in the Columbia and Snake River drainage consists of spring- or summer-run fish.

The effects of artificial propagation and other human activities such as harvest and habitat modification can be relevant to ESA listing determinations in two ways. First, such activities can genetically change natural populations so much that they no longer represent an evolutionarily significant component of the biological species (Waples 1991a). For example, in 1991, NOAA Fisheries concluded that, as a result of massive and prolonged effects of artificial propagation, harvest, and habitat degradation, the agency could not identify natural populations of coho salmon in the lower Columbia River that qualified for ESA listing consideration (56 FR 29553). Second, risks to the viability and genetic integrity of native salmon populations posed by human activities may contribute to their threatened or endangered status (Goodman 1990; Hard et al. 1992). The severity of these effects on natural populations depends both on the nature of the effects (e.g., harvest rate, gear size, or type of hatchery practice) and their magnitude (e.g., duration of a hatchery program and number and life-history stage of hatchery fish involved). For example, artificial propagation is a common practice to supplement Chinook salmon stocks for commercial and recreational fisheries. However, in many areas, a significant portion of the naturally spawning population consists of hatchery-produced Chinook salmon. In several of the Chinook salmon ESUs, over 50 percent of

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the naturally spawning fish are from hatcheries. Many of these hatchery-produced fish are derived from a few stocks, which may or may not have originated from the geographic area where they are released. This is true of the spring Chinook stock in the North Fork Lewis River where, since 1909, the stock has been supplemented and eventually replaced with Carson hatchery stock.

Artificial propagation is important to consider in ESA evaluations of anadromous salmonids for several reasons. First, although natural fish are the focus of ESU determinations, possible effects of artificial propagation on natural populations must also be evaluated. For example, stock transfers might change the genetic bases or phenotypic expression of life history characteristics in a natural population in such a way that the population might seem either less or more distinctive than it was historically. Artificial propagation can also alter life history characteristics such as smolt age and migration and spawn timing (Crawford 1979; NRC 1996). Second, artificial propagation poses a number of risks to natural populations that may affect their risk of extinction or endangerment. Finally, if any natural populations are listed under the ESA, then it will be necessary to determine the ESA status of all associated hatchery populations. The Lewis River, Merwin and Speelyai hatchery programs' influence on listed anadromous stocks is addressed through an annual reporting process under an ESA Section 10 permit issued to the State of Washington by NOAA Fisheries

3.3 STEELHEAD

3.3.1 Steelhead Status and Distribution

Steelhead is the name commonly applied to the anadromous form of the species *O. mykiss*. The present distribution of steelhead extends from Kamchatka in Asia, east to Alaska, and down to the U.S.-Mexico border (Busby et al., 1996; 67 FR 21586). Historically, steelhead likely inhabited most coastal streams in Washington, Oregon, and California as well as many inland streams in these states and Idaho. However, during this century, over 23 indigenous, naturally reproducing stocks of steelhead are believed to have been extirpated, and many more are thought to be in decline in numerous coastal and inland streams in Washington, Oregon, Idaho, and California. Forty-three stocks have been identified by Nehlsen et al. (1991) as being at moderate or high risk of extinction. Steelhead in the lower Columbia River ESU, which includes naturally spawned populations and their progeny in the North Fork Lewis River below Merwin Dam, were listed as threatened by NMFS on March 19, 1998. The lower Columbia River ESU includes all naturally spawned populations of steelhead in the Columbia River and its tributaries from its estuary up to, and including, the Hood River in Oregon. This ESU is composed of both winter- and summer-run steelhead. Ten artificial propagation programs are considered to part of the ESU: the Cowlitz Trout Hatchery, Kalama River Wild Clackamas Hatchery, Sandy Hatchery, and Hood River steelhead hatchery programs. NOAA Fisheries has determined in the proposed listing rule that these artificially propagated stocks are genetically no more than moderately divergent from the natural populations (69 FR 33102).

3.3.1.1 Consideration of Resident *O. mykiss* Populations in Listing Determinations

In addition to an anadromous *O. mykiss* life history (i.e., steelhead), *O. mykiss* exhibits freshwater resident only forms (i.e., rainbow trout). Where the two forms co-occur, the offspring of resident fish may migrate to the sea, and the offspring of anadromous fish may remain in streams as resident fish. The change from the anadromous life form to the resident life form can also result from imposed physical or physiological barriers to migration. Genetic differences, when studied, have indicated greater differences among geographically separated *O. mykiss* populations of the same life-history form than between anadromous and resident life-history forms in the same geographical area. No suite of morphological or genetic characteristics has been found that consistently distinguishes between the two life-history forms.

As is the case with hatchery fish, it is important to determine the relationship of these resident fish to anadromous populations in the *O. mykiss* ESUs under consideration. In its previous status reviews of steelhead ESUs, NOAA Fisheries concluded that the available data suggest that resident rainbow trout and steelhead in the same area generally share a common gene pool (at least over evolutionary time periods), and included resident and anadromous populations in the same ESU. Resident populations above long-standing natural barriers, and those populations that have resulted from the introduction of non-native rainbow trout, were not considered part of these ESUs. In the case of resident populations upstream of impassable human-caused migration barriers (e.g., large mainstem hydroelectric dams), NOAA Fisheries found insufficient information to merit their inclusion in steelhead ESUs. The agency generally concluded that resident populations upstream of impassable manmade barriers must be evaluated on a case-by-case basis as more information becomes available on their relationships to below-barrier populations, or on the role these above-barrier resident populations might play in conserving below-barrier populations of *O. mykiss*.

In its previous steelhead ESA listing determinations, although NOAA Fisheries considered co-occurring resident and anadromous populations as a single ESU, NOAA Fisheries did not list resident populations when it was determined that the Lower Columbia River ESU in-total warranted listing. As noted above, the Alsea court has rejected listing under the ESA only a subset of an ESU or distinct population segment (DPS). For the purposes of reviewing the viability of naturally spawned *O. mykiss* populations in this proposed rule, the BRT adopted a framework for determining the ESU/DPS membership of resident *O. mykiss* geographically associated with listed steelhead ESUs. These evaluations were guided by the same biological principles used to define ESUs of natural fish and determine ESU membership of hatchery fish: the extent of reproductive isolation and biological divergence from other populations within the ESU. Ideally, each resident population would be evaluated individually on a case-by-case basis, using all available biological information. In practice, little or no information is available for most resident *O. mykiss* populations. To facilitate determinations of the ESU/DPS membership of resident *O. mykiss*, the BRT identified three different cases, reflecting the range of geographic relationships between resident and anadromous forms within different watersheds: (1) no obvious physical barriers to interbreeding between resident and anadromous forms; (2) long-standing natural barriers (e.g., a waterfall)

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between resident and anadromous forms; and (3) relatively recent (e.g., within the last 100 years) human-imposed barriers (e.g., a dam without a fish ladder) between resident and anadromous forms.

The BRT adopted the following working assumptions about ESU membership of resident fish falling in each of these three cases. Where there was no obvious physical barrier to interbreeding between the two life-history forms, resident fish were considered part of the ESU. Empirical studies show that resident and anadromous *O. mykiss* are typically very similar genetically when they co-occur with no physical barriers to migration or interbreeding. Where long-standing natural barriers separate resident and anadromous forms, resident populations were not regarded as part of the ESU. Many populations in this category have been isolated from contact with anadromous populations for thousands of years. Empirical studies show that in these cases the resident fish typically show substantial genetic and life-history divergence from the nearest downstream anadromous populations. In cases where the resident fish were separated from the anadromous form by relatively recent human actions (e.g., impassable dams and culverts), the BRT was unable to justify any particular default assumption. The two life-history forms most likely coexisted without any barriers to interbreeding prior to the establishment of the manmade barrier(s). However, as a result of rapid divergence in a novel environment, or displacement by or genetic introgression from non-native hatchery rainbow trout, these resident populations may no longer represent the evolutionary legacy of the *O. mykiss* ESU. Given these uncertainties, the BRT left unresolved the ESU membership of *O. mykiss* above recent (usually man-made) impassable barriers. In the absence of information indicating that they are part of a common ESU, NOAA Fisheries does not find such above-barrier populations to be part of the *O. mykiss* ESUs under review.

The BRT reviewed available information about individual resident populations of *O. mykiss* to determine which of the above scenarios best defined the level of reproductive isolation between the life-history forms, and whether any information exists to override the default assumptions described above about the ESU membership of resident populations. The best available information concerning resident *O. mykiss* in Columbia River basin ESUs is summarized in the report "The Biological Implications of Non-Anadromous *Oncorhynchus mykiss* in Columbia basin Steelhead ESUs" (Kostow, 2003).

As noted above, little or no population data are available for most resident *O. mykiss* populations, greatly complicating assessments of ESU-level extinction risk. Where available, the BRT incorporated information about resident populations into their analyses of the four viable salmonid population (VSP) criteria and their assessments of extinction risk for *O. mykiss* ESUs. As was often the case, no data on the abundance, productivity, spatial structure, or diversity were available for resident populations in an ESU. The BRT noted that the presence of relatively numerous resident populations can significantly reduce risks to ESU abundance. However, there is considerable scientific uncertainty as to how the resident form affects extinction risk through its influence on ESU productivity, spatial structure, and diversity. The threats to *O. mykiss* ESUs extend beyond low population size and include declining productivity, reduced resilience of productivity to environmental variation, curtailed range of distribution, impediments to population connectivity and reproductive exchange, depleted diversity stemming from

loss or blockage of habitat and associated erosion of local adaptation, and erosion of the diversity of expressed migratory behaviors. Thus, the BRT concluded that, despite the reduced risk to abundance for certain *O. mykiss* ESUs due to numerically abundant residents, the collective contribution of the resident life-history form to the viability of an ESU in-total is unknown and may not substantially reduce extinction risks to an ESU in-total (NOAA Fisheries 2004). Based on present scientific understanding, the BRT could not exclude the possibility that complete loss of anadromous forms from within an ESU may be irreversible.

3.3.1.2 North Fork Lewis River Steelhead

Summer and winter steelhead are indigenous to the Lewis River basin; historically, large numbers of winter steelhead were known to spawn and rear in the North Fork upstream from Merwin Dam. Few summer steelhead spawned in the North Fork (WDFW 1994, NPPC 1990).

Today, North Fork Lewis River winter steelhead are thought to be native, although some interbreeding has probably occurred with introduced stocks from Elochoman, Chambers Creek, Cowlitz, and Skamania hatcheries that have been planted in the basin since the late 1940s (NPPC 1990). The summer steelhead stock in the Lewis River is also considered native, although interbreeding with introduced Skamania hatchery stock has likely occurred (NPPC 1990). In many cases, Skamania summer steelhead have been introduced to provide angling opportunities where summer steelhead did not naturally exist (LCFRB 2004). In addition, steelhead, which abandoned the Cowlitz system following the eruption of Mount St. Helens in 1980 probably strayed into the Lewis River and spawned with native Lewis stock (WDFW 1994).

Based on our review of existing literature, the historical (pre-hatchery) abundance of steelhead in the Lewis River basin is extremely limited, although Smoker et al. (1951) estimated that the total spawning escapement exceeded 1,000 steelhead. Lavoy (1983) estimated that the total spawning escapement ranged from 8,000 to 11,000 fish. Between 1930 and 1950, an average 403 summer and winter steelhead were collected at the Merwin Dam fish collection facility (range 86 to 1,366) (Smoker et al. 1951).

From 1962 through 1998, annual angler catch of summer steelhead in the mainstem and North Fork Lewis River has averaged just over 3,600 fish. Catch of winter steelhead during this same period has averaged about 3,400 fish (Figure 3.3-1) (PacifiCorp and Cowlitz PUD 2004: AQU 18 – Appendix G). In most years, Lewis River catch rates paralleled steelhead returns to the entire Columbia River basin (ODFW and WDFW 2000). Prior to 1994, all steelhead captured at the Lewis River Hatchery were returned to the river for angler harvest. Therefore, hatchery returns are not the best indicator of total run size.

Currently, there is very little wild steelhead production in the North Fork Lewis River below Merwin Dam; wild steelhead returns account for approximately 7 percent of the total North Fork run size (WDFW 1994). Due to the low return of wild summer steelhead in the North Fork, no escapement goal has been established. The escapement goal for wild winter steelhead on the North Fork is 698 fish.

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The primary spawning areas for wild North Fork Lewis River steelhead are located downstream of Merwin Dam in Cedar Creek and Johnson Creek, and the East Fork Lewis River. Rearing occurs in those same tributaries and the mainstem North Fork Lewis River between Merwin Dam and Eagle Island. Rearing and spawning habitat is limiting in the tributaries given the size of Cedar and Johnson creeks and the presence of upstream migration impediments. WDFW continues spawning surveys on Cedar Creek and has installed a trap at the Grist Mill fish ladder to monitor upstream migration and to segregate hatchery and wild stocks. There are no existing data on the average annual size of the natural outmigration.

There is no legal harvest for wild steelhead in the North Fork Lewis River basin; all wild steelhead caught must be released unharmed. Hatchery fish are adipose fin clipped for easy identification.

3.3.2 Steelhead Life History

O. mykiss is considered by many to have the greatest diversity of life history patterns of any Pacific salmonid species, including varying degrees of anadromy, differences in reproductive biology, and plasticity of life history between generations. The species can be anadromous (steelhead) or freshwater resident ("rainbow" or "redband" trout), and it is believed that the progeny from resident rainbow trout have the potential to become anadromous and that the progeny of steelhead have the potential to become resident rainbow trout (Peven 1990). Those that are anadromous can spend up to 7 years in fresh water prior to smoltification, and then spend up to 3 years in salt water prior to first spawning. *O. mykiss* is also iteroparous (meaning individuals may spawn more than once), whereas the Pacific salmon species are principally semelparous (meaning individuals spawn once and die).

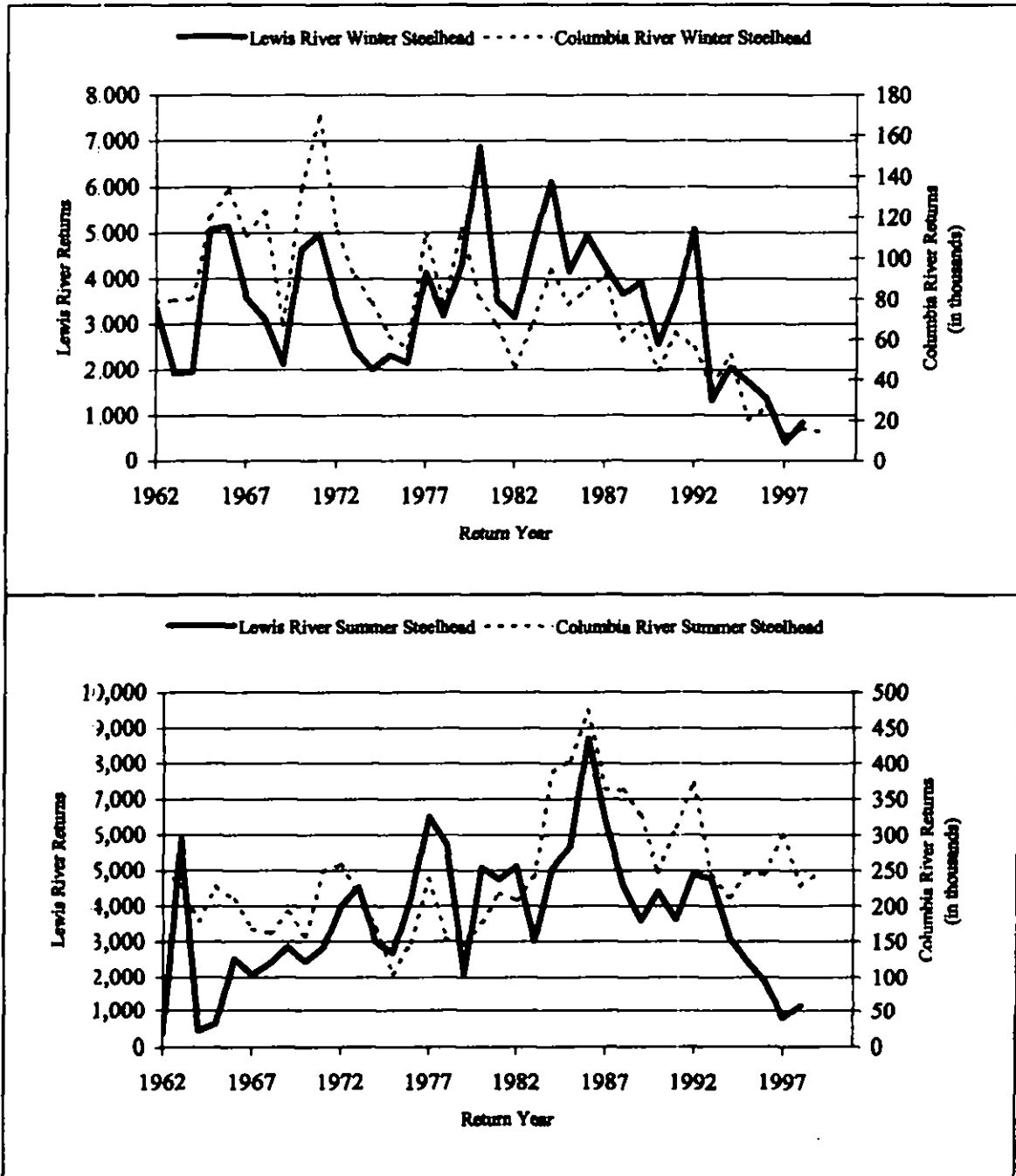


Figure 3.3-1. The number of winter and summer steelhead harvested in the Lewis River basin recreation fishery compared with Columbia River basin returns (1962 through 1998).

Within the range of West Coast steelhead, spawning migrations occur throughout the year, with seasonal peaks of activity. In a given river basin there may be one or more peaks in migration activity; since these “runs” are usually named for the season in which the peak occurs, some rivers may have runs known as winter, spring, summer, or fall steelhead.

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Biologically, steelhead can be divided into two reproductive ecotypes (races), based on their state of sexual maturity at the time of river entry and duration of their spawning migration. These two ecotypes are termed “stream maturing” or “summer” steelhead and “ocean maturing” or “winter” steelhead. Summer steelhead enter freshwater in a sexually immature state during the summer months and require several months of maturation before they spawn. Winter steelhead enter freshwater ready to spawn in late winter or early spring (Busby et al. 1996). On average, there is a 2-month difference in peak spawning time between winter and summer steelhead, although there is probably some overlap in the spawning distribution (Busby et al. 1996). Furthermore, within the same watershed, winter and summer steelhead spawn in geographically distinct areas. Summer steelhead populations occur above barrier falls, which are generally impassable during the winter-run migration.

Adult winter-run steelhead normally enter rivers from November to May and are near final stages of maturity upon entry. Summer-run steelhead generally return as immature fish between April and October. Spawning takes place for both runs, between December and June, with most spawning occurring in the early spring. Eggs incubate for 1.5 to 4 months, depending on water temperature, before hatching. Juveniles rear in freshwater 1 to 4 years, then migrate to the ocean during the spring. They usually reside and mature in marine waters for 2 to 3 years prior to returning to spawn as 4 or 5-year-old fish.

Steelhead prefer relatively small, fast flowing streams with a high proportion of riffles and pools (Barnhart 1991). As with most salmonids, spawning typically occurs in streams where the water is cool, clear, and well oxygenated. The most common steelhead redd site is at the tail of a pool. Like other Pacific salmon, these areas are often associated with deep pools and abundant instream cover. The optimum spawning temperature for steelhead is about 7°C, but they have been reported spawning at temperatures of 3.8° to 12.6°C (Bell 1990, Barnhart 1991).

Most steelhead, in their first year of life, live in riffles but some larger fish also inhabit pools or deep fast runs (Barnhart 1991). Instream cover such as large rocks, logs, root wads, and aquatic vegetation are very important for juvenile steelhead. This cover provides resting areas, visual isolation from competing salmonids, food, and protection from predators. Often steelhead densities are highest in streams with abundant instream cover. The preferred water temperature for rearing steelhead ranges from 10 to 13°C (Bjornn and Reiser 1991).

3.3.2.1 Age and Growth

Growth differs dramatically among different stocks of steelhead in the Lower Columbia ESU. Length of time spent in the juvenile freshwater phase and length of time rearing at sea can greatly influence growth even within stocks. In the Lower Columbia River ESU, most wild steelhead are 4 to 6 years of age at first spawning, 50 to 91 cm in length, and 2 to 8 kg in weight. However, they can attain ages of 9 years and reach lengths of over 100 cm (12 kg) (Busby et al. 1996).

3.4 PROPOSED SPECIES

Section 7(a)(2) of the ESA requires federal agencies to consult over the effects of their actions on listed species. Section 402.10 of the ESA implementing regulations allows Federal agencies to confer over the effects of actions on "proposed species." Lower Columbia River coho are the only proposed species identified by NOAA Fisheries in the action area that were not listed previously. As discussed earlier in the BE, NOAA has proposed that the Lower Columbia River Chinook ESU, the Columbia River chum and the Lower Columbia River *O. mykiss* ESU remain listed under the ESA as threatened species (69 FR 33102). Therefore, these species were discussed as both proposed and listed species in section 3.0.

3.4.1 Coho Salmon

3.4.1.1 Coho Status and Distribution

Coho salmon is a widespread species of Pacific salmon, occurring in most major river basins around the Pacific Rim from Monterey Bay, California, north to Point Hope, Alaska, through the Aleutians, and from the Anadyr River south to Korea and northern Hokkaido, Japan (69 FR 33109). Introductions have also occurred in most of the Great Lakes and in other cold temperate areas of North America (Scott and Crossman 1973, Sanderson 1991).

All coho salmon stocks in the Columbia River basin above Bonneville Dam (except Hood River) are considered extinct (Nehlsen et al. 1991). Hood River, Sandy River, and all other lower Columbia River tributary stocks are at high risk of extinction, except the Clackamas River stock, which is at moderate risk of extinction. NOAA Fisheries published a status review of Lower Columbia River coho salmon stocks in 1991 (Johnson et al. 1991). In this review, NOAA Fisheries concluded that, historically, at least one ESU of coho salmon probably occurred in the lower Columbia River Basin, but the agency was unable to identify any remaining natural populations that warranted protection under the ESA. Lower Columbia River coho were reevaluated in 1995 and NOAA Fisheries designated the Southwest Washington/Lower Columbia River (South West Washington/Lower Columbia River) coho ESU as a candidate species to be listed under the ESA (60 FR 38011). In 1996, NOAA Fisheries updated the 1995 status review, and concluded that the South West Washington/Lower Columbia River ESU may warrant splitting into separate South West Washington and Lower Columbia River ESUs. In 2001 NOAA Fisheries updated information on the viability of Lower Columbia River coho and concluded that Lower Columbia River coho was a separate ESU from South West Washington coho. This conclusion was supported by new tagging data and analyses indicating that South West Washington and Lower Columbia River coho populations have differing marine distributions and are genetically distinct (Shaklee et al. 1999). NOAA Fisheries reevaluated the listing determination for 26 ESUs of West Coast salmonids in response to the 2001 Alsea decision, which resulted in the proposed listing of 27 ESUs of West coast salmonids on June 14, 2004. In the proposed listing (69 FR 33101), NOAA Fisheries concluded that the Lower Columbia River coho ESU is likely to become endangered within the foreseeable future over all or a significant portion of its

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range, and proposed that the Lower Columbia River coho ESU be listed under the ESA as a threatened species.

The Lower Columbia River coho ESU includes all naturally spawning populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood rivers, as well as twenty-one artificial propagation programs, including the Lewis River hatchery coho program. The core natural spawning in the ESU occurs in the Sandy and Clackamas rivers. Based on available information, most of the adult coho salmon returning to natural or hatchery areas outside these two streams are hatchery fish or are progeny of hatchery fish. The loss of naturally spawning populations, the low abundance of extant populations, diminished diversity, and fragmentation and isolation of the remaining naturally produced fish confer considerable risks to the ESU.

The very large number of hatchery-produced adults contrasts the small returns of naturally produced spawners in this ESU. The abundance of hatchery coho returning to the Lower Columbia River in 2001 and 2002 exceeded one million and 600,000 fish, respectively (69 FR 33101). At present, the Lower Columbia River coho hatchery programs reduce risks to ESU abundance and spatial structure, provide uncertain benefits to ESU productivity, and pose risks to ESU diversity. Overall, artificial propagation mitigates the immediacy of the ESU extinction risk in the short-term, but is of uncertain contribution in the long term. Over the long term, reliance on the continued operation of these hatchery programs needs to be monitored to ensure that the hatcheries are continuing to provide benefits to the listed species. These hatchery stocks at present collectively represent a significant portion of the ESUs remaining genetic resources. Armed with this information, on June 14, 2004, the BRT concluded that the naturally spawned component of the Lower Columbia River coho ESU is "in danger of extinction." The minority opinion was that the ESU is "likely to become endangered within the foreseeable future (69 FR 33133)."

3.4.1.2 North Fork Lewis River Coho

Coho in the North Fork Lewis River persist primarily through hatchery production of two stocks; a late run Type-N stock and an early run Type-S stock. Both are produced at the Lewis River Hatchery Complex. Type-N coho are north-turning and contribute more heavily to the northern ocean fisheries, while Type-S coho are south-turning and contribute more heavily to the southern ocean fisheries (NPPC 1990, Wydoski and Whitney 1979). The WDFW has supplemented the early-run (Type-S) coho in the North Fork Lewis River with Toutle stock since the days of the Johnson Creek fish facility dating back to 1906. Late-run (Type-N) Cowlitz River stock coho were introduced to the Lewis River in 1971-72. Today, the North Fork Lewis River hatchery continues to produce coho for PacifiCorp's obligation under the Merwin license. PacifiCorp funds 100 percent of the hatchery operations and maintenance for that facility.

Coho salmon returns to the Lewis River basin declined following the completion of Merwin Dam. The initial decrease in the abundance and high degree of annual variability in the late 1930s and early 1940s was believed to be the result of "poor intermittent spilling" over Merwin Dam (Smoker et al. 1951). However, these declines in abundance

were also occurring in the Columbia River basin as whole, and may be more closely related to intensive harvest or changes in ocean productivity. In the 1960s and 1970s, the number of coho returning to the Lewis River basin remained relatively low despite increasing returns in the entire Columbia River basin (Figure 3.4-1). Since 1980, coho abundance in the Lewis River has increased dramatically and has in large part paralleled coho returns to the Columbia River.

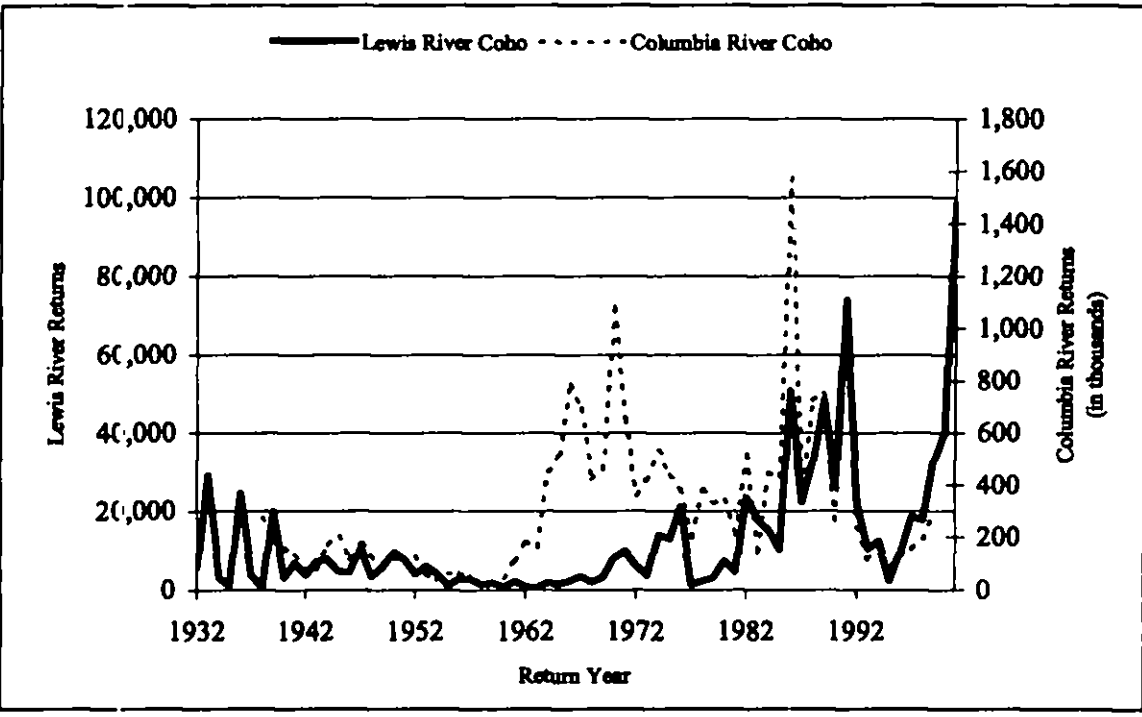


Figure 3.4-1. The number of adult coho collected at the Merwin Dam Anadromous Fish Collection Facility and Lewis River Hatchery (Lewis River returns) compared with Columbia River basin returns (1932 to 2000).⁷

Like spring Chinook, there is very little natural production of coho salmon in the Lewis River basin. The majority of coho returning to the basin are captured at the Merwin Fish Trap, although an estimated 5 to 10 percent spawn naturally within the mainstem Lewis River below Lake Merwin and in several tributaries including the East Fork Lewis River, Ross, Cedar, Chelatchie, Johnson, and Colvin creeks, and numerous smaller tributaries (WDF, et al. 1993, PacifiCorp and Cowlitz PUD 2004: AQU 1).

3.4.1.3 Coho Life History

Coho salmon exhibit a three-year life cycle. The coho salmon life history consists of roughly 18 months of freshwater rearing followed by approximately 18 months of ocean rearing (Weitkamp et al. 1995). Adults typically begin their freshwater spawning migration in the late summer and fall, spawn by mid-winter, and then die. Run and spawning timing of adult coho salmon varies between and within coastal and Columbia River Basin populations. Some precocious males, called jacks, return to spawn after less

⁷ Lewis River coho returns do not include jacks or fish harvested by recreation anglers.

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than one year at sea. Coho salmon typically spawn in relatively small and shallow tributary streams from October through February. Their preferred spawning substrate is gravel ranging from 1.3 to 10.2 cm (Reiser and Bjornn 1979). Spawning generally occurs in temperatures from 5.4 to 9.4°C. Depending on the temperature, eggs incubate in redds for 1.5 to 4 months before hatching.

At least one year of freshwater residence is normal for juvenile coho salmon (USFWS 1986). Coho salmon parr are frequently associated with side channels, wetlands, and off-channel sloughs for rearing (Sandercock 1991). Other important juvenile habitats include large wood accumulations, undercut banks, and complex pool habitats. Juveniles are generally absent in channels lacking cover. Fry densities are greatest in backwater pools, beaver dam pools, and off-channel areas (WDW 1991). Mason and Chapman (1965) reported that coho salmon juveniles are aggressive and territorial soon after emergence, and establish intraspecific dominance hierarchies. Where coho and Chinook salmon juveniles occurred together in streams, the coho were socially dominant, defending optimum feeding territory (Stein et al. 1972). Coho salmon juveniles were reported to grow faster and heavier than Chinook salmon juveniles of the same length (Stein et al. 1972). Water temperatures that average between 10° to 15°C in the summer are considered optimum for juvenile coho salmon rearing (USFWS 1986). Bell (1973) reported the upper lethal limit to be 25.8°C. Out-migration of smolts to marine areas usually occurs from April to August of the year following their hatching, with peak migrations in May in nearly all areas (USFWS 1986).

3.4.1.4 Coho Population Dynamics and Hatcheries

A review of published accounts indicates that homing fidelity in coho salmon is generally strong, with low levels of straying (about 1 percent) estimated for most natural populations that have been studied. On the other hand, coho salmon habitat typically includes small tributaries that experience relatively frequent, temporary blockages, and there are a number of examples in which coho salmon have rapidly recolonized vacant habitat that had only recently become accessible to anadromous fish. Because ESU determinations focus on units that are strongly isolated over evolutionarily important time frames, NOAA Fisheries concludes that, in general, local spawning populations of coho salmon are unlikely to meet the criterion of reproductive isolation. However, groups of local populations among tributaries within a river drainage may experience substantial, long-term isolation from other such groups.

Genetic data provide useful indirect information on reproductive isolation because they integrate information about migration and gene flow over evolutionarily important time frames. Published results from several studies of genetic characteristics of coho salmon populations are available (Solazzi 1986, Reisenbichler and Phelps 1987, Wehrhahn and Powell 1987, Gall 1991, Hjort and Schreck 1982, Currens and Farnsworth 1993, Forbes et al. 1993). Although collectively these studies show that the pattern of relationships among populations is complex, there is a strong geographic component to the observed population structure, and several major stock groupings can be identified. While a few individual samples proved to be exceptions to the general patterns, possible explanations for these results include true ancestral relationships, stock transfers, and random variation in an analysis involving a large number of samples.

A major cluster in the NOAA Fisheries genetic analysis includes all of the lower Columbia River samples, as well as samples from the southwest Washington coast. Within this larger group, several smaller clusters can be identified. Two of the subclusters, one dominated by samples from Washington and the other by samples from Oregon, include most of the samples from the lower Columbia River. Another subcluster contains three samples from Willapa Bay on the southwest Washington coast.

Stock transfers of coho salmon have been (and continue to be) common throughout the West Coast and influence population dynamics; the nature and magnitude of these transfers varies by geographic region. Southwest Washington hatcheries are relatively large and numerous for the area, and most produce 1 to 3 million juveniles annually. Hatcheries in southwest Washington have used native stocks in addition to those from Puget Sound/Strait of Georgia, Olympic Peninsula, and the Columbia River. Currently, the magnitude and frequency of stock transfers from outside the area are relatively small. Within southwest Washington, there has been some movement of stocks between rivers draining into Grays Harbor and Willapa Bay. Outplants show a similar pattern to hatchery transfers; coho salmon from Puget Sound/Strait of Georgia, Olympic Peninsula, and a limited number from the Columbia River have been outplanted in southwest Washington, but the most frequent and largest outplants have used southwest Washington stocks.

Hatchery production of coho salmon in the Columbia River far exceeds that of any other area with respect to the number of hatcheries and quantities of fish produced. Many Columbia River hatcheries produce several million smolts annually, with the largest hatcheries releasing up to 10 million smolts in a given year. Extensive stock transfers have occurred within the Columbia River, both within and between hatcheries from Washington and Oregon. Prior to about 1960, transfers of coho salmon from the Oregon coast were also common, and there have been a few introductions of Puget Sound stocks. Columbia River outplanting records show a similar pattern of extensive use of Columbia River and Oregon coast coho salmon, and some Puget Sound stocks.

Advancement and compression of run timing are common phenomena in hatchery populations, and these changes can affect future generations of naturally reproducing fish. Fry of early spawning adults generally hatch earlier and grow faster, and can thus displace fry of later-spawning natural fish (Chapman 1962). Conversely, early spawning coho salmon redds are more prone to being destroyed by early fall floods. Consequently, early spawning individuals may be unable to establish permanent, self-sustaining populations, but may nevertheless adversely affect existing natural populations (Solazzi et al. 1990). A recent study found that over a period of 13 years, the range of spawning timing of coho salmon at five Washington hatcheries decreased from 10 weeks to 3 weeks, causing the range of the period of return to the hatcheries to decrease by one-half (Flagg et al. 1995).

Another common hatchery practice with coho salmon is release of excess hatchery production into natural habitat as fry or parr. Outplanting large numbers of large hatchery juveniles into streams already occupied by naturally-produced juveniles may place the resident fish at a competitive disadvantage and may force them into marginal habitats that have low survival potential (Chapman 1962, Solazzi et al. 1990).

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3.5 SALMON AND STEELHEAD CRITICAL HABITAT

NOAA Fisheries is directed by the ESA to designate critical habitat at the time of listing. Critical habitat is defined to include all geographical areas necessary to the survival and recovery of the species. The destruction or adverse modification of critical habitat is prohibited by rule.

NOAA Fisheries designated critical habitat for all three of the listed anadromous fish species in the Lewis River Project area on February 16, 2000 (65 FR 7764). While the critical habitat has been withdrawn and vacated (*see* discussion below), the original designations provide information on habitat NOAA Fisheries determined was occupied by or essential to the listed anadromous fish species. In particular, with respect to Lower Columbia River Chinook salmon, Lower Columbia River steelhead, and Columbia River chum, the Lewis River was designated as critical habitat with Merwin Dam representing the upstream extent of critical habitat.

The National Association of Homebuilders brought suit against NOAA, seeking to vacate the critical habitat designations for salmon and steelhead ESUs in the Pacific Northwest. NOAA eventually entered into a consent order and agreed to withdraw and reconsider the critical habitat designations for 19 salmon and steelhead populations. *National Association of Homebuilders v. Evans*, Consent Decree, Case No. 1:00-CV-02799 (DDC, filed Mar. 25, 2002). This Biological Evaluation does not include a critical habitat analysis, because critical habitat designations for all relevant anadromous fish species (including Lower Columbia River Chinook salmon, Lower Columbia River steelhead, and Columbia River chum) have been vacated by court order. The latest proposed rule for critical habitat issued by NOAA Fisheries on November 30, 2004 does not designate habitat upstream of Merwin dam. However, even in the absence of critical habitat listing for these species, the proposed action is not likely to destroy, adversely affect, or adversely modify habitat critical of any listed, proposed, or candidate species in the North Fork Lewis River project area. These findings are made based in part on the existence of an ongoing, conservation measures currently implemented under NOAA Fisheries and USFWS' 2002 Lewis River biological opinion that will ensure interim conservation requirements for aquatic species until a new biological opinion is issued.

The draft Salmon Recovery Plan (NPPC 2004) addressed fish habitat in the Lewis River including limiting factors and threats related to the recovery of the listed salmon and steelhead. These limiting factors include:

- 1) Habitat connectivity – blockages to stream habitats due to structures;
- 2) Habitat diversity – lack of stable instream woody debris and altered habitat unit composition;
- 3) Channel stability – bed and bank erosion and mass wasting;
- 4) Riparian function – reduced bank/soil stability and reduced wood recruitment;
- 5) Water quality – altered stream temperature regime and excessive turbidity
- 6) Substrate and sediment – excessive fine sediment;

- 7) Forest practices – timber harvests, riparian harvests, and forest roads; and,
- 8) Hydropower operations – passage obstructions.

These elements certainly would be the most influential impacts to critical habitat and would affect the foraging, migration, spawning, incubation and rearing habitat for the listed species. These elements were contemplated in the settlement discussions and were addressed through: passage measures and culvert repair/replacement; habitat funds to protect and restore riverine and riparian habitat; land and timber management practices to reduce erosion, forest road inputs, and fine sediment; and changes in hydro operations to protect fish habitat in the project area of influence. For these reasons, we expect that the proposed action will benefit those components of the habitat that are considered important for the listed salmon species.

4.0 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 impact of State or private actions which are contemporaneous with the consultation in process 50 CFR § 402.02(d). PacifiCorp and Cowlitz PUD have previously consulted on ongoing operations of the Lewis River Hydroelectric Projects. See FERC RIMS DOC No. 2293041 “Endangered Species Act – Section 7 Consultation Biological Opinion for the Interim Operation of the Lewis River Hydroelectric Projects, June 27, 2002.” The baseline provides a reference for NOAA Fisheries to evaluate the species’ current status in relationship to the proposed action. The Licensees believe the Lewis River Hydroelectric facilities are currently in place and are part of the existing baseline. Additionally, the Lewis River Hydroelectric Projects have blocked passage for anadromous species and therefore these species are extirpated in this part of their range.

4.1 HABITAT FACTORS AFFECTING LISTED SPECIES WITHIN THE ACTION AREA (ENVIRONMENTAL BASELINE)

The Lewis River is a natural-cultural ecosystem that has undergone considerable change since the arrival of Euro-Americans. The three Project dams (Merwin, Yale and Swift) and the Lewis River bypass reach located in the North Fork Lewis River between about RM 40.5 and RM 43.5 represent a major modification of the river’s salmonid habitat and the ecological processes that form and maintain salmonid habitat. The Projects are part of the current environmental baseline. The historical and ongoing effects of the Projects include:

- Limited access of anadromous salmonids to the lower 20 miles of the watershed, preventing access to as much as 174 miles of potential historical habitat.

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- Converted 39 miles of mainstem river into reservoirs inundating high quality habitat for salmonids.
- Diverted all river flow (except during spill events) from a 3-mile-long reach of the Lewis River above Yale Lake.
- Reduced or eliminated habitat connectivity for resident and adfluvial fish, such as bull trout.
- Altered temperature and flow regimes in the mainstem Lewis River below Merwin Dam.
- Limited the downstream transport of habitat building materials.
- Caused the loss of marine derived nutrients (from salmon carcasses) above Merwin Dam for over 70 years.
- Shifted the natural salmonid production system to a heavy reliance on artificial propagation (with the exception of fall Chinook).
- Extirpated salmon and steelhead species in the basin upstream of Merwin Dam.

It is important to keep in mind that other land uses, such as residential, commercial, and industrial development; agriculture; and natural resource extraction industries, such as gravel mining and timber harvest, have also had significant historical effects on the Lewis River basin and continue to impact the environment today. These land uses have:

- Drastically reduced floodplain and off-channel habitat connectivity in the Lower Lewis River, primarily due to extensive diking.
- Degraded riparian habitats throughout the basin, which has likely increased sedimentation and erosion, increased water temperatures, and impacted LWD recruitment potential.
- Increased road density and drainage network patterns, which have likely altered hydrology, increased fine sediment inputs to streams, and blocked fish passage due to impassable culverts.

Habitat-altering actions affect salmon population viability, frequently in a negative manner. However, it is often difficult to quantify the effects of a given habitat action in terms of its impact on fish population abundance. With the current state of the science, usually the best that can be done is to determine the effects an action has on a given habitat component and, since there is a direct relationship between habitat condition and population viability, extrapolate that to the impacts on the species as a whole. Thus by examining the effects a given action has on the habitat portion of a species' biological requirements, NOAA Fisheries has a gauge of how that action will affect the population variables that constitute the rest of a species' biological requirements and, ultimately, how the action will affect the species' current and future health.

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

In the PFC framework, baseline environmental conditions are described as "properly functioning" (PFC), "at risk" (AR), or "not properly functioning" (NPF). The PFC concept includes a recognition that natural patterns of habitat disturbance will continue to occur. For example, floods, landslides, wind damage, and wildfires result in spatial and temporal variability in habitat characteristics, as will anthropogenic perturbations. If a proposed action would be likely to impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat toward PFC, it will usually be found likely to jeopardize the continued existence of the species or adversely modify its critical habitat, or both, depending upon the specific considerations of the analysis. Such considerations may include, for example, the species' status, the condition of the environmental baseline, the particular reasons for listing the species, any new threats that have arisen since listing, and the quality of the available information.

In this section of the BE, we summarize existing environmental conditions and parameters for the action area, and present the status of each indicator as PFC, AR, or NPF (Table 4.1-1). Criteria for PFC, AR and NPF are described in detail in NMFS (1996), but summarized for each indicator following Table 4.1-1 along with a detailed justification for the status of each indicator in the action area. The effects that the proposed action may have on each environmental indicator are analyzed subsequently in Section 5.0. It is important to note that the current status of a particular environmental indicator can be independent of current operations. For example, road density in the Lower Lewis River watershed may rate as "not properly functioning" under existing conditions even though the Project may have no influence on this indicator. In addition, the entire action area is used to make a determination for a particular indicator, even though anadromous salmonids are restricted to habitats below Merwin Dam. It should be noted that the term "upper watershed" refers to the Lewis River watershed upstream of Swift Creek Reservoir. The term "middle watershed" refers to the portion of the Lewis River watershed between Swift Creek Reservoir and Merwin Dam. The term "lower watershed" refers to the Lewis River downstream of Merwin Dam.

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Table 4.1-1. Matrix of indicators and pathways for documenting the environmental baseline on relevant indicators.

Baseline Environmental Conditions			
Pathway			
Indicators	Function	Description	Cause of Degradation from PFC
Water Quality			
Temperature	AR	Temperature conditions meet State standards in project waters, but warm surface waters in Yale tailrace are present during adult upstream migration and in some tributaries. Temperatures in some potential spawning and rearing areas outside the project area also appear to be AR, but these areas are not currently used by anadromous salmonids.	Degraded riparian areas due to timber harvest, agriculture, and development; water diversions; and reservoir stratification have had a minor effect on temperature.
Sediment/Turbidity	NPF	Vast areas of the upper river landscape were devastated by the Mount St. Helens eruption in 1980. Heavy rain and high runoff conditions create high turbidity in the streams and reservoirs from this natural event, but these areas are not currently used by anadromous salmonids.	Mt. St. Helens eruption and continuing erosion in areas degraded by the eruption. Timber harvest and related road construction have also contributed to sediment loading. This is a non-project effect.
Chemical Contamination/Nutrients	AR	No 303(d) listed river or stream reaches are present in the action area. Lack of marine derived nutrients above Merwin dam represents a departure from PFC.	Lack of marine derived nutrients above Merwin dam is due to an anadromous fish range that is limited to below Merwin dam.
Dissolved Oxygen	PFC	Low DO has not been observed in the action area. Reservoir stratification can result in lower DO in the hypolimnion which does not change this indicator from PFC.	The reservoirs were created by the construction of the dams.
Total Dissolved Gas	AR	Some WDOE TDG exceedences have occurred in Project waters. There are three proposed 303(d) listed reaches in the action area.	Operation of Swift No. 1 and Yale increases TDG.
Habitat Access			
Physical Barriers	NPF	Upstream and downstream migration impeded.	Anadromous fish migration blocked by Project dams; impassible project and non-project culverts are present in the watershed
Habitat Elements			
Substrate	AR	High sediment loads exist upstream of Merwin Dam and natural sediment transport has been interrupted Below Merwin, gravel and sediment conditions are near PFC but the reach between Yale Lake and Swift dam can be considered AR.	Substrate transportation from the upper basin is blocked by dams, but gravel supply downstream of Merwin Dam is stable and supports anadromous spawning populations; Project retained heavy sediment loads from Mount St. Helens eruption thus protecting downstream reaches from fine sediment impacts.
Large Woody Debris	NPF	Low levels of LWD.	Downstream LWD transport blocked by Project dams. Timber harvest, agriculture, diking and development have degraded

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Baseline Environmental Conditions			
Pathway Indicators	Function	Description	Cause of Degradation from PFC
			riparian areas, leading to a loss of available wood for natural recruitment as LWD.
Pool Frequency and Quality	NPF	Pool numbers reduced in streams draining Mount St. Helens (Pine Creek, Muddy River) due to sediment input and channel scour, other streams have few pools due to natural high gradient (Rush Creek), but these areas are not currently used by anadromous salmonids.	Pool forming LWD reduced by impacts listed above, and sediment inputs derived from Mount St. Helens eruption, roads, and land uses such as timber harvest.
Off-Channel Habitat	NPF	Poor connectivity to off-channel habitat in lower river.	Diking and development have reduced the floodplain area (non-project effect).
Channel Conditions and Dynamics			
Width/Depth Ratio	AR	Many broad shallow stream reaches, primarily in streams draining Mount St. Helens.	Channel form altered by sediment input due to Mount St. Helens eruption; lower watershed habitat has been impacted by dikes; reduced LWD that is habitat forming; reservoirs inundated riverine habitat; reduced peak flows from the projects likely limit some channel forming processes.
Streambank Condition	NPF	Streambanks do not support natural floodplain function in the lower river and are actively eroding in upstream areas.	Mt. St. Helens eruption; diking; and timber harvest have all impacted hill slope and stream bank erosion; reservoirs have altered the riverbank.
Floodplain Connectivity	NPF	The Lower Lewis River is disconnected from its historic floodplain.	Dikes prevent connection to lower river floodplain (non-project effects).
Flow/Hydrology			
Change in Peak/Base Flow	NPF	Peak flows are lower and base flows are higher than unregulated river flows.	Lower Lewis River hydrology affected by seasonal reservoir drafting and refilling, and flood control operation.
Change in River Stage (Ramping)	AR	Flow fluctuations likely occur more frequently compared to unregulated flows.	Changes in river stage result from Project operations.
Watershed Conditions			
Road Density and Location	NPF	High road densities exist in the Lewis River basin, and many roads exist in valley bottoms.	Large network of logging roads in upper basin. Road network in lower basin associated with urban, agricultural, and industrial development. This is a non-project effect.
Disturbance History	NPF	Disturbance is frequent.	Intensive industrial logging, fires, and Mount St. Helens eruption (non-project effect).
Riparian Reserves	NPF	>40 percent late-successional forests in the upper watershed (USFS 1995), very little in the lower watershed.	Forests impacted by timber harvest and urbanization (non-project effect).

Source: NMF3 1996

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4.2 WATER QUALITY

4.2.1 Water Temperature

NMFS (1996) defines PFC as water temperatures 10 to 13.9°C and NPF is defined as greater than 15.6°C for spawning and greater than 17.8°C for rearing. Project affected 7-day mean maximum water temperatures range from 13.3 to 17.5°C in August. Median temperatures during the primary spawning periods consistently fall below NMFS' 13.9°C PFC criteria.

Water temperature in the lower portion of the Lewis River bypass reach has been recorded as occasionally exceeding the WDOE water temperature standards (18°C) (PacifiCorp and Cowlitz PUD 2004: WAQ 1). In accordance with WDOE's 7-day mean maximum water temperature standard, there are no water temperature violations in the Lewis River project area. Water temperature in the lower portion of Speelyai Creek is up to 5°C cooler than that observed upstream of the PacifiCorp diversion (PacifiCorp and Cowlitz PUD 2004: WAQ 1). Water temperature in the Merwin tailrace is consistently higher than that observed at the upstream end of Swift Reservoir on an instantaneous basis. The largest differences in daily mean temperature occurs in September through December, when the Merwin tailrace temperatures are generally between 4 and 10°C warmer than the inflow to Swift Reservoir (PacifiCorp and Cowlitz PUD 2004: WAQ 1). However, with retention times in each reservoir exceeding several months, it is inappropriate to make direct instantaneous temperature comparisons. Changes in generation at the Yale powerhouse cause fluctuations in water temperature in the upper portion of Lake Merwin; surface water temperature can fluctuate as much as 10°C in a 24-hour period (PacifiCorp and Cowlitz PUD 2002, WAQ 1; PacifiCorp and Cowlitz PUD 2003). However, the fluctuations are minimal to the extent that the 7-day average maximum temperature does not exceed WDOE standards.

USFS water quality monitoring data (USFS 1997, USFS 1998, USFS 1999, USFS 2000, USFS 2001 and USFS 2002) show that non-project related water temperatures in the upper mainstem Lewis River (upstream of the Lewis River projects), Quartz Creek, Clearwater Creek, Muddy River, Clear Creek, Siouxon Creek, Canyon Creek, and East Fork Lewis River regularly exceed 16°C. Water temperatures above 20°C have been recorded in the Muddy River, Clear Creek, Clearwater Creek, East Fork Lewis River, and Siouxon Creek.

4.2.1.1 Conclusion

All project affected river and stream reaches meet the WDOE 7-day mean maximum water temperature criteria; however, portions of the Lewis River bypass reach and some rearing and migration areas outside the project area, but included in the action area, occasionally exceed NMFS's 17.8°C rearing criteria. This indicator should be considered AR for the basin as a whole and may rate as NPF in discrete areas.

4.2.2 Sediment/Turbidity

NMFS (1996) defines PFC as containing less than 12 percent fines in gravel, and NPF is defined as having greater than 17 percent surface fines.

Historically, input of sediment to the Lewis River upstream of Swift Dam included periodic large inputs from lahars and ash fall associated with volcanic activity at Mount St. Helens, Mt. Hood, and the Indian Heaven volcanic field. This sediment would have been transported through the watershed into the lower Lewis River and Columbia River. Current sediment inputs to streams in the watershed are due to natural processes and land management practices that have increased the erosion potential of managed areas, and to the construction of dams or barriers that block downstream transport of sediment. This blockage may have provided a benefit to spawning gravels downstream of Merwin.

The eruption of Mount St. Helens provided a recent and overwhelming source of sediment to several streams in the upper watershed, instantaneously contributing large amounts of sediment and fine ash via mudflows, and providing a source of easily erodible ash to streams in portions of the upper watershed. Mudflows during the initial eruptions swept nearly 18 million cubic yards of water, wood, and debris down these streams and into Swift Creek Reservoir (Tilling et al. 1990). The Muddy River, Pine and Swift creeks still carry large volumes of sediment into the reservoir; over 15 million tons of sediment were transported from 1982 through 1990 (Dinehart 1997). Thick deposits of tephra covered the upper portions of Smith Creek and Clearwater Creek, reducing infiltration rates and increasing erosion following the 1980 eruption (Dinehart 1997).

Several large fires burned in the East Fork Lewis River watershed in the past century (Wade 2000). The Yacolt Fire of 1902 covered 238,900 acres and was a particularly hot burn, leaving little live vegetation. Portions of the area were re-burned in subsequent fires in 1927, 1929, and the 1950s. These fires likely increased fine sediment inputs for several years until vegetation was re-established. Associated timber salvage operations also likely greatly increased sediment inputs as wood was pulled from riparian areas and stream channels. Road building, timber harvest, farming/grazing, or urbanization has taken place in nearly all portions of the Lewis River watershed. These activities have the potential to increase the fine sediment supply to streams through associated mass wasting, surface erosion, or bank erosion.

4.2.2.1 Conclusion

Due to high levels of fine sediment, the majority of which is likely derived from the Mount St. Helens eruption, logging, and road building, this indicator rates as NPF.

4.2.3 Chemical Contamination/Nutrients

NMFS (1996) defines PFC as low characterized by levels of contamination with no 303(d) designated reaches, and NPF is defined as high levels of chemical contamination and nutrients and more than one 303(d) listed reach.

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The WDOE has not listed any 303(d) reaches for contamination in the North Fork Lewis River basin or the mainstem Lewis River downstream to the confluence with the Columbia River (WDOE 1998). The lack of anadromous fish access to habitats above the dams has eliminated the input of marine derived nutrients (PacifiCorp and Cowlitz PUD 2004: AQU 18 – Appendix G). In this case, instead of a problem with nutrient enrichment, the lack of nutrients likely represents a departure from properly functioning conditions. It is likely that, annually, several hundred tons of marine derived nutrients, in the form of salmon and steelhead carcasses, entered the upper Lewis River basin prior to the completion of Merwin dam (PacifiCorp and Cowlitz PUD 2004: AQU 18 – Appendix G).

4.2.3.1 Conclusion

Although there are no listed 303(d) reaches in the action area, this indicator rates as AR due to the lack of marine derived nutrients in the upper basin.

4.2.4 Dissolved Oxygen

NOAA Fisheries defines PFC as dissolved oxygen (DO) concentrations that meet the WDOE standards for fish bearing streams (DO levels exceeding 8.0 mg/l) (Washington Administrative Code 173-201A).

The Lewis River and Project area tributaries generally meet or exceed the WDOE minimum DO standard of 8.0 mg/l (PacifiCorp and Cowlitz PUD 2004: WAQ 1). In 1999, sites designated Class AA (Pine Creek, Drift Creek, Swift Creek, Canyon Creek, and upper Speelyai Creek) met the DO standard of 9.5 mg/l, with few exceptions. Dissolved Oxygen at Canyon Creek was 9.3 mg/l in September 1999. Drift Creek also had a DO concentration of 9.3 mg/l in August 1999. Speelyai Creek upstream of the diversion had DO concentrations ranging from 8.4 to 9.0 mg/l in August and September 1999.

Three values (of 183 DO observations) were recorded under the Class A standard of 8 mg/l. Two of these were at Ole Creek during very low flow conditions in August and September 1999 (7.3 and 4.4 mg/l, respectively), and the other at the inflow to Lake Merwin in August 1999 (7.4 mg/l). The latter is not a chronic condition, however, and does not exceed 7-day average maximum criteria. Dissolved oxygen concentrations at the Merwin, Yale and Swift No.2 tailrace sites averaged between 10.9 and 11.7 mg/l. DO concentrations in the Swift No. 2 tailrace closely mirror those in the Swift No. 1 tailrace with an average concentration of 11.8 mg/l.

Measurements of DO in Lake Merwin and Swift Creek Reservoir were more variable than in streams in the Project area. Dissolved oxygen at Swift Creek Reservoir remained above 9 mg/l during late summer, while DO near the bottom of Lake Merwin decreased from approximately 11 mg/l in May to 4 mg/l in August and to 3 mg/l in September. However, DO in the majority of the Lake Merwin water column (above 40-45 meters in August and September) remained at or near 8 mg/l.

4.2.4.1 Conclusion

No low DO events have been documented for the Lewis River basin (with the exception of deep reservoir waters which are not generally considered as salmonid habitat) so this indicator is rated as PFC.

4.2.5 Total Dissolved Gas

NOAA Fisheries defines PFC as total dissolved gas (TDG) concentrations that meet WDOE standards for fish bearing waters with TDG concentrations of less than 110 percent (Washington Administrative Code 173-201A).

Water quality studies conducted by the Licensees have documented total dissolved gas (TDG) in excess of state standards at the Swift No. 1, Swift No. 2, and Yale powerhouse tailraces.

Sampling at sites in the upper end of Lake Merwin (Yale tailrace) resulted in 10 values greater than 110 percent in over 5,000 observations. No exceedences were observed at the Merwin tailrace. Out of 1,261 measurements in the Swift No. 1 tailrace, TDG saturations exceeded the WDOE standard of 110 percent saturation 766 times, or 61 percent. Of those, 72 were characterized by values greater than 120 percent saturation. Over 58 percent of the exceedences in the Swift No. 1 tailrace and Swift No. 2 canal occurred during periods when neither Swift No. 1 nor Swift No. 2 were generating. This was most likely due to the relatively small volume of water within the canal and the cessation of flow during non-operation periods.

[REDACTED]

Of 1,262 measurements in the Swift canal, TDG saturation exceeded the WDOE standard 455 times, or 36 percent. Yale tailrace saturations exceeded State water quality standards for 348 of 2,823 observations, or 12 percent of the observations.

To address TDG at the Swift and Yale projects, PacifiCorp avoids operating in the inefficient range (between 20 and 50 MW) at these projects, and has installed an automatic air valve at Yale to reduce air entrainment. In addition, at Swift No. 1, a similar air-valve will be installed. Also a permanent monitoring equipment to test water temperature and TDG will be installed at each of these projects.

4.2.5.1 Conclusion

Occasional observations of TDG exceedences lead us to rate this factor as AR.

4.3 HABITAT ACCESS

4.3.1 Physical Barriers

NMFS (1996) defines PFC as man-made barriers that allow upstream and downstream passage at all flows without significant levels of mortality or delay, and NPF as man-

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made barriers that do not allow upstream and downstream fish passage at a range of flows.

When Merwin was constructed in 1932 it blocked 174 miles of potentially accessible anadromous fish habitat in the upper Lewis River basin. Therefore, since that time, anadromous fish have existed only in the lower Lewis River. A non-project small dam in Colvin Creek originally built for the Lewis River Hatchery blocks fish migration and created an impoundment that is now full of sediment. Two project-related diversion dams are currently located on Speelyai Creek. Both the upper and lower diversions are total barriers to fish migration; however, fish do have access to upper Speelyai Creek via the canal from Yale Lake. It should be noted that prior to the completion of Merwin Dam, a natural anadromous fish migration barrier existed at the mouth of Speelyai Creek (Hamilton, et al. 1970). That barrier is now inundated allowing access to part of lower Speelyai Creek.

Under existing conditions, the only fish passage facility in the Lewis River basin is the upstream fish collection facility at the base of Merwin dam. This trap and transport system is operated year-round and is currently used to support the hatchery broodstock program. Collected fish are loaded into tanker trucks and transported to hatchery facilities, or released in the lower Lewis River to support harvest by anglers. This facility has not been used to transport anadromous fish upstream of Merwin Dam since 1957, because lack of downstream fish passage facilities at Yale and Merwin dams made this measure impractical (Chambers 1957).

None of the Lewis River Project structures are equipped with downstream fish passage facilities. Juvenile and adult migrants can, however, pass downstream of each facility through the project turbines and spillways. Both turbine and spillway entrainment have the potential to injure or kill downstream migrating fish, although survival rates at the Lewis River projects are currently unknown. Fisheries literature indicates that juvenile survival through Francis turbines ranges from 65 to 97 percent (Eicher and Associates 1987). Forty-eight hour survival rates for hatchery coho and steelhead smolts passing through two Francis turbines at Mayfield Dam on the Cowlitz River ranged from 83 to 97 percent (Normandeau Associates, Inc. and Skalski 2003).

4.3.1.1 Conclusion

Because the range of anadromous fish is limited to below Merwin Dam, this indicator rates as NPF.

4.4 HABITAT ELEMENTS

4.4.1 Substrate

NMFS (1996) defines PFC as reach embeddedness of less than 20 percent and NPF as embeddedness greater than 30 percent.

Sediment from reaches upstream of project dams is blocked from being transported to downstream reaches. As a result, the Lewis River bypass reach, lower Speelyai Creek,

the Lewis River downstream from Merwin Dam, and the Columbia River and estuary have a much lower rate of sediment movement than would have occurred if the dams were not in place. However, gravel in the reaches downstream of Merwin dam have been retained and continue to provide quality spawning habitat. The high peak flows in the Lewis River bypass reach result in a cobble-boulder bed, with little gravel except downstream from Rain and Ole creeks. Lower Speelyai Creek has a stable channel with a variety of grain sizes; if the upper Speelyai diversion were not in place, the channel would be very wide and active, with a cobble bed similar to the creek upstream of the diversion structure. The Lewis River downstream from Merwin Dam and upstream of Cedar Creek has a mix of substrate sizes, and has retained spawning-sized gravel, likely as a result of the very low gradient. The current annual hydrograph is similar to pre-project conditions although peak winter and spring flows are somewhat less and summer flows are slightly higher. If the project facilities were not in place and the lower river undiked, the reach would be much different in the area downstream of Cedar Creek, with a very active channel and abundant sediment and large woody debris as a result of the huge influx of such material following the Mount St. Helens eruptions. Given the magnitude of winter flows, it is likely, though, that large woody debris would be high in the dry channel thus not providing much long-term benefit. Large woody debris piles that were deposited on high ground around Eagle Island during the flood of 1996 can still be seen today.

Quantitative estimates of the amount of sediment input to streams from management-related sources have been made for a few portions of the watershed. In these sub-basins, sediment input ranged from very little in Lower Speelyai, Cedar Creek, and the Lewis River bypass reach, to several hundred tons per square mile per year in Upper Speelyai, Ole Creek, and the Lewis River downstream of Merwin dam (PacifiCorp and Cowlitz PUD 2004: WTS 3).

Other disturbances in the watershed that affect the movement of sediment through the river system included gravel mining, forest practices, and road construction. In the past, gravel mining activities have occurred in the Lewis River downstream of Merwin Dam and in the East Fork Lewis River. Gravel was also mined in the Lewis River bypass reach to provide materials for dam construction. Gravel mining operations reduce the in-channel amount of gravel, and often results in reduced spawning habitat availability.

4.4.1.1 Conclusion

Due to high levels of fine sediment upstream of Swift Creek Reservoir, the majority of which is likely derived from the Mount St. Helens eruption, logging, and road building, and the blockage of sediment transport downstream by the dams, this indicator rates as NPF.

4.4.2 Large Woody Debris

NMFS (1996) defines PFC as greater than 80 pieces of wood per mile, which are greater than 24 inches in diameter and greater than 50 feet long. NPF is defined as "wood does not meet the criteria of PFC and sources of LWD recruitment are lacking." While this PFC criterion applies to all stream and river channels in the action area, it has been

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shown that the frequency of pieces of LWD in old growth watersheds in southwestern Washington decreases dramatically as channel width increases (Bilby and Ward 1991, Peterson et al. 1992). These changes are related to the increased capacity of larger streams to move material downstream. Because of this, the 80 pieces of wood per mile criteria may not be directly applicable to rivers the size of the mainstem Lewis and Columbia.

Current levels of large woody debris were measured during field surveys of the Lewis River in the Lewis River bypass reach, downstream of Merwin Dam, and Speelyai Creek. Lower Speelyai Creek had the highest density of large wood, with 108 pieces/mile; upper Speelyai had 77 pieces/mile. The Lewis River bypass reach had an average of 21 pieces/mile, with most of the wood in the lower end of the reach downstream from Ole Creek. The Lewis River downstream of Merwin Dam had 15 pieces/mile. Rating of large woody debris in the rest of the watershed was considered "poor" in the WRIA 27 limiting factors report (Wade 2000). The USFS rated 26 streams upstream of Swift Dam as "not properly functioning". The lack of wood downstream of Merwin Dam is the result of cumulative effects of project and non-project actions: removal of wood from the channel long before the projects were constructed, the lack of input from upstream sources (project effect), and low recruitment of large wood from within the reach due to previous harvest of the riparian areas before, during and after construction, and the more stable channel and peak flow regime (project effect).

It should be noted that large woody debris and logjams were removed from most large western Washington rivers in the late 1800s and early 1900s to decrease flooding and improve navigation. The combination of instream wood removal and harvesting of lowland riparian forests resulted in very little large woody debris in or being recruited to most large western Washington streams by the early to mid 1900s (Collins et al. 2002). It is very likely that there were historic accumulations of large woody debris in log jams in the lower Lewis River that were removed in the late 1800s since there was very little wood in the river in the earliest (1938) aerial photographs, even as far downstream as the confluence with the Columbia River (PacifiCorp and Cowlitz PUD 2004: WTS 3).

4.4.2.1 Conclusion

Because recruitment of LWD is limited, this indicator rates as NPF.

4.4.3 Pool Frequency/Quality

NMFS (1996) defines PFC for pool frequency based on channel width; the standard for the lower portion of the action area is 4 to 9 pools/mile, and upper reach is approximately 39 to 60 per mile. Pool quality for PFC is defined as pools with good cover with only minor reduction of pool volume caused by fine sediments and many pools greater than 1 meter in deep. NPF is defined as pool frequency that is considerably less than under PFC, cover and temperature is inadequate, with high fine sediment loads, and no pool greater than 1 meter deep.

The USFS rated 26 streams upstream of Swift Dam for pool frequency. In order to be rated as PFC there would have to be approximately 39 pools per mile. According to

USFS (2002a), the average pool frequency for these streams was 17.5 pools per mile, which the USFS rated as NPF. In addition, lack of habitat forming LWD in the basin, diking in the lower river, and high sediment loads in the upper basin due primarily to the Mount St. Helens eruption, have likely impacted pool frequency and quality.

No specific data were reviewed for this indicator that quantifies the exact number of large pools in the action area; however, many pools are known to be present that are greater than 1 meter deep throughout the Lewis River basin, but the frequency of these pools is likely impaired by the same processes as listed for the "pool frequency/quantity" indicator.

4.4.3.1 Conclusion

Based on the observed low occurrence of pools relative to PFC, impairment of pool-forming processes, and high sediment loads this indicator rates as NPF.

4.4.4 Off-channel Habitat

USFWS defines PFC for off-channel habitat as many backwaters with cover and low energy, off-channel areas, including ponds and oxbows. NPF is defined as the watershed with few or none of these habitat types.

The lower Lewis River is characterized as a simple channel that has been subject to dredging; and diking. Connectivity to off-channel habitat is generally absent or extremely limited. Eagle Island and some areas near the golf course and Echo Park are the only areas in the lower river that provide off-channel habitat.

4.4.4.1 Conclusion

Because of reduced connection of off-channel habitat areas to the Lewis River downstream from Merwin Dam, this indicator rates as NPF.

4.5 CHANNEL CONDITION AND DYNAMICS

4.5.1 Width/Depth Ratio

NMFS (1996) defines PFC for the average width/depth ratio as less than or equal to 10 and for NPF as greater than 20.

No specific data were reviewed for this indicator that quantifies the average width/depth ratio for pools in the action area; however, the average width/depth ration for pools is likely impaired by the same processes as listed for the "pool frequency/quantity" indicator.

4.5.1.1 Conclusion

Based on the observed lack of pools, impairment of pool-forming process, and high sediment loads this indicator is AR.

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4.5.2 Streambank Condition

NMFS (1996) defines PFC as greater than 90 percent of any stream reach of which 90 percent or more is stable NPF is defined as less than 80 percent stability.

Residential and agricultural land uses have eliminated most of the riparian vegetation in the lower reaches, and the lower 7 miles of the Lewis River floodplain is almost entirely disconnected from the river due to extensive diking (Wade 2000). In the East Fork Lewis River, over 50 percent of the off-channel habitat and associated wetlands within the floodplains have been disconnected from the river. Many slopes in the upper basin are actively eroding, primarily due to impacts from the Mount St. Helens eruption.

4.5.2.1 Conclusion

This indicator rates as NPF due to ongoing impacts from diking and the Mount St. Helens eruption.

4.5.3 Floodplain Connectivity

NMFS (1996) defines PFC as well-connected, off-channel areas with overbank flows of sufficient frequency to maintain function. NPF is defined as a severe reduction in hydrologic connection with off-channel habitats.

4.5.3.1 Conclusion

Flood control operations have reduced peak flows but non-project diking in the lower basin has disconnected the majority of the historical Lewis River floodplain from the main channel. Therefore, this indicator rates as NPF.

4.6 FLOW/HYDROLOGY

4.6.1 Change in Peak/Base Flows

NMFS (1996) defines PFC for the watershed hydrograph as being similar in terms of peak flow, base flow, and timing characteristics to an undisturbed watershed with similar geology and geography. NPF is defined as pronounced changes in various hydrologic parameters.

Streamflow patterns of upper basin reaches show a marked spring runoff peak, very low flows in summer and early fall, and a secondary peak resulting from fall and early winter rainstorms. Streams in the lower elevations of the watershed, where a snow pack does not develop, have a fall/winter rainfall peak and low summer flows. Smaller tributaries in the watershed often show a "flashier" runoff pattern than larger streams. They are more responsive to changes in precipitation, with relatively higher peak to mean flow ratios and lower baseflow to mean flow ratios. Baseflows for most streams in the watershed occur during August, September, and October when little rain falls in the area. Baseflows vary with stream size, but are generally 1/3 to 1/4 of the average annual flow. The exception to this is Speelyai Creek, a small tributary to the Lewis River that has very

low base flows (about 14 times lower than average annual flow). This may be an affect of timber harvest practices in the upper watershed and its relatively small watershed.

Currently, the 3.3-mile-long Lewis River bypass reach (North Fork Lewis River) has no *minimum flow requirement*. During summer low flows, surface flow at the downstream end of the bypass reach is estimated to be about 21 cfs. Flows in the Lewis River bypass reach are normally limited to inflow from groundwater/seepage and tributaries except during spill events when large quantities of water are released into the reach. Normal daily flows between Swift Dam and Ole Creek average 5-10 cfs (PacifiCorp and Cowlitz PUD 2004: WTS 2) and more recently August flows were measured at 21 cfs. The low daily flows limit the area of available aquatic habitat in this 3.3-mile long reach.

Flows downstream of the upper diversion on Speelyai Creek are currently limited to groundwater and tributary inflow. The water right for the upper Speelyai diversion includes the provision for 15 cfs (or inflow if less than 15 cfs) to be diverted into lower Speelyai Creek. As a result of concerns for fish health at the hatchery, the upper diversion has only been opened 3 times since 1979 to allow water to flow into lower Speelyai Creek (during extremely dry years). Even during those times when extra water is needed, a base flow of only about 1 to 3 cfs is available (PacifiCorp and Cowlitz PUD 2004: AQU 9). Due to a shift in the upper Speelyai channel away from the diversion structure, water is not currently able to flow from upper to lower Speelyai Creek. Instead, this flow enters Yale Lake. Normal daily flows downstream of the upper diversion increase downstream to an average of 15-20 cfs at the hatchery intake and are fairly constant throughout the year as a result of constant groundwater input (see PacifiCorp and Cowlitz PUD 2004: AQU 9).

Flows in the Lewis River downstream from Merwin Dam are altered as a result of project operations to manage floods, produce power, and augment late summer flows (Figure 4.6-1). Normal daily flows downstream from Merwin Dam are higher during the late summer, fall, and winter due to flow augmentation (for fish) and reservoir level reductions for peak flow storage. Normal daily flows are lower during the spring as reservoirs are re-filled for the summer recreation season (see PacifiCorp and Cowlitz PUD 2004: WTS 2). Operation of the projects reduces the frequency of flows in the 10,000-20,000 cfs range and results in a "stepped" pattern of flows (PacifiCorp and Cowlitz PUD 2004: WTS 2). The more stable flow regime provides additional area of aquatic habitat in the summer months and reduces the frequency of scouring flows during the winter months.

An analysis of changes in flow patterns downstream from Merwin Dam using the Indicators of Hydrologic Alteration (IHA) method (Richter et al. 1996) was completed to compare pre-project and with-project conditions (Kaje 2002). The results were similar to those reported in the Streamflow Study (PacifiCorp and Cowlitz PUD 2004: WTS 2). The project storage and flood control operations result in higher median flows during fall and winter months (September- March) as the reservoirs are drawn down to regulate winter peak flow events. Median flows are lower between April and July as the reservoirs are refilled for the summer recreation season. Project operations have slightly lower minimum flows (2 to 9 percent lower) and daily maximum flows (13 to 14 percent lower) and shifted the timing of low flows from September to August. The

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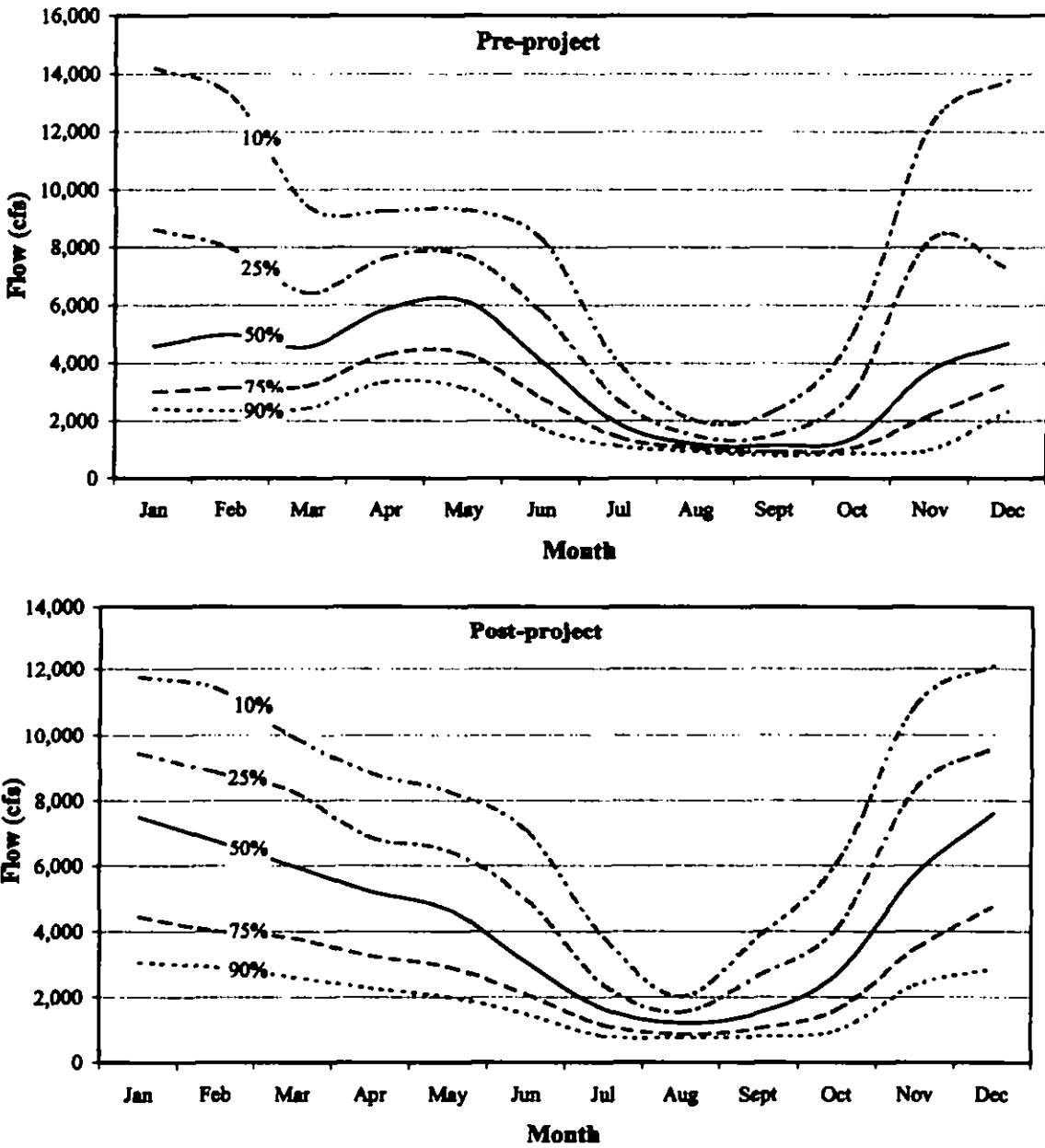


Figure 4.6-1. Daily flow exceedence curve for Lewis River at Ariel (below Merwin Dam).

USGS Gage 14220500: pre-project data are from 1909 through 1930 and post-project data are from 1932 through 1998. Daily flow from 1910 through 1923 was estimated based on Lewis River flow at USGS Gage 14219500 near Amboy.

timing of the one-day maximum daily flow has shifted from December to January. Flows rise and fall more frequently under regulated conditions, with more gradual flow increases and more rapid flow decreases.

These flow changes have resulted in more wetted area in the Lewis River downstream from Merwin Dam during the summer and early fall months than prior to construction of the projects, inundating more potential aquatic habitat and likely more side channel habitat. The reduction in peak flows has resulted in a more stable channel with less scour of redds and less sediment transport than prior to project operation. These conditions are different than a "natural" system that is often quite dynamic.

Existing minimum instream flows below Merwin Dam were developed in the early 1980s and adopted by FERC in September 1995. They were purposefully developed by WDFW and PacifiCorp to maintain and enhance native fall Chinook salmon spawning and rearing in the mainstem Lewis River (WDF 1991). Fall Chinook rearing habitat studies and population estimates conducted between 1977 and 1990 (McIsaac 1980, NESC 1984; Norman et al. 1987; and WDF 1991) found that higher flows in the spring and early summer produce more wild fall Chinook smolts, and that flows in the 3,000 to 5,000 cfs range represent optimum rearing conditions for pre-smolt wild fall Chinook. The basis for the flow regime was to protect wild fall Chinook and was arranged in periods to reflect the most critical life stages. Under existing conditions, minimum flows in the fall are 1,200 cfs; late fall minimum flows range from 2,700 to 5,400 cfs; the winter minimum flow is 1,500 cfs; minimum flows in the spring range from 1,000 to 2,700 cfs; Summer minimum flows range from 1,200 to 2,700 cfs (Table 4.6-1). In addition to these minimum flows, WDFW requests weekly flows reductions to 1,200 cfs from mid-October through December to facilitate annual fall Chinook spawning surveys. Compliance with these minimum flows is evaluated from gage readings at the Ariel gaging station located approximately ¼ mile downstream of Merwin Dam.

Table 4.6-1. Minimum flow provisions downstream of Merwin, as stipulated in Article 49 of the existing Merwin Project license.

Time Period	Existing Article 49 Minimum Flow Requirement
November 1 to November 15	Lesser of 4,200 cfs or natural flow at Merwin plus 2,000 cfs.
November 16 to December 7	Lesser of 5,400 cfs or natural flow at Merwin plus 2,000 cfs.
December 8 to February 28	1,500 cfs
March 1 to March 31	Between 1,000 and 2,000 cfs, depending on runoff volume forecast on March 1.
April 1 to April 30	Between 1,300 and 2,700 cfs, depending on runoff volume forecast on April 1.
May 1 to May 31	Between 1,650 and 2,700 cfs, depending on runoff volume forecast on May 1.
June 1 to June 30	2,700 cfs, as long as natural flow at Merwin is equal to or greater than 2,000 cfs.
July 1 to July 15	2,000 cfs, as long as natural flow at Merwin is equal to or greater than 1,600 cfs.
July 16 to July 31	1,500 cfs, as long as natural flow at Merwin is greater to or equal to 1,200 cfs.
August 1 to October 15	1,200 cfs
October 16 to October 31	2,700 cfs

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Although these minimum flows have been established to maintain and enhance native fall Chinook and protect other aquatic resource in the lower Lewis River, actual flows releases from Merwin Dam exceed these minimum flow requirements during much of the year (Figure 4.6-2).

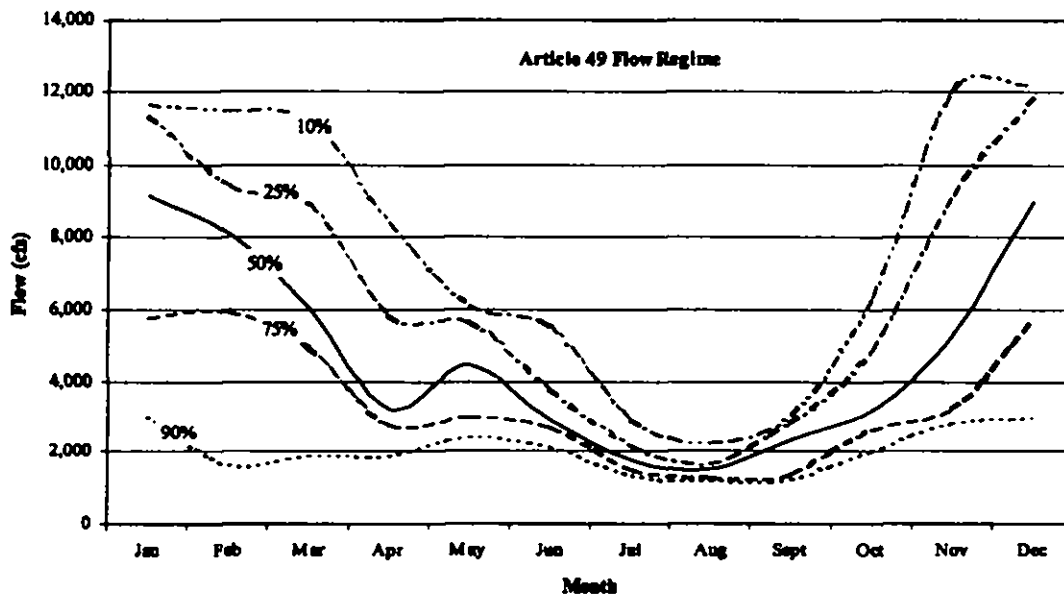


Figure 4.6-2. Daily flow exceedence curve for Lewis River at Ariel (Post Article 49 flow regime).

4.6.1.1 Conclusion

Flood management operations have reduced the magnitude of peak flows and habitat protection measures have increased base flows downstream of Merwin Dam. Although the watershed hydrograph in the mainstem Lewis River below Merwin Dam is similar in terms of peak flow, base flow, and timing characteristics to pre-project conditions, flows in the Lewis River bypass reach and lower Speelyai Creek are substantially different than what would be expected in an undisturbed watershed. Because of this, this habitat element is rated NPF.

4.6.2 Change in River Stage (Ramping)

In 1993, PacifiCorp implemented a voluntary 2-inch per hour down-ramping rate below Merwin Dam to protect aquatic resources. In the past, multiple fish losses have occurred in the Lewis River as a result of project-induced change in river stage. PacifiCorp and Cowlitz PUD (2004: AQU 3) documents 5 separate incidents of rapid flow reductions in a 2-year period. Down-ramping rates of unregulated rivers are thought to rarely exceed 1 or 2-inches per hour (Hunter 1992).

In addition to the above measures, PacifiCorp has finished mechanical upgrades to provide back-up power and additional alarms to prevent future losses of anadromous salmonid from mechanical failures. Past emergency shutdowns have de-watered the adult fish trap and downstream channels. It was estimated that the June 1999 shutdowns killed 101 adult salmonids in the trap and that the loss of juveniles was equivalent to 1,500 adult fall Chinook. A series of alarms and a video system to observe the tailrace area have been installed to aid the operator manage shutdowns. In addition, secondary and tertiary power back-up systems have been installed to allow automatic gate openings to maintain river flows.

4.6.2.1 Conclusion

Due to changes in flow fluctuations downstream from Merwin Dam, this habitat element is AR under the Interim Biological Opinion ramping criteria, which is currently used.

4.6.3 Road Density and Location

NMFS (1996) defines PFC as less than 1 mile of road per square mile with no valley bottom roads and NPF as greater than 2.4 miles of road per square mile with many valley bottom roads.

Extensive networks of non-project logging roads are present in the upper basin, many of which are subject to erosion or failure. The lower basin has large networks of roads associated with non-project activities such as agricultural, urban, and industrial development.

As mentioned previously, much of the Lewis River basin is managed as commercial forest, and as a result, it contains numerous logging roads managed by the counties, DNR, USFS, and private landowners. According to Wade (2000), road densities in the Lewis River basin (up to Merwin Dam) average 4.48 miles per square mile. In the East Fork Lewis River basin, road densities average 4.13 miles per square mile (WDFW 1998). The average road density within the Lower Lewis River Watershed Analysis Area (between the upper portions of Yale Lake [RM 42.4] to just above Pine Creek [RM 59.5]) is 3.41 miles per square mile (USFS 1995). Pine Creek is one of the most densely roaded subbasins within the analysis area with 6.44 miles of road per square mile. In the Middle Lewis River Watershed Analysis area (from above Pine Creek [RM 59.5] to just above Alec Creek [RM 74.7]) the average road density is 2.53 miles per square mile. These road densities on National Forest System lands are significant, as areas exceeding 3.0 miles of road per square mile are thought to have high potential for road-related environmental degradation (USFS 1996).

4.6.3.1 Conclusion

Because of the high non-project road density throughout the North Fork Lewis River basin, this indicator rates as NPF.

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4.6.4 Disturbance History

NMFS (1996) defines PFC as having less than 15 percent equivalent clear-cut area (entire watershed) with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for Northwest Forest Plan area (except adaptive management areas), 15 percent retention of late successional old growth timber in the watershed.

Historically, fire was the strongest natural disturbance influencing vegetation structure and composition within these different plant communities. However, the eruption of Mount St. Helens has shown the potential influence that volcanism can also exert on vegetation composition and riparian structure within the watershed. Logging and grazing have also had substantial impacts on vegetation structure and composition in riparian areas throughout the Lewis River basin. The USFS, the largest public landholder in the Lewis River watershed, manages approximately 321,000 acres of non-wilderness Federal forestlands. Since about 1940, approximately 31 percent of the National Forest land within the agency's 166,000-acre Lower Lewis River Watershed Analysis area has been subject to intensive timber harvest (USFS 1996). This area includes lands drained by Panamaker, Cougar, Swift, Marble, Pine, Drift, Siouxon, and Canyon creeks, and several smaller streams (Figure 4.1.1-1). All of these streams are located above Merwin Dam. Overall harvest rates for the Pine Creek drainage, a major tributary to the North Fork Lewis River above Swift Dam, were calculated at 75 percent for the upper basin, 69 percent for the middle basin, and 52 percent for the lower basin (USFS 1996). Approximately 28 percent of the land in the USFS's "Middle Lewis River Watershed Analysis" area has been harvested since 1950, with a much higher proportion of that harvest occurring on privately owned lands (USFS 1995). The 102,000-acre "Middle Lewis River Watershed Analysis Area" begins at the confluence of the Muddy River and includes lands drained by Alec Creek, Chickoon Creek, Crab Creek, Big Creek, Little Creek, Meadow Creek, Rush Creek, Curley Creek, Outlaw Creek, Hardtime Creek, Miller Creek, Drift Creek, Range Creek and several smaller streams. All of these streams are located upstream of Swift Dam.

4.6.4.1 Conclusion

Because of large-scale non-project disturbances in this area, this indicator rates as NPF.

4.6.5 Riparian Reserves

NMFS (1996) defines PFC as a riparian reserve system that provides adequate shade, LWD recruitment, habitat protection, and connectivity to all sub-watersheds. This reserve must be greater than 80 percent intact and the vegetation must be greater than 50 percent similar to the potential natural community composition.

The riparian reserves surrounding the vast majority of the tributaries in the USFS Lower Lewis River Watershed Analysis Area are impaired and have been severely affected by timber harvest, volcanism, fire and floods (USFS 1995, USFS 1996, Wade 2000). According to the USFS, it could take "a century or more before historic levels are reached." It is important to note that the Pine Creek and Swift Creek drainages

previously were privately owned and were acquired by the USFS in an effort to consolidate its ownership south of Mount St. Helens. However, much of the Pine Creek drainage is still under private ownership and one lower tract is being developed for recreation housing. Timber harvest, farming, and urbanization along the lower river have also severely degraded riparian communities.

4.6.5.1 Conclusion

Because of depletion of riparian reserves by high levels of logging and other disturbances in the Lewis River basin, this indicator rates as NPF.

5.0 EFFECTS OF THE ACTION

5.1 EFFECTS OF THE ACTION ON LISTED, PROPOSED AND CANDIDATE SPECIES

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

There are a number of local effects on ESA listed species associated with the operation of the Lewis River hydroelectric projects. These effects are discussed in Section 4.0 of this document and include blockage of fish passage, entrainment, power operations (including instream flow), reservoir fluctuation, spills, water quality, and habitat reduction and modification. Two non-project-related effects also exist. These are indirectly related to project effects and include fish harvest management and fish hatchery production. Table 1.4-1 summarizes PacifiCorp's and Cowlitz PUD's proposed measures.

This portion of the BE evaluates the effects of proposed actions on listed salmon and steelhead in the context of their biological requirements, as described in this Section 5.

NOAA Fisheries may use either or both of two independent techniques in determining whether the proposed action jeopardizes a species' continued existence. First, NOAA Fisheries may consider the impact in terms of how many listed salmon will be killed or injured during a particular life stage, and then gauge the effects of that take on population size and viability. Alternatively, NOAA Fisheries may consider the effect on the species

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freshwater habitat requirements, such as water temperature, stream flow, etc. The habitat analysis is based on the well-documented cause and effect relationships between habitat quality and population viability. While the habitat approach to the jeopardy analysis does not quantify the number of fish adversely affected by habitat alternation, it considers this connection between habitat and fish populations by evaluating existing habitat condition in light of habitat conditions and functions known to be conducive to salmon conservation (Spence et al. 1996). In other words, it analyzes the effect of the action on habitat functions that are important to meet salmonid life cycle needs. The habitat approach then links any failure to provide habitat function to an effect on the population and to the ESU as a whole. For this consultation, NOAA Fisheries utilizes the habitat approach in considering the biological requirements best described by important habitat characteristics. The effects are summarized with respect to whether they impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of the impaired habitat toward PFCs (NOAA Fisheries 1999b).

NOAA Fisheries, in its effects analysis, considers the ongoing effects of the existing dams as an effect of relicensing the projects. Thus, NOAA Fisheries' effects analysis considers the net effect of the environmental conditions of ongoing effects of project operations as well as the ongoing effects of the existence of the dams. NOAA Fisheries uses PFC to inform its effects analysis because PFC is the sustained presence of natural habitat forming processes in a watershed (e.g. riparian community succession, bedload transport, precipitation runoff pattern, channel migration) that are necessary for the long-term survival of the species through the full range of environmental variation. By adding ongoing effects of the existence of the dam to the proposed action, the Licensees believe that this approach significantly overstates the negative effects of proposed relicensing and underestimates the beneficial effects of the proposed conservation action of reintroducing listed species that are extirpated above the projects.

Under the Licensees' interpretation of the ESA and its implementing regulations, the scope of the analysis would be framed in terms of the action proposed by the Licensees, implementation of the Settlement Agreement and new licenses for a term of 50 years. Such an analysis would consider the ongoing effects of the existence of the dam as part of the environmental baseline only. Therefore, all the measures for reintroduction and passage facilities would provide a net benefit to listed anadromous salmonids when compared to the environmental baseline. As indicated in the Effects of the Action column of Table 5.1-1 below, all proposed measures either would not impair, reduce or retard the functioning of affected habitat, or would improve habitat function, thus providing a net benefit to listed anadromous salmonids. The analysis in this BE is based upon NOAA's environmental baseline and therefore analyzes the ongoing effects of leaving the dams in place. Therefore, the analysis in this BE is extremely conservative in its evaluation.

5.1.1 Direct Project Effects on Anadromous Fish

Direct effects are the direct or immediate effects of the Project on the species or its habitat. Direct effects result from agency action, including the effects of interrelated actions and interdependent actions. Future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not considered in this analysis.

The primary limiting factors to salmonid populations associated with past Project operations (as summarized in Table 4.1-1 of the Environmental Baseline description) include:

1. Barriers to upstream and downstream migration of salmonids resulting in the loss of spawning and rearing habitat.
2. Reservoir inundation and passage blockage.
3. Modified flow regimes in the Lewis River below the projects.
4. Blocked downstream movement of substrate and LWD.

Unless identified herein, effects from past Project operations which were defined in the Environmental Baseline section of this Opinion are expected to continue. In other words, NOAA Fisheries expects past impacts to continue into the future if they are not explicitly modified by the new licenses. As noted above, under a Licensees' interpretation of the ESA and its implementing regulations, such effects would be considered as part of the environmental baseline and not as an effect of relicensing the projects.

5.1.1.1 Fish Passage and Reintroduction Measures

The proposed action will potentially make available approximately 117 miles of spawning, rearing and migration habitat upstream of Swift dam and potentially 57 miles of spawning, rearing and migration habitat upstream of Merwin and Yale dams for Chinook, coho, and steelhead. According to the draft Salmon recovery and fish and wildlife subbasin plan NPCC (2004), making this upstream habitat available in the North Fork Lewis River is one of the most substantial salmon recovery measures in the lower Columbia region. This is especially true since Lewis River spring Chinook and steelhead are considered core populations in the draft plan.

Under the proposed action, the Licensees will reintroduce spring Chinook, coho, and late-winter steelhead into the upper Lewis River basin above Merwin, Yale and Swift dams. Upstream (trap and transport) and downstream fish passage (modular surface collector and transport) facilities will be installed and/or upgraded at all three dams (unless otherwise directed by the Services). The fish passage program will follow a phased approach, incorporating the principles of adaptive management, to achieve genetically viable, self-sustaining, naturally reproducing, harvestable populations of these species. Access to habitat located upstream from Swift Dam will be provided in the fourth year of the reintroduction program as fish are trapped at Merwin and transported upstream to Swift Creek Reservoir. Over the next 17 years, unless otherwise directed by the Services,

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each species will be reintroduced to Yale Lake (year 13) and Lake Merwin (year 17) via newly constructed upstream (also in year 17) and downstream fish passage facilities at each project dam. Ultimately, this program will result in connectivity via upstream fish passage through all three of the reservoirs associated with the Lewis River Projects. For the safety of the downstream migrants and to increase the likelihood of success of the reintroduction program, the downstream migrants will continue to be transported by truck to a stress release pond located below Merwin Dam unless the decision is made to bypass downstream migrants through each reservoir.

The fish passage program will be subject to rigorous fish passage facility performance standards including overall quantitative survival standards, specific salmon life stage standards, and facility design standards. These will help gauge program success and determine if there is need for facility adjustments or ultimately, facility modifications. The program will also include two "status checks" in years 27 and 37 to allow a detailed review of program measures and to track progress toward the program goals. If goals have not been met at each status check, a "limiting factors analysis" will be undertaken to more precisely determine whether performance standards and species goals have been met. Additional details describing major program goals and implementation of the phased fish passage program are summarized in Section 1.4.2.1.

Providing upstream and downstream fish passage at Merwin, Yale and Swift dams will allow Chinook, coho, and steelhead to be transported to and from as much as 174 miles of potentially accessible anadromous fish habitat including tributaries (Table 5.1-1) (PacifiCorp and Cowlitz PUD 2004: AQU 4). Access to approximately 117 miles of habitat located above Swift No. 1 Dam will be provided in the fourth year of the reintroduction program, as fish are trapped at Merwin dam and transported upstream to Swift Creek Reservoir. Over the next 17 years, unless otherwise directed by the Services, the remaining 57 miles of habitat between Merwin dam and Swift No. 1 dam will be made accessible to anadromous species.

Table 5.1-1. Length of potentially accessible anadromous fish habitat, including tributaries, and the percent of total accessible habitat in the three reaches of the Lewis River upstream of Merwin Dam.

Reach Name*	Length of Potentially Accessible Habitat (miles)	Percent of Total Accessible Habitat (by length)
Lake Merwin**	29.4	17
Yale Lake	27.4	16
Swift Creek Reservoir	117.1	67
Grand Total	173.9	100

* The Lake Merwin reach extends from Merwin Dam to the base of Yale Dam; the Yale Lake reach extends from Yale Dam to the base of Swift Dam; and the Swift Creek Reservoir reach extends from Swift Dam to the lower falls on the North Fork Lewis River.

** Estimates of habitat for Merwin include all of Speetyai Creek since historically it did not flow into the Yale Lake area.

Source: Based on estimates developed for the EDT analysis (Mobrand Biometrics, Inc. 2003).

While the actual production potential of aquatic habitat in the Lake Merwin, Yale Lake, and Swift Creek Reservoir reaches is unknown, results of EDT modeling (Mobrand Biometrics, Inc. 2003) predict that together, all three Lewis River reaches are currently

capable of producing 2,014 adult spring Chinook, 12,253 adult coho, and 2,005 adult steelhead (assuming 100 percent survival past the dams and no harvest) (Table 5.1-2). The vast majority of adult production (76 percent) will result from tributaries located upstream from Swift Dam and will occur early in the period of the new licenses, 17 percent will result from tributaries to Yale Lake, and 7 percent will result from tributaries to Lake Merwin.

It is important to note that EDT, which is a construct of assumptions (best professional judgment of knowledgeable biologists), provides a “ball-park” estimate of anadromous fish production potential in a given river reach, primarily based on habitat quality and quantity. If the EDT model predicts that a reach will produce 2,000 adult salmon per year, one could reasonably expect the actual production to range from several hundred to several thousand adults per year, but the reach will not likely produce tens of thousands of adults. The reason the EDT model, and fish production models in general, have substantial error in predicting precise salmonid production levels based on habitat attributes is due to stochastic environmental variables, such as yearly variations in flow regimes, temperature, ocean conditions, food availability, and interactions with other species that are extremely difficult, if not impossible to model simultaneously.

Table 5.1-2. EDT estimates of adult abundance under current habitat conditions for spring Chinook, coho, and steelhead by geographic area (introduction reach).¹

Species/Stock	Adult Abundance by Introduction Reach			Total Abundance
	Swift	Yale	Merwin	
Spring Chinook	1,893	121	0	2,014
Coho	8,866	2,500	887	12,253
Steelhead	1,680	154	171	2,005
Percent of Total Adult Abundance by Introduction Reach	76 percent	17 percent	7 percent	

¹ Adult abundance is the number of adults entering the mouth of the Lewis River.

It is anticipated the increase in salmon and steelhead production associated with the reintroduction program in the Lewis River basin will contribute to the recovery of lower Columbia River Chinook, steelhead, and coho by allowing these species to fully utilize the available habitat and production capacity. Whether or not the available habitat above Merwin Dam is capable of supporting self-sustaining, genetically viable, harvestable populations of each species (without periodic hatchery supplementation) is not known at this time, and will only be known after reintroduction efforts have been implemented and monitored for several salmon and steelhead generations. However, other benefits to the populations also exist such as within-population diversity and spatial structure. Monitoring activities will assist with analysis of the phased approach to fish passage and the year 27 and 37 status checks will evaluate the effectiveness of the reintroduction measures and will allow the consideration of other limiting factors influencing the success of the program. As an added benefit, the reintroduction of anadromous salmonids may benefit bull trout, cutthroat trout, and other aquatic species by increasing primary productivity through the addition of marine derived nutrients (MDN). The addition of MDN will, in turn, likely increase the aquatic invertebrate biomass, which

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will increase the forage base for juvenile and adult salmonids, including the reintroduced species.

Phased Approach to Fish Passage –

The proposed phased approach provides for a carefully devised plan to protect the listed species while allowing for the reintroduction program to take affect. For the first 3 years anadromous fish will continue to be collected at the Merwin trap but will not be transported to the upper watershed. These fish will remain in the lower Lewis River and either contribute to the fishery, or be used for the broodstock program for both hatchery production and initiation of the Supplementation Program, or allowed to spawn naturally in the lower river. In addition to the previously described program, adult salmon and steelhead will be transported to above Swift Dam for habitat preparation. However, juveniles will not be collected until the Swift downstream collector is in place. As with the current conditions, the listed stocks in the lower Lewis River are expected to persist and not decrease by any significant numbers. Once the Swift downstream collector is in place, spring Chinook, winter steelhead and late-run coho will be collected at Merwin and transported to above Swift dam as part of the adult supplementation program marking the formal initiation of the reintroduction program. Based on the experiences of other operators such as Portland General Electric on the Clackamas River and Tacoma Power on the Cowlitz River, collection and transport of adult anadromous salmonids is very successful and results in less than 1% mortality (PGE 2004). In the initial years, the fish transported will essentially be surplus hatchery broodstock that would normally either be removed from the system or allowed to spawn naturally in the river below Merwin dam. Later, it is anticipated that the collected and transported fish will be natural returns. These fish will be subject to “natural” mortality once released into the upper watershed. This mortality could include predation by raptors and mammals, incidental catch by anglers, and pre-spawning mortality due to disease or other unknown causes and would contribute to the marine-derived nutrient base. There will likely be some inter- and intra-specific competition for spawning and rearing space, the results of which are indiscernible. Collection and transport of steelhead kelts is anticipated and these adult steelhead will be returned to the river below Merwin dam. There are not likely to be large numbers of kelts. For example, iteroparity rates average 1.6 to 3% for steelhead in the Yakima River (Evans, et al. 2004). There are, however, likely to be mortalities given the physical condition of these fish once they are collected (Hatch, et al. 2003). Juvenile fish collection and transport is expected to cause losses to the downstream migrant component of the naturally spawned salmonids in the upper watershed. Capture, survival, injury and transport standards are established to protect the downstream migrants and will be monitored for fish passage effectiveness.

As anadromous fish are collected and transported to Yale Lake during the second phase of the reintroduction program, similar costs and benefits will accrue to the overall Chinook, steelhead, and coho populations although on a much smaller scale given the amount of habitat available in Yale Lake compared to upstream of Swift dam. Until reintroduction to Yale Lake is implemented, listed stocks in the Lewis River are expected to persist and not decrease by any significant numbers, and in fact are expected to increase in numbers due to the reintroduction efforts above Swift Dam. Since the bull

trout population in Yale Lake is so small, coho competition for spawning space could have negative impacts on the bull trout. On the other hand, bull trout that continue to survive salmon reintroduction will benefit from the increased prey base provided by the salmon and steelhead rearing in Yale Lake and its tributaries. Adult and juvenile fish are expected to experience effects similar to those described for the Swift facilities.

Introduction into Lake Merwin marks installation of a downstream collector and upstream passage at each dam. Until reintroduction to Lake Merwin is implemented, listed stocks in the Lewis River are expected to persist and not decrease by any significant numbers, and in fact are expected to increase in numbers due to the reintroduction efforts above Swift Dam and into Yale Lake. So adults collected at the Merwin trapping and sorting facility will be either trucked or transported via truck or alternative technology to Lake Merwin and allowed to either remain and seek spawning there or swim through Lake Merwin to the Yale adult fish collector. Fish remaining in Lake Merwin will experience natural mortality in the form of incidental catch, predation by mammals and raptors or potentially tiger musky or other causes. Adults placed in Yale Lake will be allowed to either remain and seek spawning there or swim through Yale Lake to the Swift adult fish collector. Adults remaining in Yale Lake will experience natural mortality in the form of incidental catch, predation by mammals and raptors, or other causes. Any adult fish that are collected and sorted at the Swift Upstream trap will be either trucked or transported via truck or alternative technology to Swift Creek Reservoir and allowed free access to the upper watershed tributaries while experiencing natural mortalities similar to Yale.

Downstream Fish Passage Facility Performance Standards - As is the case with all downstream fish passage facilities, mortalities are expected among some downstream migrating salmon and steelhead smolts (and potential adult fallbacks) as they move through the project reservoirs and downstream fish passage facilities and are transported to a release pond below Merwin Dam. Mortalities can occur through sorting, handling, and marking, injury caused by the collection and transfer equipment, or from crowding within the holding facility prior to transport. This expected loss will ultimately reduce the numbers and distribution of fish destined for the lower river. However, overall the anticipated comparable benefits of increased smolt production and increase in natural versus hatchery fish would outweigh the potential losses and would not likely cause significant reduction in the ESU. Passage survival performance standards (e.g., ODS, CE, and CS,) have been set by the Services at each facility at levels that are expected to minimize take and to allow for sustainable populations above the dams. The ODS target at Swift No. 1 is 80 percent until downstream passage is implemented at Yale, at which point ODS goal at Swift and Yale is 75 percent due to increased production habitat in Yale. The Licensees will develop and implement studies at each project dam to inform the design of the fish passage facilities to meet the passage performance standards that have been set by the Services. The probability of attaining 75 to 80 percent ODS is unknown, but the facilities will be designed to meet this target, in consultation with NOAA Fisheries, and activities will be ongoing during the terms of a new licenses in an effort to meet the ODS targets and the overall goal of producing self-sustaining anadromous fish populations upstream of Merwin Dam. The CE performance standard for each downstream passage facility is equal to or greater than 95 percent and the CS is equal to or greater than 99.5 percent for smolts and 98 percent for fry. If monitoring

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indicates that performance standards are not being met, the Licensees will make adjustments or modifications to the facilities as directed by the Services in an effort to achieve the targets. As a result, these facilities will likely provide safe, timely, and effective downstream passage of juvenile Chinook, coho, and steelhead, and will in any case assist in the recovery of these species even if the performance standards are not met. In addition, if NOAA Fisheries concludes at any time that downstream passage at the Swift No. 1 Dam is not effective for collecting spring Chinook because of that species' behavior patterns, and that a satellite collection facility has a reasonable likelihood of more effectively collecting spring Chinook, then PacifiCorp will design and install such a facility. This measure will likely provide safe and effective downstream passage of spring Chinook salmon.

Although the CE of the downstream passage facilities will not be known until the facilities are constructed and evaluated, the CE of the Baker River gulper system on Baker Lake, upon which the proposed downstream fish passage facility system designers will be based, has been estimated at between 53 and 70 percent (pers. comm. Cary Feldman, Puget Sound Energy, 2003, as cited in PacifiCorp 2004). Because the Swift, Yale, and Merwin floating surface collectors will benefit from experience at the existing Baker system and other surface collectors in the Pacific Northwest, it is anticipated that its collection efficiency will exceed the high end of the Baker gulper efficiency range. In addition, Baker River data show that approximately 98 percent of the juveniles survive the collection and transport process (pers. comm. Cary Feldman, Puget Sound Energy, 2003, as cited in PacifiCorp 2004). Given these efficiency and survival targets, floating surface collectors at Swift, Yale and Merwin dams will reduce potential project entrainment through turbines and spillways, increase passage survival, and thus facilitate fish passage past the projects.

Fish passage facility monitoring studies and sorting activities may adversely affect individual fish as a result of tagging injury or mortality, but will provide long-term population level benefits as facilities are adjusted and ultimately modified to better meet performance standards. Any injury or mortality associated with this action is contemplated in this Biological Evaluation however, a Section 10 (a)(1)(a) permit will still be required.

Release Pond – All juvenile anadromous salmonids collected at the Swift, Yale and Merwin downstream fish passage facilities will be transported directly to a stress release pond located downstream of Woodland. After acclimating in the pond, they will be released to the lower river to continue their migration to the ocean. This measure will help to alleviate transportation stress prior to entering the Lewis River, likely increasing juvenile survival. Survival data (48 hour) on juvenile anadromous salmonids transported from Cowlitz Falls Project fish collection facility to release ponds at the Cowlitz Salmon Hatchery in 1998 show that survival was higher than 98 percent over the entire migration season (Tacoma Power 1999). It is anticipated that survival rates at the Lewis River projects will be similar to that observed at the Cowlitz Falls Project. Locating the release ponds near the mouth of the Lewis River will minimize any potential negative interactions with naturally produced Lewis River fall chinook (i.e. predation and competition). The configuration of the release pond is yet to be decided but the facility will function in a similar manner to the Cowlitz River stress release facility. The facility

located downstream of Woodland will not be built in-water and will likely be constructed on top of the existing dike. The area will be fenced to protect the fish and facility from vandalism. The water supply is likely to be provided from the Lewis River using a screened pump. Released fish and water will flow back the Lewis River. Certain kinds of short-term construction impacts will likely occur but will be minimized through best management practices and construction measures called-for in WDOE's 401 construction permit.

Upstream Fish Passage Facility Performance Standards – Under the proposed action, PacifiCorp and Cowlitz PUD will use safe, timely and effective methods to trap and transport adult Chinook, coho and steelhead to habitat located upstream of Merwin, Yale, and Swift dams; however, fish passed upstream via trap and transport could be adversely affected by trapping injury or mortality and any natural mortality as mentioned in previous paragraphs. The probability of attaining the proposed action's 99.5 percent adult UPS target at each facility is high, based on the best available technology and survival noted at other facilities in the Pacific Northwest. Preliminary data from the first 4 years of anadromous salmonid reintroduction efforts into the Upper Cowlitz River basin indicate that trap and transport methodology has been successful at reestablishing some level of anadromous salmonid production, especially for coho salmon (Dammers, et al. 2002 as cited in NOAA Fisheries 2003). The Pelton trap and transport facility (Pelton Round Butte Hydroelectric Project) has been operating nearly continuously since 1956, with many thousands of fish captured, sorted, and transported. Mortality rates at this facility have been less than 1 percent (PGE 2004). Again, if monitoring indicates that upstream passage performance standards are not being met, the Licensees will make changes to the facilities as directed by the Services in an effort to achieve the targets.

As additional upstream fish passage facilities are constructed at Yale and Swift dams (in years 13 and 17 of the new licenses), adult upstream migration through all three project reservoirs and two additional fish upstream passage facilities would increase the potential for injury, delay, or mortality, especially for adult Chinook, coho and steelhead bound for habitat located upstream of Swift Dam. During project relicensing, the ARG assumed a 96 percent survival value for fish passing each dam and reservoir. Under this scenario, of 100 fish collected at Merwin Dam that are bound for habitat located upstream of Swift Dam, 88 would survive passage through all three facilities and reservoirs. Since the vast majority of the available salmon and steelhead habitat is located upstream of Swift Dam, this loss of upstream migrants (cumulative mortality) may outweigh the benefits of reintroduction into Yale Lake and Lake Merwin. However, the positive benefits include but are not limited to spatial distribution and replenishment of marine nutrients to tributaries of those reservoirs. At the 9th and 13th anniversary of the Licenses being issued, the Services will require reintroduction unless they decide that In Lieu funds may provide greater benefits to the listed populations than passage into Merwin and Yale. Monitoring and information gathered associated with the phased approach to reintroduction will allow NOAA Fisheries to evaluate the pros and cons associated with reintroduction into the Lake Merwin and Yale Lake reaches.

Species Interactions - Reintroduction of Chinook, coho and steelhead above Merwin, Yale and Swift dams may displace resident rainbow and coastal cutthroat trout from

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preferred habitats that have been colonized in the absence of anadromous species; however, this is not expected to result in adverse effects to anadromous species (PacifiCorp and Cowlitz PUD 2004: AQU 16).

Coho and bull trout (listed as Threatened under the ESA) have similar run timing, spawning habitat requirements, and general egg burial depth characteristics (Sandercock 1991 and Shepard et al. 1984). It is uncertain how the overlapping spawning of these two species will affect either species. If bull trout have expanded their distribution due to the absence of coho and are now spawning in areas historically used by coho, then spawning interactions could adversely affect bull trout. Chambers (1957) noted 46 coho redds and 28 live coho in Cougar Creek during his observations of coho behavior prior to construction of Swift dam. The potential adverse effects of bull trout predation on introduction efforts is highly uncertain, as are the possible benefits of increased food sources to bull trout in the Lewis River. However, the number of bull trout currently present in the system is very small compared to the potential salmon and steelhead production numbers and is not likely to have a major affect on the reintroduction success.

Predation Study - It should be noted that the survival of juvenile Chinook, coho and steelhead migrating through Lake Merwin might be severely reduced due to the presence of tiger musky and large numbers of northern pikeminnow. Northern pikeminnow are known to prey heavily upon resident and anadromous salmonids. Northern pikeminnow predation was believed to be the major cause of very low coho salmon survival in Lake Merwin the late 1950s and early 1960s (Hamilton et al. 1970). The impacts of northern pikeminnow predation on reintroduced anadromous fish are currently unknown. To address this uncertainty, PacifiCorp will conduct a study of whether predation in Lake Merwin is likely to be a limiting factor to the success of the anadromous salmonid reintroduction.

In Lieu Fund - If the Services determine that reintroduction should not occur at Lake Merwin or Yale Lake because it is inappropriate, PacifiCorp will contribute to an In Lieu Fund as follows: \$10 million in lieu of a juvenile surface collector at Yale Dam; \$10 million in lieu of a juvenile surface collector at Merwin Dam; \$5 million in lieu of an upstream adult fish passage facility at Yale Dam; \$5 million in lieu of an upstream adult fish passage facility in the vicinity of the Swift Projects. The In Lieu Fund will be used for mitigation measures that collectively contribute to meeting the objective of achieving equivalent or greater benefits to anadromous fish populations as would have occurred if passage through Yale Lake and/or Lake Merwin had been provided. The Services will ensure that mitigation measures implemented with this fund are consistent with achieving the equivalent or greater benefits to salmonid populations as would have occurred with passage in place. Measures may include habitat enhancement, habitat protection, or other appropriate actions that will benefit listed species. Section 1.4.2.1 lists examples of the kinds of mitigation measures that would be implemented with the In Lieu Fund. Implementation of those or similar mitigation measures is expected to alleviate certain passage problems by removing dams or replacing culverts thus opening up currently unavailable spawning, incubation and rearing habitat; reconnecting and enhancing off-channel and floodplain habitats along the lower reaches of the mainstem Lewis River thus improving rearing survival for listed species; enhancing floodplain and side channel

habitat around Eagle Island which will also improve rearing habitat for the listed species; restoring degraded riparian conditions along the tributaries to the lower Lewis River thus improving early rearing conditions; increasing functional LWD structures, or similar natural structures, in appropriate stream reaches which also improves rearing and holding conditions and may contribute to spawning gravel retention; and restoring and enhancing wetlands, springs, and seeps in the sub basin which will assist in improving water quality conditions in the basin and its tributaries. The list of potential projects provided in Section 1.4.2.1 illustrates, without limitation as to scope or type, some projects that qualify as mitigation measures under the In Lieu Fund are based on conditions as of the Effective Date of the Settlement Agreement. These specific projects may or may not be undertaken with the In Lieu Fund. In addition, some measures identified may already have been completed by the time the In Lieu Funds become available, if ever. Although some short term effects from construction or implementation of potential projects, the proposed projects and projects like these are expected to have significant positive effects on listed salmonid populations in the Lewis River basin and to contribute to their eventual recovery.

Reintroduction Outcome Goal Status Checks - The overarching goal of the anadromous fish reintroduction program is to achieve genetically viable, self-sustaining, naturally reproducing, harvestable populations of these species above Merwin Dam at greater than minimum viable populations. The two reintroduction program status checks (year 27 and year 37) and their associated limiting factor analyses will allow the resource managers to determine whether the reintroduction outcome goal has been achieved for each Lewis River anadromous fish population and will allow the consideration of other limiting factors influencing the success of the program over time. If program goals are not being met in year 27, and it is determined that the primary limiting factor is attributable to the projects, the Licensees will implement measures to provide biological benefits substantially equivalent to the impact of the project-related limiting factor (e.g., habitat enhancement projects, continuing juvenile supplementation, etc.). If the program goals are still not being met in year 37 and it is determined that the primary limiting factors analysis concludes that a Project effect is a significant limiting factor in any reintroduction outcome goal not being met then the Licensees shall consult with the Services to determine what further actions by Licensees would be necessary to meet reintroduction outcome goals. Such actions may include, without limitation, consideration of structural or operational changes with respect to the generating facilities or Project reservoirs or construction of new or replacement passage facilities. In the event that the Services and the Licensees cannot reach agreement on implementing such further actions, the Services may exercise their applicable authorities to direct what actions should be implemented, subject to the approval of the Commission.

Construction Activities - Construction of the proposed fish passage facilities has the potential to cause short-term adverse effects on water quality, such as increased turbidity. Although water quality may be affected temporarily during construction through increased erosion and sedimentation, these effects will be minimized and avoided by implementing best management practices (e.g., installing silt fencing and other sediment trapping devices on land and silt curtains in water) and covering exposed soil until permanently stabilized. PacifiCorp and Cowlitz PUD will be required by federal, state,

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and county regulations to develop sediment and erosion control plans as part of the construction process. Chemical spills could also occur during construction, but development of a pollution prevention plan in accordance with appropriate federal, state, and county requirements will minimize the effects of such an occurrence. Typically, a pollution prevention plan will specify areas for equipment maintenance and refueling, spill prevention and emergency response strategies, and requirements for keeping emergency response spill containment kits onsite and for having trained personnel present onsite during construction. PacifiCorp and Cowlitz PUD currently have Spill Prevention Containment and Control (SPCC) programs in place that address these activities. Construction impacts related to the passage facilities are likely to create short-term effects such as turbidity and disturbance around in-water activities. These impacts are not expected to result in significant losses to the listed species either locally or regionally. Through the construction permitting process, plans will be developed to minimize and avoid temporary construction-related effects to the extent feasible using best management practices. No long-term negative effects on aquatic resources are anticipated from construction of new fish passage facilities. Overall, it is anticipated that effects from construction of new fish passage facilities will be overshadowed by the benefits to Chinook, coho, and steelhead that occur by providing access to the upper watershed, expanding the range of the populations, and increasing the overall production for these species in the Lewis River.

5.1.1.2 Additional Aquatic Resources Measures

Yale Spillway Modifications

In its current configuration, the Yale Dam spillway is steep and terminates on rough bedrock. There have been no tests of spillway mortality at Yale Dam; however, there is concern that these conditions can cause injury or mortality due to fish colliding with the boulder outcrop at the tail of the spillway or through spill hitting the embankment opposite the spillway tail. Under the proposed action, PacifiCorp will implement improvements to the Yale Dam spillway to improve fish survival during spill events (to be completed within 4 years of the issuance of the new licenses). Although this measure is designed primarily to provide greater protection for any bull trout that attempt to migrate downstream during the spill season, this measure will also improve conditions for juvenile Chinook, coho and steelhead that happen to pass over the spillway.

Construction activities associated with the modification of the spillway will include excavating a large amount of rock. These activities have the potential to temporarily generate suspended sediment that could be carried downstream, increasing turbidity below the Yale Dam. The operation of heavy machinery needed during the modification of the spillway will also temporarily increase the risk of fuel and other toxic chemical spills in Lake Merwin. It is anticipated that the extent of these effects will be managed through the implementation of erosion control measures and best management practices regulating the storage, use, and disposal of toxic materials. As a result, construction-related changes in water quality such as turbidity or unexpected oil or chemical spills will be short term and very minor

TDG Testing

Elevated TDG levels resulting from power generation in the Swift No. 1 and Yale tailraces have the potential to adversely affect fish rearing or migrating in Yale Lake and Lake Merwin. As a component of the Lewis River Settlement Agreement, PacifiCorp will monitor TDG at the Swift No. 1 and Yale tailraces to determine compliance with state water quality standards (120 percent TDG), and implement measures to minimize effects on ESA listed species if standards cannot be met. Although this measure is designed primarily to benefit bull trout, it will also benefit Chinook, coho, and steelhead rearing or migrating in these reservoirs and other species present in the reservoirs.

Conservation Covenants

PacifiCorp currently owns lands in the Cougar/Panamaker Creek area, and both Utilities own land along the Swift Creek arm of Swift Creek Reservoir. Under the Lewis River Settlement Agreement, PacifiCorp and Cowlitz PUD propose to maintain the existing conservation covenants on those lands to protect and conserve habitat for bull trout, cutthroat trout, and other aquatic species (including reintroduced ESA listed anadromous species) in perpetuity. The covenant will include a 500-foot buffer along each side of Cougar Creek and a 200-foot buffer along each side of Panamaker Creek. Along the Swift Creek arm the covenant and protection buffer will extend along the east side of the Devil's Backbone from the high water mark to the upper bench where a road currently exists. The proposed conservation covenants will result in increased protections for the adjacent riparian zone beyond that currently required by the Washington Forest Practices Act and associated regulations. The proposed width of these covenants will protect the intact riparian zone, preserve the function and provide a significant buffer to the riparian zone. Protection of these riparian areas will preserve and enhance spawning and rearing habitat for bull trout in Cougar Creek and the Swift Creek Arm of Swift Reservoir by reducing the effects of upslope activities. In addition to benefiting bull trout, these covenants will maintain high quality habitat for Chinook, coho and steelhead. The effect of this action is to improve the future survival of Chinook, coho, and steelhead by avoiding additional losses of this crucial habitat.

5.1.1.3 Flow Releases for Fish and Other Aquatic Species

Flows in the Lewis River Bypass Reach

As discussed in Section 4.6.1, the 3.3-mile-long Lewis River bypass reach (North Fork Lewis River) has no minimum instream flow requirement. Flows in the reach are normally limited to inflow from groundwater/seepage and tributaries except during Swift No. 1 spill events when large quantities of water are released into the reach. During the summer low flow period, surface flow at the downstream end of the bypass reach is estimated to be about 21 cfs. Spill events occur sporadically, but in general, spills of several thousand cfs or greater occur every few years. Under these conditions, median summer water temperatures in the Lewis River bypass reach meet the state water temperature standards; however, maximum summer water temperatures exceed the preferred ranges for all salmonid species except rainbow trout. Although the bypass reach supports populations of cutthroat trout, rainbow trout, mountain whitefish,

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largescale sucker, and other resident fish species (including occasional bull trout), the quality and quantity of habitat in this reach is limited by the lack of flow, warm summer water temperatures, and the sporadic spill events.

Under the proposed action, minimum instream flows will be released into the Lewis River bypass reach from two points, a water release structure located at the upstream end of the bypass reach (upper release point) and a canal drain located approximately one mile downstream of the Swift No. 1 tailrace (lower release point). Flow releases will vary by season and will range from 60 to 100 cfs. The objective of also providing flow releases at the upper release point is to maintain some level of connectivity between large pools that exist in the upper bypass reach (upstream from the canal drain. The maximum flow release at the lower release point is estimated to be 47 cfs, which is the maximum capacity of the valve. Unless the ACC determines otherwise, PacifiCorp and Cowlitz PUD will also design and construct an "improved habitat channel" between the lower release point and Yale Lake. Conceptual design of this approximately 1,500-foot-long channel incorporates placement of large woody debris (LWD) and boulders to increase velocity and depth in the reach. Focusing habitat improvement efforts in this off-channel area will maximize the benefits of the engineered channel and reduce adverse impacts associated with spill events in the main bypass reach. Any fish residing in the existing channel will need to be removed from the area and placed in the lower bypass reach prior to construction to minimize loss associated with dewatering the channel for construction. In-channel work will include some excavation, placement of LWD and potentially gravel, and flow control structures. Once completed, the channel will be re-watered. At that time, high turbidity will likely occur for a short period until the channel is completely watered and stabilized. The proposed action's minimum instream flow regime will improve aquatic habitat connectivity, reduce summer water temperatures, and increase the amount of habitat area for Chinook, coho, steelhead (once fish passage is implemented), cutthroat trout, rainbow trout, kokanee, brook trout, and mountain whitefish (PacifiCorp and Cowlitz PUD 2003f and 2004: AQU 2). Largescale sucker, northern pikeminnow, threespine stickleback, and sculpin are native to the Lewis River basin and these species will also benefit from the increase in flow. The flow regime will also create additional foraging habitat for bull trout during the winter and spring; however, summer and fall water temperatures in excess of 11°C will likely preclude successful bull trout spawning in this reach. According to Pratt (2003), water temperatures above 9°C will delay or abort bull trout spawning, as appropriate spawning temperature (<9°C) will not occur until late November or December. If a trap and transport facility is eventually installed at or near Swift No 2 tailrace, the increased flows in the bypass reach will also have the potential to attract migrating anadromous fish that are bound for habitat located above Swift Dam. Any such delay in reaching the trap entrance could decrease the survival of these upstream migrants. However, the proposed bypass flows are a fraction of the outflow from the tailrace and not likely to deter the majority of fish attempting to migrate upstream.

There will be little change to stream morphology in the bypass reach associated with the proposed action's flow regime, as there will not be enough flow to alter channel form, but the wetted channel will be somewhat wider and deeper and will be more persistent throughout the year. While the amount of instream habitat will increase substantially in

the bypass reach compared to existing conditions, periodic spill events will continue to transport wood and gravel particles from the reach, limiting the amount of spawning gravel and instream cover. The same very large spills will scour redds and wash out encroaching riparian brush and shrubs from within the high water channel. As a result, it is likely that spawning and rearing habitat in the main bypass reach will continue to be limited by a lack of gravel and instream cover (PacifiCorp and Cowlitz PUD 2003f and 2004: A(QU 2), but the proposed action's constructed channel will generally be less impacted by these events, especially in the upper section where it is separate from the main bypass reach. As a result, aquatic habitat will be maintained in the constructed habitat channel even after large spill events.

Regarding juvenile outmigrants, spill events at the Lewis River Projects occur during the winter (November to February) outside of the outmigration period for the species and stocks that could be affected. Therefore, it is likely that effects will be minimal from spill on salmonids. Overall, the bypass reach flows will provide a net benefit to fish and other aquatic species in the reach.

Swift No. 2 Canal Surge Arresting Structure

Surge Arresting Structure- In the event that the SAS were to operate, it would be doubtful that, if any fish were present in the canal, they would survive passage through the cone valves. Therefore, there is a potential for the SAS to impact salmon, steelhead or bull trout that may be present in the canal.

Canal Inspections - Starting shortly after the canal returns to full operation, Cowlitz PUD will be required to examine the integrity of the canal on a periodic basis. This examination would require dewatering the canal. During the dewatering if any salmon, steelhead or bull trout were present in the canal, they would be recovered and released into Yale Lake in coordination with the NOAA Fisheries, USFWS and WDFW. The "improved habitat channel" in the bypass reach could also potentially be affected by dewatering the canal because the intake for the existing water source (canal drain) is currently located in the portion of the canal to be dewatered and inspected. The proposed action provides for development and implementation of plans for expeditious installation and operation of temporary replacement facilities for delivery of flows from the canal drain in the event maintenance activities (e.g. dewatering of the canal for inspection) reduce or interrupt flows to the habitat channel. In addition, a second canal drain is being evaluated for installation in the canal above the check structure. If needed, this canal drain would be used to dewater the canal above the check structure to examine the upper section of the canal. Operation of this drain is intended to be covered as part of the proposed action, contingent only on a decision by Cowlitz PUD that construction of the second canal drain is necessary and obtaining any required approvals. If this additional canal drain is installed, it could potentially be used to provide water to the habitat channel if the canal below the check structure were to be dewatered.

Fish, and salmon, steelhead and bull trout in particular, except trout that may be planted in the canal prior to fishing season, are not expected to be present in the Swift No. 2 canal after installation of the floating surface collector and guide net system in Swift Creek Reservoir. The floating surface collector at Swift No. 1 will be designed to preclude

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entrainment of fish into the Swift No. 2 canal, but some fish would likely be able to migrate past the floating surface collector and guide net system, because these facilities cannot be designed to be 100 percent effective. Thus, there is potential to entrain some fish into the Swift No. 2 Canal. However, entrainment potential would be substantially reduced under the proposed action compared to the current conditions where no system is in place to limit entrainment into the canal. Also, salmon, steelhead and bull trout that do enter the canal will be rescued during scheduled canal dewatering and released into Yale Lake. This action provides an opportunity for those salmon and steelhead surviving turbine entrainment at Swift No. 1 and entering the Swift No. 2 canal to be reinstated to the gene pool in Yale Lake or the river downstream of Merwin. Through monitoring of the downstream passage system, along with any facility adjustments deemed necessary through the monitoring process (as specified in the Lewis River Settlement Agreement), entrainment into the Swift No. 2 canal would likely be minimized. Any on-going entrainment and subsequent rescue would represent a positive local population level effect.

Minimum Flows in the Lewis River below Merwin Dam

Flows in the Lewis River downstream of Merwin Dam are affected by the coordinated operation of the three upstream project reservoirs. Flows in this reach are highest during the winter, decrease gradually in the spring, and are lowest during summer months (Figure 4.6-1). This flow regime has resulted in more wetted habitat area in the Lewis River downstream from Merwin Dam during the summer and early fall months than prior to construction of the projects, inundating more potential aquatic habitat and likely more side channel habitat. Operation of the projects has also reduced the frequency of flows in the 10,000-20,000 cfs range and changed the shape of the mid-range flow fluctuations. A reduction in peak flows has resulted in a more stable channel with less scour of redds and less fine sediment transport than prior to project operation, while ample spawning gravels remain and appear to be stable over the long term (McIsaac 1990; PacifiCorp and Colwitz PUD 2004 – WTS 3). Lower flows during the spring may affect juvenile salmonid migration rates, as their survival appears to increase with increasing river flows (Norman et al. 1987; Cada et al. 1993). The causal mechanisms for this increased survival is poorly understood but is likely related to water temperature, change in predation rates, and the timing of juvenile arrival in the Columbia River estuary. The Settlement Agreement calls for higher flows during the early outmigration period and flows similar to existing flow requirements in the spring and early summer. This regime will likely benefit early outmigrants and will continue to provide spring flows that were originally developed to benefit fall chinook rearing and outmigration but will also likely benefit the other anadromous species in the lower river.

Under the proposed action, minimum flows below Merwin Dam in the winter will be 2,000 cfs; minimum flows in the spring will range from 2,200 to 2,700 cfs; summer minimum flows will range from 1,200 to 2,700 cfs; fall low flows will be 1,200 cfs; late fall minimum flows will range from 2,500 to 4,200 cfs (Table 5.1-3).

Table 5.1-3. Minimum flow provisions downstream of Merwin, as stipulated in the proposed action.

Time Period	Proposed Action Minimum Flow Requirement
November 1 through December 15	4,200 cfs
December 16 through March 1	2,000 cfs
March 2 through March 15	2,200 cfs
March 15 through March 30	2,500 cfs
March 31 through June 30	2,700 cfs
July 1 through July 10	2,300 cfs
July 11, through July 20	1,900 cfs
July 21 through July 30	1,500 cfs
July 31 through October 15	1,200 cfs
October 15 through October 31	2,500 cfs

A flow of 4,200 cfs from November 1 through December 15 was determined by WDFW to provide the "maximum amount of spawning area" for bright fall Chinook during their peak spawning period (November and early December). Under the proposed action, the existing 5,400 cfs minimum flow in December will be reduced to 4,200 cfs to minimize the difference between the highest sustained flow during the peak spawning period and the lowest flow during egg incubation, while maintaining ample spawning habitat for Chinook, coho, and chum. By minimizing the difference between spawning flows and incubation flows, redd dewatering will be minimized increasing Chinook, coho, and chum egg and alevin survival. Avoiding higher short-term discharge rates in the fall that are of a sufficient duration to encourage Chinook and chum salmon spawning can improve fish survival and increase abundance (Connor and Pflug 2004). Salmon spawning in channel areas coincidental with high flows can be difficult to keep watered throughout incubation and emergence period so any action to reduce this potential loss through dehydration can result in greater overall production.

To minimize redd dewatering risk, the minimum flow in January and February will be increased from 1,500 cfs under existing conditions to 2,000 cfs, and in March from 2,000 cfs under the existing conditions to 2,500 cfs. Actual flows during this time period will be considerably higher except during very rare winter droughts. Minimum flows in July will be slowly reduced to mimic a similar reduction in natural flows; however, flows will be slightly higher than under existing conditions to reduce potential adverse effects on emerging steelhead fry. Flows in September and October will be similar to existing conditions increasing the amount of rearing habitat compared to baseline (pre-project) conditions. It was determined by the WDF that flows less than 1,500 cfs adequately supported rearing salmon and steelhead (PacifiCorp meeting notes – Sept. 1981).

Compared to existing conditions, the proposed action flow regime will reduce the difference between the Chinook, coho, and chum spawning and incubation flows, and will slightly increase minimum flows in July (to protect emerging steelhead fry). Therefore, the proposed action will result in decreased potential for redd dewatering and increased Chinook, coho, chum, and steelhead survival.

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During years when PacifiCorp projects that sufficient water will not be available to achieve minimum flow levels, or to fill or maintain Project reservoirs for recreation purposes, or when it appears likely that redds will be dewatered below Merwin Dam, PacifiCorp will convene a Flow Coordination Committee consisting of representatives from PacifiCorp, NOAA Fisheries, USFWS, WDFW, Yakama Nation and Cowlitz Indian Tribe.. The FCC will independently evaluate available data regarding water availability during the projected low flow period and decrease the minimum flows to levels that consider the needs of fish species, with a priority on ESA-listed species, including without limitation consideration for keeping redds watered. This action will minimize potential adverse effects on Chinook, coho, chum and steelhead.

Plateau Operations in the Lewis River below Merwin Dam

Under the proposed action, PacifiCorp will restrict daily flow fluctuations below Merwin during the period of February 16 through August 15 of each year by maintaining flow plateaus (periods of near-steady discharge). Once a flow plateau is established, the plateau will be maintained for as long a duration as practicable, but flow plateaus may be altered to a new level as a result of changes in natural flow or operational demands on the Lewis River power system subject to the limitations of the ramping restrictions.

Plateau Operations have been designed to limit flow fluctuations on a daily to weekly basis, as opposed to ramping rate restrictions that have been designed to limit flow fluctuations on an hourly basis (discussed below). Daily to monthly flow fluctuations have been shown to reduce benthic macroinvertebrate diversity and total biomass and can change invertebrate species composition. A study on the Skagit River, Washington found that flow fluctuations had a greater adverse effect on the aquatic invertebrate community than a substantial reduction in average flow (Gislason 1985). Alterations in the annual hydrograph of rivers may also contribute to disruptions in aquatic food webs as documented in several northern California river systems (Power et. al 1996). Shifts in the composition of benthic fauna to more predator resistant taxa have been found to occur in regulated river a system, which potentially results in decreasing the energy transfer from algae to fish (Power et. al 1996).

A reduction in the aquatic invertebrate forage base can negatively affect fish production potential. Flow fluctuations can affect aquatic invertebrates through stranding (similar to fish stranding), increase drift response, and may reduce aquatic invertebrate forage. It is anticipated that by implementing Plateau Operations impacts to macroinvertebrates caused by flow fluctuations will be reduced. Therefore, the proposed action may increase macroinvertebrate production in the Lewis River downstream of Merwin Dam. This will represent an increase in anadromous fish forage, benefiting ESA listed species.

Ramping Rates in the Lewis River below Merwin Dam

Rapid changes in river flow associated with hydroelectric project operations have the potential to adversely affect aquatic resources. Adverse effects can include the stranding of fish in shallow, low-gradient areas and off-channel habitat (causing immediate or delayed mortality); temporary loss of habitat or loss of habitat access; and dewatering of fish redds, amphibians, aquatic insects, and plant life (Hunter 1992). Rapid changes in

stream flow (both increases and decreases) also can affect fish behavior that could reduce survival or growth.

Limits governing the rate and timing of project-induced river stage changes (ramping rates) are often established to protect aquatic organisms from these project-related effects. A ramping rate is the rate of change in stage resulting from regulated discharges and is usually measured in inches per hour. Ramping rates should be gradual enough to allow fish and other aquatic organisms to move into and out of shallow rearing areas without becoming stranded when flows decrease (Hunter 1992). In most cases, ramping rates that are similar to those that occur under natural, unregulated conditions are adequate to protect fish and other aquatic organisms.

Under Article 49 of the existing Merwin license, PacifiCorp is required to limit down-ramping below Merwin Dam to 1.5 feet (18 inches) per hour from August 1 through February 18. For the remainder of the year, required ramping rates range from 300 to 750 cfs per hour, depending on flow (as measured at Ariel gage). These ramping rates represent fairly rapid changes in river stage and consequently could strand large numbers of juvenile fish. Since 1993, PacifiCorp has implemented a voluntary two-inch per hour down-ramping rate at all release levels to protect aquatic resources below Merwin Dam and to reduce juvenile fish stranding. In their Biological Opinion for the Interim Operation of the Lewis River Hydroelectric Projects (USFWS and NMFS 2002), the USFWS and NMFS required FERC to alter PacifiCorp's Merwin Article 49 ramping rates to meet a limit of (1) 2 inches per hour for down-ramping or 0.5 feet per three-hour period; and (2) 1.5 feet per hour for up-ramping. Up-ramping limitations focus on public safety for those using the river below the project.

Ramping rate restrictions included in the proposed action will be similar to those recommended by the Services in their 2002 Interim Operations Biological Opinion, except that no down-ramping will be allowed from February 16 through June 15, between one hour before and one hour after sunset and one hour before and one hour after sunrise each day (crepuscular hours) since these are the times of day when juveniles are expected to be more heavily concentrated near the shoreline (Hunter 1982). A critical ramping flow will be set at 8,000 cfs (measured at the Ariel gage). Ramping criteria will be imposed at flows less than the critical flow, and no ramping restrictions will be required when flows were equal to or greater than the critical flow. In an addendum to Aquatics Study AQU 3 (PacifiCorp and Cowlitz PUD 2004: AQU 3) it was determined that a flow greater than or equal to 8,000 cfs substantially wetted gravel bars with a high potential for juvenile fish stranding.

The most widely studied biological impact associated with project down-ramping is stranding. Stranding is the separation of fish and other aquatic organisms from flowing surface water as a result of declining river stage. Stranding can occur during any drop in stage. It is not exclusively associated with substantial dewatering of a river and can occur in unregulated as well as regulated river systems. In addition to hydropower operations, stranding can occur as a result of other events, including natural declines in flow, ship wash, municipal water withdrawals, and irrigation withdrawals. In most cases, the faster the reduction in water surface elevation (or stage), the more likely fish and other aquatic organisms are to be stranded or adversely affected.

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Fish stranding associated with hydropower operations has been widely documented in the Pacific Northwest and has been documented in the Lewis River downstream of Merwin Dam. Stranding mortality can occur many miles downstream of a powerhouse, and stranding mortality is difficult or impossible to estimate. The fish species and life stage, substrate type, channel morphology, ramping rate and range, critical flow, ramping frequency, season, and time of day all affect the incidence of stranding.

Under the proposed action, PacifiCorp will incorporate the ramping regime approved by the Services in the Interim Operations Biological Opinion. In addition to these measures, no down-ramping will be allowed during the crepuscular hours. Implementing these restrictions will limit the potential for entrapment and stranding of juvenile Chinook, coho, steelhead, chum, and other aquatic organisms. The proposed action will provide a substantial reduction in fish stranding compared to the existing License Article 49 and will provide additional stranding protection over the Interim Operations Biological Opinion ramping requirements. In addition, a study will be conducted to further evaluate fish stranding potential under the proposed action, which will provide information that may lead to additional measures to minimize stranding. The potential for stranding tends to be greatest shortly after emergence, when young-of-year fish inhabit and are reluctant to leave shallow areas near channel margins. This period extends from around mid-February through mid-June in the Lewis River.

In addition to the above measures, PacifiCorp has finished mechanical upgrades to provide back-up power and additional alarms to prevent future losses of anadromous salmonids from mechanical failures. Past emergency shutdowns have de-watered the adult fish trap at Merwin Dam and a portion of downstream river channels. It was estimated that the June 1999 shutdown killed 101 adult salmonids in the Merwin trap and that the loss of juvenile salmonids downstream, due to stranding, was equivalent to 1,500 adult fall Chinook. To prevent this type of catastrophic event in the future, a series of alarms and a video system to observe the tailrace area have been installed to aid the operator to manage shutdowns. In addition, secondary and tertiary power back-up systems have been installed to allow automatic gate openings to maintain river flows.

5.1.1.4 Aquatic Habitat Enhancement Actions

Under existing conditions, Swift Creek Reservoir, Yale Lake, and Lake Merwin intercept virtually all LWD generated in upstream areas. This loss of LWD will continue to reduce the formation of isolated, low-velocity, pool-type microhabitats in the Lewis River. These habitat types are very important for rearing juvenile stream-type anadromous fish (e.g., Lower Columbia River Chinook salmon, steelhead, chum, and coho salmon). By providing a LWD collection and funding program to supplement LWD in the lower Lewis River, the proposed action will enhance both juvenile rearing habitat and adult resting habitat and will enhance habitat-forming processes throughout the life of the Licenses. This measure is expected to enhance juvenile survival, benefiting Lower Columbia River Chinook salmon, steelhead, and coho salmon populations that spawn in the Lewis River and its tributaries.

The Aquatics Fund included in the proposed action may be used to fund resource projects such as: road abandonment and restoration which will reduce fine sediment input to

tributaries and result in better spawning and incubation conditions increased macroinvertebrate production and additional cover in the substrate; strategic placement of LWD and gravel which will enhance cover and rearing conditions; and riparian restoration, including coniferous planting, bank stabilization and elimination of non-native, invasive species, all of which will improve shading, stream temperatures and future LWD input. The Aquatics Fund will also be utilized for constructed channel improvements or repairs, specific bull trout habitat improvements, and potential measures to address reservoir survival. All resource projects will be reviewed and approved by the ACC, which includes NOAA Fisheries. The proposed action also includes a measure to develop and implement a spawning gravel study downstream from Merwin Dam. Based on this study, PacifiCorp will develop and implement a spawning gravel monitoring and augmentation plan. It is likely that gravel placed in the Lewis River downstream from the Merwin Dam will be redistributed and may be transported out of the reach by hydraulic conditions that vary throughout the lower river; however, areas of suitable spawning gravel deposition will likely persist for a sufficient length of time to facilitate Chinook, coho, chum, and steelhead spawning activity. If a lack of gravel were found to be a limiting factor, this measure will enhance spawning opportunity in the Lewis River. As a result, it will provide long-term benefits to Chinook salmon, coho, chum, and steelhead salmon populations.

Northern pikeminnow are known to be primarily a predator on salmonids and can be found in large numbers in project reservoirs, bypass systems, and tailraces. Because of their preference for stillwater habitat, it is likely that northern pikeminnow occurred in the lower Lewis River basin prior to the construction of the Lewis River projects. Following the creation of substantial reservoir habitat, northern pikeminnow populations in Lake Merwin increased dramatically. In partial response to the increased northern pikeminnow population, WDFW has implemented a tiger musky program to help control the northern pikeminnow population. Tiger musky (a hybrid cross between northern pike and muskellunge) are known predators of soft-rayed fishes like salmonids and northern pikeminnow. However, northern pike are documented predators of bull trout (Schmetterling 2001) so there is reason to believe muskies will prey on bull trout and introduced salmon and steelhead.

In 1961, the population of northern pikeminnow > 20 cm in length in Lake Merwin was estimated to be about 350,000 fish (Hamilton et al. 1970). Northern pikeminnow and rainbow trout predation was believed to be the major cause of very low coho salmon survival in Lake Merwin the late 1950s and early 1960s. As a component of the proposed action, PacifiCorp will conduct a one-time study of whether predation in Lake Merwin is likely to be a limiting factor to the success of the anadromous salmonid reintroduction program. If warranted by study results, PacifiCorp may identify steps that could be undertaken to control predation. The objective of this program will be to increase the survival rate of juvenile salmonids within the project area. Northern pikeminnow predation of juvenile anadromous salmonids is a well-documented occurrence in the Columbia River basin (NPPC 1996, Tacoma 1999). Since 1990, numerous northern pikeminnow control programs have been implemented in the Columbia River. These programs have met with some success, reducing the overall rate of predation of northern pikeminnow on juvenile salmon (NPPC 1996). If predation is

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found to be limiting factor in Lake Merwin and steps are taken to reduce predator populations in Lake Merwin, salmon productivity will likely increase.

5.1.1.5 Hatchery Programs and Supplementation

Three facilities comprising the Lewis River Hatchery Complex (Lewis River, Merwin, and Speelyai hatcheries) have been releasing Chinook, coho, steelhead, and other species into the Lewis River basin for over 70 years (PacifiCorp and Cowlitz PUD 2004: AQU 18 - Appendix G). Although hatchery production and management strategies have changed over time, the ultimate goal of this program has been to provide adult resident and anadromous fish for commercial and recreation harvest (in lieu of lost natural production associated with dam construction). In general, the Lewis River Hatchery Complex has been able to meet this goal; however, hatchery practices and out-of-basin stock releases, mixed-stock fisheries, lost historical habitat, and habitat degradation have adversely affected a number of native Lewis River salmon and steelhead stocks (PacifiCorp and Cowlitz PUD 2004: AQU 18 - Appendix G).

Although hatchery production is often a successful strategy for maintaining fish runs, the release of millions of hatchery fish into a stream can negatively impact native fish populations through competition for food and space, predation, disease outbreaks, genetic alteration, and harvest. These interactions may result in the loss or reduction of wild native fish population abundance and diversity (NRC 1996; ISG 2000; Flagg, et al. 2001). While the interactions between hatchery and wild fish do occur, the relative impact of hatchery operations and releases on the long-term fitness of wild stocks is unknown and continues to be a topic hotly debated within the fisheries scientific community (HSRG 2001).

Currently, the Lewis River Hatchery Complex produces spring Chinook, early coho, late coho, summer steelhead, winter steelhead, rainbow trout, and kokanee. The facility releases approximately 4 million juvenile anadromous fish each year into stream reaches primarily located below Merwin Dam. The overall goal of the anadromous fish program is to produce 92,000 pre-harvest adults.

Under the proposed action, PacifiCorp and Cowlitz PUD will undertake a hatchery and supplementation program. The goals of the program are to support (i) self-sustaining, naturally-producing, harvestable native anadromous salmonid species throughout their historical range in the North Fork Lewis River basin, and (ii) the continued harvest of resident and native anadromous fish species. To ensure that this program is meeting the established goals, PacifiCorp and Cowlitz PUD will develop and implement a hatchery and supplementation plan to adaptively manage and guide the program. The plan will be designed to achieve the adult hatchery fish targets presented in Table 1.4-2, taking into account harvest and escapement. Production obligations will include juveniles for the supplementation program and for harvest opportunities; however, at some point in the future, a smaller number of hatchery juveniles may be needed to achieve the same number of returning adults. Anadromous fish stocks used in the reintroduction program will include a mixture of indigenous and hatchery stocks.

When the number of natural returning ocean recruits of any species exceeds the natural production threshold specified in Table 1.4-3, PacifiCorp and Cowlitz PUD will decrease the hatchery target(s) on a fish for fish (1:1) basis; however, PacifiCorp and Cowlitz PUD will not decrease the hatchery targets below a hatchery target floor (Table 1.4-3). If the number of returning ocean recruits subsequently decline, PacifiCorp and Cowlitz PUD will increase the hatchery targets on a fish for fish (1:1) basis provided that they not exceed the initial hatchery targets.

In addition to the above anadromous species, PacifiCorp and Cowlitz PUD will continue to produce up to 20,000 pounds of resident rainbow trout (800,000 juveniles with an estimated weight of 40 juvenile fish per pound) per year and stock these in Swift Creek Reservoir. They will also produce up to 12,500 pounds of resident kokanee (93,000 juveniles) to be planted in Lake Merwin. These resident fish production levels are the same as those under existing license conditions.

Under the proposed action, a reduction in hatchery anadromous fish production would be gradual and would be in response to a successful reintroduction program that establishes a trend of significant and stable natural production. The hatcheries would not be expanded but will be modernized along with improvements to the sorting facilities at the Lewis River Hatchery. Annual monitoring of wild production would be used to adjust juvenile hatchery fish production levels to achieve the pre-harvest ocean recruitment goal. Because initial hatchery production under the proposed action will be reduced on a fish for fish (1:1) basis as natural populations are restored, adverse hatchery effects such as increased predation, disease, and competition will remain a concern in the short term, and improvements will be sought through the HGMP. But for purposes of this effects analysis, to be conservative, we are assuming the effects will be similar to existing conditions. However, under the proposed action, these effects will be greatly reduced as wild production replaces hatchery production. The genetic risks associated with hatchery fish spawning in the wild or interbreeding with wild fish will also be reduced, as will predation and competition. Using native stocks (when possible) will also help reduce the genetic risks associated with hatchery fish spawning in the wild, or interbreeding with wild fish. The risk of hatchery fish transmitting diseases to wild fish will continue to be a concern as long as hatchery fish are being produced in the basin; however, lower production levels and lower rearing densities under the proposed action may reduce the incidence of disease outbreaks.

It is assumed that the wider geographic distribution of reintroduced anadromous fish will increase life history diversity, gene flow, and genetic fitness of introduced stocks. These naturally produced fish will be better adapted to the Lewis River and its tributaries and theoretically, exhibit higher smolt to adult survival rates than their hatchery counterparts. This action will also increase system productivity and the available prey base for naturally produced anadromous salmonids and bull trout in all three reaches.

Maintaining a hatchery target floor of Chinook, coho and steelhead will result in overall increase in number of fish in the basin because of increasing natural production, and it will maintain a source of locally adapted broodstock for use if natural populations suffer a catastrophic loss.

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Hatchery rainbow and kokanee will continue to be stocked at the same level as occurs under existing conditions. Presumably, the ACC will recommend rainbow trout and kokanee supplementation programs that will incorporate current scientific information in order to reduce or eliminate hatchery impacts on wild fish populations to the extent practicable.

5.1.1.6 Aquatic Monitoring and Evaluation

Under the proposed action, numerous measures will be implemented to protect and enhance salmon and steelhead populations and their habitat in the Lewis River basin. These measures include the reintroduction of spring Chinook, coho, and steelhead above Merwin, Yale and Swift dams, the construction of upstream and downstream fish passage facilities, hatchery supplementation programs, and several habitat enhancement measures. These altered environmental conditions will affect the distribution and abundance of Chinook, coho, chum, and steelhead, and other native and non-native species.

According to NPCC (2004), future monitoring and analysis of lower Columbia salmon and steelhead recovery programs is of utmost importance because, without sufficient data, it will be impossible to determine whether remedial actions are helping. Fish habitat and population monitoring is often conducted to determine if environmental measures, like those included in the proposed action, provide the desired level of protection and enhancement for target fish species and aid in the development of responsive adaptive management strategies.

Under the proposed action, PacifiCorp and Cowlitz PUD will monitor and evaluate the effectiveness of various aquatic measures including fish passage performance standards; adult anadromous salmonid migration, spawning, distribution, and abundance; water quality; hatchery supplementation programs; bull trout populations; and resident fish populations. PacifiCorp and Cowlitz PUD will prepare annual monitoring reports.

Monitoring is a necessary tool for providing data critical to adaptive management. None of the proposed Monitoring and Evaluation measures are currently being implemented. Their implementation will allow for the improvement of salmonid spawning and rearing habitat and for the long-term protection of habitat for aquatic species in the Lewis River basin. Furthermore, the proposed monitoring programs will ensure that managers have information to determine the effectiveness of the proposed aquatic measures. This monitoring information will also allow adaptive management decisions to be made to ensure the long-term persistence of listed fish species in the Lewis River basin, as well as the ability to respond to significant changes in environmental conditions.

Some adverse effects are expected during monitoring activities. These include potential injury or mortality due to handling and/or marking. Fish that enter a collection facility are subject to handling by one or more people depending on the scope of each monitoring activity. There is an immediate risk of injury or mortality due to mishandling and a potential delayed mortality due to mishandling. The number of fish subjected to this impact is expected to be small. Those same fish that survive initial handling may also be subject to tag insertion or physical clipping for identification purposes during monitoring

activities. There is an expected 1 percent loss of juveniles associated with tagging (PacifiCorp and Cowlitz PUD 2004). Adult losses due to tagging and marking are expected to be considerably less.

Summary of Proposed Aquatics Measures

Based on the conservation measures proposed in the Settlement Agreement to be implemented, current operation of the Merwin, Yale, and Swift No. 1 and Swift No. 2 hydropower projects will not impair recovery of the continued existence or recovery of any listed, proposed, or candidate species in the North Fork Lewis River project area. Such measures will (1) expand the range of listed species by providing access to approximately 174 miles of habitat (2) maintain or improve water quality, temperature, and ecological productivity in the project area; (3) protect listed species and their progeny from stranding as a result of rapid flow fluctuations; and (4) preserve and protect juvenile and adult habitat.

Overall, the Licensees believe the expected benefits of the aquatics implementation package under the Lewis River Settlement Agreement far outweigh any potential negative effects. The benefits accrue to the listed aquatic species for the following reasons:

- 1) upstream habitat is made available that the anadromous species have not had access to for over 70 years;
- 2) overall population numbers will increase over present levels due to increased production from upstream tributaries;
- 3) the habitat that currently exists will be improved through aquatic enhancement funded projects;
- 4) hatchery production will eventually decrease as success of the reintroduction program increases; and,
- 5) water quality will be maintained at the high levels that currently exist (PacifiCorp and Cowlitz PUD 2004).

These benefits and many others will contribute to the recovery process and will ensure the continuing existence of the listed species in the Lewis River basin.

5.1.1.7 Terrestrial Measures

The proposed terrestrial measures consist of providing funds to purchase and enhance wildlife mitigation lands and to develop wildlife management plans, along with effectiveness monitoring. These measures will benefit aquatic habitats to the extent that protecting upland habitat preserves watershed process that influence the aquatic environment, such as preserving natural storm water runoff patterns and reducing hill slope erosion. Therefore, the proposed terrestrial measures will likely benefit Chinook, coho, steelhead, and chum habitat in the Lewis River basin.

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5.1.1.8 Recreation Measures

Expansion and improvement of recreation facilities under the proposed action may increase human presence in several locations in the basin, increasing angling pressure in the mainstem, reservoirs, and tributary streams. Increased angling pressure has the potential to result in an increase in mortality of ESA listed salmonids. This mortality can occur through unintentional capture and release of fish that subsequently die from hooking injury or mishandling and from poaching which illegally captures and removes fish from the population. Funding three full time law enforcement officers, one of who will be a full time wildlife officer, will minimize this risk.

Construction of new recreational facilities under the proposed action has the potential to cause short-term adverse effects, such as increasing turbidity. Even though most of the recreation improvements occur on dry land, potential erosion, dust or spills may temporarily affect the aquatic environment. These effects are not expected to result in injury or death to the listed aquatic species. Although, water quality may be affected temporarily during construction, primarily through increased erosion and sedimentation, these effects can be minimized and avoided by implementing best management practices (e.g., installing silt fencing and other sediment trapping devices on land and silt curtains in water) and covering exposed soil until permanently stabilized. PacifiCorp will be required by federal, state, and county regulations to develop sediment and erosion control plans as part of the construction process. Chemical spills could also occur during construction. These spills may enter the waterways and cause temporary displacement, injury or even mortality depending on the extent of the spill but development of a pollution prevention plan in accordance with appropriate federal, state, and county requirements will minimize the effects of such an occurrence. Typically, a pollution prevention plan will specify areas for equipment maintenance and refueling, spill prevention and emergency response strategies, and requirements for keeping emergency response spill containment kits onsite and for having trained personnel present onsite during construction. PacifiCorp currently has a Spill Prevention and Containment Control (SPCC) program in place that addresses these activities.

Through the construction permitting process, plans will be developed to minimize and avoid temporary construction-related effects to the extent feasible using best management practices that are similar, but not limited to, the previously mentioned actions. No long-term negative effects on aquatic resources are anticipated to result from construction of new recreational facilities.

5.1.1.9 Cultural Resources Measures

Under the proposed action, cultural resources measures include managing and protecting historic properties and cultural resources; preserving tribal access to cultural sites; monitoring; and constructing a new visitor center in Cougar. None of these measures are anticipated to have a negative effect on ESA listed salmonids or their habitat. New facility construction of any type will avoid impacts to surface waters and habitats as described above. Effects of cultural resource measures on Chinook, coho, steelhead, and chum are anticipated to be negligible.

5.1.1.10 Socioeconomic Measures

Under the proposed action, socioeconomic measures include funding three full time law enforcement officers, one of whom will be dedicated to wildlife law enforcement; providing funding for the maintenance of Forest Road 90; and funding development of the visitor center in Cougar. Potential benefits to ESA listed salmonids from the funding of wildlife officer are discussed under the effects of recreational measures above. Funding the maintenance of Forest Road 90 will likely reduce impacts to the aquatic environment by maintaining the road in good working order, which will limit sedimentation and erosion into streams. Construction related impacts such as potential erosion, dust or spills may temporarily affect the aquatic environment. These effects are not expected to result in injury or death to the listed aquatic species. Such impacts resulting from the new visitor center in Cougar will be minimized or avoided by following best management practices as listed previously.

5.1.2 Indirect Project Effects on Anadromous Fish

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action.

Hatchery practices and fish management have the potential to affect the listed, proposed and candidate fish species. Introduction of non-native fish can negatively affect listed species by increasing competition for food, hybridization, loss of genetic fitness, and increased predation on listed species. Impacts to all listed species resulting from hatchery operations funded by the Licensees, but carried out by WDFW, are considered in this BE and are being addressed through separate consultations during the development and evaluation of specific Hatchery Genetic Management Plans.

Roads contribute more sediment to streams than any other land management activity (Gibbons and Salo 1973; Meehan and Bjornn 1991), and most of the land management activities are dependent on roads. Road-related mass soil movements can continue for decades after roads have been constructed (Furniss et al. 1991). Roads are recognized as a long term source of sediment even after erosion control measures have been implemented (Furniss et al. 1991). Removing vegetation and ditch rock can increase downstream sedimentation. Lack of adequate culvert cleaning before winter storms can result in major mass wasting and extreme sedimentation for miles downstream. Such habitat alterations can adversely affect all life-stages of fishes, including migration, spawning, incubation, emergence, and rearing (Furniss et al. 1991; Henjum et al. 1994; Rhodes et al. 1994). PacifiCorp is currently working on a road management plan to minimize the potential for detrimental effects to aquatic habitat on project lands.

Localized and dispersed recreational use within the Lewis River basin has the potential to affect ESA listed anadromous salmonids. People that use this recreational area are drawn to water and engage in activities that may adversely affect salmon and steelhead populations and habitat. Recreationists take part in a variety of activities, including camping, hiking, boating, fishing, and swimming in areas that may affect salmon and steelhead. The effects include large wood removal by recreationists for firewood, and

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changes in streambank conditions due to trampling along streams. These impacts will be addressed through the proposed improvements to recreation sites including dispersed camp sites where these types of impacts are most likely to occur.

5.1.3 Summary of Effects of the Proposed Action on the Environmental Baseline

As discussed in Section 4.1, the PFC framework baseline environmental conditions are described as “properly functioning,” “at risk,” or “not properly functioning.” If a proposed action is likely to impair properly functioning habitat (Impair), appreciably reduce the functioning of already impaired habitat (Reduce), or retard the long-term progress of impaired habitat toward PFC (Retard), it is usually be found likely to jeopardize the continued existence of the species, or adversely modify its critical habitat, or both, depending on the specific consideration of the analysis. Such considerations may include, for example, the species’ status, the condition of the environmental baseline, the particular reasons for listing the species, any new threats that have arisen since listing, and the quality of available information. Actions which do not compromise a species’ biological requirements to the degree that appreciably reduces the species’ viability and chances of survival in the action area are considered not to reduce or retard (NR). The effect of the proposed action on baseline environmental conditions (summarized from Section 4.1) is presented in Table 5.1-4. The latest proposed rule for critical habitat issued by NOAA Fisheries on November 30, 2004 does not designate habitat upstream of Merwin dam.

Even without critical habitat listing for these species upstream of Merwin dam, the proposed action is not likely to destroy, adversely affect, or adversely modify habitat of any listed, proposed, or candidate species in the North Fork Lewis River project area. These findings are made based in part on the existence of an ongoing, conservation measures currently implemented under NOAA Fisheries and USFWS’ 2002 Lewis River biological opinion that will ensure interim conservation requirements for aquatic species until a new biological opinion is issued.

Table 5.1-4. Analysis of proposed Project effects on the environmental baseline including ongoing effects from the existence of the project dams.

<i>Pathway</i> Indicators	Baseline Function	Description	Effects of Proposed Action
<i>Water Quality</i>			
Temperature	AR	Proposed action will address temperature issues in tributaries through habitat enhancement projects (note: these areas are not influenced by project operations), but temperature improvements will likely be localized. Instream flow releases ranging from 60 to 100 cfs will improve water temperature conditions in the Lewis River bypass reach	NR in tributaries, PFC in the Lewis River bypass reach
Sediment/Turbidity	NPF	The projects will continue to trap high sediment loads resulting from the Mt. St. Helens eruption (a positive effect) and will block sediment movement downstream; gravel monitoring and augmentation is expected to maintain gravel levels or increase them as appropriate.	NR, but may improve
Chemical Contamination /Nutrients	AR	Spill prevention plans will be in place to minimize and avoid contamination.	NR

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Pathway Indicators	Baseline Function	Description	Effects of Proposed Action
Dissolved Oxygen	PFC	Low DO has not been observed in the action area. The proposed action will not alter this condition.	NR
Total Dissolved Gas	AR	Through corrective action plans, the proposed action is expected to eliminate TDG exceedences in Project waters.	PFC
Habitat Access			
<u>Physical Barriers – Downstream Passage</u>	NPF	<p>The intent of proposed action is to achieve “genetically viable, self-sustaining naturally reproducing, harvestable populations above Merwin Dam that are greater than minimum viable populations.” The ODS target at Swift No. 1 is 80 percent until downstream passage is implemented at Yale, at which point ODS goal at Swift and Yale is 75 percent.</p> <p>The probability of attaining 75 to 80 percent ODS (PFC) is unknown, but facilities will be designed to meet this target and activities will be ongoing during the term of the new licenses to meet the ODS targets and overall goal of producing self-sustaining anadromous fish populations upstream of Merwin Dam. PFC conditions of 75 to 80 percent ODS may not be reached in the near-term and therefore passage at project facilities should be considered AR until ODS can be monitored and evaluated during the year 27 and 37 status checks.</p>	Will improve to AR, may improve to PFC
<u>Upstream Passage</u>	NPF	Under the proposed action, Licensees will use safe, timely and effective methods to collect upstream migrants. Probability of attaining 99.5% adult upstream passage survival is very high based on the best available technology and survival noted at other facilities in the Pacific Northwest.	PFC
Habitat Elements			
Substrate	AR	Under the proposed action, gravel monitoring and augmentation is expected to maintain gravel levels or increase them as appropriate.	NR, but may improve.
Large Woody Debris	NPF	Under proposed action, LWD will be stockpiled and the Licensees will make funding available to entities for LWD projects in the lower Lewis River and its tributaries below Merwin Dam.	NR, but may improve.
Pool Frequency and Quality	NPF	Habitat enhancement measures under the proposed action may improve the condition of pool frequency and quality. Because such improvements cannot be quantified at this time, this analysis makes a conservative assumption that the proposed action will not appreciably change pool conditions.	NR, but may improve.
Off-Channel Habitat	NPF	Habitat enhancement measures under the proposed action may improve the condition of off-channel habitat. Because such improvements cannot be quantified at this time, this analysis makes a conservative assumption that the proposed action will not appreciably change off-channel habitat conditions.	NR, but may improve
Channel Conditions and Dynamics			
Width/Depth Ratio	AR	Reservoirs inundate riverine habitat and reduced peak flows from the projects, limiting pool formation below Merwin Dam. These effects will continue under the	NR, but may improve

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<i>Pathway</i> Indicators	Baseline Function	Description	Effects of Proposed Action
		proposed action. However, pools from LWD projects may be funded under the Proposed projects, which may offset these effects to some degree. Conservatively, it's assumed that the proposed action will not degrade pool quality, but will also not appreciably enhance pool quality by placement of LWD.	
Streambank Condition	NPF	Habitat enhancement funds may be used to improve streambank condition. Because such improvements cannot be quantified at this time, this analysis makes a conservative assumption that the proposed action will not appreciably change streambank conditions.	NR, but may improve
Floodplain Connectivity	NPF	Dikes prevent connection to lower river floodplain (non-project effects). Habitat enhancement funds may be used to improve off-channel habitat by conducting dike set-back projects. Because such improvements cannot be quantified at this time, this analysis makes a conservative assumption that the proposed action will not appreciably change floodplain connectivity.	NR, but may improve
Flow/Hydrology			
Change in Peak Flow	NPF	Under the proposed action, the lower Lewis River hydrology will continue to be affected by seasonal reservoir drafting and refilling, and flood management operations; peaks that remain are lower. However, high flows greater than 50,000 cfs (base flow of approx. 6,000 cfs)	NR
Change in Base Flow	NPF	Under the proposed action, lower Lewis River hydrology will continue to be affected by seasonal reservoir drafting and refilling, and flood control operations; summer base flow will remain higher than historic flows.	NR
Change in River Stage (Ramping)	AR	Changes in river stage from project operations can result in fish stranding below Merwin, but limiting down ramping to 2 inches per hour and up-ramping to 1.5 feet per hour consistent with the interim biological opinion, and no ramping will be allowed between 1 hour before and after the sunrise and sunset in the winter and spring in order to minimize the potential for fish stranding. Implement stranding study under the proposed action and identify additional stranding measures if needed.	NR, but may improve
Watershed Conditions			
Road Density and Location	NPF	Implementation of Road Maintenance and Abandonment Plan on utility-owned lands is expected to reduce road density, habitat fragmentation and sediment inputs; however, utility roads comprise a small amount of the overall roads affecting density and location parameters. Conservatively we estimate no change from baseline conditions, but there is a potential to reduce road densities on Project lands.	NR, but may improve
Riparian Reserves	NPF	Through terrestrial habitat enhancement funds, late-successional forest stands may be preserved. Because such improvements cannot be quantified at this time, this analysis makes a conservative assumption that the proposed action will not appreciably change the amount of late successional forest habitat.	NR, but may improve

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

As described in Section 4.1, Merwin, Yale and Swift dams are complete barriers to upstream and downstream migration and, as a result, Chinook, coho, steelhead, and chum have been extirpated from historical habitat located above Merwin Dam. The physical barriers baseline function is therefore rated as NPF. The fish passage facility measures included on the proposed action and the reintroduction of anadromous fish to habitat locate above Merwin Dam will, if they achieve their targets, result in PFC upstream and downstream fish passage conditions. Even if those targets are not achieved, however, we expect that making habitat above the dams available to listed anadromous fish will assist in their long-term recovery.

Reestablishing self-sustaining, naturally reproducing populations of anadromous fish above Merwin Dam depends on the efficacy of the upstream and downstream fish passage measures. To achieve target recovery goals, the Services have determined that overall downstream survival (ODS) past the project facilities should be greater than 75 percent. However, this required ODS is based on untested habitat-based EDT estimates of production potential in the Lewis River above Merwin Dam. Therefore, the ODS necessary to achieve self-sustaining populations of anadromous salmonids upstream of Merwin Dam is based on model output and is assumed to be PFC if ODS meets or exceeds 75 to 80 percent. If NOAA Fisheries determines that fall chinook should be introduced into the upper watershed we expect that ODS for fall chinook will be difficult to achieve with the presence of fry less than 100 mm.

Under the proposed action, ODS will be monitored and evaluated to determine if targets are being met, and to determine whether or not the reintroduced anadromous salmonid populations upstream of Merwin Dam are meeting the performance objective of a "genetically viable, self-sustaining naturally reproducing, harvestable populations above Merwin Dam that are greater than minimum viable populations." This process is important since achieving an ODS of 75 to 80 percent may be optimistic based on observed downstream survival and collection efficiencies at other hydropower projects, such as the Baker River Project (see section 5.1.1.2). It is important to recognize that natural self-sustaining anadromous salmonid populations may be achievable with ODS values less than these targets, depending on the natural production levels actually realized upstream of Merwin Dam. For example, if production is higher than estimated by EDT modeling, then an ODS value less than the target may lead to reaching recovery abundance goals. As stated previously, it is important to note that the actual production potential of the habitat upstream of Merwin Dam is unknown, and although downstream passage facilities will be designed to attain the ODS performance targets, the actual ODS will be estimated through monitoring of the reintroduction program. Moreover, even if ODS target numbers are not achieved, we expect that proposed downstream fish passage efforts will assist listed anadromous fish in their long-term recovery.

Under the proposed action, Licensees will use safe, timely and effective methods to collect and transport upstream migrants past Merwin, Yale and Swift dams. The proposed action establishes that upstream transportation survival will be at least 99.5 percent. Based on the best available technology and survival noted at other facilities in the Pacific Northwest, such as at Baker River and Cowlitz River projects, the probability of achieving this target is high.

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Water management to maximize power production and manage floods will continue to negatively affect fish and fish habitat downstream from Merwin Dam through unnatural stream flow conditions (e.g., seasonal flow reductions and increases, and flow fluctuations). However, through measures taken to improve flow related habitat functions (e.g., minimum flows and ramping rate restrictions), those effects will be minimized. Increasing minimum spawning and incubation flows, and reducing ramping rates can increase juvenile salmon survival and salmon spawner abundance downstream of hydropower projects (Connor and Pflug 2004). Available information suggests that those improvements will not retard a return to PFC or reduce the functioning of currently impaired habitat downstream of Merwin Dam. This conclusion is based in part on the adaptive management program, which will help identify any inadequacy and define appropriate remedial actions. Through these actions, the negative effects of hydrologic alteration under the proposed action will not retard the return of important downstream habitats to PFC.

Gravel monitoring and augmentation and the LWD stockpile and funding program will offset effects of the projects blocking transport of substrate and LWD, and the resulting effects on habitat elements (substrate, LWD, pool frequency and quality, off-channel habitat) and channel morphology. It is unlikely that the function of already impaired habitat below the projects will be reduced through the implementation of these programs. If the programs were successful, some improvement in habitat condition downstream of Merwin Dam will be achieved, improving the chances of the habitat returning to PFC (NR).

There may be temporary negative effects from construction activities and fish habitat improvement projects, but these effects will be minimized and/or avoided by implementing project specific best management practices that will be identified by agencies such as WDOE, WDFW, and the ACOE through the construction permitting process.

Through corrective action plans, the proposed action is expected to eliminate TDG exceedences in Project waters, returning TDG conditions to PFC. The proposed action will not retard the return of other important water quality parameters to PFC.

5.1.4 Cumulative Effects on Anadromous Fish

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." Future Federal actions, including the ongoing operation of hatcheries, fisheries, and land management activities, are not considered within the category of cumulative effects for ESA purposes because they require separate consultations pursuant to Section 7 of the ESA, after which they are considered part of the environmental baseline for future section 7 consultations. The area of cumulative effects analysis for the proposed action is the action area, which is defined in Section 1.4.1 as the Lewis River basin from its headwaters downstream to its confluence with the Columbia River. Potential cumulative effects including urban and rural development, timber harvest on private and public lands, exotic fish transplants, road building on

private forest lands, and increased fish harvest do exist and are likely to have an effect on the future recovery of listed species.

Expansion of the local economy and diversification will likely contribute to population growth. This growth will likely result in increased demand for electricity, water, and buildable land in the action area which will, in turn, increase demand for transportation, communication and other social infrastructure. These actions will affect habitat features such as water quality and quantity which will directly affect the listed aquatic species. The Total Maximum Daily Load (TMDL) process, administered by the Washington Department of Ecology (WDOE), will help alleviate some of the daily fluctuation in water quality.

6.0 CONCLUSION

6.1 ESA DETERMINATION OF EFFECTS

6.1.1 Background

The primary objective of this BE is to determine of effects that the proposed action will have on ESA listed Chinook, steelhead, chum and coho salmon. This determination will be used by FERC and NOAA Fisheries to determine whether the proposed action is likely to jeopardize the continued existence of the listed species or to adversely modify their critical habitats (if applicable). To facilitate and standardize the determination of effects for ESA consultations, NOAA Fisheries use the following definitions for listed species (USFWS and NMFS 1998):

No effect: This determination is only appropriate "if the proposed action will literally have no effect whatsoever on the species and/or critical habitat, not a small effect or an effect that is unlikely to occur." Furthermore, actions that result in a "beneficial effect" do not qualify as a no-effect determination.

May affect, not likely to adversely affect: *The appropriate conclusion when effects on the species or critical habitat are expected to be beneficial, discountable, or insignificant. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat.*

May affect, likely to adversely affect: The appropriate conclusion when there is "more than a negligible potential to have adverse effects on the species or critical habitat." In the event the overall effect of the proposed action is beneficial to the listed species or critical habitat, but may also cause some adverse effects to individuals of the listed species or segments of the critical habitat, then the proposed action "is likely to adversely affect" the listed species or critical habitat. It is not possible for NOAA Fisheries to concur on a "not likely to adversely affect" determination if the proposed action will cause harm to the listed species.

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6.1.2 Determination of Effects

Implementation of the measures included in the proposed action will be beneficial to listed Chinook, steelhead, and chum salmon in the Lewis River by providing access to historical habitat located upstream of Merwin Dam, improving flow conditions and reducing ramping rates below Merwin Dam, and increasing habitat protection and enhancement over existing conditions. Studies and ongoing monitoring activities (i.e. fish passage efficiency and trap efficiency; adult anadromous salmonid migration, spawning, distribution, and abundance; water quality; and hatchery supplementation programs) also will ensure that these measures achieve their original objectives. As summarized in Section 5.1.3, the proposed action will not likely reduce the functioning of already impaired habitat or retard the progress of impaired habitat towards properly functioning conditions. The proposed action will likely result in properly functioning conditions for TDG and adult upstream passage, and will likely improve downstream fish passage over existing conditions, possibly to the level of properly functioning conditions.

While the overall effect of the proposed action will likely be beneficial to the listed species and their habitat, the risk of incidental adverse effect to individual fish cannot be entirely eliminated. For example, the potential for entrainment cannot be completely eliminated at the projects and some small level of Chinook, coho, steelhead and chum salmon handling mortality is unavoidable under any fish passage facility scenario. Other take examples may include juvenile harm or mortality caused by stranding below Merwin Dam and delay or injury during adult and juvenile passage at the Project dams. Future construction activities (e.g., juvenile collectors, etc.) may also cause short-term impacts including, but not limited to, disruption to the waterway and introduction of sediment and other materials. Therefore, in accordance with definitions contained in the USFWS and NMFS (1998), although the proposed action will have an overall net benefit compared to current conditions, the Project operations under the proposed action are "likely to adversely affect" listed Lower Columbia River Chinook, Lower Columbia River steelhead, and Columbia River chum salmon. The proposed action will have a similar adverse affect on individual Lower Columbia River coho. However, the proposed action will minimize these project effects and provide substantial benefits for Lower Columbia River coho in the long term. Based on these determinations, formal Section 7 consultation between FERC and NOAA Fisheries is required to ensure that the proposed action is not likely to jeopardize the continued existence of these listed species.

6.2 MAGNUSON-STEVENSONS ACT

6.2.1 Background

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

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH.

- NOAA Fisheries must provide conservation recommendations for any Federal or State action that would adversely affect EFH.
- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries' EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. 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 that 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 NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and uplope activities.

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

6.2.2 Identification of EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Federally-managed Pacific salmon: Chinook, coho, and Puget Sound pink salmon (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 man-made barriers (PFMC 1999), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). The Lewis River basin included EFH for Chinook and coho salmon. 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.

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6.2.3 Proposed Action

The proposed action and action area are detailed above in Section 1.4 of this BE. The action area includes habitats that have been designated as EFH for various life-history stages of Chinook and coho salmon.

6.2.4 Effects of Proposed Action

As summarized in Section 5.1.3, the proposed action will not likely reduce the functioning of already impaired habitat or retard the progress of impaired habitat towards properly functioning conditions. The proposed action will likely result in properly functioning conditions for TDG and adult upstream passage, and will improve downstream fish passage over existing conditions, possibly to the level of properly functioning conditions. However, regulated flows will continue to have some adverse impacts on aquatic habitat, but will be offset by measures, such as the LWD stockpile and funding program and the gravel monitoring and augmentation plan. The amount of Chinook and coho riverine habitat that will remain lost as a result of inundation by Project reservoirs is believed to be small relative to the available habitat upstream of Merwin Dam that will be accessible to Chinook and steelhead through the reintroduction program.

6.2.5 Conclusion

PacifiCorp and Cowlitz PUD conclude that the proposed action will adversely affect designated EFH for Chinook and coho salmon, but that the proposed action will minimize such adverse effects to such EFH.

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APPENDIX A

SPECIES LIST PROVIDED BY NOAA FISHERIES

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
525 NE Oregon Street
PORTLAND, OREGON 97232-2737

November 10, 2004

Frank C. Shrier
Lead Aquatic Scientist
Lead Licensing Project Manager
PacifiCorp
825 NE Multnomah
Portland, OR 97232

RE: Endangered Species Act Species List for the Lewis River FERC Relicensing Project
Settlement Agreement

Dear Mr. Shrier:

This letter responds to your May 12, 2004, letter to Bob Lohn, National Marine Fisheries Service's (NOAA Fisheries) Regional Administrator, requesting identification of Endangered Species Act (ESA) listed species under NOAA Fisheries' jurisdiction in the Lewis River Basin. Further information on these species can be obtained at <http://www.nwr.noaa.gov/>.

Available information shows that the following three anadromous fish species listed under the ESA are present in or historically occupied the Lewis River Basin (the proposed action area).

- Lower Columbia River chinook salmon (*Oncorhynchus tshawytscha*; listed as threatened on March 24, 1999 [64 FR 14308]; proposed as threatened June 14, 2004 [69 FR 33102], in response to Judge Michael R. Hogan's September 12, 2001, order in *Alsea Valley Alliance v Evans*)
- Lower Columbia River steelhead (*O. mykiss*; listed as threatened on March 19, 1998 [63 FR 13347]; proposed as threatened June 14, 2004 [69 FR 33102], in response to Judge Michael R. Hogan's September 12, 2001, order in *Alsea Valley Alliance v Evans*)
- Columbia River chum salmon (*O. keta*; listed as threatened on March 25, 1999 [64 FR 14508]; proposed as threatened June 14, 2004 [69 FR 33102], in response to Judge Michael R. Hogan's September 12, 2001, order in *Alsea Valley Alliance v Evans*)

The following proposed species is present in the project area.

- Lower Columbia River coho salmon (*O. kisutch*; proposed as threatened on June 14, 2004 [69 FR 33102])



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Please refer to the ESA Section 7 implementing regulations, 50 CFR Part 402, for information on the conference and consultation process. If you have any questions or comments, please contact Michelle Day of my staff at 503-736-4734.

Sincerely,



Keith Kirkendall, Chief
FERC & Water Diversions Branch
Hydropower Division