COVER SHEET

FEDERAL ENERGY REGULATORY COMMISSION

FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR THE LEWIS RIVER PROJECTS
Docket Nos. P-2071-000, et al.

Section 3
Environmental Consequences
Pages 3-1 to 3-196
FEIS

3.0 ENVIRONMENTAL CONSEQUENCES

In this section, we first describe the general environmental setting in the vicinity of the projects and any environmental resources that could be cumulatively affected by relicensing the Lewis River Projects. Then, we address each affected environmental resource. For each resource, we first describe the affected environment—the existing condition and the baseline against which to measure the effects of the proposed projects and any alternative actions—and then the environmental effects of the proposed projects, including proposed enhancement measures. Our final recommendations regarding each resource are found in section 5.1, *Comprehensive Development and Recommended Alternative*. Unless otherwise stated, information in the following sections is from the PDEA and the supplemental PDEA for the four projects (PacifiCorp, 2004a; Cowlitz PUD and PacifiCorp, 2004).

3.1 GENERAL DESCRIPTION OF THE LEWIS RIVER BASIN

The Lewis River is a tributary of the Columbia River in southwest Washington, with a drainage area of 1,050 square miles. The North Fork Lewis River originates in the Cascade Range of the GPNF and flows westward about 93 miles, joining the Columbia River near Woodland, Washington (see figure 2.1.1-1). Two volcanic peaks, Mount Adams and the recently active Mount St. Helens, lie on the northern and eastern extremities of the basin. Mount St. Helens is about 9 miles to the north of Swift dam. Foothills in the central portion of the watershed are generally steep and forested and extend up to approximately 3,000 feet msl. From upstream to downstream, the projects include Swift No. 1, Swift No. 2, Yale, and Merwin. Downstream of Merwin dam, the Lewis River enters a terrain of rolling hills that eventually transition to the essentially flat woodland bottoms near the river's confluence with the Columbia River. Forested areas are dominated by conifer, including Douglas-fir and western hemlock forest types. Upland deciduous and mixed conifer-deciduous forests also occur in the watershed.

The Lewis River Basin has the predominantly temperate marine climate typical of the Pacific Northwest. A narrow range of temperatures, dry summers, and mild but rainy winters are typical. Terrain influences the rainfall and temperature patterns, with lower elevations experiencing warmer temperatures and less rainfall and higher elevations receiving more rain, snow, and cooler temperatures.

Average annual precipitation near the mouth of the watershed is 37 inches, while average annual precipitation on Mount Adams exceeds 140 inches. Snowfall is minimal at lower elevations but greater than 200 inches/year at elevations over 3,000 feet. In the warmest summer months, afternoon temperatures range from the middle 70s to the lower 80s degree Fahrenheit (ºF), with nighttime temperatures in the 50sºF. Maximum temperatures exceed 90ºF on 5 to 15 days each summer. Temperatures in the foothills and higher elevations are slightly lower than those recorded in the valleys.

3.2 CUMULATIVELY AFFECTED RESOURCES

According to the Council on Environmental Quality's regulations for implementing NEPA (§1508.7), a cumulative effect is the effect on the environment that results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time to include hydropower and other land and water development activities.

We evaluate the cumulative effects of the proposed action and other recommended measures with regard to other existing and foreseeable development on the Lewis River upstream and downstream from the projects.

Based on information in the PacifiCorp and Cowlitz PUD license applications, PDEA, supplemental PDEA, agency comments, other filings by the applicants on the projects, comments from the scoping process, and our analysis, geology and soils, water quality and quantity, aquatic resources, terrestrial resources, and recreational resources could be affected in a cumulative manner by the continued operation of the Lewis River Projects in combination with other activities in the Lewis River Basin. The following non-project activities were considered in the cumulative effects analyses:

- Timber harvest on non-project lands
- Recreation activities on non-project lands
- Land development in Woodland
- Land development in rural areas
- Proposed Mount St. Helens loop road
- Ocean and river harvest of fish
- Hunting
- Management of ESA-listed species (e.g., northern spotted owl and various fish species)
- Collection of botanical resources important to Native Americans
- Anticipated population growth in the region.

We used the resource areas to determine the geographic and temporal scope of the draft EIS analysis.

3.2.1 Geographic Scope

The geographic scope of analysis for cumulatively affected resources is defined by the physical limits or boundaries of (1) the Lewis River Projects' effects on the resources;

and (2) the contributing effects from other activities within the Lewis River watershed or the surrounding socioeconomic area. Because a proposed action may affect some resources differently, the spatial scope of analysis may vary slightly as noted within each resource area, but is generally considered to be the Lewis River watershed upstream from the confluence with the Columbia River.

3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis includes past, present, and future actions and their possible cumulative effects on each resource. Based on the potential license term, the temporal scope looks 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion, by necessity, is limited to the amount of available information for each resource, and existing conditions are the baseline for comparison of alternatives.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

3.3.1 Geology and Soils

3.3.1.1 Affected Environment

The Lewis River watershed is underlain by primarily volcanic rocks that have been sculpted by subsequent glaciation, recent volcanic activity, and stream processes. Bedrock is comprised of Eocene-Oligocene basaltic-andesite lava flows, Oligocene volcaniclastic rocks, and Quaternary volcaniclastic deposits. This is a geologically active watershed, shaped by several large-scale geomorphic processes active during the Holocene (past 10,000 years). The most obvious of these processes is the active volcanism from Mount St. Helens, Mount Adams, and the Indian Heaven volcanic field. There are three main types of volcanic activity that have had a major effect on the watershed: lava flows, debris avalanche/lahars, and tephra (ash) falls.

Lava flows are probably the least common of the three and have most often affected smaller, localized areas near the volcanic vents. Debris avalanches, mudflows, and lahars are more common on Mount St. Helens and Mount Adams. They 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, emptying nearly 18 million cubic yards of water, mud, and debris into Swift Creek reservoir. These types of features have the ability to alter the streambed and valley characteristics of affected drainages in a matter of hours, and result in long-term contributions of very high sediment load that alters 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 wiped out and is slowly recovering as sediment loads decrease with time.

Tephra, ash, and/or pumice falls are the most common and widespread volcanic activity originating from Mount St. Helens and Mount Adams. Thick deposits of tephra can reduce infiltration rates and increase erosion rates. This results in an increase in sediment laden runoff which, over time can affect the hydrologic properties of the streams, rivers and reservoirs. Seven to eight tephra deposits (including the 1980 eruption) from Mount St. Helens have occurred over the past 10,000 years.

Alpine glacial activity has sculpted the tributary and mainstem valleys of the Lewis River in the past, and is still active to a smaller extent on the tops of Mount Adams and Mount St. Helens. Streams with a large percent of flow from glacial melt carry heavy loads of both fine-grained sediment and bedload, resulting in high summer turbidities and braided, shifting channels. Past alpine glacial activity has shaped the upper valleys of these same creeks into U-shaped troughs with steep sidewalls. Timber harvesting and the construction of timber hauling roads throughout the watershed has destabilized soils historically part of the forest environment. Together, the glacial activity and more recent timber harvesting have created areas where mass wasting, or landslides are now active.

Soils in the Lewis River watershed are generally deep and moderately well drained, and reflective of the volcanic rocks, glacial deposits, or alluvial terraces upon which they formed. Most soils have a moderate erosion potential, but soils on steeper slopes or those formed from unconsolidated ash or mudflow deposits have a high erosion potential.

Areas around most project facilities and reservoir shorelines are stable and not subject to erosion or landslides, with a few exceptions. Mapping of reservoir shorelines showed that 54 to 79 percent of the reservoir shorelines had only minor ongoing erosion, with bank heights of 0 to 5 feet (table 3.3.1-1). An additional 4 percent of the Yale shoreline and 24 to 27 percent of the Merwin and Swift shorelines had bank heights of 5-10 feet. Approximately 11 to 18 percent of each reservoir had bank heights over 10 feet high. The majority of the high banks are located in areas of Quaternary volcaniclastic deposits, relatively young, unstable volcanic mudflow deposits. These deposits are subject to undercutting by wave erosion and form steep cliffs on faces exposed to wave action. There is relatively little landsliding along reservoir shorelines.

Table 3.3.1-1. Summary of reservoir shoreline bank heights. (Source: PacifiCorp and Cowlitz PUD, 2004a)

	Total Miles and Percent of Shoreline in Each Category		
Bank height in feet	**Merwin**	**Yale**	**Swift**
Developed shoreline	1.3 mi. (5%)	0.0 mi. (0%)	0.0 mi. (0%)
0-5	13.6 mi. (54%)	19.9 mi. (79%)	20.0 mi. (59%)
5-10	6.0 mi. (24%)	1.1 mi. (4%)	9.3 mi. (27%)
10-20	4.4 mi. (18%)	4.1 mi. (17%)	3.7 mi. (11%)
20-60	0.0 mi. (0%)	0.0 mi. (0%)	0.9 mi. (3%)

In general, turbidity levels, which provide a measure of sedimentation due to erosion, are very low throughout the project-influenced reaches of the Lewis River. PacifiCorp and Cowlitz PUD sampled the various project reaches and reservoirs monthly over the 1999-2000 year. Total suspended solids and total dissolved solids, other indicators of sedimentation, were not measured during the sampling program. Sampling results from 1999 and 2000 indicate that turbidity levels at mainstem sites was generally low during the summer months (1-4 nephelometric turbidity units [NTUs]), and comparatively high with the onset of fall rains from November through January. Values at the Swift reservoir inflow were 18 and 33 NTUs in November and December, respectively.

Turbidity in Lewis River tributaries ranged from less than 0.25 to 12 NTUs, with the mean of most readings below 2 NTUs. The maximum of 12 NTUs was recorded in December at the Pine Creek mouth near the top of Swift reservoir. Turbidity readings from hatchery effluent followed a similar pattern with all readings below 4 NTUs.

3.3.1.2 Environmental Effects

The primary project effect on geology and soils is erosion, which can affect water quality, aquatic habitat, and in some cases, terrestrial resources. Because the majority of areas around project facilities are stable and not subject to erosion, continued operation would have little effect on shorelines in the immediate vicinity of these facilities. This operation, however, would slowly erode shorelines in susceptible areas elsewhere in the reservoirs, with the consequent loss of some upland habitat and the addition of sediment to the reservoirs. Although minor erosion may continue to occur in some locations in the reservoirs, no issues specific to geology and soil resources were raised during the NEPA scoping process. We, however, have identified one issue related to the construction of environmental enhancement measures under the proposed action.

Construction Activities

The applicants have proposed to develop new upstream and downstream fish passage facilities at Merwin, Yale, and above Yale Lake (assumed to be at Swift No. 2 tailrace), with a "footprint" of 3.75 acres, as well as upgrade existing hatchery sites; improve approximately 1,200 linear feet of the channel in the Lewis River bypassed reach; and develop 25.4 acres of additional recreation facilities. Erosion control plans would be developed for each facility prior to construction, and measures to minimize and contain eroded soil would be implemented during all construction. In addition, disturbed areas would be revegetated and/or stabilized following construction.

Our Analysis

Construction of new project facilities as proposed would increase the amount of disturbed soils in the project vicinity, potentially increasing the amount of erosion or sediment loading into project waters. With the development and implementation of erosion control plans, it is anticipated that there would only be minor amounts of erosion during and following construction activities, assuming adequate protective measures are implemented. The revegetation of disturbed areas following construction would further decrease the amount of loose soils available to erode and enter the reservoirs. Development and adherence to revegetation guidelines and use of species appropriate vegetation would further protect the soil, water quality and upland habitat.

Other Settlement Provisions

The SA was developed primarily as a means to protect and enhance aquatic, recreational, and socioeconomic resources while also meeting the projects' primary purpose of generating electricity. Provisions agreed to within the settlement, although designed primarily for other resource areas would also provide secondary effects on the geology and soils resources within the Lewis River Basin. These provisions include the Aquatics Fund, the Aquatics Monitoring Program, and the FR 90 Maintenance Cost Sharing measure (see sections 3.3.3 and 3.3.4 for more details on these measures).

Our Analysis

The establishment of the $5.72 million Lewis River Aquatics Fund to support resource protection measures would enhance and improve wetlands, riparian and riverine habitat. These improvements would provide additional benefits to riparian and riverine bank stability reducing the rates of soil erosion and sediment entering the project waters from these sources. The enhanced wetlands would also act as sediment traps, further protecting the soil resources and water quality. These benefits would occur to the shoreline areas where the funds are directly applied.

Adherence to the Aquatics Monitoring Program, and specifically the water quality monitoring plan as agreed upon in the SA would provide additional benefit to the soil resources. The monitoring plan would likely include testing for TDS, TSS, and Secchi

depth, parameters that describe water clarity, which can be related to erosion and sedimentation processes. The monitoring plan is part of the larger adaptive management strategy adopted within the SA and could help identify areas where land uses or policies need adjustment to protect the soil, water quality and terrestrial resources.

The FR 90 Maintenance Cost Sharing measure originated as a means to maintain a sufficient budget for upkeep of the road at a time when Forest Service revenues from timber harvesting in the upper basin are decreasing, yet the road continues to receive project related use (access to project facilities and recreational use of project waters and areas of Mt. St. Helens). The soil resources would be protected by making funds available and ensuring their availability throughout the license period to provide a suitable road surface. A suitable road surface and design would stabilize the immediate top soils in the road area and would be designed to accommodate rain events properly, compared to an improperly-maintained logging road. Although this may be a minor effect, nonetheless it protects the soils and has secondary benefits to water quality and terrestrial resources.

3.3.1.3 Cumulative Effects

Erosion associated with past and continued timber harvest and development in the Lewis River Basin delivers sediment to streams in the watershed. Ongoing erosion of reservoir shorelines and erosion associated with potential new project facilities could also contribute to the sediment load in area streams and reservoirs. The combined effects of project and non-project erosion, as well as sediment input from the 1980 eruption of Mount St. Helens (a natural event), would result in continued sediment accumulation in project reservoirs, a minor loss of reservoir storage capacity, minor loss of upland habitat, and moderate adverse effects on turbidity and sediment supply. It is expected that changes in timber harvest practices, natural stabilization of Mount St. Helens deposits, and erosion control practices at any potential new project facilities would decrease quantities of sediment contributed to project streams over time, resulting in reduced cumulative effects to geology and soil resources in the future.

3.3.1.4 Unavoidable Adverse Effects

None.

3.3.2 Water Resources

3.3.2.1 Affected Environment

Water Quantity

Streams in the Lewis River watershed have flow patterns characteristic of a wet maritime climate: low flows in the late summer and early fall when little precipitation falls, and high flows during the wet winter and spring months. Streams in the upper portions of the watershed, with drainage basins at high elevations, show a marked

snowmelt runoff peak in May and June that is even higher than the winter peak. The spring snowmelt peak becomes more and more muted in streams in the lower watershed. Lower elevation streams do not show a snowmelt peak but have high flows from November through April in response to winter rains, and have very low summer flows. Flow characteristics of streams in the Lewis River watershed are shown in table 3.3.2-1 and are based on historic flows measured at USGS stream gages in the basin (see figure 2.1.1-1 for gage locations).

Table 3.3.2-1. Streamflow statistics for Lewis River stream gages. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Stream Gage (Period of record)[a]	**Drainage Area (sq mi)**	**Annual 50% Exceedance Flow (cfs)**	**Average 1-day Baseflow (cfs)**	**2-year Peak Flow (cfs)**	**Baseflow: Annual Flow Ratio**	**Peak: Annual Flow Ratio**
Lewis River near Trout Lake (upper watershed)	127	500	113	5,890	0.23	12
USGS 14213200						
(10/1/1958 - 12/7/1971)						
Lewis River above Muddy River (upper watershed)	227	917	283	9,240	0.31	10
USGS 14216000 (9/1/1927 – 9/30/2004)						
Muddy River below Clear Creek	135	620	144	6,720	0.23	11
USGS 14216500 (10/1/1927 – 9/30/2004)						
Lewis River near Amboy	665	3,050	949	33,600	0.31	11
USGS 14219500 (10/1/1910 – 4/30/1931)						

Stream Gage (Period of record)[a]	Drainage Area (sq mi)	Annual 50% Exceedance Flow (cfs)	Average 1-day Baseflow (cfs)	2-year Peak Flow (cfs)	Baseflow: Annual Flow Ratio	Peak: Annual Flow Ratio
Speelyai Creek USGS 14219800 (6/1/1959 – 9/30/2004)	12.6	56	4	1,680	0.07	30
Lewis River at Ariel USGS 14220500 (7/1/1909 – 9/30/2004)	731	3,790	767	22,000	0.20	6

[a] The period of record shown here is the start and end dates for the period of record maintained by the USGS and used in the flow analysis. Complete details are available in the Stream Flow Study WTS 2 (PacifiCorp and Cowlitz PUD, 2004a).

Baseflows for all streams studied 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 (table 3.3.2-1). The exception to this is Speelyai Creek, a small tributary to Lake Merwin that has very low baseflows (about 14 times lower than average annual flow).

Peak flows in the watershed occur in response to winter rain and rain-on-snow events between November and April. In some years, the annual peak flow at upper watershed gages occurs during the spring snowmelt season, but these peaks are lower than the large rain-on-snow events. At most gages throughout the Lewis River Basin, the 2-year peak flow is 8-12 times higher than the mean annual flow. The exception is again Speelyai Creek, which has much higher peak flows, with the 2-year peak 30 times higher than the mean annual flow, indicating a very "flashy" hydrologic regime.

Project operations affect and cause variations in reservoir water levels and flows in two stream reaches: the Lewis River bypassed reach and the Lewis River downstream of Merwin dam. The effects of current project operations on reservoir water levels and daily average stream flows were determined through analysis of observed water level and flow data for representative recent years. The effects of current flood management operations on peak flows in the Lewis River downstream of Merwin dam were analyzed using a computer model of the three-reservoir system as described below.

Reservoir Levels

Plots of actual reservoir water surface elevation data from 1997 through 2001 are shown in figures 3.3.2-1 through 3.3.2-3 for Swift, Yale, and Merwin reservoirs respectively. The graphs illustrate typical drawdown of water levels under current conditions due to flood management and power generation in the fall and winter months, and relatively stable high water levels during the summer recreation season. Swift Creek reservoir exhibits more variation between years in the winter months in relation to anticipated runoff conditions, while the reservoir is maintained at or near maximum surface elevations through the summer until fall. Yale and Merwin lakes exhibit similar trends where winter and spring surface elevations are quite variable depending on the water year, while the reservoirs are held at or near maximum pool throughout the recreation season.

Lewis River Bypassed Reach

Under current conditions, flows from the Lewis River are diverted at Swift dam into the Swift No. 2 canal and do not enter the 3.3-mile-long Lewis River bypassed reach except during spill events. Flow in the bypassed reach is a result of inflow from tributaries, groundwater, and canal seepage and spill. During high runoff conditions, when the projects are operating to manage floods in the basin or during operational emergencies, water is spilled into the reach from either the Swift dam spillway or the Swift No. 2 canal spillway, located 1.25 miles downstream of Swift dam. Flow in the Lewis River bypassed reach is very low most of the time (approximately 5 to 10 cfs measured at the former USGS gage site upstream from the canal spillway, and an estimated total of 21 cfs of accumulated groundwater and seepage at the downstream end of the reach). Flows below Ole Creek, near the downstream end of the reach, are higher as a result of inflows from the creek. Spill events occur sporadically, with spills of several thousand cfs or greater occurring every few years. The largest spill into the bypassed reach from Swift dam since the project was constructed was about 45,000 cfs in February 1996. The capacity (without flooding) of the bypassed reach channel is not reported.

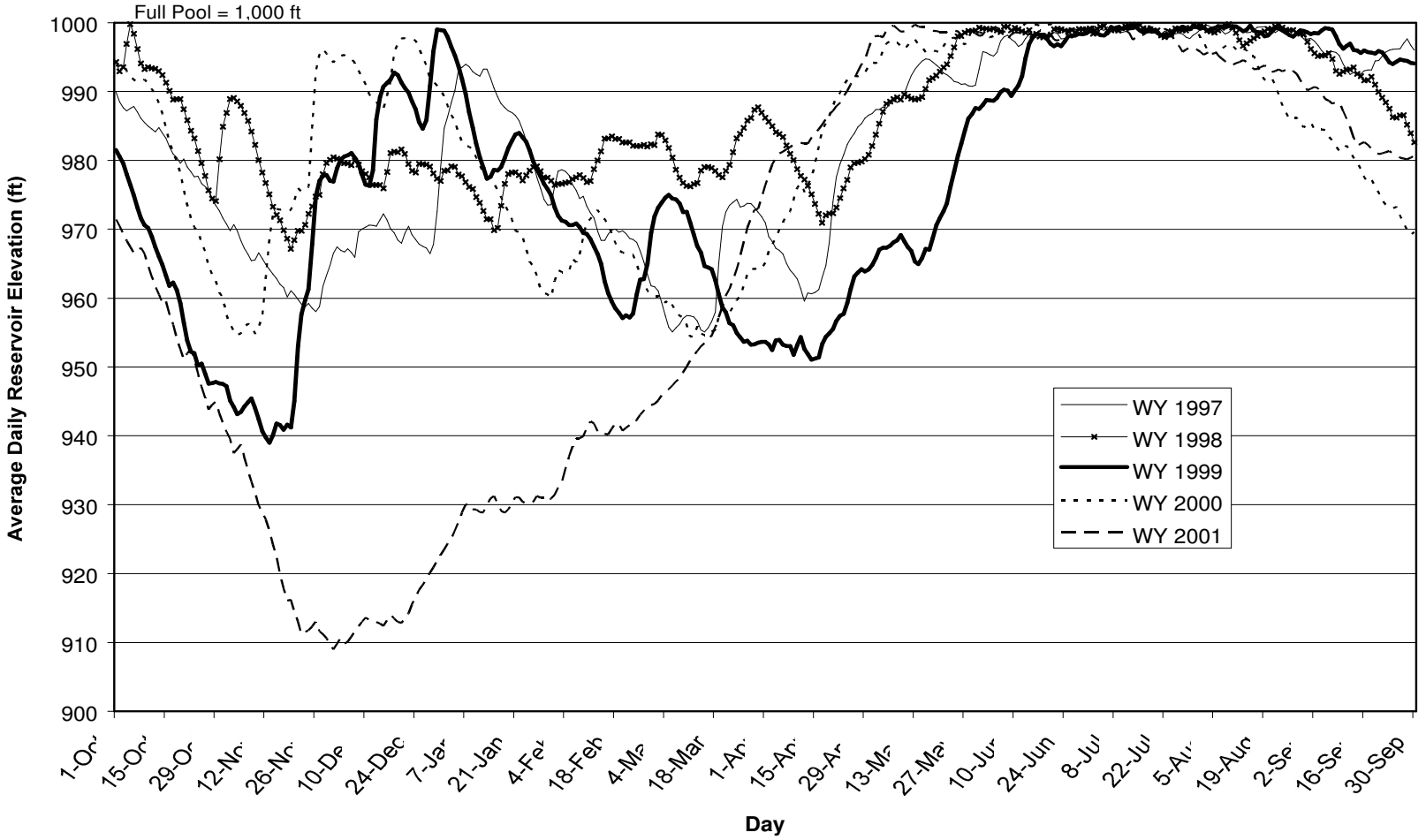

Figure 3.3.2-1. Swift Creek reservoir average daily water surface elevations, water years 1997–2001. (Source: PacifiCorp and Cowlitz PUD, 2004a)

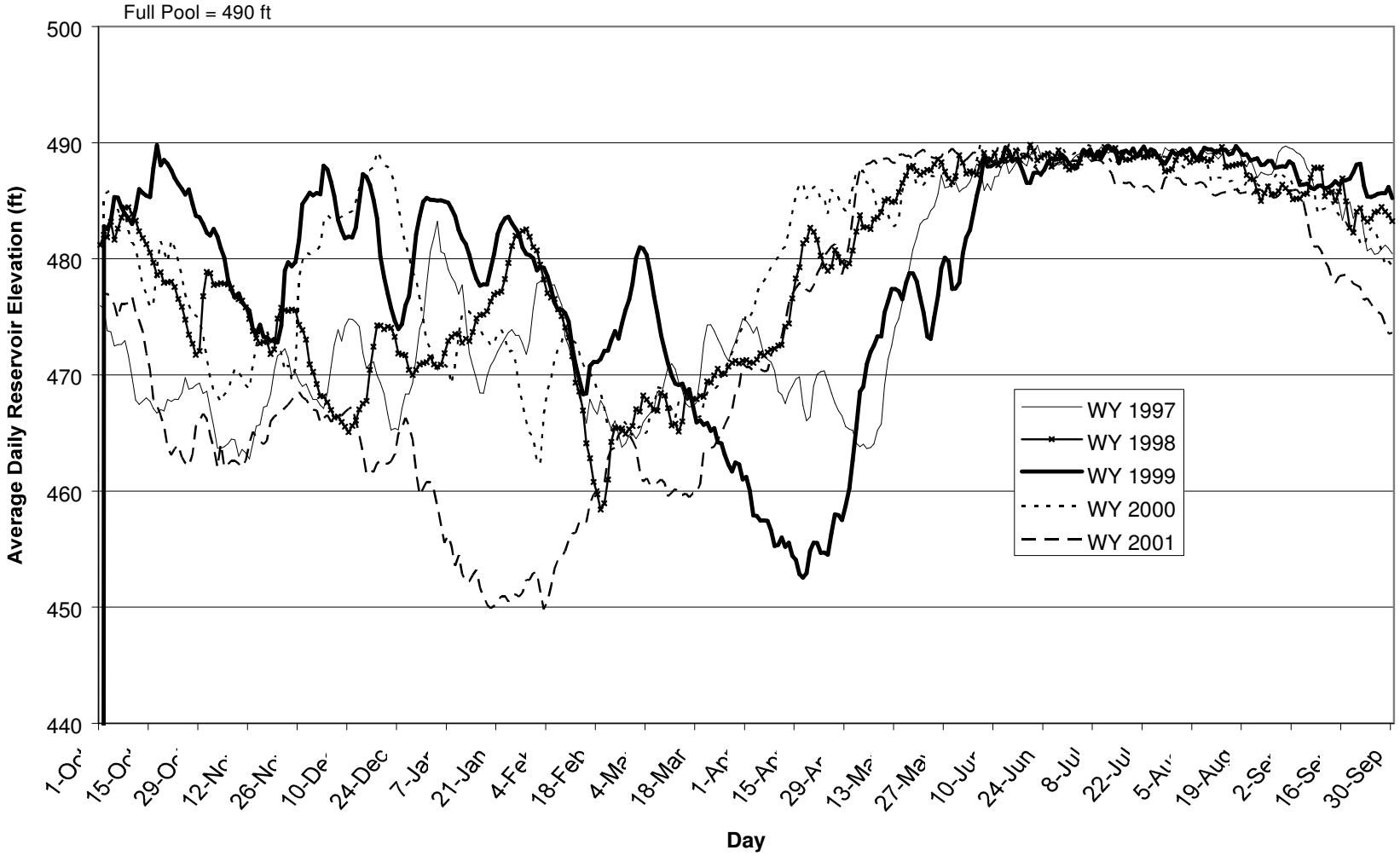

Figure 3.3.2-2. Yale Lake average daily water surface elevations, water years 1997–2001. (Source: PacifiCorp and Cowlitz PUD, 2004a)

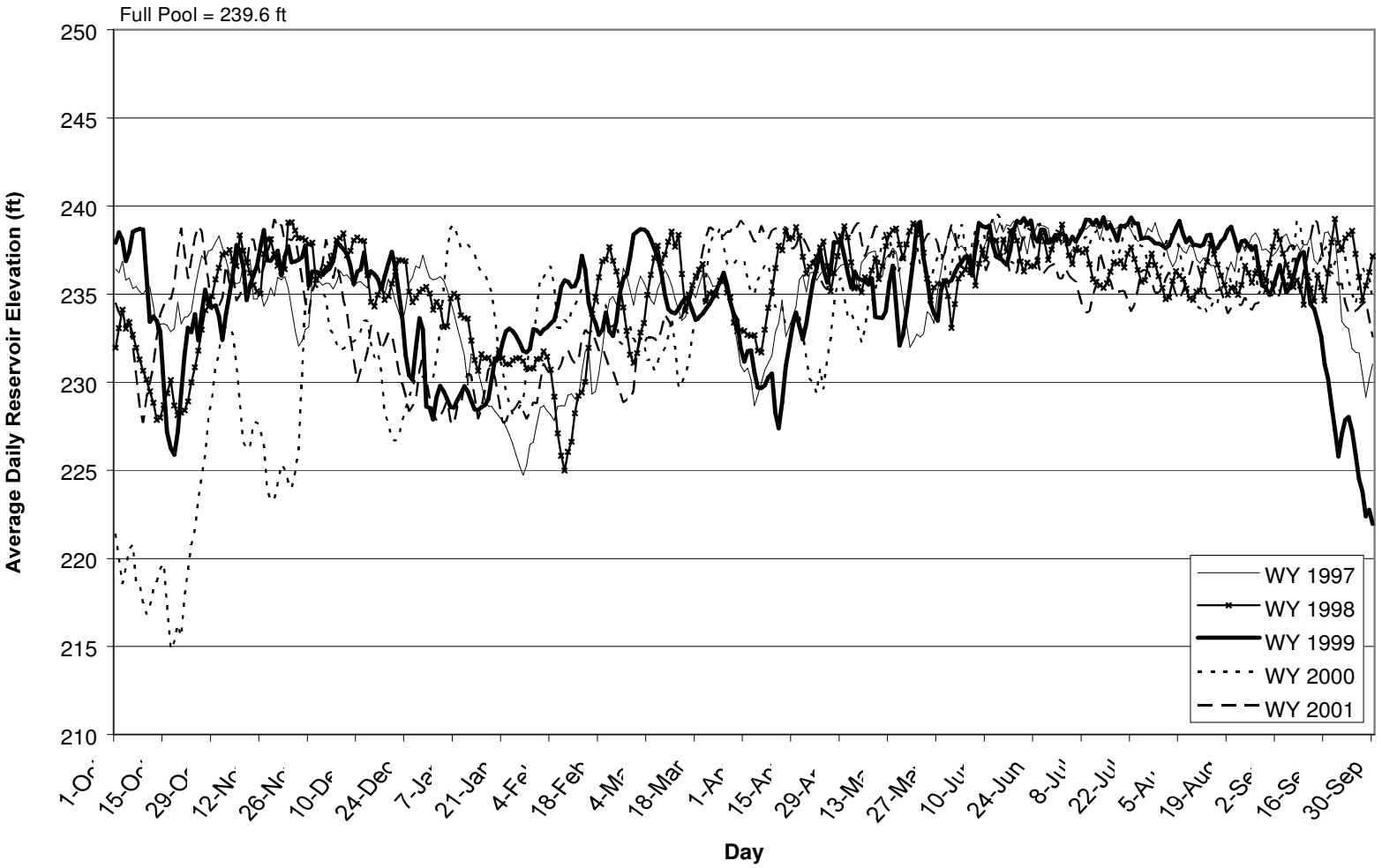

Figure 3.3.2-3. Lake Merwin average daily water surface elevations, water years 1997–2001. (Source: PacifiCorp and Cowlitz PUD, 2004a)

A flood frequency analysis was conducted on spill data from Swift Creek reservoir to the Lewis River bypassed reach for the period from 1976 through 2000, representative of existing conditions. Estimated maximum hourly spill rates by return period for current conditions are provided in table 3.3.2-2. Based on the spill analysis, under current conditions, flows of 5,000 cfs would typically occur every other year, while flows of 43,000 cfs would occur (statistically) once every 10 years.

Table 3.3.2-2. Magnitude and frequency of spill from Swift Creek reservoir. (Source: PacifiCorp and Cowlitz PUD, 2004a)

	Swift Spill Quantile by Return Period (years)				
	1.5	**2**	**5**	**10**	**20**
Current Conditions	0 cfs	5,000 cfs	28,000 cfs	43,000 cfs	55,000 cfs

Flows in Speelyai Creek

Speelyai Creek is a tributary to Lake Merwin. A diversion structure 4.3 miles upstream of the mouth of the creek was installed to divert water from the upper watershed into the Speelyai canal that carries flow into Yale Lake. This diversion has been non-functional since 1996 when floods altered the channel. The new channel directs flow into the canal regardless of the diversion structure. A second diversion structure, which supplies water to Speelyai Hatchery, is located 0.1 mile upstream of the mouth. The original purpose of the upper diversion structure was to divert all but 15 cfs of flow into the canal and Yale Lake with remaining flows supplying Speelyai Hatchery. The hatchery, however, receives higher quality water when flows from the upper watershed are diverted to Yale Lake because the lower reach is spring fed and supplies pathogen-free water to the hatchery. Consequently, for the health of the fish in the hatchery and the desire for pathogen-free water, the upper diversion structure has remained closed, diverting all flow into the Speelyai Canal since 1979, except for three occasions. The three occasions it was opened were during severe low flow conditions in October when additional water was needed at the hatchery. However, when the upper diversion structure was damaged during the 1996 high flows, the main channel moved northeast away from the diversion structure rendering it ineffective. As a result, water can no longer be diverted into Lower Speelyai Creek, and there are no plans to restore flows from the upper watershed to lower Speelyai Creek. Flows in lower Speelyai Creek are supplied by springs and small tributaries. At the hatchery intake, flow averages 17 cfs in the summer months (July to September), and 21 to 28 cfs during the spring and winter. The Speelyai Hatchery operators report considerable leakage at the hatchery diversion structure, so it is likely that total streamflow (intake plus leakage) is greater than the reported intake flows.

Lewis River Downstream of 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 3.3.2-4 shows the daily flow exceedance curves for the Merwin Project based on analysis of flows measured at Ariel below Merwin dam. The figure shows that flows rarely exceed 2,000 cfs in August, while in December and January they are typically (50 percent exceedance) above 7,000 cfs. Storage of water in project reservoirs and operation of the turbines result in a step-wise flow pattern[15] as units are turned on and off for power generation.

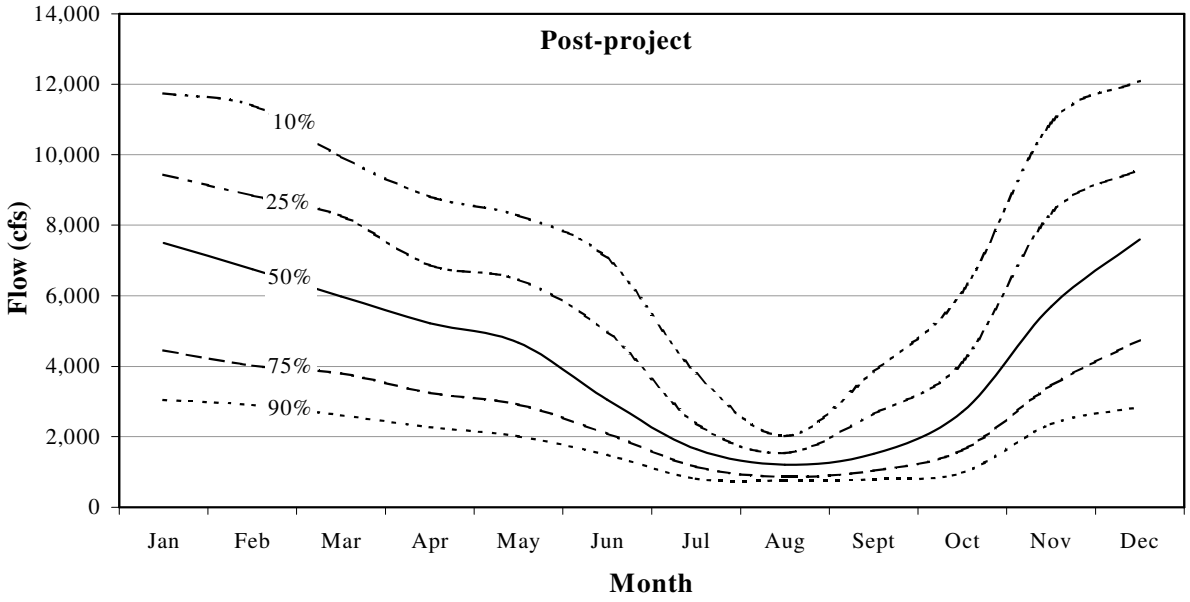

Figure 3.3.2-4. Daily flow exceedance curve for Lewis River at Ariel (below Merwin dam, USGS Gage 14220500; 1932 through 1998). (Source: PacifiCorp and Cowlitz PUD, 2004a)

Flood Management

One of the current operational objectives of the Lewis River Projects is to provide flood management for the lower Lewis River between Merwin dam and the confluence

[15] A step-wise flow pattern means that flows below the dam can increase and decrease in large blocks or volumes, and remain at the same level for a period of time. For example, as generators are turned on, flow below a dam will increase and hold steady at the new higher flow level until the generating units are turned off or additional units are turned on. If these flows were graphed, the resulting line would look like a step pattern up and down.

with the Columbia River. This objective is accomplished in accordance with procedures established under a 1983 contract between PacifiCorp and FEMA, the terms of which are a condition of PacifiCorp's existing Commission licenses. The current flood management procedures are fully documented in PacifiCorp's Standard Operating Procedures. Key aspects of these procedures are described in PacifiCorp and Cowlitz PUD's PDEA and supplemental PDEA.

Under current operations, PacifiCorp provides 70,000 acre-feet of dependable flood control storage space in the three-reservoir system of Swift, Yale, and Merwin between November 1 and April 1. Drawdown of the reservoirs to provide this storage starts by September 20. The reservoirs may be gradually refilled after April 1 such that the normal full pool is reached by April 30. The surface area of each of the three reservoirs at full pool is about 4,000 acres. The 70,000 acre-feet of mandated flood control storage thus requires a total cumulative drawdown among the three reservoirs of about 17 feet. Past and current operating experience demonstrates that actual drawdown during the flood management season is usually significantly greater than this required minimum as a result of snowpack conditions, climatological conditions, and normal operations for power generation. Plots of actual reservoir water surface elevations over five recent years are provided in figures 3.3.2-1 through 3.3.2-3.

Estimates of the magnitude and frequency of floods for the Lewis River below Merwin dam, based on analysis of flood control operations and historic flood data, are provided in table 3.3.2-3. Flood frequency values in table 3.3.2-3 show, for example, that the 10-year flood (or flow that would be expected once in 10 years) is 60,000 cfs at Ariel, while the 100-year flood would measure 90,000 cfs. The largest major flood in recent years, 85,000 cfs recorded at Ariel in February 1996, had a return period of approximately 50 years and caused considerable damage in the Lewis River Valley below Merwin dam. That event has been used as a benchmark in studies comparing the effect of current operations and alternative actions on flood hazard. The estimated peak flows under current flood control operations during the February 1996 flood and during a repeat of other significant historic floods are provided in table 3.3.2-4. This table highlights the historic flows estimated in both natural (unregulated) conditions and with current (regulated) conditions. The socioeconomic effects of the February 1996 flood are discussed in section 3.3.9, *Socioeconomic Resources*. Further details of the applicants' flood management analyses conducted for relicensing can be found in the PDEA and supplemental PDEA (2003f and 2004: FLD 1).

Current project operations for flood control include the drawdown of project reservoirs beginning no earlier than September 20 to achieve storage capacity of 70,000 acre-feet (17-foot hole), and refill procedures that begin on April 1. Flood control storage allocations (assigned releases) are identified in the High Runoff Procedures and set the regulated outflow based on the available storage. Additional flood control policies were developed with FEMA and incorporated into the High Runoff Procedures. This

collaboration and formal recognition of flood control procedure allowed FEMA to delineate revised floodplain maps.

Table 3.3.2-3. Flood magnitude and frequency for Lewis River below Merwin dam.[a] (Source: PacifiCorp and Cowlitz PUD, 2004a)

	Flow Quantile (cfs) by Return Period (yrs)					
Location	**1.5**	**2**	**10**	**50**	**100**	**500**
Ariel[b]	12,000	22,000	60,000	85,000	90,000	140,000
Woodland[c]	n/a	n/a	65,600	92,600	98,400	150,500
Mouth[d]	n/a	n/a	85,400	119,400	128,200	187,600

[a] Analyses based on the period of record 1912–2000. Flows based on actual or expected storage available for flood management.
[b] Less than 1 mile below Merwin dam.
[c] Approximately 10 miles below Merwin dam.
[d] Confluence with the Columbia River.

Table 3.3.2-4. Natural and regulated peak flows for specific Lewis River flow events at Ariel (below Merwin dam). (Source: PacifiCorp and Cowlitz PUD, 2004a)

Date of Peak	**Natural (Unregulated) Peak Flow (cfs)**	**Current Conditions (Regulated) Peak Flow (cfs)**
18 December 1917	92,000	85,000
22 December 1933	116,000	90,000
13 December 1946	67,300	n/a[a]
20 November 1962	79,200	60,000
20 January 1972	76,600	60,000
15 January 1974	76,200	60,000
4 December 1975	80,700	60,000
2 December 1977	82,900	60,000
8 February 1996	111,400	85,000

[a] Data available from the December 1946 flood are insufficient to determine regulated peak flow under current conditions.

Water Quality

Documentation of whether the projects comply with water quality standards for surface waters in the state of Washington has been important in characterizing the environmental baseline, and has been an objective of all water quality-related studies completed by the applicants. WDOE water quality standards are contained in Chapter

173-201A of the Washington Administrative Code (WAC). These standards recently were revised by WDOE in 2003; however, as of this writing WDOE will continue to use the 1997 standards (until EPA approval) for the following criteria: temperature, turbidity, dissolved oxygen (DO), pH, aquatic life uses, and antidegradation. WDOE will use the 2003 water quality standards for recreational, water supply and miscellaneous use designations for water bodies; lake nutrient criteria; toxics and aesthetics; variance procedure; site specific criteria; use attainability analysis; water quality offsets; and compliance schedules for dams.

As such, project waters are classified as either AA (extraordinary), A (good), or Lake Class (for natural lakes and reservoirs with more than a 15-day retention time). Numeric water quality standards exist for each class of water body, although "no measurable change from natural conditions" is the criterion for most parameters in Lake Class. Mainstem Lewis River reaches within the project area (downstream of the boundary of the GPNF) are designated Class A. Feeder streams to the project reservoirs are designated Class AA and the reservoirs themselves Lake Class. Existing standards for these classes of water bodies are summarized below (table 3.3.2-5).

As noted above, on July 1, 2003, WDOE adopted revised standards for temperature, and restructured the water quality standards to a "use-based" format (i.e., numeric temperature criteria specific to salmonid spawning, rearing, etc.) (although EPA has not yet approved all the revised standards). Under the revised standards, former Class AA waters are designated core rearing waters, and former Class A waters are designated noncore rearing waters (WDOE, 2003). The revised numeric temperature criteria are stated as 7-day averages of consecutive daily maximum temperatures (7DADMax). The criterion for non-core rearing waters (formerly Class A), is a 7DADMax of 17.5ºC. The criterion for core rearing waters is a 7DADMax of 16°C. In addition to the revisions noted above, WDOE adopted a 7DADMax 12°C temperature criterion to protect native char (includes bull trout and Dolly Varden). Finally, if summer compliance with these criteria would not result in protective spawning and incubation temperatures during spawning and incubation (e.g., late summer and fall), the revised criteria apply a 7DADMax 9ºC criterion to protect waters supporting char spawning and a 7DADMax 13ºC criterion to waters supporting trout and salmon spawning.

For lakes and reservoirs, the new standards are very similar, requiring that natural conditions be maintained. In all waters, the revised standards include a 0.3ºC cumulative allowance for anthropogenic warming.

The revised standards do not change the DO criteria, with the exception of the change from a class-based to a use-based designation system, as discussed above, and allowing up to a cumulative 0.2 milligrams per liter (mg/L) depression from all combined human activities when natural conditions cause DO concentrations to fall below the criterion. No changes were made to the pH, turbidity, or TDG standards. A summary of all changes to the 1997 standards is provided on the WDOE website (WDOE, 2003).

Table 3.3.2-5. Summary of WDOE surface water quality standards for Class A, Class AA, and Lake Class water bodies. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Parameter	Class A Standard	Class AA Standard	Lake Class Standard
Fecal coliform	Not to exceed geometric mean of 100 col./100 ml, less than 10% of all samples exceeding 200 col./100 ml	Not to exceed geometric mean of 50 col./100 ml, less than 10% of all samples exceeding 100 col./100 ml	Not to exceed geometric mean of 50 col./100 ml, less than 10% of all samples exceeding 100 col./100 ml
Dissolved oxygen	Must exceed 8.0 mg/L	Must exceed 9.5 mg/L	No measurable decrease from natural conditions
Total dissolved gas	Not to exceed 110% of saturation	Not to exceed 110% of saturation	Not to exceed 110% of saturation
Temperature	Must not exceed 18ºC[a]	Must not exceed 16ºC	No measurable change from natural conditions
pH	Within 6.5 to 8.5[b]	Within 6.5 to 8.5[b]	No measurable change from natural conditions
Turbidity	Not to exceed 5 NTU over background or 10% over background of 50 NTU or more	Not to exceed 5 NTU over background or 10% over background of 50 NTU or more	Not to exceed 5 NTU over background conditions

[a] When natural conditions exceed 18ºC (Class A) or 16ºC (Class AA), no temperature increase will be allowed which raises receiving water temperature by more than 0.3ºC. Incremental increases from point source activities may not exceed t=28/(T+7) (Class A) or t=23/(T+7) (Class AA), where t = maximum possible increase at the mixing zone boundary, and T is background, unaffected upstream temperature. Incremental increases from non point sources may not exceed 2.8°C.

[b] Human-caused variations must be within a range of 0.2 pH units.

Water Temperature

Baseline stream temperatures and water quality in the Lewis River watershed are, in general, supportive of salmonids and other beneficial uses. Year-round water temperatures in project-affected reaches measured during the applicants' studies were within the former WDOE criteria, with a single exception. The exception was at the downstream end of the Lewis River bypassed reach, where a single daily maximum temperature of 18.2 ºC was recorded on August 4, 1999 (an exceedance of the former 18 ºC criterion for Class A water bodies).

As a Class A water body, the Lewis River bypassed reach is subject to the non-core salmonid rearing temperature criterion of 17.5 ºC (measured as a 7DADMax) under the revised temperature standards. When the 7DADMax values were calculated at the downstream end of the Lewis River bypassed reach, there were no exceedances of the revised standard. Stream temperatures in excess of former WDOE criteria have been recorded at other, non-project-affected sites in the vicinity, including Speelyai Creek upstream of the diversion, Canyon Creek, and Siouxon Creek. This indicates that stream temperatures, at times, would be expected to be observed outside the WDOE criteria, even under "natural stream" conditions.

Water temperatures at the Yale tailrace, and to a lesser extent at the Swift No. 2 tailrace, fluctuate in response to generation. While these plants generate, tailrace temperatures are determined by water temperature at the turbine intake. During reduced generation, the Yale tailrace is warmed by surface waters of Lake Merwin, and in mid-to late-summer there may be large daily temperature fluctuations as generation is changed to meet electricity demands. In contrast, there is little fluctuation in temperatures or releases at the Merwin powerhouse tailrace (figure 3.3.2-5). Temperatures at the Swift No. 1 tailrace are also relatively constant in response to changes in generation.

Thermal stratification in project reservoirs creates a thermal banking effect, whereby warmer temperatures extend later into the year at project tailraces than occur at the inflow to Swift Creek reservoir. This pattern can be seen below the projects during the 1999-2000 field seasons (figure 3.3.2-6). The greatest differences among tailrace sites and the inflow to Swift Creek reservoir occurred in October, when median monthly temperatures at the reservoir inflow were approximately 8°C, in contrast to 15°C at the Merwin tailrace. Annual maximum temperatures were seen in October at the Swift No. 1, Swift No. 2 and Merwin tailraces, and in September at Yale. In contrast, maximum temperatures at the Swift inflow were observed in August. Heat loss is delayed by reservoir storage, maintaining higher temperatures for 30 to 60 days. Temperatures throughout the projects converge during the winter months until April, when less than 2°C separates Swift Creek reservoir inflow temperatures and all powerhouse tailraces.

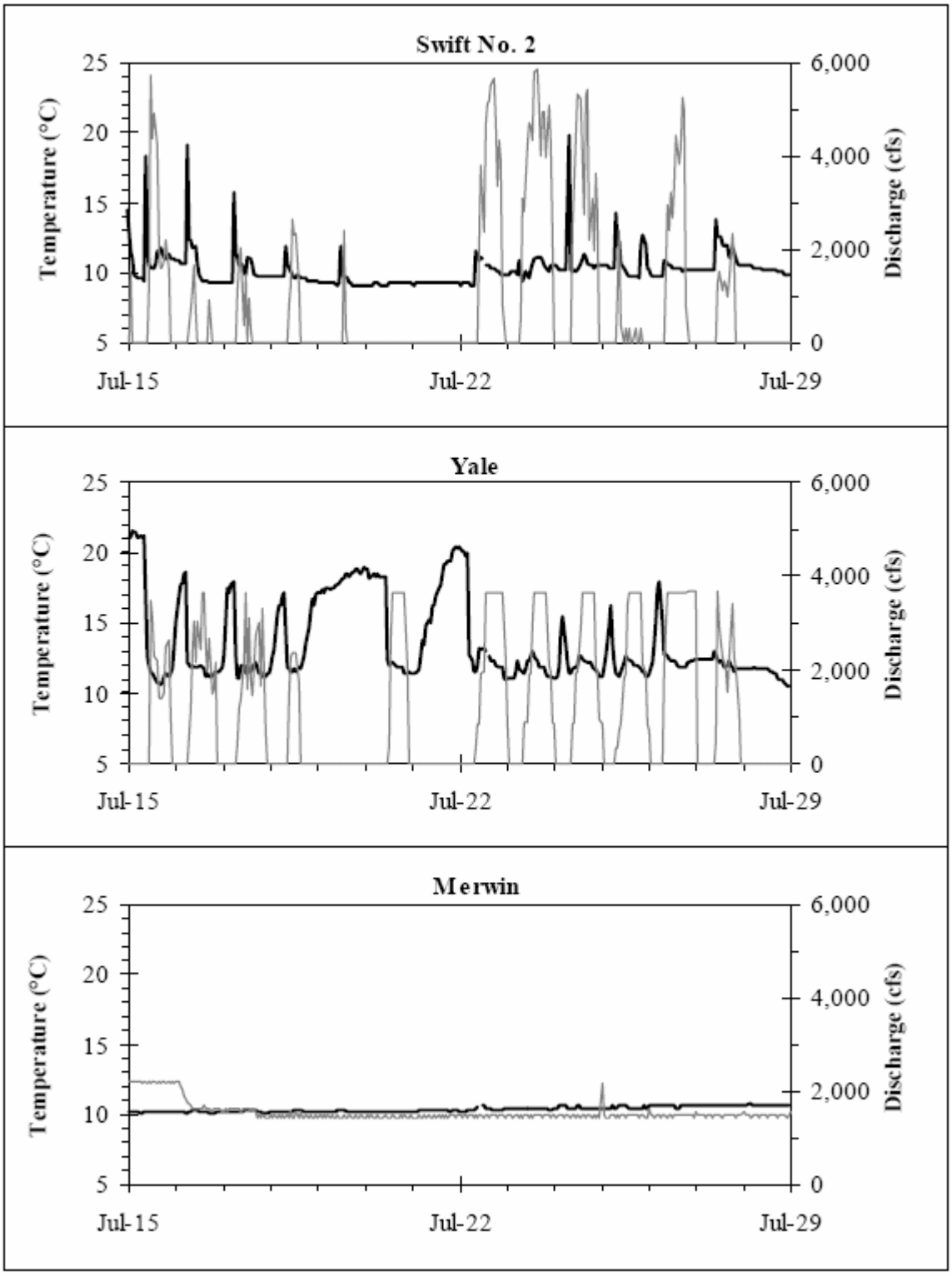

Figure 3.3.2-5. Recorded water temperatures (bold) in the Swift No. 2, Yale, and Merwin powerhouse tailraces and corresponding releases, July 15 through July 28, 1996. (Source: PacifiCorp and Cowlitz PUD, 2004a)

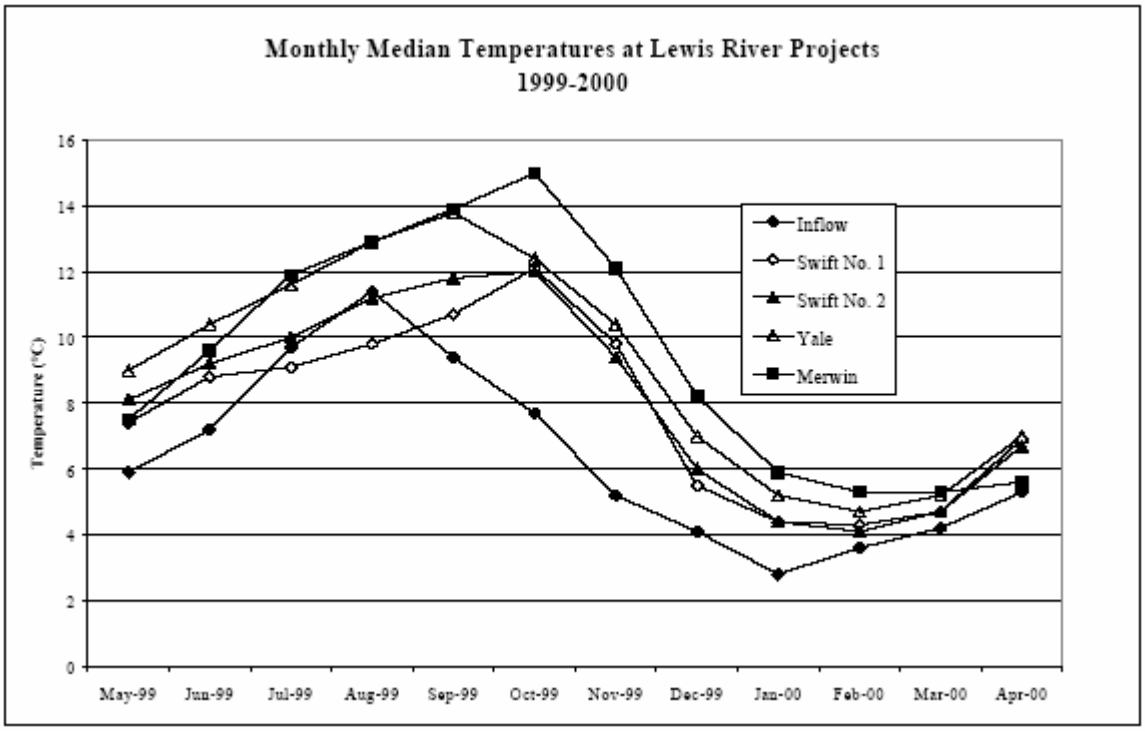

Figure 3.3.2-6. Monthly median temperatures at the Swift Creek reservoir inflow, Swift No. 1 tailrace, Swift No. 2 tailrace, Yale tailrace, and Merwin tailrace; May 1999 through April 2000. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Total Dissolved Gas

TDG is the measure of atmospheric gases, primarily nitrogen, in the water column. TDG water quality studies conducted by the applicants have documented TDG in excess of state standards at the Swift No. 1, Swift No. 2, and Yale powerhouse tailraces. While this is a concern from a regulatory standpoint, biological effects have not been investigated, and none have been established or documented. TDG studies have been conducted by the applicants to investigate the sources of elevated TDG and the spatial extent of the problem (i.e., whether exceedances occur within the reservoirs). Major findings of these studies include the following:

- Elevated TDG pressures resulting from power generation within the Lewis River hydropower complex were limited to the Swift No. 1 tailrace, Swift No. 2 canal, and to the tailrace area immediately below the Yale Project. No exceedances of TDG standards were documented in the forebays of Yale or Merwin dams. Sampling at sites in Lake Merwin was conducted over the course of 6 weeks (September through November 2000), and resulted in 10 values greater than 110 percent saturation in over 5,000 observations of the Yale tailrace. No exceedances were observed at the Merwin tailrace.

- All stations measured downstream of Swift No. 1 in the Swift No. 2 canal and hydropower complex, including the Swift No. 2 tailrace, demonstrated a relationship with pressures in the Swift No. 1 tailrace.
- Approximately 60 percent of the exceedances in the Swift No. 1 tailrace and further downstream in the Swift No. 2 canal occurred during periods after Swift No. 1 had shut down, indicating that after the turbines ramped down TDG remained in solution (under hydrostatic pressure), until the canal was flushed by subsequent operation cycles (in this case 13 hours later).
- Exceedances of the state TDG water quality standards in Swift No. 2 canal (resulting from operations at Swift No. 1) may lead to violations of the standard in the Swift No. 2 tailrace; however, no direct correlation between TDG saturation in the Swift No. 2 tailrace and Swift No. 2 operations was observed in these studies.
- Based on the relationship between TDG saturations measured in the Swift No. 2 tailrace and Swift No. 2 forebay, elevated pressures in upper Yale Lake likely resulted from generation at Swift No. 1.
- Elevated forebay levels of TDG were not observed during follow-up investigations at stations near Yale and Merwin dams.[16] These data suggest that elevated TDG from upstream power generation at Swift No. 1 does not extend into lower Yale Lake and Lake Merwin.

PAH/Metals

The effects of boating on reservoir water quality were identified as an issue during the NEPA scoping process. Discussions among the Aquatic Resource Group focused this issue on the potential effects of polycyclic aromatic hydrocarbons (PAH) in project reservoirs, where personal watercraft (PWC [e.g., jet skis]) use and associated fuel loss were identified concerns. The applicants and the Aquatic Resource Group designed and conducted a study to address this issue. This study, conducted at Yale Lake in August 2001, found measurable levels of PAH at three of the four Yale Lake boat ramps studied: Yale Park, Cougar Creek, and Beaver Bay. Of the 19 component analytes measured in each sample, two were measurable at Cougar Creek and Beaver Bay (fluoranthene and pyrene), and three at Yale Park (fluoranthene, pyrene, and anthracene). All are phototoxic compounds. WDOE has no criteria for these compounds, although total PAH

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[16] The applicants conducted additional TDG sampling in 2001, with the objective to determine the ability to modify turbine operations to meet state water quality standards. The results were reported in WAQ 4 study "Total Dissolved Gas (TDG) Monitoring -2001: Response of Dissolved Gas Saturation Downstream of the Swift No. 1 Project to Reduced Turbine Air Inflow." The report was filed with the license applications.

at Yale Park (7.28 nanograms per liter [ng/L]) exceeded toxicity thresholds for *Ceriodaphnia* survival (6.5 ng/L) and reproduction (3.4 ng/L) developed specifically for Lake Tahoe (Oris et al., 1998). However, applicability of these threshold values to Yale Lake is questionable given differences in water clarity, hydraulic residence time, and boat use, factors critical to the toxicity of these compounds.

Results of analyses for a number of metals, including mercury, as well as PCBs and other cations and anions are presented in PacifiCorp and Cowlitz PUD (2001). No exceedances of WDOE Freshwater Chronic Criteria presented in WAC 173-201A-040(3) (if available) were reported.

Dissolved Oxygen/Thermal Stratification

Dissolved oxygen (DO) is a measure of oxygen present in the water and is a common indicator of the waters ability to support a diverse biological community. DO levels met state standards (9.5 mg/L for Class AA/core salmonid rearing and 8 mg/L for Class A/non-core salmonid rearing reaches); however, levels below state standards were noted at several tributary sites (unaffected by project operations) at times of maximum air temperatures and/or low flow conditions. This indicates that even in some of the natural flowing streams, DO concentrations can be expected to fall below the WDOE criteria.

The DO regimes at Swift and Merwin reservoirs are quite different, reflecting the different temperature regimes of these reservoirs. All three reservoirs thermally stratify during the summer months. Temperatures at the bottom of Swift Creek reservoir varied little, and were approximately 5ºC throughout the 1999 monitoring period. In contrast, temperatures near the bottom of Lake Merwin gradually increased from 6ºC in May to nearly 14ºC in October. Snowmelt from Mount St. Helens and Mount Adams, combined with a shallower intake at Swift (approximately 147 feet deep), creates a more stable and colder hypolimnion (bottom waters of a thermally stratified lake). The intake at Lake Merwin is deeper (approximately 180 feet deep), well below the thermocline, which is the transition zone between the warmer layer at the reservoir surface and the deep, colder water layer. This results in quicker turnover in the fall and a more pronounced depletion of colder water during the summer months. DO in the Merwin and Swift tailrace sites averaged between 10.9 and 11.7 mg/L.

Reservoir profiles at Yale Lake were more similar to Swift than to Lake Merwin; temperatures at depth remained near 4ºC year-round during the 1996 and 1997 field seasons. Summer surface temperatures (July 1997) were 21ºC, while temperatures near the bottom of Yale Lake (about 260 feet deep) were 4ºC.

DO near the bottom of 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 the 130 to 150-foot depth in August and September) remained at or near 8 mg/L. Similarly, the water column was well oxygenated in Yale Lake throughout PacifiCorp's monitoring period (1996-1997).

Summer DO levels (June through September) near Yale dam ranged from 9 to 12 mg/L. The reservoir bottom did not approach anoxic, or oxygen depleted conditions during either field season (1996 or 1997). Minimum DO at Yale Lake was observed in November and December 1996, when values were near 7 mg/L at a depth of 200 to 210 feet. Yale tailrace DO levels, however, typically were higher, ranging from 8.5 to 11.1 mg/L during a week of continuous hourly monitoring in August 1997.

Trophic Status and Nutrients

Nutrient levels in the waters of the Lewis River hydropower complex are primarily related to the surrounding soil composition. All of the streams in the upper Swift watershed drain volcanic soils. Most of the soils were formed in pyroclastic flows of volcanic ash, with ash influences extending to 60 inches or more. The southeast side of Swift Creek reservoir is composed of slightly different materials, and although more diverse, the dominant soil type in the subbasin is Swift cindery sandy loam, also derived from volcanic ash with a mantle of ash and pumice. Subsequently, these soils are low in nutrient content and provide very few nutrients to the Lewis River necessary for primary production.

Trophic status of the project reservoirs can be inferred from phytoplankton data collected during Yale relicensing studies (PacifiCorp, 1999), as well as from nutrient and DO data summarized above. Yale Lake phytoplankton data (1996 and 1997) documented short-term algal blooms during early summer, which temporarily increased trophic status from generally oligotrophic (low in nutrients and primary production) to more mesotrophic conditions (moderate levels of nutrients [N and P]). Blue green algae, often used as indicators of eutrophic conditions, were dominant at upper and lower Yale Lake during early summers of 1996 and 1997. The shift from diatoms to blue-greens was most dramatic in June 1996, when the blue-green algae *Anabaena flos-aquae* was dominant at both upstream and near-dam stations (85 percent of the biovolume at the upstream station, and 94 percent near the dam). Algal biovolume during most months was less than 100,000 cubic µM/ml; however, in June 1996 biovolume was approximately eight times higher than this at the upstream station, and approximately four times higher at the downstream station. Blue-green algae were also observed later in the summer at Yale during both field seasons.

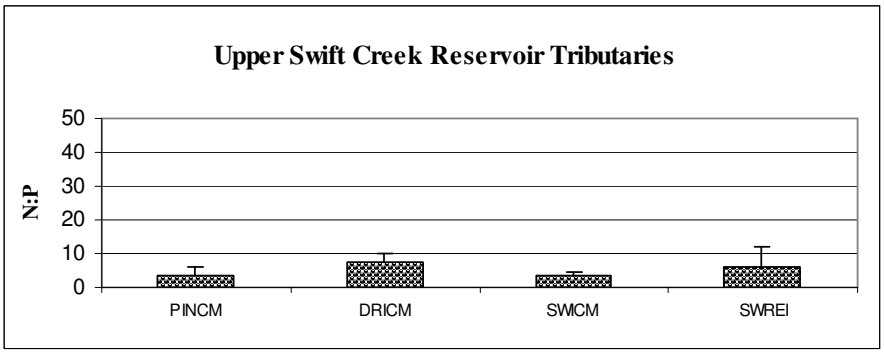
Based on field study results of other water quality parameters, patterns in phytoplankton community composition observed at Yale are likely similar at Swift and Merwin. Carlson Trophic State Index (TSI) (Carlson, 1977) values calculated for Swift and Merwin based on 1999 data show similar, short-term changes in trophic status indicative of algal blooms, although no phytoplankton data were collected. Summertime chlorophyll α and Secchi disk-based TSI values were in the mesotrophic range for both reservoirs; however, total phosphorus-based values increased to near 60 in July, well above the 40 to 50 level indicative of mesotrophic conditions. As discussed above, nutrient levels among upper watershed sites (including Swift reservoir) differed markedly

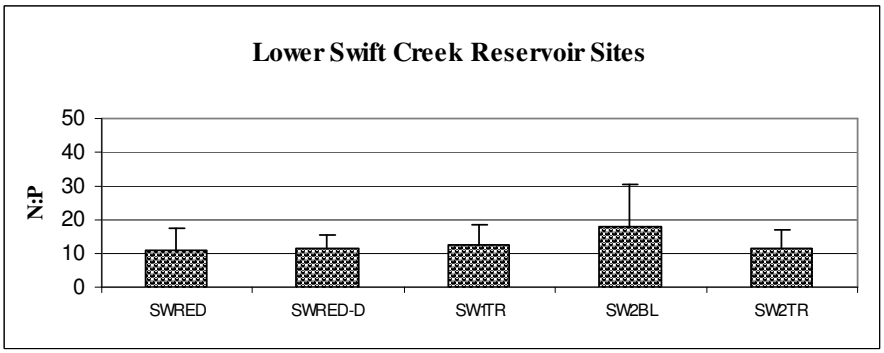
from those in the lower watershed (Merwin reservoir). The pattern observed at the inflow to Swift Creek reservoir suggested increasing total phosphorus concentrations correlated with snowmelt from Mount St. Helens, and, in general, higher total phosphorus values were recorded for upper watershed sites. These data suggest that soil geochemistry is not uniform throughout the project area.

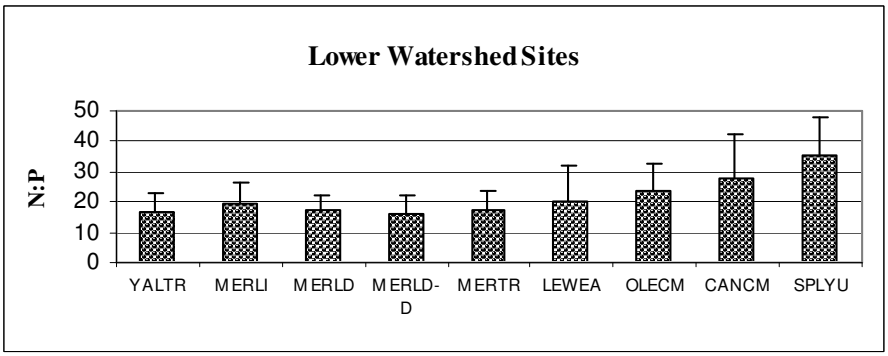
While this region of the Lewis River watershed historically may have had higher soil phosphorus levels, it is likely that the Mount St. Helens eruption continues to influence water quality here. Exposure of previously subsurface ash as a result of the 1996 flood also may have caused higher phosphorus concentrations in Mount St. Helens runoff.

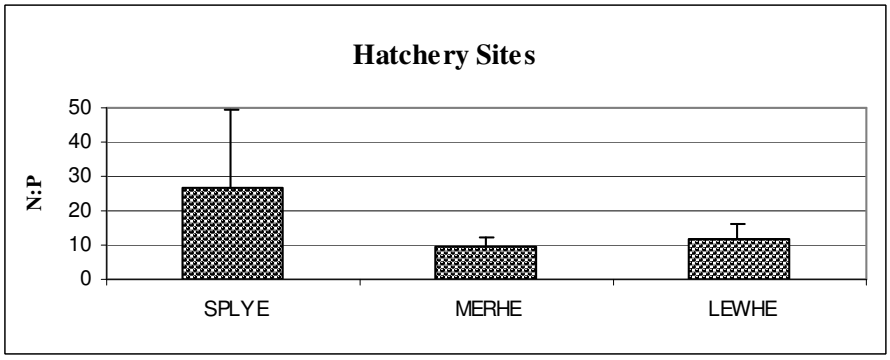
Nitrogen-to-phosphorous (N:P) ratios for all monitored sites strongly suggest nitrogen limitation for streams draining to Swift Creek reservoir (figure 3.3.2-7). Sites designated as "Lower Swift Creek Reservoir" are also likely nitrogen-limited, while the Merwin reservoir and parts of the Yale reservoir sites are more likely phosphorus limited. Lewis River and Merwin Trout hatchery effluents had N:P ratios similar to Merwin reservoir and downstream sites, although Speelyai ratios were higher, indicative of greater nitrogen contribution from this hatchery. High ratios (greater than 10:1) suggest that phosphorous is the limiting nutrient, while ratios less than 5:1 are indicative of nitrogen limitation (Rast et al., 1989). Welch (1980) suggests that N:P ratios less than 16 are indicative of nitrogen limitation. Nitrogen limitation is not uncommon in Pacific Northwest streams. The nitrogen term in the ratio was total persulfate nitrogen, the sum of biologically available nitrogen forms (organic N, ammonia, and nitrate+ nitrite). Total phosphorous was used for the phosphorous term of the ratio. In general, nitrogen limitation in lakes and reservoirs creates a competitive advantage for nitrogen-fixing algae, such as the *Anabaena* sp. mentioned above.

The proportion of total nitrogen inputs contributed by annual algae blooms to project affected reaches and associated nitrogen fixation is unknown. In light of the volcanic, nitrogen-poor soils that dominate the watershed, and the absence of marine-derived nitrogen to reaches upstream of Merwin dam, the contribution from algae blooms could be significant.









Notes:

Error bars are one standard deviation.

Water quality sampling site locations: PINCM – Pine Creek near mouth; DRICM – Drift Creek near mouth; SWICM – Swift Creek near mouth; SWREI – Lewis River inflow to Swift reservoir; SWRED – Swift reservoir near dam; SWRED-D – Swift reservoir below dam; SW1TR – Swift No. 1 tailrace at the canal; SW2BL – Lower Lewis River bypassed reach; SW2TR – Swift No. 2 tailrace; YALTR – Lewis River near Yale powerhouse tailrace; MERLI – Lake Merwin inflow to Lake Merwin at Hwy 503 crossing; MERLD – Lake Merwin near the dam; MERTR – Lewis River near Merwin powerhouse tailrace; LEWEA – Lewis River near Eagle Island; OLECM – Ole Creek near mouth; CANCM – Canyon Creek near mouth; SPLYU – Speelyai Creek upper site; SPLYE – Speelyai Hatchery effluent; MERHE – Merwin Hatchery effluent; LEWHE – Lewis River Hatchery effluent.

Figure 3.3.2-7. Nitrogen to phosphorus ratios for sites sampled monthly during May 1999 through April 2000. (Source: PacifiCorp and Cowlitz PUD, 2004a)

3.3.2.2 Environmental Effects

Water Quantity

This section discusses the effects of the proposed action on flow regimes in river reaches affected by project facilities, operations, flood control and compliance monitoring. The effects of these changes on aquatic habitat, riparian habitat, hatcheries, and other resources are discussed in subsequent sections.

Lewis River Bypassed Reach (Swift Bypassed Reach Flows)

The 3-mile reach of the Lewis River, located between Swift dam and the upper end of Yale Lake, is known as the Lewis River bypassed reach (see figures 2.1.1-2 and 2.1.1-3). Currently, river flows are bypassed around this reach through the canal between the dam and the Swift No. 2 powerhouse. Under the current Commission licenses, there is no minimum flow requirement for this reach, but seepage from the canal provides approximately 21 cfs of flow to the reach. Groundwater seepage and Ole Creek, which enters the lower portion of the reach, also are sources of some flow. In addition, occasional high river flows require water to be spilled from the Swift reservoir into the bypassed reach via the Swift dam spillway. These spills are often in excess of 5,000 cfs and have been as high as 45,000 cfs.

With implementation of the SA, increased flows would be provided in the bypassed reach totaling 55,200 acre-feet per year at a rate of 60 cfs to 100 cfs, according to a monthly schedule, to be provided at two release points (the existing canal drain and the newly constructed upper release structure). The flows would vary seasonally as determined by the ACC, but would not exceed 55,200 acre-feet (55,349 acre-feet in a leap year) and (1) no more than 17,078 acre-feet (average of 70 cfs, not to exceed 80 cfs in any month) between July 1 and October 1; and (2) no more than 100 cfs per month between November 1 and June 30.

Construction of a new water delivery structure (the upper release point) would provide flows to the upper reach and connect large pools located there to the lower portions of the reach. The existing canal drain located approximately one-third the length of the canal downstream of the Swift No. 1 tailrace would provide flows up to the drain's maximum capacity of approximately 47 cfs (see figure 2.1.1-3). Flows from the canal drain (lower release point) would be provided once reconstruction of the Swift No. 2 project is complete, benefiting aquatic resources even before the license is issued. A "constructed channel" associated with the canal drain discharge location would be built to increase habitat benefits from the flow releases and to improve connectivity. The constructed channel would utilize an existing side channel in the bypassed reach, which would be improved to increase flow capacity in the channel and at the same time habitat enhancement measures would be installed. The lower bypassed reach would also be modified, if required, to connect the constructed channel to Yale Lake. Construction of

this improved habitat side channel, which would receive the 47-cfs discharge from the canal drain, would provide maximum habitat benefits from the flow release. The constructed channel would be built as soon as practicable after construction of the upper release point.

Our Analysis

The proposed flow regime and constructed channel would reduce the hydrologic isolation of the reach and increase overall habitat diversity and connectivity to benefit a variety of aquatics species. Increased flows from the new upper release point would connect large pools in the upper end of the reach and provide a flow corridor through to the lower end of the reach producing benefits to the aquatic resources as discussed in more detail in section 3.3.3, *Aquatic Resources*. Construction of the channel would also help to reduce the overall negative effects of large spill events into the bypassed reach by providing a protected side channel area that would not be as subject to large-scale scouring.

As previously stated, minimum flows would be released from the Swift No. 2 canal into the bypassed reach at two points. The newly constructed upper release point would be located downstream of the Swift No. 1 powerhouse, while the lower release point would use the existing canal drain structure (see figure 2.1.1-3). A final combined release schedule (monthly or seasonal) would be determined by the ACC within one year of construction of the new flow release structure, although maximum flows from the lower release point would be 47 cfs. Flows from the lower release point would be directed into the approximately 1,200-foot-long improved side channel that is described in more detail in section 3.3.3, *Aquatic Resources*. The water in the improved side channel then would join with the main bypassed reach channel.

Flows in the bypassed reach would be increased above the proposed 60 to 100 cfs as a result of local inflows and canal seepage. Further, during peak flows, releases from Swift No. 2 canal or the Swift dam spillway would continue to pass through the bypassed reach. High runoff operating procedures are expected to result in high flows through the bypassed reach similar to current conditions. Mid-range peak flows could possibly be slightly smaller due to the newly constructed side channel's ability (by design) to dampen the flows by increasing the complexity of the channel substrate.

Lewis River Downstream of Merwin Dam

The proposed action would modify the existing minimum flows released from Merwin dam and powerhouse for the purpose of maintaining and enhancing habitat for species downstream of the dam, including native fall Chinook and other anadromous species, amphibians, aquatic insects, and plant life, while balancing the needs for recreation and power production. Currently, required minimum flows range from a low of 1,200 cfs in the late summer/fall (August 1 to October 15) to a high of 5,400 cfs in late fall (October 16 to December 7). The full set of minimum flows is shown in table 3.3.3-3

in section 3.3.3, *Aquatic Resources*. The proposed flows would lower the late-fall minimum flow to 4,200 cfs, but would still vary seasonally to benefit specific life history stages of the anadromous species.

Our Analysis

Rapid changes in river flow due to hydroelectric project operations (i.e., changes in generation, shutdowns associated with maintenance, unexpected generation outages, spill events, or other activities) have the potential to adversely affect aquatic resources. Generally, the faster the reduction in water surface elevation, the more likely fish and other aquatic organisms would be stranded or adversely affected. The proposed action provides for restrictions on ramping and plateau operations (operations that bring flows up or down in a prescribed manner [ramping], while holding the flows steady for a time between ramping events) to protect anadromous fish from the adverse effects of stranding (resulting in immediate or delayed mortality) and the temporary loss of habitat or loss of habitat access. Ramping rates would be unrestricted above the critical flow of 8,000 cfs (the flow at which gravel bars in the lower Lewis River become inundated). However, PacifiCorp would also conduct a stranding study and habitat evaluation to better assess the potential effects of project operations on anadromous fish below the projects.

Releases from Merwin dam would range from 1,200 to 4,200 cfs, with a 2-inch per hour downramping rate. The minimum releases would be varied seasonally, with 10 specified periods of different minimum flows, designed to maintain and enhance fish species downstream of Merwin dam, including native fall Chinook. During years when insufficient flows are available to provide these minimum flows, the applicant would convene a Flow Coordination Committee, composed of representatives from PacifiCorp, NMFS, FWS, WDFW, the Cowlitz Indian Tribe, and the Yakama Nation. The Committee would independently evaluate available data regarding water availability during the projected low flow period and decrease or maintain the minimum flow levels as it deems appropriate.

No ramping would be permitted from one hour before and after sunrise or from one hour before and after sunset, to protect aquatic species. Daily fluctuations would be restricted from February 16 through August 15 by maintaining flow plateaus (periods of near steady discharge). Below the critical flow level of 8,000 cfs, these plateau changes would be limited to not more than one change in 24 hours, four changes in a 7-day period, or six changes per month in order to protect salmonid redds during spawning and fry emergence. Downramping rates would be limited to 2 inches per hour, except when flows are greater than 8,000 cfs. The effects of these ramping rates and flow releases are discussed in greater detail in section 3.3.3, *Aquatic Resources.*

Flood Management

The three-reservoir, four-project system is currently operated to provide power production, with Merwin, Yale, and Swift No. 1 also operated to meet Commission and FEMA requirements for flood management and minimum instream flows below Merwin dam. In addition, PacifiCorp voluntarily maintains water levels at each reservoir during the recreation season. Because this also has a recreation component, any effects associated with recreation season reservoir levels is discussed in section 3.3.6, *Recreational Resources*.

Our Analysis

Under the proposed action, the amount of dependable flood control storage would be maintained at 70,000 acre-feet (17 feet of project hole); however, that storage would be used more effectively through various operational changes based on weather and flow forecasts. The modified operations would include pre-releases from Merwin dam, triggered by forecasts, and implementation of a policy to allow the projects to be operated at higher water levels on the falling limb of inflow hydrographs, thereby allowing for additional reduction in peak releases from Merwin dam.

The effects of these changes would be a moderate reduction in the magnitude of floods from about the five-year flood up to about the 50-year flood. Such reductions would be expected to slightly reduce property damages over this range of floods. Model results detailed in the Flood Management Study (FLD1) Final Technical Report confirm that under the proposed action, the magnitude of severe floods (recurrence interval of 100 or 500 years) (see table 3.3.2-3) would be unchanged. In summary, 100 or 500 year floods are so large that flood control operations and the limits of available capacity reach their operational limit and can no longer affect the magnitude of the flows passing through the reservoir system.

Pre-releases (turbine flows plus spill) from Merwin dam, based on flow forecasts, would be made about once a year on average, ranging in magnitude from about 15,000 to 25,000 cfs. Pre-releases would be made up to about 48 hours in advance of forecasted high flow events and would temporarily lower pool elevations at one, two, or all of the reservoirs. It is anticipated that pre-releases would not affect the magnitude and frequency of spill to the Lewis River bypassed reach below Swift dam. Pre-releases can be expected to result in a temporary additional increase of flood management storage of up to 60,000 acre-feet. As a component of flood management operations, pre-releases would be exempt from ramping rate restrictions.

In years with below average March runoff forecasts, the flood management season would be shortened by two weeks, ending on March 15 instead of April 1. This measure would allow earlier project refill in dry years, slightly reducing the risk of failing to achieve refill due to low water conditions and thereby improving both recreational reservoir levels and energy generation. Drawdowns in the winter months are primarily

determined by snowpack, climatological factors, and power generation operations, and drawdown for flood management itself generally does not affect refill.

Flow and Water Level Monitoring

The applicants' proposed flow regimes for project-affected riverine reaches (Swift bypassed reach and downstream of Merwin), entail a series of minimum flows, supplemental flows, and ramping rates. Releases downstream of Merwin dam can be measured via an existing USGS flow gage at Ariel (see figure 2.1.1-1), while minimum flows to the Swift bypassed reach would be based on calibrated flow settings at the upper release point and the canal drain.

PacifiCorp proposes, in accordance with SA measure 9.8, to include a Monitoring & Evaluation Plan to monitor flows and ramping rates designed for fish and other aquatic and terrestrial species. PacifiCorp would pay the costs of operation, maintenance, and replacement of the Ariel gage for the term of the new Merwin license. PacifiCorp would also provide to the ACC the results of monitoring and evaluations under the proposed plan, as well as any scheduled maintenance events that would interrupt flows, as part of PacifiCorp's annual report, which is discussed in greater detail in section 14.2.6 of the SA. PacifiCorp would periodically confirm the accuracy of calibration of the upper release point and the canal drain, and would include the results of calibrations in the annual report.

Our Analysis

Consistent with the SA, PacifiCorp and Cowlitz PUD specify the agreed-upon compliance point for flow releases below Merwin dam as USGS gage no. 14220500 at Ariel, Washington. Flow compliance monitoring in the Swift bypassed reach would be based on calibrated flow settings at the upper release point and canal drain lower release point. This method would allow for immediate compliance monitoring without installing a new gage within the reach, and should provide adequate data to meet the proposed compliance monitoring plan requirements. The proposed ramping rates would be set at a change in water surface elevation per hour (e.g., upramping rate of 1.5 feet per hour or downramping rate of 2 inches per hour), along with plateau operations. To accurately monitor the flows, the gage at Ariel should be adequate, in that it records river stage and computes discharge at 15-minute intervals. Data for this station collected during water year 2004 were also rated "good" – 95 percent of the daily values were within 10 percent of the true value. Consultation with USGS, however, during the development of the flow monitoring scheme for the reach below Merwin should ensure that accurate measurements would be recorded during the term of any new license.

Water Quality

In general, waters in the project areas met applicable water quality standards for temperature, DO, pH, metals, fecal coliform, and other pollutants, in the majority of the

samples collected by the applicants. Although DO levels in the tailraces of all three dams were above state standards, lower DO concentrations were recorded at depth near the intake structures in Lake Merwin and Yale Lake, and if those waters were passed downstream, state standards might not be met under all circumstances. In those few instances where standards are not met in the reservoirs, exceedances can be attributed to non-project sources (e.g., natural conditions) and not related to project operations.

Water quality studies conducted by the applicants have documented TDG in excess of state standards at the Swift 1, Swift 2, and Yale powerhouse tailraces; however specific biological effects were not investigated by the applicant. To address TDG at the Swift and Yale projects, PacifiCorp would avoid operating in the turbine inefficient range (between 20 and 50 MW) at these projects, and has installed an automatic air valve at Yale to reduce air entrainment. A similar air valve would be installed at Swift No. 1, and permanent monitoring equipment to test water temperature and TDG would be installed at each of these projects. Spill events during peak flows, although infrequent, may increase the number of TDG exceedances of the state standard.[17] TDG monitoring performed by the applicants did not occur during spill events, so it remains to be seen if TDG levels are affected by spills at the dams. Permanent monitoring equipment as proposed by the applicants would collect information on TDG concentrations in relation to spill events at the dams. Characterization of the receiving waterbody (landscape character, topography, materials, etc.) could advance the understanding of TDG concentrations in relation to spill events and prove useful in potential future water quality enhancement efforts.

Operational changes agreed upon in the SA, as well as construction of new project facilities, such as the canal water outlet structure, fish passage facilities and recreational facilities have the potential to degrade project waters. Therefore, we further consider water quality issues pertaining to instream flows, anadromous fish population measures, enhanced recreation facilities, and facility development/ground disturbing activities.

Instream Flows

The applicants propose to release specific instream flows and to maintain certain attraction flows for upstream and downstream fish passage. Although these flow releases would primarily be provided to enhance aquatic habitat, they have the potential to affect water temperatures in the receiving reaches. Flood management pre-releases could also affect water quality. The applicants have proposed to develop and implement a water

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[17] TDG may not exceed 110 percent saturation; however, WDOE water quality standards exempt dam operators from abating TDG exceedances resulting from spills due to high runoff events. The typical exemption is the 7Q10, which is the maximum average peak annual flow for 7 consecutive days that has a recurrence interval (statistically) every 10 years.

quality monitoring plan to monitor compliance with water quality and quantity standards as required by their respective 401 certifications and submit the plan to the Commission for approval.

Our Analysis

As previously described, flows would be released continuously from the Swift No. 2 canal to the Lewis River bypassed reach through two release points and would range from 60 to 100 cfs. PacifiCorp and Cowlitz PUD predicted average monthly temperatures at the downstream end of the Lewis River bypassed reach (modeled using the FWS' SSTEMP model), at flows of 50 to 400 cfs, would remain between 4°C and 14°C, depending upon the month and the starting water temperature (figure 3.3.2-8). These results suggest that the proposed flow regime (minimum of 60 cfs) would result in water temperatures at the downstream end of the bypassed reach well under the state of Washington non-core salmonid rearing standard of 17.5°C (measured as 7DADMax), as well as the former state Class A standard of 18°C. We discuss effects of water temperature on aquatic organisms in section 3.3.3, *Aquatic Resources*.

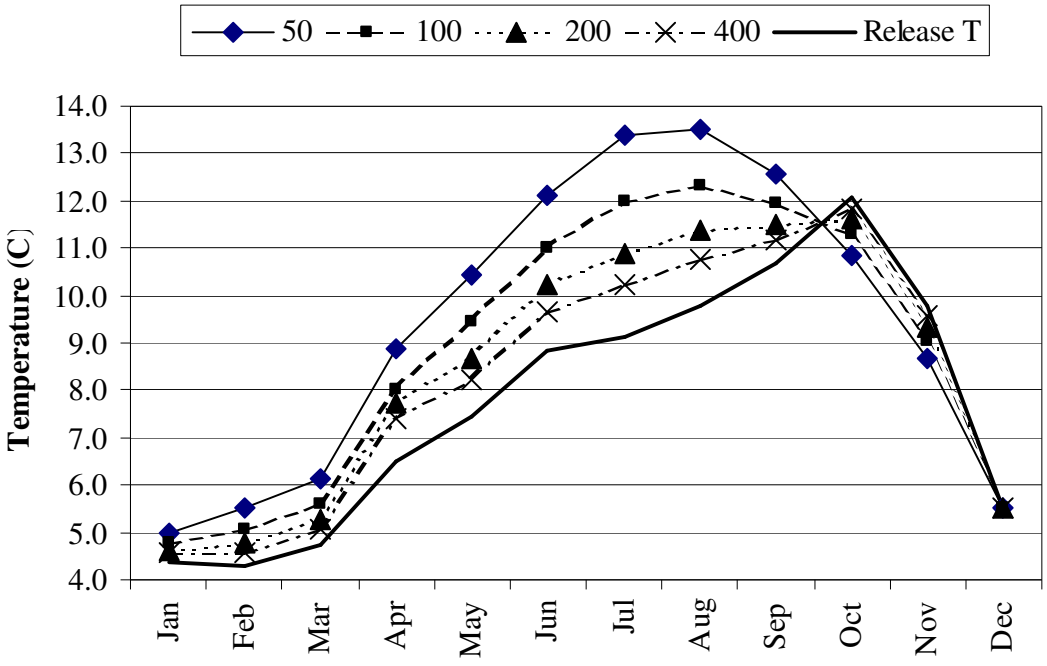

Figure 3.3.2-8. Observed Swift dam release temperature and modeled water temperature at downstream end of Lewis River bypassed reach for four release flows (in cfs) under average temperature conditions. (Source: PacifiCorp and Cowlitz PUD, 2004a)

The bypassed reach release structures would transfer water from the Swift canal to the bypassed reach. Water in the Swift canal originates in Swift reservoir at about 147 feet below full pool and is passed through Swift No. 1 powerhouse into the Swift canal.

As such, turbidity levels in the bypassed reach should mirror those at depth in the reservoir, which are within state standards (generally less than 5 NTUs)—increasing during the winter months to between 5 and 10 NTUs, and decreasing to 1-2 NTUs during the summer and fall (PacifiCorp and Cowlitz PUD, 2004a).

In addition, minimum flows could further reduce the number of TDG exceedances in this reach because approximately 60 percent of the exceedances occurred during periods when neither Swift No. 1 nor Swift No. 2 was generating, and directly after Swift No. 1 stopped generating, as noted above in the description of existing water quality conditions. These recorded exceedances could be attributed to the relatively small volume of water within the canal. Examination of TDG monitoring results within the Swift No. 2 canal with respect to generation flows from Swift No. 1 suggests that when generation ceases, TDG saturated water remains in the canal and is not adequately mixed with non-TDG saturated waters or flushed downstream. Automating the air entrainment system at Swift, as proposed by PacifiCorp (similar to work already completed at Yale), would help reduce the amount of air entrainment and lower TDG exceedances in the Swift canal. Permanent monitoring equipment to test water temperature and TDG as indicated in the proposed Water Quality Monitoring Plan would further assist in evaluating the biological effects, and those effects could be considered in the adaptive management strategy proposed by the applicants to protect aquatic resources, as discussed in more detail in section 3.3.3, *Aquatic Resources*. Continuous water quality monitoring during critical months of the year would help to ensure water quality standards and aquatic resource needs are met. The details of such efforts would be included in the water quality adaptive management plan.

Under continued project operations, upper Speelyai Creek would be diverted into the Speelyai Canal and Yale Lake. Flows downstream of the upper diversion would originate solely from groundwater and tributary inflow, thus temperatures would remain cooler than those upstream of the diversion during the summer months (see table 3.3.2-6).

Table 3.3.2-6. Monthly median water temperatures (°C) for Speelyai Creek, June 1999-September 1999. (Source: PacifiCorp & Cowlitz PUD FTR-WAQ, as modified by staff)

Location	June 1999	July 1999	August 1999	September 1999
Upper Speelyai Creek (above diversion)	9.9	13.1	15.2	13.3
Lower Speelyai Creek (below diversion)	10.9	11.5	11.8	11.0

Flows downstream of Merwin dam would be similar to current operations, although changes in release levels between mid-February and mid-August would be

restricted, to limit flow fluctuations on a daily and weekly basis. Pre-releases (turbine flows plus spill) would be made in advance of high flow events about once a year, on average, from Merwin dam, based on flow forecasts. Water temperature profile data collected at Merwin from May 1999 through December 2000 by the applicants indicates minimal thermal stratification between November and April. Because these releases would occur during periods of minimal thermal stratification, effects on water temperature would not be expected.

Upstream fish passage attraction flows released from Merwin dam and powerhouse are unlikely to have a measurable effect on water temperature below Merwin dam. The attraction flows for the Merwin fish collection facility would be provided similar to current practice, with water pumped directly from the tailrace to provide the flows. Flows required to operate downstream passage facilities would be minimal in comparison to turbine flows, and therefore are not expected to affect the temperature of reservoir releases.

Other fisheries measures would include a release pond to temporarily hold downstream migrants below Merwin dam, ideally located downstream of Eagle Island to minimize interaction of the transported fish with wild fall Chinook. The release pond would be an approximately 10-foot-wide by 100-foot-long raceway, 4 feet deep, constructed off-channel downstream of Woodland. Fish would be held in this pond for approximately 24 hours. Re-entry to the Lewis River would be either volitional or fish would be flushed to the river with a crowding device. Flow through the pond would be continuous. Based on these conceptual design elements, no effects on water quality or temperature are anticipated from the holding pond.

Flood management pre-releases would occur in anticipation of forecast high flow events. Because these would consist of surface flows, little, if any, increase in turbidity would be expected during these pre-release flows. Other constituents (e.g., DO, nutrients, pH) would be expected to be fairly uniform throughout the water column during late fall and winter; thus, effects of pre-releases on other indices of water quality also would be minimal. Similarly, pre-release flows are unlikely to increase TDG relative to levels that would naturally occur during spill events.

Anadromous Fish Population Measures

The proposed fish passage, transport and population enhancement measures are designed to increase certain anadromous fish populations throughout the Lewis River system. Successful enhancements, meaning increased viable fish populations, have the potential to increase the amount of nutrient loading into the upper watershed above Swift Creek reservoir.

Our Analysis

Introduction of anadromous fish provides a mechanism by which MDN would be transported to reservoir tributaries capable of supporting spawning fish, offsetting the current absence of trace elements and nutrients in these streams. Consistent with elements of the salmonid habitat preparation plan, introduction of anadromous fish to Swift Creek reservoir tributaries may increase reservoir nutrient levels, possibly shifting phytoplankton species composition and trophic status. These changes may be ecologically positive, providing greater diversity and reduced dominance of nitrogen fixing blue-green algae during the summer months. Measurable differences in MDN and corresponding benefits may not occur for quite some time, however, as the fish populations are gradually rebuilt and contribute a greater amount of MDN to the system.

Enhanced Recreation Facilities

The proposed action includes construction of an additional 25 acres of recreational facilities, which includes upgrades to boat ramps and lake access points, day use areas, campgrounds, and sanitation facilities. The improved ability to access and recreate on Project waters could increase the number of people recreating (as discussed in more detail in section 3.3.6, *Recreational Resources*), which could affect water quality. The applicants have proposed to develop and implement a water quality monitoring plan to monitor compliance with water quality and quantity standards set by their respective 401 Water Quality Certifications, and would submit the plan to the Commission for approval.

Our Analysis

Increased boating opportunities and boat traffic would increase the risk of introducing more petroleum based pollutants into project area waterways, while increased numbers of people in the water could affect bacteria levels, in turn compromising water quality. To the extent that proposed recreational enhancements bring greater numbers of visitors to the project area, and a corresponding increase in use of personal watercraft, there may be an increase in levels of PAH compounds, for which no state water quality standards exist. Increases in numbers of swimmers and people recreating near the water creates the potential for higher bacteria levels in the reservoirs. However, proposed water quality monitoring in the reservoirs to document any increases in either PAHs or fecal coliform levels would alert the applicants and involved agencies to potential reduced water quality conditions. The proposed improvements to the day-use and campsite sanitation facilities are likely to prevent human waste from entering project waters, so many improvements to the recreational facilities may actually improve water quality.

Facility Development/Ground-Disturbing Activities

Most new construction would be related to either upstream or downstream fish passage facilities (3.75 acres), an improved channel in the Lewis River bypassed reach (about 1,200 linear feet), and recreation facilities (25.4 acres). The applicants would develop erosion and sedimentation control plans to protect water quality.

Our Analysis

Ground-disturbing activities have the potential to increase the amount of erosion and sedimentation entering project area waters. Properly implemented erosion and sedimentation control measures should be effective at minimizing the amount of erosion and soil loss during construction of these new facilities. Revegetation of disturbed areas after completion of construction would also reduce erosion and sedimentation on a long-term basis in the vicinity of new facilities.

Draft Water Quality Certifications

WDOE has determined that water quality standards for project waters are attainable. In February 2006, WDOE published draft 401 Certifications for the four Lewis River Projects for public comment. These draft certifications contain several conditions, some general and some specific, for each project to ensure that the standards will be met for the term of a new license, and are summarized below in table 3.3.2-7. The general conditions focus on how the conditions are to be interpreted; the certificate holder responsibilities to protect the waters of the state, and WDOE expectations and caveats. The specific conditions include prescribed instream flows for the Lewis River bypassed reach; TDG and temperature monitoring and reporting requirements; and standard requirements for proposed construction activities, oil spill prevention practices, pesticide, herbicide and fertilizer applications, and compliance reporting. Many of the proposed conditions/requirements are related to monitoring and reporting efforts to ensure compliance with water quality standards, and are associated with adaptive management strategies similar to what was presented in the SA.

Our Analysis

Our review of the draft conditions for water quality certification indicate that they are in general agreement with the terms of the SA, although they provide more specifics than the similar provisions of the SA. For example, the instream flow schedule for the Lewis River bypassed reach contains more detail than the flow schedule described in the SA. The SA states that interim flows of 60 to 100 cfs would be provided into the reach until a final monthly flow schedule is developed, in consultation with the ACC, upon the completion of construction of the upper release point (which would release flows into the upper end of the bypassed reach) and the constructed channel (which would receive the flows from the canal drain). The SA also allows for a 1-year "Adjustment Period," after which a final flow regime would be designed in consultation with the ACC, based on observations made during the Adjustment Period. The draft 401 condition specifies a monthly schedule for the upper release point, as well as a specified flow for the canal drain (see table 3.3.2-7). The total volume of flow to be released, however, would be the same as specified in the SA.

Table 3.3.2-7. Summary of draft water quality certification conditions for the four Lewis River projects, issued by WDOE in February 2006. (Source: http://www.ecy.wa.gov/programs/wq/ferc/wq_certs.html, accessed February 28, 2006)

Sec.	Conditions	Requirements	S1[a]	S2[a]	Y[a]	M[a]
4.1	General Requirements	Project shall comply with all water quality standards; discharges without approval of WDOE to the waters of the state is prohibited; WDOE review and approval is necessary prior to any activity that might affect water quality; Ecology reserves the right to modify, revoke, amend, or terminate the order accordingly; permittees must fully respond to all reasonable requests for materials to assist WDOE in making decisions under this certificate.	X	X	X	X
4.2	Instream Flows & Habitat	Must comply with the instream flow obligations identified in the SA	X[b]	X[b]		X
		Follow instream flow schedule developed for the upper release point, Lewis River bypassed reach, as follows: 11/1 - 11/15: 76 cfs 11/16 – 11/30: 56 cfs 12/1 – 1/31: 51 cfs 2/1 – 2/28 (29 on leap years): 75 cfs (74 cfs only for 1st week in leap year) 3/1 – 5/31: 76 cfs 6/1 – 9/30: 54 cfs 10/1 – 10/31: 61 cfs The canal drain minimum flow will be 14 cfs.	X	X		
		Gravel augmentation in the mainstem bypassed channel.	X	X		
		Monitor and report instream habitat and spawning success in the mainstem bypassed reach and constructed channel.	X	X		
4.3	TDG	Monitor powerhouse releases below dam for turbine air injection generated TDG.	X	X	X	X
		Monitor spill events to minimize TDG production to within 110% saturation.	X		X	X

Sec.	Conditions	Requirements	S1[a]	S2[a]	Y[a]	M[a]
		Develop a TDG Water Quality Attainment Plan within 6 months of the discovery of any exceedance of the 110% TDG criterion caused by spill[c]	X		X	X
4.4	Temperature	Monitor temperature in the forebay and tailrace of the dam as well as any other monitoring required under the Temperature Water Quality Attainment Plan (TWQAP).	X	X	X	
		Develop a TWQAP that provides a detailed strategy for maintaining the highest attainable water quality condition to best protect the biota.	X	X	X	
	Dissolved Oxygen	Monitor DO in the forebay and tailrace in addition to any monitoring required in the TWQAP.				X
4.5	Construction/Habitat Modification	Develop a Water Quality Protection Plan (WQPP) prior to any work in or near the water that has the potential to affect surface and/or ground waters quality. Elements include stormwater pollution prevention plan; in water work protection plan.	X	X	X	X
4.6	Oil Spill Prevention and Control	Measures to reduce the likelihood of oils, fuels, or chemicals reaching the waters of the state. Include points on oil-water separators; transformers; sumps; storage containers; and site security.	X	X	X	X
4.7	Herbicide/Pesticide/ Fertilizer Applications	Permits, BMPs, and water quality monitoring plans should be obtained or developed.	X	X	X	X
4.8	Monitoring & Reporting	Water Quality Management Plans prepared by PacifiCorp and Cowlitz PUD for FERC are incorporated as a requirement of this certificate as well as additional monitoring.	X	X	X	X

[a] S1 = Swift No. 1; S2 = Swift No. 2; Y = Yale; M = Merwin.

[b] WDOE will not allow PacifiCorp at its discretion to stop instream flow releases through the upper release point as described in section 6.1.5a of the SA.

[c] Strict compliance with meeting the 110 percent TDG criteria is waived when flows in the Lewis River exceed the rate equivalent to the 7Q10 flows.

We discuss the effects of flow releases into the bypassed reach in sections 3.3.2.2 and 3.3.3.2 of this EIS, but we did not consider this draft 401 condition, because WDOE did not provide any basis for the specific flows that it would require. There is insufficient information in the record to effectively compare the habitat benefits of the flows specified by the draft 401 condition against the 60 to 100-cfs interim flow schedule included in the SA. The following summarizes the two flow regimes, using the time periods specified in the 401 condition:

Time period	401 Condition flows (cfs)*	SA interim flows (cfs)
11/1 – 11/15	76	100
11/16 – 11/30	56	100
12/1 – 1/31	51	100
2/1 – 2/28	75	75
3/1 – 5/31	76	75
6/1 – 9/30	54	75 (6/1-6/30) 60 (7/1- 9/30)
10/1 – 10/31	61	60.

* This would be from the upper release point. The canal drain minimum flow would be 14 cfs.

This comparison indicates that SA interim flows would be higher during the summer, late-fall, and mid-winter months, but about the same during the fall (October), late-winter, and spring months. We cannot predict any differing effects on habitat, but expect that effects would be similar, with an overall enhancement of aquatic habitat compared to existing conditions with no minimum flows. However, because we cannot determine the basis for the 401 condition flows, we believe that the SA interim flow regime, with the ability to design (and later modify) a final flow regime for the bypassed reach would be a more reasonable and scientific approach to setting minimum flows.

The SA commits to the development of a water quality monitoring plan, which would include elements to assess compliance with water quality standards as required by the respective 401 certifications. The draft 401 certificates contain the specific elements for the monitoring programs referred to in the SA by detailing the schedule, location, timing, frequency, parameters, and depths for sampling. These details ensure that WDOE would receive the information it needs to evaluate the compliance with state water quality standards, and according to the SA would be incorporated into the final water quality monitoring plan developed by the ACC and filed with the Commission. As such, the 401 conditions and the SA are consistent, with the 401 conditions to be incorporated into the SA Monitoring and Evaluation Plan, described in section 9.1 of the SA. Draft 401 conditions related to construction and habitat modifications; oil spill prevention programs; and pesticide, herbicide, and fertilizer applications provide measures beyond what the SA includes, and would ensure that water quality in the Lewis River is protected during any habitat modifications proposed in the SA or routine maintenance activities.

3.3.2.3 Cumulative Effects

Prevention of the transfer of MDN to upstream reaches by the project dams, combined with the natural geochemistry of the Lewis River watershed, has been an ongoing moderate cumulative effect of the Lewis River Projects on water quality. Introduction of anadromous fish under the proposed action would offset project effects on MDN, and in turn decrease the cumulative effect of the projects on water quality. MDN has been shown to create significantly higher growth rates in trees near spawning streams, thus improving spawning and rearing habitat for subsequent generations by improving riparian cover (Helfield and Naiman, 2001). Increased productivity has also been observed in stream macroinvertebrates and in terrestrial invertebrates in carcass-enriched streams, compared to sites upstream of reaches with spawning salmon (Wipfli et al., 1998; Hocking and Reimchen, 2002).

3.3.2.4 Unavoidable Adverse Effects

The Lewis River Projects would continue to control flows in the Lewis River downstream of project facilities under all alternatives considered. To varying degrees, operational and flow-related effects on sediment transport and aquatic habitat would continue in project reservoirs, the Lewis River bypassed reach, and Speelyai Creek.

Operational effects related to TDG in the Swift No. 1 and Yale tailraces would continue throughout the term of the proposed licenses. Monitoring of TDG and other parameters under the Water Quality Management Plans would document compliance with state standards and would allow identification of potential remedial measures.

3.3.3 Aquatic Resources

3.3.3.1 Affected Environment

Fish Distribution and Abundance

The Lewis River Basin downstream of Merwin dam supports wild fall Chinook salmon and hatchery stocks of spring Chinook, early and late coho salmon, and winter and summer steelhead. Chum salmon, Columbia River smelt (Eulachon), Pacific lamprey, white sturgeon, and sea-run cutthroat trout also spawn and rear in the mainstem Lewis River and tributaries below Merwin dam (table 3.3.3-1). Life history periodicity for Lewis River Basin anadromous fish is presented in figure 3.3.3-1.[18] Except for occasional releases of excess hatchery fish to supplement the sport fishery, no anadromous fish populations are present above Merwin dam.

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[18] Anadromous species live in the ocean and enter freshwater rivers to spawn. Life history periodicity is the month/season of the year that specific life history stages occur (such as spawning, rearing, migration).

Table 3.3.3-1. Resident and anadromous fish species present in the Lewis River Basin. (Source: Cowlitz PUD, 2004)

Species	Project Reach			
	Lewis River Downstream of Merwin dam	**Lake Merwin and Tributaries**	**Yale Lake and Tributaries**	**Swift Creek Reservoir and Upper Lewis River**
Fall Chinook salmon[a]	X			
Spring Chinook salmon[a]	X	X[b]		X[c]
Coho salmon[a]	X	X[b]		X[c]
Winter steelhead[a]	X	X[b]		X[c]
Summer steelhead[a]	X	X[b]		
Chum salmon[a]	X			
Sea-run cutthroat trout	X			
White sturgeon	X	X		
Pacific lamprey	X			
Eulachon (smelt)	X			
Kokanee		X	X	
Bull trout[a]	X	X	X	X
Resident rainbow trout	X	X	X	X
Resident cutthroat trout	X	X	X	X
Northern pikeminnow	X	X	X	
Tiger musky	X	X		
Brook trout			X	X
Mountain whitefish	X	X	X	X
Sculpin (spp.)	X	X	X	X
Carp		X		
Bluegill		X		
Crappie		X		
Threespine stickleback	X	X	X	X
Largescale sucker	X	X	X	X
Brown bullhead		X		

[a] Species listed under the ESA.
[b] Excess hatchery salmonids are planted into Lake Merwin to supplement the sport fishery.
[c] Progeny of experimental releases in the upper watershed.

Resident fish species in the Lewis River Basin above and below Merwin dam include bull trout, kokanee (landlocked sockeye salmon), cutthroat trout, rainbow trout, northern pikeminnow, tiger musky, mountain whitefish, sculpin, carp, bluegill, crappie, threespine stickleback, and largescale sucker (table 3.3.3-1). All are native to the Lewis

River Basin with the exception of kokanee, bluegill, tiger musky, and crappie. The non-native species were introduced following dam construction to enhance the recreational fishery.

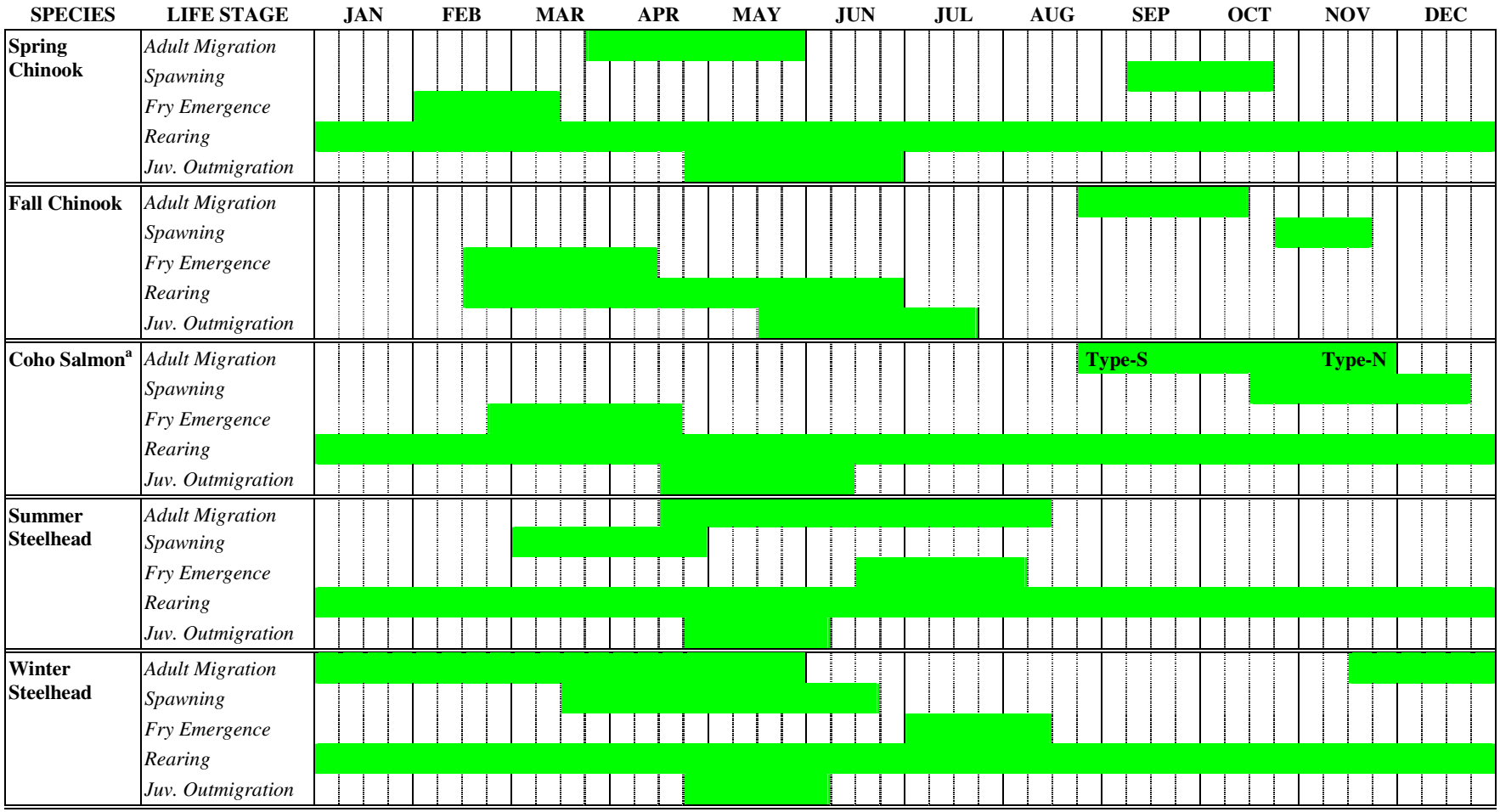
Chinook Salmon

Chinook salmon are anadromous and have a broad range of life history traits. There are three races of Chinook, spring, summer, and fall run, classified as to the season in which they return to their natal streams to spawn. The majority of Chinook spawning occurs in the fall, however, spring Chinook generally spawn in the upper reaches of tributaries, summer Chinook typically spawn in the mouths of tributaries, while fall Chinook generally spawn in the mainstem of larger streams and rivers (Wydoski and Whitney, 2003). Chinook salmon die after spawning. Chinook juveniles can also be classified as "stream-type," which are usually spring Chinook that spend up to a year in freshwater before migrating to the ocean, or "ocean-type" that are typically from fall Chinook and migrate to the ocean by the end of their first summer (Wydoski and Whitney, 2003). Life history periodicity for spring and fall Chinook in the Lewis River is presented in figure 3.3.3-1. There are no summer Chinook in the Lewis River.

Three Chinook salmon stocks are found in the Lewis River Basin: spring Chinook and two fall Chinook stocks. Spring Chinook have been supplemented with hatchery stocks for decades, and current returns are thought to be primarily hatchery origin (personal communication, R. Nicolay, WDFW, 1999, as cited in PacifiCorp et al., 2005). The current distribution of spring Chinook is limited to the mainstem Lewis River below Merwin dam, and Cedar Creek up to RM 18.2 (PacifiCorp et al., 2005). Life history periodicity for naturally spawning spring Chinook in the Lewis River is presented in figure 3.3.3-1.

From 1980 through 2001, the total adult spring Chinook return (including hatchery returns, natural escapement, and sport harvest) has ranged from a low of 1,269 in 2001 to nearly 17,000 in 1987, with an average of approximately 5,400 fish (figure 3.3.3-2).

NMFS listed the lower Columbia River Chinook salmon Evolutionarily Significant Unit (ESU) as a threatened species on March 25, 1999 (64 FR 14508). This includes all naturally-spawning spring Chinook and the Lewis River hatchery spring Chinook, as well as two fall Chinook stocks in the Lewis River Basin. The two fall stocks include the "tules" and the "brights." The tules enter the river earlier in the fall, while the brights enter in late fall. Both spawn at about the same time from late-October to late-November. The fall Chinook stocks are self-sustaining, and their production is entirely natural. WDFW discontinued a Lewis River Hatchery fall Chinook program in 1986 to eliminate negative interactions with wild fish. Lewis River fall Chinook represent about 80 to 85 percent of the wild fall Chinook returning to the lower Columbia River (NPPC, 1990).



[a] Type-S are early-run coho, and Type-N are late-run coho.

Figure 3.3.3-1. Periodicity chart for life stages of fish species (with known life history information) in the Lewis River Basin. (Source: PacifiCorp and Cowlitz PUD, 2004a)

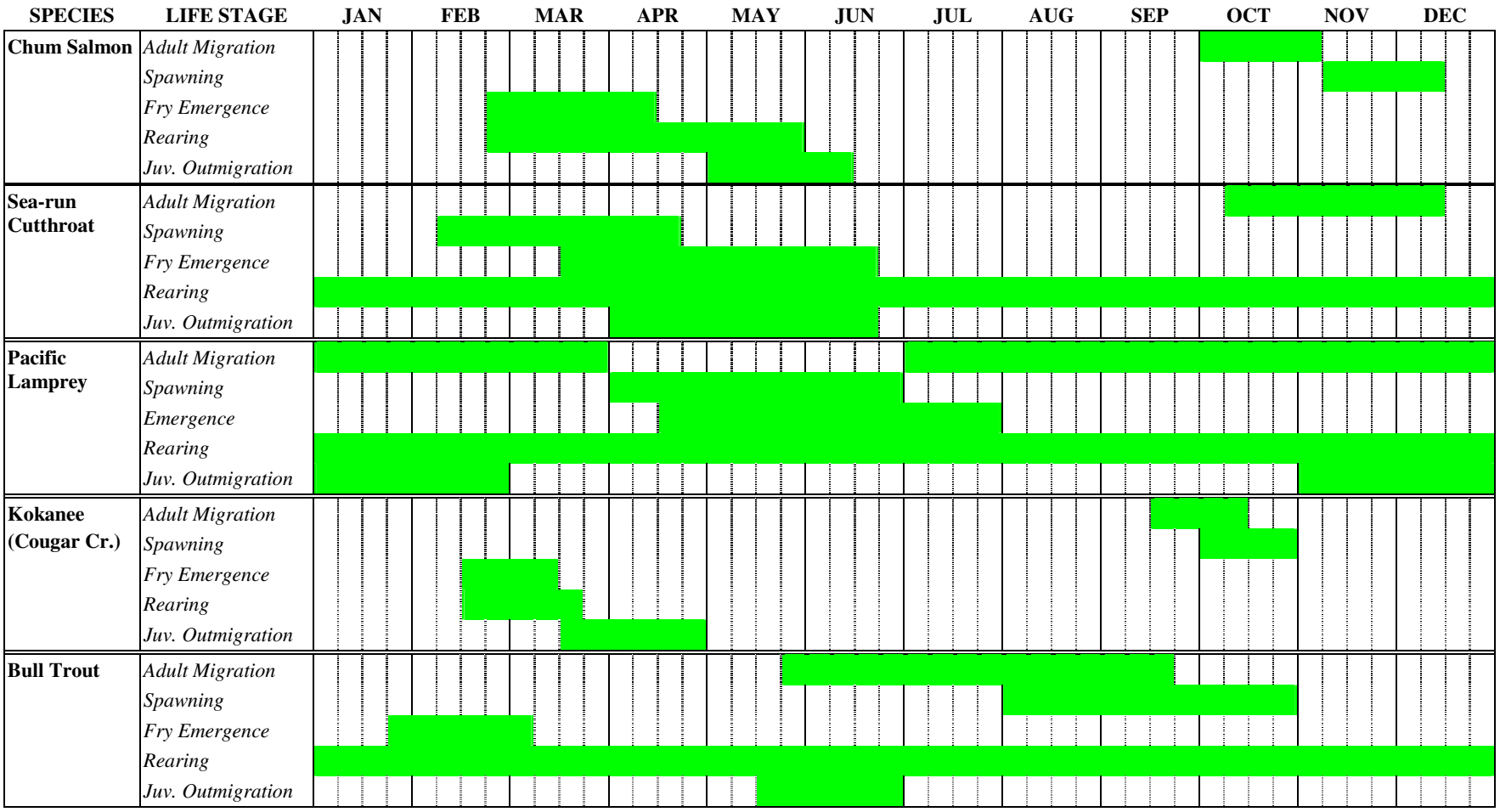


Figure 3.3.3-1. Periodicity chart for various life stages of fish species (with known life history information) in the Lewis River Basin (cont.).

The distribution of fall Chinook is limited to the mainstem Lewis River from its mouth to Merwin dam, in the East Fork Lewis River from its mouth to RM 20.6, and in Cedar Creek from its mouth to RM 8.2 (PacifiCorp et al., 2005). Between 1980 and 1999, the number of fall Chinook returning to the Lewis River has ranged from a low of 6,200 in 1998 to approximately 21,200 in 1989 (figure 3.3.3-2). The average over this period was 11,600 fish.

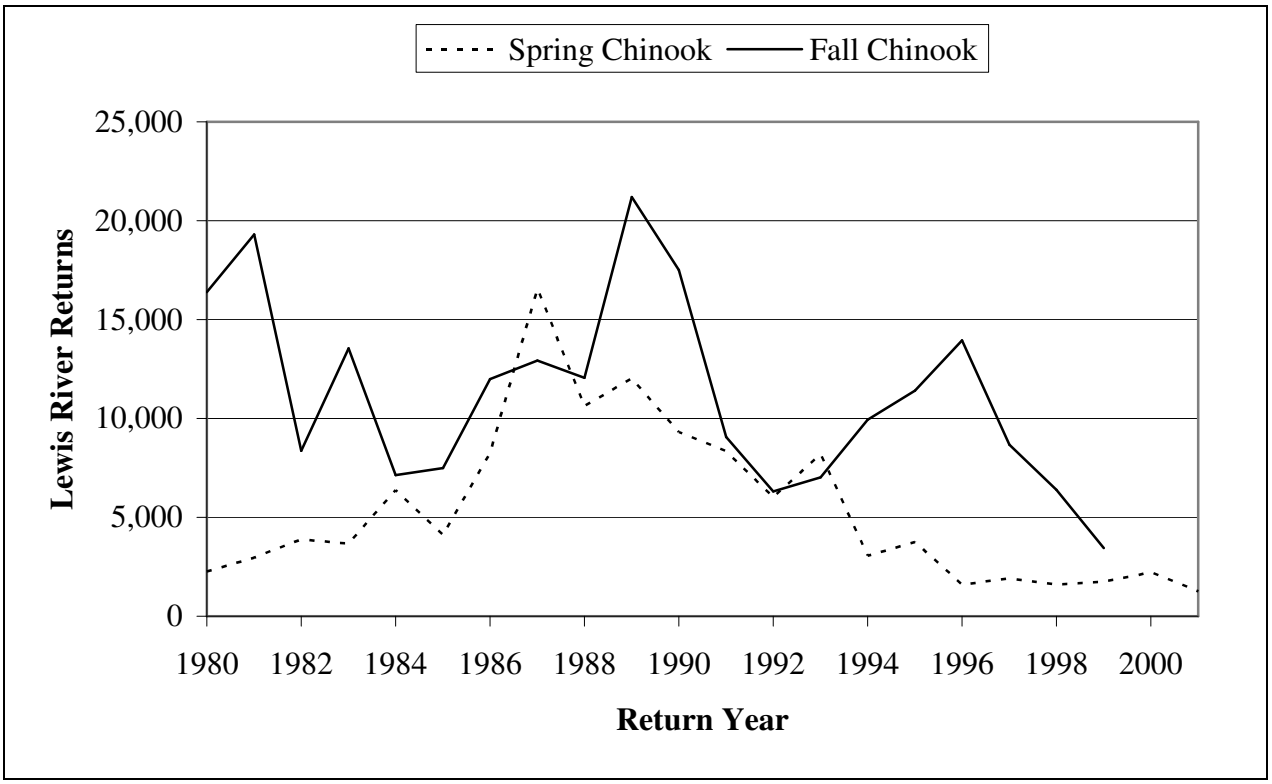


Figure 3.3.3-2. Adult spring Chinook and fall Chinook returns to the North Fork Lewis River (1980–2001). (Source: Cowlitz PUD, 2004)

Coho Salmon

Coho salmon are anadromous. Juvenile coho rear in freshwater, typically migrate to sea in the spring of their second year, spend 16 to 20 months rearing in the ocean, and return to freshwater to spawn in the autumn as 3-year-old adults. Some males return to freshwater to spawn after only 5 to 7 months in the ocean (Wydoski and Whitney, 2003). Coho salmon die after spawning. Although they are indigenous to the Lewis River Basin, returning coho salmon are currently managed for two hatchery stocks, a late run (Type-N) stock and an early run (Type-S) stock. Since 1952, annual releases of hatchery coho have ranged from 457,000 in 1959 to over 12.2 million in 1989. Most (65 percent) were released as yearlings. The original Lewis River Hatchery coho stock was taken from native coho trapped at Merwin dam (WDFW, 2000a). Since then coho have been supplemented from stock sources including late-run (Type-N) Cowlitz River stock and

early-run (Type-S) Toutle River stock. Life history periodicity for naturally spawning coho in the Lewis River is presented in figure 3.3.3-1.

There is very little natural production of coho salmon in the Lewis River Basin. The majority of returning coho are captured at the Merwin Hatchery, although an estimated 5 to 10 percent spawn naturally within the mainstem Lewis River below Merwin dam and in several tributaries including the East Fork Lewis River, Ross, Cedar, Chelatchie, Johnson, and Colvin creeks, and numerous smaller tributaries.

From 1980 to 2001, returns of both Type-S and Type-N coho have ranged from approximately 2,400 to over 98,000 fish, with an average of around 28,000 fish (figure 3.3.3-3). In recent years, coho abundance has increased dramatically. Returns to the hatchery account for only a small portion of the adult coho produced at the Lewis River hatcheries, since the bulk of the production (65 to 85 percent) is harvested in the mainstem Columbia River and Pacific Ocean (WDFW, 1994).

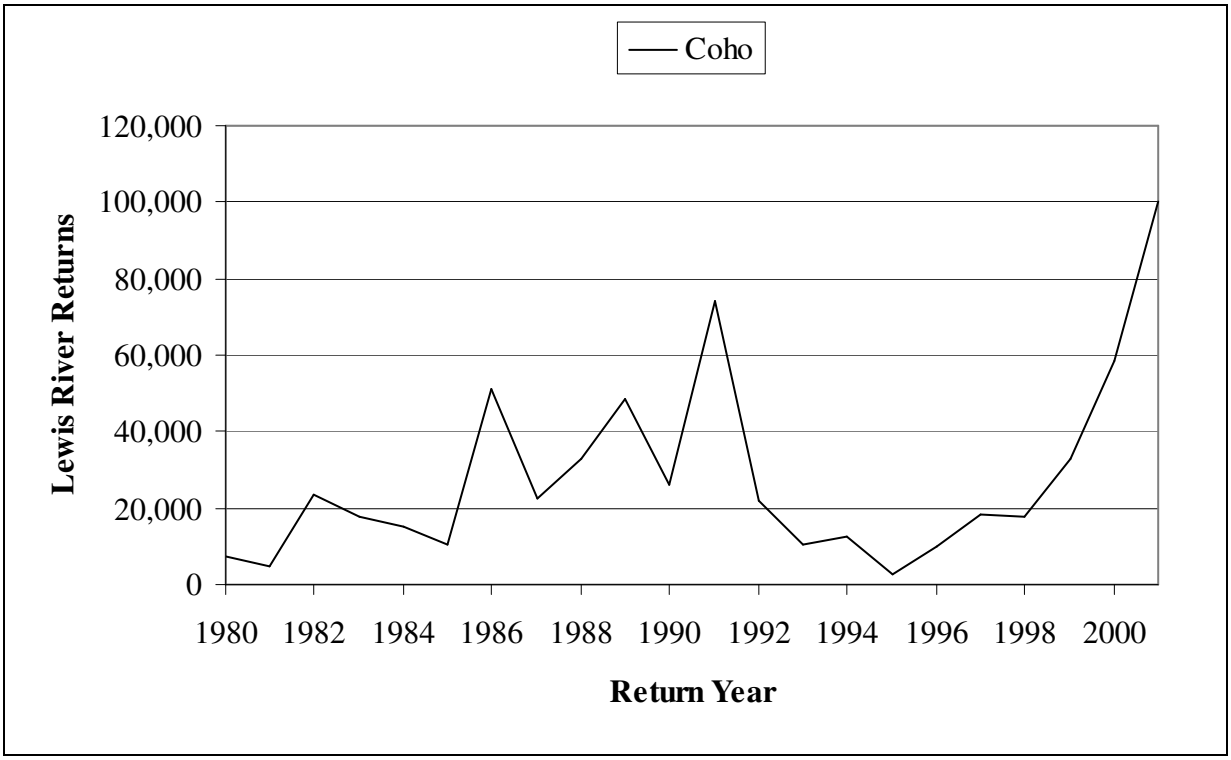


Figure 3.3.3-3. Adult coho returns to the North Fork Lewis River. (1980 to 2001). (Source: PacifiCorp and Cowlitz PUD, 2004a)

In June 2005, NMFS designated the naturally spawning lower Columbia River coho ESU as threatened under the ESA (70 FR 70 37160). Included in the listing are coho from the Lewis River Type-N and Type-S hatchery programs.

Steelhead

Oncorhynchus mykiss occur in two forms: the anadromous steelhead and the non-anadromous rainbow trout. Steelhead are 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 trout). Rainbow trout are discussed in a separate section below.

Biologically, the anadromous steelhead can be divided into two reproductive ecotypes based on their state of sexual maturity at the time of river entry and duration of their spawning migration: "stream maturing" (summer steelhead) and "ocean maturing" (winter steelhead). Summer steelhead enter freshwater during the summer months in a sexually immature state and require several months of maturation before they spawn the following spring. Winter steelhead enter freshwater ready to spawn in late winter or early spring and spawn the same spring that they enter the river (Busby et al., 1996) (see figure 3.3.3-1). Steelhead do not usually die after spawning as do salmon and can repeat their ocean/stream migration to spawn again (Wydoski and Whitney, 2003).

Steelhead in the lower Columbia River ESU, which includes naturally-spawned populations and their progeny in the Lewis River downstream of Merwin dam, were listed as threatened by NMFS on March 19, 1998 (63 *Federal Register* 13347). Both summer and winter steelhead are indigenous to the Lewis River Basin; however, hatchery summer and winter steelhead (Skamania and Beaver Creek stocks) have been planted in the system since the late 1940s. Annual hatchery releases in the past 20 years have averaged just under 500,000 fish (PSMFC, 2001, accessed at http://query.streamnet.org/). The majority of the steelhead releases have been yearlings from the Merwin Hatchery (post 1993), as well as from the Skamania, Vancouver, and Beaver Creek hatcheries.

There is little wild steelhead production in the Lewis River below Merwin dam; wild steelhead returns account for approximately seven percent of the total run size (WDFW, 1994). Steelhead distribution in the mainstem Lewis River occurs from the mouth to Merwin dam and throughout the tributaries, with natural spawning concentrated in Cedar Creek (NPCC, 2004).

Hatchery winter and summer steelhead support a popular recreational fishery in the lower Lewis River. From 1980 through 1998, annual angler catch of summer steelhead in the mainstem and North Fork Lewis River has averaged just over 4,150 fish. Catch of winter steelhead during this same period has averaged 3,380 fish (figure 3.3.3-4). Prior to 1994, all steelhead captured at the Lewis River Hatchery were returned to the river for harvest by anglers. Therefore, hatchery returns are not the best indicator of total run size. Selective harvest regulations allow only the harvest of adipose-fin clipped fish. There is no legal harvest for wild steelhead in the Lewis River Basin; all wild steelhead caught must be released unharmed.

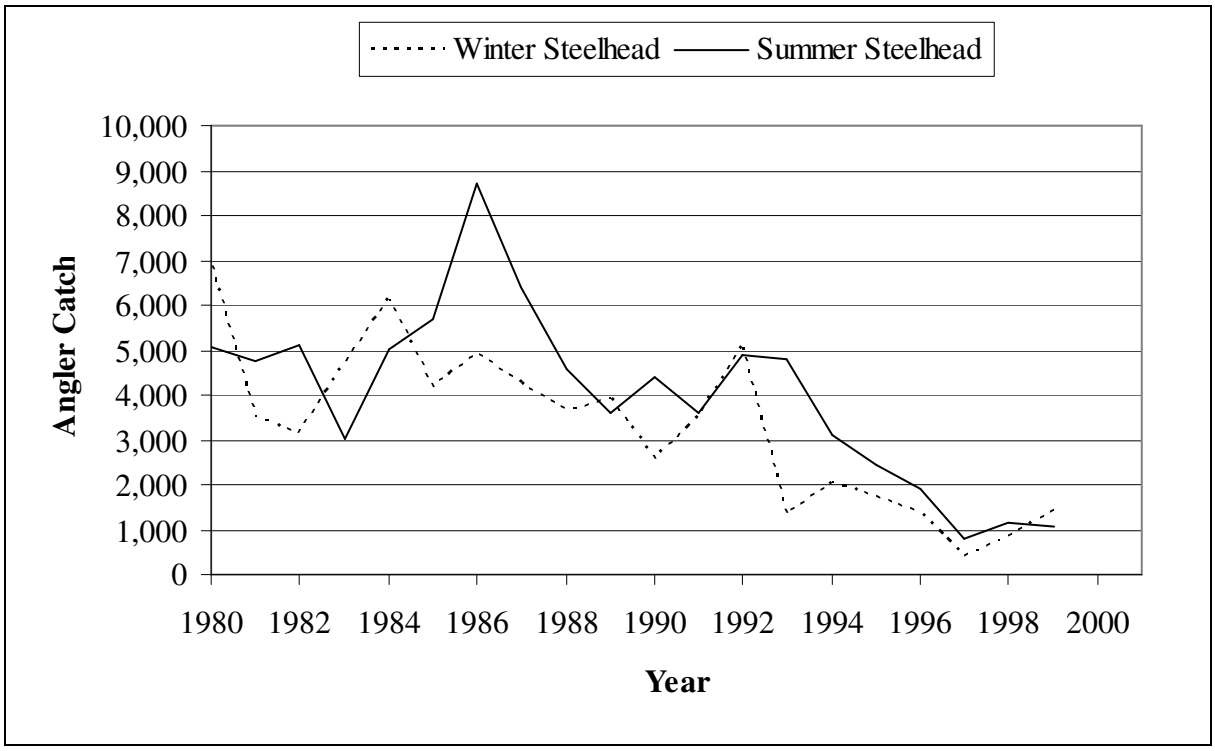


Figure 3.3.3-4. The number of winter and summer steelhead harvested in the Lewis River Basin recreation fishery (1980 through 1998). (Source: PacifiCorp and Cowlitz PUD, 2004a)

Chum Salmon

Chum salmon are anadromous and spend an average of 4 years in salt water before returning to freshwater streams to spawn. Mature adults enter freshwater at an advanced stage of sexual development and spawn in the lower reaches of coastal streams (typically, just above tidal influence). Chum salmon die after spawning. Rarely do chum salmon penetrate rivers more than 100 miles inland (Scott and Crossman, 1973). Although very capable swimmers, they are not leapers and are usually reluctant to enter long-span fish ladders (Salo, 1991; Powers and Orsborn, 1985). Figure 3.3.3-1 shows the life history periodicity for chum salmon in the Lewis River.

The Columbia River chum salmon were listed as a threatened species on March 25, 1999 (64 FR 14508). Only a remnant population of chum salmon (of uncertain stocking history) exists in the Columbia River and its tributaries below Bonneville dam. Most of these chum salmon spawn in the Grays River system near the mouth of the Columbia River and near Bonneville dam in Hardy and Hamilton creeks (WDF, WDW, and WWTIT, 1993).

In the lower Lewis River, spawning chum salmon were sighted occasionally during 1998 fall Chinook spawning surveys, and four adult carcasses were observed in Cedar Creek. In addition, about 45 juvenile chum salmon were captured during seining operations related to a smolt residual study in 1998. Three or four adult chum salmon have also been captured annually at the Merwin fish trap. All of these fish were believed to be wild; hatchery supplementation has not occurred since 1940 (NPPC, 1990).

Cutthroat Trout

Cutthroat trout *(Oncorhynchus clarki)* are found throughout the Lewis River watershed. The anadromous form (sea-run cutthroat trout) is currently found in the Lewis River and its tributaries up to Merwin dam (RM 19.4). Fluvial and resident coastal cutthroat trout are found upstream and downstream of Merwin dam, and adfluvial fish have been observed in Merwin, Yale, and Swift Creek reservoirs (WDFW, 2000b). Fluvial cutthroat trout spawn in small upstream tributaries and move into larger rivers as they mature. Adfluvial cutthroat spend 1 to 4 years as juveniles in tributaries before moving into lakes, and then they move back into tributaries only to spawn. Resident cutthroat are found in headwater streams and stay there throughout their life history (Wydoski and Whitney, 2003). Although hatchery-origin anadromous cutthroat trout were released annually from 1993 through 1999 as smolts into the Lewis River (Cowlitz River and Skamania River stocks), the existing Lewis River coastal cutthroat trout stock is considered native. WDFW staff believes that few genetic interactions have occurred between wild and hatchery populations. Life history periodicity for sea-run coastal cutthroat trout in the Lewis River is presented in figure 3.3.3-1.

Information describing the abundance of coastal cutthroat trout in the Lewis River Basin is extremely limited. According to WDFW (2000b) there are no data available that describe 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). Life history periodicity for sea-run coastal cutthroat trout in the Lewis River is presented in figure 3.3.3-1.

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

Pacific Lamprey

The distribution of Pacific lamprey is similar to that of Pacific salmon. In Washington the species is found in most large coastal rivers and tributaries including the

Columbia, Snake, and Yakima River systems (Wydoski and Whitney, 2003). 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.

Larval lamprey are referred to as ammocoetes, spending up to 7 years in freshwater, burrowed in the sediment, and feeding on diatoms and detritus by filtering the water column. Pacific lamprey metamorphose into a juvenile stage termed macropthalmia in the fall and migrate downstream in late fall (Wydoski and Whitney, 2003). While in the ocean they are believed to be parasitic for 20 to 40 months, feeding on bodily fluids of fishes. Upon reentry to freshwater to spawn, they stop feeding.

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 species are currently being developed. Life history periodicity for Pacific lamprey in the lower Columbia River is presented in figure 3.3.3-1.

Bull Trout

Bull trout exhibit two distinct life-history strategies: resident and migratory. 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 fish rear for up to six years before migrating to either a lake (adfluvial), river (fluvial), or in certain coastal areas, to saltwater (anadromous). Maturity is reached in one of these three habitats (Fraley and Shepard, 1989; Goetz, 1989). Resident and migratory forms may be found together (Wydoski and Whitney, 2003) and it is suspected that bull trout give rise to offspring exhibiting both resident and migratory behavior (Federal Register, Vol. 63, No. 111, June 10, 1998; Rieman and McIntyre, 1993).

Bull trout have more specific habitat requirements than other salmonids. Cold water temperature is likely the most important habitat component, and water temperature above 15°C is believed to limit bull trout distribution. Studies show that temperatures must drop below 9 or 10°C for spawning to occur. Complex cover including LWD, undercut banks, coarse substrates, and pools correspond to the distribution and abundance of bull trout. Preferred spawning habitat is low gradient streams with loose, clean gravels. Bull trout habitat requires stream channel and flow stability. Embryos and juveniles may be particularly vulnerable to flooding and channel scour.

FWS listed the Columbia River Distinct Population Segment (DPS) of bull trout as threatened on June 10, 1999 (63 FR 31647). The Columbia River Basin supports a total of 141 subpopulations of bull trout, and two occur in the Lewis River Basin (Federal

Register, Vol. 63, No. 111, June 10, 1998). Genetic analysis (Neraas and Spruell, 2004) of the Lewis River bull trout population indicated that there are statistically significant subpopulations, the Pine Creek subpopulation and the Rush Creek subpopulation. Although both subpopulations can be found in Swift Creek reservoir, the study indicates that there is not significant genetic exchange between the bull trout spawning in these two streams. Downstream from Swift dam, genetic samples from Lake Merwin, Yale Lake, and Cougar Creek were indistinguishable and a mix of individuals from upstream sources. Furthermore, the ability of fish to move downstream through the dams but not upstream most likely explains the "mixed stock" genetics of the bull trout below Swift dam. Life history periodicity for bull trout residing in Yale Lake and Swift Creek reservoir is presented in figure 3.3.3-1.

No known spawning sites are accessible to bull trout in the tributaries to Lake Merwin or the mainstem below Merwin dam. Bull trout found in Lake Merwin are believed to have moved downstream from Yale Lake. Adults and sub-adults have also been observed in the Swift No. 2 canal and Lewis River bypassed reach (PacifiCorp, 1999b). A small number of unidentified adult char (bull trout or Dolly Varden) have also been captured in the ladder at the Lewis River hatchery downstream of Merwin dam.

Bull trout spawning and rearing habitat in the Lewis River Basin is limited. Most bull trout spawning and juvenile rearing occurs in Cougar, Rush, and Pine creeks (tributaries to Yale Lake and Swift Creek reservoir) (Faler and Bair, 1992; Lesko, 2001). The primary limiting factor for bull trout production appears to be the availability of adequate spawning and rearing habitat. One and three-quarters miles of Cougar Creek are the only spawning and rearing habitat for the Yale Lake population.

From 1979 through 2003, the number of adult bull trout spawning in Cougar Creek (based on annual peak counts) has ranged from 0 in 1981 and 1982 to 40 in 1979 (figure 3.3.3-5). The low number of spawners observed in the early 1980s may be related to effects associated with the May 1980 eruption of Mount St. Helens. 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 (PacifiCorp et al., 2005a).

In Swift Creek reservoir, bull trout populations appear to have increased since the early 1990s. Between 1994 and 2003, the annual spawner population there has ranged from 101 to 792 fish (figure 3.3.3-6) (Lesko, 2002; pers. comm., D. Rawding and J. Weinheimer, WDFW, 2000).

Bull trout adults enter the Yale dam tailrace in the fall, apparently attempting to migrate upstream. It is believed they enter Lake Merwin from Yale Lake via spill over Yale dam or as a result of turbine entrainment and are subsequently isolated from upstream habitat. Lake Merwin contains no appreciable bull trout spawning habitat, while Cougar Creek, a major tributary to Yale Lake, contains important bull trout spawning and early rearing habitat. Pine and Rush creeks, two tributaries to the Lewis

River upstream of Swift Creek reservoir, also provide important spawning and early rearing habitat for bull trout. According to FWS and NMFS (2002), a gill netting program has reduced the number of adult bull trout that are isolated from Cougar Creek. Since the program began in 1995, an average of 21 percent of the annual Cougar Creek spawners were fish that had been trapped and transported from the Yale tailrace. In addition, Cowlitz PUD and PacifiCorp initiated a pilot net-and-haul program at the Swift No. 2 tailrace in 1999. No bull trout were captured or observed at the tailrace, but two were netted in the Lewis River bypassed reach directly upstream from the Swift No. 2 powerhouse (FWS and NMFS, 2002).

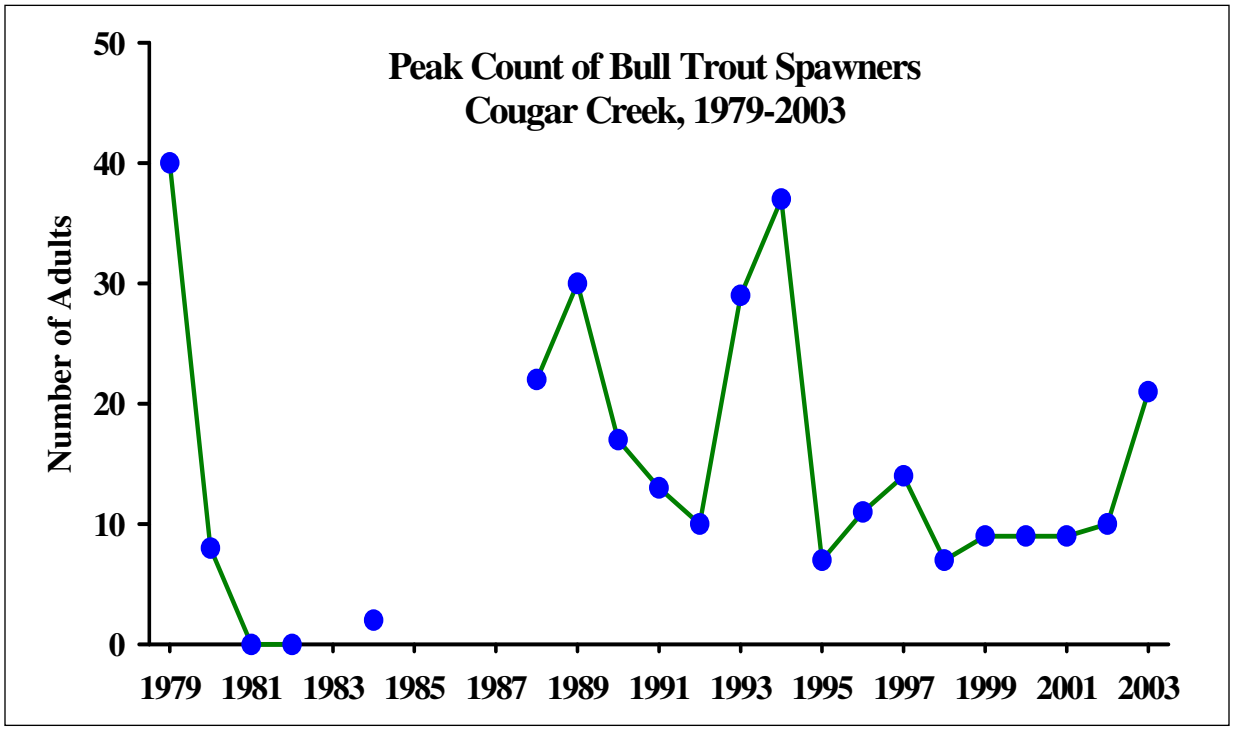


Figure 3.3.3-5. Annual peak counts of bull trout spawners observed in Cougar Creek 1979 through 2003. (Source: PacifiCorp and Cowlitz PUD, 2004a)

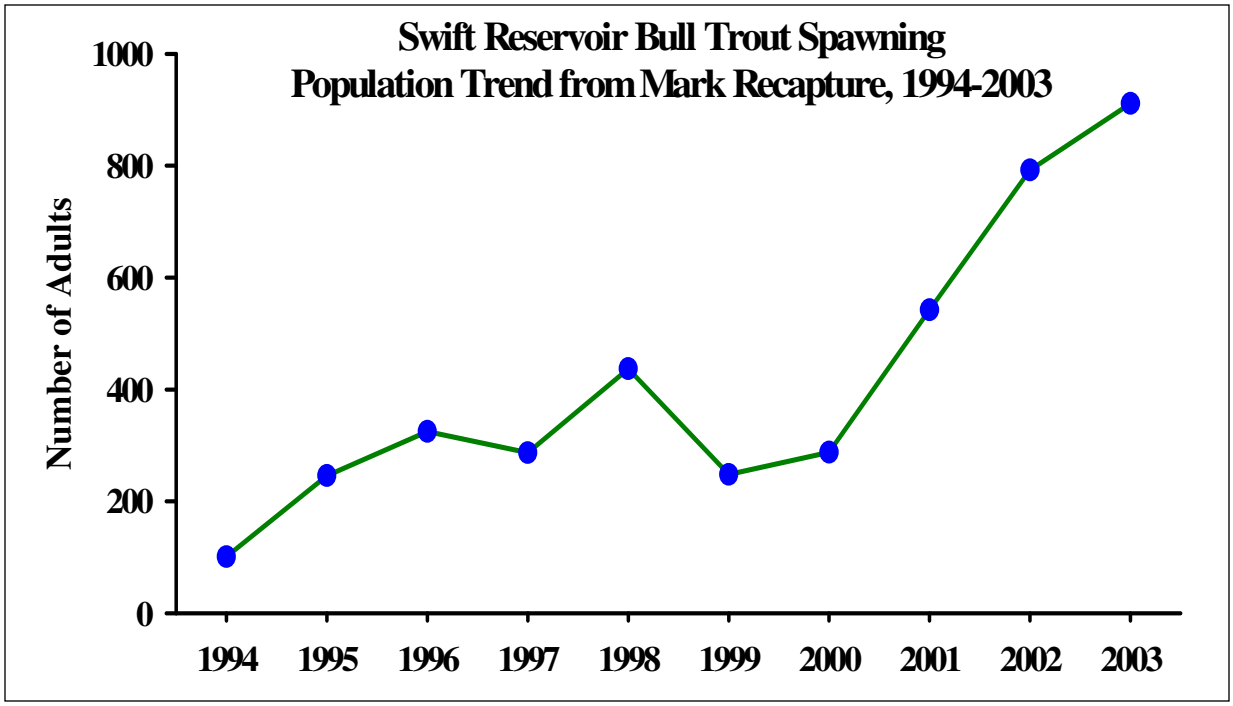


Figure 3.3.3-6. Spawning population estimate of bull trout in Swift Creek reservoir for the years 1994 through 2003. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Kokanee

Oncorhynchus nerka occur in two forms: the anadromous sockeye salmon, and the non-anadromous kokanee. Anadromous sockeye salmon typically spend their first year of life in a lake before migrating to the ocean to rear and mature, while kokanee complete their entire life cycle in freshwater (Meehan and Bjornn, 1991). Kokanee usually mature at a smaller size than sockeye salmon because there is typically less food in lake environments than in the ocean (Meehan and Bjornn, 1991). Throughout its range, the average life span of kokanee is 4 years (3 years in southern populations), although some as old as 8 years have been reported (Scott and Crossman, 1973).

Kokanee are not native to the Lewis River Basin, but were first introduced into Yale Lake and Lake Merwin in 1957, and into Swift Creek reservoir in 1961. To create a reservoir fishery, tributaries to all three reservoirs were stocked with kokanee from Kootenay Lake and Cultus Lake, both of which are located in British Columbia. Kokanee are currently found in Lake Merwin and Yale Lake, with Yale Lake supporting the only self-sustaining population in the basin.

Yale Lake kokanee spawn primarily in Cougar Creek, where PacifiCorp's annual surveys since 1978 indicate large annual fluctuations in the spawning (and presumably the reservoir) population. Spawning estimates (excluding the years 1982 to 1984, when the fishery was affected by severe mud flows from the Mount St. Helens eruption) range

from a high of about 180,000 (1991) to a low of 5,357 (1998) (figure 3.3.3-7). Limited kokanee spawning has also been documented in the Lewis River bypassed reach and Ole Creek (PacifiCorp, 1999b). Kokanee outmigration is highly synchronized and occurs during the night, so that thousands of fry swim or drift en mass to the lake in an attempt to minimize predation (Burgner, 1991). In the Lewis River Basin, juvenile kokanee rear for an average two to three years before spawning. Life history periodicity for kokanee residing in Yale Lake and Lake Merwin is presented in figure 3.3.3-1.

Kokanee in Lake Merwin spawn primarily in the lower 300 feet of Canyon Creek, because a natural barrier prohibits upstream passage beyond this point. Limited spawning also occurs in Speelyai Creek (downstream from the hatchery diversion), in lower Rock Creek, and in the Yale tailrace (Graves, 1982).

Kokanee are the primary target species for anglers in Yale Lake and are the most popular target species in Lake Merwin (WDFW, 1998). In 1996, WDFW supplemented the kokanee population in Lake Merwin using kokanee spawned and reared at Speelyai Hatchery. In 1999, Yale Lake received its first planting of kokanee since 1957, a practice that was discontinued in late 2001. The current kokanee production goal at Speelyai Hatchery is 45,000 fingerlings and 48,000 yearlings, all of which are planted in Lake Merwin.

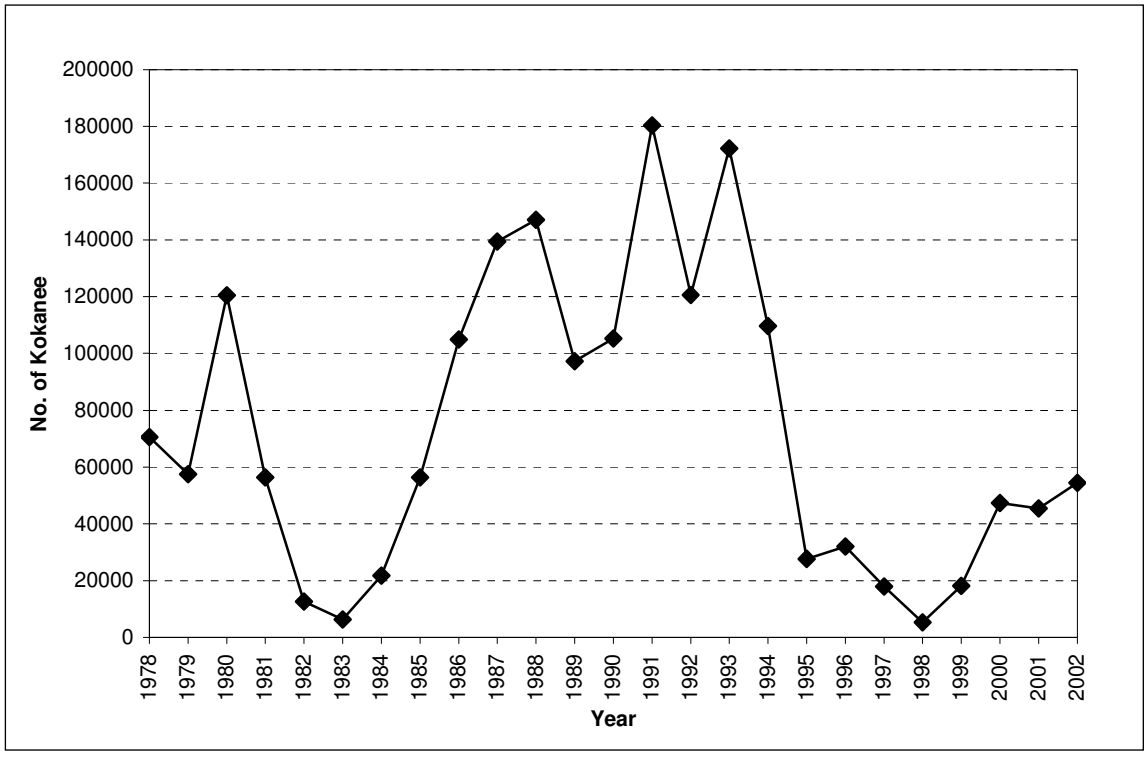


Figure 3.3.3-7. Peak counts of kokanee spawning in Cougar Creek (1978 to 2002). (Source: PacifiCorp and Cowlitz PUD, 2004a)

Rainbow Trout

Rainbow trout are the non-anadromous form of *Oncorhynchus mykiss*. Although rainbow trout are native to the Lewis River Basin, non-native stocks of rainbow trout have been planted in Swift Creek reservoir since 1978. The goal of this program is to support a popular sport fishery. Since 1978, approximately 800,000 to 1,000,000 rainbow trout fingerlings have been stocked annually.

In 1992, the Clark/Skamania Fly Fishers Club funded a genetic analysis of rainbow trout collected in Canyon and Siouxon creeks to help determine the effects of past stocking on the native rainbow trout population (Phelps, 1992). No evidence of hatchery rainbow trout gene flow was found in the population collected in upper Siouxon Creek (i.e., these fish are pure native), and only minor gene flow was found in the lower Siouxon Creek collection (i.e., there appears to be a low level of hatchery introgression into this population). The Canyon Creek population does not appear to be hybridized with hatchery-origin rainbow trout (Phelps, 1992).

Northern Pikeminnow

The northern pikeminnow is one of the largest native minnows (family Cyprinidae) in North America. In the Columbia River downstream of Bonneville dam they reach an average length of 15.9 inches (Wydoski and Whitney, 2003). Juvenile northern pikeminnow feed on a variety of aquatic invertebrates, but fish are the favored prey of larger northern pikeminnow. In the Pacific Northwest, they are considered serious predators of anadromous salmonids and much effort has been expended in attempts to eradicate them.

Because of their preference for stillwater habitat, it is likely that few northern pikeminnow occurred in the Lewis River Basin prior to the construction of the Lewis River Projects. Following the creation of substantial reservoir habitat, northern pikeminnow populations increased dramatically. In the last 40 years, large numbers of pikeminnow have been observed in Lake Merwin, with smaller numbers observed in Yale Lake. In 1961, the population of northern pikeminnow greater than 20 cm in length (7.9 inches) in Lake Merwin was estimated to be about 350,000 fish (Hamilton et al., 1970).

Tiger Musky

Tiger musky, 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. Their preferred habitat consists of heavily vegetated, non-turbulent shorelines (Wydoski and Whitney, 2003). Northern pikeminnow are known to be one of the main predators on emigrating juvenile salmonids

in the Columbia River Basin. Annual tiger musky plants into Lake Merwin have ranged from 375 to just over 1,700. Funding for this program is provided by WDFW.

Recently, tiger muskies have been observed in the mainstem Lewis River below Merwin dam; however, no studies have been conducted to determine how these fish moved there (i.e., over the spillway or through the turbines), nor have there been efforts to determine the number of tiger muskies that have migrated out of the reservoir.

Aquatic Habitat

The existing aquatic habitat conditions of project-affected reaches in the Lewis River watershed are described in detail in the PDEA, and additional information is presented in several studies (WTS 1, WTS 3, WTS 4, AQU 9, and AQU 12) published in the Final Technical Study Reports. Information from these documents is summarized below.

Lewis River Bypassed Reach

The Lewis River bypassed reach extends approximately 3.3 miles between Swift dam and Yale Lake. Flow in the reach comes from seepage from Swift No. 2 canal, groundwater inflow, tributary inflow, and infrequent spillage into the reach from Swift dam during high flow events. Under the current Commission license, there is no minimum flow requirement for this reach, but seepage from the canal provides approximately 21 cfs of flow to the reach. In addition, occasional high river flows require water to be spilled from the Swift reservoir into the bypassed reach. These spills are often in excess of 5,000 cfs and have been as high as 45,000 cfs. Groundwater seepage and Ole Creek, which enters the lower portion of the reach, also are sources of some flow. Ole Creek flows into the reach approximately 2.5 miles downstream of Swift dam and provides a source of water, gravel, and LWD during the fall, winter, and spring. The majority of this reach is characterized by riffles and glides with small boulder/cobble substrate (table 3.3.3-2).

Lower Speelyai Creek

Lower Speelyai Creek is a spring-fed system with stable flows increasing from 0 cfs below the upper diversion (RM 4.4) to 17 to 28 cfs at the Speelyai Hatchery intake, as a result of groundwater and tributary contributions (see section 3.3.2.1). Aquatic habitat in lower Speelyai Creek is dominated by glides and pools, with some riffles (table 3.3.3-2). Aquatic habitat is of good quality, with diverse pool (resting habitat), riffle and run conditions, ample LWD, and spawning gravel resources.

Table 3.3.3-2. Current aquatic habitat metrics in measured stream reaches in the Lewis River watershed. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Stream Reach	Riffle (percent by length)	Glide (percent by length)	Pool (percent by length)	Side Channel (percent by length)	Dominant/ sub-dominant substrate	Total area of spawning gravel (sq yd)	Average percent fines (<1mm) in spawning gravel	LWD (pieces/ mile)
Lewis River bypassed reach	12%	11%	15%	62%	Small Boulder/ Cobble	Not measured	1-5%	21
Lower Speelyai Creek	18%	42%	40%	0%	Cobble/ Gravel	730	Not measured	108
Lewis River: Merwin dam to Lewis River Hatchery (confined channel)	22%	56%	22%	0%	Cobble/ Gravel	38,600	0-4%	10
Lewis River Hatchery to Eagle Island (unconfined channel)	17%	60%	0%	23%	Cobble/ Gravel	40,600	2-10%	20

Lewis River Downstream from Merwin Dam

The Lewis River is confined to a narrow valley from Merwin dam (RM 19.4) downstream to the Lewis River Hatchery (RM 15.7). The river channel below Merwin is fairly stable, with few areas of active bars, little channel migration, and little bedload transport. Riparian habitat is affected by development, agriculture, and recreation.

Aquatic habitat in the confined reach is characterized by glides, riffles, and pools. Bedrock outcrops are the dominant pool-forming mechanism. Substrate in this reach is cobble/gravel in the glides and riffles, and boulder/bedrock/cobble in the pools. Over 38,000 square yards of spawning-sized gravel was mapped and is distributed throughout the reach. The good quality of the gravel is substantiated by the high use of the reach for spawning. There is little LWD (an average of 10 pieces per mile), the majority of which is located on bars within the bankfull channel, but above the wetted channel. The current flow regime, combined with the extremely low gradient of this reach, results in low bedload transport rates. As a result, the gravel deposits appear to be relatively stable and provide good quality spawning habitat.

The unconfined reach of the Lewis River from the hatchery (RM 15.7) to the downstream end of Eagle Island (RM 10) is characterized by glides, side channels, and riffles. The dominant substrate is cobble/gravel in the main channel and gravel/silt/sand in the side channels. Over 40,000 square yards of spawning-sized gravel was mapped in the reach. The gradient of the river decreases toward the downstream end of this reach,

and the substrate is predominantly sand and gravel by the downstream end of Eagle Island. The influence of tides and backwater effects from the Columbia River extend upstream to this reach.

Flow

Lewis River Bypassed Reach

As described above, the Swift No. 1 powerhouse releases flow from Swift reservoir into Swift No. 2 canal, which bypasses about 3.3 miles of the Lewis River between Swift dam and the Swift No. 2 powerhouse. During high runoff conditions, when the projects are operating to manage floods or during operational emergencies, water is spilled into the bypassed reach from either the Swift dam spillway or the Swift No. 2 canal spillway. Spill events occur sporadically, but in general, spills of several thousand cfs or greater occur every few years. Median summer water temperatures in the Lewis River bypassed reach approach the upper end of preferred ranges for most salmonids. Maximum summer water temperatures exceed the preferred ranges for all salmonid species except rainbow trout.

Although the bypassed reach supports populations of cutthroat trout, rainbow trout, mountain whitefish, largescale sucker, and other resident fish species (including an occasional bull trout), the quality and quantity of habitat in this reach is limited by lack of flow, under current conditions.

Lewis River below Merwin Dam

The existing flow regime as stipulated in Article 49 of the existing Merwin license (table 3.3.3-3) was developed by WDFW and PacifiCorp to maintain and enhance native fall Chinook in the mainstem Lewis River (WDF, 1991). It provides stable wetted habitat area in the mainstem Lewis River in the summer and fall, benefiting resident and anadromous fish, especially native Lewis River fall Chinook.

Controlled peak flows have created a stable channel condition with little scour of redds and infrequent gravel transport. Low flows during the spring may affect juvenile salmonid migration rates in the lower river, 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 are poorly understood but likely related to water temperature, change in predation rates, and timing of juvenile arrival in the Columbia River estuary.

Ramping Rates

In 1992, WDFW recommended ramping rates for hydroelectric projects on large rivers in Washington. These range from “no ramping” to two inches per hour, depending on season and time of day (table 3.3.3-4) and are usually applied to flows less than a “critical flow” (Hunter, 1992). Typically, this critical flow is the point at which low gradient gravel bars (stranding areas) become exposed.

Table 3.3.3-3. Minimum flow provisions downstream of Merwin dam, as stipulated in Article 49 of the existing Merwin Project license.

Time Period	Minimum Flow Requirement
December 8 to February 28	1,500 cfs
March 1 to May 31	During March, between 1,000 and 2,000 cfs, depending on runoff volume forecast on March 1.
	During April, between 1,300 and 2,700 cfs, depending on runoff volume forecast on April 1.
	During May, between 1,650 and 2,700 cfs, depending on runoff volume forecast on May 1.
June 1 to July 31	During June, 2,700 cfs, as long as natural flow at Merwin is equal to or greater than 2,000 cfs.
	During July 1-15, 2,000 cfs, as long as natural flow at Merwin is equal to or greater than 1,600 cfs.
	During the period July 15-31, 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 December 7	During the period Oct. 16 – 31, minimum flow of 2,700.
	During the period Nov. 1 – 15, minimum flow is lesser of 4,200 cfs or natural flow at Merwin plus 2,000 cfs.
	During the period Nov. 16 – Dec. 7, minimum flow is the lesser of 5,400 cfs or natural flow at Merwin plus 2,000 cfs.

Table 3.3.3-4. WDFW interim ramping rate criteria. (Source: Hunter, 1992)

Season	Daylight Rates[a]	Night Rates
Feb. 16 to June 15[b]	No Ramping[c]	2 inches/hour
June 16 to Oct. 31[d]	1 inch/hour	1 inch/hour
Nov. 1 to Feb. 15	2 inches/hour	2 inches/hour

[a] Daylight is defined as one hour before sunrise to 1 hour after sunset.
[b] Salmon fry are present.
[c] No changes in river stage.
[d] Steelhead fry are present.

Under Article 49 of the existing Merwin license, PacifiCorp must limit downramping 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 the Ariel gage). Because these ramping rates represent fairly rapid changes in river stage, they could strand juvenile fish.

Since 1993, PacifiCorp has implemented a voluntary 2-inch-per-hour downramping rate at all release levels to protect aquatic resources below Merwin dam. The 2-inch-per-hour downramping rate is designed to protect juvenile Chinook, coho, steelhead, and other aquatic resources, and to minimize fish stranding. In their Biological Opinion for the Interim Operation of the Lewis River Hydroelectric Projects (FWS and NMFS, 2002), FWS and NMFS stipulated that PacifiCorp alter their Article 49 ramping rates to meet a limit of (1) 0.5 foot per 3-hour period; (2) 2 inches per hour for downramping; and (3) 1.5 feet per hour for upramping.

Fish Passage

Upstream Passage Facilities

Of the four projects, only Merwin dam is equipped with upstream fish passage facilities. The upstream facility at Merwin is a trap-and-haul system that is operated continuously throughout the year. The system consists of a fish entrance located on the left bank below the dam, a fish elevator, and truck transport loading facility. Collected fish are loaded into 1,000-gallon tanker trucks and transported to hatchery facilities, or released in the lower Lewis River to support sport 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 all three dams has made such transport impractical.

Downstream Passage Facilities

No Lewis River Project structures are equipped with downstream fish passage facilities, but juvenile and adult migrants can pass downstream of each dam through the project turbines and spillways. Both turbine and spillway entrainment have the potential to injure or kill downstream migrating fish, although survival rates are currently unknown.

Hatcheries

The Lewis River Hatchery, located downstream of Merwin dam at RM 15.7, constructed in 1932 and put into operation shortly after the Merwin dam was completed, is the oldest of the three hatcheries in the Lewis River Basin. Its construction and all operation costs are funded by PacifiCorp, although the facility is owned by WDFW. The facility uses up to 65 cfs of water pumped from the Lewis River. A Denil steep pass fish ladder at the hatchery attracts returning adults and allows them passage into an adult holding pond. Fish are sorted, some are spawned, and many are transported to Speelyai and Merwin for spawning (Tetra Tech/KCM, Inc., 2002). The Lewis River Hatchery currently produces coho salmon.

Speelyai Hatchery, located at the confluence of Speelyai Creek and Lake Merwin at RM 28, was completed in 1958. Hatchery operations are a joint responsibility of both utilities, with Cowlitz PUD providing 20 percent of annual funding and PacifiCorp providing 80 percent. The hatchery is used for adult holding, spawning, incubation, and rearing of spring Chinook, coho, and kokanee. There is a small adult return trap for kokanee that are part of the production program at Speelyai. The hatchery uses up to 20.5 cfs, almost the entire flow of lower Speelyai Creek. Due to this pathogen-free water supply, which is often cooler than the water at Lewis River Hatchery, Speelyai Hatchery is used as a satellite facility to incubate and rear salmon collected from Lewis River Hatchery, and rear steelhead (net pen program) (Tetra Tech/KCM, Inc., 2002).

Merwin Hatchery became fully operational in 1993. PacifiCorp constructed, owns and funds operation of the Merwin Hatchery, which is operated by WDFW. Located at RM 19 on the Lewis River, 0.4 mile downstream of Merwin dam, the facility provides winter and summer steelhead and rainbow trout to support the recreational fishery. The hatchery uses approximately 11 cfs of water pumped from Lake Merwin. About two-thirds of the flow is ozone-disinfected prior to use. The disinfected water is used in incubation and adult holding. The remaining water is routed to outdoor rearing ponds after passing through packed column degassing units (Tetra Tech/KCM, Inc., 2002).

Together the Lewis River Hatchery, Merwin Hatchery and Speelyai Hatchery (the Lewis River Hatchery Complex) produce spring Chinook, early coho, late coho, summer steelhead, winter steelhead, rainbow trout, and kokanee. Current juvenile production goals are summarized in table 3.3.3-5. The overall goal of the anadromous fish program is to produce 92,000 pre-harvest adults.

Table 3.3.3-5. WDFW fish production goals for the Lewis River Basin in 2003.

Species	Hatchery	Release Site	Production Goal
Spring Chinook	Lewis River/Speelyai	Lewis River	1,050,000 (5–7/lb)
Early coho (Type-S)	Lewis River/Speelyai	Lewis River	880,000 (13–15/lb)
Late coho (Type-N)	Lewis River	Lewis River	815,000 (13–15/lb)
Summer steelhead	Merwin	Lewis River	175,000 (5/lb)
Winter steelhead	Merwin	Lewis River	100,000 (5/lb)
Kokanee	Speelyai	Lake Merwin	45,000 fingerlings, 48,000 yearlings
Rainbow trout	Merwin	Swift Creek reservoir	800,000 (25/lb)

Commercial and Recreational Fisheries

Native and introduced salmonid stocks in the Lewis River Basin are harvested in both commercial and recreational fisheries. Depending on species and stock, ocean commercial fisheries can intercept Lewis River fish off the coasts of Washington, Oregon, California, Canada, and southeast Alaska. Salmon can also be taken incidentally in the Bering Sea/Aleutian Islands and the Gulf of Alaska groundfish fisheries. A restricted commercial fishery targeting lower Columbia River spring Chinook (including Lewis River spring Chinook) occurs in the mainstem Columbia River below the Willamette River. Recreation fisheries target Lewis River salmon and steelhead stocks in the lower mainstem Columbia River, mainstem Lewis River and tributaries. The current tribal fishery in the Columbia River Basin has little or no effect on Lewis River stocks, since this fishery occurs on the Columbia River above the Lower Columbia River Management Area (WDFW, 2001).

Between 1980 and 1998, an average of approximately 4,300 spring Chinook, 1,400 fall Chinook, 3,500 coho, and 7,500 steelhead were harvested annually in the Lewis River recreation fishery (table 3.3.3-6). In addition, the Lewis River reservoirs support rainbow trout, cutthroat trout, and kokanee fisheries.

Table 3.3.3-6. The average number of salmon and steelhead harvested in the Lewis River recreation fishery based on punch card returns to WDFW. (Source: PacifiCorp and Cowlitz PUD, 2003f, AQU 8)

Species/Stock	Average Annual Recreation Harvest	Data Range
Spring Chinook	4,300	1980 through 1998
Fall Chinook	1,400	1980 through 1998
Coho	3,500	1980 through 1998
Winter steelhead	3,400	1962 through 1998
Summer steelhead	3,600	1962 through 1998

3.3.3.2 Environmental Effects

Enhancement of Anadromous and Resident Species

Under the proposed action, Chinook, coho, and steelhead would be reintroduced to the Lewis River upstream of Merwin, Yale, and Swift dams. The goal of the introduction program is to achieve "genetically viable, self-sustaining, naturally reproducing, harvestable populations above Merwin dam that are greater than minimum viable

populations."[19] Adult and juvenile Chinook, coho and steelhead would be transported and released above the dams, with the adults spawning and the juveniles rearing in these upstream areas. Upstream fish passage would be provided above Merwin, Yale, and Swift dams via trap-and-haul facilities. Downstream passage would be via floating surface collectors.

The anadromous fish introduction program would follow a phased approach, where Chinook, coho, and steelhead would first be introduced into habitat above Swift dam (within 6 months of the 4th anniversary of Merwin license issuance), and then introduced into the habitat between Merwin and Swift dams (following the 13th and 17th anniversaries of the new licenses), unless otherwise directed by FWS and NMFS. Downstream migrating Chinook, coho, steelhead, and sea-run cutthroat trout captured by the surface collector would be transported from Swift Creek reservoir, and potentially from Yale Lake and Lake Merwin, directly to a release pond below Merwin dam before release into the lower Lewis River. If NMFS determines that the Swift downstream facility does not adequately collect juvenile spring Chinook, PacifiCorp, in consultation with the ACC and with the approval of NMFS, would evaluate the behavior of the spring Chinook to determine why they are not being collected by the Swift surface collector. If NMFS concludes that the Swift downstream facility is not working because of fish behavior and that a different type of satellite passage facility has a reasonable likelihood of collecting spring Chinook, PacifiCorp, in consultation with the ACC and with the final approval of the agencies, shall design and install the satellite passage facility. The probable location of the facility would be upstream of the Swift reservoir, and would likely be a device such as a modular screw trap.

Upstream passage for resident fish species, such as bull trout, would be provided by net-and-haul or trap-and-haul, and downstream passage would be provided by the floating surface collectors. Kokanee would continue to be planted in Lake Merwin and rainbow trout would continue to be planted in Swift Creek reservoir at the same level that occurs under existing conditions.

Our Analysis

Under the proposed action, the distribution of Chinook, coho, and steelhead would be expanded to an estimated 174 miles of potential habitat (100 percent of the potential habitat above Merwin, Yale, and Swift dams) (table 3.3.3-7). Bull trout distribution would not be expanded, as they are present in all project reservoirs and have been documented downstream of Merwin dam; however, connectivity between these currently isolated habitats would be established, allowing for both upstream and downstream

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[19] A minimum viable population is the smallest population having a good chance of surviving for a given number of years despite the foreseeable effects of demographic, environmental, and genetic events and natural catastrophes.

migration. Distribution of all other fish species under the proposed action would likely be unaffected by these proposed measures, although as with bull trout, connectivity between currently isolated habitats would occur as well.

Table 3.3.3-7. Length of potentially accessible anadromous fish habitat and the percent of total accessible habitat in the three reaches of the Lewis River upstream of Merwin dam. (Source: Mobrand Biometrics, Inc., 2003)

Reach Name[a]	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

[a] 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.

The abundance of Chinook, coho, and steelhead would increase in the Lewis River Basin. During pre-application studies, PacifiCorp and Cowlitz PUD used Ecosystem Diagnosis and Treatment (EDT) modeling to estimate anadromous fish production potential above Merwin, Yale, and Swift dams (Mobrand Biometrics, Inc., 2003). Results of EDT modeling predict that together all three Lewis River reaches (Lake Merwin, Yale Lake, and Swift Creek reservoir) are currently capable of producing 2,014 adult spring Chinook, 12,253 adult coho, and 2,005 adult steelhead (assuming SAR of 5 percent and 100 percent survival past the dams and no harvest) (table 3.3.3-8).[20] EDT estimates predict that most fish (76 percent) would likely be produced upstream of Swift dam. Facilitating downstream juvenile passage using the floating surface collector, or a satellite collection facility, and transportation to a release pond downstream of Merwin dam would avoid potential mortality associated with passage through the spillways and turbines at Yale and Merwin dams. Thus, these fish passage measures would be an important factor in restoring salmon and steelhead to the upper river.

[20] In comments on the draft EIS, NMFS, American Rivers, and the Cowlitz Indian Tribe all state that they feel the EDT analysis underestimates the potential production of fish that would result from the fish passage and habitat measures provided for in the SA. None of the commenters, however, provided revised estimates of what that production may be.

Table 3.3.3-8. EDT estimates of potential spring Chinook, coho, and steelhead adult abundance under current habitat conditions by geographic area (introduction reach).[a] (Source: Mobrand Biometrics, Inc., 2003)

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	

[a] Adult abundance is the number of adults entering the mouth of the Lewis River.

Because the initial estimates of production potential assumed 100 percent survival past the dams, an alternative scenario was analyzed for coho salmon, using the Lewis River fish passage model, which included adjustments for fish passage efficiency and smolt to adult survival. These results indicate lower production rates for Swift and Yale if more realistic factors that may affect the re-introductions are considered (table 3.3.3-9).

Although the applicants did not run the Lewis River fish passage model for spring Chinook and steelhead, it is likely that the model would have predicted an even greater reduction in production for these species, because the Swift reach would comprise 94 percent and 84 percent of the total production of these species, respectively (see table 3.3.3-8). The Swift reach is also the most upstream habitat that would be reopened to anadromous species, and spring Chinook and steelhead would be exposed to a greater degree of mortality and lower fish passage efficiencies because of the cumulative effect of passage over several dams.

Introduction of Chinook, coho and steelhead above Merwin dam under the proposed action may also have negative effects by competing with resident rainbow and coastal cutthroat trout for preferred habitats that have been colonized by these species in the absence of anadromous species. However, we note that all of these species co-existed in the upper Lewis River Basin prior to the construction of Merwin dam and currently co-exist in downstream reaches. Therefore, the overall effects on these resident species are expected to be minimal.

Table 3.3.3-9. Lewis River fish passage model estimates of adult coho production for the proposed action (results of Inter-Annual Variation Analysis [summary of spawner and smolt abundance over 100 generations, with smolt to adult survival (SAR) variable but smolts/female fixed]).[a,b]

Introduction Reach		Coho Abundance
Total	Average	8,637
	Max	22,472
	Min	2,457
	No. <50 fish[c]	0
Swift	Average	5,178
	Max	13,626
	Min	1,466
	No. <50 fish[c]	0
Yale	Average	2,070
	Max	5,333
	Min	592
	No. <50 fish[c]	0
Merwin	Average	1,389
	Max	3,512
	Min	400
	No. <50 fish[c]	0

[a] The coho data were generated using the Lewis River fish passage model. Model settings were selected based on Aquatic Resource Group agreed-upon inputs for factors such as transport, reservoir and bypass survival. This run assumes that the proposed juvenile collection facilities under each alternative have a fish collection efficiency of 95 percent.

[b] Values presented in this table are lower than EDT estimates (table 3.3.3-8) as they were produced in a model that varies SAR from 1 percent to 13 percent. In contrast, EDT uses a static SAR of 5 percent.

[c] Number of generations when spawner abundance is less than 50 fish.

The introduction of anadromous salmonids may also benefit bull trout, cutthroat trout, and other aquatic species by increasing primary productivity through the addition of MDN. The addition of MDN likely would increase the aquatic invertebrate biomass, which would increase the forage base for juvenile and adult trout. The production of juvenile salmon would also increase the forage base for adult and subadult bull trout.

Negative effects associated with the introduction of anadromous salmonids into areas currently occupied by bull trout may include interspecific competition for food and space, competition for spawning sites, and redd super-imposition. Coho juveniles rear in habitats similar to juvenile bull trout, and are considered to be aggressive and territorial (Chapman, 1962). If bull trout are currently spawning and rearing in areas historically

used by the anadromous species, then reintroduction of anadromous fish could adversely affect bull trout survival through competition for prey and habitat. The licensees propose to implement bull trout monitoring to determine the potential effects of anadromous fish introductions on bull trout. Information on such effects would serve to inform the ACC so that adaptive management strategies could be employed should new information indicate a need to limit effects on ESA-listed bull trout.

Aquatic Habitat

Winter Drawdowns

The proposed action would increase winter reservoir drawdowns in Swift reservoir by 4 feet and in Yale reservoir by 2 feet. There would be little difference in Lake Merwin levels for the proposed action.

Our Analysis

Increasing reservoir drawdowns in the winter may affect riparian vegetation along the shorelines; we discuss this in section 3.3.4.2. The proposed drawdown, however, is within the current range of seasonal and annual fluctuations. Therefore, winter drawdowns should not adversely affect the aquatic habitat. Fish usage of the shoreline would likely be minimal during the winter period, so most resident fish would be unaffected.

Gravel Augmentation

PacifiCorp, in consultation with the ACC, would initially conduct spawning gravel monitoring downstream from Merwin dam to establish the current level of spawning gravels, and an annual monitoring program thereafter. If results of the monitoring indicate a depletion of gravel or a reduction in gravel recruitment is found to be a limiting factor for anadromous fish, PacifiCorp would develop and implement a spawning gravel augmentation plan.

The draft 401 WQCs published by WDOE for comment in February 2006 also includes a condition for augmenting spawning gravels in the Lewis River bypassed reach. This condition states that gravels would be obtained from existing gravel benches along the river channel or from other sources, as determined by WDOE and the ACC. The details on the amount and placement of the gravels would also be determined in conjunction with the ACC, and there would be an annual report on the success of the augmentation program.

Our Analysis

Currently, more than 38,000 square yards of spawning-sized gravel occurs, and is distributed throughout the confined reach downstream of Merwin dam. The unconfined reach of the Lewis River from the hatchery (RM 15.7) to the downstream end of Eagle

Island (RM 10) contains more than 40,000 square yards of mapped spawning-sized gravels (PacifiCorp and Cowlitz PUD, 2004b). Although we initially concluded that there was no need for a gravel monitoring and augmentation program, as a result of clarifications and information provided at a section 10(j) teleconference, held on December 7, 2006, there appears to be justification for such a program. Implementation of the initial gravel monitoring would confirm and characterize the existing levels of spawning gravels to establish the monitoring baseline, and monitoring thereafter would inform managers when augmentation might be necessary to maintain those levels.

Gravel augmentation in the Lewis River bypassed reach was not analyzed in the draft EIS, but is a potential requirement of the 401 WQC. There currently is no information in the record regarding the amount of gravel in the reach, or the potential need for an augmentation program. However, the Aquatics Fund provision of the SA would provide funds for projects to enhance fisheries habitat in the Lewis River. Gravel augmentation in the bypassed reach, which would have an obvious nexus to the Swift No. 1 and No. 2 projects, would be a program that could be implemented under that fund, under the guidance of the ACC.

Large Woody Debris Enhancement

Under existing conditions, Swift Creek reservoir, Yale Lake, and Lake Merwin intercept virtually all LWD generated in upstream areas. The applicants propose to provide an LWD collection and funding program to supplement LWD in the lower Lewis River. LWD collected from the Swift reservoir would be stored and used as appropriate to restore aquatic habitat in other areas of the Lewis River Basin lacking LWD.

Our Analysis

LWD is an important habitat component for aquatic resources because it provides biological and ecological benefits by providing rearing habitat and protection for fry and juveniles, an additional food base, cover from predators, and aids in the retention of gravels for spawning. The addition of LWD in the Lewis River habitat where LWD is lacking would likely improve fish habitat and would enhance habitat-forming processes throughout the life of any licenses issued. The best areas to target for this program would be reaches immediately below the project dams, where the effects of the dams in reducing the supply of LWD has been most pronounced. This measure is expected to enhance juvenile fish survival, benefiting Lower Columbia River Chinook salmon, steelhead, and coho salmon populations that spawn in the Lewis River and its tributaries.

Other Aquatic Habitat Measures

Several other aquatic habitat measures would be implemented, in consultation with the ACC, to protect and enhance aquatic habitat and water quality. Bull trout conservation covenants would be maintained in perpetuity; a bull trout limiting factors analysis would be conducted for all three project reservoirs; a predation study would be

conducted in Lake Merwin; and several funds would be set up to support stream and riparian habitat protection and enhancement projects in the Lewis River Basin. In addition, monitoring plans would be developed to determine compliance with 401 water quality criteria.

As directed by the ACC and approved by the Commission, the licensees propose that monies from the Aquatic Habitat Enhancement Fund provided by PacifiCorp and Cowlitz PUD (totaling $5.7 million) would be used for aquatic habitat protection, restoration, and enhancement through acquisition, easements, or restoration projects. Representative projects may include but are not limited to repairing the highest priority culvert passage problems on Ross, Johnson, Colvin, Cedar, Beaver, John, and 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.

If FWS and NMFS determine that introduction of anadromous salmonids into Yale or Merwin reservoirs via fish passage facilities is not desirable based on additional study results, the licensees propose that PacifiCorp would establish the "In Lieu Fund" to support aquatic enhancement measures. PacifiCorp would contribute up to a total of $30 million. Funds would be spent on projects in consultation with the ACC and approved by FWS and NMFS, and PacifiCorp would submit annual reports reviewing project actions, implementation, and monitoring. As described in the SA, the In Lieu Fund would be used for FWS and NMFS-approved 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.

Within 2 years of the issuance of new licenses, PacifiCorp would also conduct a limiting factors analysis for bull trout occurring in Lake Merwin tributary streams and Swift Creek reservoir tributary streams. The analysis would examine the location and characteristics of critical life stage habitat components for bull trout and determine if enhancement measures might be beneficial. If the results of this analysis determine that one or more locations have the potential to provide long-term, sustainable habitat for critical life stages of bull trout, the licensees, in consultation with the ACC and with the approval of FWS, may implement enhancement measures through the use of the Aquatic Enhancement Fund.

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 potential effects of northern pikeminnow predation on reintroduced anadromous fish are currently unknown. To address this uncertainty, PacifiCorp would 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, such as targeted fishing derbies or other measures. The objective of this program would be to increase the survival rate of juvenile salmonids within the project area.

PacifiCorp proposes to provide ongoing support to WDFW for monitoring the wild fall Chinook spawner population and distribution, including juvenile tagging, below Merwin dam. In addition, it would monitor the chum salmon spawning population and distribution below Merwin dam, provided that juvenile tagging would not be required for chum until technological improvements make such tagging practicable. This information may be used by the ACC to monitor the effects of environmental measures on these populations.

Our Analysis

The measures described above should benefit all aquatic species in the basin. Both the Aquatic Habitat Enhancement Fund and the In Lieu Fund would be used for fisheries habitat protection, restoration, and enhancement through acquisition, easements, or restoration projects, although it is unclear whether the In Lieu Fund would ever be implemented or what measures would be funded. Repairing culverts that present passage problems for resident and anadromous fish would increase access to available habitats not now accessible, potentially increasing production above existing levels as new areas are used. However, we note that poor passage at culverts is not necessarily a project effect, unless the culverts occur on project roads or on roads constructed for the benefit of the project. Additionally, any passage problems on Johnson Creek are not a project effect. Johnson Creek is a small tributary located 4 miles downstream of the Merwin dam (figure 2.1.1-1), and passage into this creek is not related to the project. Reconnecting and enhancing off-channel, side-channel, and floodplain habitats along the lower Lewis River mainstem and around Eagle Island would provide increased refuge and rearing habitat for juvenile salmonids, aiding population recovery efforts.

The identification of potential limiting factors for bull trout would be an important factor in guiding habitat restoration efforts. Targeting habitat elements such as riparian vegetation, suitable spawning gravels, or migration barriers that are deficient in quality or quantity for enhancement or restoration would potentially lead to an increase in available bull trout spawning and rearing habitat and would provide long-term protection of critical habitat for bull trout in the Lewis River Basin.

Investigation of the effects of northern pikeminnow on anadromous fish populations would aid in the creation of predator control programs. Such programs, if deemed necessary by the ACC, would potentially reduce predator abundance and would likely increase the survival of anadromous fish migrating through or rearing in Lake Merwin, ultimately enhancing anadromous fish restoration efforts.

Monitoring wild populations of Chinook and chum salmon below Merwin dam would help to provide an indication of the success of the reintroduction measures in increasing adult returns to the Lewis River.

All the above discussed aquatic enhancement measures would likely have a positive effect on fisheries in the Lewis River Basin, including the listed bull trout, fall Chinook, and steelhead. Some of these general enhancement measures, however, are either not directly related to ongoing project effects, or do not have a direct nexus to the project. Therefore, in section 5.1, *Comprehensive Development and Recommended Alternative*, we discuss which of the measures we recommend be included as conditions of the licenses.

Flow Releases

Lewis River Bypassed Reach

Current operations result in the dewatering of most of this 3.3-mile reach (figure 2.1.1-3), except for leakage, tributary inflow, and occasional spillage flows, resulting in adverse effects on aquatic habitat. Minimum instream flows would be released into the bypassed reach from two points along the Swift No. 2 power canal: a water release structure located downstream of the Swift No. 1 powerhouse (upper release point), and a canal drain located approximately one mile downstream of Swift dam (lower release point). Flow releases would vary by season and would range from 60 to 100 cfs. The lower release point would contribute up to 47 cfs (the maximum capacity of the canal drain) into an "improved habitat channel" located between the lower release point and Yale Lake. Conceptual design of this approximately 1,200-foot-long channel incorporates placement of LWD and boulders to increase habitat complexity in the channel. It is expected that the improved habitat in this off-channel area would not be adversely affected by periodic spill events in the main bypassed reach, providing a long term benefit to aquatic resources. The remaining flow would be released into the upper bypassed reach (via the upper release point) to maintain some level of habitat connectivity between several large pools that exist in this reach.

Our Analysis

The Lewis River bypassed reach has essentially been dewatered for decades, except for minor leakage and local inflow. This has severely reduced the suitability and availability of aquatic habitat in the reach. The proposed flow regime would provide a continuous minimum flow to the reach and therefore improve aquatic habitat connectivity

and increase the amount of spawning and rearing habitat for Chinook, coho, steelhead (once fish passage is implemented), cutthroat trout, rainbow trout, kokanee, brook trout, and mountain whitefish. Large-scale sucker, northern pikeminnow, threespine stickleback, and sculpin are native to the North Fork Lewis River Basin and these species would also benefit from the increase in flow, which would provide habitat connectivity and an increase in habitat complexity that would enhance spawning, rearing, and foraging habitat for these species.

Higher instream flows would create additional foraging habitat for bull trout during the winter and spring; however, summer and fall water temperatures in excess of 9°C would likely preclude successful bull trout spawning in this reach. According to Pratt (2003), water temperatures above 9°C would delay or abort bull trout spawning, because appropriate spawning temperatures (<9°C) would not occur until late November or December, at all flow releases (figure 3.3.2-8). Therefore, if bull trout spawned before mid-November, egg mortality would likely be complete (Pratt, 2003). Fall water temperatures in the bypass reach would exceed 9°C at all flow releases (figure 3.3.2-8), so augmenting the flows in the bypassed reach would not provide additional spawning habitat for bull trout residing in Yale Lake.

Spring and fall water temperatures in the Lewis River bypassed reach would likely be within the preferred range for spawning cutthroat trout, rainbow trout and mountain whitefish (figure 3.3.2-8). These water temperatures would also be ideal for brook trout, a species that is known to hybridize and compete with bull trout. Hybridization with brook trout is one of the major factors contributing to the decline and lack of recovery of bull trout throughout its range. Until more detailed habitat surveys are conducted in the bypassed reach during the proposed flow releases, it is not known if Chinook and steelhead would successfully spawn and rear in this reach. However, the predicted water temperatures are within the preferred range for spawning for Chinook and steelhead (Wydoski and Whitney, 2003).

If a trap-and-haul facility is eventually installed at Swift No. 2, the increased flows in the Lewis River bypassed reach may also attract migrating anadromous fish that are bound for higher quality habitat above Swift dam. Any delay in reaching the trap-and-haul facility entrance at Swift No. 2 could decrease the survival of these upstream migrants. If the trap-and-haul facility is eventually installed at the base of Swift dam, the 60 to 100 cfs flow release would facilitate anadromous fish migration to this facility by providing an attraction flow greater than what currently exists.

There likely would be little change to stream morphology in the bypassed reach associated with the proposed flow regime, as flows would not be large enough to change channel form. The wetted channel, however, would be somewhat wider, deeper and more persistent throughout the year. While instream habitat area would increase substantially compared to current conditions, periodic spill events from Swift dam would continue to transport wood and gravel particles from the reach, limiting the amount of

spawning gravel and instream cover (i.e., habitat quality would be limited by physical factors in addition to instream flow). The same very large spills would also scour redds and wash out encroaching riparian brush and shrubs from within the high water channel. The newly constructed habitat channel would be less affected by these events, especially in the upper section where it is separate from the main bypassed reach. Overall, there would be a net benefit to fish and other aquatic species in the reach.

Lewis River below Merwin Dam

Flows in the Lewis River downstream of Merwin dam are affected by the coordinated operation of the three project reservoirs. Flows are highest during the winter, decrease gradually in the spring, and are lowest during the summer months (see section 3.3.2.1, under *Water Resources*). The current 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 reduced the frequency of flows in the 10,000 to 20,000 cfs range and changed the shape of mid-range flow fluctuations, due to the highly regulated nature of the flow regime and more constant flows. A reduction in magnitude of peak flows likely has resulted in a more stable channel with less scour of redds and less fine sediment transport than prior to project operations, while ample spawning gravels remain and appear to be stable over the long term.

The existing minimum instream flow regime downstream of Merwin dam was developed in the early 1980s and approved by the Commission in September 1995 (table 3.3.3-3). This regime was 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 on the Lewis River between 1977 and 1990 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. Although these minimum flows were established in 1995 to enhance native fall Chinook and protect other aquatic resources in the lower Lewis River, actual flow releases from Merwin dam exceed these minimum flow requirements during much of the year (see table 3.3.3-3 and figure 3.3.3-8).

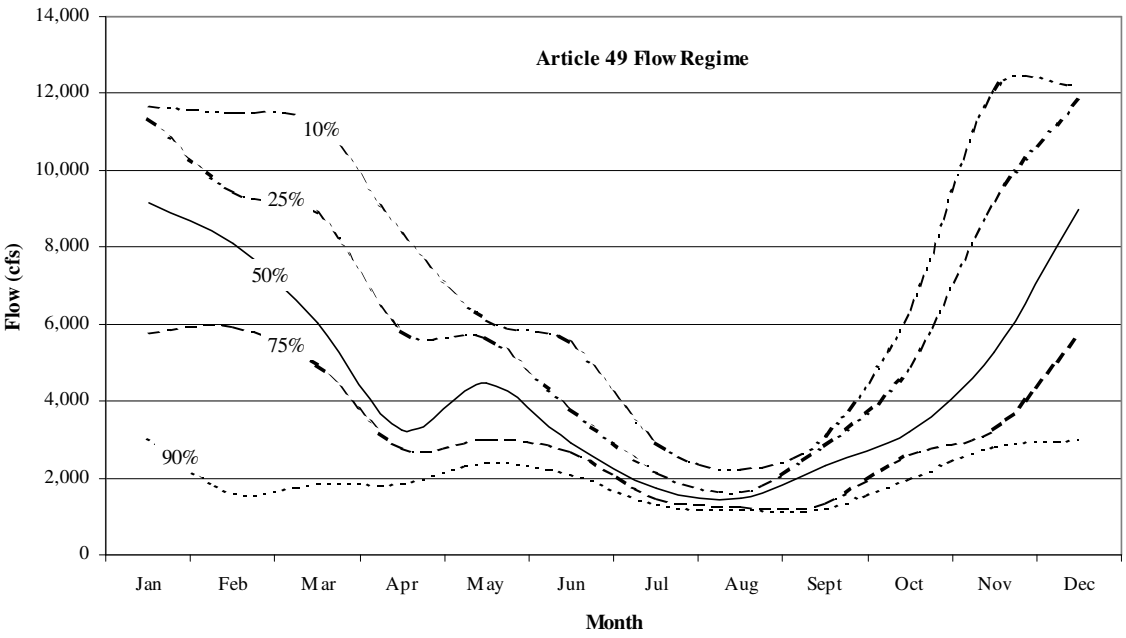

Figure 3.3.3-8. Daily flow exceedance curves for observed Lewis River flows at Ariel[21] since 1995. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Our Analysis

Minimum Flows—Proposed minimum flows below Merwin dam in the winter would be 2,000 cfs; minimum flows in the spring would range from 2,200 to 2,700 cfs; summer minimum flows would range from 1,200 to 2,700 cfs; fall low flows would be 1,200 cfs; and late fall minimum flows would range from 2,500 to 4,200 cfs (table 3.3.3-10).

WDFW determined that a flow of 4,200 cfs from November 1 through December 15 would 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 would be reduced to 4,200 cfs, to reduce 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 would be minimized, increasing Chinook, coho, and chum egg and alevin survival. Fish survival and abundance should improve by avoiding higher fall discharge rates that are of a sufficient duration to encourage Chinook and chum salmon spawning in channel areas that would be difficult to keep watered throughout the incubation and emergence period during low flow years.

[21] The Ariel gage is located at RM 19, immediately downstream of the Merwin Project.

Table 3.3.3-10. Proposed minimum flow releases downstream of the Merwin Project. (Source: PacifiCorp and Cowlitz PUD et al., 2004)

Period	Proposed Minimum Flow Releases
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 16 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 16 through October 31	2,500 cfs

To minimize the redd dewatering risk, minimum flows in January and February would increase from 1,500 cfs under existing conditions to 2,000 cfs, and in March from 2,000 cfs to 2,500 cfs. Minimum flows in July would slowly decrease to mimic a similar reduction in natural flows. These flows would be slightly higher than under existing conditions. Flows in September and October would be similar to existing conditions, increasing the amount of rearing habitat compared to pre-project conditions. In 1981, WDF determined that flows less than 1,500 cfs would be acceptable for August and September because natural flows are usually less in that period. Therefore, 1,200 cfs was established as a minimum flow for the time period up to October 15 (table 3.3.3-10).

Compared to current conditions, the proposed flow regime would reduce the difference between the Chinook, coho, and chum spawning and incubation flows, and would slightly increase minimum flows in July to protect emerging steelhead fry. Therefore, the proposed flows should result in decreased redd dewatering and increased Chinook, coho, chum, and steelhead survival.

Plateau Operations— Under the proposed action, PacifiCorp would restrict daily flow fluctuations below Merwin during the period of February 16 through August 15, by maintaining flow plateaus (periods of near-steady discharge). Once a flow plateau is established, it would be maintained for as long 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. Changes in level would be subject to the limitations of the ramping restrictions discussed below and the number of allowable plateau changes.

Plateau operations were designed to limit flow fluctuations on a daily to weekly basis, as opposed to ramping rate restrictions 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 have a greater adverse effect on the aquatic invertebrate community than does 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 systems, which potentially decreases 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), increasing drift response, and reducing aquatic invertebrate forage. It is anticipated that by implementing plateau operations, effects on macroinvertebrates caused by flow fluctuations would be reduced. Therefore, the proposed action may increase, or at a minimum, stabilize macroinvertebrate production in the Lewis River downstream of Merwin dam, potentially improving the fish forage base and benefiting resident and anadromous fish species.

Ramping Rates—Current ramping restrictions under Article 49 are those recommended by FWS and NMFS in their 2002 Interim Operations Biological Opinion. These require ramping limits of 0.5 foot per 3-hour period, 2 inches per hour for downramping, and 1.5 feet per hour for upramping. The proposed action calls for the same ramping limits, except that no downramping would be allowed from February 16 through June 15, between one hour before and after sunset and one hour before and after sunrise each day. A critical ramping flow would be set at 8,000 cfs (measured at the Ariel gage). Ramping criteria would be imposed at flows less than the critical flow, and no ramping restrictions would be required when flows are equal to or greater than the critical flow. The applicants' studies determined that a flow greater than or equal to 8,000 cfs substantially wetted gravel bars that have a high potential for juvenile fish stranding (PacifiCorp et al., 2005a).

Implementing these restrictions would limit the potential for entrapment and stranding of juvenile Chinook, coho, steelhead, chum, and other aquatic organisms. The proposed ramping restrictions would provide a substantial reduction in fish stranding compared to the existing license Article 49, and would provide additional stranding protection over the Interim Operations Biological Opinion ramping requirements. As a way to verify the protection benefits of the proposed requirements, the applicants are also proposing a monitoring study to evaluate fish stranding potential under the new operating regime.

Fish Passage

Background

A fish passage option studied by the applicants as part of pre-filing consultations was the construction of fish ladders at Swift No. 2 and at Yale and Merwin dams, and exclusionary fish screens with bypass pipelines at Swift, Yale, and Merwin dams. The objective would be to provide volitional passage for upstream and downstream migrating fish to each project reservoir, in lieu of providing trapping/collection and transportation facilities.

Designs that were analyzed by the applicants for upstream passage included three concrete ladders with minimal fish sorting capabilities, conceptually illustrated in the PDEA and supplemental PDEA (PacifiCorp and Cowlitz PUD, 2004b; 2004c). This series of ladders would be the tallest in the world, in rise over length dimensions. From the base of Merwin dam, upstream migrants would navigate a 2,300-foot-long ladder with a total rise of 197 feet, exiting through a structure designed to adjust to the fluctuating level of Merwin Lake. A 3,900-foot-long ladder around Yale dam would have a total rise of 259 feet, with similar design requirements to accommodate a 16-foot fluctuation in Yale Lake. Fish passage around Swift dam would commence adjacent to the Swift No.2 powerhouse, with a combination conventional ladder and canal totaling 16,950 feet in length. The overall rise of this feature would be 530 feet, culminating in a large exit structure to accommodate the 40-foot fluctuation of Swift Creek reservoir. The overall construction cost for this series of ladders was estimated by the applicants at $83.4 million, including back-up trap-and-haul facilities.

Designs analyzed for downstream passage included two types of full exclusionary V-screen systems at each dam: a "criteria" screen system and an increased velocity screen system. These alternatives are conceptually illustrated and described in PacifiCorp and Cowlitz PUD (2003f and 2004: AQU 5, Appendix 1).

For the "criteria" exclusionary system, the fish screens were sized to meet NMFS criteria for an approach velocity of 0.4 foot per second, with a 60-second maximum travel time to a bypass system for each site. The screens were developed to accommodate flows and reservoir fluctuations of 9,120 cfs/40 feet; 9,760 cfs/16 feet; and 11,470 cfs/10 feet at Swift, Yale, and Merwin dams, respectively. Fish and water leaving the bank of V-screens would flow to a secondary dewatering facility that would release about 30 cfs to a bypass pipeline. The bypass pipelines would be routed through a subsampling facility, and then directly to the reservoir or river below each project. Fish would be released to the receiving water body through an outfall structure designed to accommodate the tailwater fluctuation at the release point.

To accommodate high flows, the criteria screens were designed in a bank of four parallel V-screens, resulting in a complex about 240 feet wide by 600 feet long including

the secondary dewatering screens. The banks of screens were envisioned to be located on a bench excavated into the shoreline near the intakes of each dam. The construction cost for the screen systems alone was estimated by the applicants to be $192.5 million. An additional $30 to $40 million would be required for the bypass pipelines, subsampling and head dissipation facilities to allow operation within the specified forebay fluctuations, resulting in a total system cost of about $232 million for all three dams.

Due to the large size, difficult and costly site work necessary, the need to accommodate large reservoir fluctuations and the untested nature of this magnitude of a screening system, resource agency comments during the applicants' conceptual design phase indicated a willingness to examine a higher velocity screen system. Specifically, concepts were developed to examine screens with an approach velocity of 0.8 foot per second, with a 120-second maximum travel time to a bypass system for each site. This approach resulted in banks of two parallel V-screens that were half the size of the criteria screens. Costs were estimated at $156.8 million for the screen system, and about $196 million for the entire system with bypass and subsampling facilities for all three dams.

Given the height and length of the studied ladder system, there is biological risk that significant numbers of fish may not be capable of successfully migrating past this series of ladder and reservoir complexes relative to other alternatives. The applicants also estimated that the fish ladder alternative would be more costly relative to other upstream passage options. Similarly, the exclusionary screens considered are unprecedented in the industry at the 10,000-cfs flow range and noted reservoir fluctuations (up to 40 feet). The anticipated biological performance of this type system is unknown, and the logistics of screening 100 percent of the turbine flows would create significant operational difficulties with debris handling, especially at the most upstream projects.

The fish ladder and exclusionary screening alternative would be substantially more costly than other alternatives with respect to capital facilities and in annual operating cost, considering power generation losses caused by water diversions to the ladders and screens. Because the performance of this option is not known, and because the ladder system has significant risk associated with even meeting the biological goals, the applicants eliminated the fish ladder and exclusionary fish screen alternative as an option for further evaluation. We agree with the applicants' conclusions regarding the fish ladder and exclusionary screening alternative.

Existing and Proposed Fish Passage Facilities

Currently, the only fish passage facility in the Lewis River Basin is the upstream fish collection facility at the base of Merwin dam. This is a trap-and-transport system that is operated year-round. This facility has not been used to transport anadromous fish upstream of Merwin dam since 1957, because a lack of downstream passage facilities at all three dams has made this measure biologically impractical.

While no Lewis River Project structures are equipped with downstream fish passage facilities, juvenile and adult migrants can pass downstream of each dam through the project turbines and spillways. Both turbine and spillway entrainment have the potential to injure or kill downstream migrating fish, although project-specific survival rates are currently unknown. Scientific 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. The survival rates differed between the two turbines (two different designs) but not between species within each turbine (Normandeau Associates, Inc., and Skalski, 2003).

Under the proposed action, both upstream (trap and transport) and downstream (surface collector) fish passage facilities would be installed and/or upgraded at Merwin, Yale, and Swift dams (unless otherwise directed by FWS and NMFS). As described below, installation of these facilities would follow a phased approach. PacifiCorp would also construct improvements to the Yale spillway by the fourth anniversary of the new licenses to improve fish survival over the spillway during spill events.

Upstream Fish Passage

Within 6 months after the fourth anniversary of the new Merwin license, PacifiCorp would construct and begin operating an upgraded upstream fish passage facility at Merwin dam that would collect, sort and transport upstream-migrating adult Chinook, coho, steelhead, sea-run cutthroat trout, and bull trout. Initially, adult Chinook, coho, and steelhead collected at Merwin dam would be transported and released above Swift dam. Any bull trout collected below Merwin dam would be transported to Yale Lake unless otherwise directed by FWS. By the 17th anniversary of the new license for the Yale Project, unless otherwise directed by NMFS and FWS, PacifiCorp would construct and begin operating an adult trap and transport facility at the base of Yale dam. By the 17th anniversary of the Swift licenses, PacifiCorp and Cowlitz PUD would construct and begin operating an adult trap and transport facility at the single best site located at the upstream end of Yale Lake.[22]

The adult handling protocols (by species at each facility) would depend on the fish management objectives of the resource agencies. In general, adult anadromous hatchery fish (identified by fin clips) would be transported to the hatchery to meet broodstock needs or released back to the river for harvest. Naturally-produced anadromous fish (adipose fin intact) would be transported and released into the upper end of Swift Creek reservoir, Yale Lake, or Lake Merwin (once all passage facilities are complete). Resident

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[22] The location for an adult trap and transport facility at the upstream end of Yale Lake has not yet been determined, but would be based on biological and hydrological factors and could be a location such as the Swift No. 2 tailrace.

fish (i.e., bull trout) would either be returned to the lower river or transported and released above Merwin, Yale or Swift dams, depending on agency fish management policies. The target for adult collection and transport survival would be 99.5 percent.

Our Analysis

The probability of attaining the 99.5 percent adult upstream passage survival target is high, based on the best available technology and survival noted at other facilities in the Pacific Northwest. Preliminary data from the first four years of anadromous salmonid introduction efforts in the Upper Cowlitz River Basin indicate that trap and haul methodology has been successful at reestablishing some level of anadromous salmonid production, especially for coho salmon (Dammers et al., 2002 as cited in NMFS, 2003). The Pelton-Round Butte trap and haul facility 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 one percent (PGE, 2004).

One disadvantage of trap and haul facilities (compared to fish ladders) is that some handling of the fish is required, which may result in handling stress and mortality. In addition, if monitoring studies (i.e., fish tagging) are conducted, they would also have the potential to affect individual fish, resulting in tagging injury or mortality. Trap and haul facilities, however, are generally more feasible (both biologically and engineering/cost-wise) at relatively high-head dams, such as on the Lewis River, and historical data with existing facilities indicate that fish handling effects have not been significant. Although tagging programs would have some potential for injuring fish, these programs would provide long-term benefits by allowing assessment of whether fish passage is meeting program goals and objectives.

Downstream Fish Passage

PacifiCorp would construct and operate a downstream fish passage facility at Swift dam within 6 months of the fourth anniversary of the Swift license, to collect, sort, and transport downstream migrating Chinook, coho, steelhead, and sea-run cutthroat trout to a release pond below Merwin dam, before release into the lower Lewis River. Unless otherwise directed by FWS, bull trout collected in the Swift downstream collection facility would be transported to Yale Lake, except that bull trout with a smolt-like appearance would be transported below Merwin dam. All salmonids would be passed downstream using trap and transport methods, unless FWS, NMFS, and the ACC determine, after some period of operation and evaluation, that there may be greater benefits from downstream movement of migrating juvenile salmonids via a bypass facility such as a pipe or flume to the next downstream waterbody.

On or before the 13th anniversary of the new licenses (unless otherwise directed by FWS and NMFS), PacifiCorp would construct and begin operating a downstream fish passage facility at Yale dam. On or before the 17th anniversary of the new licenses (unless otherwise directed by FWS and NMFS), PacifiCorp would construct and begin

operating a downstream passage facility at Merwin dam. PacifiCorp would transport downstream migrating Chinook, coho, and steelhead and sea-run cutthroat from both Yale Lake and Lake Merwin to the release pond below Merwin dam.

Our Analysis

EDT analysis performed by PacifiCorp and Cowlitz PUD indicates that survival of anadromous fish migrating downstream through Swift Creek reservoir was approximately 90 percent (Mobrand Biometrics, Inc., 2003). However, some mortalities are expected among downstream migrating salmon and steelhead smolts (and potential adult fallbacks) as they move further downstream through the projects and downstream fish passage facilities. Passage survival performance standards have been set by FWS and NMFS at levels that are expected to allow for sustainable populations above the dams, and the fish passage facilities would be designed to meet these targets. The overall downstream survival (ODS) target[23] at Swift dam is 80 percent until downstream passage is implemented at Yale, at which point the ODS goal at Swift and Yale is 75 percent. The probability of attaining 75 to 80 percent ODS is unknown, but facilities would be designed to meet this target with the overall goal of producing self-sustaining anadromous fish populations upstream of Merwin dam. If monitoring indicates that performance standards are not being met, PacifiCorp and Cowlitz PUD would, with Commission approval, make modifications to the facilities to achieve the targets.

The collection efficiency of the downstream passage facilities would not be known until constructed, however, collection efficiency at the existing Upper Baker River facility ranges between 50 and 75 percent (personal communication, Cary Feldman, Puget Sound Energy, 2003, as cited in PacifiCorp and Cowlitz PUD [2004b]).[24] Under the terms of a recent Settlement Agreement for that project the existing "gulper" is being replaced with a new floating surface collector, with the expectation that newer technology will improve passage survival in comparison to the existing facility. The construction of new floating surface collectors at Swift, Yale and Merwin dams would incorporate new technology, and would likely reduce project entrainment through turbines and spillways, increase passage survival, and facilitate fish movement through the project area with greater survival than under current conditions. Modifications to the Yale spillway under the proposed action would also provide greater protection for any bull trout or other fish species that attempt to migrate downstream during the spill season.

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[23] The percentage of juvenile anadromous fish for each designated species that enters the reservoirs from natal streams and that survive to enter the Lewis River below Merwin dam by collection, transport and release via the juvenile fish passage system, passage via turbines, or some combination thereof.

[24] The existing downstream passage facility at the Upper Baker dam is a 44-year-old floating surface collector, commonly referred to as the "gulper," located in the forebay immediately upstream of the dam.

All juvenile anadromous salmonids collected at the downstream fish passage facilities would be transported to a release pond below Merwin dam, near the mouth of the Lewis River (the exact location has yet to be determined). After acclimating in the pond, they would be released to the lower river to continue their journey to the ocean. Survival data (48-hour) on juvenile anadromous salmonids transported from the 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). The lower Lewis River area release pond is expected to provide similar survival statistics for the transported fish.

Construction of the proposed fish passage facilities has the potential to cause short-term adverse effects, such as increased turbidity. Although water quality may be affected temporarily during construction through increased erosion and sedimentation, these effects can be minimized and avoided by implementing BMPs (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 would 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 would minimize the effects of such an occurrence. Typically, a pollution prevention plan would specify areas for equipment maintenance and refueling, spill prevention and emergency response strategies, and establish requirements for keeping emergency response spill containment kits onsite and for having specially trained personnel. PacifiCorp and Cowlitz PUD currently have Spill Prevention and Containment Control programs in place.

Through the construction permitting process, plans would be developed to minimize and avoid temporary construction-related effects to the extent feasible using BMPs. 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 would benefit aquatic species.

The wider geographic distribution of anadromous fish under the proposed reintroduction program would likely increase life history diversity, gene flow, and genetic fitness of introduced stocks. These naturally-produced fish would be better adapted to the Lewis River and its tributaries and should exhibit higher smolt to adult survival rates than their hatchery counterparts. This action would also increase system productivity and the available prey base for bull trout in all three introduction reaches. It is likely that this action would help increase bull trout abundance, especially in stream reaches where resident hatchery fish are not planted, by reducing competition for available spawning and rearing habitats.

Yale Spillway Improvements

PacifiCorp proposes improvements to the Yale spillway by the fourth anniversary (plus 6 months) of the new licenses to improve fish survival over the spillway during spill events. PacifiCorp provides no design details for the improvements, although based on staff site visit observations, they would likely involve modifications to the downstream end of the spillway, which currently discharges water to a series of "rough" ledges and boulders. The SA provides for development of the designs for the improvements with the ACC, and the filing of the proposed designs for Commission approval within 1 year of any new license issued.

Our Analysis

Modifying the spillway to reduce the mortality of any fish passing the spillway during spillage events would benefit both resident species, including the listed bull trout, and any downstream-migrating anadromous species after the introduction of those species upstream of the Yale Project. The effects of construction of any improvements would likely be minor, assuming that the modifications would occur in the area of existing ledges and boulders. Construction would likely occur during non-spill periods, and assuming that normal erosion and sedimentation control procedures would be employed, there would be no discharge of fines or construction-related fuels and other debris. There may be some effects related to construction vehicle access to the site, if a new access road is required, but at this time PacifiCorp has not provided any information regarding construction plans.

Section 18 Fishway Prescriptions

NMFS, by letter dated February 3, 2005, and Interior, by letter dated February 4, 2005, filed their preliminary terms and conditions under section 18 of the FPA and stated that they were consistent with the relevant provisions of the SA. Both agencies recently filed modified fishway prescriptions (NMFS filed on February 17, 2006, and Interior filed on February 22, 2006), and indicate that these prescriptions are consistent with the terms of the SA that relate to fishways and fish passage, and as such the prescriptions refer specifically to elements of the SA. They also indicate that they are consistent with the draft license articles that were prepared by the applicants in consultation with the agencies, and that were filed with the Commission on December 19, 2005, and January 6, 2006. Table 3.3.3-11 summarizes the fishway prescriptions for the four Lewis River projects. Both agencies' prescriptions include programs or structures for upstream and downstream passage at the projects, performance standards, outcome goals and other measures to ensure effective passage that are identical to the applicant's proposal.

Table 3.3.3-11. Summary of NMFS and Interior's Section 18 Fishway Prescriptions for the Merwin Project. (Source: NMFS, 2006a, 2006b, 2006c, 2006d; Interior, 2006)

Prescription	Agency	Project[a]				Description
		M	Y	S1	S2	
Anadromous Fish Outcome Goals	NMFS	X	X	X	X	Implement PMEs in the SA to achieve reintroduction goals specified in SA section 4.1.6 for Chinook, steelhead and coho.
Monitoring and Evaluation	NMFS	X	X	X	X	Monitor progress for achieving reintroduction goals periodically as set forth in SA.
Phase I status check	NMFS	X	X	X		After year 27 of license or 12th year after reintroduction of anadromous fish above Swift 1, determine if reintroduction outcome goals are being met, and continue implementing SA measures to meet relevant performance goals.
Phase II status check	NMFS	X	X	X	X	After year 37 of license or 7th year after Phase I Status Check determine if reintroduction outcome goals are being achieved, and continue to implement SA measures to meet relevant performance goals.
Fish Passage Facilities Design	NMFS Interior	X				Develop Merwin Downstream Facility and Merwin Upstream Facility per SA provisions.
Fish Passage Facilities Design	NMFS Interior		X			Develop Yale Downstream Facility and Yale Upstream Facility per SA provisions.
Fish Passage Facilities Design	NMFS Interior			X		Develop Swift Downstream Facility and with Swift No 2 Project develop and implement Swift Upstream Facility per SA provisions.
Fish Passage Facilities Design	NMFS Interior				X	With Swift No 1 Project develop and implement Swift Upstream Facility per SA provisions.
Studies To Inform Design Decisions	NMFS Interior	X	X	X		Develop and carry out studies to design fish passage facilities to improve likelihood of successful performance.

Prescription	Agency	Project[a]				Description
		M	Y	S1	S2	
Design Review	NMFS Interior	X	X	X	X	Design passage facilities to meet performance standards outlined in SA section 4.1.4.b, and provide specific levels of design for Services and WDFW review.
Permits and Time for Construction	NMFS Interior	X	X	X	X	Acquire permits in timely manner to allow passage facilities to be placed in operation when specified in SA.
Performance Standards for Fish Passage	NMFS Interior	X	X	X	X	Provide for safe, timely, and effective passage of all life stages of salmonids being transported past the project, meeting the performance standards as described in SA section 4.1.
Overall Fish Passage Performance Standards for Salmonids	NMFS Interior	X	X	X	X	Lists the overall performance standards for upstream and downstream passage, as described in SA section 4.1.4.
Passage Facility Design Performance Standards for Salmonids	NMFS Interior	X	X	X		Lists the specific fishway performance standards by life stage and species.
Fish Passage Performance Standards for Upstream Facilities	NMFS Interior				X	Lists the overall performance standards for upstream passage, as described in SA section 4.1.6.
Passage Facility Design Performance Standards for Salmonids	NMFS Interior				X	Design and construct Swift Upstream Facility to achieve Upstream Passage Survival ≥ 99.5 percent and Adult Trap Efficiency to be established as described in the SA.
Adult Trap Efficiency (ATE) for Salmonids	NMFS Interior	X	X	X	X	Develop an ATE performance standard for the each licensee's Upstream Transport Facility, using NMFS' fish passage guidelines in the interim, for use in judging future performance of the facilities.
Monitoring and Evaluation of Performance Standards	NMFS Interior	X	X	X	X	Requires evaluation of whether performance standards are being met at each project's passage facilities for each species designated in the SA, in accordance with SA section 9.

Prescription	Agency	Project[a]				Description
		M	Y	S1	S2	
Adjustments or Modifications to Passage Facilities to Achieve Performance Standards	NMFS Interior	X	X	X	X	When making facility adjustments requires adherence to the design process set out in SA section 4.1.2, and determination of the effectiveness of the adjustment or modification.
Species to be transported	NMFS Interior	X	X	X	X	Provide for transport of spring Chinook, winter steelhead, coho, bull trout, and sea-run cutthroat, as well as fall Chinook or summer steelhead that enters the passage facilities.
Upstream Transport Before Full Adult Fish Passage	NMFS Interior	X	X	X	X	Provide for transport according to the Upstream Transport Plan described in SA section 4.1.8.c.
Upstream Transport After Full Adult Fish Passage	NMFS Interior	X	X	X	X	On or before the 13th anniversary of the issuance of the last of the licenses for the four Lewis River projects, evaluate alternative adult fish transport technologies and implement, if appropriate, based on effectiveness and costs, compared to truck transport.
Upstream Transport Plan	NMFS Interior	X				In accordance with SA section 15.14, develop a plan to achieve safe and effective upstream passage from the Merwin Upstream Transport Facility, and modify this plan, as required, to address transport from the Yale Upstream Facility and the Swift Upstream Facility.
Upstream Transport Plan	NMFS Interior		X			In accordance with SA section 15.14, develop plan for safe and effective upstream passage from Yale Upstream Transport Facility, and modify plan, as required, to address transport from Swift Upstream Facility.
Upstream Transport Plan	NMFS Interior			X		In accordance with SA section 15.14, develop plan for safe and effective upstream passage from the Swift Upstream Transport Facility, and modify plan, as required, to address transport from the Swift Upstream Facility.

Prescription	Agency	Project[a]				Description
		M	Y	S1	S2	
Upstream Transport Plan	NMFS Interior				X	In accordance with SA section 15.14, modify the Upstream Transport Plan prepared for Merwin and Yale to address transport from the Swift Upstream Facility before facility is built.
Downstream Transport	NMFS Interior	X	X	X		Provide for downstream truck transport of migrating fish collected in the project's Downstream Facility, or provide bypass passage facility if the Services determine such system would provide equal or greater biological benefit.
Downstream Transport Plan	NMFS Interior	X	X	X		Modify the Downstream Transport Plan prepared in accordance with the licensee for the Merwin, Yale and Swift No. 1 projects, after consultation with the ACC and Services, and subject to SA section 15.14.
Downstream Transport at Swift No 1 Dam	NMFS Interior			X		By 6 months after 4th anniversary of Swift No.1 license construct the Swift Downstream Facility and transport migrating salmonids to release pond below Merwin dam. Monitor performance as described in SA section 9. Provide satellite passage facility if necessary, or modify existing facility per SA section 4.1.6.
Merwin Trap Flow Restrictions	NMFS Interior	X				Limit discharge from the Merwin powerhouse for safety purposes to a maximum of 5,250 cfs, or other flow level to be determined by the licensee and WDFW, when personnel are working in the existing fish trap, until upgrades to the Merwin Trap are completed.

Prescription	Agency	Project[a] M	Y	S1	S2	Description
Merwin Trap Upgrades	NMFS Interior	X				By the 2nd anniversary of the license modify the Merwin Trap to allow safe operations for both trap operators and fish at flow levels greater than the above flow restriction, provide for daily trap clearing, and provide for fish sorting at the Lewis River Hatchery.
Interim Merwin Trap Operations	NMFS Interior	X				Until construction of the Merwin Upstream Transport Facility is complete, operate upgraded Merwin Trap solely to collect returning hatchery fish and transport bull trout collected to Yale Lake. Fish other than hatchery fish and bull trout will be returned to the river below Merwin dam.
Merwin Upstream Collection and Transport Facility	NMFS	X				By 6 months after the 4th anniversary of the license, provide for adult trap and transport as provided in the SA. The Merwin Upstream Transport Facility must be compatible with truck transport and alternate modes of transport selected as described in SA section 4.1.8.
Release Ponds	NMFS Interior	X	X	X		In consultation with the ACC and approval by NMFS, construct stress release ponds below the Merwin Project to be used for downstream migrating fish collected at upstream facilities, as described in SA section 4.4.3.
Downstream Passage at Merwin Dam	NMFS Interior	X				On or before 17th anniversary of' the license, operate downstream passage facilities at Merwin dam unless otherwise directed by the Services per SA section 4.1.9. Downstream migrating salmonids will be transported to release ponds below Merwin dam, and bull trout will be returned to Lake Merwin unless otherwise directed by FWS, per SA section 4.1.8.

Prescription	Agency	Project[a]				Description
		M	Y	S1	S2	
Downstream Passage at Yale Dam	NMFS Interior		X			On or before 13th anniversary of' license, construct and operate downstream passage facilities at Yale dam, unless otherwise directed by Services pursuant to SA section 4.1.9. Downstream migrating salmonids will be transported to release ponds below Merwin dam, and bull trout collected will be returned to Yale Lake unless otherwise directed by FWS, per SA section 4.1.8.
Upstream Passage at Yale Dam	NMFS Interior		X			Unless otherwise directed by Services per SA section 4.1.9, on or before 17th anniversary of license, complete adult trap and transport facility for upstream migrating salmonids from Lake Merwin into Yale Lake, except FWS may direct bull trout be transported elsewhere.
Yale Spillway Modifications	NMFS Interior		X			Design, permit and construct improvement to Yale spillway by 6 months after 4th anniversary of license to improve fish survival during spill events.
Upstream Passage at Swift Projects	NMFS Interior			X	X	Unless otherwise directed by Services per SA section 4.1.9, on or before 17th anniversary of license, complete adult trap and transport facility for upstream migrating salmonids from above Yale Lake to above Swift No.1 dam, except FWS may direct bull trout be transported elsewhere.
Monitoring and Evaluation Plan	NMFS	X	X	X	X	Pursuant to SA section 9.1 complete a master monitoring and evaluation plan in consultation with the ACC (including at least the Services), to monitor and evaluate the effectiveness of aquatic environmental measures contained in the SA, and assess achievement of Reintroduction Outcome Goals as provided in the SA.

Prescription	Agency	Project[a]				Description
		M	Y	S1	S2	
Monitoring and Evaluation of Fish Passage Facilities	NMFS	X	X	X	X	Monitoring and evaluation plan must assess the efficiency of the upstream and downstream passage facilities, and related fish timing and survival for adult and juvenile Chinook, steelhead, coho, bull trout and sea-run cutthroat, including survival measured at the stress release ponds downstream of Merwin dam.
Adult Migration/Spawning Assessment	NMFS	X	X	X	X	Identify the spawning timing, distribution, and spawning abundance for anadromous species transported upstream to identify preferred spawning areas and provide information for any revisions to the Hatchery and Supplementation Plan and the Upstream Transport Plan, and ACC decisions related to the Aquatics Fund.
Adjustment to Monitoring Frequency	NMFS	X	X	X	X	Once fish passage standard has been achieved, limit future monitoring to periodic checks to determine continued compliance with the standard.
Response to Fish Monitoring Results	NMFS	X	X	X	X	Obligations of the Lewis River projects licensees, based on the results of monitoring related to fish passage facilities are set forth in SA section 4.
Interim Bull Trout Collect and Haul Programs	Interior		X	X	X	Implement bull trout collect and haul program until earlier of operation of Yale and Swift Upstream facilities or alternative measures implemented per SA section 4.9.1.
Investigation of Alternative Bull Trout Collection Methods	Interior		X	X	X	Investigate use of alternative bull trout collection methods for Bull Trout Collection and Transport Program described in SA section 4.9.1.

Prescription	Agency	Project[a]				Description
		M	Y	S1	S2	
Implementation of Alternative Bull Trout Collection Methods	Interior		X	X	X	Implement alternative interim collection method for bull trout if more safe and effective method is identified, pending concurrence of FWS.
Bull Trout Entrainment Reduction	Interior	X	X			Evaluate bull trout entrainment reduction methods in consultation with ACC.
Downstream Bull Trout Facilities	Interior	X				If by the 17th anniversary of the license bull trout populations in Lake Merwin have increased significantly, provide bull trout downstream passage facility at Merwin dam.
Downstream Bull Trout Facilities	Interior		X			If by the 13th anniversary of the license the Yale Downstream Facility is not built provide a bull trout downstream collection and transport facility at Yale dam.
Upstream Bull Trout Facilities	Interior		X			If by the 17th anniversary of the license the Yale Upstream Facility is not built, and the bull trout collect and haul program is not meeting performance standards per SA section 4.1.4, construct and provide a bull trout upstream collection and transport facility at Yale dam.
Swift Upstream Bull Trout Facilities	Interior			X	X	Per SA Section 4.1.9, if the Swift Upstream Facility is not constructed and FWS determines before 13th anniversary of Swift No. 1 or Swift No. 2 license, whichever is later, that bull trout performance standards of SA section 4.9.1 or 4.9.2 are not being met, then by 17th anniversary of the Swift No. 1 or Swift No. 1 license (whichever is later) complete the Swift Upstream Bull Trout Facility.

Prescription	Agency	Project[a] M	Y	S1	S2	Description
Obligation to Consult	NMFS Interior	X	X	X	X	Convene the ACC subject to SA section 15.12. In the event the SA is terminated, the only obligation will be to consult with the Services, except as described in SA section 15.13
Dispute Resolution	NMFS Interior	X	X	X	X	Allow for the resolution of disputes, among the Parties to the SA in accordance with the non-binding Alternative Dispute Resolution procedures set forth in the SA.

[a] M = Merwin; Y = Yale, S1 = Swift No. 1; S2 = Swift No. 2

Our Analysis

Upstream and downstream fish passage measures proposed by the applicants are consistent with the Services' section 18 fishway prescriptions and are analyzed in the previous sections. Providing these fish passage measures according to the schedule in the SA are expected to result in enhancement of the anadromous fish stocks in the Lewis River Basin, with no long-term negative effects on existing aquatic resources in the basin.

The wider geographic distribution of anadromous fish facilitated by the proposed passage facilities would likely increase life history diversity, gene flow, and genetic fitness of introduced stocks. These naturally-produced fish would be better adapted to the Lewis River and its tributaries and should exhibit higher smolt to adult survival rates than their hatchery counterparts. Higher survival would also increase system productivity and the available prey base for bull trout in all three introduction reaches of the Lewis River. Development of passage facilities and programs would help increase bull trout distribution and abundance, especially in stream reaches where resident hatchery fish are not planted, by reducing competition for available spawning and rearing habitats.

Hatcheries

PacifiCorp and Cowlitz PUD would commence a Hatchery and Supplementation Program including continued support to the existing hatchery program on the Lewis River. The Hatchery and Supplementation Program would be consistent with the ESA, applicable state and federal fisheries policies, and regional recovery plans, and should be consistent with recommendations of the Hatchery Science Review Group and the Northwest Power Planning Council's Hatchery Review (Artificial Production Review & Evaluation), to the extent practicable.

The program goals would support (1) self-sustaining, naturally producing, harvestable native anadromous salmonid species above Merwin dam, and (2) continued harvest of resident and native anadromous fish species. The supplementation portion of the program would be linked to the anadromous salmonid introduction program and would be limited to spring Chinook, winter steelhead, and late-run coho (Type-N).

To ensure that this program is meeting the established goals, PacifiCorp and Cowlitz PUD would develop and implement a hatchery and supplementation plan to adaptively manage and guide the program. The plan would address both anadromous and resident fish, and be designed to achieve the adult hatchery fish targets presented in table 3.3.3-12, taking into account harvest and escapement. PacifiCorp and Cowlitz PUD would use the existing Lewis River, Merwin, and Speelyai hatchery facilities to meet production obligations. Initial juvenile production goals under the Proposed Action would be 1.35 million spring Chinook, 1.8 million coho, and 275,000 steelhead. Production obligations would 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.

Table 3.3.3-12. Initial Lewis River Hatchery Complex targets. (Source: PacifiCorp and Cowlitz PUD, 2004a)

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

Anadromous fish stocks to be used in the introduction program would include a mixture of indigenous and hatchery stocks (table 3.3.3.-13).

Table 3.3.3-13. Broodstock sources to be used for supplementation above and below Merwin dam. (Source: PacifiCorp and Cowlitz PUD, 2004a)

	Stock Source		
Program	**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

When the number of natural returns to the Lewis River of pre-harvest ocean recruits of any species exceeds the natural production threshold specified in table 3.3.3-14, PacifiCorp and Cowlitz PUD would decrease the hatchery target(s) identified in table 3.3.3-12 on a fish for fish (1:1) basis. However, PacifiCorp and Cowlitz PUD would not decrease the hatchery targets below the hatchery target floor specified in table 3.3.3-14. If PacifiCorp and Cowlitz PUD reduce hatchery targets based on the number of returning natural pre-harvest ocean recruits, but the number of returning pre-harvest ocean recruits subsequently decline, they would increase the hatchery targets on a fish for fish (1:1) basis provided that they not exceed the initial hatchery targets in table 3.3.3-12. The SA also allows for a reduction in production levels if it is determined that such actions would benefit recovery for ESA-listed stocks, or would support other recovery efforts in the basin.

Table 3.3.3-14. Numbers governing modifications to hatchery targets. (Source: PacifiCorp and Cowlitz PUD, 2004a)

	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

Juvenile spring Chinook and steelhead would be transported from the hatcheries to locations above Swift, Yale, and Merwin dams for 10 years, commencing upon completion of each of the Swift, Yale, and Merwin downstream fish collection facilities. Coho would be transported above Swift, Yale, and Merwin dams for 6 years. At the end of these periods, the ACC would assess on a year-by-year basis whether to extend the transportation of juvenile salmonids.

In addition to the above anadromous species, PacifiCorp and Cowlitz PUD would 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. PacifiCorp would also produce up to 12,500 pounds of resident kokanee (93,000 juveniles) to be planted in Lake Merwin. These production levels are the same as current levels.

Our Analysis

Under the proposed action, the hatchery facilities would continue to maintain hatchery "reserve" populations (hatchery target floor) of Chinook, coho, and steelhead for use if the natural populations suffer a catastrophic loss. Because initial hatchery production under the proposed action would be reduced on a fish for fish (1:1) basis as natural populations are restored, any adverse effects of hatchery fish on wild fish, such as increased predation, disease, and competition, would be a concern only in the short term,

and would be similar to that of current operations. However, these effects would be reduced if wild production replaces hatchery production. The genetic risks associated with hatchery fish spawning in the wild or interbreeding with wild fish would be reduced, as would predation and competition. The potential risk of hatchery fish transmitting diseases common to hatchery fish to wild fish would continue to be a concern as long as hatchery fish are being produced in the basin; however, lower production levels and lower rearing densities may reduce the incidence of disease outbreaks.

Hatchery rainbow trout and kokanee would continue to be stocked at the same level as occurs under existing conditions, as part of WDFW's Hatchery and Genetics Management Plan for the Lewis River. Presumably, the ACC would recommend rainbow trout and kokanee supplementation programs that would incorporate current scientific information in order to reduce or eliminate hatchery effects on wild fish populations to the extent practicable.

Recreational fishing associated with the release of hatchery rainbow trout in Swift Creek reservoir would likely result in fishing pressure on native fish stocks, such as cutthroat trout. 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 introduction 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 would provide forage for adfluvial cutthroat trout in Swift Creek reservoir and Lake Merwin. Hatchery rainbow trout would also move into Yale Lake during spill events and would have a similar effect on cutthroat trout in Yale Lake as described above.

3.3.3.3 Cumulative Effects

The introduction of anadromous salmonids into the upper Lewis River Basin and the development of fish passage facilities would likely increase the distribution and abundance of resident and anadromous salmonids. These actions, combined with measures included in the proposed action together with improved timber harvest regulations (Forest Service, 1990; Forest Service and BLM, 1994; WAC 222-08 through WAC 222-50), improved hatchery management, ongoing habitat restoration measures (Forest Service, 1999; Wade, 2000), and increased enforcement in the basin (WDFW, 2001) would likely increase the chances that fish restoration goals could be achieved.

Existing and future ESA recovery efforts in the Columbia River Basin, including those being developed and recommended by the Lower Columbia River Fish Recovery Board and Bull Trout Draft Recovery Plan (FWS, 2002), would also work in conjunction with project-related enhancement measures to improve conditions for ESA-listed stocks. While these actions would likely benefit resident and anadromous salmonids, ongoing

effects associated with trapping of sediment and LWD in project reservoirs, urban and rural development, increased recreation, future road construction, population growth, and past timber harvest practices would continue to affect aquatic habitat in the watershed. The proposed action, however, would offset some of the negative cumulative effects on aquatic resources in the Lewis River Basin and should result in an overall beneficial effect on fisheries in the basin.

3.3.3.4 Unavoidable Adverse Effects

Operation of the Lewis River Projects under the proposed action would continue to trap most sediment and woody debris in the three project reservoirs and alter flow regimes in the Lewis River bypassed reach, and in the Lewis River downstream from Merwin dam. As a result, aquatic and riparian habitat in the Lewis River bypassed reach and in the lower Lewis River downstream from Merwin dam would continue to be affected by project operations, although to a reduced degree. Upstream migrating adults may suffer injury or mortality through transport, and downstream migrating fishes would be subject to injury or mortality from entrainment, although installation of downstream fish passage facilities would reduce the level of entrainment. Downstream-migrating juvenile fish may also be subject to mortality from predation during passage through the project reservoirs.

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

The Lewis River Projects straddle the boundary between the Puget Trough and the Southern Washington Cascades physiographic provinces. The Puget Trough area consists primarily of rolling hills and terraces. Ridges separated by steep, dissecting valleys characterize the Southern Washington Cascades (Franklin and Dyrness, 1988). Area vegetation is supported by a temperate maritime climate. The 54,608-acre study area surrounding the four projects, with elevations ranging from about 200 feet near Eagle Island to over 1,000 feet upstream of Swift Creek reservoir, is entirely within the western hemlock vegetation zone, which is characterized by coniferous forest dominated by Douglas-fir, western hemlock, and western red cedar.

Vegetation

Land use practices significantly influence vegetation associated with the Lewis River Projects. Lands around Swift Creek reservoir are relatively unaffected by development, and include a patchwork of managed timberlands consisting of various age classes of coniferous forest typical of the western hemlock vegetation zone. Around Yale Lake and Lake Merwin, pastures, farmlands, and small residential and recreational developments are interspersed with large areas of managed timberlands and deciduous forest stands. Along the lower river, the effects of development are most pronounced; the

area is dominated by a riparian deciduous and mixed deciduous-coniferous forest surrounded by residential and recreation developments and agricultural lands.

As part of relicensing, a comprehensive map of cover types in the 54,608-acre study area was developed. Cover types are broad categories that represent combinations of vegetation community types, which are typically defined by plant species, as well as land uses (i.e., disturbed/developed) and water types (i.e., riverine, lacustrine). In total, 44 distinct cover types were identified in the study area; these were consolidated into nine generalized types.

Nearly 21,420 acres, or about 40 percent of the study area, is covered by upland coniferous forest, which includes seven individual cover types distinguished by species or age class (table 3.3.4-1). Upland conifer forests are dominated by stands of Douglas-fir and western hemlock, and range in age from recent clearcuts less than 1 year old to old-growth with trees greater than 150 years in age. Over 51 percent of the old-growth and mature conifer forest and nearly 56 percent of the seedling/sapling stands in the study area are located around Swift Creek reservoir. Most of the old-growth occurs along the south side of the reservoir, while the seedling/sapling stands are concentrated on the north side where lands are actively managed for timber production. An unusual community of lodgepole pine and Douglas-fir occurs on the lava flow found to the north and south of portions of the Swift No. 2 canal.

Approximately 23 percent of the study area, or 12,771 acres, is represented by upland deciduous forest and mixed conifer-deciduous forest (table 3.3.4-1). In general, the deciduous forests are more common in the lower elevation areas of the projects where disturbance and residential development are comparatively more extensive. Over 58 percent of the mixed conifer-deciduous and upland deciduous forests occur along Yale Lake, Lake Merwin, and the lower Lewis River. The deciduous overstory component of these forests is largely limited to big-leaf maple and alder, except at the south end of Lake Merwin where there are a few small stands of Oregon white oak.

Riparian cover types in the study area include grass/forbs, deciduous shrubs, deciduous forests, and young and mature mixed conifer-deciduous forests. Combined, these riparian types total approximately 1,958 acres (3.6 percent) (table 3.3.4-1). Most of the riparian habitat occurs in the Lewis River bypassed reach and along the Lewis River below Merwin dam, including Eagle Island. Wetlands occupy only 279 acres, or 0.5 percent of the total study area. Most of the wetlands are small, and some are created; forested, scrub-shrub, emergent, and aquatic bed wetland types are all represented in the study area. The greatest number of individual wetlands and the largest amount of wetland acreage are associated with the Yale Project. Relatively few wetlands in the study area show evidence of a direct hydrological connection to the project reservoirs. Wetlands that are influenced by reservoir water levels include the Beaver Bay, IP, and Yale Park wetlands at Yale Lake; the Speelyai Point, Riparian Bridge, and Buncombe Hollow wetlands at Lake Merwin; and the Drift Creek mouth wetland at Swift Creek

Table 3.3.4-1. Summary of cover type acreages in the study area for the Lewis River Projects. (Source: PacifiCorp and Cowlitz PUD, 2004a)

	Segment[a]									
COVER TYPES	**Eagle Island**	**Lower River**	**Merwin**	**Swift No. 1**	**Lewis River Bypass**	**Swift No. 2 Canal**	**T-line**	**Yale**	**Grand Total**	**Percent of Total**
Conifer Forests										0.0
Seedling/Sapling-new (SS1)	0	0	172.4	343.4	0	0	0	0	515.9	0.9
Seedling/Sapling (SS)	17.4	43.3	1,331.6	3,838.7	227.3	0	87.5	1,349.7	6,895.7	12.6
Pole Conifer (P)	62.8	80.2	839.1	2,856.7	57.0	5.0	36.6	1,205.9	5,143.3	9.4
Pole Conifer-thinned (P-t)	0	0	49.9	0	0	0	0	27.1	77.0	0.1
Mid-Successional Conifer (MS)	13.1	0	1,518.0	926.7	18.9	56.6	102.9	1,917.2	45,553.5	83.4
Mid-Successional Conifer-thinned (MS-t)	0	0	226.5	0	0	0	0	0	226.5	0.4
Mature Conifer (M)	0	76.5	567.8	209.0	54.1	0	124.7	502.0	1,534.0	2.8
Old-Growth (OG)	0	0	86.5	1,622.6	6.3	0	10.2	284.4	2,010.0	3.7
Lodgepole Pine (LP)	0	0	0	10.2	70.6	300.5	0	80.9	462.3	0.8
Conifer Forest Total	**93.3**	**200.0**	**4,791.7**	**9,807.4**	**434.2**	**362.2**	**362.0**	**5,365.7**	**21,418.2**	**39.2**
Upland Deciduous Forests										0.0
Young Upland Deciduous (YUD)	20.5	17.6	32.1	14.2	0	0	0	3.2	87.6	0.2
Upland Deciduous (UD)	15.0	37.4	832.1	662.8	160.0	349.0	410.4	2408.6	487.2	0.9
Upland Deciduous Forest Total	**35.5**	**55.0**	**864.2**	**677.0**	**160.0**	**349.0**	**410.4**	**2,411.8**	**4,962.8**	**9.1**
Upland Mixed Forests										0.0
Young Upland Mixed (YUM)	155.5	53.5	245.7	0	0	0		97.6	552.3	1.0
Upland Mixed (UM)	293.9	1,740.2	2,567.3	1,160.9	21.0	40.3	226.5	1,198.5	7,248.5	13.3
Upland Mixed-thinned (UM-t)	3.5	0	3.7	0	0	0		0	7.2	0.0
Upland Mixed Forest Total	**452.9**	**1,793.7**	**2,816.6**	**1,160.9**	**21.0**	**40.3**	**226.5**	**1,296.1**	**7,808.0**	**14.3**
Riparian										0.0
Riparian Shrub (RS)	136.2	43.0	3.2	0.7	20.7	0	0	3.7	207.6	0.4
Riparian Deciduous (RD)	64.6	211.4	197.5	235.2	71.0	35.1	15.5	188.8	1,019.1	1.9
Young Riparian Mixed (YRM)	0	0	0	5.2	0	0	0	0	5.2	0.0
Riparian Mixed (RM)	116.3	142.4	206.2	76.3	14.6	0	1.7	157.2	714.8	1.3

COVER TYPES	Segment[a]								Grand Total	Percent of Total
	Eagle Island	Lower River	Merwin	Swift No. 1	Lewis River Bypass	Swift No. 2 Canal	T-line	Yale		
Riparian Grassland (RG)	0.2	10.3	0.8	0	0	0	0	0	11.3	0.0
Riparian Total	**317.3**	**407.1**	**407.8**	**317.4**	**106.4**	**35.1**	**17.2**	**349.7**	**1,958.0**	**3.6**
Oak Woodland (OW)	0	0	13.8	0	0	0	0	0	13.8	0.0
Wetland										**0.0**
Palustrine Aquatic Bed (PAB)	0	0	0	1.6	0	0	0	0	1.6	0.0
Palustrine Unconsolidated Bottom (PUB)	0	0	10.9	7.0	0.5	8.0	0	23.9	50.2	0.1
Palustrine Emergent Wetland (PEM)	0.0	7.1	19.9	27.1	2.5	5.9	0	19.6	82.1	0.2
Palustrine Scrub-Shrub Wetland (PSS)	6.1	3.4	4.3	9.2	9.4	3.9	3.0	13.8	53.1	0.1
Scrub-Shrub/Emergent Wetland (PSS/PEM)	0	1.2	0	0	0	0	0	0	1.2	0.0
Palustrine Forested Wetland (PFO)	6.0	2.7	18.6	24.0	6.4	2.7	0	30.4	90.8	0.2
Wetland Total	**12.1**	**14.4**	**53.7**	**68.9**	**18.8**	**20.5**	**3.0**	**87.7**	**279.0**	**0.5**
Other Upland Cover Types										0.0
Rock Talus (RT)	0	0	0.4	2.5	0	1.7	0	1.5	6.2	0.0
Exposed Rock (ER)	0	0	1.7	16.2	0	0.7	0	12.0	30.6	0.1
Sparsely Vegetated (SV)	0	0	28.1	81.1	2.2	0	0	2.8	114.0	0.2
Shrub (SH)	19.8	0	166.8	103.5	7.7	0	4.0	123.3	425.0	0.8
Pasture (PA)	111.4	277.2	173.5	0	0	0	13.6	101.6	677.3	1.2
Meadow (MD)	0	148.0	84.3	5.0	0	7.8	9.7	200.1	454.9	0.8
Orchard (OR)	0	0	2.7	0	0	0	0	4.3	7.0	0.0
Other Upland Cover Types Total	**131.2**	**425.2**	**457.4**	**208.3**	**9.9**	**10.2**	**27.3**	**445.5**	**1,715.0**	**3.1**
Lake and Riverine										0.0
Riverine Unconsolidated Bottom (RUB)	100.9	216.1	34.2	79.8	19.3	0	0	0	450.3	0.8
Riverine Unconsolidated Shore (RUS)	1.1	3.4	0	8.5	57.9	0	0	0	70.9	0.1
Lacustrine Unconsolidated Bottom (LUB)	0	1.0	3,886.5	4,487.4	0	99.9	0	3,673.9	12,148.7	22.2
Lacustrine Unconsolidated Shore (LUS)	0	0	1.2	88.8	0	0	0	1.0	91.0	0.2
Lake and Riverine Total	**102.0**	**220.5**	**3,921.9**	**4,664.6**	**77.2**	**99.9**	**0.0**	**3,674.9**	**12,760.9**	**23.4**

COVER TYPES	Segment[a] Eagle Island	Lower River	Merwin	Swift No. 1	Lewis River Bypass	Swift No. 2 Canal	T-line	Yale	Grand Total	Percent of Total
Developed and Disturbed										0.0
Developed (DV)	0	11.9	132.1	77.8	0	104.7	1.2	49.0	376.8	0.7
Recreation (REC)	0	230.5	25.9	47.9	0	0	0	69.4	373.8	0.7
Disturbed (DI)	0.4	2.1	23.5	25.0	22.9	0	0	76.3	150.3	0.3
Residential (RES)	8.9	92.2	673.6	175.7	0	0	16.7	232.0	1,199.1	2.2
Agriculture/Residential	254.3	966.7	0	0	0	0	0	0	1,221.0	2.2
Transmission line Right-of-Way (ROW)	0	9.9	148.9	0	0	35.1	60.8	116.5	371.2	0.7
Developed and Disturbed Total	**263.6**	**1,313.3**	**1,003.9**	**326.5**	**22.9**	**139.8**	**78.7**	**543.3**	**3,692.2**	**6.8**
Grand Total	**1,407.9**	**4,429.2**	**14,331.0**	**17,231.0**	**850.4**	**1,057.0**	**1,125.1**	**14,176.0**	**54,607.9**	

a Study area segments are based on geography, not ownership:

Eagle Island = Eagle Island + the Lewis River + land within the 240-foot contour line on both sides of the river north/south of the island;

Lower Lewis River =Lewis River + land within the 240-foot contour line on both sides of the river from 0.5-mile downstream of Merwin dam to the upstream end of Eagle Island;

Merwin = Lake Merwin and lands within 0.5-mile of the reservoir to the base of Yale dam + the Lewis River and lands on both sides within 0.5-mile downstream of Merwin dam;

Yale = Yale Lake and lands within 0.5-mile of the reservoir to 0.25-mile upstream of the Swift No. 2 tailrace + PacifiCorp-owned lands contiguous with the Yale Project but over 0.5-mile from the reservoir;

Lewis River Bypass = Lewis River bypassed reach and land 0.5-mile to the south;

Swift No. 2 = Swift No. 2 canal and most land within 0.5-mile to the north side of the canal;

Swift No. 1 = Swift Creek reservoir and lands within 0.5 mile of the reservoir to about 0.25-mile upstream of the reservoir;

T-line = The Yale to Merwin transmission line corridor and land within 0.125 mile of each side.

reservoir. Of these, Beaver Bay and IP have other water sources and beaver activity that maintain the hydrology in these wetlands, so they do not appear to be greatly affected by reservoir fluctuations. All other wetlands are either upslope and distant from the reservoirs, or artificially created and maintained.

WDFW has designated a number of cover types in the vicinity of the Lewis River Projects as priority habitats. A priority habitat is defined as an area that meets one of the following criteria: (1) comparatively high fish or wildlife density and/or diversity; (2) important fish or wildlife breeding habitat, seasonal range, and/or movement corridors; (3) limited availability; (4) high vulnerability to alteration; or (5) supports unique or dependent species (WDFW, 2002). Priority habitats in the study area include caves, freshwater wetlands, fresh deepwater, streams, old-growth and mature forest stands, Oregon white oak woodlands, riparian areas, rural open space, areas with abundant snags and logs, and talus.

Rare Plants

There are no known occurrences of ESA-listed plant species in the study area for the Lewis River Projects (letter from K. Berg, Manager, Western Washington Field Office, FWS, June 24, 2003; letter from S. Swope Moody, Environmental Coordinator, WNHP, Department of Natural Resources, Olympia, WA, July 1, 2003). There are, however, a number of plant species that are state-listed, or considered by FWS, the Washington Natural Heritage Program, or the Forest Service to be at risk of decline or in need of monitoring or protection. These species are collectively referred to as rare plants.

The Washington Natural Heritage Program, FWS, and the Forest Service provided lists of rare plant species potentially occurring in the study area. Of the 49 vascular plant species on these lists, only one, cold-water corydalis (*Corydalis aquae-gelidae*), had been documented within the general vicinity of the Lewis River Projects. Surveys for rare plants in the study area were conducted in 1997, 2000, and 2001, and located only one rare taxa: the green-fruited sedge (*Carex interrupta*). It was found during the 1997 surveys in a wetland along the south shore of the Lewis River between Lake Merwin and Yale dam upstream of Highway 503, in a wetland at the base of the Swift No. 2 canal berm, and in several wetlands associated with the Yale Project. The green-fruited sedge was a WNHP List 4 species through 1998, when it was de-listed because of mounting evidence that it was more common than previously thought (WNHP, 2002).

Exotic and Invasive Plant Species

Noxious weeds potentially occurring in the study area were identified from the Washington State Weed Control Board list of weeds for Clark, Cowlitz, and Skamania counties, the Pacific Northwest Exotic Pest Plant Council list of invasive plants (WSWCB, 2002), and consultation with the Forest Service. This process resulted in a target list of 27 species, which was used to guide field surveys for noxious weeds. Several invasive species, such as reed canarygrass (*Phalaris arundinacea*), were not

included on the target weed list because they are ubiquitous throughout western Washington and the Lewis River area. Conversely, the target weed list included some native species, such as trailing blackberry (*Rubus ursinus*), that are not considered weeds in Washington but can be invasive and are of interest to the Forest Service.

Nine of the 27 target weed species were found in the study area, with most infestations concentrated around project facilities, roads, ROWs, and other disturbed sites. Weed species identified in the study area include the following:

- Bull thistle (*Cirsium vulgarae*)
- Canada thistle (*Cirsium arvense*)
- Himalayan blackberry (*Rubus discolor*)
- Japanese knotweed (*Polygonum cuspidatum*)
- Policeman's helmet (*Impatiens glandulifera*)
- Scot's broom (*Cytisus scoparius*)
- St. John's wort (*Hypericum perforatum*)
- Tansy ragwort (*Senecio jacobaea*),
- Trailing blackberry (*Rubus ursinus*)

Overall, weed infestations occupy a relatively small portion of the study area. Himalayan blackberry is perhaps the most pervasive, particularly in riparian areas and wetlands. Scot's broom is common along roadways and the transmission line ROWs. Japanese knotweed and policeman's helmet are confined to a few locations along the lower river. Many weed taxa thrive in full sun, and the second-growth Douglas-fir stands that dominate the study area eventually shade out most invasive species.

Wildlife

Located in the Cascade Mountains and foothills of western Washington, the Lewis River Basin supports a diverse assemblage of wildlife. Wildlife surveys and studies for relicensing the Lewis River Projects were conducted in the same 54,608-acre study area as the botanical resources studies, which includes all lands within 0.5 mile of project facilities and reservoirs, PacifiCorp and Cowlitz PUD-owned lands in the project vicinity, the Swift to Merwin and Yale to Merwin transmission line ROWs, Eagle Island, and riparian habitat along the 240-foot contour line from Merwin dam to the downstream end of Eagle Island, and in the bypassed reach of Speelyai Creek. These studies documented 16 amphibians, 4 reptiles, 103 birds, and 13 mammals.[25] Most wildlife species inhabit

[25] Table 3.3.4-2 later in this section identifies the rare species found in the project area and their state and/or federal status.

the coniferous forest stands that dominate the area. The local distribution of these populations is continually affected by the harvest cycle and age of managed forest stands. There are also a number of species dependent on the wetland and riparian habitats provided by the study area. Wildlife species composition and distribution has also been influenced by the project reservoirs and associated facilities, as well as by residential and recreational developments in the Lewis River Valley.

Amphibians

The Lewis River Basin is extremely rich in amphibian abundance and diversity; all 16 amphibian species known to occur in the western Cascades of Washington were documented in the study area. A large population of Larch Mountain salamanders (*Plethodon larselli*), a species with very restrictive habitat requirements, was documented on Yale dam, apparently colonizing the area from adjacent moist cliff/talus habitat. Van Dyke's salamander (*P. vandykei*), another rare species, was found in a seep near the Yale Project. The Cascade torrent salamander (*Rhyacotriton cascadae*), a species restricted to the Cascades between central Washington and Oregon, was common in tributary streams, particularly in the vicinity of Lake Merwin and Yale Lake. Cope's giant salamander (*Dicamptodon copei*), another species with a relatively limited range, was also documented in a few tributaries to Yale Lake. The northern red-legged frog (*Rana aurora*), a species thought to be in decline in other areas of the Pacific Northwest, was a common breeder in study area wetlands; numerous adults were observed along the Lewis River and tributary streams during the summer. The western toad (*Bufo bufo*), another species thought be declining, was observed breeding in an aquatic bed wetland along Swift Creek reservoir near the mouth of Drift Creek. Relatively ubiquitous species included the Pacific treefrog (*Hyla regilla*), ensatina (*Ensatina eschscholtzii*), and rough-skinned newt (*Taricha granulosa*). The non-native bullfrog (*Rana catesbeiana*) was also present in a number of wetlands associated with the Yale Project, including the Frazier Creek, IP, and the Saddle Dam Farm wetlands.

Reptiles

In general, reptiles are poorly represented in the Pacific Northwest (Brown et al., 1995), with only two turtle, one lizard, and four snake taxa native to the western Washington Cascades. Four of these seven species—the painted turtle (*Chryemys picata*), northern alligator lizard (*Elgaiia coerula*), rubber boa (*Charina bottae*), and northwestern garter snake (*Thamnophis ordinoides*)—were documented in the project vicinity. The painted turtle was observed in several wetlands, such as Frazier Creek wetland, with large areas of open water. The alligator lizard and rubber boa were both noted on the rocky face of Yale dam. The alligator lizard was also common in other open habitats such as shrublands, ROWs, and clearcuts. The northwestern garter snake was common in riparian and wetland areas.

Birds

Of the 120 bird species known to be associated with low elevation conifer forests in western Washington (Johnson and O'Neil, 2001), 103 were recorded in the study area. Woodpeckers were well represented and probably breed in the vicinity of the projects, with hairy, downy, and pileated woodpeckers (*Picoides villosus*, *P. pubescens*, and *Dryocopus pileatus*) observed, as well as the red-breasted sapsucker (*Sphyrapicus ruber*) and northern flicker (*Colaptes auratus*). Other bird species common to coniferous and mixed conifer/deciduous forest habitats and likely breeding in the study area include the black-throated gray warbler (*Dendroica negrescens*), Steller's jay (*Cyanocitta stelleri*), dark-eyed junco (*Junco hyemalis*), Swainson's thrush (*Catharus ustulatus*), spotted towhee (*Pipilo maculatus*), and chickadee (*Poecile* sp.).

Many of the less-represented habitat types in the study area support a higher density and diversity of wildlife species than the predominant coniferous forest. Although wetland and riparian habitat combined account for only about four percent of the study area, a disproportionately large number of common and special status avian species occur in these communities. Riparian, wetland, and shoreline areas provide habitat for a number of swallow species, as well as cedar waxwings (*Bombycilla cedrorum*), Wilson's warblers (*Wilsonia pusilla*), song sparrows (*Meospiza melodia*), and warbling vireos (*Vireo gilvus*). There were 79 avian species observed in wetlands, far more than in any other habitat type in the study area. Observations of the common yellowthroat (*Geothlypis trichas*), green heron (*Butorides virescens*), red-winged blackbird (*Agelaius phoeniceus*), wood duck (*Aix sponsa*),[26] blue-winged teal (*Anas discors*), and Bullock's oriole (*Icterus bullockii*) were confined primarily to wetland habitats. All of these species are known or suspected to breed in the study area.

The project reservoirs, particularly Yale and Merwin, provide habitat for waterfowl and waterbirds, especially in the winter. Summer use is quite low, probably because some wintering species migrate north to breed and nesting habitat for resident species is very limited. Mallards (*Anas platyrhynchos*), common mergansers (*Mergus merganser*), American wigeon (*Anas americana*), and glaucous-winged gull (*Larus glaucescens*) were some of the more common species. The reservoirs also provide foraging habitat for ospreys (*Pandion haliaetus*) and bald eagles (*Haliaeetus leucocephalus*), as well as great blue herons (*Ardea herodias*).

Two non-native avian species that thrive in disturbed and developed sites —the house sparrow (*Passer domesticus*) and European starling (*Sturnus vulgaris*)—were noted around project facilities. The brown-headed cowbird (*Molothrus ater*), an avian parasite and another non-native species in the Pacific Northwest, was present in a number of habitats, but not commonly observed.

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[26] A WDFW priority species.

Mammals

Relicensing studies did not include specific surveys for mammals; however, observations were recorded. Of the 72 mammals associated with low elevation conifer forests in western Washington, only 13 were recorded in the study area. However, most small mammal and bat species are nocturnal and/or cryptic, and are therefore difficult to observe without specific surveys. Many of these species are common and likely occur in the study area.

Perhaps the most visible wildlife in the Lewis River Valley are elk (*Cervus elaphus*) and black-tailed deer (*Odocoileus hemionus hemionus*). In addition to game mammals, the Townsend's chipmunk (*Eutamias merriami*) and Douglas' squirrel (*Tamiasciurus douglasii*) were frequently observed in conifer forests. Evidence of beaver (*Castor canadensis*) was noted in most wetlands, and mink (*Mustela vison*) were observed in several wetland and riparian areas. Although not common, the black bear (*Ursus americanus*), bobcat (*Lynx rufus*), river otter (*Lutra canadensis*) and coyote (*Canis latrans*) were also recorded.

Special Status Wildlife Species

Thirty-two special status species potentially occur in the vicinity of the Lewis River Projects (table 3.3.4-2), 24 of which were documented during relicensing studies. Most of the special status species found in the project vicinity also depend upon WDFW designated priority habitats described in the *Vegetation* section above. The Lewis River Project area includes critical big game wintering habitat and important migration corridors for elk and black tailed deer, both of which WDFW designates as species of recreational, commercial or tribal importance that are vulnerable (WDFW, 2005).

Elk are dependent on low-elevation winter range and interconnected movement corridors. According to a 1996 national hunting expenditure survey, approximately $30.4 million is generated by hunters in the area encompassed by the Mount St. Helens herd. However, the size of the herd has decreased considerably over the last 15 years, and the State Elk Herd Management Plan for the project area includes goals to increase the herd by 1,500 animals to return to a pre-1995 population of 15,000. Elk deaths in the project vicinity due to starvation in the winter of 2001-2002, not an especially hard winter, indicate a likely relationship to poor forage habitat conditions (WDFW, 2005).

Additional data, including survey descriptions and results, on special status species can be found in PacifiCorp (1999d) and PacifiCorp and Cowlitz PUD (2003c, 2003f, and 2004). Federally listed species (bald eagle and northern spotted owl) that are found in the project area are discussed in section 3.3.5.

Table 3.3.4-2. Special status species documented or potentially occurring in the study area for the Lewis River Projects.[a]

Species[b]	Status			Habitat	Location in Study Area
	FWS[c]	Forest Service[d]	WDFW[e,f]		
Amphibians and Reptiles					
Cope's giant salamander (*Dicamptodon copei*)	--	S	SM	Small rocky creeks & seeps	Documented in six tributary streams along the east side of Yale Lake
Larch Mountain salamander (*Plethodon larselli*)	SoC	S S/M	SS P1	Associated with steep, shaded talus slopes & old-growth	A large population occurs on the face of Yale dam & at the base of an adjacent cliff; WDFW also has records for Moss Cave
Van Dyke's salamander (*Plethodon vandykei*)	SoC	S S/M	SS P1	Splash zones of creeks or waterfalls; seeps over talus or rock faces	Recorded on a south-facing slope at the edge of an old lava flow just north of Swift No. 2 Canal.
Cascade torrent salamander (*Rhyacotriton cascadae*)	--	S	SC P1	Associated with headwater streams & cold water	Found in 37, 16, & 7 tributary streams/seeps to Lake Merwin, Yale Lake, & Swift Creek reservoir, respectively
Tailed frog (*Ascaphus truei*)	SoC	--	SM	Clean, cold mountain streams	Found in one tributary stream to the upper end of Lake Merwin; Ole Creek; the Lewis River bypassed reach; one & three tributary streams to Yale Lake & Swift Creek reservoir, respectively
Oregon spotted frog (*Rana pretiosa*)	FC	S	SE P1	Founds in wetlands & ponds; breeds in very shallow water	Not found – thought to be nearly extirpated from western WA
Northern red-legged frog (*Rana aurora*)	SoC	--	--	Breeds in wetlands & still water habitats	Egg masses found in at least 27 separate wetlands or ponds throughout the area; adults common in riparian areas

Species[b]	Status			Habitat	Location in Study Area
	FWS[c]	Forest Service[d]	WDFW[e,f]		
Cascades frog (*Rana cascadae*)	SoC	--	--	Breeds in wetlands & still water habitats	One adult found in a beaver pond north of Swift Creek reservoir
Western Toad (*Bufo boreas*)	SoC		SC P1	Breeds in shallow wetlands & still water habitats	Numerous juvenile toads observed in an aquatic bed wetland along Swift Creek reservoir near the mouth of Drift Creek
Northwestern pond turtle (*Clemmys marmorata marmorata*)	SoC	S	SE P1	Uses ponds & wetlands that warm up in the summer, typically at lower elevations	Not found; the project is on the border of the currently known distribution; WDFW has no records for the area
Birds					
Great blue heron (*Ardea herodias*)	--	--	SM P2	Forages in shallow water; nests in large trees	Commonly observed along Yale Lake & Lake Merwin and in several wetlands. No known breeding sites
Common loon (*Gavia immer*)	--	S	SS P2	Breeds on mats of aquatic vegetation in shallow water	Several individuals observed on Yale Lake; breeding unlikely due to lack of suitable habitat
Harlequin duck *(Histrionicus histrionicus*)	SoC	--	P2&3	Breeds near cold, fast-moving streams; winters in coastal waters	Not found; WDFW has historic records on Forest Service lands upstream of the Yale Project
Wood duck (*Aix sponsa*)	--	--	P3	Breeds in cavities in large snags near still water & wetland habitat	Observed breeding in several wetlands, including Frazier Creek, IP, & Yale Pond
Hooded merganser (*Lophodytes cucullatus*)	--	--	P3	Breeds in cavities in large snags near still water & wetland habitat	Observed breeding in several wetlands, including Frazier Creek, IP, & Yale Pond
Bufflehead (*Bucephala albeola*)	--	S	P2&3	Nests in woodlands near ponds & lakes; winters in aquatic habitat throughout WA	Observed on several project reservoirs & wetlands in the winter; no known nesting

Species[b]	Status			Habitat	Location in Study Area
	FWS[c]	Forest Service[d]	WDFW[e,f]		
Northern goshawk (*Accipter gentilis*)	SoC	--	SC P1	Typically associated with mature & old-growth forests	Not found, but likely occurs in suitable habitat. WDFW has one record west of Cougar Creek
Osprey (*Pandion haliaetus*)	--	--	SM	Nests in large trees near water; forages along rivers & lakes	Active nest sites in forested areas adjacent to all three reservoirs
Peregrine falcon (*Falco peregrinus*)	SoC	S	SS	Nests on cliffs near water; forages on birds	Observed only one time in the project vicinity; no known nest sites; Eagle Cliff near Swift Creek reservoir is the only potential nest habitat
Blue grouse (*Dendragapus obscurus*)	--	--	P3	Uses conifer forest habitat throughout western WA	Observed in the Yale Project vicinity
Band-tailed pigeon (*Columba fasciata*)	--	--	P3	Uses low & mid-elevation conifer & mixed conifer stands throughout western WA	Observed in several locations west of Swift dam; one roost site documented north of Lake Merwin
Pileated woodpecker (*Dryocopus pileatus*)	--	--	SC P1	Cavity-nesting species requiring large snags & down wood in conifer forests	Observed in forested habitats associated with all four Lewis River Projects; probable breeding
Olive-sided flycatcher (*Contopus borealis*)	SoC	--	--	Uses most conifer forest types in western WA	Observed during bird surveys on lands near the Yale Project
Vaux's swift (*Chaetura vauxi*)	--	--	SC	Associated with grassland habitat & dry meadows	Observed during bird surveys on lands near the Yale Project
Mammals					
Pacific Townsend's big-eared bat (*Corynorhinus townsendii*)	SoC	S	SC P1&2	Dependent on caves & mines for roosting; highly sensitive to disturbance	Uses Moss Cave along the Swift-Yale transmission line ROW as a nursery colony, hibernacula, & communal roost site

Species[b]	Status			Habitat	Location in Study Area
	FWS[c]	Forest Service[d]	WDFW[e,f]		
Long-eared myotis (*Myotis evotis*)	SoC	--	SM P2	Occurs in forests throughout WA	WDFW has records from Clark Co., south of Yale Lake; likely occurs in the project vicinity
Long-legged myotis (*Myotis volans*)	SoC	--	SM P2	Common in montane conifer forest	WDFW has records from Clark Co., south of Yale Lake; likely occurs in the project vicinity
Mink (*Mustela vison*)	--	--	P3	Wetlands & riparian habitat	Documented in several wetlands associated with the Yale Project
Wolverine (*Gulo gulo*)	SoC	S	SC P1	High elevations-subalpine & alpine habitats	Not found; WDFW has no records for the project vicinity; unlikely to occur due to lack of suitable habitat
Fisher (*Martes pennanti*)	SoC	S	SE P1	Old-growth & mature conifer forest	Not found; thought to be nearly extirpated from WA
Black-tailed deer (*Odocoileus hemionus*)	--	--	P3	Uses a variety of forest habitats for cover & more open habitat for forage	Commonly observed in the project vicinity; density in WDFW Region 5, which includes the Lewis River, is ≈ 10.45/sq mi
Elk (*Cervus elaphus*)	--	--	P3	Dependent on low-elevation winter range & interconnected movement corridors	Observed throughout the project vicinity, especially in the winter. Lewis River-Kalama herd is ≈ 14,000 elk

[a] Sources: Letter from WDFW, Priority Habitats and Species (PHS) Program, June 27, 2003. Data sources: PacifiCorp (1999d); PacifiCorp and Cowlitz PUD (2002a, 2003f, and 2004).

[b] Species in **bold** font are those observed in the project vicinity during relicensing studies.

[c] FWS Status:
FC = Federal Candidate: Candidate for federal listing as threatened or endangered. Species for which FWS has sufficient information to support a proposal to list under ESA.
SoC = Species of Concern: Former Category 2 candidate species – species needs additional information to support proposal to list as threatened or endangered; not protected under ESA.

[d] Forest Service Status:
S = On the Region 6 Forester's Sensitive Animal Species List (Forest Service, 2002b).
S/M = Survey and Manage Species, as designated by the Northwest Forest Plan (Forest Service and BLM 1994, 2001).

[e] WDFW Listing Status:
SE = State Endangered: Any wildlife species native to Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state.
SS = State Sensitive: Any wildlife species native to Washington that is vulnerable or declining and is likely to become endangered or threatened throughout a significant portion of its range within the state without cooperative management or removal of threats.
SC = State Candidate: Species that WDFW will review for possible listing as SE, ST, or SS; species have sufficient evidence to suggest that its status may meet the listing criteria.
SM = State Monitor.

[f] WDFW Priority Species Status:
Priority species = Species that requires protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include State Endangered, Threatened, Sensitive, and Candidate species (P1); animal aggregations considered vulnerable (P2); and those species of recreational, commercial, or tribal importance that are vulnerable (P3).

3.3.4.2 Environmental Effects

Project Operations

Changes in project operations, including flows to the bypassed reach, pre-releases for flood management, and increasing winter reservoir drawdowns, could affect wetlands, riparian vegetation, and associated wildlife habitat that occur in the shoreline vicinity.

The SA proposes some changes in project operations. Continuous flows would be released in the Lewis River bypassed reach ranging from 60 cfs to 100 cfs. At all release levels, up to 47 cfs would be provided from the existing Swift No. 2 canal drain, which is located about one mile downstream of Swift dam. The remaining 13 to 53 cfs would be provided by a new release structure from the Swift No. 2 canal, which would be constructed about 2,000 feet downstream of Swift dam. Minimum flows below Merwin dam would range from a high of 4,200 cfs (November 1 to December 15) to a low of 1,200 cfs (July 31 to October 12) with a 2-inch per hour downramping rate.

Proposed high runoff procedures for flood management would include pre-releases from Merwin dam. Pre-releases (turbine flows plus spill) based on flow forecasts would be made about once a year on average, generally in spring, ranging in magnitude from about 15,000 to 25,000 cfs. Additional drawdown of Swift Creek reservoir would not be required for pre-releases for flood management and therefore would not affect spill into the bypassed reach.

The proposed action would lower reservoir levels in Swift Creek reservoir and Yale Lake during different times of the year. In winter and early-spring Swift Creek reservoir levels would be lowered by an average of 4 feet from existing operations. Average summer water levels would be essentially unchanged. Operations at Yale Lake would result in fall and winter levels averaging about 2 feet lower than existing conditions. Operations at Lake Merwin would result in little change in water levels. The

timing of the water level fluctuations within each reservoir would be approximately the same as existing conditions with the exception of years with below average March runoff releases. In those years, the flood management season would be shortened by 2 weeks ending on March 15 instead of April 1, allowing earlier project refill in dry years. Further description of the proposed changes in reservoir water levels can be found in section 3.3 2, *Water Resources*.

Our Analysis

Currently, minimum flows, high flow events, and reservoir water level management influence the composition of riparian and shoreline vegetation in the project areas. Leakage and local inflows of 10 to 21 cfs now occur in the Lewis River bypassed reach upstream of Ole Creek. Riparian vegetation, such as willow and red alder, grows in the active channel before extreme high flow events periodically remove the vegetation. In the lower Lewis River, below Merwin dam, the project reduces natural flood flows, resulting in a more stable riparian community, with mainly deciduous and mixed forest. The three project reservoirs are maintained at or near full pool from Memorial Day through Labor Day, with some daily fluctuation. Fall-winter drawdowns at Swift Creek reservoir range from 60 to 90 feet below full pool, and Yale Lake and Lake Merwin are typically 20 to 30 and 8 to 13 feet, respectively, below full pool during these drawdowns.

Increased flows in the Lewis River bypassed reach would inundate between about 5 and 8 acres (or about 5 to 8 percent) of existing riparian vegetation. Higher flows would increase the extent of the wetted channel and floodplain and increase soil moisture in riparian areas, potentially changing plant species composition. Although the inundated riparian vegetation could be lost or altered, some adjacent uplands, especially areas of low topographic relief, would be affected by higher surface or groundwater levels, which would establish riparian vegetation in these areas. The variable nature of the flows could also benefit riparian communities by providing a greater plant species diversity.

Proposed minimum flows downstream of Merwin dam are only minimally different than existing flows. From December 16 through July 10, flows would be slightly higher or the same as existing conditions, whereas minimum flows would be slightly lower or the same as existing flows from July 11 through December 15.[27] The largest difference would be during the period from November 16 through December 7, when minimum flows would be reduced from approximately 5,400 to 4,200 cfs under the

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[27] Although the seasonal cutoff dates for the minimum flows are not the same between the existing flow regime (table 3.3.3-3) and the proposed flow regime (table 3.3.3-10), proposed minimum flows for the December to July period would range from 2,000 to 2,700 cfs, compared to 1,000 to 2,700 cfs for the existing regime. For the July to December period, proposed flows would range from 1,200 to 4,200 cfs, compared to 1,500 to 5,400 cfs for the existing regime.

proposed regime. Because proposed flows would be similar to existing flows, with a balance of increased flows during half of the year and decreased flows in the other half of the year, it is unlikely that the riparian vegetation in the Merwin reach would be significantly affected.

Pre-releases from Merwin dam would reduce the magnitude of floods experienced within the 5- to 50-year recurrence intervals. The magnitude of severe floods (those with a recurrence interval of 100 years or more) would be unchanged from existing conditions. Although the effects on riparian vegetation along the lower Lewis River from reducing the magnitude of floods with a 5 to 50-year return interval are unknown, it is likely that vegetation growing along the margins of the active channel would be inundated and/or scoured less frequently by high flows. As a result, riparian communities could become more established in this reach.

The frequency of spill from Swift Creek reservoir to the Lewis River bypassed reach is expected to be similar to existing conditions, except in large events where some reduction in peak flows would be expected. Consequently, riparian vegetation in the bypassed reach would continue to be subjected to occasional scouring.

Because daily and seasonal reservoir level fluctuations would continue, the ongoing effects on shoreline vegetation and wildlife would remain. Fluctuations at Swift reservoir have resulted in a minimal vegetated littoral zone, an extremely narrow zone of riparian vegetation, and a low number of hydrophytic plant species. Winter drawdowns result in a large barren stretch of land, limiting the access to water by wildlife, especially medium sized mammals such as rabbits and raccoons that require cover for protection from predation. The increase in the winter drawdown at Swift Creek reservoir and Yale Lake would increase this barrier, causing further decreases in habitat connectivity between the reservoir and upland habitats. On a larger scale, reservoir fluctuations prevent the formation of contiguous areas of riparian vegetation and maintain fragmentation of these areas. The lower spring reservoir level at Swift Creek reservoir could also result in some alteration of the Drift Creek mouth wetland (see figure 2.1.1-2), the one wetland with a direct hydrological connection to the reservoir because water levels would be lower during the beginning of the growing season. The Yale Park wetland, near Yale Lake, could also be affected by larger lake drawdowns in late fall and winter because it is hydraulically connected to the lake (and does not have another water source like the Beaver Bay and IP wetlands). Because the additional drawdown would be outside the growing season, however, the drawdown is not expected to alter the Yale Park wetland as much as it would if it was in the growing season.

Land Management

Timber harvesting, development, human activity, reservoir fluctuations, and project related recreation all affect terrestrial species and contribute to a loss of both wildlife habitat and connectivity between available habitat. Currently, although

PacifiCorp manages some of its lands in the project area for the benefit of wildlife, habitat losses beyond those areas, and the unvegetated littoral zones and fragmentation resulting from reservoir fluctuations, limit many species' access to both the reservoirs and PacifiCorp-managed lands in the project area.

The SA provides for the establishment of three funds: the Yale Land Acquisition and Habitat Protection Fund, the Swift No. 1 and Swift No. 2 Land Acquisition and Habitat Protection Fund, and the Lewis River Land Acquisition and Habitat Enhancement Fund. These funds would be used to acquire and protect wildlife habitat, and the Yale Fund would be available prior to the issuance of any new licenses. These funds would enable the acquisition (through fee simple or through conservation easements or other protection methods) of wildlife habitat. The Yale Fund would acquire interests in land in the vicinity of the Yale Project. The Swift No. 1 and Swift No. 2 Fund would acquire interests on lands within 5 miles of their project boundaries (laterally and upstream but not downstream) or within 5 miles of lands managed by PacifiCorp or Cowlitz PUD associated with the projects, but outside the project boundaries. The Lewis River Fund would acquire interests in land or enhance wildlife habitat anywhere in the vicinity of the projects.

The use of the funds would be decided by consultation amongst the Parties participating in the Terrestrial Coordination Committee (TCC).[28] In general, these funds would be used to address the following objectives:

- Provide movement corridors for elk through the Yale Project area to improve connectivity between winter and summer range areas.
- Increase the amount of protected low elevation elk winter range, including areas where forage production can be emphasized.
- Increase the amount of forested habitat that would be managed specifically to provide wildlife habitat for a broad range of wildlife species, especially in the upper portions of the project areas adjacent to Swift reservoir where little protection or management for wildlife exists at the present time.

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[28] The members of the TCC may include one representative from both PacifiCorp and Cowlitz PUD and one representative from each party of the SA. These parties include: NOAA Fisheries, NPS, BLM, FWS, the Forest Service, WDFW, the Washington Interagency Committee for Outdoor Recreation, Confederated Tribes and Bands of the Yakama Nation, Cowlitz Indian Tribe, Cowlitz County, the City of Woodland, Clark County, Skamania County, Cowlitz-Skamania Fire District No. 7, North County Emergency Medical Service, the Woodland Chamber of Commerce, Lewis River Community Council, Lewis River Citizens At-Large, Lower Columbia River Fish Recovery Board, American Rivers, Fish First, Rocky Mountain Elk Foundation, Inc., Trout Unlimited, and the Native Fish Society.

- Protect riparian and wetland areas for wildlife species associated with these types of habitats.

The Yale Land Acquisition and Habitat Protection Fund is being established prior to license issuance to ensure funds are available to address high priorities for the Parties to protect several key areas for elk winter range connectivity and forage from impending development in those areas.

The SA also proposes the development of integrated WHMPs (PacifiCorp's WHMP would replace the existing Merwin WHMP for the MWHMA), and would specify the program for how project-associated lands would be managed over the next license periods for the benefit of wildlife species and their habitat. Two WHMPs would be developed, one by PacifiCorp for PacifiCorp-owned or managed lands and one by Cowlitz PUD for lands that they own or manage. The WHMPs would manage for lands identified in Exhibit A (PacifiCorp-owned lands) and Exhibit B (Cowlitz PUD-owned lands) of the SA. These lands include 156 acres on the south-facing slope of Swift reservoir; 770 acres near Cougar and Panamaker creeks; 129 acres associated with the Yale Project; 5,600 acres currently managed as part of the existing Merwin WHMP; lands proposed to be managed under the Yale application filed in 1999; all other PacifiCorp-owned lands adjacent to the project except as described in Exhibit A; 283 acres on the south-facing slope of Swift reservoir known as Devil's Backbone; and all other Cowlitz PUD-owned lands within the Swift No. 2 Project boundary, except as described in Exhibit B. The lands excluded from the WHMPs are primarily developed, and therefore not valuable wildlife habitat. Additionally, lands acquired with the Yale, Swift, and Lewis River funds would also be managed by PacifiCorp under its WHMP provided they are within 5 miles of the project boundaries.

Similar in concept to the existing Merwin WHMP, the WHMPs would be broadened to address all habitat types found on those lands and include additional specificity for other aspects of habitat management. Under the SA, Cowlitz PUD's property within the Swift No. 2 Project boundary and its Devil's Backbone land would also be included within a WHMP. The PacifiCorp WHMP may preclude or limit timber harvest on some PacifiCorp project lands as appropriate to meet wildlife habitat objectives. The WHMPs would likely include, but are not limited to, the following types of measures:

- Managing forests to improve habitat for big game and other native species;
- Planting native hydrophytic species to enhance wetlands;
- Installing water control structures, if needed, to improve or protect wetland hydrology;
- Planting shrubs or creating other visual barriers along roads, ROWs, and open areas to provide wildlife cover;

- Managing existing grasslands and pastures, as appropriate, to meet specific objectives to enhance wildlife habitat and provide high-quality forage for big game;
- Creating/protecting habitat for species that use cavities and snags for reproduction and foraging;
- Developing and managing additional big game forage areas;
- Maintaining and/or increasing areas of late-successional forest (large trees);
- Controlling bullfrog populations in created wetlands, if feasible; and
- Developing and implementing a noxious weed control program.

The HEP completed as part of the relicensing studies would serve as the baseline for developing the initial WHMPs, which would be based on the objectives identified in the SA and listed above. The WHMPs would include an evaluation and monitoring plan to gauge the results of management activities performed under the SA. The SA also provides for reanalysis using the HEP at year 17 of the license terms to determine progress towards the objectives of the WHMPs, which can be used in adapting the WHMPs to better achieve wildlife habitat objectives or redefine objectives based on new science available at that time.

The SA provides for annual funding that the applicants would utilize or provide to implement the WHMPs based on the number of acres owned or controlled by each licensee at that time. Management funds would carry over from year to year, providing greater flexibility in developing annual management programs tailored to the needed management actions at that time to meet the objectives of the WHMPs. This flexibility would alleviate the need to specifically identify and schedule which management actions would occur in any given year in the WHMPs.

Under the terms of the SA, if a licensee proposes to take actions on its lands managed under its WHMP, other than actions specifically prescribed in the SA or its WHMPs, and that action makes those lands no longer available for wildlife habitat, additional mitigation may be required for that loss of wildlife habitat.

Our Analysis

Currently, PacifiCorp manages the MWHMA to enhance wildlife habitat on approximately 5,600 acres of PacifiCorp lands located around Lake Merwin. PacifiCorp implements the Merwin WHMP, a plan that includes a variety of measures and practices to enhance wildlife habitat on the MWHMA. Management focuses on key habitats, including forest and old-growth habitat, oak groves, shrublands, farmland, orchard areas, meadows, transmission rights-of-way (ROW) and wetlands. In addition, PacifiCorp voluntarily manages most of the land under its ownership adjacent to Swift No. 1 and Yale for the benefit of wildlife. Timber harvest activities on these lands are focused on

improving wildlife habitat and are governed by WDNR's forest practice rules. These rules describe the minimum acceptable level of resource protection, guide how silviculture treatments are applied to the landscape, and provide recommendations for maintaining aquatic connectivity and controlling erosion along forest roads. Annual raptor surveys are conducted in conjunction with WDFW, and would continue under the proposed action.

Cowlitz PUD does not currently manage its project lands for the specific benefit of wildlife, but currently manages 284 acres on Devil's Backbone in a manner that allows natural succession to occur, for the benefit of a range of species. Forest stands on these lands are not harvested, nor are they actively managed to benefit specific wildlife species. Roads are managed to maintain existing aquatic connectivity and to control erosion.

Although some of PacifiCorp's lands are currently managed to benefit wildlife habitat, while Cowlitz PUD allows for natural succession, the proposed action, as specified in the SA, would provide more focused habitat management plans for more project lands. For example, Cowlitz PUD would develop and implement a WHMP covering a total of 525 acres to benefit a broad range of wildlife species on its project lands and Devil's Backbone property. Currently, certain project areas, such as the upper portions adjacent to Swift reservoir, have little wildlife habitat management. The funds would be used to acquire lands in order to meet the objectives of the WHMPs, thereby allowing areas that are currently outside of management jurisdiction to be used to achieve wildlife management goals. Additionally, because of the diverse nature of the HEP wildlife species, and subsequent WHMP goals, the project lands would be managed for a greater diversity of wildlife, providing a wider range of benefits.

During the course of the settlement process, several stakeholders, including FWS and WDFG, expressed their concern that the projects, through inundation of the riverine habitat along 40 miles of the Lewis River, affects the migration and dispersal of riparian dependent and associated species due to a loss of habitat connectivity. Although wildlife has likely adapted to the current project conditions, effects continue. The reservoirs and inundated riverine habitat act as a barrier to amphibians, passerine birds, and small mammals. Reservoir fluctuations limit the development of vegetated littoral zones, which limits the amount of riparian vegetation along the shoreline and fragments habitat. Wetlands that are hydrologically connected to the project reservoirs are affected by fluctuations, as well. Indirect project effects on elk and black tailed deer could occur due to loss of critical wintering habitat and migration routes from secondary development associated with the projects in the project areas, changes in land management (timber harvesting) practices, and recreation development, which may limit and fragment vital foraging habitat. As discussed above, the proposed action would increase winter drawdowns at both the Swift and Yale reservoirs, thereby increasing the effects of fluctuations and drawdowns.

Although the MWHMA is currently managed to provide high quality forage, it is important that there are migration routes with appropriate cover available to allow the elk and deer to access it. Areas around the Yale project are critical for migration between winter and summer ranges and to maintain elk numbers (WDFW, 2005). Winter range in the vicinity of the Swift No. 1 Project is also considered crucial to the overall health of the herd (Forest Service, 2005). As a result, acquiring lands that would provide this connectivity between various habitats and summer and winter ranges with high quality foraging habitat would be beneficial to elk, deer, and other wildlife species in the basin. Habitat acquisition, protection and enhancement would also ensure future availability of critical winter range, forage and migration corridors. These actions are especially important in light of decreased numbers in the Mount St. Helen's herd, concern about poor forage conditions, and the goals to increase the population to 15,000 animals (see *Special Status Wildlife Species* in section 3.3.4.1 above). Furthermore, these actions would provide an additional benefit to the purpose of the MWHMA, by making it more usable and important to wildlife in the project area.

The funding for wildlife enhancements and land acquisition and the WHMPs that are proposed in the SA, would minimize effects on wetlands, riparian habitats, and wildlife by protecting and enhancing habitat throughout the project areas. Land would be selected for acquisition and/or conservation easement and subsequent management based upon its ability to provide functions outlined in the management goals. In addition to the acquisition and management of elk and deer habitat discussed above, riparian habitat would be acquired to re-establish connectivity for wildlife species. Uncommon habitat types that provide valuable functions to area wildlife including special status species, such as deciduous forest, forested wetlands, snag rich areas, shrub wetlands, and shrub riparian and wet meadow would be managed for protection and enhancement. More habitat for special status plant and wildlife species would be protected and enhanced through acquisition and management. Furthermore, these actions would be a key restoration component for reintroduction of anadromous fish upstream of the projects (Forest Service, 2005).

Currently, most of the lands proposed to be managed under the WHMP, including MWHMA and Devil's Backbone, are almost entirely outside the project boundaries. Additionally, most of the lands that would be acquired with the land acquisition funds, which would then be managed under the WHMP, are outside the project boundaries. As discussed above, acquiring these lands and then managing them, along with lands currently owned or controlled by PacifiCorp and Cowlitz PUD, under the guidance of the WHMP would allow diverse and valuable wildlife habitat to be protected and enhanced, and connectivity restored, in the project vicinity. Overall, the habitat acquisition and enhancement funds, along with the WHMPs that are proposed in the SA, would result in a benefit to a wide range of terrestrial resources in the project areas and would offset ongoing project effects.

However, to ensure that the habitat acquisition and enhancement funds and related WHMPs focus on acquisition and management activities that would mitigate for project-related effects, it would be appropriate for the licensees, as part of their "Annual Plan" under section 10.8.3 of the SA, to also file that plan with the Commission for approval, after the plan has been approved by the TCC. The Annual Plan would describe how the funds are proposed to be used in the following year.

Secondary Effects of Project Facility Construction and Modifications

Project facilities and modifications proposed for aquatic and recreational protection, mitigation, and enhancement would result in some secondary effects on terrestrial resources. These measures would include fish passage facility construction, fish habitat enhancements, a new release structure, recreational facilities, and recreation policies.

Fish passage, as discussed in section 3.3.3, *Aquatic Resources*, would introduce salmonids to all three project reservoirs and their tributaries. Construction of fish passage facilities that may result in some loss of vegetation would include (1) the new release pond proposed downstream of Merwin dam; (2) temporary net pens for acclimation of juvenile hatchery fish in tributaries to Yale and Merwin, and juvenile salmonid acclimation sites above Swift Creek reservoir; (3) the seasonal spring Chinook satellite collection facility (modular screw trap) to be positioned upstream of Swift Creek reservoir; (4) trap-and-haul facilities at Merwin dam; (5) downstream surface collection facilities for all three reservoirs; (6) new upstream fish passage facilities for the Swift No. 1 and Swift No. 2 developments; and (7) the Yale spillway modifications to improve fish passage survival.

The proposed action also includes measures that would enhance fish habitat throughout the Lewis River Basin. These measures include the addition of LWD, boulders, and gravel to channels, and measures to reduce sedimentation and stabilize the channel. They are discussed in greater detail in section 3.3.3, *Aquatic Resources*. Additionally, fish habitat enhancement would occur in the constructed channel running from the Swift No. 2 canal drain to the bypassed reach upstream of Yale Lake.

Another proposed project facility that would affect terrestrial resources is the new release structure to be constructed downstream of Swift dam to provide flow to the upper Lewis River bypassed reach.

The SA proposes improved recreation access and facilities in the project areas. A Visitor Information Center would be funded, along with expansion of Cougar Park at Yale and Swift Camp. Six new trails would be developed, four at Yale Lake and one each at Merwin and Swift Creek reservoir. In addition to trails, several other facilities are proposed for upgrades and an expanded area for horse trailer parking would be built near

Saddle Dam Park. Further descriptions of the recreation proposals can be found in section 3.3.6.

The SA also proposes changes to some of the recreation policies, which could affect terrestrial resources. Dispersed shoreline camping would be prohibited along Lake Merwin and limited along Swift Creek reservoir and Yale Lake. Some of the existing sites would be converted to day-use sites and others, closed. Sites closed to recreation use would be rehabilitated.

Our Analysis

Dispersed recreation in the project area currently results in disturbed vegetation and loss of wildlife habitat. Additionally, anadromous fish do not exist in the project waters (except below Merwin dam), limiting the food sources of a number of wildlife species that utilize these fish species, including the bald eagle and black bear.

Construction of fish passage facilities and recreational developments would result in the loss of some vegetation. Although small areas of vegetation would need to be cleared, construction of the trap-and-haul and fish collection facilities would not be expected to have any measurable effect on vegetation or wildlife habitat because they are located in areas that are already disturbed (in the tailraces of the project dams). Although installation of the poles needed to carry the 3.2-miles of cable for the tram between Swift No. 2 powerhouse and Swift dam (if installed) would require some vegetation clearing, the alignment would be within a ROW adjacent to the Swift No. 2 canal that is already cleared of most trees.

Construction of additional fish passage facilities would have minor effects on vegetation, riparian habitat, and wildlife due to some necessary vegetation clearing. However, in many instances the locations of these facilities and therefore the type of vegetation affected is undetermined. The location of the new release pond downstream of Merwin dam has not yet been selected, but a potential site is on WDFW land at Pekins Ferry, which is downstream of the I-5 bridge, and just upstream of the confluence of the East Fork Lewis River. Construction of this pond would result in the loss of about 1 acre of vegetation of unknown type, possibly riparian. The locations for the spring Chinook satellite collector and net pens upstream of Swift dam are yet to be determined, and the collector would only be installed if the modular surface collector at Swift dam was not effective. Because these facilities would be placed within the reservoir or in the river, there would be limited land disturbance during the construction of the facilities. The only disturbance would be related to shoreline access for installing, operating, and maintaining the facilities. Juvenile salmonid acclimation facilities above Swift would be more permanently constructed, although without concrete-lined ponds or waterways. Although the exact locations and number of these facilities are unknown, it is likely that some upland and riparian vegetation would be removed or disturbed for site access and equipment installation. As a result of this vegetation disturbance, some wildlife species

that use riparian areas could be displaced; however, it is impossible to fully assess the quality of habitat that would be lost before the facilities have been sited.

Fish habitat improvements would also result in the temporary disturbance of some riparian habitat, and wildlife. Although fish passage facility construction and fish habitat enhancements would require the loss of some vegetation and riparian habitat and temporary disturbance of wildlife, overall it would be a benefit to wildlife in the project areas. The reintroduction of salmonids to the project areas would provide a valuable food source for a large number of wildlife species including black bears, osprey, and common mergansers. Many species of birds eat salmon eggs, fry, and fingerlings. The addition of LWD, boulders, and gravel in the stream channels would enhance habitat for some aquatic wildlife such as amphibians, beaver, and mink. Fish habitat enhancements in the constructed channel from the Swift No. 2 canal drain could result in some minor vegetation clearing during the placement of boulders, LWD, and other enhancement measures in the channel. These fish habitat improvements would also likely increase fish production, which would provide more food for wildlife that feed on fish.

The proposed new water release structure from the Swift No. 2 canal would require the permanent removal of about an acre of riparian habitat. Additional habitat and wildlife could be temporarily affected during construction activities. Although a small amount of riparian habitat would be lost due to construction, overall wildlife habitat would be improved by the increased amount of water in the Lewis River bypassed reach, which could improve species diversity and use.

Recreation facilities construction, upgrades, and enhancements would result in some vegetation clearing. Approximately 24.5 acres of project lands and 0.2 acres of land in the town of Cougar would be affected. Much of this disturbance would occur in previously altered areas or in areas adjacent to existing facilities. The majority of the affected acreage is associated with Cougar Park at Yale, which would be expanded by 14.5 acres; Swift Camp would also be expanded by about 1.5 acres. The Cougar Park expansion is likely to have the greatest effect on botanical resources because much of the understory shrub layer and sub-dominant trees would be removed. Many overstory trees in the existing upland mixed and mid-successional conifer stands would remain in the new area, however, minimizing the effect. In addition, it is likely that campers in this area would want to access nearby Cougar Creek, cutting trails through the riparian vegetation. Effects from the expansion of Swift Camp are expected to be less because the new area would be relatively small and in an area already influenced by day-use/boat launch activities. In addition, Cresap Bay Campground would remain open through September (four additional weeks), potentially affecting a few elk (this site is currently closed in September to protect elk). Potential ecological effects would be more pronounced in the second or third ten-year period of the new licenses when campground expansions are anticipated. At the same time, new and improved facilities would be able

to limit and absorb potential ecological effects through site hardening and facility modernization.

Six new trails would directly affect about 6.5 acres of vegetation, with the 4.2 acres associated with two new two-mile trails—one between Beaver Bay and Cougar Campground and one between Eagle Cliff Park and the Forest Service boundary. The longest proposed new trail is planned along the east side of Yale Lake on the existing IP Road; improvements to this trail would affect about 1.9 acres. This area is already bisected by the existing road and receives a great deal of dispersed use; wetlands and other vegetation communities have been damaged by off-road vehicles that access the IP Road from adjacent WDNR lands. The use of the IP Road as a trail would likely reduce dispersed use in the area, resulting in less damage to nearby vegetation communities. The remaining three trails are short, affecting a total of about 0.4 acres, and would be located in areas that are already developed or disturbed. Therefore, only minor effects on vegetation and wildlife would be expected.

The construction of additional parking for horse trailers near Saddle Dam Farm would likely result in the increase in equestrian use of trails in the area. Increased horse use in the area could increase the spread of noxious weeds along trails. Horses could also disturb big game in the area, however, big game use the area in the winter when horses are least likely to be on the trails.

Dispersed shoreline camping would be prohibited along Lake Merwin and limited along Swift Creek reservoir and Yale Lake, reducing the availability of this type of camping. This in turn would decrease disturbance to shoreline habitat throughout the project areas and would result in less disturbance to wildlife. Any rehabilitation of camping sites where damage has occurred also would reduce the amount of erosion and potentially help control noxious weeds in these areas.

3.3.4.3 Cumulative Effects

Timber harvest and development on and off project lands affects vegetation community structure and wildlife habitat in the Lewis River Basin. These practices reduce the amount of mid-successional, mature, and old-growth timber on forest lands in the basin. Additionally, the cessation of commercial timber harvesting on many Forest Service lands in the Lewis River Basin reduces the amount of forage habitat for elk. Reservoir fluctuations, both peaking and seasonal, along with development and timber harvesting also reduce habitat connectivity for a wide array of wildlife species.

Timber harvesting on project lands has been managed to improve wildlife habitat as governed by WDNR's forest practice rules. Under the proposed action, the amount of timber harvest on project lands would vary according to the SA-proposed WHMPs, to meet management goals, such as improving stand conditions at various seral stages for the benefit of wildlife. The amount of harvest activity on non-project lands, however,

would likely influence the extent of timber harvest on project lands. For example, if harvest activities increase on industrial forest, WDNR, Forest Service, and private lands near the project areas, then timber harvest may be reduced on project lands, with the goal of protecting as much mid- and later-successional forest as possible. Conversely, if harvest activities decrease on non-project lands, then it may be desirable to increase timber harvest on project lands to maintain areas as forage habitat for big game. Timber harvest on project lands would be focused on improving wildlife habitat and would not occur in existing old-growth and mature stands. Thus, it is unlikely that harvest on project lands would reduce the amount of habitat for old-growth dependent species, and would improve the foraging and cover habitat and overall habitat connectivity for elk and deer. These harvesting practices would be extended to lands purchased under the land acquisition funds and on all lands identified for management under the WHMP discussed above. Overall, the protection and management of a large amount of land would be beneficial to Lewis River Basin vegetation and wildlife communities.

Residential, road, and recreational development in the Lewis River Basin contributes to a loss of wildlife habitat and increased disturbance to wildlife. The applicants propose additional recreation development and improvements to existing recreation facilities, likely resulting in increased human disturbance in the area. Although this would result in an adverse effect on wildlife and vegetation, because the projects propose to acquire, protect, and manage a large amount of land and limit dispersed camping in the area, these negative effects are likely to be offset. Overall, the projects as proposed would likely be a net benefit to terrestrial resources.

3.3.4.4 Unavoidable Adverse Effects

The proposed action would result in the clearing of approximately 30 acres of vegetation.

3.3.5 Federally Listed Threatened and Endangered Species

3.3.5.1 Affected Environment

The Commission designated PacifiCorp and Cowlitz PUD as its non-federal representatives under FWS/NMFS ESA section 7 regulations on October 14, 2004. PacifiCorp, Cowlitz PUD, FWS, and NMFS worked collaboratively to develop biological evaluations for FWS- and NMFS-listed threatened and endangered species potentially affected by the proposed action (PacifiCorp et al., 2005a, 2005b). These biological evaluations were filed with the Commission on January 14, 2005, are hereby incorporated by reference, and are used as the basis of our discussion in the following section.

Threatened and Endangered Fish

Protected salmonid ESUs and DPSs that occur in the basin include Lower Columbia River spring and fall Chinook salmon, Lower Columbia River winter steelhead, Lower Columbia River coho salmon, Columbia River chum salmon, and

Columbia River bull trout (table 3.3.5-1). These species are not currently present above the projects (except for bull trout); however, project facilities and operations have the potential to affect these listed salmonid species that are present downstream.

Table 3.3.5-1. Federally listed fish species in the Lewis River Basin. (Source: NMFS, 2005 (http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Index.cfm)

Species	Listing Unit	Federal Status	Notes	Critical Habitat
Chinook salmon	Lower Columbia River ESU	Threatened	ESU includes all naturally spawned and hatchery fall- and spring-run Chinook salmon from the mouth of Columbia River to the crest of Cascade Range (including tributaries), excluding areas above Willamette Falls. Includes spring-run, tule, and late-fall bright populations. Lewis River spring Chinook, a hatchery stock, is considered a component of the lower Columbia ESU, but is not considered a listed species (FWS and NMFS, 2002).	NMFS final critical habitat designations 9/2/2005 70FR542487
Coho salmon	Lower Columbia River ESU	Threatened	ESU includes all naturally spawned coho salmon from the mouth of Columbia River and its tributaries, excluding areas above Willamette Falls. It also includes fish from 25 artificial propagation programs, including Lewis River hatchery Type-N and Type-S stocks.	Critical habitat has not yet been proposed.

Species	Listing Unit	Federal Status	Notes	Critical Habitat
Steelhead	Lower Columbia River ESU	Threatened	ESU includes all natural spawned winter- and summer-run steelhead in the Columbia River Basin and tributaries between Cowlitz and Wind rivers in Washington, and Willamette and Hood rivers in Oregon, excluding upper Willamette River Basin above Willamette Falls. Progeny of natural spawning steelhead in the Lewis River Basin are treated as listed for the purposes of the ESA. Merwin Hatchery summer and winter steelhead are not considered part of the ESU and are not considered essential for recovery.	NMFS final critical habitat designations 9/2/2005 70FR542487
Chum salmon	Columbia River ESU	Threatened	The ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon.	NMFS final critical habitat designations 9/2/2005 70FR542487
Bull trout	Columbia River DPS	Threatened	Columbia River DPS includes all populations occurring throughout entire Columbia River Basin within the U.S. and all tributaries, excluding bull trout found in Jarbidge River, NV. Subpopulations in the Lewis River Basin are included in this listing (FWS, 2002).	On 9/26/05, the FWS designated critical habitat for bull trout (69 *Federal Register* 59995) including only the lower Lewis River downstream of Merwin dam

NMFS announced final designations for critical habitat for Lower Columbia River spring and fall Chinook salmon, Lower Columbia River winter steelhead, and Columbia River chum salmon on September 2, 2005, as published in the Federal Register (70 *Federal Register* 542487).

On September 26, 2005, FWS designated critical habitat for bull trout, a threatened species, in the Columbia and Klamath river basins (70 *Federal Register* 56212). Designated critical habitat in the Lewis River Basin includes the lower Lewis

River downstream of Merwin dam. A draft recovery plan for lower Columbia bull trout was completed by FWS in November 2002 (FWS, 2002). It is currently under review and has not yet been formally adopted by FWS.

A description of Chinook, coho, steelhead, chum and bull trout distribution and abundance in the Lewis River Basin is included in section 3.3.3, *Aquatic Resources*. Additional information describing the life histories and habitat of these species is available in PacifiCorp et al. (2005a and 2005b).

In 1999, PacifiCorp and Cowlitz PUD proposed operations modifications and conservation measures designed to conserve salmon, steelhead and bull trout. The Commission consulted with NMFS and FWS as required by the ESA and issued biological opinions and incidental take statements in June 2002. The Commission incorporated these actions into the Merwin license.

Pursuant to that incidental take statement and amended license, PacifiCorp and Cowlitz PUD purchased several parcels of land for protection as fish and wildlife habitat in perpetuity. These lands include Devil's Backbone (87 acres), which is along the north shore of Swift Creek reservoir; and the Cougar/Panamaker Creek parcel (213 acres), abutting Cougar and Panamaker creeks, west of the Yale Project. These areas include some of the highest quality bull trout habitat in the basin.

Wildlife

FWS, WDFW, and WNHP list two wildlife species potentially occurring in the vicinity of the Lewis River Projects that are federally designated as threatened and therefore protected under the ESA (letter from K. Berg, Manager, Western Washington Field Office, FWS, June 8, 2004; letter from S. Swope Moody, Environmental Coordinator, WNHP, Department of Natural Resources, Olympia, WA, July 1, 2003; letter from L. Guggenmos, WDFW, PHS Program, Olympia, WA, June 27, 2003). These species include the northern spotted owl (*Strix occidentalis*) and the bald eagle (*Haliaeetus leucocephalus*). Based on rare plant surveys (PacifiCorp and Cowlitz PUD, 2003f) and agency consultations, there are no federally listed plant species in the project areas.

Northern Spotted Owl

WDFW has documented more than 20 breeding pairs of spotted owls in the general project vicinity, approximately 15 with territories contiguous with the project areas. These territories are at Swift Creek reservoir along Range and Drift creeks and along the south side of the Lewis River bypassed reach; along the east and west shores of Yale Lake; and along the north shore of Lake Merwin. The highest density of breeding territories in the project vicinity is south of Swift Creek reservoir and east of Yale Lake. The density in this area is sufficient to create a large, coterminous region of documented spotted owl habitat.

Spotted owls were observed only once during relicensing studies – in a parcel of mature conifers on Forest Service land north of Swift No. 2 canal. Given the known density of spotted owl breeding territories in the vicinity, the species may occur incidentally in a variety of habitat types in the project area. However, spotted owls are typically associated with old-growth, late-successional Douglas-fir, or other conifer-dominated forests (Csuti et al., 1997), and the probability of occurrence for this species is highest in these habitat types. The most extensive stands of old-growth and late-successional conifer forest exist along the south shore of Swift Creek reservoir, especially in the vicinity of Drift Creek.

Bald Eagle

Bald eagles use the project vicinity for both wintering and breeding. Late winter surveys conducted by PacifiCorp since 1996 have documented from 5 to 80 bald eagles between Woodland and the upper end of Swift Creek reservoir (table 3.3.5-2). Winter use is likely related to forage availability, particularly fish, along the Lewis River and other nearby drainages. WDFW has records of 7, 6, and 4 bald eagle communal roost sites along Yale, Swift, and Merwin reservoirs, respectively.

Table 3.3.5-2. Numbers of bald eagles recorded during PacifiCorp's late-winter aerial surveys.[a, b] (Source: PacifiCorp and Cowlitz PUD, 2004a)

Location	1996	1997	1998	1999	2000	2001	2002
Swift Creek reservoir	5/1	4/1	5/1	10/10	3/5	0/0	2/0
Swift dam to Yale Lake	5/3	2/5	1/0	2/0	3/0	0/0	0/0
Yale Lake	19/8	1/0	0/3	5/7	2/0	2/0	1/1
Yale dam to SR 503 Bridge	5/5	4/3	1/1	3/1	½	0/0	2/0
Lake Merwin	4/1	3/1	1/0	3/1	3/7	0/0	3/0
Merwin dam to Woodland	19/5	10/4	4/1	18/5	8/1	2/1	3/1
Totals	**57/23**	**24/14**	**12/6**	**41/24**	**20/15**	**4/1**	**11/2**

[a] Surveys are typically conducted in mid-late February by helicopter; the 2002 survey was conducted in late March.

[b] Adult/subadults.

There are five known bald eagle nest sites associated with the hydroelectric projects – one each on the north and south sides of Lake Merwin, one on the east side of Yale Lake, and two along Swift Creek reservoir (one near Swift dam and one in the Drift Creek drainage). There is also a nest site downstream of Merwin dam near Woodland, first observed in 1997. Activity and productivity at these nest sites vary from year to year, with at least two active nests in any given year (table 3.3.5-3). Overall bald eagle productivity along the Lewis River has ranged from two to six young per year since 1996,

with an average nesting success rate of 0.75, and a mean productivity of 1.05 young/occupied territory. Average productivity along the Lewis River slightly exceeds the standard of 1.0 young/occupied territory in the Pacific Bald Eagle Recovery Plan (FWS, 1986).

Table 3.3.5-3. Bald eagle nest activity and productivity recorded during PacifiCorp's summer aerial surveys.[a] (Source: PacifiCorp and Cowlitz PUD, 2004a)

	Activity[b]/Productivity (No. of Live Young)							
Location	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003[c]**
Swift Creek reservoir – Drift Creek site	A/2	F	A/2	UO	O	A/2	O	A
Swift Creek reservoir – Swift dam site	A/1	A/2	O	UO	A/2	O	UNK	UNK
Yale Lake – Siouxon Ridge site	A/1	A/1	UO	A/1	UO	O	A/2	A
South Lake Merwin site	UO	UNK	A/2	A/1	UO	A/1	F	A
North Lake Merwin site	--	--	--	--	--	--	--	A
Woodland site	--	A/1	A/2	A/0	A/2	A/1	A/1	A
Totals	**4**	**4**	**6**	**2**	**4**	**4**	**3**	**--**
Successful/Occupied Territories	**1.0**	**0.75**	**0.75**	**1.0**	**0.66**	**0.60**	**0.50**	**--**
No. Young/Occupied Territory	**1.30**	**1.0**	**1.50**	**0.67**	**1.30**	**0.80**	**0.75**	**--**

[a] Surveys to determine activity are conducted in March/April; surveys to determine productivity are conducted in late June.

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

[c] Productivity unknown at the time this document was prepared.

3.3.5.2 Environmental Effects

Fish

Currently, there are no upstream passage facilities for anadromous salmonids upstream of Merwin dam. Current operations of the Lewis River Projects may affect ESA-listed fish downstream of Merwin dam by restricting passage and as a result of flow manipulations in the river, particularly flow fluctuations and their associated effects on aquatic habitat. Bull trout in the upper basin may also be affected as a result of flow and reservoir fluctuations, and exposure of fish to entrainment effects, which could include

mortalities. The proposed action, the SA, offers several mitigation and enhancement measures that would reduce effects on these listed species.

Our Analysis

A detailed discussion of the potential effects of the proposed action on listed species is contained in two biological evaluations prepared by the applicants (PacifiCorp et al., 2005a, 2005b). The following summarizes the various provisions of the SA that would affect listed fish species, and how those provisions might affect listed species.

- Anadromous fish would be reintroduced into the upper Lewis River Basin above Swift dam, and potentially into Yale Lake and Lake Merwin, allowing access to up to 174 miles of potential spawning and rearing habitat. This action would expand the current range and natural production potential for listed Lower Columbia River Chinook salmon and steelhead. Monitoring associated with the anadromous salmonid introduction program would help managers to implement appropriate actions to ensure that any potential negative effects on bull trout are minimized or avoided. Anadromous fish introduction would also increase primary productivity by providing a source of MDN from spawned-out carcasses in the upper basin and also increase the bull trout forage base. Potential negative effects of anadromous fish introductions into areas currently occupied by bull trout may include interspecific competition for food and space, competition for spawning sites, and potential redd superimposition of bull trout redds by coho salmon. However, differences in spawning habitat preference and timing would reduce the potential for this competition to occur. Additionally, bull trout, Chinook and steelhead historically co-existed sympatrically in the Lewis River Basin and are expected to do so in the future.
- New upstream and downstream fish passage facilities would allow anadromous salmonids to be transported to and from additional upstream habitat. Passage survival performance standards have been set by FWS and NMFS at levels that are expected to allow for sustainable Chinook, coho, and steelhead populations above the dams, and the fish passage facilities would be designed to meet these targets. This would reduce the potential for entrainment mortality by capturing downstream migrating fish before they become entrained in project facilities. Upstream transport would enable migrating salmonids to access productive habitats in the Lewis River Basin currently unavailable due to migration barriers at project dams. Negative effects on listed fish species could occur through injuries due to fish handling procedures, and mortalities during transport and/or release operations.
- Reducing hatchery production on a 1:1 basis as natural anadromous fish runs become established in the upper basin would reduce the potential for hatchery-related effects on naturally spawning anadromous species (i.e., competition,

predation, hatchery operations, and disease). Maintaining the hatchery target floor for Chinook, coho and steelhead would continue to maintain a "reserve" of locally adapted brood stock for use if the natural population suffers a catastrophic loss.

- Modifying the Yale dam spillway would improve downstream resident fish survival (including bull trout) during spill events. Testing alternatives to limit bull trout entrainment and implementing a preferred alternative would minimize adverse effects associated with entrainment.
- Monitoring bull trout population dynamics and determining limiting factors would provide information that would allow adaptive management decisions to be made to ensure the long-term persistence of bull trout in the Lewis River Basin.
- Implementing additional downramping restrictions, modifying minimum flows, and establishing flow plateau operations below Merwin dam would protect Chinook, steelhead, chum, and bull trout from stranding or dewatering aquatic habitat in the lower Lewis River.
- Releasing flows ranging from 60 to 100 cfs to the Lewis River bypassed reach and constructing an improved habitat channel would increase the amount of riverine rearing habitat for Chinook and steelhead, and bull trout residing in Yale Lake. It is highly unlikely that successful bull trout spawning would occur in this reach (due to summer and fall water temperatures greater than 9ºC). Aquatic habitat conditions would be ideal for brook trout, a species known to hybridize and compete with bull trout (FWS, 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. It is not known if Chinook and steelhead would successfully spawn and rear in this reach.
- Development of monitoring plans that address TDG and other state water quality standards would help ensure adequate water quality conditions for listed fish in the project waters.
- Installing signs and distributing flyers to inform the public about bull trout in the project areas would help protect existing bull trout populations from illegal harvest and harassment.
- Managing existing conservation covenants would protect project area bull trout spawning and rearing habitat in perpetuity and may also benefit introduced anadromous species if they also use these habitats.
- Establishing the $5.7 million habitat enhancement fund, LWD transport program and LWD fund would provide the funds to ensure implementation of actions that would provide improved habitat conditions for listed fish species

in the Lewis River Basin. Such actions would be determined in consultation with the ACC and subject to approval by the Commission.

- Establishing the $30 million In Lieu Fund (if passage is not provided into Yale Lake or Lake Merwin) for fisheries habitat protection, restoration, and enhancement through acquisition, easements, or restoration projects would 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. These types of projects, to be determined in consultation with the ACC with approval by the Commission, would be intended to benefit Chinook, steelhead, and bull trout in the Lewis River Basin.

As stated above, more detailed analysis of the SA measures is provided in the biological evaluations prepared for the SA (PacifiCorp et al., 2005a, 2005b). We summarize some of the conclusions of determination of effects from those documents below.

Chinook, Steelhead, and Chum Salmon. Implementation of the measures included in the proposed action would 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 downstream of 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 would ensure that these measures achieve their original objectives. The proposed action would likely result in an increased functioning condition for TDG and adult upstream passage and would likely improve downstream fish passage over existing conditions.

Although the overall effect of the proposed action would likely benefit Chinook, coho, steelhead and chum salmon and their habitat, the risk of incidental adverse effects on individual fish cannot be entirely eliminated. For example, the potential for entrainment cannot be completely eliminated at the projects, and some small level of handling mortality is unavoidable under any fish passage facility scenario. Other take examples may include juvenile harm or mortality caused by stranding downstream of 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 effects including, but not limited to, disruption to the waterway and introduction of sediment and other materials. Therefore although the proposed action would have an overall net benefit compared to current conditions, the project operations under the proposed action would likely adversely affect listed lower Columbia River Chinook, lower Columbia River steelhead, and Columbia River chum salmon. The proposed action would have a similar adverse affect on individual lower Columbia River coho.

However, the proposed action would minimize these project effects and provide substantial benefits for lower Columbia River coho in the long term.

Regulated flows would also continue to have some adverse effects on aquatic habitat, but would be offset by measures such as the LWD stockpile and funding program. Additionally, available Chinook and coho riverine habitat would be increased by 174 miles through the reintroduction program. Therefore, the proposed action would adversely affect designated essential fish habitat (EFH) for Chinook and coho salmon in the Lewis River, but the proposed action would also minimize those effects.

Bull Trout. Implementation of the conservation measures in the proposed action would 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 on bull trout, such as via stranding, cannot be avoided entirely during either scheduled downramp events or during unscheduled emergency plant shutdowns.

Although the overall effect of the proposed action would be beneficial to listed bull trout and habitat in the North Fork Lewis River Basin, and the proposed action would address all four primary recovery goals for the lower Columbia River bull trout recovery unit, the risk of incidental adverse effect on individual fish cannot be entirely eliminated. Therefore, project operations under the proposed action are "likely to adversely affect" listed bull trout.

Critical habitat is designated for the Columbia River bull trout DPS. Relicensing the projects under the proposed action would improve existing habitat conditions for bull trout by providing for habitat enhancement funding, implementing minimum instream flows and flow plateau operations, maintaining habitat conservation covenants, monitoring and improving water quality, developing habitat management plans, enforcing harvest regulations, and improving fish passage. Therefore, the proposed action would not likely destroy or adversely modify designated bull trout critical habitat.

Northern Spotted Owl

Although there are no measures proposed for the northern spotted owl, some proposed actions could affect the owl. As previously discussed, the SA provides for funding the acquisition of additional lands to protect or enhance wildlife species. The SA also provides for the development of WHMPs by each applicant, establishing the goals and objectives for the lands to be acquired and managed.

Our Analysis

The northern spotted owl is mostly dependent upon old-growth late-successional Douglas-fir, or other conifer-dominated forests. Currently, within the project areas the most extensive stands of this habitat exist along the south shore of Swift Creek reservoir, especially in the vicinity of Drift Creek. One of the management objectives of the WHMPs would be maintaining and/or increasing areas of late-successional forest. As a result of these WHMPs, timber harvest would be managed on project lands, protecting the current spotted owl habitat, and likely increasing it throughout the term of the license. The land acquisition funds would increase the amount of land in the project vicinity that would be managed under the WHMPs. Although construction of project facilities for fish passage and recreation would result in the clearing of some vegetation, no old growth, late-successional forest would be affected; therefore, no adverse effects would be expected. The proposed action would likely benefit the northern spotted owl by protecting and increasing its habitat.

Bald Eagle

Although there are no measures expressly proposed for the bald eagle, several proposed actions could affect the species. As discussed above, funding would be provided for the acquisition of additional lands to protect or enhance wildlife species, and WHMPs would be developed for these lands. Other proposed measures that could affect bald eagles include (1) a variable flow release into the Lewis River bypassed reach; (2) construction of fish passage facilities restoring salmonids into the upper project areas; (3) fish habitat enhancements; (4) recreation facilities construction and enhancement; and (5) limitation of dispersed camping.

Our Analysis

Since 1996, overall bald eagle productivity along the Lewis River has had a mean of 1.05 young/occupied territory. Because the average productivity along the Lewis River slightly exceeds the standard of 1.0 young/occupied territory in the Pacific Bald Eagle Recovery Plan, it appears that the bald eagles in the Lewis River Basin are successful under existing conditions. However, several changes in operating conditions and facilities are proposed in the SA that could affect the bald eagle.

There are several new and upgraded recreation facilities and trails proposed that would result in the loss of some vegetation and increased recreational use in some areas. Bald eagles could be affected by increases in recreational activities, because they are sensitive to disturbance. For example, the proposed trail along the IP Road is within 0.25 mile of a known bald eagle nesting territory and probably represents the greatest potential source of disturbance to bald eagles. Although the trail would not be in the line of sight of this nest location, it would be close to several areas along the east side of Yale Lake used by bald eagles for roosting and perching.

Recreational use that has the potential to disturb bald eagles is greater during the summer, when recreation use is at its highest. Recreational uses of the reservoir and trails are lowest during winter months and early spring months, so the potential for disturbance during this period is relatively low. Boating, fishing, and hiking during spring and early summer months would coincide with the sensitive period when eagles are laying eggs and feeding young at the nest. Eagles may be slightly less sensitive to disturbance during June and early July than they are earlier in the nesting stage, but forage availability and undisturbed access to forage can strongly affect rearing success (Johnsgard, 1990).

Construction projects, including trail construction, improvements to roads and existing facilities and development of new facilities, could probably be timed to occur outside the breeding season to prevent disturbance to nesting birds. Special care would be needed to prevent adverse effects where proposed recreational sites overlap with areas that are known to provide important foraging and nesting opportunities for bald eagles.

Although recreational use of project reservoirs may increase with the enhancements proposed in the SA, an overall reduction in dispersed shoreline camping and better road management would reduce disturbance to bald eagles. The SA would reduce dispersed shoreline camping by prohibiting it along Lake Merwin and limiting it along Swift Creek reservoir and Yale Lake. This would result in decreased disturbance to shoreline habitat and bald eagle nesting, perching, foraging, and roosting habitat throughout the project areas. Funds would be provided to the Forest Service to manage dispersed camping on their lands around Swift Creek reservoir, which would aid in the protection of shoreline habitat in this area. Additionally, the applicants propose to continue to maintain road closures in sensitive habitat areas by installing and maintaining gates. They also propose to identify additional areas for access control on PacifiCorp land. Both of these measures would aid in the protection of bald eagle habitat.

Several other measures proposed by the applicants would result in benefits to the bald eagle and its habitat. Terrestrial habitat enhancement funds (see table 2.1-4) and the WHMPs would benefit the bald eagle by protecting and enhancing riparian and shoreline habitats and old-growth, late-successional forest, all important habitat components for the bald eagle. The addition of a variable flow release into the Lewis River bypassed reach would improve the condition of the riparian habitat in this reach, as well as improve fish populations, which makes up the majority of the bald eagle prey base.

The reintroduction of anadromous fish into the upper project areas, fish habitat improvements, and increased flows would also benefit the bald eagle by greatly improving its prey base. As discussed in section 3.3.3, these measures should improve the fish populations in the upper basin. Salmon is a preferred food source of bald eagles, especially spawned-out salmon in the winter when food is scarce.

Although the proposed action has the potential to increase disturbance to bald eagles from increased recreation use, overall the benefits outweigh these negative effects. The funding to acquire, protect, and enhance shoreline, riparian, and late-successional forest along with the WHMPs that would manage those lands and the existing project lands, should improve bald eagle habitat in the project areas throughout the terms of any licenses. Additionally, improved fish habitat and the reintroduction of anadromous fish into the Lewis River Basin above Swift dam would improve the bald eagle prey base. Overall, the proposed action would be beneficial to the bald eagle.

3.3.5.3 Cumulative Effects

As previously described in this section, the measures proposed for enhancement of aquatic and terrestrial habitat throughout the project reaches of the Lewis River, would have beneficial cumulative effects on both the listed fish and wildlife species. Fish passage facilities, fish habitat enhancements, reduced dispersed shoreline camping, and management activities to acquire, protect, and enhance habitat would improve habitat for both the listed species and for those species that may serve as prey.

3.3.5.4 Unavoidable Adverse Effects

The continued presence and operation of the Lewis River Projects has ongoing effects on listed species. Although the proposed action would have an overall beneficial effect, compared to no action, the proposed action would not eliminate all project effects.

3.3.6 Recreational Resources

3.3.6.1 Affected Environment

Recreational Resources in the Lewis River Basin

Multiple recreational facilities and opportunities are available within the project region (figure 3.3.6-1). Most regional recreational areas are managed by state and federal agencies, including WDNR and the Forest Service. The Mount St. Helens National Volcanic Monument (Monument) and the GPNF border the northern edge of the project and extend about 50 miles north, providing important regional recreational opportunities. An estimated three million visitors traveled to the Monument in 1999, and interest in the overall area is increasing. Many visitors stop at project recreational facilities, especially those at Yale Lake. Due to the proximity of the project area to the Monument and GPNF, visitation to one area affects visitation at the other areas. In addition to public recreational lands in the region, some of the extensive private timberlands in the project area are open to the public for dispersed recreational use, including a total of 98,000 acres owned by Weyerhaeuser, Longview Fibre, and Olympic Resource Management.

Merrill Lake, located about 6 miles north of Yale Lake, is managed by WDNR and is a popular area for anglers. The lake provides a campground with seven tent sites; a day-use area with three picnic tables; and a two-lane boat launch.

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FOR HYDROPOWER LICENSES

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Figure 3.3.6-1
Map

The 32,000-acre WDNR-managed Siouxon Landscape Area is a popular dispersed recreational area. Swift Creek reservoir borders the area on the north and Yale Lake on the west. Although there are no formal recreational facilities in this area, common activities include hunting, fishing, hiking, horseback riding, and mountain biking. Access to the area is by trail, boat, or logging road.

Siouxon Park is owned by Clark County and maintained in an undeveloped state. Currently, the park is used by boaters for boat-in camping and day use, and it is being considered for future development by PacifiCorp and VCPRD.

GPNF includes several recreational sites and facilities located to the north and east of the project reservoirs. The Lower Falls Recreation Area, a popular recreational area located approximately 10 miles east of Swift Creek reservoir includes one 46-site campground, and one day-use area with a picnic area and short trails leading to several waterfalls. Pine Creek Information Center, located at the east end of Swift Creek reservoir in the Monument, is a small facility that provides basic information to visitors traveling through the area. The facility is located east of Swift Creek reservoir near the junction of FRs 25 and 90. Kalama Horse Camp is a base camp for equestrian riders in the area north of the project reservoirs. Facilities at the camp include one 23-site campground, each with a corral; and one day-use area with a picnic area, horseshoe pit, loading/unloading ramp, and parking.

The Forest Service manages other recreational sites and facilities on the Monument, just north of the project reservoirs, including Ape Cave, a 2-mile trail (round trip) to a lava tube and other unique geological features; Lava Canyon, a 6-mile trail (round trip) through the Muddy River canyon; Blue Lake Trailhead, a parking and trailhead information for various trails; and several other trails and snow play areas that are popular with visitors during all seasons.

Weyerhaeuser owns large tracts of land south of the Siouxon landscape area near Yacolt and north of the project area in the Kalama Basin. Many of the roads into these lands are gated; however, non-motorized recreational use, such as hiking, is permitted behind private locked gates. Although gated much of the year, many of these roads are open during the deer- and elk-hunting season (roughly from mid-October until December 15), and dispersed camping is permitted.

Olympic Resource Management owns a large block of land on Swift Creek reservoir in addition to smaller parcels near Lake Merwin and Yale Lake. In general, the company endorses an open lands policy that allows public use on its approximately 28,000 acres in the basin. However, the company can close roads at any time, especially during periods of increased fire danger. Many of the roads into these areas are open during hunting season. Off-highway vehicle (OHV) use also occurs and is not an issue when confined to existing roads. Other recreational uses include cross-country skiing and snowmobiling.

Longview Fibre owns over 11,000 acres in the basin, including several parcels just north of Lake Merwin and in the area between Lake Merwin and Yale Lake. The company endorses an open lands policy that allows for public uses such as hunting, hiking, horseback riding, and berry picking. Camping is not permitted and is occasionally a management issue during hunting season.

Project Area Recreational Resources and Activities

The Merwin, Yale, and Swift developments create scenic reservoirs that offer recreational opportunities in a natural environment close to large urban populations (approximately 30 miles north of Vancouver, Washington). The applicants estimate that approximately 1,900,000 people live within 100 miles of the projects (PacifiCorp, 2003 – FERC Form 80 filing for the Swift No. 1 Project, filed January 29, 2004). The applicants' developed recreational sites at the projects provide public access to project lands and waters, offering opportunities for power boating, water-skiing, RV and tent camping, picnicking and swimming, and boat and bank fishing, among other outdoor activities. The applicants own and manage all of the project recreational facilities.

Recreational activities at the project reservoirs, in the river reaches below Merwin dam, and in the Lewis River bypassed reach vary by location, activity type, and season. During the peak summer months (Memorial Day through Labor Day), reservoir recreational activities include power boating, boat fishing, water-skiing, RV and tent camping, and PWC use; in other areas, recreational activities, such as shoreline fishing, relaxing, hunting, wildlife observation, and non-motorized boating, occur throughout the year. The most common activity reported by visitors at Merwin and Swift sites was relaxation, with 75 percent indicating this as one of their trip activities (EDAW, 2002). In contrast, PacifiCorp study results indicate that camping was the most common recreation pursuit at Yale reservoir. Table 3.3.6-1 shows the types of recreational activity at Swift, Yale and Merwin reservoirs.

Table 3.3.6-1. Percent activity participation at project reservoirs. (Source: EDAW, 2002)

Merwin and Swift		**Yale**	
Relaxation	75	RV/tent camping	75
Spending time with family	69	Sunbathing/swimming	65
Sunbathing/swimming	68	Hiking/walking	51
Tent camping	44	Sightseeing	50
Picnicking	43	Picnicking	47
Hiking/walking	35	Fishing	37
Sightseeing	30	Power boating	29
Power boating	28	Water skiing	24
Waterskiing	27	Kayaking/canoeing/rowing/rafting	18
Fishing from shore	24	Mountain/road biking	17

Merwin and Swift		Yale	
Fishing from boat	22	Caving/rock climbing	16
RV camping	20	Nature study/photography	15
Jet skiing/personal watercraft	14	Jet skiing/PWC	14
Mountain/road biking	14	Other	<10
Kayak/canoe/row/raft/tube	10		
Nature study/photography	7.0		
Caving/rock climbing	3.4		
Hunting	1.6		
Backpacking	1.3		
Other	1.3		
Sailing	0.8		
Windsurfing	0.4		
Horseback riding	0.1		

The projects encompass the following five different recreational areas: Swift Creek reservoir, the Swift No. 2 canal area, Yale Lake, Lake Merwin, and the Lewis River reach below Merwin dam. These different recreational areas have unique characteristics that are defined by the presence or absence of private shoreline residences, overnight camping versus a day-use orientation, roads and highway access, topography, elevation, and level of use.

Access to all developed recreational facilities in the project area is provided via Route 503, Route 503 Spur, and FR 90. These roads connect the Interstate 5 (I-5) corridor with the southern and eastern portions of Mount St. Helens and also provide access to Mount Adams and the Columbia River Gorge.

In general, the three reservoir shorelines may be accessed by boat and/or foot trails, although primary access to dispersed shoreline sites is achieved through the developed recreational sites. Due to the steep terrain, dispersed shoreline sites are generally small and limited in number, particularly around Swift Creek reservoir and Lake Merwin. One exception is on Yale Lake along the private IP Road (also called Yale Road) corridor, which receives extensive dispersed use and some unauthorized motorized use. Recreational use of dispersed shoreline sites includes camping, relaxing, angling and hiking.

Swift Creek No. 1 Development

At the highest elevation and farthest from I-5, Swift Creek reservoir receives the fewest visitors and has the shortest recreational season. Swift Creek reservoir is 11.5-miles-long with a water surface area of 4,600 acres at full pool elevation (1,000 feet msl). The length of the shoreline at full pool is approximately 35 miles, although public access is limited by steep terrain. The reservoir and adjacent project lands offer publicly

accessible developed recreational facilities and undeveloped areas, with a focus on more primitive camping and day-use activities such as picnicking, swimming, fishing, and boating. Private residential shoreline development is located at the eastern end of the reservoir.

Swift Creek reservoir is drafted more than other reservoirs in the basin, with drawdown typically beginning in late August and September to accommodate winter runoff and to maintain pool levels in the other reservoirs. Under the current license, PacifiCorp can draw down the reservoir as much as 60 feet. The pool level is raised again between April and Memorial Day weekend in May. PacifiCorp found that drawdown of the reservoir, combined with the harsher weather conditions and more distant access, reduces some recreational use at Swift Creek reservoir.

Project recreational facilities at the reservoir and their percent contribution to the total number of facilities in the basin include:

- 1 day-use area (Eagle Cliff) with 15 picnic sites (6 percent of total picnic sites);
- 1 campground (Swift Campground) with 93 sites (36 percent of total campsites);
- 1 boat launch at Swift Campground (14 percent of total boat launches); and
- 24 dispersed, undeveloped shoreline recreational sites (26 percent of total dispersed recreational sites). All are accessible by boat and most are used for camping as well as day use. Dispersed sites are not project-supported amenities.

Swift Creek No. 2 Development

Swift No. 2 canal is a 3-mile-long water body popular for bank fishing with no developed recreational facilities. Angler access is primarily restricted to two small roadside pullouts where the FR 90 highway bridge crosses the canal. Visitors frequently park at the bridge and proceed on foot along a gravel maintenance road that runs alongside the canal. South of the canal is the 3.3-mile-long Lewis River bypassed reach. Since this reach is the emergency spill channel for Swift dam, public use, particularly camping, is not encouraged.

Yale Development

Yale Lake and adjacent project lands support the greatest amount of recreational activity within the project area, including boating, day use, and camping. The lake is 10-miles-long, covers 3,800 surface acres, and has 27 miles of shoreline at full pool elevation of 490 feet msl. The western shoreline is accessible via Route 503 Spur, while access to the eastern shore is limited by the private, gated IP Road. This road parallels the shoreline, and it attracts some unauthorized use, despite several gates and barriers. On average, PacifiCorp keeps Yale Lake near full pool from May through mid

September, with an average winter drawdown of approximately 15 feet. The winter drawdown can dewater some boat ramps on the reservoir.

Popular recreational activities include picnicking, boat and bank fishing, power boating, small boat sailing, windsurfing/sail boarding, canoeing/kayaking, swimming, water-skiing, PWC, hiking and walking, horseback riding, bicycling, and camping. Hiking and mountain biking is generally limited to existing roads, such as the IP Road and Route 503 Spur, and a trail south of Speelyai Canal that extends to Saddle Dam Park. Horseback riding occurs primarily along the Speelyai Canal trail. Dispersed camping typically occurs along the eastern lake shoreline and Siouxon Creek. Sightseeing, nature observation, and outdoor photography are also popular activities. In addition, cave exploration and rock climbing are popular because of nearby lava flows and caves in both the eastern part of the basin and at Ape Cave. Recreational facilities at Yale Lake and their percent contribution to the total number of facilities in the basin are:

- 4 day-use areas (Beaver Bay, Cougar Camp, Yale Park, and Saddle Dam Park) with 75 picnic sites (28 percent of total project area picnic sites);
- 2 campgrounds (Beaver Bay Campground and Cougar Camp) with 108 campsites (42 percent of total campsites);
- 4 boat launches (Beaver Bay, Cougar Camp, Yale Park and Saddle Dam Park) (57 percent of total boat launches); and
- 48 dispersed undeveloped shoreline recreational sites (48 percent of total dispersed recreational sites).

Merwin Development

Lake Merwin is 14.5 miles long and covers 4,000 surface acres at a full pool elevation of 239.6 feet msl. Of the three reservoirs, it has the most stable water surface level, typically fluctuating not more than 5 to 10 feet throughout the year. Like Swift Creek reservoir, the surrounding terrain is generally steep and heavily wooded. Recreational development is limited because of the steep topography and the large amount of privately owned shoreline.

Lake Merwin is the closest project facility to the I-5 corridor and therefore is most accessible to the nearby metropolitan areas of Portland, Vancouver, and Kelso/Longview. Recreational facilities associated with this project are generally associated with day-use activities such as picnicking, swimming, and boating. PacifiCorp's newest and only campground on Lake Merwin, Cresap Bay Campground, is very popular. Lake Merwin has more private shoreline residences than the other project reservoirs. Recreational facilities at Lake Merwin and their percent contribution to the total number of facilities in the basin include:

- 2 day-use areas (Speelyai Bay Park and Merwin Park) with 180 picnic sites (67 percent of total project area picnic sites);
- 1 campground (Cresap Bay) with 58 campsites (22 percent of total campsites);
- 2 boat launches (Cresap Bay Campground and Speelyai Bay Park) (29 percent of the total boat launches) (does not include launches below the dam); and
- 24 dispersed undeveloped shoreline recreational sites (26 percent of total dispersed recreational sites), 21 of which can be accessed by boat. Most are primarily day-use sites, although some camping does occur. Dispersed sites are not project-supported amenities.

Lewis River Downstream of Merwin Dam

The Lewis River below Merwin dam and east of Woodland contains five river-access sites that are operated by PacifiCorp and one operated by VCPRD. These sites provide access for bank fishing and/or boat launching, the most popular recreational activities that take place in this river reach. Many private shoreline residences line the banks of the river below the Merwin dam, as do two fish hatcheries, numerous roadways, and some undeveloped natural areas.

Private Recreational Facilities

Private entities also provide recreational opportunities in the immediate project area. Private sector development along Route 503 and 503 Spur has increased steadily over the years. There are a few RV campgrounds/resorts in the vicinity of the projects, the majority of which cater to RV campers by providing hookups. The Lewis River RV Park has 70 campsites and there are several RV campsites near of the town of Cougar. A few smaller motels and bed and breakfasts operate in Woodland, Ariel, and Cougar. A variety of other private businesses support visitor activity in the corridor.

There are a number of private year-round residential and vacation developments along the project reservoirs. Many of these provide day-use facilities such as boat moorage, swim areas, and picnic facilities for their members. On Swift Creek reservoir, three private shoreline developments (Northwoods, Swift Creek Estates, and Swift View) with approximately 253 home sites provide a range of private recreational facilities. At Yale Lake, in the vicinity of Speelyai Canal, the Yale Estates Homeowner's Association includes about 10 residential lots. At Lake Merwin, three private developments (King's Lakeside Landing, Woodland Park, and Camper's Hideaway) provide approximately 1,550 home/trailer sites and a range of recreational opportunities for area residents.

Project Area Recreational Use and Capacity

Total recreational use within the project areas is high. PacifiCorp estimated annual campground occupancy data and vehicle count data at the developed recreation facilities at its three projects in order to quantify total annual visitation to the projects.

PacifiCorp converted vehicle count data into estimates of visitor numbers based on a conversion factor (3.4 average visitors per vehicle). Visitation results and trends for 1998-2000 are summarized in tables 3.3.6-2 and 3.3.6-3.

Table 3.3.6-2. Project recreational facility total annual visitation for 1998–2000. (Source: EDAW, 2002)

Year	Total Visitation
1998	926,895
1999	471,342
2000	559,059

Table 3.3.6-3. Project visitation. (Source: FERC Form 80 filing, January 29, 2004, for Swift No. 1 and Merwin; EDAW, 2002, for Yale)

	Total Annual Visitors		Average Peak Weekend Visitors	
Development	Daytime	Overnight	Daytime	Overnight
Swift No. 1	5,170	14,480	370	530
Yale	372,655	NA	2,853	NA
Merwin	200,000	17,150	2,460	370

PacifiCorp found that visitation was considerably higher in 1998 than in 1999 or 2000. PacifiCorp suggests that the large decline in recreational use was caused by a combination of poor weather conditions, as well as the implementation of new user fees and placement of new fee booths at the entrances to day-use facilities. PacifiCorp instituted user fees in 1998 to discourage "cruising" from site to site. The fee program was coupled with a prohibition on alcoholic beverages in the campgrounds with the goal of creating a more family-oriented camping experience. PacifiCorp study results indicate that the program was successful as measured by a decrease in site cruising. Because total visitation estimates were based on traffic counter data, the decrease in site cruising resulted in a substantial drop in total visitation estimates. PacifiCorp believes that the estimates after the fee program more adequately represent the true visitation to the area and will likely increase gradually over time (EDAW, 2002, appendices A and B).

Overall, PacifiCorp found that the user-fees have not resulted in a dramatic decrease in demand, but a shift in how the area is used. User-fees may have slightly decreased demand initially; however, PacifiCorp assumes that the creation of a more family-oriented experience will attract new visitors to replace those who may have stopped visiting the area due to new policies and fees. In addition, information from other areas with similar fee programs indicates that a rebound in demand and overall use can usually be expected within a few years (EDAW, 2002).

Campground occupancy data appears to validate this explanation because occupancy only declined slightly from 1998 to 1999, while day-use vehicle counts declined substantially. This indicates that visitors sightseeing along SR 503, who comprised a relatively large portion of past use, are deciding not to stop at day-use facilities, likely due to user fees. Meanwhile, campground visitation has been nearly stable since 1997 (41 to 46 percent seasonal occupancy).

Recreational demand for the projects' recreational facilities is high. As part of its recreational studies, PacifiCorp found that the projects' campgrounds function at or near capacity during peak-use periods. Table 3.3.6-4 shows percent occupancy levels for the July 4th holiday weekend for 1996–2000.

Table 3.3.6-4. Percent of holiday weekend occupancy (July 4) at PacifiCorp's five campgrounds at the Lewis River Projects from 1996 to 2000. (Source: EDAW, 2002)

Campground	**1996**	**1997**	**1998**	**1999**	**2000**
Beaver Bay (Yale)	100%	100%	69%	39%	45%
Cougar Camp (Yale)	100%	94%	72%	70%	58%
Saddle Dam (Yale)	100%	98%	13%	22%	48%
Cresap Bay (Merwin)	96%	96%	63%	57%	43%
Swift Camp (Swift)	NA	91%	64%	33%	38%

Table 3.3.6-5 shows that parking capacity is also met at day-use sites during summer peak-use season and holidays.

Table 3.3.6-5. Day-use area parking occupancy. (Source: EDAW, 2002)

	Percent Occupancy (Peak Season)	**Frequency of Use Levels that Exceed Capacity**
Beaver Bay	28	Rarely
Cougar Park	21	Rarely
Yale Park	28	Occasionally
Saddle dam	30	Occasionally
Merwin Park	7	Rarely
Speelyai Bay	73	Regularly
Cresap	80	Regularly
Swift	23	Rarely
Eagle Cliff	10	Rarely
Average for all sites	24	

PacifiCorp estimated occupancy for dispersed shoreline sites within the projects were obtained for Lake Merwin and Swift reservoir during 1998 and Yale Lake in 1996. Occupancy of the 24 sites surrounding Lake Merwin averaged 34 percent on the 5 sample

dates, with the highest occupancy observed at 45 percent. Camping on survey dates accounted for 38 percent of the occupied sites, while day use accounted for 62 percent of the occupied sites. None of the sites were occupied on all of the dates, and use appeared to spread evenly between the sites with roughly equal demand for the different areas of the reservoir.

Occupancy of the 24 sites surrounding Swift reservoir was slightly higher, although still below capacity. Occupancy averaged 39 percent on the 5 sample dates, with the highest occupancy observed at 50 percent. Camping on survey dates accounted for 62 percent of the occupied sites, while day use accounted for 38 percent of the occupied sites. Four of the sites were occupied more than 80 percent of the time, all of which were in the Drift Creek cove area.

At Yale reservoir, the area near Yale dam (cove/point) and the Siouxon Creek Bridge/IP Road area were the most popular areas of the reservoir for dispersed campers. PacifiCorp found that other areas of the reservoir shoreline, such as the East Lewis River Bridge crossing area and the cove near Saddle dam, do not appear to be in as high of demand by dispersed campers.

3.3.6.2 Environmental Effects

Project Operations

The applicants do not propose to alter project operation to address specific recreational issues. However, some elements of the operational proposal could affect recreational resources, including the proposed fish passage facilities, minimum flows in the Swift No. 1 bypassed reach, and the flood management regime. Volitional fish passage facilities would be installed in a phased approach at the four developments, and would be located near the dams and other industrial infrastructure. Minimum flows would be released from the Swift No. 2 canal to the Swift No. 1 bypassed reach, and would reduce flows for power generation in order to meet the bypassed reach objectives and maintain the Swift Creek reservoir water surface level.

Flood management changes would involve improved forecasting for both weather and project inflows. Forecasts of high flow events would trigger pre-releases from the projects (i.e., releases in excess of those required for power generation in order to maintain or increase storage capacity). Pre-releases from Merwin dam normally would be at rates of up to 25,000 cfs. In certain circumstances where severe floods are forecast, pre-releases from Merwin dam would be increased to a maximum of 40,000 cfs.

Our Analysis

The proposed fish passage facilities would be major new project facilities. However, generally they would not affect existing or new recreational facilities. Downstream fish collection facilities at each reservoir are not anticipated to limit surface

water boating because they would be located within restricted surface water areas near the dams. Surface collector operations also would not result in significant pool elevation changes in July and August at Lake Merwin and Yale Lake, and would therefore not significantly affect reservoir recreational use.

The proposed additional flows in the Swift Creek bypassed reach could improve the quality of the fishery and, therefore, creates some new recreational opportunities for anglers. The proposal would not lower Swift Creek reservoir from existing conditions. As such, the releases in the bypassed reach would not adversely affect existing flat-water recreational boating opportunities on the reservoir. Nor would other project operations significantly affect reservoir water levels. Currently, summer elevations are generally constant, with median monthly elevations near full pool of about 997 feet msl and daily fluctuations typically less than 1 foot. PacifiCorp is not proposing any changes in current reservoir operations.

Swift Creek reservoir levels during the summer recreational season would not be affected by flood management measures, which typically occur outside of the primary summer recreation season. PacifiCorp proposes to lengthen boat ramps on Swift Creek reservoir to help improve boat access to the reservoir during the winter flood-control drawdown, which would improve recreational access during flood control drawdown periods. Flood management releases may attract visitors who would view the higher releases from the dam; however, increased enforcement and gating would limit access within this unauthorized use area. Flow modeling that assumed these releases would maintain Swift Creek reservoir levels indicates very slight fluctuations from current reservoir conditions (up to 4 feet lower in winter). Reservoir elevations at Lake Merwin would not change, while elevations at Yale Lake would change only slightly (up to 2 feet lower in winter). Overall, the flood management proposal would not adversely affect recreational resources.

Recreation Plan

In order to understand recreational issues and needs associated with the projects, PacifiCorp worked with a broad group of stakeholders during the pre-application phase of relicensing to design and implement five recreational studies and two socioeconomic studies. The studies indicated that project operations, facilities, and land management practices affect recreational opportunities and management in the Lewis River Basin. Recreational use of the project developments sometimes affects terrestrial, aquatic, water quality, and cultural resources, among other values. Additionally, the studies found that the project area is an important regional destination for recreational visitors and public use of project recreational facilities and sites in the area affects local communities in a variety of ways. More specifically, and as summarized in the draft Recreation Resource Management Plan (RRMP), PacifiCorp and stakeholders found that project-related recreational issues and needs include the following:

- Some existing recreational facilities require renovations, upgrades and expansion to address maintenance needs and to improve barrier-free access (discussed in more detail in *Campground and Day-use Facilities* below).
- Demand for public recreational facilities and access is anticipated to increase in the future, and some recreational needs may change over time as additional recreational activities or visitor preferences emerge.
- Shoreline dispersed camping and day-use activities within the project boundaries need improved management.
- The projects are responsible for some portion of off-project recreational effects on Forest Service managed lands.

From these studies, PacifiCorp and the stakeholders developed a series of alternatives, as well as proposed protection, mitigation, and enhancement measures (environmental measures) as part of the draft RRMP (EDAW & PacifiCorp, 2004). The environmental measures in the draft RRMP and the implementation measures are designed to address the primary recreational issues at the project through the following five enhancement programs: (1) recreational facility capital improvements, (2) recreational facility operations and maintenance, (3) dispersed shoreline use, (4) recreational monitoring, and (5) interpretation and education.

As part of the SA, and in order to improve recreational resources at the projects and to address recreational management issues identified in the recreational studies, PacifiCorp proposes to finalize and implement the RRMP. Tables 3.3.6-6 and 3.3.6-7 show PacifiCorp's proposed measures that would be included in the finalized RRMP for the Swift 1, Yale and Merwin projects. Cowlitz PUD does not propose to develop a recreation plan, but does propose to implement the measures highlighted in the Swift 2 column of the tables.

PacifiCorp's draft Recreation Plan includes the following components:

- Recreational Facility and Capital Improvement Program
  - Recreation capital improvement responsibilities
  - Recreation capital improvement priorities
  - Recreation concept site plans
  - Recreation facility design and setting guidelines
  - ADA compliance
  - Recreation capital improvement coordination and approvals
- Recreational Facility Operations and Maintenance Program
  - Recreation facility operations schedule

- Recreation facility maintenance standards and frequency
- Day-use agreement concerning the charging of fees at PacifiCorp's Lewis River recreational facilities
- Law enforcement and public services at recreational facilities

- Dispersed Shoreline Use Program
  - Defining suitable dispersed shoreline sites
  - Dispersed shoreline site hardening responsibilities
  - Dispersed shoreline site sanitary management responsibilities
  - Dispersed shoreline site maintenance responsibilities
  - Dispersed shoreline site management controls
  - Dispersed shoreline site use and resource impact monitoring
  - Dispersed shoreline site program schedule
- Recreation Monitoring Program
  - Monitoring program responsibilities
  - Monitoring program schedule
  - Monitoring reporting
- Interpretation and Education Program
  - Recreation resources
  - Other resources

Our Analysis

Currently, management of the projects' recreational resources is not guided by a recreation plan. The proposed draft RRMP has been developed to guide operations and maintenance at PacifiCorp's developed and dispersed recreational sites. The plan would guide improvements in the general condition of the projects' recreational facilities and help improve the quality of recreational opportunities in the area.

The proposed RRMP includes annual and periodic recreational use monitoring with triggers to implement capital and management improvements based on capacity use. The monitoring data would be collected, analyzed, and discussed at annual stakeholder meetings. Any measures resulting from the meetings would be scheduled in the Rolling 5-Year Recreation Action Plan. The monitoring measures would provide the basis for changing management and improving recreational sites over the term of the new license.

The proposed draft RRMP generally includes all of the recreation-related measures included within the SA. However, through settlement discussions, some of the

recreational measures and timelines have evolved from those outlined in the draft RRMP. Finalizing the RRMP in consultation with signatories to the SA, would ensure that any inconsistencies between the SA and the draft RRMP would be resolved before implementation of recreational measures. At a minimum, any recreation plan developed for the project should included the measures detailed in the SA and the draft RRMP. We estimate that PacifiCorp would need between 3 to 6 months following new license issuance to complete and file the plan for Commission approval.

Overall, the proposed RRMP would provide a framework for PacifiCorp to implement the recreational site improvements and coordinate management of recreational resources with the many land managers with jurisdiction over project lands. The recommended site improvement and management measures that would be included in the RRMP and SA are extensive and would provide a basis for substantial improvements to recreational resources associated with the projects.

Campgrounds and Day-Use Facilities

Early in the relicensing process, PacifiCorp and stakeholders identified the need for improved public access to the reservoirs, new camping opportunities and upgrades to existing facilities. This need is based on the findings of the recreational use studies that indicate existing and projected overnight use in the project area would likely exceed annual capacity (60 percent utilization seasonally) by or before the year 2030. Peak season (July and August) use is projected to exceed capacity (90 percent utilization) at all project-developed campgrounds by or before 2015 (EDAW, 2002).

As part of the proposed RRMP, and as detailed in the SA, the applicants propose numerous improvements to campgrounds and day-use facilities to help meet some of the anticipated overnight needs during the term of the new licenses, but not all the demand. Table 3.3.6-6 summarizes the applicants' proposed measures to redevelop and expand recreational sites within the projects. The applicants would continue to operate their day use and overnight recreational facilities in the Lewis River Basin and would implement new site improvement measures as summarized below.

Table 3.3.6-6. Proposed measures to improve and expand campgrounds and day-use facilities within the projects' boundaries. (Source: PacifiCorp and Cowlitz PUD et al., 2004; PacifiCorp and Cowlitz PUD, 2004a)

Proposed Measure	Swift 1	Swift 2	Yale	Merwin	Timing
Shoreline camping would be prohibited at Lake Merwin.				X	By 4th anniversary of Merwin license.
Some shoreline campsites at Yale and along Swift Creek reservoir would be hardened, some eliminated, others managed.	X		X		Per schedules in the RRMP: within first 3 years after of issuance of licenses.
Expand Cougar Camp when monitoring establishes a sustained need by adding 78 - 90 new RV and/or tent campsites, as well as RV accessible group campsites. At Cougar, accomplish this by closing the boat ramp and converting parking areas to campsites.	X	X	X		When needed, based on demand.
Expand Swift Camp when monitoring establishes a sustained need by adding approximately 27 - 50 new RV and/or tent campsites, and 1 or 2 new group sites.	X	X	X		When needed, based on demand.
Renovate Cougar Camp.			X		By 14th anniversary of Yale license.
Redesign Beaver Bay Campground, replace older restrooms			X		By 13th anniversary of Yale license.

Proposed Measure	Swift 1	Swift 2	Yale	Merwin	Timing
Allow public to use RV holding tank dump sites at existing PacifiCorp campgrounds (Beaver Bay, Swift, Cougar, and Cresap Bay) for a fee in order to reduce illegal dumping in the basin.	X		X	X	Post license issuance.
Provide two new picnic shelters at Merwin Park, one at Swift Camp and four additional sites on Yale Lake.	X	X	X	X	By 5th and 11th anniversary of Swift No. 1 license, and by 7th anniversary of Yale license.
Renovate Eagle Cliff Park.	X	X			By 11th anniversary of Swift No. 1 license.
Upgrade restrooms and parking at Speelyai Bay Park (made ADA-compliant). Keep Cresap Bay Park open through September.				X	By 6th anniversary of Merwin license. Add parking by 12th anniversary.
Provide volleyball courts, horseshoe pits and children's play structure at Merwin Park.				X	By 4th anniversary of Merwin license.
Increase separation between wetland and day-use parking area at the Beaver Bay day-use area.			X		By 4th anniversary of Yale license issuance.
Construct ADA-accessible concrete fishing pier at Swift No. 2 Canal.		X			By 9/30/05.

Proposed Measure	Swift 1	Swift 2	Yale	Merwin	Timing
Improve boat launch facilities improved at Speelyai Bay, Yale Park, and Beaver Bay by extending one lane of these existing ramps approximately 10 to 45 horizontal feet to enable boat launching during lower reservoir levels.			X	X	By 4th anniversary of license issuance. Speelyai by 11/30/04.
Develop a primitive take-out site at Yale Bridge for non-motorized watercraft by constructing a stairway with a railing from the pullout to the shoreline.				X	By 6th anniversary of Merwin license.
Develop river access at the "Switchback" property when use levels reach capacity below Merwin dam. The site would include an existing switchback road, a small gravel parking area, and an access trail to the river.				X	When capacity is reached.
Improve ADA-accessibility at upgraded facilities.	X		X	X	Assess after license issuance and implement per Settlement schedule.
Seasonally install portable restrooms at Swift No. 2 canal.		X			By 9/30/05.
Control Swift Forest Campground - either negotiate a management agreement for the campground with WDNR for the term of the new license for the Swift No. 1 Project, or acquire ownership of the Swift Forest Campground from WDNR.	X				Within first year of new license.

In addition to the proposed recreational facility measures within the project boundary as summarized in table 3.3.6-6, the applicants propose to make improvements to recreational facilities outside of the project boundary along the lower Lewis River. As detailed in the SA, within the first year of the new license for the Merwin Project, PacifiCorp would provide new, ADA-accessible, concrete double vault toilets (similar to the type at the Cowlitz River Barrier Dam facility) at the Cedar Creek River Access Site, and the Lewis River Hatchery River Access Site, both of which WDFW currently owns and manages. By the same date, the licensee would provide one single-vault toilet at the PacifiCorp-owned Merwin Hatchery River Access Site (which is inside the project boundary) and the Johnson Creek River Access Site (which is outside the project boundary). By April 30, 2007, PacifiCorp would provide one new, ADA-accessible, concrete double-vault toilet at the Island River Access Site (outside the project boundary). PacifiCorp also would maintain its existing development at the Merwin Hatchery River and Johnson Creek River access sites and would maintain the Island River, Cedar Creek River, and Lewis River Hatchery access sites, which WDFW owns (see figure 3.3.6-1).

PacifiCorp also proposes to partner with the Forest Service and other agencies to construct a visitor information facility on PacifiCorp-owned lands outside of the project boundary in the town of Cougar. PacifiCorp would provide the lands and a portion of the development or O&M costs, and other agencies would construct the facility, if other agencies are able to secure the necessary funding. The visitor information center would provide information to the public about the upper Lewis River Basin, its history and resources, including information about the Yale and Swift Creek reservoirs, project facilities and operations, and environmental and recreational resources. A secondary purpose of the building may be to meet the projects' curation requirements for prehistoric artifacts, and provide periodic displays highlighting the culture of local tribes.

In addition, PacifiCorp proposes to develop a barrier-free public fishing access site. Beginning upon the seventh anniversary of the new license for its three projects, PacifiCorp would conduct a feasibility study to identify the most feasible location for one new ADA-accessible bank fishing access site in the following areas: the Lewis River between Merwin dam and the Island River Access, Swift reservoir, Yale Lake, and Lake Merwin. By the tenth anniversary of the new license for its three projects, PacifiCorp would construct an ADA-accessible bank fishing facility at that site. It is unclear at this time whether the site would be inside or outside of any of the project boundaries.

Our Analysis

As part of the RRMP and as detailed in the SA, the applicants proposed improvements to existing recreational facilities are site-specific, derived from a recreational needs assessment, prepared in consultation with stakeholders, and targeted at either improvements to existing facilities or development of new facilities.

The proposed campground improvements and/or expansions would include expanding camping facilities at Yale and Swift Creek reservoirs when needed, renovating the existing Cougar Camp, extending the campground season at Swift Camp and Cresap Bay Campground. Currently, these facilities are near capacity during summer months. Extending the recreational season and expanding the campgrounds' capacity would improve public recreational opportunities at Yale and Swift Creek reservoirs. Further, expanding the campgrounds, in combination with other proposed measures, would accommodate most of the existing and projected overnight use in the project areas through the terms of any new licenses.

The proposed public use of existing RV dump stations would help improve sanitation in the project area by providing an easy way for visitors to empty RV holding tanks. In addition, public use of the dump stations could help reduce the temptation to empty RV holding tanks along the roads on in other inappropriate areas.

The proposal to harden dispersed overnight sites along the Yale Lake and Swift Creek reservoir shorelines would improve the quality of the dispersed sites and would help to alleviate some of the environmental resource damage attributed to overnight camping. Over time, boaters have established informal and illegal campsites that are scattered along the shorelines and are unmanaged. This type of use has caused shoreline erosion, damage to the under story vegetation, compaction of the soils, and litter. The proposed improvements would allow motorized and paddle boaters to continue camping while allowing land managers to define where the camping takes place to prevent further environmental damage. In addition, the proposal to close all dispersed shoreline sites at Lake Merwin to overnight use, and to permanently close dispersed sites in sensitive areas at all projects, as well as the proposal to close some roads that access identified sensitive habitat and cultural resource sites, would limit the extent of potential effects on terrestrial and cultural resources. Closure of Lake Merwin dispersed sites would result in a loss of some shoreline camping opportunities and may potentially displace a small portion of overnight use to developed shoreline campgrounds or to dispersed shoreline campgrounds in the region.

Proposed improvements to day-use facilities would increase capacity at day-use sites within the projects. During consultations with agencies and stakeholders, and as reflected in the terms and conditions of the SA, it was agreed that the project areas should absorb only a limited amount of additional day use. Several existing sites would be substantially improved, including redesigning and renovating Eagle Cliff Park; providing additional day-use site facilities at Merwin Park; providing several new group picnic shelters in the project areas (one each at Swift Creek reservoir and Yale Lake and two at Lake Merwin); and upgrading and/or renovating restroom buildings at day-use sites at Speelyai Bay Park and Cougar Camp. Additionally, PacifiCorp would partially fund a visitor center in Cougar. Together, these site improvements would improve the quality of

existing recreational sites, address a backlog of maintenance needs, upgrade and modernize recreational infrastructure and expand recreational opportunities.

PacifiCorp anticipates that demand for many boating-related activities could increase by as much as 100 percent during the terms of any new licenses. To address this concern, PacifiCorp proposes a number of improvements and enhancements to boating-related facilities. During the terms of any new licenses, PacifiCorp would extend the boat ramp lanes at Speelyai Bay, Yale Park, and Beaver Bay, between from 6 to 45 feet (horizontal). This proposal would increase boating opportunities by allowing boaters to launch when the reservoirs are low. The extended boat ramps, as well as the proposed river access site at Yale Bridge, would provide substantial improvements to existing conditions, and would accommodate most existing and projected boating use in the project area. Swift Campground already has a long boat ramp that provides public access to the reservoir during the winter drawdown. Even with proposed changes in project operations, this existing ramp would continue to provide public access to the reservoir.

The applicants-proposed ADA upgrades, including upgrading or replacing worn facilities and improving accessibility to recreational facilities (boat ramps, picnic sites, campsites, parking, restrooms, trails, etc.), and constructing ADA-accessible bank fishing site, as well as several ADA-accessible restrooms, would substantially improve barrier-free access to the project from existing conditions.

The applicants propose to make improvements to five lower river access sites and the proposed new river access site downstream of Merwin dam (Switchback property). These improvements would improve sanitation, upgrade and modernize existing facilities to better serve recreational needs and would increase project-related recreational opportunities. The existing river access sites include PacifiCorp's Merwin River access site, Johnson Creek access site, Island River access site, WDFW's Cedar Creek access site, and Lewis River Hatchery access site. With the exception of the Merwin access site, these lower river access sites are located outside the project boundary.

The proposed measures outside of the project boundary, including new toilet facilities and O&M, would improve public access to the Lewis River downstream of the Merwin Project. However, there is no physical nexus between most of these sites and the project. The proposed measures would be located at sites approximately 5 miles downstream of the project. Recreational use of these areas is typically associated with floating, swimming and angling along the lower Lewis River, and recreational use would not be associated with displaced recreational use.

The proposed measure to construct a visitor information facility on non-project lands in Cougar could improve project-related interpretive and educational resources by providing public information at a primary visitor gateway to the Yale and Swift Creek reservoirs and the upper Lewis River Basin. There is a nexus between the proposed

facility and project effects, including using the facility to present and interpret project-related cultural artifacts, as well as other project-related resources.

The proposed measure to study and develop a new barrier-free shoreline fishing site would increase recreational opportunities in the project area and help to address growing recreational demand by adding a new barrier-free site.

Overall, the measures listed in table 3.3.6-6 above and as detailed in the SA and the draft RRMP would increase recreational opportunities by providing new facilities and improve visitors' experiences by improving existing conditions. These measures represent a substantial improvement over existing conditions, and would provide additional capacity in an area where existing project recreational facilities receive heavy usage, particularly on some weekends and holidays when capacities are fully met or exceeded.

Trails

The applicants estimate that demand for trail-related activities, including day hiking and backpacking, will increase significantly over the next 30 years (157 and 114 percent, respectively) (EDAW, 2002). As part of the RRMP, and as detailed in the SA, the applicants proposed to develop and improve a number of trails in the project area and improve public access to the reservoirs. The applications, RRMP, and the SA do not provide maps with sufficient detail for staff to determine if the proposed trails are located within the projects' boundaries. However, based on the site visit, and comparison of the proposed trail description in the RRMP and SA with the proposed project boundaries shown in exhibit G drawings, staff assumes that all trail segments would be within the project boundaries. Table 3.3.6-7 summarizes these proposals.

Table 3.3.6-7. Proposed measures to improve trails in the project areas. (Source: PacifiCorp and Cowlitz PUD et al., 2004; PacifiCorp and Cowlitz PUD, 2004a)

Proposed Measure	Swift 1	Swift 2	Yale	Merwin	Timing
Improve Marble Creek Trail to provide a 1/4-mile ADA-accessible path to a scenic overlook.				X	By 4th anniversary of Merwin license
Evaluate feasibility of trail easement across project lands to Lake Merwin for a potential development being considered by the Vancouver-Clark Parks and Recreation Department.				X	After license issuance

Proposed Measure	Swift 1	Swift 2	Yale	Merwin	Timing
Formalize Saddle dam trailhead parking for horse trailers.			X		By 5th anniversary of license issuance
If easements can be obtained from WDNR, develop non-motorized trail from Eagle Cliff to the Forest Service boundary. This proposed trail would cross the FR 90 bridge and then proceed above Eagle Cliff, and then extend along the southern bank of the Lewis River.	X	X			By 4th anniversary of Swift No. 1 license issuance
Develop non-motorized trail link from Saddle Dam Park to existing Saddle dam area trails.			X		By 5th anniversary of license issuance
Develop a 2-mile-long, multiple-use shoreline trail from Cougar Camp to Beaver Bay Campground that would be sited along the shoreline but away from Route 503.			X		By 5th anniversary of license issuance
If feasible, improve the Yale-IP Road as a non-motorized recreational trail. Barricades would be erected to prohibit vehicular access to the trail. Trailheads with signs, single-vault toilet buildings, and gravel parking areas would be provided at each end of the trail. In addition, a mid-point rest stop would be provided.			X		Beginning after license issuance

Our Analysis

The applicants' proposal would develop new trail spurs, and extend and improve a number of existing trails in the projects. The Washington SCORP (IAC, 1995) lists walking and hiking as the most important recreational activity in the state, and indicates that there is a need to improve and expand trail systems. The applicants' proposal would address recreational issues in the project area by improving the current condition of the trails and providing new trail-related recreational opportunities.

Several trail segments would be developed or improved in the vicinity of Yale Lake, meeting a demand for safer, off-road pedestrian and bicycle corridors within the boundaries of the projects. Measures would include the conversion of the Yale/IP Road to a non-motorized public corridor. Unauthorized use of this road along the shoreline of Yale Lake currently occurs, so while this measure would be a use change from vehicular to pedestrian traffic, it would provide a more managed approach to current use patterns and support less intensive, non-motorized uses in the environmentally sensitive area.

Overall, the proposed trail-related measures as detailed in the SA and the draft RRMP represent substantial improvements to recreational opportunities and access over existing conditions.

3.3.6.3 Cumulative Effects

The recreational measures described in the SA would contribute to a beneficial cumulative effect on recreational resources within the project areas. A primary goal of the proposed measures is to improve the recreational experience and manage recreational resources without significantly increasing the number of recreational facilities or the number of visitors. The improvements to facilities and the management measures would achieve these goals by reducing user conflicts, distributing recreational visitors more evenly throughout the project areas, improving the quality of the recreational facilities, and increasing the number of recreational opportunities over time. However, as recreational demand for boating and camping opportunities at the projects increases over time, some recreational visitors may be displaced to dispersed sites adjacent to the projects. Although individually minor, the cumulative effect of increased use of the dispersed sites may adversely affect wildlife and recreational values of these sites.

The site stabilization measures, development of new campsites, and closures of dispersed recreational areas should help preserve the recreational and wildlife attributes of these sites as demand increases. Overall, the site improvements and improved management strategies within and adjacent to the projects would offset any cumulative adverse effects of increased dispersed recreational use.

3.3.6.4 Unavoidable Adverse Effects

None.

3.3.7 Land Management and Use

3.3.7.1 Affected Environment

Predominant land uses in the vicinity of the Lewis River Projects include industrial activities associated with the hydroelectric projects, recreational uses, lands managed for fish and wildlife habitat values, forestry, agriculture, and private residential areas. Major land owners in the area include the Forest Service, WDNR, and private timber companies. Table 3.3.7-1 displays the acreage held by each major owner.

Table 3.3.7-1. Major landowners within the Lewis River watershed. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Ownership Classification	Landowner	Acres in Ownership Classification	Landowner Acres	Percent of Total Watershed
Federal Lands	Gifford Pinchot National Forest		353,660	
	Mount St. Helens National Volcanic Monument		32,712	
	Wilderness Areas		17,146	
	Other federal lands (BLM and FWS)		924	
	Total	404,442		54%
State Lands	WDNR and other state lands		87,747	
	Total	87,747		12%
County Lands	**Total**	1,670		< 1%
Private Industrial Forest Lands	ANE		4,881	
	Hampton Tree Farms		739	
	International Paper		61	
	Longview Fibre		11,668	
	Mid-Valley Resources		1,532	
	Olympic Resources Management		28,570	
	Stimson Lumber		1,829	
	Weyerhaeuser		48,761	
	Total	98,041		13%
Utility Lands	PacifiCorp		10,457	
	Cowlitz PUD[a]		577	
	Total	11,034		1%
Private Lands	Non-Industrial Private Lands		73,956	
	Other Private Lands not Identified		50,216	
	Total	124,172		17%
Project Reservoirs	**Total**	12,366		2%

Ownership Classification	Landowner		Acres in Ownership Classification	Landowner Acres	Percent of Total Watershed
Lakes/Rivers		**Total**	9,607		1%
Total Watershed			**749,079**		**100%**

[a] Includes only acres associated with Swift No. 2; Cowlitz PUD also owns other lands in the watershed.

Industrial Uses

Industrial uses within the project area are predominantly related to the PacifiCorp and Cowlitz PUD hydropower operations. These facilities include the primary generation features (described in section 2.1.1, *General Project Descriptions and Operations*), three reservoirs, transmission lines, canals (Swift No. 2 and Speelyai), and support facilities. Fish production facilities associated with the projects include the Lewis River, Speelyai, and the Merwin Trout hatcheries. All were constructed by the applicants and are operated by WDFW.

Recreational Uses

PacifiCorp provides public recreational facilities and shoreline access to the three project reservoirs (described in section 3.3.6, *Recreational Resources*). Swift Creek reservoir, with two developed sites, has the fewest public facilities, both operated by PacifiCorp. These are 40-acre Swift Camp and the one-acre Eagle Cliff Park day-use area. There are numerous undeveloped, dispersed recreational sites around Swift Creek reservoir, the most popular of which is around Drift Creek Cove on Forest Service - managed lands.

Yale Lake offers a variety of heavily used water-based and land-based recreational opportunities. There are four PacifiCorp-owned recreational facilities along the north and west sides of Yale Lake, each with boat launches. PacifiCorp maintains seasonally operated campgrounds at the 30-acre Cougar Camp and 40-acre Beaver Bay campground. Day-use facilities are associated with each campground, comprising 40 acres adjacent to Cougar Camp and 27 acres at Beaver Bay. In addition, PacifiCorp has developed shoreline day-use areas at Saddle Dam Park and Yale Park.

Dispersed recreational uses around Yale Lake include water-based activities, picnicking, camping, horseback riding, hiking, hunting, and fishing. The Siouxon Creek area is used for boat-in day use and dispersed camping. Most of the shoreline sites are accessed by boat, although there is limited and generally unauthorized vehicle access available via the Yale/IP Road along the southern/eastern shore.

PacifiCorp operates three developed recreational facilities at Lake Merwin: Cresap Bay Campground and two day-use areas, Speelyai Bay Park and Merwin Park. Cresap Bay is a 120-acre campground and day-use area / boat launch. Speelyai Bay Park occupies four acres and Merwin Park covers 16 acres near the dam. PacifiCorp identified 24 separate dispersed shoreline sites around Lake Merwin that appear to be used primarily for picnicking, although some camping may occur.

Downstream of Merwin dam are six river access sites, Vancouver-Clark Parks and Recreation Department operate one site (Haapa), and WDFW and/or PacifiCorp operate five sites.

Fish and Wildlife Habitat Uses

Lands in the project area support an array of terrestrial and wetland-dependant wildlife species. Many wildlife species inhabit the coniferous forest stands that dominate the area, and their local distribution is continually affected by the harvest cycle and age of managed stands. Wetland and riparian-dependant species distribution is influenced by the project reservoirs, as well as by residential and recreational developments in the Lewis River Valley. Since the early 1980s, PacifiCorp has managed its land between the Merwin and Yale projects specifically for wildlife. The 5,600-acre Merwin Wildlife Habitat Management Area was established to mitigate the effects of habitat loss from the original construction and operation of the Merwin Project. As described in section 3.3.4, *Terrestrial Resources*, the primary management objective for this area is to benefit elk populations that winter in these low elevations of the valley. Management of the area targets harvest actions to sustain a specific cover:forage ratio. Some cover types are designated as permanent, specialized management areas for old growth, shrublands, riparian buffers, and wetlands.

In addition, the applicants purchased several biologically significant parcels as a conservation measure under the biological opinion and incidental take statement for interim operations issued in 2002. These include 779 acres along Cougar Creek to preserve bull trout habitat; 284 acres on Swift Creek reservoir known as Devil's Backbone (purchased by Cowlitz PUD), to protect bull trout sub-adult rearing habitat; and 129 acres in the vicinity of Speelyai Creek to preclude development of this lower elevation habitat. PacifiCorp also provided funding to Clark County to assist its acquisition of Eagle Island, in order to protect anadromous fish habitat.

Agriculture Uses

In 2001, 22 percent of the area within the 240-foot contour along both sides of the river was classified as agriculture, with another nine percent in pasture. Much of the previously farmed agricultural land has reconverted to forest and now supports deciduous and mixed conifer stands. Within the project boundary, approximately 30 acres near Saddle dam are farmed as part of the Merwin WHMP. Agriculture also occurs along the Route 503 corridor, particularly in the lower basin.

Forestry Uses

PacifiCorp owns the majority of forestland along the project shorelines. PacifiCorp's primary management consideration is the protection of the terrestrial and aquatic resources, and the company operates under management guidelines for their forestlands around Lake Merwin and up to Yale dam through the Merwin WHMP. Emphasis is placed on forest health and wildlife habitat, old-growth retention, shrubland management, wetland management, orchard management at old homestead sites, and farmland management to provide winter forage for big game. Cowlitz PUD owns 577 acres, most of which is forested.

WDNR, Forest Service, and numerous private timber companies own the forestlands adjacent to but outside the boundaries of the projects. WDNR manages 87,747 acres in the Lewis River watershed to provide income for schools and other state trusts. This includes the 32,000-acre Siouxon drainage bounded on the north by Swift Creek reservoir and the west by Yale Lake, which is managed for annual timber harvests, aquatic habitat protection, wildlife habitat, and other resource values.

The Forest Service manages 403,518 acres of non-wilderness, wilderness, and national monument lands within the watershed. This includes 353,660 acres of non-wilderness forestlands under multiple use management to provide a sustained yield of wood, water, forage, wildlife, and recreation. Wilderness and national monument lands include the Mount St. Helens National Volcanic Monument (Monument), the Mount Adams Wilderness Area, and the Indian Heaven Wilderness Area. The Monument occupies 32,712 acres, and 17,146 acres are within the two Wilderness Areas. These areas include forested and non-forested lands that are managed for the protection of natural resources and unique resource values. The Forest Service prohibits commercial harvest and restricts wildlife habitat management activities on the Monument and in wilderness areas, but not on other Forest Service lands.

Private timber companies manage approximately 98,000 acres of forestland in the Lewis River watershed. The private timberlands closest to the projects belong primarily to Olympic Resources Management, Weyerhaeuser and ANE Forestry. Swift Creek reservoir is close to these units. While each company determines specific harvest practices, minimum requirements are established by the State of Washington Forest Practices Regulations to protect public resources.

Non-industrial private forestlands are owned by a variety of individuals not associated with commercial timber companies. There are approximately 74,000 acres of forestland within this ownership classification, occurring predominately in the lower third of the watershed.

Residential Uses

Three private shoreline developments with approximately 253 home sites are located around Swift Creek reservoir. The Yale Lake area has multiple small groupings of residences near Beaver Bay, in and around Cougar, and near Speelyai Creek where low-density rural residences have been built along the highway. Several small farms are also located in the project vicinity. Yale Lake currently has only one private residential development of 10 home sites that share shoreline access. Several privately developed communities on Lake Merwin support approximately 1,550 total home/trailer sites. All are on private land controlled by the homeowners associations that make use of shoreline areas leased from PacifiCorp. Residential use becomes denser along the Route 503 corridor from the western end of Lake Merwin to the city of Woodland.

Shoreline Management

As discussed in the following section, the applicants own most of the shoreline lands, and development on project shorelines is guided by county zoning. Under the state Shoreline Management Act, local governments are required to develop master programs for the regulation of shoreline uses. Program jurisdiction applies to lands within 200 feet of the ordinary high water mark, as well as to swamp areas and floodplains. Each of the three project reservoir shorelines are designated as "Shorelines of Statewide Significance" under this program. The three counties designate the shores of the reservoirs and the Lewis River as Conservancy Environments or Elements.

Cowlitz County defines Conservancy Environment as shoreline areas endowed with resources that may be harvested and naturally replenished, and other areas that are not suitable for high-density human use because of natural parameters, such as flooding or unstable soils. The objective for conservancy areas is to manage those lands with a sustained yield philosophy and establish suitable areas for non- intensive recreational uses, non-intensive agricultural, and limited intensive public access.

Clark County's definition of the Conservancy Environment is "shoreline area of sparse, scattered settlements, existing relatively free of urban activity. It is an area that, because of biophysical characteristics, is intolerant of intensive land uses and is used primarily for recreation, timber harvesting in a sustained yield basis, and passive agricultural practices" (Clark County, 1974, as cited in EDAW, 2001). The Clark County Shoreline Management Plan states that large concentrations of intensive use recreational activities should be discouraged in conservancy areas.

Skamania County's policy for activities within the Conservancy Element is to preserve the aesthetic qualities of the shoreline, protect wildlife habitat, and restore damaged features (Skamania County, 1986, as cited in EDAW, 2001). Management actions should have minimal adverse effect on the environment.

As described below, the Swift Creek reservoir is entirely contained within Skamania County, while the Merwin and Yale lakes form the border between Cowlitz County (north shore) and Clark County (south shore).

Land Use Management and Jurisdiction

Federal Lands

GPNF is a major land manager in the basin surrounding Swift Creek reservoir, with holdings concentrated in areas north and south of the reservoir and within Skamania County. Forest Service land within the Swift No. 2 Project boundary totals 3.79 acres in the Swift No. 2 Canal. The Gifford Pinchot Land and Resource Management Plan and the Northwest Forest Plan provide management direction for some of these lands, with the principles of multiple use guiding decisions regarding timber yield, water, forage, wildlife, and recreation. Opportunities to harvest timber are limited to areas specifically designated in the Forest Plan. Further constraints have been placed on harvest to protect fish habitat, wildlife habitat, and soils. The primary access road to the upper basin, FR 90, is constructed on land for which the Forest Service holds an easement, conveying authority to construct and maintain the road, but without a real property interest.

Monument lands extend north of Yale Lake and the Swift No. 2 Project, and have incorporated approximately 300 acres of former PacifiCorp land north of Beaver Bay Campground. Monument lands are managed to protect geological, ecological, and cultural resources for scientific study and research, while providing compatible recreational and interpretation opportunities.

BLM retains 84 acres within the Yale project boundary, including the land on which Yale dam was constructed. BLM relies on PacifiCorp to manage these lands for maintenance of the hydropower facilities. PacifiCorp's right to occupy these lands is authorized under a long-term FPA withdrawal. BLM lands within the project boundaries total 121 acres at the Merwin Project and 67 acres at the Swift No. 1 Project. PacifiCorp pays an annual fee for its right to occupy and use these parcels.

State Lands

WDNR manages 12 percent of the lands in the basin (87,747 acres), including several small parcels on the eastern side of Swift Creek reservoir. Swift Camp occupies 20 acres that WDNR leases to PacifiCorp. Another parcel is located along the eastern shore of Swift Creek reservoir and includes a segment of FR 90. Additional WDNR holdings are scattered north of the project area, extending from Swift Creek reservoir west to Woodland, including a small parcel on the south shore of Lake Merwin. A majority of these holdings are located outside the FERC project boundaries and are managed by the Forest Resources Plan and WDNR's Habitat Conservation Plan, developed to conserve threatened and endangered species on its lands within the range of the northern spotted owl. The most extensive WDNR holdings in the basin include

approximately 32,000 acres east of Yale Lake and south of Swift Creek reservoir that make up the Siouxon Landscape Area, managed under the Siouxon Landscape Plan.

The Washington State Department of Transportation is responsible for Route 503. This corridor bisects the project area on the northern side of the reservoirs from I-5 to approximately 1.5 miles west of Swift dam, at which point it becomes FR 90. Also known as the Lewis River Road, it is the main east-west transportation corridor through the basin. Use of Route 503 has increased substantially since the eruption of Mount St. Helens, and as residents of the Portland/Vancouver areas have discovered the recreational opportunities available in the upper basin.

County Lands

Skamania County encompasses all of the project area associated with Swift No. 1 and extends westward along 2 miles of the Swift No. 2 canal. The comprehensive plan for this county depicts the project area as unzoned. As such, Skamania County does not identify any land use designations in the project area.

Clark County covers an area from just upstream of the Swift No. 2 powerhouse downstream to the Columbia River, following the southern and eastern edges of the Yale and Merwin reservoirs. The southern half of Yale and Merwin dams and reservoirs, both powerhouses, and switchyards are within Clark County. These county lands are relatively remote and are predominantly designated Forest Tier I under the Clark County Comprehensive Growth Management Plan. Land management objectives focus on the long-term production of commercial forest products and other natural resources. Some lands along the southern shore of Lake Merwin are zoned for denser development (one principal dwelling per 40 acres). Project features are within the Shoreline Conservancy environment of both Clark and Cowlitz counties. As such, power-generating facilities are allowable uses where they create minimal visual effects and when shoreline restoration is performed.

Clark County owns an 80-acre site along the east side of Yale Lake. This parcel is designated as Parks / Open Space under its comprehensive plan. Absent a recreational easement along the only access road (the IP Road), the site has remained undeveloped.

Cowlitz County includes lands to the west and north of Yale Lake, extending along the west and north edges of the Yale and Merwin reservoirs from the Skamania County line near the Swift No. 2 powerhouse to the Columbia River. Swift No. 2 and the northern half of Yale and Merwin dams and reservoirs are within Cowlitz County, as is the Hydro North Headquarters facilities, where operation of the Lewis River Projects and other smaller PacifiCorp hydro projects are coordinated. Project features occupy lands designated as Rural Residential–2 and Forestry-Open Space. The Swift No. 2 powerhouse, Saddle dam, and portions of Yale dam, located within the boundaries of the Cowlitz County Shoreline Management Master Program, are consistent with the

Economic Development component of this program. Within the designated Shoreline Conservancy environment, power-generating facilities are permitted where they create minimal visual effects and when shoreline restoration is performed. Transmission lines associated with the Swift No. 1 and Swift No. 2 projects span a number of management designations, generally through permitted uses. Project recreational facilities in Cowlitz County occupy areas designated as Parks/ Open Space or Rural Residential-2 by the County Comprehensive Plan and as Rural District shorelines by the Shorelines Management Master Program. Recreational uses are consistent with these designations.

Private Lands

PacifiCorp owns the majority of private lands adjacent to the FERC project boundaries, with several parcels held by various timber companies and residential/ recreational communities. The majority of the non-PacifiCorp private land is located around Swift Creek reservoir. Privately owned lands that are not in timber production are scattered around the three project reservoirs, including the private residential communities described above. Residential ownership is more common around Lake Merwin than around Yale or Swift Creek reservoirs. On privately owned reservoir frontage, PacifiCorp retains flowage easements.

Law Enforcement and Public Safety

PacifiCorp contracts with private security personnel who assist with security issues and crowd control for the projects. PacifiCorp also contracts with the Cowlitz County Sheriff's Office, which provides one or two land-based officers on weekends and holidays to patrol Cowlitz County land bordering Lake Merwin and Yale Lake. At Swift Creek reservoir, PacifiCorp employs private security personnel; there are no additional land-based patrols by county law enforcement personnel. Current use levels at Swift Creek reservoir are comparatively low. PacifiCorp hires private security personnel at variable levels for two employees for three days in the middle of the week, and three employees for the other four days a week through the summer months.

There are no permanent law enforcement facilities in the Lewis River Valley. The Cowlitz County Sheriff's Office deputies work from their vehicles, using the Kelso Station as their base of operations. Recreational facilities associated with the projects generate demand for law enforcement services. Seasonal operations from approximately Memorial Day to Labor Day define the peak operations period in the project area for the Cowlitz County Sheriff's Office during the summer months. The Clark and Cowlitz County Sheriff's Office rely on a combination of extensive overtime and the assistance of private security forces to meet the additional summer demand. PacifiCorp pays the Cowlitz County Sheriff's Office for overtime salaries and hires private security personnel during the peak recreation season to supplement law enforcement. The Washington State Patrol has jurisdiction for patrolling SR 503 and SR 503 Spur, the main travel routes through the project area.

The Marine Patrol provides additional law enforcement on the reservoirs. The Clark County Sheriff's Office maintains a patrol boat on the water on variable weekends and weekdays. In 1999, they issued 61 citations to Lake Merwin visitors and 105 citations to Yale Lake visitors. These citations were issued for violations related to boat speed, personal floatation device usage, illegal fires, fishing regulations, water-skiing/personal water craft use, and intoxication. The Cowlitz County Sheriff's Office also conducts boat patrols of the reservoirs through the summer, although these are not regularly scheduled. Patrols typically coincide with good weather patterns when recreational boat traffic is highest. Swift Creek reservoir does not have similar Marine Patrol enforcement at this time due to its lower use levels.

NCEMS provides emergency services to the project area from their base in the Yacolt Fire Station, and the various regional fire departments. NCEMS is the only organization that provides hospital transport and advanced life support in the study area (personal communication, D. O'Brien, February 15, 2002, as cited in the PDEA). The four fire departments provide basic life support and first-responder capability to support NCEMS. An auxiliary station adjacent to the Cresap Bay Campground entrance is staffed on weekends in the summer, from Memorial Day until Labor Day. The facilities at the Cresap Bay Station were donated by PacifiCorp to NCEMS and house an ambulance, a fire engine (Fire District No. 7), and a patrol boat (Clark County Sheriff's Marine Patrol).

3.3.7.2 Environmental Effects

The applicants are not proposing any specific land use measures for the projects. However, the applicants list a number of measures in the supplemental PDEA as benefits to socioeconomic resources and recreational resources, including implementing improved communication and safety systems and developing an I&E program. While we agree with the applicants that those proposed measures would affect socioeconomic and recreational resources in the project, we believe that they have more direct effects on how the applicants and visitors to the projects use the land. Therefore, we consider those measures in this section.

Visitor Management

During the pre-application phase of relicensing, the applicants and stakeholders identified the need to improve public information systems and management of visitors to the project area.

As part of the proposed RRMP, and as detailed in the SA, the applicants propose to develop and implement an I&E program. The purpose of the I&E program is to provide enhanced experiences for visitors and residents, encourage participation in resource protection measures by area visitors, and promote cooperative, safe behaviors to benefit all project area resources and visitors. In addition to the I&E program, the

applicants would implement a series of specific measures to improve management of visitors to the projects. Table 3.3.7-2 summarizes the applicants' proposals.

Table 3.3.7-2. Proposed measures to improve management of visitors within the project area. (Source: PacifiCorp and Cowlitz PUD et al., 2004)

Proposed Measure	Swift 1	Swift 2	Yale	Merwin	Timing
Develop and implement an I&E program, including information about protecting bull trout.	X	X	X	X	By 1st anniversary of new licenses
Increase visitor management controls, such as additional signs, barriers and enforcement.	X		X	X	Upon issuance of new licenses
Allow managed recreational access to project lands except where conditions are unsafe.	X	X	X	X	Ongoing
Install interpretive signs at the Beaver Bay wetland.			X		By 13th anniversary of Yale license
Provide earlier public notice that project recreational sites are full.	X		X	X	Upon issuance of new licenses
Discourage dispersed upland camping and motorized use on project lands.	X		X	X	After issuance of licenses
Manage parking at Swift No. 2 canal fishing facility.		X			After 9/30/05 installation
PacifiCorp provides $5,220/yr and Cowlitz provides $780/yr to the Forest Service to manage dispersed camping on its land in the project vicinity.	X	X			Upon issuance of new licenses

Our Analysis

The proposed I&E program would improve visitors' experience by providing information about the projects and project-related recreational, wildlife, aquatic, and cultural resources. Much of the I&E program included in this measure would be developed at recreational sites that provide primary access to the projects lands and waters, which is an appropriate place to capture the majority of visitors to the area. The program would educate visitors about appropriate uses and areas for recreational

activities and would subsequently help protect the environmental resources of the projects.

The fisheries component of the I&E program would provide public benefits similar to the I&E plan discussed above. The program could provide information to anglers and other recreational visitors about important practices to help protect the bull trout population in the free-flowing reaches of the Lewis River and its tributaries. The proposed public education program specific to fishery resources that includes information about applicable regulations could provide substantial protections to bull trout and other fish populations.

Other site-specific measures detailed in the RRMP and the PDEA would benefit environmental resources by closing degraded areas to more intense recreational use. The applicants would continue to allow appropriate non-motorized access to all existing and future PacifiCorp-owned lands except where unsafe. When possible, conservation easements for recreational purposes would be provided, including hunting access. PacifiCorp would also implement additional visitor management controls where needed, such as signs, barriers, and enforcement, to ensure a high quality recreational experience and to enhance public health and safety. Additionally, PacifiCorp would discourage dispersed upland (non-shoreline) camping and motorized use by keeping project roads gated and maintained as necessary. Implementing these measures would clarify the applicants' intended land uses and reflect the goals of natural resource protection while encouraging appropriate uses.

The proposed measures include providing annual funding contributions to the Forest Service for the management of Forest Service dispersed camping on its lands outside the project boundary and in the project vicinity. Currently, the capacity of some project campground facilities is met or exceeded during some peak-use periods, and, as a result, some displaced camping use may occur on Forest Service lands during peak-use periods. The applicants propose to expand or improve specific campground facilities at the Yale and Swift reservoirs and at other sites in the projects. Further, the proposed RRMP includes provisions to monitor recreation use in the project area and provide new or improved recreation facilities at the projects as needed through the license terms. These measures would help address the need for increased camping opportunities during peak-use periods now and in the future, and, in turn, would help alleviate displaced camping use on Forest Service lands. While the proposed funding contributions would assist the Forest Service in its management of dispersed camping on lands outside the project boundary, we conclude that the other proposed measures noted above would be sufficient to address camping use during peak-use periods and that annual funding contributions to the Forest Service are not needed.

In response to our analysis in the draft EIS, the Forest Service makes an argument for establishing a nexus with the projects, for funding the dispersed campsites. However, that nexus is not strong enough for us to establish a link for funding. Although it may be

appropriate to fund any such sites that may be within the project boundary, there is insufficient information in the record to indicate where the sites are located, and by their nature as being "dispersed," there may not be a total accounting of where many of the sites are located. If funding were to occur, any dispersed sites covered by the funding should be included in the project boundary, because these sites would be considered part of the project purposes. However, because many of these sites may not be well known or mapped in any way, or can be tied directly to the projects, we do not see the need for funding the dispersed sites.

Together, many of the above measures would provide new protections to environmental resources within the project area, would improve communication with visitors about acceptable and inappropriate uses within the project boundaries, and would help educate visitors about the natural resources within the project areas.

Communication Systems, Law Enforcement, and Public Safety

As discussed above, the applicants support federal, state, and county law enforcement in the project area. However, the applicants and stakeholders recognized certain shortfalls in enforcement and emergency service delivery within the project areas. Table 3.3.7-3 summarizes the applicants' proposed measures that are designed to improve communication in the project area and would affect public safety.

Table 3.3.7-3. Summary of applicant-proposed measures related to public safety. (Source: PacifiCorp and Cowlitz PUD et al., 2004; PacifiCorp and Cowlitz PUD, 2004a)

Proposed Measure	Swift 1	Swift 2	Yale	Merwin	Timing
Fund 3 FTE law enforcement (marine and land-based) positions provided by state and local government.	X		X	X	Within 6 months of license issuance
Contribute to County-developed installation and maintenance of emergency phone system for flood notification.	X		X	X	Annual contribution
Fund NOAA weather radio transmitter installation.	X		X	X	Annual contribution

Proposed Measure	Swift 1	Swift 2	Yale	Merwin	Timing
PacifiCorp and Cowlitz PUD would make one-time contributions to the Forest Service to assist in the repair of the Canal Bridge on FR 90 ($7,474 and $2,626 respectively), and annual contributions for the maintenance of FR 90 ($19,980 and $7,020 respectively). In addition, the applicants would pay appropriate use fees to the Forest Service for hauling heavy loads on FR 90 on a case-by-case basis.	X	X			One-time payments within 6 months of Settlement. Annual payments begin in April 2005
Continue to support Pine Creek Work Center communication link (Forest Service radio-telephone link between Swift dam and the Pine Creek Work Center).	X				Ongoing
USGS Flow Information- install a conduit and phone line to facilitate transmissions from a voice-synthesizer modem intended to speak flow numbers in cfs, and the river level or stage when called, to provide real-time flow information from the existing Ariel gage.	X	X	X	X	Capital costs of installing phone-line and modem (completed); ongoing maintenance costs

Our Analysis

The applicants and stakeholders expect that land development and visitor pressure would increase over the term of the new licenses, in part because of the projects' proximity to major metropolitan areas, the regional attractions of the Mount St. Helens National Volcanic Monument and the project reservoirs, and a good transportation network. Overall, the proposed land use measures would improve communication as well as improve the conditions and facilities to meet some portion of future demand.

The law enforcement measures would help encourage visitors, including anglers and boaters, to comply with regulations. An increase in the number of visitors over the term of the new license would likely increase the need for public services, including law enforcement, fire protection, and emergency services, which are provided by the Cowlitz

County Sheriff's Office, four Fire Protection Districts, and the North County Emergency Medical Services. More visible WDFW marine patrols would help reduce conflicts between recreational users and improve boater safety by providing an authoritative presence to encourage compliance with navigational laws. Additional law enforcement patrols at the more remote areas of the project would improve management of environmental resources by increasing visitor contact with enforcement agencies, and help to educate visitors about appropriate and restricted uses.

However, within the project area, the state and counties are responsible for law enforcement activities at public recreational sites. The applicants pay property taxes to the counties within the project area, which is partially used to fund law enforcement. In addition, WDFW sets fishing guidelines and is responsible for enforcing fishing regulations along the Lewis River, including the project area. The applicants post signs that provide public information about acceptable and prohibited recreational uses, and have proposed new measures that would improve the public education to help improve visitor compliance with project-area rules and regulations. Further, funding FTE law enforcement and marine patrol, as proposed, provides no assurance that the law enforcement officer would be used exclusively within the project area, in addition to current levels of patrols within the project area. As such, there is no indication that the proposed measure would reduce any existing recreational conflicts or further protect project environmental resources for the term of the new licenses.

The proposal to assist the Forest Service in the reconstruction of the Canal Bridge recognizes the project's direct effects on the Forest Service-maintained bridge, in that the bridge crosses the Swift No. 2 power canal and is located within the project boundary. FR 90, however, although serving as the primary access road to project recreation sites along the Swift Creek reservoir and to other project facilities for O&M by the applicant, is primarily a multi-purpose road with many more uses than just to access the project facilities. The road is not considered a project facility, and applicant funding for maintenance of the road is not appropriate.

The proposed funding of the county's emergency phone system, the NOAA weather transmitter, and the Forest Service radio link would help to improve communications coverage in this rural area. In the draft EIS we had concluded that PacifiCorp should construct and operate the weather transmitter, because it could provide important information to the public regarding project operations during flooding events. PacifiCorp, however, in its comments on the draft EIS indicated that it had already signed a Memorandum of Understanding with NOAA for this transmitter on August 23, 2003, and NOAA had already constructed and currently operates the transmitter, using the National Weather Service frequency that is unavailable to PacifiCorp. Thus, it would make more sense for PacifiCorp to simply provide funding to NOAA to support the operation of the transmitter, as the SA provides. We agree, but in the event that NOAA were to lose its funding for the transmitter, or decides to no longer operate the

transmitter, it would be appropriate for PacifiCorp to fully fund or assume operation of the transmitter, because it would provide important information to the public on project operations during extreme weather events.

These measures would improve the ability of emergency and safety personnel to communicate, improve day-to-day management of emergency and safety activities, and improve how the general public communicates with emergency personal in the project area. In addition, the proposed communication measures would help reduce risks associated with flooding by allowing valley residents to keep themselves better informed of developing flood conditions and by improving lead times for flood warnings and evacuation notices.

The proposed flow-information system would provide timely flow information to boaters, anglers and other recreational visitors from the region who are interested in recreational use of the projects or the river below the projects.

Overall, the proposed measures would substantially improve public safety by improving emergency service communication.

Effects of Other Measures on Environmental Resources

In addition to the effects of specific land-use related measures discussed above, several proposed measures have the potential to affect land uses in the basin. Specific measures proposed to enhance wildlife habitat, fish passage, and recreation could alter current land uses, as summarized below.

Our Analysis

Measures proposed to protect and enhance wildlife habitat on project lands include replacing some damaged or undersized culverts on PacifiCorp lands, restricting dispersed camping in some shoreline and riparian areas, and closing some roads to vehicles. In addition to benefiting amphibians and aquatic species, culvert replacement would reduce potential land use effects associated with erosion and overflow that can occur with undersized or damaged culverts. PacifiCorp would stop dispersed camping some sensitive areas, a measure that would benefit wildlife and vegetation while forcing the relocation of some campers. Road closures on project lands to benefit wildlife would not be expected to significantly change current uses, as these are private roads. None of these measures would have an adverse effect on land uses.

The proposed expansion of the applicants' recreational facilities would reduce encroachment on adjacent federal, state, and private lands by meeting a portion of the expected demand for water-based recreation. This represents a moderate land management improvement over existing conditions.

Although construction of trap-and-haul facilities for upstream fish passage and floating surface collectors for downstream fish passage would not introduce new land uses, it would increase short-term construction-related traffic. Depending on the facility development schedules, this effect could have from moderate to major short-term effects on transportation networks adjacent to the construction activity. Construction of downstream passage facilities would have a major short-term effect on FR 90 in the vicinity of Swift dam and a moderate effect on road use in the Merwin dam vicinity. When these facilities become operational, truck traffic on area roads between Merwin dam and Swift Creek reservoir, and between Yale dam and Swift Creek reservoir would increase somewhat as fish are transported into and out of the upper basin.

3.3.7.3 Unavoidable Adverse Effects

None.

3.3.8 Cultural Resources

3.3.8.1 Affected Environment

Area of Potential Effects

The area of potential effects (APE) is the area in which National Register-listed or eligible resources, if they occur, could be affected by a project (36 CFR 800.16(d)). PacifiCorp and Cowlitz PUD delineated a primary APE for archaeological sites and historical structures close to the reservoir shorelines, encompassing the hydroelectric, recreation, and fishery facilities (HRA, 2003). The applicants also delineated a secondary APE that includes the wildlife enhancement and other mitigation lands. Detailed inventories were conducted for the primary APE, with inventories to be conducted as needed for specific project activities in the secondary APE.

Studies for Traditional Cultural Properties (TCPs) also adopted primary and secondary APEs, which differ from those mentioned above. The primary APE for TCPs encompasses the North Fork of the Lewis River from its mouth to the headwaters, its tributaries, and lands lying within one mile of the river channels. Within the primary APE, the investigation placed emphasis on the locations of the four hydroelectric projects. Stretching from the Cowlitz River on the north, to Mount Adams on the east, and to the Columbia River on south and west, the secondary APE provided a regional context for the TCP study.

Archaeological Resources

Limited archaeological studies accompanied original development of the Yale and Swift reservoirs, locating a few sites, one of which contained a human burial. Cultural resources inventory and evaluation work for the relicensing started in 1996 with several studies at the Yale Project (PacifiCorp, 1999). In 1998 and 1999, archaeological inventory took place at Swift Creek reservoir. In 1999, studies included archaeological

survey and testing at the Merwin Project; historical inventory and evaluation for the Swift No. 1, Swift No. 2, and Merwin projects; and traditional cultural property work for the project area. The applicants filed copies of all cultural resources studies with the Washington Department of Archeological and Historic Preservation (State Historic Preservation Officer [SHPO]).

The Swift No. 1 Project boundary includes approximately 1,200 acres within the exposed drawdown zone, areas downstream of the dam, and dispersed campsites above the full pool level. Although the normal full pool level for Swift Creek reservoir is 1,000 feet msl , the level was down to about 950 feet msl at the time of the archaeological resources inventory.

The archaeological work surveyed approximately 900 of the 1,200 acres in the APE, recording two archaeological sites and 10 isolated finds. Subsurface testing was performed at one of the sites, 45SA449, but the limited number and diversity of cultural materials at the site, along with the apparent lack of an extensive subsurface component, led the archaeologists to recommend the site as not eligible for listing in the National Register on the basis of archaeological information value (Criterion d). At 45SA448, field personnel noted debitage, bifaces, a uniface, and a leaf-shaped projectile point on the surface. However, no subsurface testing was performed as the site was too difficult to access with the necessary field equipment. Although the site remains unevaluated for the National Register, it will be treated as eligible until some threat makes it important to define the site's eligibility. The work also included a study of the distribution in the Swift reservoir of the sediments resulting from the 1980 eruption of Mount St. Helens that likely have buried some archaeological sites.

GPNF archaeologists have recorded five archaeological sites within or near the Swift Creek reservoir drawdown zone. Two historic-period sites are located under water near the former mouth of Range Creek. Site 7N6E-30/01 is a circa-1935 trail shelter, and 7N6E-31/01 is the location of the 1910s basket ferry across the river along the Overland Trail. A third historical site, 7N6E-34/01, also a basket ferry crossing now covered by the impoundment, is located south of the present boat ramp. The fourth site, the Pine Creek Guard Station (7N6E-26/01), was built in 1946 between FR 9030 and 9031, outside the current survey area. A Forest Service survey in 1977 noted that the guard station buildings had been removed. The fifth site, lithic scatter 6N6E-05/01, is situated near Drift Creek. Archaeologists recorded a basalt biface and two unidentified lithics from the site, but shovel probes did not yield additional cultural materials. The Forest Service Archaeologist and the Washington State Archaeologist determined that the site was ineligible for listing in the National Register.

The Yale Project archaeological APE comprises approximately 2,280 acres, including the area below the high water line, the area between the reservoir margin and the main access roads, the area bordering Lewis River bypassed reach, and the area associated with the Merwin-Yale 115-kV transmission line. The normal full pool level

for Yale Lake is 490 feet msl, although the reservoir pool was drawn down on average to 464 feet msl during the archaeological survey. The archaeological survey included 1,100 acres, with 700 located in the drawdown zone.

The archaeological inventory located eight prehistoric sites (45CW101, 45CW102, 45CW103, 45CW104, 45CW105, 45CW106, 45CW468, 45CW469); five historic-period sites (H-1, H-2, H-3, H-4, H-5); and nine isolated finds (ISO-1, ISO-2, ISO-3, ISO-4, ISO-P4/1, ISO-P4/2, ISO-P4/3, TL-1, TL-2). The prehistoric sites and isolates consisted mostly of lithic debitage and formed tools. Five of the sites contained ground stone tools, and one of the sites (45CW102) contained a feature that may have been a pit house. Historic-period features included a ditch, trash scatter, road grades, and a house/cellar site. Five of the prehistoric sites (45CW101, 45CW102, 45CW103, 45CW105, 45CW106) were considered eligible for inclusion in the National Register. The other three prehistoric sites, the five historic sites, and the nine isolated finds were all deemed not eligible.

The Merwin Project primary APE totals about 721 acres, while the secondary APE includes about 5,000 acres of PacifiCorp land around the reservoir. The normal operating elevation of Lake Merwin is between 235.0 and 239.6 feet msl. Typically the reservoir fluctuates between 5 and 10 feet throughout the year, although drawdowns of more than 60 feet have occurred during the reservoir's 70 years of operation. The level at the time of the cultural resource surveys was 219 feet msl, and the archaeological survey covered 537 acres.

During the Lake Merwin inventory, archaeologists recorded 20 sites (7 historic-period and 13 prehistoric), and recommended six of them as eligible for the National Register. One of these sites, 45CW108, is an historic cemetery and was considered to be eligible as a heritage site (Criterion a). The other five sites (45CW100, 45CW111, 45CW116, 45CW118, 45CL519) were prehistoric and considered to be important as sites likely to provide information about one or more of several regional research themes (Criterion d).

During consultations, the Yakama Nation and Cowlitz Indian Tribe representatives expressed their views that all of the prehistoric archaeological sites hold cultural heritage value (National Register Criterion A). Therefore, the prehistoric sites will be treated as National Register-eligible unless or until project effects on them make it necessary for a formal determination of eligibility for the resolution of adverse effects.

Historical Resources

The historic resources work inventoried and evaluated the buildings and structures of the four projects in accordance with National Register criteria. The historians recommended that resources of the Swift No. 1 Project be considered eligible for the National Register based on their importance in the region's history (Criterion A); the dam

is also significant as the highest earthfill dam of its time (Criterion C). The Swift No. 1 Historic District boundaries include Swift dam, the Swift No. 1 powerhouse, and penstocks. Following the canal failure of April 2002, the resources associated with the Swift No. 2 Project no longer retain the physical integrity necessary for National Register listing.

The buildings and structures associated with the Yale Project were determined to be ineligible for listing in the National Register due to the project's lack of association with significant themes in local and state history.

Work at the Merwin Project (historically called "Ariel Dam") recommended several resources as eligible for the National Register based on the project's importance to regional history (Criterion a) and its distinctive construction (Criterion c). The Ariel Dam Historic District boundaries include resources built in association with the dam that have retained their integrity. These consist of the dam and water conveyance system, the powerhouse, and the control house. Ariel Village, the employee-housing compound, no longer retains integrity and is not considered to contribute to the historic district.

Project operations and maintenance activities, future construction, and proposed enhancement measures could affect the two historic districts.

Traditional Cultural Properties and Resources

Studies of traditional cultural properties have been conducted in the Lewis River area, both for the hydroelectric projects and for other purposes such as management of the GPNF. Project-related studies were guided by the Cultural Resource Group, whose members included the Yakama Nation and Cowlitz Indian Tribe, and who met 14 times. Project work and communications from 1996 to 2002 have revealed some general place names or TCPs, but the information is not specific enough to prepare inventory forms or to develop particular treatments or management actions. It is possible that the lack of data reflects the loss of this type of information since the time when early Euroamerican contact in the lower Columbia River region brought deadly diseases and disrupted traditional Indian activities in the area. Regardless of the reason, the tribes consider information on traditional places and activities to be private and confidential. Fearing the disturbance of archaeological sites, burials, and resources such as native vegetation, tribal representatives are uncomfortable about documenting this information in detail and sharing it.

3.3.8.2 Environmental Effects

NHPA (16 U.S.C. 470 et seq.) (as amended) requires federal agencies to manage cultural resources under their jurisdiction and authorizes the Secretary of the Interior to maintain a National Register. The law also provides for the creation of SHPOs to facilitate the implementation of federal cultural resource policy at the state level, and for the responsible federal agency (i.e., agency official) to consult with Native American

tribes who attach religious or cultural importance to cultural resources under their jurisdiction. Section 106 of the Act requires federal agencies to take into account the effect of any proposed undertaking on properties listed in, or eligible for listing in the National Register. If the agency official determines that the undertaking may have adverse effects on properties listed in or eligible for listing in the National Register, the agency official must afford an opportunity for the Advisory Council on Historic Preservation (Advisory Council) to comment on the undertaking. The relicensing of the Lewis River Projects is considered an undertaking and the Commission acts as the agency official.

Effects of the Proposed Action

Continued operation of the projects without protective measures could adversely affect both known and yet-to-be-identified historic properties. Most of the known archaeological sites are within the drawdown zones of PacifiCorp's reservoirs, where they can be affected by the rise and fall of pool levels as well as by the erosive effects of waves. Archaeological sites near campgrounds, fishing access spots, and other areas that experience human contact are vulnerable to erosive effects of human traffic as well as the effects of unauthorized artifact collectors. While project operations could beneficially affect historic project facilities through continued use and maintenance, maintenance activities and upgrades to the structures could degrade the character-defining elements that qualify these resources for inclusion in the National Register. Ongoing project operations could affect TCPs and TCRs in several ways, for example by blocking fish passage into the upper basin. The presence of campgrounds, particularly many of the dispersed sites, as well as logging and other forest management activities, would continue to affect the native plants and animals, and the ability of Indian people to use these resources.

PacifiCorp anticipates that several archaeological sites could be affected by project-related construction activities, facility upgrades, or recreation activities. Specifically, site 45CW121 along Lake Merwin near the dam could be affected by future modifications or construction. Also along Lake Merwin, sites 45CW114 and 45CW100 lie close to Speelyai Bay Park, and could be affected through increased human traffic associated with site improvements such as the restroom or the boat ramp modifications. Sites 45CW110, 45CW118, and 45CW119 are located near the Cresap Bay Campground, which could be affected by increased recreation use. Around Yale Lake, site 45CW103 is located between the town of Cougar and Cougar Park, and potentially could be affected by trail development.

PacifiCorp proposes to finalize the HPMP based on the draft Historic Properties Management Plan submitted to the Commission in PacifiCorp's Final Application for New License for Major Project, Volume III of III, April 2004. Upon approval by the Commission, PacifiCorp would implement the HPMP for each of the Merwin, Yale, and Swift No. 1 projects as any new licenses for each project are issued. The HPMP would

guide the treatment of known and yet to be discovered cultural and historic resources through the new license terms and would outline the consultation requirements with the Cowlitz Indian Tribe, Yakama Nation, SHPO, and GPNF. Additionally, PacifiCorp has agreed to the following specific protections of cultural resources:

(1) Archeological artifacts recovered from the project areas and associated documentation would be curated at the proposed visitor information facility or at another project facility created by PacifiCorp in one of its existing buildings that meets the applicable federal curation guidelines;

(2) Changes contemplated to National Register-eligible facilities within the Swift No. 1 Historic District or the Ariel (Merwin) Historic District would be planned in a manner that is compatible with preservation of the districts' historic value;

(3) Access by the Cowlitz Indian Tribe and Yakama Nation to project lands for traditional cultural practices would be provided by PacifiCorp except where unsafe conditions exist;

(4) A program of monitoring and protection of cultural resources in the draw-down zones;

(5) Designation of a cultural resource coordinator for PacifiCorp's Lewis River Projects; and

(6) A program for annual training and education of PacifiCorp employees whose work may affect cultural resources in the project areas.

Other measures proposed by PacifiCorp for other resource areas have potential to enhance TCPs and/or TCRs. Trap-and-haul facilities would introduce fish to Lake Merwin and Yale Lake, as well as to the watershed above Swift dam. PacifiCorp also proposes to fund terrestrial habitat enhancement and protection, along with implementation of the WHMPs and protection of sensitive habitats from timber operations and construction disturbances. These measures would help sustain traditional cultural values by protecting a variety of native plant and animal resources. Preparation of an I&E program could educate the public to help protect these habitat values from adverse effects of recreational enhancements.

No historic properties have been identified within the Swift No. 2 Project. However, Cowlitz PUD proposes to operate its project in accordance with the Cultural Resources Unanticipated Discovery Plan filed with the Commission as Volume 2 Appendix 3 in the Application for New License for Swift No. 2 in April 2004. During the term of any new license, Cowlitz PUD would evaluate the potential for development actions to affect previously undiscovered archeological sites or traditional cultural properties that could be eligible for listing in the National Register. Cowlitz PUD would consult with the State Historic Preservation Officer, the Cowlitz Indian Tribe, and the Yakama Nation about development actions, land acquisitions, or emergency response

activities that would disturb soils in areas exceeding 0.1 acre. If cultural resources are identified, Cowlitz PUD would evaluate their eligibility for National Register listing and would file a plan for mitigation and management of such resources with the Commission, after consultation with the Office of Archeology and Historic Preservation, Cowlitz Indian Tribe, and Yakama Nation. Cowlitz PUD would evaluate the National Register eligibility of buildings and structures that could be affected by project operation and development actions at the time such structures attain 50 years of age. Cowlitz PUD also proposes to allow tribal access to land within the Swift No. 2 Project boundary for traditional cultural practices except where unsafe conditions exist.

Our Analysis

Finalization and implementation of PacifiCorp's HPMP in consultation with the SHPO, Tribes, Advisory Council, and Forest Service, would ensure that adverse effects on historic properties arising from project operations or project-related activities over the term of the new license would be avoided or satisfactorily resolved. The HPMP would include specific measures to resolve any potential adverse effects arising from license requirements.

On November 17, 2005, the Commission sent the final programmatic agreement (PA) and HPMP to the SHPO, PacifiCorp, the Cowlitz Tribe, the Yakama Nation, and Forest Service. The Advisory Council, after reviewing the draft PA and HPMP has elected not to participate. On November 24, 2005, the SHPO signed the final PA, followed by PacifiCorp on December 15, 2005, and the Forest Service on December 16, 2005.

Although no historic properties are currently known to exist in the Swift No. 2 Project, the Commission would, as a condition of any license issued, require Cowlitz PUD to implement its Cultural Resources Unanticipated Discovery Plan in any instance, over the term of the license, in which archaeological resources or human remains are encountered in the course of project operations.

3.3.8.3 Unavoidable Adverse Effects

Regardless of the alternative selected and the mitigation measures undertaken, continued operation of the projects would affect traditional cultural resources. For example, fish runs would not be completely natural under any of the alternatives. Facility modifications and new construction would alter some historic structures. Some archaeological sites would be affected by reservoir erosion and possibly by fish passage facilities that cannot be re-sited. These effects would add to the cumulative loss of traditional cultural resources, historic structures, and archaeological sites over time in the upper Lewis River Valley.

3.3.9 Socioeconomic Resources

3.3.9.1 Affected Environment

The primary areas that experience socioeconomic effects from the Lewis River Projects are the small rural communities of Ariel, Cougar, Woodland, Yale, Northwoods, Yacolt, and Amboy. The first four (Ariel, Cougar, Woodland, and Yale) are in Cowlitz County; Northwoods is in Skamania County; and Yacolt and Amboy are in Clark County. In order to establish a baseline from which to consider socioeconomic effects of the projects, the applicants and stakeholders conducted a study of the towns in the project area[29] (EDAW, 2001). Unless otherwise noted, the discussion in this section is based on the study findings and other information in the PDEA.

Population and Demographics

Clark County has been one of the fastest-growing counties in the state for the past two decades and has gained attention as one of the faster growing areas on the national level. As shown in table 3.3.9-1, the population of Clark County was approximately 345,238 in 2000, 45 percent larger than 1990. Current growth in Clark County is occurring principally along the urban fringe of Vancouver, located at the opposite end of the county from the Lewis River valley, but rural areas of the county are experiencing high growth levels as well. Vancouver is the largest city in Clark County.

Table 3.3.9-1. Recent growth rates in the project vicinity. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Jurisdiction	1990 Population	2000 Population	Percent Growth
Clark County	238,053	345,238	45.0%
Cowlitz County	81,119	92,948	14.6%
Skamania County	8,289	9,872	19.1%
Lewis River Valley	18,126	27,231	50.2%

The population in Cowlitz County was approximately 92,948 in 2000, an increase of 13 percent from 1990. The restructuring of the timber industry caused the population to decline and stagnate during the 1980s. While population growth was positive during the 1990s, it was less than the overall statewide growth rate. Woodland, the largest community in the study area, is the third largest city in Cowlitz County, behind the cities of Kelso and Longview.

[29] The study included all of Cowlitz County in the area of primary effect due to the importance of the projects to Cowlitz PUD and the role that Cowlitz PUD plays as the electrical utility for residences and businesses in the county.

In Skamania County, most of the population is located in the Columbia River Gorge area, far from the Lewis River. The Lewis River Valley is separated from the rest of Skamania County by large tracts of Forest Service-managed forestlands. Skamania County experienced moderate growth during the 1990s, with countywide population increasing by 19 percent.

Population in the Lewis River Valley was approximately 27,231 in 2000, a 50 percent increase over 1990 population levels, which is a very high growth rate for a rural area with no major employers in the vicinity. Of this total, 70 percent live in Clark County and 30 percent live in Cowlitz County, and less than one-half of one percent live in Skamania County. The Clark County portion of the Lewis River Valley had a population of 19,092, accounting for 5.5 percent of the total Clark County population in 2000. The Cowlitz County portion of the Lewis River Valley had a population of 8,056, accounting for 8.7 percent of the total Cowlitz County population in 2000. The study area includes only 83 persons in Skamania County, accounting for just 0.3 percent of the study area population and less than one percent of the total Skamania County population in 2000.

Table 3.3.9-2 details population projections for each of the three counties in the study area and shows that steady growth occurring in this region is projected to continue until at least the year 2020. Since these three counties are also the place of residence for the majority of visitors (70 percent) to the study area, population trends will influence potential growth in demand for recreational activities provided at the projects. Additionally, a significant proportion of recreational visitors (23 percent) are residents from the Portland, OR metropolitan area, which is expected to experience increases in population similar to those in Clark, Cowlitz, and Skamania counties.

Table 3.3.9-2. Population estimates and forecasts for selected areas of Washington. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Area	1999 Population	Estimated 2020 Population	1999–2020 Population Change (percent)
Washington State	5,757,400	7,610,089	+32.2
Cowlitz County	94,100	134,122	+42.5
Clark County	337,000	425,502	+26.3
Skamania County	9,900	12,809	+29.4

Labor Force and Employment

As shown in table 3.3.9-3, unemployment rates in Clark County have consistently hovered around four to seven percent over the past decade, but have risen sharply in recent years partly due to volatile and rising energy prices, which affected such basic manufacturing sectors as the aluminum industry. Historically, the county depended on

wood products as the key industry, but, with the decline of the timber industry in the early 1980s, the economy has rebounded with new industries locating in the county. A number of high technology companies established a presence in Clark County.

Table 3.3.9-3. 2000 and 2002 labor force and employment estimates for Clark, Cowlitz, and Skamania counties. (Source: PacifiCorp and Cowlitz PUD, 2004a)

	2000			2002		
	Clark County	**Cowlitz County**	**Skamania County**	**Clark County**	**Cowlitz County**	**Skamania County**
Total Labor Force	179,700	41,060	4,020	181,900	39,490	3,850
Total Employment	170,900	37,890	3,660	166,800	35,410	3,520
Total Unemployment	8,800	3,170	360	15,100	4,080	330
Average Unemployment Rate	4.9%	7.7%	8.9%	8.3%	10.5%	8.5%

Unemployment in Cowlitz County has largely followed trends similar to those in Clark County. Traditional manufacturing, however, has maintained a larger employment base in Cowlitz County. The restructuring and modernization of the timber industry eliminated a large number of jobs, resulting in a jobless rate that hovers just above the statewide average. Since the early 1990s, there has been significant expansion in the labor force due to population growth, the stabilization of timber jobs, and the attraction of new industries, all of which contribute to the relative health of the Cowlitz County economy through the 1990s. However, with the economic downturn over the past several years, county unemployment rates are up sharply.

None of these manufacturing operations are present in the Lewis River Valley. Basic manufacturing and other employment centers in Clark and Cowlitz counties tend to be located close to the Columbia River, in or near cities such as Kelso, Longview, Vancouver, and Camas and the Lewis River area remains remote and rural. Employment in the Lewis River Valley is principally related to rural resources, including the wood products industry, and recreation and tourism.

PacifiCorp has 25 full-time employees and four seasonal employees at the projects. Lewis River recreational operations provide seasonal jobs for approximately 42 campground hosts and maintenance personnel under contract with Thousand Trails, up from 33 seasonal employees as recently as 2000. Cowlitz PUD employs 143 people at its offices in Longview, including one FTE for relicensing/license compliance and up to two FTEs for other activities related to the Swift No. 2 Project.

Three fish hatcheries are operated by WDFW with funding by PacifiCorp and Cowlitz PUD on the Lewis River. Operation of the fish hatcheries currently provides employment for 20 to 25 people.

Existing recreational resources within the project boundary include campgrounds at Swift, Beaver Bay, Cougar, and Cresap Bay (totaling 259 campsites); day-use recreation at Merwin Park, Speelyai Park, Cougar Park, Eagle Cliff Park, Saddle dam, and Yale Park (totaling 270 picnic sites); seven boat ramps on the reservoirs and five boat launch sites on the river operated by PacifiCorp; and numerous dispersed sites in the basin. Annual recreational use is estimated to be 594,000 visitors per season for all recreational sites. These facilities provide seasonal jobs for approximately 42 campground hosts and maintenance personnel under contract with Thousand Trails.

Retail Services

To support the increasing demand of visitors traveling to the Mount St. Helens National Monument, GPNF, and project-related recreational facilities and reservoirs, private sector development along Lewis River Road (Route 503) has increased steadily over the years. In addition to the PacifiCorp-owned and operated campgrounds and day-use areas on the project reservoirs and lower Lewis River, there are a few private campground facilities in the vicinity, the majority of which cater to RV campers desiring hookups. The Lewis River RV Park provides 70 campsites adjacent to Lewis River road. Several campsites are offered in the immediate vicinity of the town of Cougar as well, including the Cougar RV Park (18 campsites) and the Lone Fir Resort and Trailer Park (32 campsites). A few small motels and bed and breakfast establishments, including as the Lone Fir Resort (17 motel rooms), operate along Lewis River Road, in Woodland, Ariel, and Cougar.

A variety of other private businesses support visitor activity in the Lewis River Basin as well. Several restaurants and services are dependant on recreation-related traffic in the vicinity of the projects, with the majority of their revenues occurring during the peak summer recreational season. General stores selling food, gas, recreational equipment, souvenirs, guidebooks and maps, and local crafts are concentrated in the town of Cougar. Jack's Restaurant and Store, at the intersection of Route 503 and the Route 503 Spur, is the location of the Forest Service Climber Registration for ascents of Mount St. Helens. Farther west, developed facilities such as hotels, motels, and larger stores are concentrated in the Woodland area. Although somewhat distant from the projects, Woodland is important as a major gateway into the Lewis River Valley from I-5, and project visitors are an important source of revenue for Woodland businesses. Based on sales patterns and discussions with management, it is clear that much of the strategy of these businesses is recreation-driven. Various factors including weather patterns, conditions in the Monument and GPNF, and operations of the projects that affect visitors' recreational experience can have a substantial effect on their revenues.

Housing

As of the 2000 census, the Lewis River Valley had 9,126 occupied housing units, a 49 percent increase in occupied housing units since the 1990 census. Of these, approximately 75 percent are located in Clark County, with most of the remainder located in Cowlitz County. Approximately 367 units of private housing are located in Skamania County, in the Northwood and Swift Creek reservoir area. Nearly all of these (339 units) have been constructed since 1990. Most are second family units, with very few being rented or owner-occupied. Approximately 83 percent of the occupied housing units in the Lewis River Valley were owner-occupied, with the remaining 17 percent renter-occupied (table 3.3.9-4).

Table 3.3.9-4. Year 2000 occupancy status by area. (Source: PacifiCorp and Cowlitz PUD, 2004a)

	Renter Occupied		Owner-Occupied			
	Total Units	Percent	Total Units	Percent	Vacant	Total Units
Clark County	42,454	33%	87,609	67%	3%	134,032
Cowlitz County	11,598	32%	24,252	68%	7.1%	38,594
Skamania County	980	26%	2,775	74%	17.9%	4,576
Lewis River Valley Area	1,529	17%	7,595	83%	9.5%	10,081

Electrical Utilities

Cowlitz PUD is the electric service provider for Cowlitz County. All ratepayers in Cowlitz County purchase electric power from Cowlitz PUD, with a few exceptions for some residential customers nearer to adjoining utility service areas and a few large industrial users. Cowlitz PUD currently offers favorable electric rates to its customers, with a rate structure less than the average of the state's 18 utilities. Table 3.3.9-5 compares 2002 residential rates of a number of northwest utilities.

Table 3.3.9-5. Comparison of northwest utility electricity rates for 2002. (Source: PacifiCorp and Cowlitz PUD, 2004a)

Electric Utility	Cost for 1,500 kWh	Average Cost per kWh
Douglas PUD	$35.64	2.38¢
Chelan PUD	$42.15	2.81¢
Pend Oreille PUD	$58.50	3.9¢
Clatskanie PUD (Clatskanie)	$59.25	3.95¢
Grant PUD	$63.23	4.21¢
PacifiCorp - Washington	**$66.90**	**4.46**
Lewis PUD	$72.75	4.85¢

Electric Utility	Cost for 1,500 kWh	Average Cost per kWh
Clatskanie PUD (Rainier)	$74.25	4.95¢
Okanogan PUD	$76.00	5.07¢
Cowlitz PUD	**$76.80**	**5.12¢**
City of Richland	$81.00	5.4¢
Puget Sound Energy	$90.53	6.04¢
Mason PUD (No. 3)	$91.20	6.08¢
Tacoma Power	$91.85	6.12¢
All Washington PUD customers *	$99.00	6.6¢
Clallam PUD	$102.36	6.82¢
Eugene Water & Electric Board	$104.30	6.95¢
Seattle City Light	$112.03	7.47¢
Portland General Electric	$113.15	7.54¢
Klickitat PUD	$114.01	7.6¢
Benton PUD	$113.70	7.58¢
Grays Harbor PUD	$114.85	7.66¢
Clark Public Utilities	$116.80	7.79¢
Snohomish PUD	$117.85	7.86¢
Franklin PUD	$117.85	7.86¢

As a public utility, Cowlitz PUD is a BPA preference customer. Excluding unusual load growth, BPA is required by law to meet Cowlitz PUD's needs in excess of the assured capability from Swift No. 2, the PUD's only generation resource. Cowlitz PUD currently obtains approximately 90 percent of its power for its residential, commercial, and small industrial customers from the BPA. Another 5 percent of its power mix for these customers comes from Grant County PUD's Priest Rapids/Wanapum Project, and the final 5 percent is from the Swift No. 2 Project. Swift No. 2 is used as a load-following plant in times of maximum power demand, and can therefore provide up to 30 percent of the load peaking needs of the residential, commercial, and smaller industrial customers in Cowlitz County. No power from the Swift No. 2 Project is allocated to the PUD's largest industrial customers, such as Weyerhaeuser. Pursuant to Cowlitz PUD's Partial Requirements contract, the Swift No. 2 power may not be sold into the open market.

As shown in table 3.3.9-6, Cowlitz PUD had eight major customer groups and 44,361 accounts as of the end of 2000. The single largest account is Weyerhaeuser Company, which contracts for more than half of Cowlitz PUD's load. Weyerhaeuser is also the largest employer in Cowlitz County, with 2,400 employees (River Cities Chamber of Commerce, 2001).

Table 3.3.9-6. Cowlitz PUD and PacifiCorp customer base. (Source: PacifiCorp and Cowlitz PUD, 2004a)

	Number of Customers	
Type	**Cowlitz PUD**	**PacifiCorp**
Residential	39,188	1,262,293
Commercial lighting and power	5,047	-
Small commercial or industrial	-	175,420
Small industrial	58	-
Large industrial	24	35,004
Public streets and highways	12	4,218
Other sales to public authorities	20	28
Sales to other electric utilities	2	-
Inter-departmental sales	10	-
Totals	**44,361**	**1,476,963**

PacifiCorp has a much larger customer base than the PUD, with approximately 1.5 million customers throughout six western states (table 3.3.9-6). The majority of these are residential customers. The power generated by PacifiCorp on the Lewis River goes into their overall power mix, which in turn is distributed throughout the west. The Lewis River Projects are only a portion of PacifiCorp's overall generating capacity within their service area, but the projects provide a significant portion of load-following and auxiliary benefits. In 2002, PacifiCorp's electricity rates were lower than the average rate ($66.90 for 1,500 kWh) of the 24 Northwest utilities, most of which are public utility districts, as seen in table 3.3.9-5.

Tax Revenues

Property/Utility Tax Revenues

The projects generate tax revenues that help support public services in the Lewis River Valley. A primary purpose of property taxes is to provide local governments with the necessary funds to provide public services, including fire and police protection, education, and infrastructure development and maintenance, as well as other basic human services. The majority of the human service demand generated by the projects, consisting of law enforcement and emergency response services, is driven by recreation-oriented visitation during the period from Memorial Day to Labor Day.

As a private corporation, PacifiCorp pays a state property tax on its lands and facilities. Revenues are distributed to the counties based on project valuation. Total 1999 property tax payments by PacifiCorp on the Lewis River facilities were $1.38 million, distributed as follows: Clark County received $680,956; Cowlitz County received $388,467; and Skamania County received $316,626.

As a Public Utility District, under state law Cowlitz PUD pays a Generation Privilege Tax directly to the state of Washington on power generated, rather than paying property taxes on its lands and facilities. A portion of this tax is then rebated to those counties where the power facilities are located. For the 1999 tax year, Cowlitz PUD paid a total of $1.39 million in privilege taxes, of which $0.78 million was rebated to Cowlitz County. Payments to Clark and Skamania counties were negligible. Table 3.3.9-7 presents combined tax payments from Cowlitz PUD and PacifiCorp to Washington State and the three counties affected by the projects.

Table 3.3.9-7. Combined Cowlitz PUD and PacifiCorp tax payment in 1999.[a] (Source: PacifiCorp and Cowlitz PUD, 2004a)

County	Tax Revenue	% of Total Taxes Paid
State of Washington		
▪ Cowlitz PUD Privilege Tax	$613,428	22.1
Cowlitz County (including cities)		
▪ Cowlitz PUD Privilege Tax	$779,919	
▪ PacifiCorp	$388,467	
Subtotal	$1,168,386	42.0
Clark		
▪ Cowlitz PUD Privilege Tax	$513	
▪ PacifiCorp	$680,956	
Subtotal	$681,469	24.5
Skamania		
▪ Cowlitz PUD Privilege Tax	$131	
▪ PacifiCorp	$316,626	
Subtotal	$316,757	11.4
Total Combined Project Taxes – 1999	**$2,780,084**	**100**

[a] The PUD tax payments to the state are reflective of the entire revenue of the PUD, of which the Swift No. 2 Project is only a small part.

Sales Tax Revenues from Recreation-Related Spending

Spending associated with recreational activities generates a substantial amount of economic activity in the U.S. Participants spend money on a variety of trip-related goods and services such as food, lodging, and transportation. Because this spending directly benefits towns and communities where these purchases are made, recreation can have a substantial effect on local economies, especially in small towns and rural areas such as the project area. To identify an approximate value of this benefit, the applicants estimated the total annual sales associated with the projects' recreational activity and the resultant sales tax revenue for Cowlitz County, indicating annual expenditures in the

study area to be $1.09 million. Local sales tax distributed to Cowlitz County as a result of recreation-related expenditures in the project area is approximately $109,000, based on a conservative estimate of daily expenditure rates by visitors when estimating actual expenditures. In actual practice, annual revenue probably fluctuates widely, as visitation can vary widely from year to year.

Flood Management

Life and property values in the Lewis River Valley below Merwin dam are periodically threatened by flooding. Floods causing significant damage are expected to occur about once every 25 years on average. Flood hazard is currently managed through flood management operation of the Lewis River Projects, issuance of flood notifications and warnings, and regulatory restrictions on development and land use in areas affected by flooding.

The applicants' assessment of the socioeconomic effects of current flood management practices was based on the flood damage experienced during the severe flood of February 1996. No estimates are available of the dollar value of flood damages experienced in this event; however, information is available on the area inundated by floodwaters and the number of dwellings or businesses affected. Under existing flood management operations at the Lewis River Projects, it is estimated that some 250 homes and businesses on the mainstem Lewis River below Merwin dam were flooded to levels above their finished floor levels. An unknown number of additional outbuildings, barns, sheds, and other structures also suffered some degree of flood damage. New FEMA requirements essentially prohibit new development within the regulatory floodway and require that new structures built within the 100-year floodplain outside the floodway have finished floor elevations one foot above the 100-year water surface elevation.

3.3.9.2 Environmental Effects

The applicants include a number of measures as part of their socioeconomic proposal, including the following:

- Fund three FTE law enforcement (marine- and land-based) positions.
- Contribute to County-developed installation and maintenance of emergency phone system for flood notification.
- Fund NOAA weather radio transmitter installation.
- Partially fund development of the Visitor Information Center (either $75,000 or enter into maintenance agreement.
- Contribute funds to maintain FR 90 as follows: one-time payment of $10,100 for bridge repair and annual payment of $ 27,000.
- Continue to support Pine Creek Work Center communication link.

- PacifiCorp would contribute $20,000 to Cowlitz-Skamania Fire Protection District No. 7.

While these measures may have indirect effects on socioeconomic resources within the project areas, they provide direct benefits to the management of recreational visitors and improve education and interpretation of natural resources in the project areas. As such, we consider these measures in section 3.3.6, *Recreational Resources*, and section 3.3.7, *Land Management and Use*.

Other environmental measures included in the applicants' proposal would have positive or negative effects on socioeconomic resources in the project area. Possible effects include direct changes in employment, tax revenue, and local expenditures, as well as indirect influences on the local economy. Overall, we find that the proposed measures would not have significant adverse effects on social and economic conditions in the area surrounding the projects, although electricity rate increases in Cowlitz County would adversely affect local residential, commercial, and light industrial customers. Most of the proposed measures would enhance the local economy by attracting more visitors and by constructing fish passage and recreational facilities. These are discussed in more detail below.

Effects of New Facilities on Local Economic Conditions

The applicants' proposed measures would involve the construction of a sorting facility and an improved entrance to the existing trap at Merwin dam for upstream passage of adult fish. A floating surface collector at Swift dam, along with facilities for holding and trucking the fish, plus spillway modifications at Yale dam, barrier nets at Yale and Merwin dams, a seasonal screw trap upstream of Swift Creek reservoir, and a release pond would be provided for downstream passage of juvenile fish. These facilities would be constructed following the fourth anniversary of the new licenses at an estimated cost of $14.2 million for the upstream improvements and $63.3 million for the downstream facilities.

Our Analysis

The equipment to be installed would require custom steel fabrication that most likely would be completed outside of the immediate area, possibly in Longview or, more likely, the Portland area. Thus, the labor related to fabrication would not support the Lewis River Valley, but would support either Cowlitz County or the broader regional economy. The applicants estimate that on-site construction labor would average approximately 34 construction workers per month for about 24 months. Since the construction work force would involve a number of different trades, an individual laborer is unlikely to be employed for the entire duration of construction. Given the limited duration of the construction period and the availability of construction workers within the adjacent three-county area, many of these workers are likely to commute to the site and/or stay in temporary housing such as campsites or RV parks for all or portions of

their on-site work. Thus, the economic benefit of the additional employment and demand for housing, goods, and services would be dispersed among the three-county region.

Over the life of the new licenses, the proposed trap-and-haul facilities would require crews to handle both upstream and downstream operations. A typical crew for the trap-and-haul facility would be two operators and one truck driver working 40-hours/week for the full year. A typical crew for the surface collection facility would be two full-time workers. Thus, a total of about 15 FTE employees would be needed for the three upstream and three downstream passage facilities. When the salmon are running at their peak returns (approximately 3 months of the year), temporary employees may be added. The regular workers are likely to be PacifiCorp employees, while the temporary employees may be hired locally. This would add a total of six PacifiCorp employees (five full-time and one seasonal) and a variable number of temporary employees to the local economy, an increase in PacifiCorp's on-site full time employees from 25 to 40 and seasonal employees from 42 to 45. The estimated payroll of $780,000 for the 15 full-time staff and $90,000 for the seasonal workers would have a multiplier effect on the local economy through expenditures on housing, goods, and services.

The applicants' fish passage proposal also includes additional fish passage improvements in future years. Downstream passage facilities would be added to Yale dam by the 13th anniversary of the new license and to Merwin dam by the 17th license anniversary. Upstream passage facilities would be added at both Yale and the Swift projects by the 17th anniversary as well. The applicants estimate that the costs for these additions would be about $119.2 million.

As with the initial passage facilities, the additional fish passage facilities would be fabricated off site, benefiting the larger region but not the immediate project area. Since the downstream facilities at Yale would be constructed in Year 13 and the remaining upstream and downstream facilities would be constructed in Year 17, there would be two construction periods. The Yale downstream construction period would require approximately 22 workers for 18 to 24 months. The remaining construction would require approximately 18 to 24 months and would average 40 workers per day. These labor forces would include a variety of different skills such that most workers would be needed for only a limited portion of this time. Given the short duration of the construction period for individual skills and the availability of construction workers within the adjacent three-county area, these workers are likely to commute to the site and/or stay in temporary housing such as campsites or RV parks.

The total number of workers over these 2-year construction periods would have economic effect on the local area – both positive and negative. The positive economic benefit would be the additional employment opportunities in the area and the associated demand for housing, goods, and services. The labor force would require an average payroll of approximately $1.2 million for the construction period, with a multiplier effect that would benefit the local and regional economy through expenditures on housing,

goods, and services. The potential negative effect would be two-fold: (1) if local RV parks and campgrounds that typically cater to tourists are filled by construction workers for two to three recreational seasons, the tourists may develop interest in other locations and not return to the Lewis River Basin; and (2) at the end of the construction period, the loss of construction workers may cause new or expanded businesses serving that labor force to lay off staff or to close.

The applicants' proposal includes many new recreational facilities, including trails, boat launches, day-use facilities, campgrounds, and the Visitor Information Center at Cougar. The various new facilities would encourage higher use levels within the project areas—estimated at a 20 to 25 percent increase over current levels, or approximately 120,000 to 150,000 additional recreation days (over the anticipated term of the new license). Increased use would support the economic development of the Lewis River Valley, particularly in Cougar, where the Visitor Information Center would induce travelers to stop. The center could orient visitors to events and commercial establishments throughout the valley. The applicants estimate that new operational employment associated with this alternative would be approximately nine seasonal employees for staffing the visitor center and for general maintenance. This represents an increase of 21 percent over the current level of 42 seasonal employees, if seasonal employees are hired.

Flood Management

The applicants do not propose to increase the amount of dependable flood control storage of 70,000 acre-feet. However, they propose to modify project operations and high runoff procedures to take advantage of flow forecasts. This would include implementation of pre-release policies in anticipation of forecast high flow events.

Our Analysis

As a result of adopting pre-release procedures and other forecast-based operating policies, the magnitude of floods from about the 5-year flood up to about the 50-year flood would be reduced. As such, releases from Merwin dam during an event similar to the February 1996 flood would be held to a peak flow of 60,000 cfs; actual peak discharge from Merwin dam during the 1996 event was about 85,000 cfs. The proposal would substantially reduce flooding above finished floor levels for an event the magnitude of the 1996 flood. The increase in flood magnitude for 2-year floods and smaller would have minimal adverse effect since flows at that level are unlikely to damage property and would have little effect on access to residential property. The magnitude of very severe floods (those that occur about once every 100 years on average and less frequently) would not change. The flood management season would be reduced by 2 weeks in years with below average March runoff forecasts (ending March 15 rather than April 1) to facilitate refilling the reservoirs. Overall, the proposed action would reduce flood damages and inconvenience in the Lewis River Valley below Merwin dam

for most flood events, and improve notification over existing conditions, thereby reducing socioeconomic effects.

3.3.9.3 Unavoidable Adverse Effects

None.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, PacifiCorp and Cowlitz PUD would continue to operate the Lewis River Projects under the terms and conditions of the current licenses. The environmental measures proposed under the SA would not be implemented, although the existing mitigation and enhancement measures (see section 2.1.2) would continue. These measures would essentially maintain the natural resources of the Lewis River Basin in a "status quo" condition, with some potential for enhancements in the areas of terrestrial resources (as habitat is allowed to improve via natural succession in protected areas) and recreational resources (as facilities are maintained or improved).

3.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Continued operation of the existing projects under any of the alternatives considered, would continue to commit the lands and waters previously developed for energy production. This commitment of resources would not necessarily be irreversible or irretrievable because removal of the project dams and restoration of disturbed areas could return the project areas to near pre-project conditions. However, given the substantial costs and the loss of energy, recreational, and socioeconomic benefits, removal of the dams is unlikely in the foreseeable future.

3.6 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Under all alternatives considered, the projects would continue to generate power for the customers of Cowlitz PUD and PacifiCorp and provide recreation and socioeconomic benefits for the duration of any new licenses. The proposed action and staff recommended alternative would provide significant long-term protection and enhancement of biological, cultural, and recreational resources in the Lewis River Basin, although energy generation at the projects would be somewhat reduced.

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