Draft

Cowlitz River Subbasin Summary

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Subbasin Description

General Description

Subbasin Location

The Cowlitz River is a second order stream that originates on the west slope of the Cascade Mountain Range in Southwest Washington State. The river flows west from its source, then south to where it empties into the Columbia River at Kelso, Washington, about 68 river miles upstream from the Pacific Ocean (Figure 1).

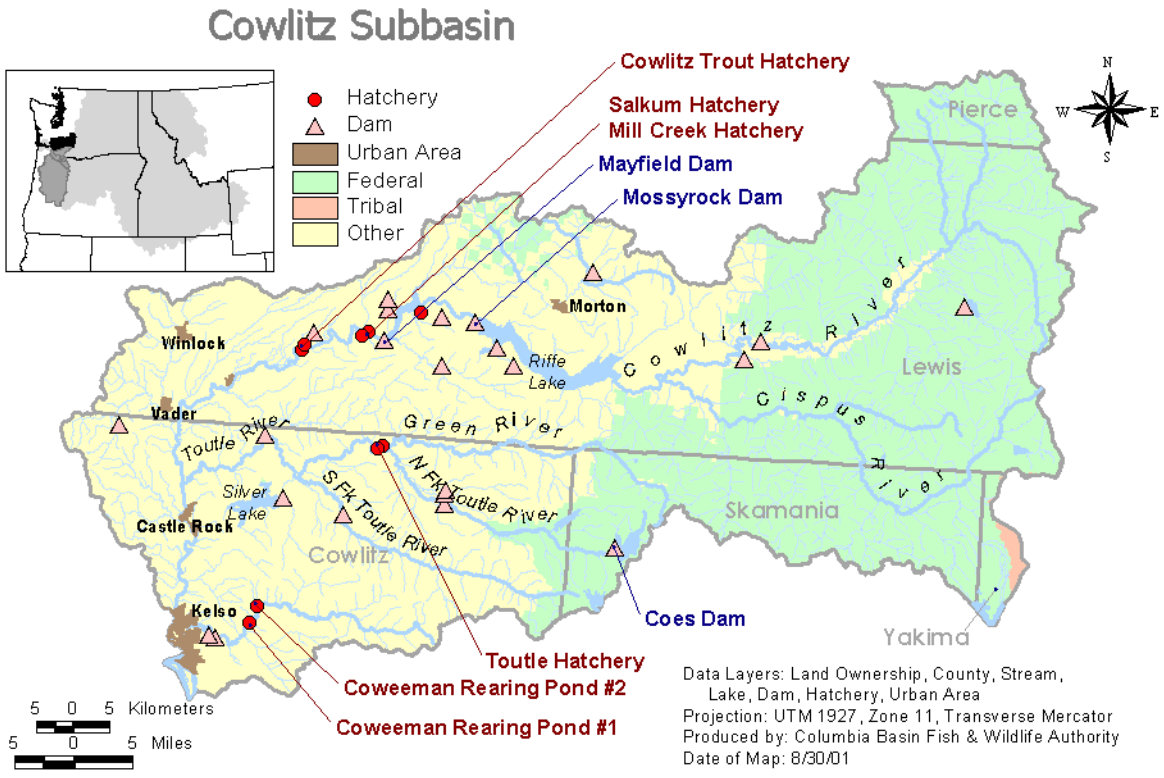

Figure 1. Cowlitz Water Resource Subbasin map.

Drainage Area

The Cowlitz River drains approximately 2,480 square miles over a distance of 151 miles. Principle tributaries to the Cowlitz River include the Coweman, Toutle, Tilton, Cispus, Ohanapecosh and the Clear Fork. The Toutle River is the largest, draining 512 square miles and enters the Cowlitz River at RM 20.0. The Cispus River (RM 89.8) is the most

significant tributary in the upper Basin and drains 433 square miles. The mainstem above the confluence of the Cispus-Cowlitz River drains 609 square acres.

Climate

The climate in the Cowlitz Basin is tempered by the Pacific Ocean, with moderately warm summers and cool, but normally not extremely cold winters. The average summer temperature in the upper valley (Glenoma) is 64 degrees Fahrenheit. The comparable winter average is 38 degrees. During summer, rainfall is relatively light, typically with several weeks of no precipitation. Rains are more frequent the rest of the year, particularly in late fall and winter. Snow and freezing temperatures are fairly uncommon in the major portion of the watershed, but regularly occur during the winter months at higher elevations. Annual precipitation varies from 45 inches near Kelso to over 150 inches on Mount Rainier, Adams, and St. Helens, with over 69 percent of the annual precipitation falling between October 1st and March 31st.

Topography

The Cowlitz River flows generally westward from Mount Rainier, the highest mountain in Washington State at 14,410 feet, to the Columbia River. The eastern part of the Cowlitz River valley is located in the Cascade physiographic province and is characterized by a deeply cut trough and flat bottomlands, terraces, and broad plains. To the north and south of the valley, the uplands have rugged mountainous topography, modified by glacial activity and drained by rivers that trend generally westward (Harza 1999c). Landscape characteristics include, long steep slopes and relatively straight, parallel drainage-ways. The western portion of the Cowlitz River valley lies within the northern end of the Puget-Willamette Lowlands physiographic province, and has moderate relief with a broad floodplain; elevations seldom exceed 500 feet (WDW 1990).

Geology

The Cowlitz River originates in the volcanic peaks of the Southern Cascade Mountains. The river flows west through a valley heavily influenced by alpine glaciers, then turns south and flows between the Cascades and the Willapa Hills to the Columbia River (Harza 1999c). The upper Cowlitz Basin (located in Washington's southern Cascades) are made up primarily of andesite and basalt flows and associated breccias and tuffs. Areas adjacent to volcanic peaks are generally mantled with pumice deposits (WDW 1990).

The runoff from portions of Mount Rainier, Mount Adams and Mount St. Helens drains into the Cowlitz River. These normally inactive volcanoes have helped shape the geography of the area. The eruption of Mt. St. Helens on May 18, 1980 sent a tidal wave of melted ice and pulverized rock down the Toutle Valley into the Cowlitz River, and carried so much of this coarse sandy material and debris all the way to the Columbia River that dredging was required to clear the channel before river shipping could be resumed.

Large scale removal of this volcanic material in the Cowlitz River began at the lower end of the Toutle River by July, 1980 and continued on down the Cowlitz River until engineers were reasonably confident that the cleared channel could handle expected winter

flows without topping dikes and flooding Castle Rock, Longview and Kelso. A dam to control sediment was then constructed further up the Toutle River by the Corp of Engineers to prevent the re-silting of the dredged sections.

Soils in alluvial deposits along the major west-flowing streams are generally coarse textured soils (Franklin and Dyrness 1973 as cited in WDW 1990). The lower half of the basin is generally comprised of Eocene basalt flows and flow breccia. Haplohumults (reddish brown lateritic soils) are the most common under forest vegetation; soils under grasslands are classed as Argixerolls (prairie soils) (WDW 1990).

Potentially severe erosion would occur on over 83 percent of the land in the Cowltiz Basin if vegetative cover were removed. Over 81 percent of the land with severe to very severe erosion hazard is in commercial forest (USSCS 1974). The greatest erosion problems are from ground disturbance from road building and other activities associated with logging (USSCS 1974).

During the Pleistocene (3 million years to 8,000 years ago) several alpine glaciers moved down the Cowlitz River valley depositing till and outwash (glacial river sand and gravel deposits). These glaciers, 1000 feet thick or more, cut down into the former river channel and underlying bedrock (Coombs 1989 as cited in Harza 1999c). At least six alpine glacial advances have been documented. Glacial outwash sands and gravels form terraces in the vicinity of the Cowlitz River and were deposited by streams from the melting alpine glaciers located up the valley. Silt-loam loess, representing windblown glacial silt, blankets large areas of the basin (Crandall and Miller 1974 as cited in Harza 1999c). The thickness of the loess varies from a few feet to 20 feet.

Following deposition of the youngest glacial deposits, approximately 13,000 to 25,000 years ago, the Cowlitz River eroded and reworked the glacial deposits. The resulting alluvial deposits range from coarse boulders to cobbly gravel to fine sand and silty sand. Thick alluvium is generally confined to the area of the immediate Cowlitz River flood plain (Harza 1999c).

Vegetation Structure and Composition

The forest series or zones in the Cowlitz watershed are typical of those found in the southern Cascades of Washington State. These forest zones are based on the climax tree species of the four major plant communities within the basin (western hemlock, Pacific silver fir, mountain hemlock, and subalpine fir). Above 3,500 feet, forests are generally Pacific silver fir with Douglas fir, western hemlock, mountain hemlock, and lodgepole pine as common associates. Understory is primarily huckleberry, fool's huckleberry, and salal. Below 3,500 feet, climax species are western hemlock, Douglas fir, and western red cedar. Understory species include vine maple, huckleberry, salal, sword fern, and devil's club. Hardwood species (alder, cottonwood, maple, and willow) are concentrated in riparian corridors along larger streams and rivers (WDW 1990).

Historically, fire was the strongest natural disturbance influencing vegetation structure and composition within these different plant communities (USFS 1997a). However, the eruption of Mount St. Helens has shown the potential influence that volcanism can also exert on vegetation composition and structure within the watershed.

Logging, and in some areas grazing, have also had substantial impacts on vegetation structure and composition and riparian areas throughout WRIA 26 (WDW 1990).

The Washington Department of Natural Resources derived vegetation cover for 26 WRIAs in Western Washington, including WRIA 26, using 1988 Landsat 5 TM data (PMR 1993) and updated with 1991 and 1993 TM data (see Lunetta et. al. 1997 for additional details). Forest cover was broadly categorized into four classes based on forest type and age class. The non-forest land cover and most surface water features were then overlaid on the forest-cover classification to discriminate non-forest lands, such as agriculture and urban areas from forest lands (PMR 1993).

Late seral stage vegetation still covers a fairly large percentage of the Cowlitz River basin. USFS (1997a) estimates that 28% of the vegetative cover in the upper Cowlitz River watershed and 19% in the middle Cowlitz watershed is in "large tree" (similar characteristics to late seral stage).

Disturbance Regime

Historically, fire has also been the most significant overall disturbance mechanism in the Cowlitz watershed (USFS 1997a and 1997b). Large fires within a watershed will tend to increase siltation through erosion, alter the timing and quantity of high and low flows, influence stream temperatures, and increase the short-term large woody debris (LWD) supply to streams and decrease the long-term supply (USFS 1995). In general, riparian areas tend to have microclimatic effects which somewhat protect them from many wildfire events so that late-seral stands are more prevalent there. This effect is more pronounced in steeper drainages.

Historically, fires in the Cowlitz basin were low in frequency, but high in severity, and had the potential to be quite large. For example, six fires of 1,000 acres or larger burned in the Middle and Upper Cowlitz watershed analysis areas between approximately mid- to- late 1800 to 1920. The largest fire burned approximately 27,000 acres (USFS 1997a). Fire suppression activity since the 1930's has significantly reduced the potential natural wildfire effects for this watershed (USFS 1997a).

Volcanic activity can have significant influence on aquatic habitats as evidenced by the recent eruption of Mount St. Helens. Mount St. Helens has deposited ash and pumice across portions of the Cowlitz watershed at least twice over the last 4,000 years; it erupted a cluster of times during the Smith Creek Eruptive Stage (3,900 to 3,400 years ago) and again during the 1980 eruptive phase (USFS 1997b). Mount St. Helens has erupted about once every century for the last 500 years, and is expected to follow a similar pattern in future centuries (USFS 1997b). Mount Rainier is another active volcano in the Cowlitz Basin and is potentially the most dangerous volcano in the Cascade Range. Many debris flows and their distal phases have inundated areas far from the volcano during postglacial time (Scott et. al. 1995 in USFS 1997b). According to recent hazard maps of the area (Scott and Valance 1995 in USFS 1997b), most of the upper Cowlitz River valley (floodplain) could be inundated by a mudflow, with or without an associated volcanic eruption.

The 1980 eruption of Mount St. Helens devastated fisheries resources in the North and South Fork Toutle River watersheds (WDW 1990; Lucas 1986; Jones and Salo 1986; Lislie et al. 1982; Collins and Dunne 1981). Tributaries in the upper North Fork Toutle watershed were completely destroyed as massive landslides and debris-flows traveled 21.7 km (13.5 miles) down the North Fork (Jones and Salo 1986). Deposition of debris flows buried 59 km² (23 square miles) of terrain to an average depth of 46 meters (150 feet), including more than 43.4 km (27 miles) of anadromous stream habitat (Jones and Salo 1986). Many stream systems that were not directly affected by the debris flows were still blanketed with substantial amounts of ashfall and most of the vegetation in the watershed was blown down by the eruption (Lucas 1986).

Over 74 million cubic yards of material had to be removed from the Cowlitz River within the first year after the 1980 eruption to maintain flood capacity (Cowlitz County 1983). Floodplain and wetland habitat along portions of the lower Cowlitz and Toutle Rivers was filled with the dredge spoils. Stream systems are recovering slowly from the effects of the eruption; however, elevated sediment loads, channel widening, lack of large woody debris and riparian cover all remain problems today.

Hydrology

Primarily, Cowlitz River runoff results from rainfall. During the late spring, however, snowmelt from the headwaters area contributes appreciably to the stream flow (WDF1951). In the upper basin, river flows are influenced by spring snowmelt and dry summer conditions. A few major tributaries drain glaciers on Cascade peaks and contribute glacial meltwater during the summer months. Stream gages near Kosmos (RM 88.7) show a few peaks in May and June triggered by rapid snowmelt (Harza 1999c). However, the majority of peak flows occur between November and February, indicating that winter rain or rain-on-snow events trigger most floods in the basin (Harza 1999c). Flow in small tributary streams in the lower basin is controlled more by rainfall than snowmelt, and peak flows are usually triggered by fall and winter rainstorms (Harza 1999c).

Three major hydroelectric projects have been constructed on the mainstem Cowlitz River. The first is Mayfield Dam (RM 52.0), followed by Mossyrock Dam (RM 65.5), and furthest upstream is the Cowlitz Falls Dam (RM 88.5). The combination of the Mayfield and Mossyrock dams comprise the Cowlitz River Project owned by Tacoma Power, and are identified as FERC No. 2016. In addition, Tacoma Power placed a low Barrier Dam below Mayfield to intercept fish as part of the operation of it's salmon hatchery.

Construction began on the Mayfield Dam in 1956, and the Mossyrock Dam was completed in 1968. Riffe Lake, the reservoir behind Mossyrock Dam provides 1,686,000 acre/feet of storage, and has a length of 24 miles. Its surface area is 11,830 acres and the Mayfield Dam reservoir has a surface area of 1,250 acres, and 133,764 acre/feet of storage. The two dams have a combined rated capacity of 1,904,000,000 kilowatt hours annually.

Riffe Lake acts as a huge storage facility to both control flood flows and to hold water for future power generation. Flows out of Mayfield Dam are controlled by managing the storage in Riffe Lake (Harza 1999c). Riffe Lake is drawn down in the fall to provide

flood storage for winter flood flows. Mayfield Lake is generally not drawn down and does not provide significant flood storage (Harza 1999c). When inflow to Mayfield Lake from the Tilton River and Winston Creek is high, generation at Mossyrock powerhouse can be shut down entirely to minimize flows to the lower river.

Cowlitz Falls Dam, the third hydroelectric dam on the river, is owned and operated by Public Utility District No. 1 of Lewis County under FERC license No. 2833. It is a smaller run-of-the-river project located just above Riffe Lake and began commercial operation in 1994. The rated capacity is 70 megawatts, with an average generation of less than 30 megawatts. Lake Scanewa, the small reservoir created by the dam, is approximately 11 miles long, with 610 surface acres. The Bonneville Power Administration purchased all the power that will be generated at Cowlitz Falls in an agreement that expires in 2032.

The analysis of flood frequencies is based on the highest (peak) instantaneous flow that occurs at a stream gage each year for the analysis period (1969-1997). The results of the analysis are described as the probability of a peak flow occurring in a given year, or a typical return period for a given peak flow (Harza 1999c). Under current conditions, the effects of the operation of the dams can be seen by comparing the peak flows for certain return periods at the Kosmos gage (at Cowlitz Falls Dam) with the gage below Mayfield Dam. Lower Cowlitz River flows are increased further by water from the Toutle River and other lower Cowlitz River tributaries.

Minimum flows have also been affected by the operation of the dams on the Cowlitz. In November 1997, an agreement was reached between Tacoma and the Washington Department of Fish and Wildlife to maintain flows below Mayfield Dam at a level that protects salmon and steelhead resources in the lower Cowlitz mainstem (Harza 1999c).

Other dams and major passage barriers within WRIA 26 include:

- The North Fork Toutle River Sediment Retention Structure Project (SRS) is operated by the Army Corps of Engineers (the Corps) to prevent Mt. St. Helens coarse sediments deposits in the lower watershed. The SRS has filled with coarse bedloads to spillway level. Coarse sediments are expected to flow over the SRS spillway during high flows (LCSCI 1998).

- The North Fork Toutle River - Fish Collection Facility, is just downstream from the SRS, and is operated by WDFW. This facility was installed to collect and separate fish. (LCSCI 1998). TAG members with the WDFW state that the FCF is inoperable much of the time due to sediment that jams the doors. This has occurred at crucial times during adult fish migration, and they have been unable to allow any adult passage when heavy sediment loads are moving through the system.

- The Barrier Dam is a 12-foot-high, concrete barrier constructed on the Cowlitz River at RM 49.5 in 1969 to divert all adult anadromous migrants into the Cowlitz River Salmon Hatchery. It is the first barrier anadromous fish encounter on the mainstem Cowlitz. Since its completion, the Barrier Dam diverts almost all of the

adult migrants into the salmon hatchery. The TAG members state that very few adults get over the Barrier Dam.

- The Mill Creek Hydroelectric Project was constructed in the early 1980s and is operated by Lewis County PUD. It was constructed just over one mile from the mouth and is at or near the historic upstream limit to anadromous fish migration. It operates as a run-of-the-river, non-storage project. (LCSCI 1998).

- The Green River has two hatchery barriers that are a complete block to anadromous fish.

- A private dam on Ferrier Creek is a reported barrier to fish passage (TAG).

- The Blue Creek Hatchery forms a complete block to anadromous fish.

- The Silver Lake Water Level Control Structure on Outlet Creek.

Major Land Uses

Forestry is by far the most dominant land use for all subbasins within WRIA 26 (Wade 2001). In the Cowlitz River floodplain below Mayfield Dam, agriculture and other uses made up only 16 percent of land use in 1974 (WDW 1990). Some of the percentages have changed since 1974 due to substantial amounts of residential and industrial development within the basin. The percent increase in population for Cowlitz and Lewis County from 1970 through 1996 was 24% and 31% respectively (Harza 1999c). The most substantial population growth during this period in both counties occurred between 1990 and 1996.

There is a significant amount of the land base in WRIA 26 in public ownership. Tacoma Power also owns 14,514 acres that are designated as wildlife mitigation lands for the hydroelectric projects on the Cowlitz River (Harza 1999 DEA). Most of the federal and state owned lands are in commercial forestry.

The earliest and most extensive assessment of fish habitat in the Cowlitz River Basin was completed by the Bureau of Fisheries from 1938-1942 (Bryant 1949). These surveys provide exceptional historical information for anyone interested in additional data on the quality and quantity of fisheries habitat within Cowlitz River watershed.

Agriculture has never been a major use of land in either county. Lewis County has a total harvested cropland of 29,440 acres, and Cowlitz County only 8,227 acres. The vast majority of land in of both counties is used for growing trees. Less than 1 percent of the total wages paid in Lewis County in 1994 were related to agriculture, forestry, or fishing. The comparable figure for Cowlitz County was 2.7 percent.

Demographics

All of the Cowlitz Subbasin falls within Lewis and Cowlitz counties. Most of the Cowlitz River lies in Lewis County, with less than 30 miles of the river in Cowlitz County.

Lewis County has a total population of 65,500, with 25,323 living in the unincorporated areas. The total land area is 2,407.8 square miles (1,540,992 acres), giving the rural population an average density per square mile of only 10.5 or 11 people. Cowlitz County has a total population of 89,400 with 37,755 living in unincorporated areas. It has a land area of 1,138.7 square miles (728,768 acres), and a rural density of about 33 persons per square mile. Most of this rural population is actually concentrated in unincorporated suburb communities to Longview and Kelso.

Fish and Wildlife Resources

Fish and Wildlife Status

Fish

The Cowlitz River historically supported abundant runs of anadromous salmonids including spring and fall chinook, coho, steelhead and cutthroat. Most of the anadromous fish production occurred in the watershed upstream of Mayfield Dam. Harvest, habitat degradation and the construction of Mayfield and Mossyrock Dams contributed to the decline of these populations. All of the spring chinook, 46% of the fall chinook, 77% of the coho and 80% of the steelhead were estimated to have spawned in the upper watershed (GAIA, 1994). The construction of the two dams effectively removed this area from wild fish production. The 1980 eruption of Mt. St. Helens also dramatically degraded the Toutle River system, and the mainstem Cowlitz River below the mouth of the Toutle.

Since the completion of Mossyrock and Mayfield Dams, and the hatchery complex below Mayfield Dam, the Cowlitz River has been managed primarily as a hatchery system. Until recently, all salmon were managed as hatchery stocks. Cowlitz River Steelhead (late winter) and cutthroat were a mixture of both hatchery and natural stocks(WDW 1990; Tipping 2000, personal comm.). Limited natural production has occurred in the Tilton River, lower Cowlitz, the Toutle, Green, Coweeman Rivers and other small tributaries. The Cowlitz subbasin is managed for winter and summer steelhead, coastal cutthroat, fall and spring chinook, and coho. Chum salmon are also present, but in extremely low numbers. Sturgeon and pacific lamprey are present in the lower reaches in reduced numbers, and smelt runs still occur cyclically.

In 1994 a trap and haul program to reintroduce anadromous salmonids to the watershed above the Cowlitz Falls Dam began. Adults collected at the hatchery complex are trucked upstream and released to spawn naturally, and juveniles produced at the hatchery are released in the upper watershed to produce additional smolts. Smolts from the progeny the adults that spawned naturally and from the releases of juveniles are collected at the Cowlitz Falls Fish Collection Facility. These smolts are identified and enumerated and transported downstream to stress relief ponds at the Cowlitz Salmon Hatchery from where they are released into the Cowlitz to continue their migration. Currently, the anadromous reintroduction plan is placing native (late) winter steelhead, and coho in the Upper Cowlitz, Cispus and Tilton subbasins. Spring and Fall chinook have been released in the Upper Cowlitz and Cispus. Fall chinook and coastal cutthroat have been released in the Tilton.

An anadromous component from the coastal cutthroat trout population in the Upper Cowlitz and Cispus still exists and the number of smolts collected has steadily increased each year since the collection facility was completed.

The Cowlitz River may be the most intensively-fished subbasin by the sport-fishery in the state. It has been the top winter steelhead river in Washington, and the Toutle was in the top five before the 1980 eruption of Mt. St. Helens. Both rivers are also popular summer steelhead streams. In good return years, the Cowlitz attracted immense angler effort for spring chinook. Both the Cowlitz and Toutle attracted considerable angler effort for fall chinook and coho (WDW 1990).

The fish assemblages in the Cowlitz River Basin are summarized below by species and location within the basin, beginning with a historical overview. Fish found in the watersheds above the dams have been primarily resident since 1973, however anadromous fish are now being re-introduced into both the Tilton and upper Cowlitz watersheds. The Cowlitz Falls Anadromous Fish Reintroduction Program began in 1994 with late winter steelhead, coho and spring chinook. A similar plan for the Tilton is being developed and will be gradually implemented (Dammers, 2000 pers. Comm.)

Steelhead (*Oncorhynchus mykiss)* (Threatened, Lower Columbia ESU, 3/98)

There is little information available to indicate that lower-Columbia winter steelhead stocks are genetically distinct from one another. The stocks are treated separately by WDFW due to geographical isolation of spawning populations (WDF et. al.1993). Winter Steelhead are indigenous to the Cowlitz Basin where they were historically abundant and probably present throughout the watershed (WDW 1990). Between 1961 and 1966, WDF collected an annual average of 11,081 adult steelhead at the Mayfield fish passage facility (Meekin and Birtchet 1963; Thompson and Rothfus 1969). After the construction of Mossyrock Dam in 1968, wild steelhead returns plummeted due to lack of juvenile outmigration and adult upstream passage (LCSCI 1998). It is estimated that wild steelhead production in the mainstem Cowlitz is minimal, but key wild production areas still exist in lower river tributaries such as Olequa Creek (LCSCI 1998).

Cowlitz River Winter Steelhead

Upper Basin

The estimated annual production of winter steelhead in the upper Cowlitz River in 1948 was 22,000, with an estimated escapement of 11,000 (WDG/WFC 1948). Between 1961-62 and 1965-66 an average of 11,081 adult steelhead were collected at the Mayfield Dam fish collection facility with a low of 8,821 in 1962-63 and a high of 13,155 in 1964-65 (Thompson and Rothfus 1969). Winter steelhead were known to spawn in the mainstem Cowlitz River near Riffe and in a reach from the mouth of the Muddy Fork to the mouth of the Clear Fork (Kray 1957). Substantial spawning was also observed in the Tilton and lower Ohanapecosh rivers (Kray 1957). Approximately 80 percent of the historic winter steelhead spawning and rearing areas were above the dams (WDF et. al. 1993). Restoration of the steelhead population upstream of Cowlitz Falls Dam should provide an estimated 6,000 to 7,000 wild adult steelhead (WDF et. al. 1993).

Adult steelhead released into the upper watershed have increased from 27 females in 1996-7 to 274 females in 2000-1. These fish were a combination of hatchery and naturally reared fish, and spawning has been observed in the main Cowlitz and Cispus Rivers. Field surveys have found steelhead/rainbow trout juveniles in all of the anadromous tributaries. Juveniles have been collected at the Cowlitz Falls Dam since 1996 and trucked below the Barrier Dam (John Serl 2000, personal comm.).

Lower Cowlitz River

The wild stock in the lower river is considered depressed based on chronically low returns (LCSCI 1998). Most of the natural spawning takes place in Olequa, Ostrander, Salmon, Arkansas, Delameter, and Monahan creeks (WDF et. al. 1993). Currently, the Cowlitz Trout Hatchery is the primary source of winter steelhead production in the lower Cowlitz River. In 1990, it was estimated that naturally spawning steelhead below Barrier Dam were less than two percent of the total run (WDW 1990). Between 1983 and 1995, the average annual escapement of Cowlitz River winter steelhead was 16,240, and has ranged from 4,067 fish in 1983 to 30,200 fish in 1995 (Harza 1999c). As part of the WDFW/Tacoma City Light mitigation agreement, WDFW is managing for 750,000 smolts, which are intended to provide a return of 22,000 adults and a sports catch of 15,400 fish (WDW 1990).

North Fork Toutle River

The mainstem North Fork Toutle River has been planted with hatchery steelhead since 1953 (WDF et. al. 1993). No historical production estimates are given for this stock. Currently, winter steelhead spawning occurs in Hoffstadt, Outlet, Alder, and Deer creeks (WDF et. al. 1993). Current winter steelhead stocks are considered depressed based on chronically low returns. Spawning escapements were estimated from 1989 through 1992 with a low of 18 in 1989 and a high of 322 in 1992. The stock will likely remain depressed until spawning and rearing habitat in the mainstem improves from the 1980 eruption of Mt. St. Helens (WDF et. al. 1993). There has been no escapement goal set. The mean escapement from 1991 to 1996 for the mainstem North Fork winter steelhead was 185 fish. It is estimated that from 1991 to 1996, none of the run was from hatchery fish (LCSCI 1998). The Toutle River is managed for natural winter steelhead production (WDW 1990).

Green River

Historical production estimates are unavailable for Green River winter steelhead stock. Currently, the winter steelhead spawning occurs in Devils Creek, and Elk Creek (WDF et. al. 1993). Aside from several small fry plants after the 1980 eruption of Mt. St. Helens, no hatchery winter steelhead have been stocked into the Green River (WDF et. al. 1993), and the river is currently managed for wild production (Tipping 2000, personal comm.). Current winter steelhead stocks are considered depressed based on a short-term severe decline (LCSCI 1998). Spawning escapements were estimated from 1985 through 1992 (except 1986) with an average of 265, a low of 44 in 1989, and a high of 402 in 1987 (WDF et. al. 1993). There has been no escapement goal set for the Green River. Mean escapement from 1991 to 1996 for the Green River winter steelhead is estimated at 108

fish. It is estimated that from 1991 to 1996, 17 percent of the run was from hatchery fish (LCSCI 1998).

South Fork Toutle

The South Fork Toutle winter steelhead are a mixed stock of wild production (Tipping 2000, personal comm.). Current winter steelhead stocks are considered healthy, with most spawning occuring in the mainstem. Spawning escapements were estimated from 1984 through 1992 with an average of 1,381, a low of 752 in 1990, and a high of 2,222 in 1988. The escapement goal of 1,058 was exceeded 6 of the 9 years (WDF et. al. 1993). The mean escapement from 1991 to 1996 was estimated to be 893 fish. An estimated 17 percent of the run during these years were hatchery fish (LCSCI 1998).

Coweeman River

The Coweeman River has been planted with hatchery steelhead since 1957 (WDF et. al. 1993). These fish were intended to supplement the sport fishery. No historical production estimates are given for this stock. Currently, winter steelhead spawning occurs throughout the basin (WDF et. al. 1993) as a mixed stock of wild production (Tipping 2000, personal comm.). While hatchery steelhead smolts have been stocked in this and nearby streams, there is little contribution to the wild winter steelhead stock from hatchery fish spawning in the wild (WDF et. al. 1993), although it is managed for both natural and hatchery production (WDW 1990). Winter steelhead stocks are currently considered depressed based on chronically low returns (LCSCI 1998). Spawning escapements were estimated from 1987 through 1990, with a low of 392 in 1989 and a high of 1,088 in 1988. The escapement goal of 1,064 wild steelhead was exceeded only during 1988 (WDF et. al. 1993). The mean estimated escapement from 1991 to 1996 was 351 fish. It is estimated that from 1991 to 1996, 27 percent of the run were hatchery fish (LCSCI 1998).

Summer Steelhead (Oncorhynchus mykiss)

Historically, few summer steelhead were produced in the Cowlitz River watershed. Very little information is available describing historical abundance and life history of summer steelhead prior to the construction of the Cowlitz Trout Hatchery in 1968 (WDW 1990). From 1962 through 1966, 75 of the 54,044 steelhead counted at the Mayfield Dam upstream fish-passage facility were observed from July to October (Thompson and Rothfus 1969). Summer steelhead only exist below Mayfield Dam as a hatchery stock.

Summer steelhead were introduced into the Coweeman River in 1966 and into the Cowlitz and Toutle rivers in 1968 (WDW 1990). The WDFW management objective is to provide a sport harvest in the Cowlitz and Toutle Rivers with 15,000 and 3,000 fish, respectively. Between 1983 and 1992, the average summer steelhead adult return to Cowlitz River was 4,556, and has ranged from 759 fish in 1983 to 9,019 fish in 1992 (Harza 1999b). WDFW does not address the Cowlitz River summer steelhead stock in the SaSSI report (WDF et. al. 1993); however, for 1980 and 1981, natural fish contributed a mean of 8.7 percent of sampled adults (Tipping 1981 and 1982 as cited in WDW 1990). In the Toutle River, natural fish comprised 6.9 percent of the sampled fish in 1981; however,

the number of natural fish present is now estimated at about 50 fish due to the eruption (WDW 1990).

Cutthroat (Oncorhynchus clarki clarki) (ESA propsed)

In the late 1940s, coastal cutthroat trout were abundant in the Cowlitz River and distributed throughout the watershed (WDF/WGC 1948; Bryant 1949). In 1948, the estimated annual production, based on angler spot-checks in the "upper river", was 49,722 adults. Spawning escapement was estimated to be 24,861 fish. Between 1961 and 1966, adult coastal cutthroat returns to the Mayfield fish passage facility averaged 8,158 fish, ranging from 5,458 fish in 1961 to 12,324 in 1964 (Thompson and Rothfus 1969). Angler-harvest data was not collected or estimated during this period, so actual production from the upper watershed is difficult to estimate. Because of the assumptions involved with this method of estimation, it is likely that these estimates contain a substantial amount of error. Also, these counts do not represent production for tributaries that enter the Cowlitz River below Mayfield Dam (Harza 1997b).

Upper Cowlitz Basin

Coastal cutthroat trout exist in the upper Cowlitz basin as both resident and anadromous forms. Populations exist in almost all tributaries both below and above anadromous barriers. These are all wild and self-sustaining. An average or 816 smolts are captured at the Cowlitz Falls Fish Facility per year (217-1,323) with between 2 and 23 adults returning each year. Marking for adult return identification began in 1998. One of the returning adults had otolith micro-element content analysis performed and the results suggested that the fish reared in saltwater, and it appears that anadromy can be reintroduced into the population. Smolts migrate from the upper river from May through June, adults return from August to January.

Tilton River

Anadromous cutthroat smolts were first tagged for return to the Tilton in 1998 (Tipping 2000, personal comm.). An average of 337 smolts emigrated from the Mayfield Dam facility in 1998-1999, of which only 2.8% returned to the Barrier Dam as adults (Tipping and Harmon 2000). SaSI Coastal Cutthroat (WDFW 2000) lists the Cowlitz River as depressed based on chronically depressed adult and juvenile trap counts and a long-term decline in Columbia River catch from RM 72 to RM 48.

Lower Cowlitz Basin

The present status of the mixed origin hatchery coastal cutthroat trout in the Cowlitz River is relatively stable (Tipping 2000 personal comm.). After completion of Mayfield and Mossyrock dams, the Cowlitz Trout Hatchery has been used to maintain runs. Hatchery returns averaged 23,454 fish for the 1970s, 2,420 fish for the 1980s, and 2,550 fish for the 1990s (Tipping and Harmon 1999).

The WDFW/Tacoma City Light mitigation agreement states that runs to the Cowlitz are to be a total of 38,600 adult anadromous game fish, and that WDFW shall select the numbers and kinds of species to rear and plant. Currently, the WDFW is

managing for 10,000 coastal cutthroat. The agreement further stipulates sport harvest and rack returns would both be at 50 percent (WDW 1990). Hatchery objectives are to maintain the run and provide a recreational fishery with a mitigation goal of 160,000 smolts per year (Tipping 2000, personal comm.). The migration peak of wild and hatchery cutthroat occurs in August and September, and the spawning peak of hatchery fish is from November to December, about two weeks earlier than wild fish (Tipping 2000, personal comm.; WDFW 2000).

Little is known of the recent status of wild coastal cutthroat trout. A 1979 survey found that an estimated 40% of the 5,014 fish harvested were wild fish (Tipping and Springer 1981). In recent years, anglers could not retain wild cutthroat, impairing estimates of abundance. Most wild fish production is assumed to occur in the Toutle and Coweeman rivers and the habitat-impaired lower river tributaries (Tipping 2000, personal comm.).

Little information is available for either the historic or present status of coastal cutthroat in the Toutle River. Lavier (1960) (cited in Wade 2000) reported that 74 fish were captured at the Toutle River Hatchery in 1960. An estimated 40% of the 5,014 cutthroat harvested from the Cowlitz in 1979 were wild fish, many of which probably originated in the Toutle River (Tipping and Springer 1981). No hatchery plants of coastal cutthroat have been made in the Toutle River and none are anticipated (WDW 1990).

All Toutle coastal cutthroat are considered one stock (WDFW 2000). Entry into the North Fork Toutle peaks between September and November, with a smaller number of fish moving throughout the winter (WDFW 2000). Spawning time occurs from January to June, and genetic data is unavailable for this stock (WDFW 2000). The status of the Toutle coastal cutthroat is depressed, based on chronically-low escapement measured at the Toutle River Fish Collection Facility and the North Toutle Hatchery, a long-term negative trend in the Columbia River catch from RM 72 to RM 48, and the habitat destruction from the 1980 eruption of Mt. St. Helens(WDFW 2000). The stock is showing a slow recovery since 1980, but the escapement is chronically low. Another way to measure the status of this stock is by comparing the North Toutle Hatchery count. In 1959, 74 wild coastal cutthroat were captured during coho and chinook collections. After 1991, annual counts have remained below 6 fish (WDFW 2000).

Data on the Coweeman River stock is limited and no genetic studies have been performed. Other unknowns are the size, age, river-entry times, and spawning times of these stocks, although it is believed they are similar to others nearby (WDFW 2000). WDFW (2000) states that Coweeman cutthroat are considered to be native and are sustained by natural production; however it also states that from 1989 to 1993, a yearly average of 12,000 coastal cutthroat smolts from the Beaver Creek Hatchery were released in the Coweeman River. Most recently, releases were reduced to 5,000. Most of these smolts were acclimated at a rearing site below Goble Creek (WDFW 2000). Although spawning time for the hatchery stock has been advanced compared to the native stock, interactions between hatchery and wild cutthroat remain a concern (WDFW 2000). Harvest has only recently been restricted to marked hatchery fish. The status of this stock is depressed, based on a long-term negative trend in the Columbia River catch from RM 48 to 72. Run-size data is not available for this stock (WDFW 2000).

Coho Salmon (Oncorhynchus kisutch) (ESA Candidate, Lower Columbia ESU, 7/95)

Coho are indigenous to the Cowlitz Basin, and were historically abundant throughout most of the watershed (WDF 1951). Annual counts of coho indicate this is the most abundant salmon species in the Cowlitz Subbasin. Bryant (1949) called the Cowlitz River system, "the greatest silver salmon producing area in the entire Columbia River watershed." In 1948, the estimated annual escapement of coho to the Cowlitz River basin was 77,000. Of this total, 24,000 (31 percent) of the Cowlitz River coho were estimated to have come from above Mayfield Dam (WDF/WGC 1948). Shortly thereafter in the early 1950s, the estimated annual escapement for the Cowlitz River basin was 32,500 fish (WDF 1951). From 1950 to 1961, 77 percent of the coho run in the Cowlitz River was estimated to come from above Mayfield Dam (Easterbrooks 1980). Between 1961 and 1966, an average of 24,579 adult coho were collected at the Mayfield Dam fish collection facility. (Thompson and Rothfus 1969). All fish were passed over the dams until 1967. From 1967 to 1980, a portion of the coho run was hauled to the Tilton River and upper Cowlitz. In 1981 and 1982, transport was temporarily interrupted, then resumed in 1983. From 1980 until reintroduction efforts resumed, adult and jack coho salmon plants were the only sport fishery of anadromous salmon above Mayfield Dam (Stober 1986).

Historically, two separate runs of coho were reported to enter the Cowlitz River. The early run (Type-S) entered the Cowlitz from late August and September with a spawning peak in late October, and the late run (Type-N) entered from October through March with a spawning peak in late November (WDG/WFC 1948). Type-S and Type-N were named for stocks either turning south or north upon reaching the Pacific Ocean. In the early 1950s, the spawning escapement was estimated at 16,000 early coho and 16,500 late coho for a total of 32,000 fish (WDF 1951). The mitigation goal for fish returning to the Cowlitz Salmon Hatchery is 25,500 coho, which is equivalent to 53,600 jacks and adults (WDW 1990).

Upper Cowlitz Basin

Coho reintroduction initially began with plants of up to one million fry planted annually. Since 1999, no fry have been planted and all smolts captured in 2001 were naturally produced. Smolt production is now primarily from hatchery adults spawning in the upper watershed, and also by returns of fish that reared in the upper watershed. The number of adult coho transported to the upper watershed has increased from 594 females in 1996-7 to over 15,000 females and over 42,000 total adults in 2000-1. Coho juveniles have been observed throughout the mainstems of the rivers and in the lower reaches of every tributary examined. The coho stock used for reintroduction was derived from native Cowlitz River coho and is the late or N-type. Estimates of coho production potential in the Cowlitz River basin above the dams range from 6,319 (Stockley 1961) to 261,254 (Easterbrooks 1980).

Tilton River

Tilton River downstream migrants pass through Mayfield Dam. Adults to the Tilton are trucked upstream as part of the trap and haul operation (Wolf Dammers 2000, personal comm.).

Cowlitz River coho are managed for a large range of return timing; but all are considered to be of "Type-N", or late-returning stock. However, Meekin (1962) reported significant early runs of coho in the upper Cowlitz index areas. Results for the five years of data collected for each run show a higher count for early coho in 3 of the 5 years (Meekin 1962). The Type-N stock returns after the fall chinook season, so their harvest in the Columbia River gill-net fishery was not affected by chinook conservation efforts. The Type-N stock has dominated Cowlitz Hatchery production because catch distribution favors the Washington ocean fishery (WDW 1990).

Most coho in the Cowlitz River basin are of hatchery origin. DeVore (1987) examined the 1982-brood hatchery release and concluded wild/natural production was minor. Of the 4,635 naturally spawning coho in the Cowlitz in 1985, an estimated 91% were hatchery smolt releases, and hatchery fingerling releases could account for the additional naturally spawning fish. Hatchery coho have been planted in the Cowlitz since at least 1915, as releases from the Tilton River Hatchery which operated downstream of Morton until 1921. Stock mixing probably began in 1915 (DeVore 1987). Since 1968, the Cowlitz Salmon Hatchery has been producing coho salmon. The mitigation goal is to maintain annual returns of 25,500 coho adults to the hatchery. Between 1983 and 1992, the average annual escapement to the hatchery and Cowlitz River was 28,572, and has ranged from 13,009 fish in 1990 to 54,685 fish in 1995 (Harza 1999b).

Current wild coho stocks in the lower Cowlitz River are considered depressed (WDF et. al. 1993). Most of the natural spawning takes place in Olequa Creek, with smaller numbers spawning in Ostrander, Arkansas, Stillwater, Campbell, Foster, Hill, Lacamas, Brights, Blue, Otter, and Mill creeks (WDF et. al. 1993).

Coho are native to the Toutle River, were historically abundant, were present throughout the watershed, and spawned in all accessible tributaries. A major portion of the spawning area, however, was destroyed by the 1980 eruption of Mt. St. Helens (WDF et. al. 1993). Toutle River coho were, generally, an early-returning stock (Type-S), with most fish returning from August through October. Late runs are also present. Early Toutle River coho are generally more southerly distributed in the ocean than the early component of the Cowlitz stock (WDW 1990).

The naturally spawning Toutle coho are an unknown stock of composite. They currently spawn in all accessible tributaries, are considered depressed, and show signs of a long-term negative trend (WDF et. al. 1993). The run-size of naturally spawning segment for 1972-1979 was estimated to be 1,662 fish, based on average rack returns of 14,406 fish (WDW 1990). Adult coho are trapped and hauled above the sediment-retention dam on the North Fork Toutle (WDW 1990). Hatchery fingerlings were seeded in the watershed beginning in 1983 and this continued as least until the writing of the SaSSI report in 1993. Coho production by hatcheries is attempting to include both "early" and "late" coho to meet harvest-management requirements. A number of tributaries in the Toutle River have good production potential; among these are Stankey and Outlet creeks (WDF et. al. 1993).

Coho are native to the Green River and historically spawned in all accessible tributaries. Both early and late runs existed in the Green River (Meekin 1961). Some

spawning grounds in the lower Green River were destroyed by the 1980 eruption of Mt. St. Helens (WDF et. al. 1993). Green River coho natural-spawners are a mixed stock. Current coho stocks are considered depressed, based on chronically low production (WDF et. al. 1993). Natural spawning escapements are not available but believed to be quite low. Hatchery coho production includes both "early" and "late" coho to meet harvest-management requirements. A number of tributaries in the Toutle River have good production potential. Among these are Devils, Elk, and Schultz creeks (WDF et. al. 1993).

Coho are native to the South Fork Toutle River and spawn throughout the river and its tributaries. Some spawning areas were destroyed by the 1980 eruption of Mt. St. Helens (WDF et. al. 1993). South Fork Toutle coho natural spawners are a mixed stock of composite production. Current coho stocks are considered depressed based on chronically low production (WDF et. al. 1993). Naturally spawning escapement estimates are not available. Hatchery coho production includes both "early" and "late" coho to meet harvest-management requirements. A number of tributaries in the Toutle River have good production potential. Among these are Johnson, Studebaker, Disappointment, and Herrington creeks (WDF et. al. 1993).

Little is known of historic or present status of Coweeman coho (WDW 1990). Currently, the most extensively used spawning area is in the 8-mile section below the confluence of Mulholland Creek (WDF et. al. 1993). The number of naturally spawning coho in the Coweeman is presumed to be quite low, estimated at 200 fish. The annual escapement of hatchery coho in the Coweeman is estimated to be 300 fish (WDW 1990). Historically, Coweeman coho were considered an early (Type-S) stock. Currently, Coweeman coho consist of both "early" and "late" coho, due to hatchery manipulation to meet harvest-management requirements (WDF et. al. 1993). Goble, Mulholland, and Baird creeks have good coho production potential. Current coho stocks are considered depressed (WDF et. al. 1993). Natural spawning escapements from WDFW are not available.

Spring Chinook (Oncorhynchus tshawytscha)

Historically, spring chinook were abundant in the Cowlitz River upstream from the Mayfield Dam site. Most of the spawning took place on the Cowlitz above Packwood and in the Cispus River (WDF 1951). By the early 1900's, Columbia River salmon populations were declining from overfishing and a combination of land use practices that proved detrimental to salmon habitat (WDFW 1998; vol. 1). In 1948, an estimated 32,490 adult spring chinook were produced annually in the upper Cowlitz River, with an estimated spawning escapement of 9,000 fish above the dam site (WDF/WFC 1948). In the early 1950s, the estimated annual spawning escapement was 10,900 spring chinook, with a distribution estimated to be 400 fish in the upper Toutle River, 200 fish in the Tilton River, 8,100 in the Cispus River, and 1,700 in the upper Cowlitz (a total of 10,000 above the dam site)(WDF 1951). Spring chinook were not found in the Tilton after about 1950 (Thompson and Rothfus 1969). Ninety-six percent of the spring chinook production in the Cowlitz River was estimated to have occurred above Mayfield Dam from 1950 to 1961 (Easterbrooks 1980).

Upper Cowlitz Basin

Spring chinook were planted above the Cowlitz Falls Dam in 1995. From 1996 to the present, WDFW began collecting juveniles at Cowlitz Falls Fish Collection Facility and trucked them below Barrier Dam (John Serl 2000, personal comm.). Tacoma Power, under WDFW direction, continues to truck adults above the Cowlitz Falls Dam as part of the anadromous reintroduction program. There are no plans to reintroduce chinook to the Tilton River. Reintroduction of spring chinook has taken place primarily with hatchery juveniles to date. The hatchery stock is derived for native Cowlitz River stock. In 2000 and 2001, about 200 adult chinook have been transported to the upper Cispus River and allowed to spawn naturally. The first documented adult to return from the reintroduction effort was recovered in 2001. Hatchery juveniles have been observed rearing in the mainstem of the Cowlitz and Cispus Rivers, and migrate as sub-yearling smolts during the late summer. Migration timing of the naturally reared fish is not yet known. Maximum adult production potential above the dams was estimated to be 55,555 by Beck (1982) (cited in Wade 2000) and 57,052 by Easterbrooks (1980).

Tilton River

From 1974 through 1980, an average of 2,838 spring chinook adults from the Cowlitz Salmon Hatchery were trucked to the Tilton and upper Cowlitz rivers for the sport fishery and natural production. The program was discontinued due to the risk of IHN-virus contamination of the water supply at the Cowlitz Salmon Hatchery (WDF et. al. 1993). The pre-eruption (1977-1979) harvest of spring chinook was estimated at 99 percent in the Cowlitz and 1 percent in the Toutle (WDW 1990). The Cowlitz Salmon Hatchery mitigation goal is to return 17,300 spring chinook adults to the hatchery each year. This is based on the highest return to the upper Cowlitz which occurred in 1965, when 17,274 fish were trapped at the Mayfield fish facilities. The jack returns that year was 3,487, for a total of 20,761 returning spring chinook (Easterbrooks 1980). Between 1983 and 1992, the average annual escapement to the hatchery and Cowlitz River was 11,573, and has ranged from 6,417 fish in 1990 to 18,302 fish in 1983.

Lower Cowlitz Basin

Spring chinook in the Cowlitz River are a hatchery stock of mixed origin, and very few individuals are produced from natural spawning (WDF et. al. 1993). Stock mixing likely began when hatchery supplementation was initiated in 1967 at the salmon hatchery below Mayfield Dam (WDF et. al. 1993). Most of the natural spawning on the Cowlitz River occurs in an 8-mile reach between the Cowlitz Salmon and Trout hatcheries (WDF et. al. 1993). Fall chinook spawn in the same areas and redd superimposition occurs (WDW 1990). A hatchery program for spring chinook was established at Cowlitz Salmon Hatchery in 1968. Naturally-spawning Cowlitz River spring chinook are hatchery fish that did not enter the facilities (Tipping 2000 personal comm.). Cowlitz River spring chinook stock status was listed in SaSSI (WDF et. al. 1993) as “healthy” based on escapement trends but the stock status is now considered depressed (Tipping 2000, personal comm.). Natural spawning escapement from 1980-1991 averaged 389 fish, with a low of 90 in 1987 and a peak of 1,116 in 1981.

Toutle River spring chinook are not recognized by WDFW as a separate stock (WDF et. al. 1993). In the early 1950s, annual spawning escapement was estimated to be 400 fish in the upper Toutle River (WDF, 1951). The current estimated return is 164 fish (WDW 1990). The Toutle Hatchery produced spring chinook from 1967 until 1980, when it was destroyed by the Mt. St. Helens mudflows (WDW 1990). Most Toutle spring chinook were reared in Deer Springs Pond, which was destroyed in the winter of 1981-82 when a temporary flood-control dam was breached. Evaluation of the fish plants was not conducted, and returning adults were not captured at the hatchery. The primary management objective for the Toutle River is to produce 500 fish for the sport harvest. This would represent an estimated subbasin return of 1,697 fish and a total production of 2,976 fish (WDW 1990).

Summer Chinook (Oncorhynchus tshawytscha)

The original separation of chinook into spring and fall races was an arbitrary determination by hatchery personnel reached by imposing an arrival-at-hatchery date of July 31 and then declaring those chinook arriving at the hatchery prior to that date to be "spring chinook" and those arriving at the hatchery after it "fall chinook" (Senn, H. ,1993). This method ignores the entry time of summer chinook adults, which is the criterion used by field managers to determine race. As a result, summer chinook have been mixed with both spring and fall races. Full utilization of the upper-river habitats available could well require the use of all races of chinook. While spawning temporal distributions are not now apparent, certainly there were spatial separations among the components of the races that may allow the eventual reconstruction of three discrete, chinook-spawning components in terms of time and/or space. This within-species diversity may be of importance to the populations and their ability to maintain themselves under a host of conditions. When the fish are allowed to breed where they choose and migrate at will, it is expected that a summer component will develop. Agencies are leaving open the option to introduce all races, depending on how the program progresses (Gaia NW, Inc. 1993)

Fall Chinook (Oncorhynchus tshawytscha)

Fall chinook are indigenous and historically were abundant in the Cowlitz Basin (WDW 1990). In 1951, the fall chinook escapement to the Cowlitz River and tributaries was estimated at 31,000, with the following distributions: 10,900 to the mainstem Cowlitz and its minor tributaries, 8,100 to the Cispus, 500 to the Tilton, 6,500 to the Toutle, and 5,000 to the Coweeman (WDF 1951).

Historically, fall chinook spawning occurred throughout the area available to anadromous fishes, from the first favorable gravel riffle to the headwaters (WDF 1951). They migrated to and spawned within all the major tributaries to the Cowlitz, several of the smaller tributaries, as well as the main river. In 1948, the WDF and WDG estimated that the upper Cowlitz River produced 63,612 adult fall chinook annually. Escapement above the Mayfield Dam site was believed to be "no less than 14,000 fish".

In 1951, WDF estimated that the annual escapement of fall chinook to the Cowlitz River totaled 31,000. The distribution was thought to be 10,900 to the mainstem Cowlitz and "minor tributaries," 500 in the Tilton River, and 8,100 to the Cispus (WDF 1951).

Most of the spawning was reported to occur in the mainstem Cowlitz near Randle, and in the Cispus and Tilton rivers (Thompson and Rothfus 1969; WDF/WGC 1948; WDF 1951).

Forty-six percent of the fall chinook run in the Cowlitz River was estimated to have come from above Mayfield Dam in 1950 to 1961, and 28 percent of the spawning grounds were inundated by Mayfield and Mossyrock reservoirs (Easterbrooks 1980). Redd counts from 1961 through 1966 indicated returns to the Cowlitz River would have been 23,067 fish (WDW 1990). In 1961 through 1966, an annual average of 5,992 adult and 2,543 jack fall chinook were counted at Mayfield Dam (Thompson and Rothfus 1969).

All fish were passed over the dams from 1962 to 1966. From 1967 to 1980, only small numbers of fall chinook were hauled to the Tilton River and upper Cowlitz. Since 1980, only a small number of jacks have been passed upstream due to the inability to achieve hatchery spawning needs (WDF et. al. 1993).

Lower Cowlitz

In the 1980s, fall chinook spawned primarily in the eight-mile stretch between the Cowlitz Trout Hatchery and the Cowlitz Salmon Hatchery (85 percent of the natural escapement in 1983), although there were over 30 miles of suitable spawning habitat available below the Cowlitz Salmon Hatchery. Based on coded-wire recoveries, hatchery-produced fish dominate the system's production (DeVore 1987). A comparison of observed and estimated adult wild fall chinook returning to the Cowlitz River from about 1820 to the present shows that production, once estimated at 100,000 adults, declined to ~18,000 in the 1950s, ~12,000 in the 1960s and recently has declined to less than 2,000 (Mobrand Biometrics, 1999).

The EDT analysis attributes the extreme loss in major production from the lower Cowlitz, downstream of the Toutle, to major human-caused changes to the river channel, such as dredging, diking, and straightening. The EDT analysis states that "uncertainty exists with all of the run-size estimates discussed, and the results must be applied with caution; however, the pattern seen in the table above is troubling" (Mobrand Biometrics 1999).

The Cowlitz River fall chinook natural spawners are a mixed stock of composite production. While SaSSI stock status (WDF et. al. 1993) was listed as healthy, current fall chinook stocks are considered depressed by WDFW (Tipping 2000, personal comm.). Natural spawning escapements from 1967-1991 averaged 6,778 (WDF et. al. 1993), but they have since declined to about 2,600 fish per year (Tipping 2000, personal comm.). Most of the spawning takes place between the Kelso Bridge and the Cowlitz Salmon Hatchery (WDF et. al. 1993). In 1987, DeVore estimated that naturally spawning fish comprise just over ten percent of adult returns.

The Cowlitz River, downstream of Barrier Dam to the Toutle River is the only section of the basin included in the EDT analysis that sustains fall chinook production (excludes the Toutle and Coweeman watersheds). Widely different distribution potentials between historic and current conditions were projected. Much of this difference is due to the fish-passage barrier created by the mainstem dams (Mobrand Biometrics 1999). WDFW has plans to reintroduce fall chinook above the Cowlitz Falls Dam in the future

(John Serl 2000, personal comm.). The Cowlitz Salmon Hatchery mitigation goal is to return 8,300 fall chinook adults to the hatchery each year. Between 1983 and 1992, the average annual escapement to the hatchery and Cowlitz River was 11,666 and has ranged from 3,778 fish in 1992 to 20,071 fish in 1988 (Harza 1999c). Maximum adult production potential in the upper Cowlitz watershed was estimated to be 63,818 by Beck (1982)(cited in Wade 2000) and 93,015 by Easterbrooks (1980).

Toutle Subbasin

The following information refers to fall chinook in the mainstem Toutle and North Fork Toutle Rivers. The SaSSI report (WDF et. al. 1993) does not specifically refer to fall chinook stocks in these streams, but does recognize South Fork Toutle and Green River stocks. The estimated annual escapement of fall chinook in the Toutle and its tributaries in the early 1950s was 6,500. An estimated 80 percent of the total Toutle fall chinook run spawned in the lower five miles of the mainstem Toutle (WDF 1951). Annual surveys show the greatest abundance of adult fall chinook on the North Fork Toutle River to be in a five-mile stretch from the Toutle River Hatchery (1/2 mile up the Green River) to Kid Valley Park on the North Fork Toutle. An average spawning escapement of 2,700 fall chinook was observed from 1968 to 1972, with a sharp increase beginning in 1971. Fall chinook were observed as far upstream as Spirit Lake (WDF 1973). Natural spawners (hatchery and natural origin) from 1964 through 1979 averaged 42 percent (equal to 4,517 fish) of the Toutle subbasin spawners, which were estimated at 10,756 fish (Kreitman 1981 as cited in WDW 1990). The spawning grounds were destroyed by the 1980 eruption of Mt. St. Helens. The Toutle River Hatchery, located 0.5 miles up the Green River, began collecting brood stock again in 1990. Surplus hatchery fish were released upstream of the hatchery to spawn naturally. Brood stock has been from a mixture of sources since the 1980 eruption (WDW 1990)

An average of 10,756 adults returned each year to the Toutle River basin from 1964 through 1979 (pre-eruption). Of these, natural spawners of both hatchery and natural origin in the Toutle subbasin averaged 6,573 fish from 1964 through 1979 with the following distribution: 4.8 percent from the mainstem, 3.8 percent South Fork Toutle, 49.4 percent North Fork Toutle, and 42 percent Green River (Kreitman 1981 as cited inWDW 1990). The Toutle River has been stocked with fall chinook since at least 1951 until 1980 (WDF 1990). Spawning areas in the mainstem Toutle, North Fork, and Green rivers were destroyed by the 1980 eruption of Mt. St. Helens (WDW 1990). DeVore (1987) assumed that 12.8 percent of the Toutle River fall chinook spawned naturally and estimated that an average of 1,528 naturally spawning fall chinook entered the Toutle subbasin.

Green River Fall Chinook Fall chinook are native to the Green River. About 20 miles of spawning and rearing area are available above the hatchery trap on the Green River (excluding tributaries). (WDF 1973). The Green River fall chinook natural spawners are an unknown stock. Natural spawning escapements from 1967-1979 averaged 3,025 fish with a low of 948 in 1977 and a high of 6,654 in 1972. Post eruption escapements in 1980 and 1981 were zero and 10 fish, respectively. Spawning ground counts were suspended until 1990, where the escapement was 123 fish in 1990 and 126 in 1991. They spawned in the 0.5-mile reach from the mouth to the Toutle River Hatchery. Natural fall chinook

stocks were listed as depressed in SaSSI and show signs of a long-term negative trend (WDF et. al. 1993).

Fall chinook are native to the South Fork Toutle River. Natural spawners from 1964 through 1979 were, on average, 3.8 percent of the Toutle subbasin total (Kreitman 1981 as cited in WDW 1990). They currently spawn in the South Fork Toutle in the 2.6 miles from the 4700 Bridge (RM 2.6) to the confluence with the mainstem Toutle River. Current fall chinook stocks are considered depressed and show signs of a long-term negative trend (WDF et. al. 1993). Natural spawning escapements from 1967-1979 averaged 257 fish with a low of 42 in 1968 and a high of 578 in 1971. Post eruption escapements in 1980 and 1981 were zero and 81 fish, respectively. Spawning ground counts were suspended until 1991, when the escapement was 33 fish (WDF et. al. 1993). .

Coweeman

Historically, Coweeman River fall chinook spawned from Mulholland Creek (RM 18.4) downstream approximately 6 miles to the Jeep Club Bridge (WDF et. al. 1993). The estimated annual escapement of fall chinook in 1951 was 5,000, although splash dams probably impacted production (WDW 1990). The Coweeman River has received fall chinook plants from at least 1951 until 1979 (WDW 1990). The Coweeman River fall chinook are a mixed stock of composite production. Fall chinook have been planted in the Coweeman River since 1951. SaSSI (WDF et. al. 1993) listed fall chinook stocks as healthy in 1993; however, the status today is unknown. Natural spawning escapements from 1967-1991 averaged 182 with a low of 38 in 1981 and a high of 1,108 in 1988 (WDF et. al. 1993). Coweeman River fall chinook are presently managed as a lower Columbia River hatchery stock (WDW 1990). Although derived from a mixed stock composition this population appears to be representative of the indigenous fall chinook populations in the Cowlitz watershed as only one coded wire tagged hatchery stray has ever been recovered in spawning surveys (Hymer, personal comm., 2001).

Chum Salmon (Oncorhynchus keta)

Little data is available on the historical abundance and life history of chum in the Cowlitz River. The Cowlitz River had a total estimated escapement of 1,000 chum in the early 1950s (WDF 1951). An estimated 137,257 chum fry passed the Mayfield Dam site between March and May 1955. Between March and May 1956, an estimated 8,203 chum fry passed the site (Stockley 1961). A run of adult chum was observed 15 miles upstream from the Mayfield dam site prior to any impoundment of the Cowlitz River (Thompson and Rothfus, 1969). Between 1961 and 1966, the Mayfield fish-passage facility only 58 chum salmon adults were counted. Recent WDFW observations report chum salmon in the headwaters of Lacamas Creek (TAG). Detailed records describing the number of chum captured each year have not been kept, but typically, less than ten adults are collected in an average year at the Cowlitz Salmon Hatchery (Harza 1999c). There are no plans to reintroduce chum to the upper watershed (USFS 1998).

Pink Salmon (Oncorhynchus gorbuscha)

There are few references to pink salmon in the Cowlitz River system. Six pink salmon were trapped and hauled around Mayfield Dam on September 8, 1961 (Meekin 1961). The presence of pink salmon has been noted on a few WDFW survey cards.

Bull Trout (Salvelinus confluentus)/Dolly Varden (Salvelinus malma)

Fish identified as Dolly Varden, which may actually be bull trout, were supposedly caught for food by Taidmapam, or upper Cowlitz Indians in the upper Cowlitz River watershed (USFS 1997a). There are no recent, official records of these species in the watershed and they are considered to be extinct or to never have existed (USFS 1998). No bull trout have been reported at the Cowlitz Falls fish-collection facility or at the Mossyrock or Mayfield dams (TAG). It is likely if populations did exist, they would have been found at the Cowlitz Falls Fish Collection Facility, or during on-going electrofishing and stream surveys (TAG). As of May 2000, the USFWS has not yet made a final decision as to whether bull trout exist in the Cowlitz River system.

Other anadromous fishes

Other anadromous fishes that occur in the lower Cowlitz River include smelt (Eulachon)(*Thaleichthys pacificus*), white and green sturgeon (*Acipenser transmontanus and A. medirostris*) and pacific lamprey (*Entophenus tridentatus*).

Columbia River smelt stocks are depressed and are being reviewed for ESA listing. The lower Cowlitz River provides the primary tributary spawning habitat for smelt in the lower Columbia. Adult returns of smelt are variable and have not been sufficient to provide a harvest most years.

Sturgeon population status in the Cowlitz River Basin is unknown, but they exist below Mayfield Dam, and remnant populations are likely to exist above Mayfield Dam, especially in Riffe Lake.

The status of pacific lamprey in the Cowlitz River basin is unknown. Population would only be extant below the Mayfield Dam.

Resident fishes

Resident endemic species include cutthroat and rainbow trout; largescale, bridgelip, and mountain sucker (*Catostomus macrocheilus, C. columbianus, C. platyrhynchus*); mountain whitefish (*Prosopium williamsoni*), sculpin (*Cottus spp.),* longnose dace (*Rhinichthys cataractae*), speckled dace (*R. osculus*), western brook lamprey (*Lampetra richardsoni),* and northern pikeminnow (*Ptychocheilus oregonensis*). Introduced species found in the upper watershed include large and small mouth bass (*Micropterus salmoides, M. dolomieui*), brook trout (*Salvalinus fontinalis*), crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*) and brown bullhead (*Ictalurus nebulosus*). Mayfield Lake also has received plants of tigermusky (*Esox lucius x E. masquinongy*), a sterile cross of northern pike and muskellunge, as a sport fish and for northern pikeminnow control.

Wildlife

Wildlife populations and their respective habitats have been monitored throughout the Cowlitz Basin by federal and state resource agencies and by public utilities districts. Recently, much of the monitoring efforts have focused on threatened and endangered species due to Endangered Species Act. Management activities have focused on protecting these rare, threatened and endangered (RTE) species as well as managing other species for public recreation; i.e. hunting. During the last five years several evaluations have been funded to evaluate RTE species and their respective habitats while continuing to manage the lands for multiple uses including; hunting big game species such as black tailed deer and elk.

A rare, threatened and endangered (RTE) species evaluation was undertaken by Tacoma Power for lands within the Project boundary and other associated lands in 1997. The primary objective was to evaluate existing and potential habitat for plants and animals that are listed as threatened, endangered, or species of concern under the Endangered Species Act. Habitat for species designated as threatened, endangered or candidates for listing within the state of Washington were also evaluated.

"A list of RTE wildlife that could occur in the study area was developed by reviewing regional distribution of species identified in the *Priority Habitats and Species List* (WDFW 1996) for those likely to occur in Region 5, which includes Lewis County. The initial list was narrowed down by eliminating species for which there is no habitat in the study area (i.e., high elevations, talus slopes). Habitat requirements of the 15 remaining species (Table 1) were compared to vegetation cover type maps to help determine potential for occurrence. Information about documented occurrences was reviewed by searching the Priority Habitats and Species (PHS) database for areas within approximately five miles of the Project boundary and Peterman Ridge lands" (HARZA, 1997).

Table 1. Rare, Threatened and Endangered Wildlife Species Documented or Potentially Occurring in the Study Area.

Scientific Name	Common Name	Federal/State Status	Habitat
Haliaeetus leucocephalus	Bald eagle	Threatened/ Threatened	Mature forest near open water and along rivers and large streams.
Falco peregrinus	Peregrine falcon	Endangered/ Endangered	Mature forest, rocky cliffs.
Strix occidentalis caurina	Northern spotted owl	Threatened/ Endangered	Old-growth conifer forest and mature conifers forest with old-growth characteristics
Brachyramphus marmoratus	Marbled murrelet	Threatened/ Threatened	Old-growth conifer forest and younger stands with large-diameter remnants.
Aquila chrysaetos	Golden eagle	---/Candidate	Open areas and rocky cliffs.
*Accipiter gentilis**	Northern goshawk	Species of Concern (SOC)/Candidate	Old-growth and mature forest.
Dryocopus pileatus	Pileated woodpecker	---/Candidate	Closed canopy forest with large-diameter snags.
Histrionicus histrionicus	Harlequin duck	SOC/---	Swift-flowing streams and rivers during the breeding season.
Chaetura vauxi	Vaux's swift	---/Candidate	Old-growth and mature forest, snags.
Plecotus townsendii	Townsend's big-eared bat	SOC/Candidate	Caves, bridges, cracks in rock faces, bark.
Martes pennanti	Fisher	SOC/Candidate	Remote forested areas.
Clemmys marmorata marmorata	Northwestern pond turtle	SOC/Endangered	Ponds and slow-moving backwaters of rivers.
Rana aurora aurora	Red-legged frog	SOC/---	Ponds, streams, and lake margins.
Gavia immer	Common loon	---/Candidate	Ponds, lakes and lake margins.
Sialia mexicana	Western bluebird	---/Candidate	Secondary cavity-nester; forages in open farmland and forest edges.

Federal-listed threatened and endangered species

Bald eagle: Foraging habitat for bald eagles is abundant in the study area in shallow areas of the reservoirs, and along the Cowlitz River and its tributaries. Potential perch trees, including cottonwoods and open-crowned conifers are scattered along the reservoir

margins and on the riverbanks. Bald eagles are documented in the study area year-round, and five bald eagle nesting territories have been confirmed (Kohn, 1999)

"Peregrine falcon: A successful hack site was established near Randle in 1991 (WDFW 1991) and peregrines are occasionally seen in the study area, but no cliffs suitable for nesting have been identified" (HARZA 1997).

"Northern spotted owl: Nine spotted owl activity centers are documented on National Forest System lands upstream of the Project (USFS 1997), and six are documented on commercial timberlands north of the Tilton River" (HARZA 1997).

Marbled murrelet: Within the study area there is less than one hundred acres of habitats that may be suitable for marbled murrelets, but murrelets have been detected on commercial timberlands north of the Tilton River (Beak, 1993).

Cowlitz Falls Project and Bald eagles:

A monitoring program to evaluate the impacts from the Cowlitz Falls Project on bald eagle (*Haliaeetus leucocephalus*) was performed by Public Utility District No. 1 of Lewis Country from 1992 through 1997. The primary objectives were to evaluate pre and post construction impacts, determine areas of highest utilization and determine if there were any nests and roost sites on the Project.

A report summarizing the six years of monitoring was produced. The monitoring results concluded that although bald eagles continued to perch in an old eagle nest tree that no new nesting activities were observed, except by osprey. The bald eagles did build a new and productive nest upstream of the Cowlitz Falls Project along the north shore of the Cispus River in 1997. The report summarized that because of the reintroduction of anadromous fish to the upper Cowlitz Basin and because of the releases of large mitigation trout the eagles numbers had increased throughout the upper Cowlitz Basin. The trend in increased bald eagle numbers has coincided the last few years with increased adult coho numbers and observations are confirmed by USFS monitoring program (Kogut, 1997 pers. comm.)

Habitat Areas and Quality

A vegetation cover type mapping evaluation was undertaken by Tacoma Power for lands within the Project boundary and other associated lands in 1997. "The primary objective was to provide baseline information about the distribution and abundance of botanical resources in the Cowlitz River Hydroelectric Project area. Mapping products were developed in a geographical information system (GIS) to document habitat characteristics. The GIS map products show both forested and non-forested cover types, including habitats defined by the Washington Department of Fish and Wildlife (WDFW) as priority habitats, such as wetlands and riparian areas" (HARZA, 1997).

"The two vegetation classification systems used for the 1986 HEP study and the Peterman Ridge forest inventory were reviewed and compared. A uniform classification key was developed to utilize the greatest amount of information possible from both of the previous mapping projects. All mapping that could be retained in the existing format was

combined onto one GIS coverage. Field verification occurred primarily where new mapping was conducted and in areas where additional mapping detail was needed. This was conducted on the lands surrounding Mayfield and Riffe lakes, as well as on selected areas on Peterman Ridge. To produce an accurate, geographically correct map, the cover type polygons for newly mapped areas were transferred from aerial photos to orthophoto overlays" (HARZA, 1997).

The vegetation classification and mapping for the Cowlitz Project area was developed to provide information regarding the dominant forested and non-forested cover types. The forested cover types were further subdivided into structure classes based on their successional staged development in 1997. Each cover type and structure class combination was classified for its value as black-tailed deer forage and cover (hiding, thermal and optimal). The current distribution of cover and forage between areas of separate timber rights shows that Tacoma has a high proportion of forage, while Hancock has a high proportion of cover.

Tacoma Power also performed an assessment of the distribution, abundance, and quality of wildlife habitat within Tacoma City Light's ownership and updated information about wildlife use of specific habitats within the study area, with emphasis on the priority habitats and species defined by the Washington Department of Fish and Wildlife (WDFW). The study area includes land and water within the Project boundary approximately 21,000 acres); the Peterman Ridge lands (approximately 6,900 acres); and additional wetland parcels (860 acres) that have been acquired as part of the Wildlife Settlement Agreement (Tacoma 1993).

"Information collected during the site visits focused on the habitat characteristics of each cover type, including parameters such as structural and species diversity; percent cover of dominant tree, shrub and herbaceous species; percent canopy closure; relative abundance of snags and dead and down material; proximity to year-round or seasonal water; interspersion of habitat types; connectivity with large blocks of contiguous habitat; and levels of human and/or physical disturbance. Observations of wildlife or wildlife use (visual, auditory, or sign) were also documented".

"The review of existing information and search of WDFW's PHS database indicated that 12 priority species (or groups of species) that are not listed as threatened, endangered or candidates for listing in the state of Washington are likely to occur in the study area. Table 2 includes species designated as priority based on their tendency to breed or concentrate in specific areas, where large segments of the population would be vulnerable to the pressure of habitat loss, habitat alteration, poaching, harassment, or other disturbance. It also includes species designated because of their importance for recreation or commercial activities, or because they provide ceremonial or subsistence resources for Native Americans."

Table 2. Species Designated as Priority Species Based on Vulnerability of Aggregations or Recreational, Commercial, Ceremonial or Subsistence Importance.

Common Name	*Scientific Name*	Priority Area
Great blue heron	*Ardea herodias*	breeding areas
Cavity-nesting ducks Wood duck Barrow's goldeneye Common goldeneye Hooded merganser	 *Aix sponsa* *Bucephala islandica* *B. clangula* *Lophodytes cucullatus*	 breeding areas, regular large concentrations
Snow goose	*Chen caerulescens*	regular large concentrations in winter
Dabbling duck concentrations	*Anatidae*	significant breeding areas and regular large concentrations in winter
Osprey	*Pandion haliaetus*	breeding areas
Blue grouse	*Dendragapus obscurus*	breeding areas, regular concentrations in winter
Mountain quail	*Oreortyx pictus*	any occurrence
Band-tailed pigeon	*Columa fasciata*	breeding areas, regular concentrations, occupied mineral springs
Marten	*Martes americana*	regular occurrences
Mink	*Mustela vison*	regular occurrences
Columbian black-tailed deer	*Odocoileus hemionus columbianus*	regular and regular large concentrations, migration corridors
Roosevelt elk	*Cervus elaphus roosevelti*	calving areas, migration corridors, regular and large concentrations in winter

Cover type mapping conducted for the study area indicates that of the 15 priority habitats defined by WDFW, four are found within the Cowlitz study area. These include old-growth and mature forests, riparian zones, snag habitat (e.g., old-growth individuals that would provide perching or roosting habitat adjacent to open water), and freshwater wetlands and deepwater habitat. In the study area, the most abundant priority habitats are riparian areas, freshwater wetlands and deepwater habitat. Priority areas in the Cowlitz vicinity include winter range for black-tailed deer *(odocoileus hemionus)* and winter range for Roosevelt elk (*Cervus elaphus*).

RTE Plants:

No federally-listed RTE species are thought to occur in Lewis County. Nineteen species that are identified as threatened, endangered, or sensitive in the state of Washington

could occur in the study area. Of these species, tall bugbane (*Cimicifuga elata*), hairy-stemmed checker mallow, and small-flowered trillium (*Trillium parviflorum*) are documented to occur within one mile of the Project boundary. Lance-leaved grapefern (*Botrychium lanceolatum*), St. John's moonwort (*B. pinnatum*), moonwort, common blue-cup, pine broomrape (*Orobanche pinorum*), giant helleborine, and fringed pinesap are documented to occur on National Forest System lands upstream of the Project (USFS 1997).

Cowlitz Falls HEP:

A Habitat Evaluation Procedure (HEP) was conducted on the Cowlitz Falls Project lands near Randle, Washington in 1997. The primary objective was to provide a quantitative assessment of the terrestrial habitat baseline condition and to project future habitat values for the years 2013 and 2029. The Cowlitz Falls Project HEP utilized six indicator species and their associated habitat models as representative of the habitat types found on the 2089-acre project. Twenty-six vegetative cover types were mapped using ARC Info Geographical Information System (GIS). The GIS maps show both forested and non-forested cover types, including priority habitats, such as wetlands and riparian areas.

Wildlife models were selected for six target species: Copper's hawk (*Accipiter cooperii*), mink (*Mustela vison*), pileated woodpecker (*Drycopus pileatus*), savannah sparrow (*Passerculus sandwichensis*), spotted towhee (*Pipilo maculates*) and yellow warbler (*Dendroica petechia*). These species were selected on the basis of the match between their individual habitat requirements and the vegetative cover types found on the project. In addition to the HEP model information, data on snag size and distribution, and deer and elk thermal cover parameters were also collected.

The data measurements were used to develop a Habitat Suitability Index (HSI) having a value between 0.0 and 1.0, with 1.0 being optimal. The HSI is multiplied by the total area of a particular cover type to obtain a quantitative value for the actual amount of habitat available to a species. Further calculations yield Average Annual Habitat Units (AAHU's) for the species, which indicate the change in habitat quality over time and under different management alternatives.

Habitat quality for the baseline condition was fair to good with the mean HSI > 0.51 for all species and ranging as high as 0.70 for mink. Habitat quality tended to improve slightly in future target years for mink, pileated woodpecker, savannah sparrow and yellow warbler. Habitat quality peaked in target year 2013 and then returned to baseline for target year 2029 for Cooper's hawk and spotted towhee. This pattern resulted from predicted growth followed by the decline of deciduous trees preferred by the Cooper's hawk and the decline of shrub strata preferred by the spotted towhee as forests matured.

The predominant feature of the Cowlitz Falls Project was the reservoir that inundated the Cowlitz and Cispus Rivers near their confluence, followed by the largely forested cover types adjacent to the reservoir. "Approximately 30 percent of the Project forest stands provided optimal thermal cover for deer and elk. Thermal cover was predicted to improve substantially in future target years as forest cover types matured." "Snag densities are expected to meet the needs of cavity-excavating woodpeckers

throughout the study (License) period." "HEP study results indicated that current management practices on the Cowlitz Falls Project promote gradual improvement of habitat conditions for a diverse group of wildlife" (WDFW, 1998).

Anadromous fish barriers

In 1992, WDW evaluated natural passage barriers to anadromous fish throughout the upper Cowlitz River Basin. Barriers were determined by a combination of factors including vertical drop, gradient, and plunge pool. Leaping ability of winter steelhead was used to judge whether fish could penetrate further upstream. The data was compared to observations by Bryant (1949), Kray (1957) and helicopter and foot surveys performed in 1992 to determine the upper Basin anadromous zone (Lucas, letter to TAC, Dec 14, 1992).

Watershed Assessment

An Ecosystem Diagnosis and Treatment Methodology (EDT) was applied to the Cowlitz River Basin beginning in 1997. The goal of the EDT was to provide a scientific framework and analytical support for the Cowlitz Project relicensing process. "The EDT method includes a step-by-step procedure for organizing information in support of structured decision making, helping move management of the Cowlitz watershed toward a basin-wide, ecosystem approach" (Mobrand Biometrics, 1999).

The primary goal is to return salmon production to the upper watershed (above the dams) and to increase salmon abundance and harvest opportunities. In addition, the EDT would be used to evaluate several Basin strategies (NEPA alternatives) that were under consideration as part of Tacoma's relicensing process. The EDT objectives include "1) diagnosis of current conditions as they affect salmon in the Cowlitz Basin, 2) identification of alternative basin plans designed to meet the goals, and 3) analysis of fish resources outcomes from each basin plan" (Mobrand Biometrics, 1999.

Fall chinook and steelhead were selected as the diagnostic species for the Cowlitz River Basin. The choice of these two species provided the necessary diversity to evaluate the various Basin strategies from the headwaters to the lower river. Fall chinook primarily utilize the mainstem and spawn in the fall, while the steelhead utilize small tributaries and spawn in the spring. The Cowlitz River was divided into six distinct segments: the Upper, Mid, and Lower Cowlitz River, Cowlitz River Reservoirs, and the Cispus and Tilton rivers. The various tributaries were linked to the appropriate reaches listed above.

The Basin alternatives included alternatives 1) status quo – no action alternative, 2) return to a more natural riverine system by removing the dams, reintroduction of salmonids to the upper Basin by natural straying, 3) provide upstream and downstream passage for natural fish while retaining a reduced level of hydroelectric operations and emphasize innovative rearing strategies and supplementation, 4) restoration of anadromous fish in the upper basin by trapping and hauling both upstream and downstream and include innovative rearing strategies and supplementation, 5) restoration of anadromous fish in the upper basin by trapping and hauling juveniles downstream while providing volitional passage for adults upstream and include innovative rearing strategies and supplementation. Each management alternative was compared to historic conditions.

The results suggest that alternative 2 would produce the largest number of steelhead and chinook adults at spawning if no innovative rearing strategies and supplementation were imposed. Because chinook supplementation is planned, alternatives 5 followed closely by alternative 4 will provide the most chinook at spawning. These management strategies and thus the EDT results may be modified when the Federal Energy Regulatory Commission (FERC) makes it final ruling on Tacoma's relicensing. In addition, it should be noted that Tacoma Power and Mobrand Biometrics, Inc. is currently performing an EDT analysis on Cowlitz River coho.

Limiting Factors

The primary limiting factor for natural salmonid production in the Cowlitz River Basin is the presence of Mayfield and Mossyrock Dams which block access to approximately 80% of the watershed's historical production area. The limiting factor in reintroducing salmonids to habitat upstream of the dams is the effectiveness of collection and passage facilities. Much of the habitat in the lower 20 miles of Cowlitz River and in the Toutle River was damaged and degraded by the 1980 Mt. St. Helen's eruption, thereby increasing the relative proportion of productive habitat above the dams. Further habitat degradations have been caused by logging and road construction. Channel alterations for flood control, and to a lesser extent agriculture and urbanization have also degraded habitat within the Basin. Diseases endemic to the Cowlitz, especially *C.shasta*, could also significantly limit salmonid production.

The Washington Conservation Commission's completed report on habitat factors limiting steelhead and salmon populations in the Cowlitz Watershed (WRIA 26) (Wade, 2000) provides a great deal of specific detail. The following paragraphs summarize by reach section within the Cowlitz watershed the limiting factors: The Upper Cowlitz, above Cowlitz Falls Dam including Lake Scanewa and the Cispus River; Riffe Lake, Mayfield Lake, including the Tilton River; The Lower Cowlitz, below Mayfield Dam; the Toutle; and the Coweeman.

Upper Cowlitz, above Cowlitz Falls Dam, including Lake Scanewa and the Cispus River

A trap and haul program for adults and juvenile salmonids coupled with a surface collection system and fish facility at the dam provide the key components of an effort to reintroduce and restore populations of restore spring chinook, late winter steelhead and coho to the upper watershed (Serl & Morrill, 2000). Natural cutthroat populations are also present and an anadromous component still exists. The success of the reintroduction effort hinges upon collection efficiencies for the anadromous smolts at the dam. Collection efficiencies vary with species and flow. Current flood rule guidelines for spill at the Cowlitz Falls Project can be a limiting factor. Drawdowns during the smolt migration result in the loss of smolts to Riffe Lake. At other times of the year drawdowns flush juvenile salmonids into Riffe Lake. Smolts that pass the dam and enter Riffe Lake are lost to anadromous production.

Natural barriers to anadromous fish passage occur on many tributaries within a mile or two of their confluence with the upper Cowlitz River. The low-gradient habitat within these tributary channels and the big bottom area of the Cowlitz provides a large proportion

of the habitat within this reach. Channel alterations, combined with increased sediment inputs, have created low-flow passage problems and reduced habitat quality within these important reaches. LWD is generally lacking, resulting in limited pool habitat, cover, and habitat diversity in the mainstem and lower reaches of most tributaries. LWD recruitment potential is also low.

The reservoir created by Lake Scanewa inundated the lower reaches of the Cowlitz River, Cispus River and Copper Canyon Creek, eliminating riverine habitat important for spawning, incubation, and fry colonization for anadromous and resident salmonids. The reservoir provides a habitat that enhances the likelihood of predation on juvenile salmonids as they approach the Cowlitz Falls Dam.

Riffe Lake

Mossyrock Dam at the downstream end of Riffe Lake forms a complete barrier to both upstream and downstream passage. Downstream migrants (coho, chinook, steelhead and cutthroat) that enter Riffe Lake are unable to navigate the 23-mile long lake successfully. Until problems with migration are addressed, reintroduction of anadromous salmonids is not planned or feasible within this reach.

Mayfield Lake, including the Tilton River

Mayfield Dam forms a complete barrier to natural upstream migration and inhibits downstream migration. Miles of formerly productive habitat were inundated by the reservoir and conditions now favor predators of juvenile salmonids.

Extensive timber harvest, high road densities, and numerous stream adjacent roads in the Tilton River watershed combine to decrease riparian function and water quality and to increase peak flows, inputs of fine sediments, and channel instability. Over-winter survival in the Tilton River watershed is likely limited due to elevated peak flows and a lack of pools and off-channel habitat for refuge. Juveniles emigrating downstream into Mayfield reservoir are likely exposed to predators not present in the riverine environment. With the high flows and lack of LWD, spawning gravels are also scoured from many areas of the Tilton watershed.

The Lower Cowlitz, below Mayfield Dam

Mayfield Dam has blocked upstream passage to approximately 80% of the historic habitat in the Cowlitz basin, altered the hydrology of the system, and blocked the movement of sediments to downstream habitats. An eight-mile section of the mainstem Cowlitz now provides most of the very limited spawning and rearing habitat for fall chinook and steelhead below the dams. Fish passage problems also occur on a number of tributaries in this reach.

The mainstem Cowlitz and many tributaries have experienced losses in key habitat areas and habitat diversity for most salmonid life-stages due to channel simplification and diking. Grazing, agriculture, forestry, and residential and commercial development have also substantially reduced riparian function, increased bank instability, and added fine sediments to many stream systems within this reach.

The Toutle

The 1980 eruption of Mount St. Helens severely impacted salmonid populations and their habitat. Yet, most stream systems are naturally recovering from the disturbance. The North Fork Toutle is one exception were recovery has lagged behind. The slow recovery is believed to be the result of the Sediment Retention Structure (SRS) that has altered natural recovery processes.

A number of habitat constraints still limit production within this basin including; limited floodplain, off-channel, and pool habitat, high width-to-depth ratios and poor riparian conditions that contribute to elevated stream temperatures, lack of instream cover and LWD, and unstable substrate conditions. Hydrologic immaturity and high road densities within the subbasin contribute to increased peak flows and additional channel instability. High road densities and numerous stream adjacent roads also contribute excessive amounts of fine sediment to stream channels. Access and water quality are two major limiting factors within the Silver Lake watershed.

The Coweeman

Floodplain habitat within the lower 20 miles of the Cowlitz mainstem and within the lower Coweeman has been filled with Mount St. Helens deposits and disconnected from the river. Rearing and over-wintering habitat is very limited within this reach. Extensive logging and high road densities have left the subbasin hydrologically immature and subject to increased peak flows. High road densities and 69 miles of stream adjacent roads have also contributed excessive fine sediments to stream channels. Riparian conditions and Large Woody Debris (LWD) levels are generally poor throughout the subbasin, especially along the diked and developed lower reaches of the Cowlitz and the Coweeman rivers. Water quality is generally good within the Cowlitz, but lack of riparian cover has contributed to elevated water temperatures and turbidity in the Coweeman watershed.

Artificial Production

The hatchery complex on the Cowlitz River including the Cowlitz Trout and Salmon Hatcheries were constructed by, and are owned, funded and maintained by Tacoma Power (TP). The hatchery facilities are operated by the State of Washington Department of Fish and Wildlife (WDFW) to mitigate for the impact of Mayfield and Mossyrock Dams on Cowlitz River salmon and steelhead stocks. The Cowlitz Salmon Hatchery is located at river mile 49 and the Cowlitz Trout Hatchery at river mile 41 on the Cowlitz. Currently the hatchery complex rears spring and fall chinook, coho, early and late winter steelhead, summer steelhead and cutthroat trout. The program is designed to provide harvest opportunity where applicable and maintain viable stocks for listed and candidate species under the Endangered Species Act. The program provides adults and juveniles to support efforts to reintroduce anadromous populations of fall chinook, coho, late winter steelhead and cutthroat in the Tilton and in the Cowlitz watershed above the Cowlitz Falls Dam including spring and fall chinook, late winter steelhead and coho. Two additional hatchery facilities in the basin include the North Toutle River Hatchery located on the Green River, a tributary to the Toutle, and the Coweeman Rearing Ponds on the Coweeman. The North Toutle facility rears and releases Cowlitz chinook and Skamania summer steelhead.

Hatchery and Genetic Management Plans for spring chinook, steelhead, coho, cutthroat stocks present in the basin are included in Appendices A through J.

Appendix A: Cowlitz River Spring Chinook Salmon (Onchorynchus tshawytscha): mitigation and reintroduction.
Appendix B: Cowlitz River Fall Chinook Salmon (Oncorhynchus tshawytscha): mitigation and reintroduction.
Appendix C: Cowlitz River "Type N" Coho Salmon (Onchorynchus kisutch): mitigation, reintroduction, and support other programs within the basin.
Appendix D: Cowlitz River "Late" Winter Steelhead (Oncorhynchus mykiss): mitigation and reintroduction.
Appendix E: Cowlitz River Summer Steelhead (Onchorynchus mykiss): mitigation to provide harvest opportunity.
Appendix F: Cowlitz River "Early" Winter Steelhead (Onchorynchus mykiss): mitigation to provide harvest opportunity.
Appendix G: Cowlitz River Sea-run Cutthroat (Onchorynchus clarkii): mitigation, harvest opportunity and reintroduction (Tilton).
Appendix H: Toutle River Summer Steelhead, Skamania stock (Oncorhynchus mykiss): augmentation and mitigation
Appendix I: Toutle River Chinook, Cowlitz stock (Oncorhynchus mykiss): augmentation and mitigation
Appendix J: Coweeman Winter Steelhead, Elochoman stock (Oncorhynchus mykiss): augmentation

A citizens volunteer group, Fish 1, with funding from the Lower Columbia River Recovery Board is working to construct a rearing/acclimation site at Hall Creek on the upper Cowlitz that would be used to assist the reintroduction effort and provide additional fish for harvest.

Current hatchery complex production goals reflect on-going WDFW discussions with Tacoma Power, NMFS, and USFWS and the existing mitigation agreements. Tacoma Power submitted to FERC a settlement agreement in August 2000, signed by WDFW, NMFS, USFWS that lays out the principles for future mitigation efforts in the basin and establishes a Fisheries Technical Team to guide implementation of the mitigation and restoration efforts within the basin. If this agreement in principle is accepted by FERC, the new license would become effective December 31, 2001

Existing and Past Efforts

BPA's Cowlitz Falls Anadromous Fish Re-introduction Project

The Bonneville Power Administration (BPA) completed construction of the Surface Collection System and Fish Facility at the Cowlitz Falls Dam in 1996 marking the beginning of a unique opportunity to restore anadromous salmonids to an estimated 240 miles of historically productive habitat in the upper Cowlitz and Cispus watershed. The Cowlitz River historically supported abundant runs of anadromous salmonids including spring and fall chinook, coho, steelhead and cutthroat. Estimates of adult passage at

Mayfield Dam in the 1960s indicate run sizes of 25,000 coho, 9,900 spring chinook, 8,500 fall chinook, 11,000 winter steelhead and 8,700 sea-run cutthroat (GAIA, 1994). The completion of Mayfield Dam in 1962 and Mossyrock Dam in 1968 created an effective barrier to volitional upstream and downstream passage of adult and juvenile anadromous salmonids. Although adults were transported and released in the upper watershed after the dams were completed, the dams and reservoir environment were an effective block to the downstream migration and passage of smolts from the upper Cowlitz until BPA's new juvenile fish collection facility went online.

BPA became involved with the Cowlitz Falls Project on January 28, 1991 when they entered into a "Power Purchase Agreement" to buy the energy generated at the new Project. In the Agreement, BPA agreed to pay all the costs through the year 2032 associated with construction, operation and maintenance of the new hydroelectric project. This prompted a suit against BPA by the Friends of the Cowlitz, a sportsman group. The suit was based on the belief that BPA's acceptance of the original Project Environmental Impact statement was inadequate, claiming it was necessary for BPA to perform a more comprehensive EIS. It was settled without action by the court when BPA agreed to build a juvenile fish collection facility at the Project. BPA has funded the operations and maintenance of the fish facility and the stress relief ponds, located downstream at the Tacoma's salmon hatchery since 1996, through contracts with WDFW, Tacoma Power and Lewis County PUD.

The Cowlitz Falls Dam was completed and began operation in 1994. The surface bypass collection system, modeled after the successful baffled spillway system at Wells Dam on the mid-Columbia River, and the fish facility were completed at the end of 1996. The Cowlitz Falls Fish Facility (CFFF) incorporates fish attraction, surface collection, handling, sampling, and transport facilities. The completion of the fish facility and surface collection system marked the beginning of an opportunity to collect, transport and release anadromous smolts into the lower Cowlitz River. These facilities and associated stress-relief ponds located at the CSH were funded by BPA at a cost of 22 million dollars. This trap and haul operation is the fundamental activity necessary to restore anadromous salmonids to the upper Cowlitz watershed.

The reintroduction strategies for spring chinook, coho, and late winter steelhead identified in the Cowlitz Falls Anadromous Reintroduction Program (GAIA, 1994) included fry and fingerling plants, smolt releases, and the transport and release of hatchery adults from the Cowlitz Hatchery complex to the upper watershed to spawn. Additionally, satellite facilities in the upper watershed to rear and acclimate fry and fingerlings to pre-smolts prior to release have been suggested.

Since 1996, the CFFF has captured over 877,000 total smolts (Table 3). The majority of these smolts were released into Stress Relief Ponds at the Cowlitz Salmon Hatchery where they could continue their ocean-ward migration. Average yearly smolt collections include 23,094 sub-yearling spring chinook, 12,624 unmarked steelhead, 114,070 coho and 816 cutthroat. Observed mortality and descaling have been lower than expected. Mortality rates at the fish facility during normal collection have been 0.12% and 0.16% for the 1999 and 2000 seasons. The overall mortality rates from the reintroduction program, including facility, delayed and transport mortality, is typically less than 0.5%.

Rates of descaling observed at the fish facility averaged 0.02% in 2000 and 0.26% in 1999 for all species of smolts collected.

Table 3. Cowlitz Falls Fish Facility Smolt Catches, 1996-2001.

Season	Spring Chinook		Steelhead			Coho	Cutthroat	Total
Totals	0+	1+	hatchery	RV smolt	Um smolt	smolts	smolts	Fish
2001	36,449	25	4,659	33,510	17,798	334,740	1,077	434,108
2000	32,587	0	55	16,400	16,889	106,869	1,323	177,613
1999	8,702	1	4,832	10,783	9,967	15,094	530	52,431
1998	14,917	49	2	25,921	15,691	109,974	888	168,193
1997	22,815	149	5	15,621	2,777	3,673	260	46,016
1996		*36*		*3,537*	*2,248*	*5,953*	*217*	*11,991*
Averages, '97-'01	***23,094***	***45***	***1,911***	***20,447***	***12,624***	***114,070***	***816***	***175,672***
					To Date Project Smolt Total			877,023
					To Date Project Fish Total			890,352

The most critical function of the CFFF is to capture smolts during their downstream migration. The effectiveness of the CFFF is measured by the Fish Collection Efficiency (FCE). FCE is defined as the percent of total smolts migrating down the river and passing the dam that are collected in the CFFF. We have measured FCE by mark-recapture each year. This consists of taking fish collected in the CFFF, marking them and releasing them into the reservoir above Cowlitz Falls Dam. The percentage of these marked smolts returning to the CFFF is an estimate of FCE. We have also estimated FCE by Fyke netting the turbine intakes and by radio telemetry. We have attempted to improve FCE by modifying the baffle panel openings, changing the shape of the flume entrances, testing strobe lights and placing directed flow devices in the forebay. The changes to the baffle panels has provided some gain in FCE, while the directed flow appears promising but needs more research. Rounding of the flume entrances has not yet produced any improvement in FCE and the strobe lights had a negative effect (Adams et. al. 1998, Darland et. al. 2001 Evans et.al. 1999, Hausmann et.al. 2001).

Current estimates of FCE by mark-recapture are approximately 58-65% for steelhead smolts, 42-45% for coho smolts and 23-24% for chinook smolts with the new baffle panel configuration adopted in 2000 (Table 4). Radio telemetry studies conducted by USGS personnel have estimated FCE to be slightly higher than concurrent mark-recapture estimates. The Fyke net method of estimating FCE was used in 1998 at river flows less than 6,500 and generated estimates of 92% for steelhead, 81% for coho and 29% for chinook.

Table 4. CFFF Fish Collection Efficiency by year, 1996-2001.

Year	Steelhead			Coho			Chinook		
	Average	*Low*	*High*	*Average*	*Low*	*High*	*Average*	*Low*	*High*
2001	**58%**	41%	75%	**42%**	13%	61%	**23%**	12%	29%
2000	**65%**	55%	79%	**45%**	19%	76%	**24%**	13%	36%
1999	**41%**	20%	63%	**17%**	6%	42%	**24%**	7%	46%
1998	***19%**	3%	38%	**32%**	16%	53%	**18%**	11%	44%
1997	**45%**	17%	76%	**21%**	5%	50%	**17%**	10%	45%
1996	**50%**	37%	74%	**15%**	5%	25%	-	-	-

* Poor retention of the PanJet marks this year.

Each of the methods used to estimate FCE are biased. Mark recapture estimates of FCE are biased because of mortality and changes in behavior that effectively reduce the number of fish in each mark group and underestimate actual FCE for each species. The fyke netting may be inaccurate due to the hydraulic changes caused by placing fyke nets in one-half of the turbine intake. Radio-telemetry is a useful tool to identify ways to improve FCE, but the physical tag itself may cause behavioral changes. We have used mark-recapture to consistently measure FCE and it is an important tool to measure improvement, however it is important to remember that these underestimate actual FCE.

The upper Cowlitz Basin was historically a highly productive ecosystem for rearing anadromous salmonids. Nearly one million smolts were estimated to have migrated out of the upper basin in the spring-summer of 2001 (Figure 2). A majority of these fish were naturally produced coho and represents an egg-to-smolt survival of over 1.5%. Planted fry-to-smolts survivals have been estimated between 1.7% and 8.3% for steelhead and between 7.8% and 24.9% for spring chinook. The upper Cowlitz and Cispus Rivers clearly are still capable of producing significant numbers of salmonid smolts. Additionally, pathological examinations of these smolts have found them generally free of diseases.

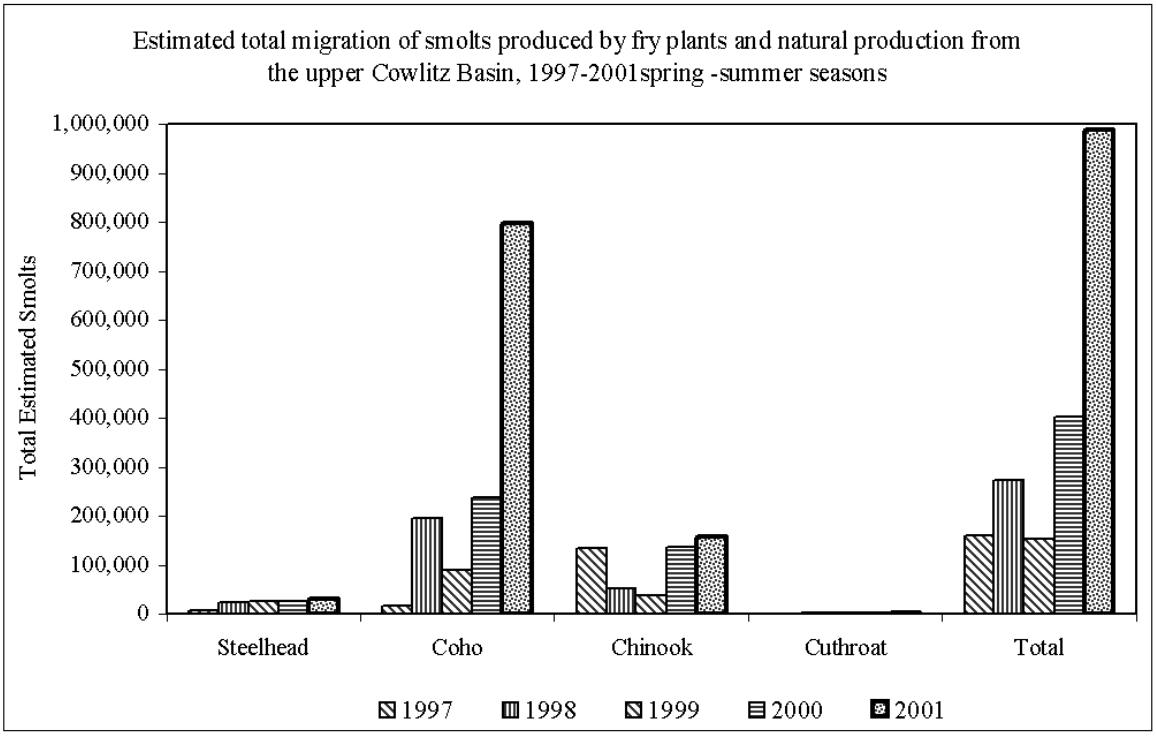

Figure 2. Estimated total smolt migration from the upper Cowlitz Basin from natural production and fry plants, by year 1997-2001.

Significant numbers of hatchery origin coho adults have been released into the upper Cowlitz basin. Lower numbers of steelhead and chinook have been available. Currently, late winter steelhead, coho and cutthroat adult originating from the upper watershed that return to the Barrier Dam at the Cowlitz Salmon Hatchery are returned upstream. To date we have limited smolt-to-adult survival estimates. Cutthroat returns are known because of marking, while coho and steelhead are estimated. Cutthroat smolt-to-adult returns were 2.4% for 1999 season smolts and 1.4% for the first year of 2000 season returns. We have two years of coho estimates at 1.9% and 5.0%. Steelhead return rates have been estimated at approximately 2.5% total return.

Increasing numbers of anadromous fishes are being transported into the upper watershed (Table 5). The seeding of the upper watershed with coho has now been accomplished entirely with naturally spawning adults in recent years, while chinook and steelhead are still supplemented with hatchery fry. Coho, steelhead and spring chinook adults have been observed spawning throughout reaches in the upper watershed.

Table 5. Total adults and females transported to the upper Cowlitz basin with total potential egg deposition by year for late winter steelhead, coho, and spring chinook.

Chinook

Year	Total Adults	*Females*	Max. potential egg deposition
1996-7	6	*2*	7,780
1997-8	51	*0*	0
1998-9	0	*0*	0
1999-2000	268	*53*	206,170
2000-1	204	*98*	381,220

Coho

Year	Total Adults	*Females*	Max. potential egg deposition
1996-7	2,155	*594*	1,651,320
1997-8	4,500	*1,262*	3,508,360
1998-9	11,422	*4,140*	11,509,200
1999-2000	34,327	*12,992*	51,968,000
2000-1	42,000	*15,500*	62,000,000

Steelhead

Year	Total Adults	*Females*	Max. potential egg deposition
1996-7	54	*27*	113,400
1997-8	66	*37*	155,400
1998-9	157	*31*	130,200
1999-2000	412	*155*	651,000
2000-1	731	*274*	1,150,800

Mayfield smolt trap/ Tilton River reintroduction

The Tilton River historically produced substantial numbers of coho salmon, winter steelhead, sea-run cutthroat trout and chinook salmon. The Tilton River flows into Mayfield Lake, approximately mid-way between Mayfield and Mossyrock Dams. The upstream anadromous terminus of the Cowlitz River is at the Barrier Dam, two miles below Mayfield Dam. Since fish ladders are not present on the dams, adult anadromous fish have been trucked upstream to the Tilton River for about 30 years. The goal of this reintroduction effort is to provide harvestable numbers of wild fish above that needed to fully seed the Tilton River.

Mayfield Dam has a downstream migrant trap, which is operated by WDFW with Tacoma Power funding. The trap captured fish with a louver system in the surface penstock intake. For 1994-98, an average of 6,731 coho, 3,932 steelhead, 1,407 chinook and 398 cutthroat smolts have been passed at the trap yearly. Based on research in the 1960s, fish collection efficiency of the trap is estimated to be about 70%, however fish that pass through the penstocks and turbines likely have lower survival than smolts passing other turbines on the Columbia River hydrosystem. Through Tacoma Power's relicensing of Mayfield and Mossyrock Dams, fish collection efficiency of the trap will be upgraded. Since 1998, smolts captured at the Mayfield smolt trap have been tagged for identification upon adult return.

The reintroduction program will start with winter steelhead, coho and sea-run cutthroat. Fall chinook reintroduction will start in 2002. The general plan is to jump start the reintroduction with hatchery fry plants for the first five years, 100,000 steelhead and coho and 500,000 coho.

Northfork Toutle SPS and fish collection facility

The North Toutle Sediment Retention Structure (SRS) was built five years after the eruption of Mt. St, Hellens by the Army Corps of Engineers to control the rate of sediment passing out of the North Fork Toutle River. The SRS also contains facilities to collect and transport returning adults to the Northfork Toutle River above the SRS. The upper Northfork Toutle is actively managed for wild steelhead, wild cutthroat and a mix of wild and hatchery coho. These fish spawn and rear in the undamaged or recovered tributary areas. Downstream migrating smolts are able to pass the SRS volitionally. From 1995 through 2000, the fish facility passed upstream to spawn an average of 184 (range 123-238) wild winter steelhead, 67 (15-153) wild cutthroat and 243 (87-633) coho adults. Spawning surveys are also conducted to monitor the spawning activity in the Toutle basin.

Tacoma Power Cowlitz Project Fisheries Monitoring and Evaluation

As part of Tacoma Powers mitigation for the Cowlitz River dams, WDFW is funded to conduct monitoring and evaluation of the fisheries resources in the lower Cowlitz River. These include spawning and population monitoring of wild steelhead and fall chinook, angler surveys, biological sampling of the hatchery escapement and hatchery practice studies. This work is reported in the Cowlitz Fish Biologist Annual Reports (WDFW, Olympia).

Populations of wild fall chinook are monitored by aerial redd counts and biological sampling of carcasses for age, mark and other population data. The aerial surveys have been conducted annually since the 1970s. Seining and CWT tagging of fall chinook juveniles to estimate survival has also begun on the lower river.

Spawning surveys for winter steelhead are conducted on key tributaries of the lower Cowlitz River. The steelhead surveys are intended to determine hatchery fish use of these spawning areas and monitor long term trends in spawning escapement. Surveys in 1985,1997 and 1998 on King Campbell and Monahan Creeks show declines in the number of spawners. Spawners in King Creek declined from 21 in 1985 to 16 in 1997 and 4 in

1998. Campbell Creek and Monahan Creek displayed similar declines at 47 to 26 to 14 in Campbell and 129 to 54 to 54 in Monahan Creek.

Coweeman River

WDFW conducts annual spawning population surveys on the Coweeman River. Fall chinook redds are counted with aerial surveys. Winter steelhead redd counts are conducted on foot in the mainstem while coho spawning is surveyed in tributary index sites.

Fish health monitoring

Fish diseases have been a continuous problem in the adults and juvenile fish at both hatcheries on the Cowlitz River. Bacterial cold water disease (BCWD) occurs frequently in the salmon and steelhead and requires numerous antibiotic treatments each year. Erythrocytic inclusion body syndrome has occurred in many years and predisposes fish to other diseases, such as bacterial kidney disease (BKD), fungal infections and BCWD. Frequently it occurs concomitantly with these diseases. Coho anemia disease has occurred sporadically with high mortality and the etiology of this disease is not known. Adult salmon and steelhead frequently carried IHN virus and juvenile steelhead at the Cowlitz Trout Hatchery have suffered high losses. *Renibacterium salmoninarum,* the pathogen that causes BKD in salmonids, is passed from the adult via the egg stage to the juvenile fish. *R. salmoninarum* is also transmitted by the water borne route, among fish in the rearing ponds as well as from the hatchery water supply. The adults and juveniles with BKD receive numerous antibiotic treatments, which prevents high loss; however, the juvenile populations are infected with *R. salmoninarum* at their release from the hatchery, despite the treatments. The impact of the *R. salmoninarum* infection on the juvenile smolts at the time of migration to saltwater is a serious concern. Fungal infections are common in all of the stocks and extensive treatment of the adults retained at the hatcheries is required to prevent a high rate of loss.

The objectives of the fish health monitoring program have been to monitor the diseases in both juveniles and adults transferred into this region and to assess the condition of downstream migrants. Specific objectives of the fish health monitoring program are: 1) to manage the diseases (by therapies and cultural means) in fish reared at hatcheries for the upper Cowlitz reintroduction (UCR) project, 2) to assess the frequency and severity of diseases in adult and juvenile fish transferred to the UCR, 3) to assess the frequency and severity of disease in the fish transferred downstream from the Cowlitz Falls Fish Facility at Lake Scanewa to the Cowlitz Stress Relief Ponds and 4) to conduct studies to provide risk assessment for diseases in fish planted in the UCR. Data from the monitoring is applicable to the management of diseases in the UCR and at the hatcheries.

The life cycle of *Ceratomyxa shasta*, the cause of ceratomyxosis, involves an intermediate host, which is a polychaete worm. Wherever this worm exits, *C. shasta* may become established by the introduction of infected fish or infective water into the area. The lower Cowlitz River appears to harbor C.shasta. Wild and hatchery fish may contract this disease as they migrate through the lower river.

Present Subbasin Management

Goals, Objectives, and Strategies

The objectives presented here may not be quantifiable or include a time period and this reflects the ongoing watershed assessments, development of the Fisheries Management plan and status of Tacoma's application for a new license and the proposed settlement agreement. In addition, recent data from the Cowlitz and other Lower Columbia River tributaries indicates that salmon and steelhead populations have experienced wide swings in abundance making it difficult to establish meaningful quantifiable objectives without taking into account natural environmental variability. We hope to use the assessments and other data to fully develop these objectives, strategies, and actions in the coming years. Listed below are general and specific goals that we were able to identify.

Goals

Cornerstone goal for the watershed:

Restore and sustain wildlife and fish populations and habitat at levels that support ecosystem benefits and harvest, sustain and/or restore water quality, and maintain long-term economic and community sustainability.

Existing Management

State

WDFW Draft Cowlitz River Fish Management Framework (Draft 7/99):

To the extent practical, restore the productivity, production and diversity of wild salmonids and their ecosystems to sustain fisheries and non-consumptive benefits and other related cultural and ecological values. In the event that full restoration is not achieved, losses for productivity and diversity will be fully mitigated (by Tacoma Power). Mitigation may be achieved through a combination of hatcheries, flows, habitat, reintroduction efforts in the Tilton and Upper Cowlitz watersheds. Mitigation should not be tied only to numbers but should aim to maintain the genetic and life history diversity of salmon and steelhead within the basin.

State of Washington (Washington's Statewide Salmon Strategy):

Restore salmon, steelhead, and trout populations to healthy harvestable levels and improve the habitat upon which fish rely.

Washington Department of Fish and Wildlife (mission statement):

1. 1. Sound stewardship of fish and wildlife
2. 2. Protect, restore, and enhance the productivity, production, and diversity of wild salmonids and their ecosystems to sustain ceremonial, subsistence, commercial, and recreational fisheries; non-consumptive fish benefits; and other related cultural and ecological values (Wild Salmonid Policy).

Local Government

Cowlitz Falls Project Fisheries Management Plan: Anadromous Fish Reintroduction Program, Prepared for Bonneville Power Administration by GAIA Northwest, INC, 1994

The long range goal of the fisheries management plan is to restore anadromous fish runs while at the same time protecting naturally producing resident fish, to allow for a balance of wild, native and hatchery fish populations. Specifically, the strategies proposed in this plan were designed to accomplish the following goals:

1. Fulfill Project Mitigation and Northwest Power Planning Council objectives
2. Minimize risk of transmission of fish diseases consistent with federal and state policies
3. Provide safe and effective passage for upstream and downstream migrants
4. Maximize production of anadromous and resident fish species that were historically present within the available habitat in the upper basin
5. Provide a sustainable fishery for anadromous and resident fish
6. Allow for a balance of wild, native and hatchery fish populations
7. Restore, protect, and enhance fish habitat in the upper watershed affected by the Cowlitz Falls Project.
8. Utilize stocks from the Cowlitz River Basin for reintroduction

Lower Columbia River Recovery Board (Interim Regional Habitat Strategy 8/01):

Provide the habitat necessary to support healthy, harvestable populations of ESA listed fish species in the lower Columbia region of Washington. For fish populations in this region this includes:

1. Support recovery of ESA listed stocks.
2. Support biodiversity through the recovery of native wild stocks.
3. Restore or sustain geographic distribution of stocks.
4. Maintain healthy stocks of listed species.
5. Support recovery of critical stocks or listed species.

For habitat needs in the region, this includes:

1. Restore access to habitat.
2. Protect existing properly function habitat conditions.
3. Restore degraded watershed processes needed to sustain properly functioning habitat.
4. Support actions to restore or protect habitat for critical salmonid life history stages.
5. Secure both near and long-term benefits.

Differences exist on the use of hatchery salmon and steelhead within the basin. Specific action items for hatchery production can be found in the Species HGMP's for the Cowlitz Salmon and Trout hatcheries (see Appendix), the Lower Columbia Steelhead Conservation Initiative, and WDFW's Wild Salmonid Policy.

Research, Monitoring, and Evaluation Activities

WDFW believes an adaptive management approach represents the most effective way to achieve goals for the Cowlitz watershed. Objectives and strategies to reach these goals are developed, then monitored and evaluated. Based on the results, actions can be modified and improved. A final comprehensive watershed or subbasin plan still needs to be developed for the Cowlitz watershed by those responsible for management of the watershed and its fish and wildlife resources. In the interim, habitat and fish populations should be monitored to determine fish responses to the on-going management actions and reintroduction efforts throughout the basin

Cowlitz Falls Anadromous Fish Reintroduction Project

There are two main areas of research and monitoring for the Cowlitz Falls Reintroduction project: fish facility passage, and upper basin salmonid life history and ecosystem monitoring. The overall goal of the fish facility studies and operation is to maximize the safe collection and downstream passage of smolts. Fish collection efficiency (FCE) research has been conducted through a stepwise process of estimating current FCE and passage routes, determine where passage problems occur, modify collection system, reevaluate passage. Monitoring of migrating smolts includes numbers, size, age, mark, injury, disease, descaling and mortality information.

Upper Cowlitz Basin Monitoring Activities are intended to maximize the likelihood of successful reintroduction of self-sustaining populations of native salmonids in the upper Cowlitz Basin and to monitor the reintroduction to assess the level of project success. Research and monitoring need to be conducted on both the fish populations and on the ecosystem. Fish population questions that need to be addressed include questions about survival by life stage of the reintroduced species (i.e. egg-to-smolt, smolt-to-adult), success of hatchery populations used to reestablish naturally reproducing populations. Ecosystem questions include identification of important production areas, population distribution and current carrying capacity compared to historic values.

Most research and monitoring conducted on the reintroduction project has focused on fish facility issues. While a sufficiently high FCE is the key to a successfully reestablishing populations in the upper river, information about the life history and population dynamics of the fish in the upper Cowlitz Basin will be necessary to make determinations of success and what additional steps are needed to achieve success.

Tacoma Power Cowlitz Project Fisheries Monitoring and Evaluation, Mayfield smolt trap/Tilton River reintroduction

A fisheries and hatchery management plan is in development as a component of the Cowlitz Hydroelectric Project Settlement Agreement. A draft plan is scheduled to be available to the Cowlitz Fisheries Technical Committee by February 1, 2002. In the interim, fish population monitoring is being conducted as a component of the Cowlitz Evaluation Program funded by Tacoma Power. Current funded activities include: hatchery broodstock sampling for biological and mark information; Lower Columbia River fall chinook spawning ground surveys for naturally spawning fall chinook, including aerial redd counts and biological and mark examination of carcasses; tributary steelhead

spawning ground surveys for abundance; operation of Mayfield Dam juvenile collector to enumerate juvenile outmigration; creel survey of lower Cowlitz and reservoir fisheries; warm water fish population composition and abundance surveys on Mayfield Lake and Swofford Pond, reintroduction of coho, steelhead, and cutthroat into the Tilton River and hatchery production evaluations. These activities focus on the Lower River and Tilton. This plan and future decisions will be guided by a Fisheries Technical Team. Fisheries obligations will be met through a combination of effective upstream and downstream passage, habitat restoration and improvement, and an adaptive management program.

Northfork Toutle SRS and fish collection facility, Northfork and Southfork Toutle River Monitoring, Coweeman River Monitoring

WDFW conducts adult spawning escapement monitoring on these lower Cowlitz River tributaries annually. The purpose of this monitoring is to track the health of these populations and evaluate fisheries management practices.

Fish and Wildlife Needs

Determine abundance, distribution, survival by life-stage, and status of fish and wildlife naturally produced populations native to the watershed including late winter steelhead, coastal cutthroat, spring and fall chinook, coho salmon, lamprey, smelt, sturgeon, and others.

Rationale: Cowlitz River steelhead and chinook salmon are part of the Lower Columbia River ESU and are currently listed under the ESA. Coho salmon populations are candidates for and coastal cutthroat are proposed for listing under ESA. Abundance and survival estimates will be needed to determine if the combination of hatchery programs, reintroduction efforts, and habitat restoration programs are working and to determine if these fish can be removed from the Endangered Species list. Bull trout in the Columbia River are currently listed under the ESA. However, the presence of Bull trout have not been confirmed in the Cowlitz although suitable habitat exists in the upper reaches of the watershed. Very little is known about the abundance of pacific lamprey and sturgeon in the Cowlitz watershed. Smelt populations have fluctuated widely and historical catch records indicate the lower Cowlitz provides important spawning habitat for this population. All three species are likely an important part of the food chain, and documenting their distribution and status is an important factor for assessment of the health of the Cowlitz watershed ecosystem.

Monitor the success of the Anadromous Fish Reintroduction Program above Cowlitz Falls and improve collection efficiencies at the Cowlitz Falls Dam. A reintroduction effort initiated in the Tilton has similar needs.

Rationale: The Anadromous Fish Reintroduction Program continues to demonstrate that the upper watershed can produce significant numbers of healthy smolts from hatchery fry plants and adult hatchery spawners including late winter steelhead, coho, and spring chinook. Although not part of the reintroduction

program, the numbers of anadromous cutthroat smolts has steadily increased each year as well. All cutthroat are being marked and adults are being returned to the upper watershed. Progeny from adult spring chinook and late winter steelhead spawners are listed fish. Progeny from adult coho spawners are candidates for listing and coastal cutthroat trout smolts are proposed for listing. A key factor to the success of the reintroduction effort here is the collection efficiency of the collection system at the Cowlitz Falls Dam. Monitoring at the dam is a critical tool to assess collection efficiency and estimate total smolt production from the adult spawners and/or hatchery fry and fingerling releases.

Reform hatchery facilities and practices to provide harvest opportunity for hatchery stocks, maintain essential brood stocks for recovery efforts and healthy wild stocks while protecting wild stocks of concern.

Rationale: Tacoma Power is required under FERC license to provide mitigation for lost harvest opportunity by operating a hatchery complex which produces coho, fall, and spring chinook, early, late and summer steelhead and cutthroat. At the same time ESA listed stocks in the basin; chinook, and late winter steelhead require recovery: one of the key elements in this recovery effort is to minimize the impact of hatchery fish on wild or naturally produced fish. Hatchery-wild stock interaction evaluations will be major research projects in near future.

Evaluate and monitor Fisheries for meeting performance indicators identified in the NMFS Fisheries Management and Evaluation Plan for the Lower Columbia River.

Rationale: Limited monitoring of fish populations are presently occurring (see existing monitoring activities), but should be expanded to insure hatchery populations are not exceeding levels identified in the FMEP. This would allow harvest of surplus hatchery population while protecting wild populations.

Monitor and assess potential interaction between resident fish populations in Mayfield Lake and migrants from the Tilton River as they enter the reservoir and approach Mayfield Dam.

Rationale: Mayfield Lake is currently managed as a mixed stock sport fishery with both warm and cold water species that includes the northern pike minnow. Smolts and juvenile salmonids emigrating from the Tilton into the reservoir are susceptible to predation. Predation may have a significant impact on survival and could impact reintroduction and recovery efforts for listed and candidate stocks in the Tilton.

Determine genetic and life history types of native fish and wildlife and the strength of their current expression relative to historical and desired future conditions.

Rationale: Maintaining life history and genetic diversity allow fish to be productive under the current as well as a wide variety of future conditions. Determining these

levels of diversity will help develop successful strategies to protect, recover and or reestablish the desired levels of diversity.

Assess effect of hatchery production upon natural escapement of salmonid stocks present in the lower Cowlitz River.

Rationale: Releases of hatchery smolts from the Cowlitz hatchery complex presents some level of ecological risk to indigenous stocks, most sustained by hatchery stocks, that do spawn naturally in the lower river. Summer and early winter steelhead stocks are not native to the Cowlitz. These interactions should be evaluated to minimize impacts of hatchery releases upon naturally produced salmonids, including late winter steelhead, fall chinook, cutthroat, and chum salmon and assess if any interactions impact survival and recovery of these populations.

Monitor escapement abundance and stock composition of natural spawning populations of fall chinook in the Lower Cowlitz, Toutle, Green and Coweeman Rivers.

Rationale: Natural spawning populations of fall chinook throughout the lower Cowlitz and major tributaries have declined significantly since the early 1990's (Dammers, pers. Com.). Stock composition is believed to be a mix of indigenous natural stocks and Cowlitz hatchery strays. Accurate escapement estimates and stock composition data will help define and assess the success of recovery efforts and management actions.

Determine the impact of C. shasta upon the survival of naturally produced smolts from the reintroduction efforts and hatchery releases in the Cowlitz watershed.

Rationale: The presence of *C. shasta* in the watershed poses some very real risks to salmonid populations including both listed and candidate species and has the potential to reduce survival in a given population, possibly limiting recovery efforts.

Determine the effectiveness of habitat restoration projects on achieving the desired physical change and measure the response of wild steelhead populations to these changes.

Rationale: The USFS, USFWS, and BPA have spent hundreds of thousands of dollars on habitat restoration in the Cowlitz River and requests have been made to continue this effort. Large-scale monitoring and site-specific monitoring projects are needed to evaluate the effectiveness of these actions.

Implement restoration actions identified in the watershed assessments conducted by the Washington State Conservation Commission and the Lower Columbia River Fish Recovery Board that are consistent with recovery of fish and wildlife populations and their habitat.

Rationale: Restoration projects that are the outcome of watershed assessments and have gone through a review process have addressed factors that limit the recovery of fish and wildlife populations. These projects should have a high probability for success. Monitoring and evaluation programs should be funded as part of these restoration activities.

Continue watershed coordination and local stewardship programs.

Rationale: The land and resource management decision needed to recover fish and wildlife populations and their habitat will impact local residents. Many of these people are knowledgeable about these resources and should be part of the decision process. Their involvement is very important to the outcome of management decisions and address local concerns about long-term community and economic sustainability.

Preserve viable fish & wildlife populations through improved habitat protection, habitat enhancement and law enforcement.

Rationale: Enhanced fish, wildlife & habitat law enforcement is an important component of protecting and ensuring the success of efforts to protect and restore fish and wildlife programs and re-introduction efforts in the watershed.

Cowlitz Subbasin Recommendations

Projects and Budgets

The following subbasin proposals were reviewed by the Lower Columbia and Estuary Province Budget Work Group and is recommended for Bonneville Power Administration project funding for the next three years.

New Projects

Project: 31005 - Incorporating Pit Tag Technology to Evaluate and Monitor the Reintroduction Effort for Anadromous Salmonids in the Upper Cowlitz Watershed

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

We propose to update pit tag system to basin ISO standards at the Cowlitz Falls Dam and Fish Facility and use pit tags to monitor and measure collection, collection efficiency, smolt production, and a prototype surface collector entrance.

Abbreviated Abstract

We propose to upgrade the current non-ISO pit tag detection system at the Cowlitz Falls Fish Facility and Dam to the basin 134.2 ISO standard and tag juveniles to monitor and evaluate the different components of the reintroduction efforts for anadromous salmonids in the upper Cowlitz watershed. Pit tagging juveniles will provide data on species emigration, timing, collection, collection efficiency and help measure efforts to improve collection at the dam. The use of pit tags coupled with detection at the facility will allow us to limit the number of fish we need to handle and sample on a daily basis and maintain the ability to identify all pit tagged fish that enter the facility. Pit tag detection will support efforts to test and modify a larger prototype surface collector entrance to the collection facility than currently exists. We propose to complete the design and install the prototype based on research efforts scheduled in 2003. We will also use an acoustic camera to monitor fish behavior at the entrances to the surface collection flumes.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
	Cowlitz Falls Project Anadromous Fish Reintroduction Program	BPA owns the power generation at the Cowlitz Falls Project through 2032 and funds the current level Anadromous Fish Reintroduction Program through the Contract Generating Resources Office in Richland, WA

Review Comments

This project should be considered under the Mainstem and Systemwide Province. The data collected would contribute to a larger database for evaluating populations. NMFS has identified that this project is a BiOp project.

Budget

FY2003	FY2004	FY2005
Rec: $257,130 Category: Recommended Action	Rec: $211,900 Category: Recommended Action	Rec: $219,100 Category: Recommended Action

Project: 31017 - Monitor and evaluate the success of hatchery salmonid reproduction for reintroduction of anadromous salmonids to the upper Cowlitz Basin

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Monitor the success of the reintroduction of anadromous salmonids to the upper Cowltiz Basin, including distribution, timing and success of reproduction of hatchery adults and success of upper basin seeding.

Abbreviated Abstract

This proposal is intended to be the monitoring and evaluation component of the Cowlitz Falls Anadromous fish reintroduction project and will be used to design and built a long term monitoring program using index sites to reduce effort, fish handling and cost in the future. This proposal focuses on the reproductive success of hatchery salmonids spawning in the wild. Other goals are maximize the production of the upper watershed, evaluate life stage specific survivals of reintroduced fishes by population dynamics and individual fish fates, monitor interactions with resident fish populations, and characterize the adults that return from this program. Monitoring population dynamics in the upper watershed provides the information needed to determine the necessary guidance efficiency, ocean survival and exploitation levels required to maintain a self-sustaining population, the ultimate goal of the reintroduction effort. Reproductive success and population dynamics will be monitored through spawner surveys linked to juvenile population estimates, evaluation of watershed seeding levels, reach and tributary specific PIT tagging and biological monitoring of returning adults.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
	Cowlitz Falls Project, Anadromous fish reintroduction program	BPA owns the power generation at the Cowlitz Falls Project through 2032 and funds the smolt collection and transport program at Cowlitz Falls through the Contract Generating Resources Office in Richland, WA

Review Comments

This project is considered part of the Base for the Biological Opinion by NMFS.

Budget

FY2003	FY2004	FY2005
Rec: $183,661 Category: High Priority	Rec: $237,200 Category: High Priority	Rec: $220,100 Category: High Priority

Project: 31020 - Monitor Coweeman River Salmonid Populations

Sponsor: Washington Department of Fish and Wildlife

Short Description:

Determine freshwater productivity and marine survival of wild tule fall chinook and wild winter steelhead to develop risk assessments and recovery actions for these ESA listed populations

Abbreviated Abstract

The Coweeman River is managed for natural salmon, steelhead, and sea-run cutthroat production and all of these populations are either listed or proposed for listing under the Endangered Species Act (ESA). Since only one hatchery fall chinook salmon carcass has been recovered in the Coweeman River since spawning ground surveys were initiated in 1964, this stock was used by the National Marine Fisheries Service (NMFS) to develop exploitation rates that are consistent with the recovery of all ESA listed Tule fall chinook populations below Bonneville Dam. Current population estimates are based on an assumed peak count expansion factor for approximately 25% of the spawning habitat available to fall chinook in this system. Furthermore, it was assumed maturation and fishery interception rates for this stock are the same as Cowlitz River Hatchery fall chinook salmon. Since the NMFS will manage ocean and freshwater fisheries based on the abundance of Coweeman fall chinook salmon, unbiased and precise estimates of the spawning population, maturation rates, and fishery interception rates are needed. Therefore, WDFW is proposing to develop unbiased population estimates with 95% confidence intervals that are +/-25% of the point estimate using mark-recapture methodology or complete counts if the weir can be maintained during the entire spawning run, and tag juvenile wild fall chinook salmon to develop maturation and fishery interception rates. Since the juvenile fall chinook outmigrant trapping period coincides with sea-run cutthroat, steelhead, coho, and chum salmon outmigration, we propose to develop juvenile production estimates of all salmonids emigrating from the Coweeman River. As part of the 4(d) rule the NMFS requires the Washington Department of Fish and Wildlife (WDFW) to develop Hatchery Genetic Monitoring Programs (HGMP) and Fishery Monitoring and Evaluation Plans (FMEP). These plans require WDFW to monitor the number of wild and hatchery spawners and complete spawning information for steelhead fish is lacking in this basin. Therefore, we will test the feasibility of using mark-recapture estimates for steelhead and other salmonid species to meet NMFS requirements.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
	Coded Wire Tag and Recovery Project	provide wild Tule fall chinook CWT to determine fisheries impacts
	Cedar Creek Lamprey Project	provide additional lamprey data
	Non-index chum Surveys	provide chum estimates on Coweeman, which is not surveyed
	Select Area Fisheries	provide CWT fall chinook to see if these fisheries intercept wild tule fall chinook

Review Comments

The reviewers are unclear whether BPA should be responsible for funding this activity. NMFS has identified that this project is a BiOp project.

Budget

FY2003	FY2004	FY2005
Rec: $277,962 Category: Recommended Action	Rec: $182,851 Category: Recommended Action	Rec: $182,851 Category: Recommended Action

Project: 31023 - Stream Gaging Installation and Operations in the Lewis, Salmon/Washougal, and Gray/Elochoman Subbasins

Sponsor: Washington Department of Ecology

Short Description:

Purchase and install eight continuos, real-time, telemetered stream flow gages, and six staff gages, at critical reaches and tributaries in each of the three subbasins.

Abbreviated Abstract

Ecology proposes to install an accurate, fully documented, efficient, and standardized system of continuous, real-time stream gages and permanent staff gages in three subbasins critical to anadromous fish in the Lewis, Grays/Elochoman, and Salmon/Washougal subbasins. This gaging network will provide continuous flow data from eight critical reaches or tributaries, and instantaneous flow data from six additional staff gage sites in each sub basin (8 continuously measured sites + 6 instantaneously measured sites per subbasin). These gaging networks will use the same instrumentation, technical and operating protocols, and data management and web-reporting systems employed by Ecology's statewide stream gaging network to assure statewide data comparability and cross-basin calibration. The gaging networks are also comparable with the US Geological Service's network.

The gaging networks will provide the stream flow data (with the necessary resolution) that are required to meet the objectives embodied in almost all current water and salmon

initiatives and proposals. In particular, this proposal will provide stream flow data that are required to:

- Document stream flows and the seasonal variability of flows in support of watershed planning activities and development of subbasin plans under the NPPC leadership.
- Determine flow-limiting reaches and tributaries to better target and prioritize habitat and flow restoration projects and monitor their effectiveness.
- Support and improve the state of knowledge needed for EDT modeling and adaptive management decision-making.
- Verify the availability and delivery of water purchased to assist conservation and recovery of ESA-listed salmonids stocks and help offset mortality associated with water management operations.
- Establish in-stream flows and compare actual flows to those flows and other target flows.
- Provide flow records needed for TMDLs (Total Maximum Daily Loads) models, and measuring TMDL effectiveness.
- Support compliance and enforcement by providing near real-time data during periods of low stream flow.

We are requesting $593,000 over a two year period.

Relationship to Other Projects

None.

Review Comments

NMFS has identified that this project is a BiOp project.

Budget

FY2003	FY2004	FY2005
Rec: $395,000 Category: Recommended Action	Rec: $198,000 Category: Recommended Action	Rec: Category:

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