US Army Corps of Engineers ®
Portland District

Mount St. Helens Project
Lower Cowlitz River Interim Dredging

Environmental Assessment

Draft June 13, 2007

ABBREVIATIONS AND ACRONYMS

AQI	Air Quality Index
BMP	best management practice(s)
Corps	U.S. Army Corps of Engineers
cfs	cubic feet per second
cy	cubic yard(s)
DMEF	Dredge Material Evaluation Framework
EA	Environmental Assessment
EFH	essential fish habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FNC	federal navigation channel
FR	Federal Register
MDL	method detection limit
mg/L	milligram(s) per liter
mm	millimeter(s)
mcy	million cubic yard(s)
ND	non-detect
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
NAGPRA	Native American Graves Protection and Repatriation Act
PCB	polychlorinated biphenyl(s)
PAH	polynuclear aromatic hydrocarbon(s)
PCB	polychlorinated biphenyl
PQL	practical quantitation limit
RSET	Regional Sediment Evaluation Team
RM	river mile
SAP	sampling and analysis plan
SEF	Sediment Evaluation Framework
SHPO	State Historic Preservation Officer
SRS	Sediment Retention Structure
SL	screening level
TOC	total organic carbon
TBT	tributyltin and other organotins
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDOE	Washington Department of Ecology
WDFW	Washington Department of Fish and Wildlife

Mount St. Helens Project
Lower Cowlitz River Interim Dredging
Environmental Assessment

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1. Purpose and Need

The 2002 Mount St. Helens Engineering Reanalysis report by the U.S. Army Corps of Engineers (Corps) estimated as much as 414 million cubic yards (mcy) of material will erode from the Mount St. Helens sediment avalanche through year 2035. In addition, it was estimated that over the period from 2000 to 2035 as much as 27 mcy of this material would be deposited in the lower Cowlitz River and will need to be removed in order to maintain flood protection levels in Kelso, Longview, Castle Rock, and Lexington.

The purpose of this project is to provide a short-term increase in channel and sediment transport capacity in order to maintain the authorized levels of flood protection on the lower Cowlitz River until a long-term solution can be implemented. This Environmental Assessment (EA) evaluates the environmental effects of dredging approximately 4.21 mcy of sand from the lower 2.5 miles of the lower Cowlitz River and in the Columbia River from the mouth of Cowlitz River [Cowlitz river mile (RM) 0] to the Columbia River federal navigation channel (FNC transition area) as a short-term (interim) solution to maintain the upstream flood protection levels (Figures 1 and 2).

The Corps periodically updates the estimates of levels of flood protection provided at these four levee projects using hydrographic survey data. Three hydrographic surveys of the lower 10 miles of the Cowlitz River in August 2003, April 2006, and December 2006 showed a significant reduction in channel capacity. This trend is a result of increased sedimentation from the Toutle River watershed from sediments being passed through the SRS in greater amounts. The ability of the SRS to trap sand has decreased since 1998 when the sediment reservoir behind the dam filled in. All flow now passes through the spillway as designed, carrying sediment downstream.

Significant sand deposition occurred in 2006 and continues to occur at the mouth of the Cowlitz River, which has severely reduced the capacity of the river channel to transport sand. This sediment build-up at the mouth of the Cowlitz degrades the river's ability to pass sand from upstream. Channel capacity and the authorized levels of flood protection for Kelso, Longview, Lexington, and Castle Rock have been reduced below authorized levels due to sediment deposition in the lower Cowlitz River.

In addition to the initial dredging effort, annual follow-on dredging from the transition area to Cowlitz RM 2.5 to maintain the dredged channel depths and bottom widths will be needed to maintain flood protection levels for the next 5 years. The Corps is also investigating long-term dredging and non-dredging alternatives that would maintain the authorized levels of flood protection for the communities on the lower Cowlitz River through the year 2035.

Figure 1. Mount St. Helens and Vicinity

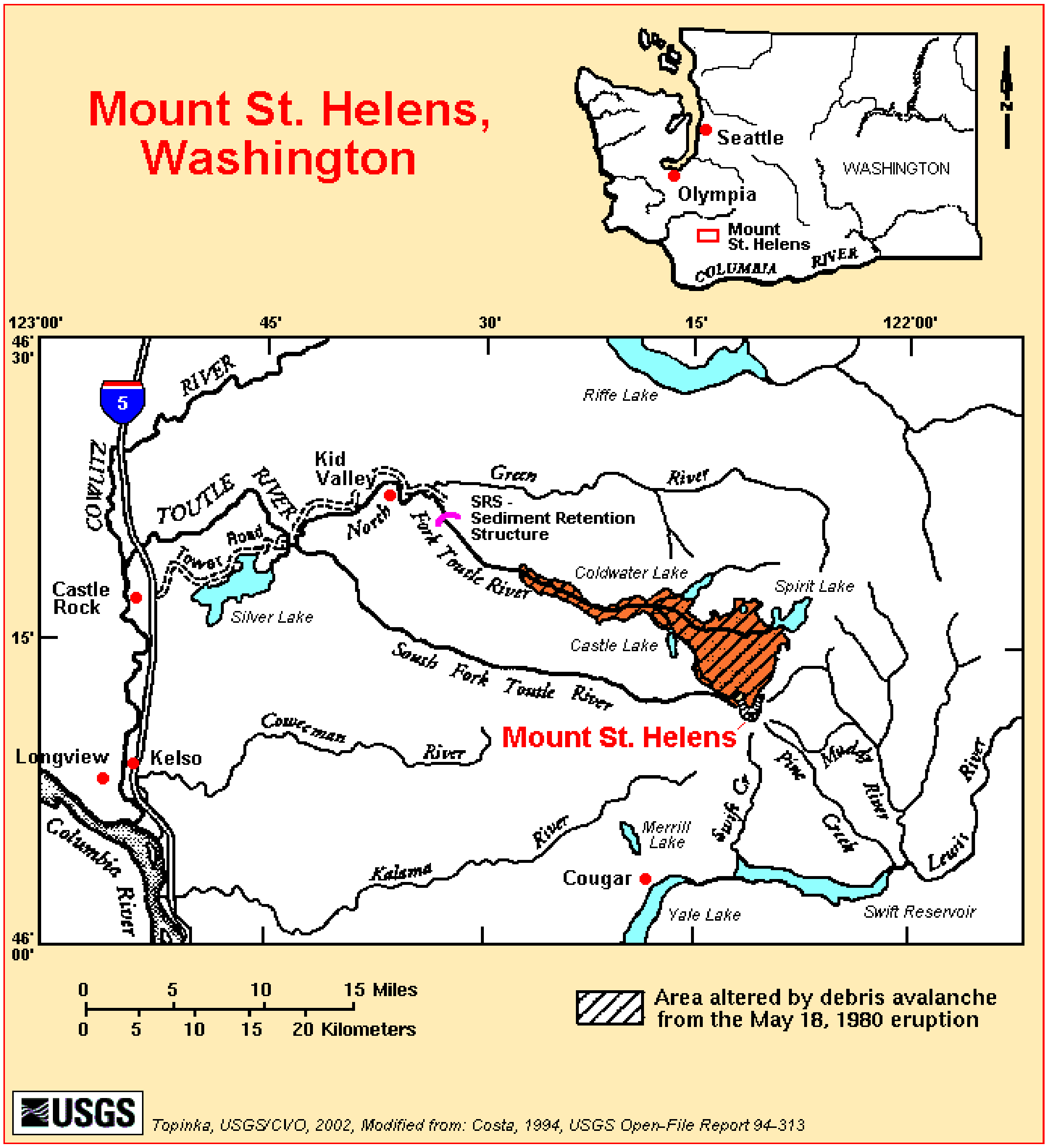
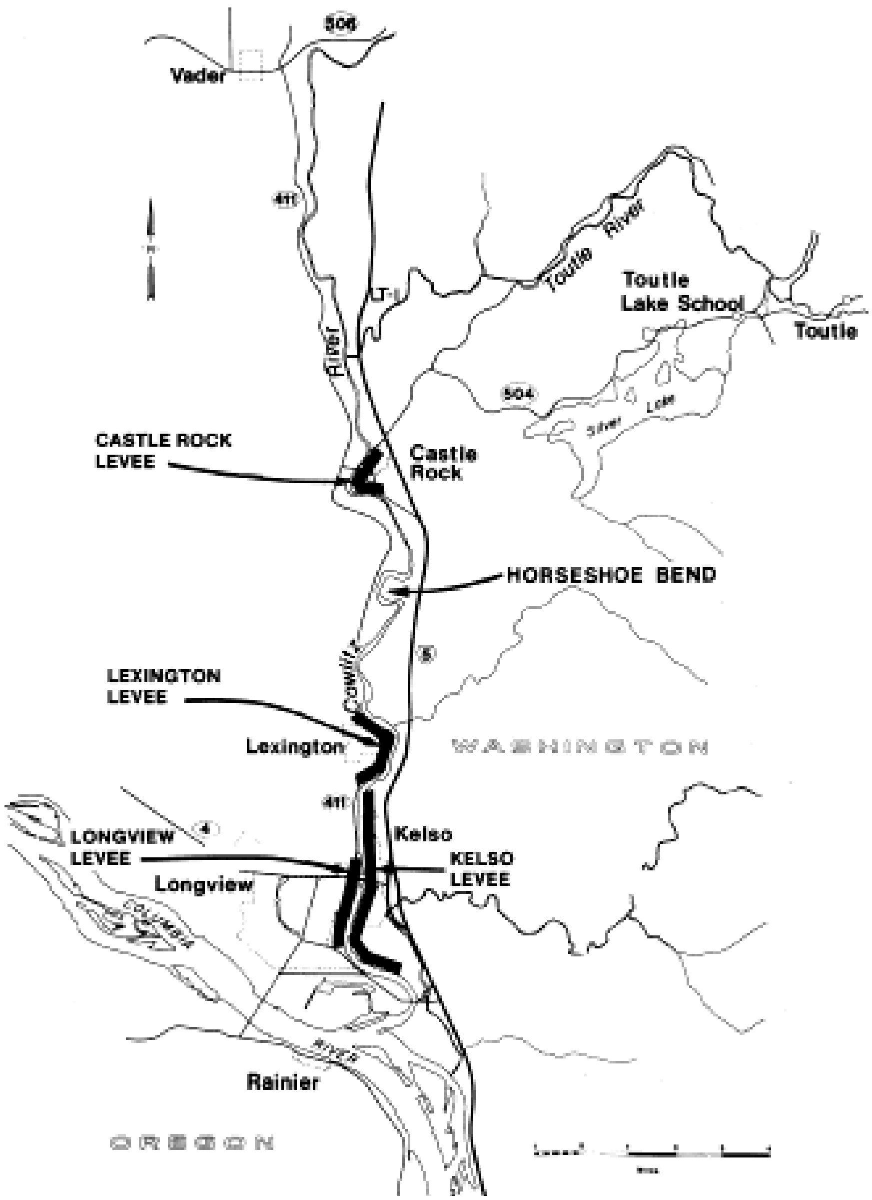


Figure 2. Mount St. Helens Project, Cowlitz River Levees



1.2. Sedimentation Trends and Flood Risk for Cowlitz River

1.2.1. Sedimentation Trends

The depositional trend in sedimentation on the lower Cowlitz River began to affect river stages and bed elevations in the Cowlitz River in fall 2003. A Corps' data logger at Cowlitz RM 2.5 showed an annual low water surface fluctuation from 6.0 feet in August 2003 to 6.3 feet in August 2005. The shift to higher water levels is indicative of a loss of channel capacity. Survey data collected in April 2006 confirmed the loss in channel capacity.

The winter of 2006 has shown to be above normal in rainfall and flooding in the Pacific Northwest. This increased activity has mobilized large amounts of sediment that continues to affect the Cowlitz River. The regional rains and flooding from November 5-10, 2006 induced a debris flow in the upper North Fork Toutle. This debris flow transitioned into hyper-concentrated, sediment-laden flow as it traveled downstream and past the SRS (Figure 3). Representative suspended sediment samples taken in November and December 2006 from the Toutle River at the Tower Road Bridge near Silver Lake are shown in Table 1.

Figure 3. Sediment-laden Flow, Toutle River at Tower Road Bridge, November 2006

The concentration level and proportion of silt/clay to sand in the Toutle River suspended sediment sample taken on November 6, 2006 at 9:00 pm contained 50,146 milligrams per liter (mg/L) of sediment finer than 0.063 millimeters (mm). The high amount of fine sediment in the sample suggests that the sediment passing the Toutle River gage was part of a sediment pulse created by a debris flow which started at the Mount St. Helens crater. Acoustic flow meter data from November 5^{th} showed a sharp spike at the four stations in the upper North Fork Toutle watershed. Sediment data from the Tower Road gage over the period November 5^{th}-7^{th} had concentrations ranging from 8,617 to 62,139 mg/L. Using average sediment concentrations of 20,000, 40,000 and 35,000 mg/L for November 5, 6, and 7, respectively, as much as 5 million tons of sediment moved past the Tower Road gage into the Cowlitz River.

Table 1. Suspended Sediment Samples, Toutle River at Tower Road Bridge

Sample Date/Time	Sediment Concentration (mg/L)	Sand* Concentration (mg/L)	Silt/Clay** Concentration (mg/L)	Toutle River Discharge (cfs)
11/5/2006 6:00 am	33,650	1,615	32,035	3,730
11/5/2006 8:51 am	27,730	4,298	23,432	3,350
11/5/2006 9:15 am	21,591	1,209	20,381	3,293
11/5/2006 9:58 am	21,307	2.344	18,963	3,150
11/5/2006 11:59 pm	8,617	3,206	5,411	2,980
11/6/2006 6:00 am	16,589	5,640	10,949	10,100
11/6/2006 1:00 pm	30,269	9,898	20,371	17,900
11/6/2006 9:00 pm	62,139	11,993	50,146	33,800
11/7/2006 2:00 am	45,985	14,163	31.822	35,000
11/7/2006 12:00 pm	35,248	11,526	23,722	30,400
11/14/2006 1:43 pm	5,907	3,143	2,764	5,500
12/4/2006 1:33 pm	1,647	871	776	1,660

Provisional data from Cascades Volcano Observatory.
* Sand is defined as sediment with grain sizes between 0.063 and 2.0 mm.
**Silt/Clay is defined as sediment with grain sizes between 1.0 µm and 0.063 mm.

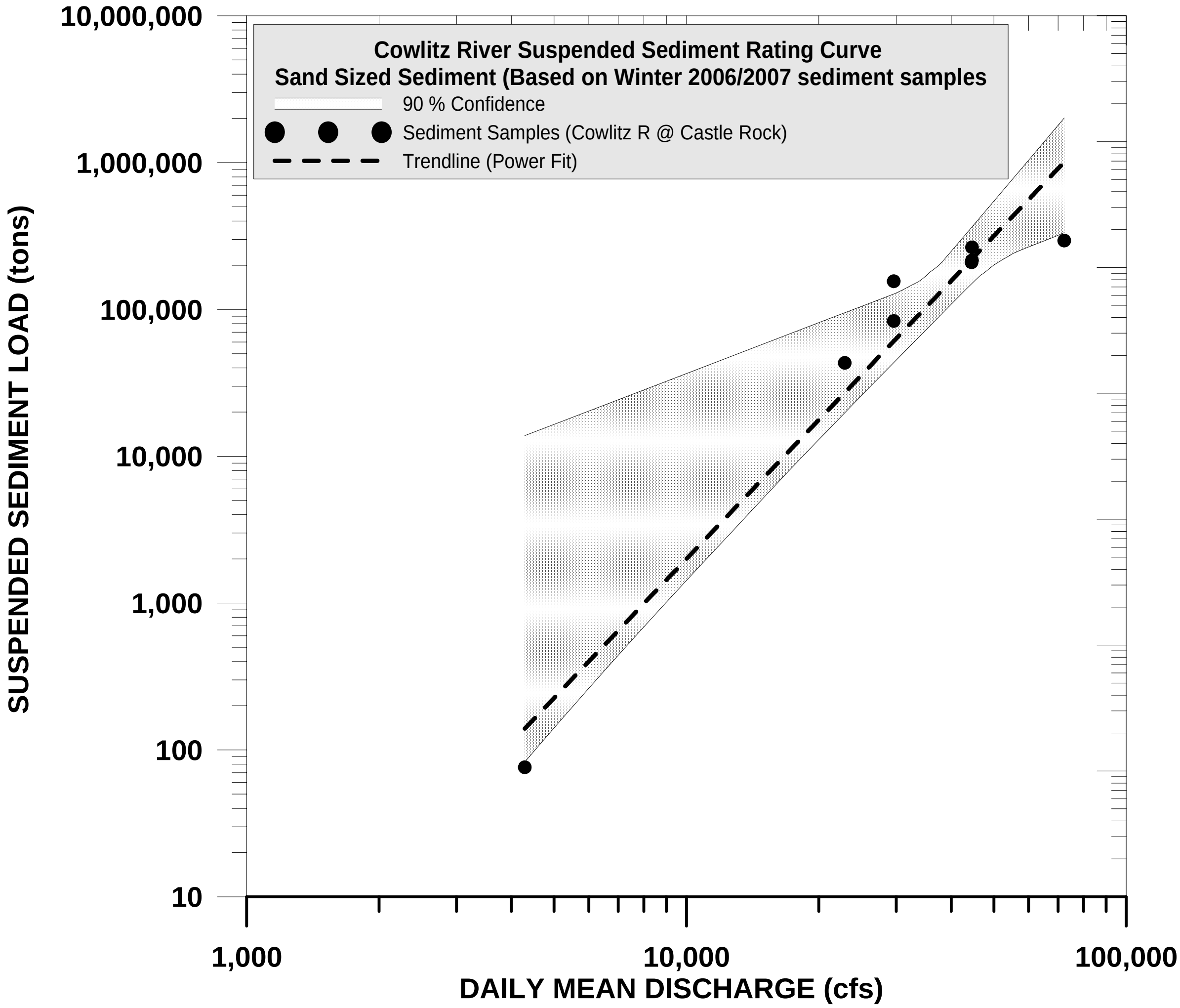
Table 2 contains the results of several Cowlitz River suspended sediment samples taken at the U.S. Geological Survey (USGS) gage at Castle Rock, WA. Concentration levels on November 7th and 8th ranged from 5,300 to 10,130 mg/L. The suspended sediment samples taken later in the winter contain higher levels of sand concentration relative to the silt-clay fraction. The general pattern of sediment discharge on the Cowlitz River has been that sand concentration and loads increase throughout the winter and begin to decline in the spring. Fall and spring flows tend to contain higher amounts of fine sediments (silt-clay fractions) relative to sand. Using the data from the suspended sediment samples, a sediment rating curve was developed to estimate the amount of sand traveling downstream into the lower Cowlitz and Columbia River (Figure 4).

Table 2. Suspended Sediment Samples, Cowlitz River at Castle Rock, WA

Sample Date/Time	Sediment Concentration (mg/L)	Sand* Concentration (mg/L)	Silt/Clay** Concentration (mg/L)	Cowlitz River Discharge (cfs)
10/30/2003 4:10 pm	57.5	6.6	50.9	4290
11/7/2006 4:38 pm	10,131	1,509	8,622	72,300
11/8/2006 3:08 pm	6,020	1,794	4,226	44,600
11/8/2006 3:10 pm	5,795	2,202	3,593	44,600
11/8/2006 3:20 pm	5,282	1,743	3,539	44,500
11/17/2006 2:32 pm	1,237	700	537	22,900
12/15/2006 1:32 pm	4,081	1,045	3,036	29,600
12/15/2006 1:34 pm	4,524	1,950	2,574	29,600

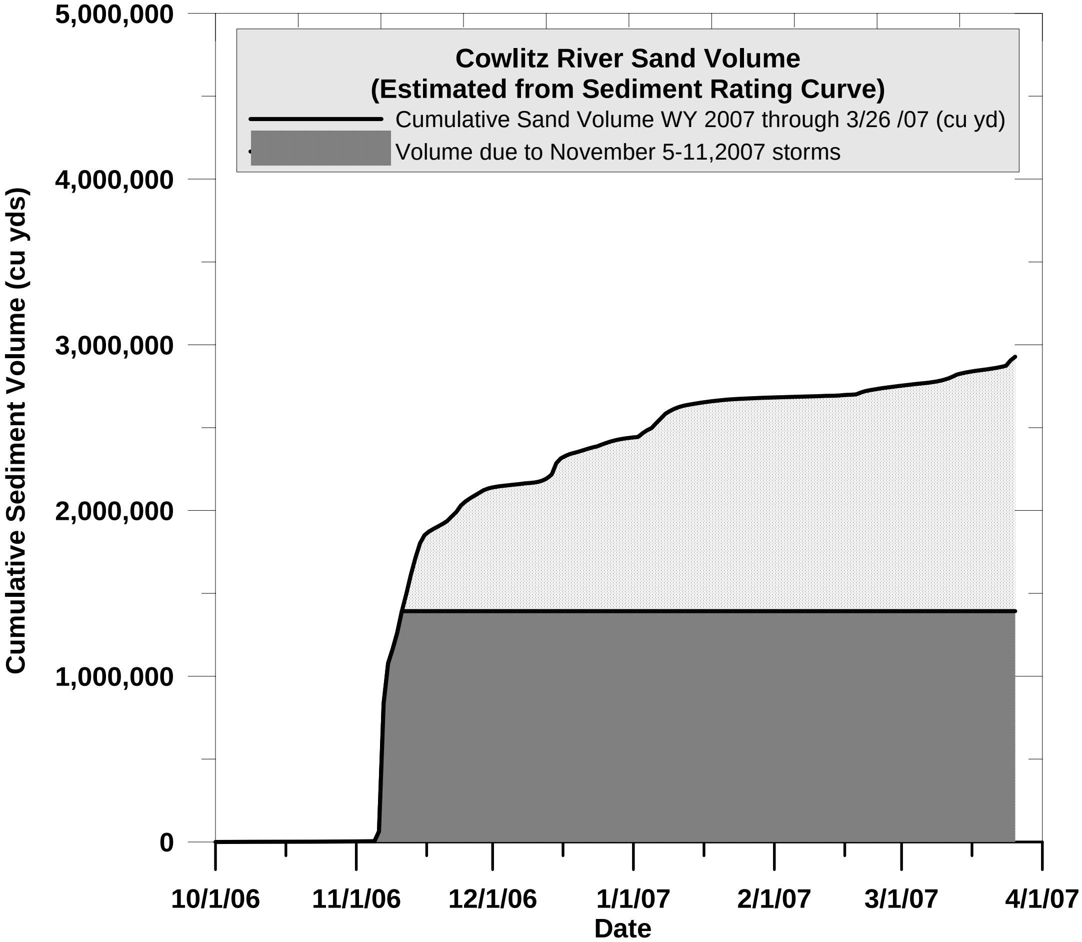
Provisional data from Cascades Volcano Observatory.
* Sand is defined as sediment with grain sizes between 0.063 and 2.0 mm.
**Silt/Clay is defined as sediment with grain sizes between 1.0 µm and 0.063 mm.

Figure 4. Suspended Sediment Rating Curve, Sand fraction.



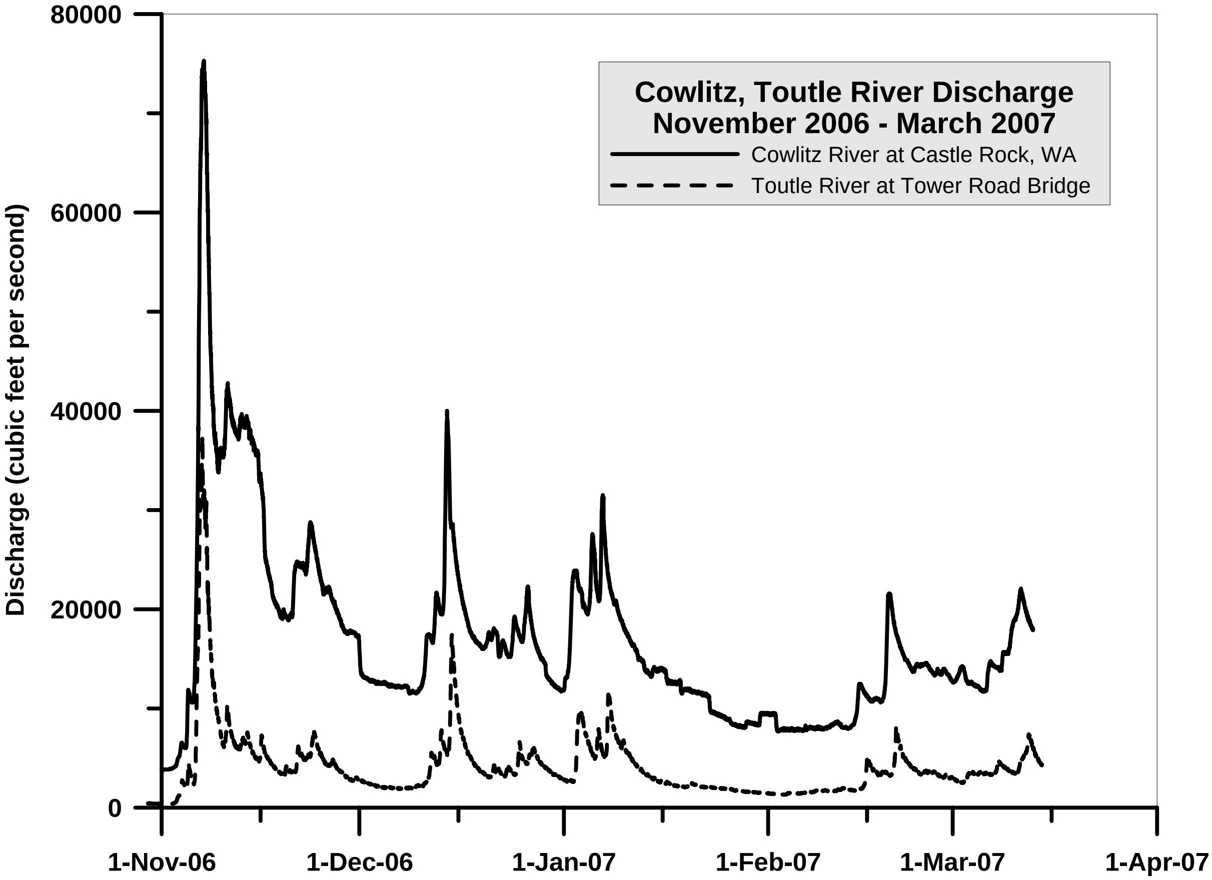
From October 1, 2006 through March 26, 2007, 3.6 million tons of sand or 2.9 mcy moved past Castle Rock (Figure 5). Most of the volume in suspension consists of very fine sand to fine sand (0.063-0.125 mm). An increase in the amount of fine sand in the river bed in the lower Cowlitz is an indication that a greater proportion of this sediment volume will be deposited before reaching the Columbia River. There is considerable uncertainty in this estimate and it could be as much as 20% higher or lower. In addition to the suspended sand volumes, a large amount of coarser sand moves as bedload. The data and estimated volumes suggest that significant amounts of sand will be moving into the Cowlitz River from the Toutle watershed over the period of interim dredging and beyond.

Figure 5. Cumulative Suspended Sediment Volume, Sand.



A major bank failure occurred on the Toutle River on November 6, 2006 at the Williams Northwest natural gas pipeline crossing, located about 2.5 miles upstream of the confluence with the Cowlitz River. The bank failure sent an estimated 320,000 to 520,000 cy of sand sized material into the Toutle River (personal communication Mike Aubele, Williams Northwest Pipeline). This volume represents 400,000 to 670,000 tons of sand. Another significant bank failure occurred on the Cowlitz River near Castle Rock in February 2006. The potential volume of sand which moved past Castle Rock from November 5-11, 2006 was estimated to be 1.4 mcy. Observed peak discharges for the early November storm on the Toutle River [37,200 cubic feet per second (cfs)] and Cowlitz River (75,300 cfs) occurred on November 7, 2006 at 3:45 am and 9:45 am, respectively. Figure 6 shows the discharge on the Cowlitz and Toutle River from November 2006 through March 2007.

Figure 6. Cowlitz, Toutle River Discharge, November 2006 - March 2007

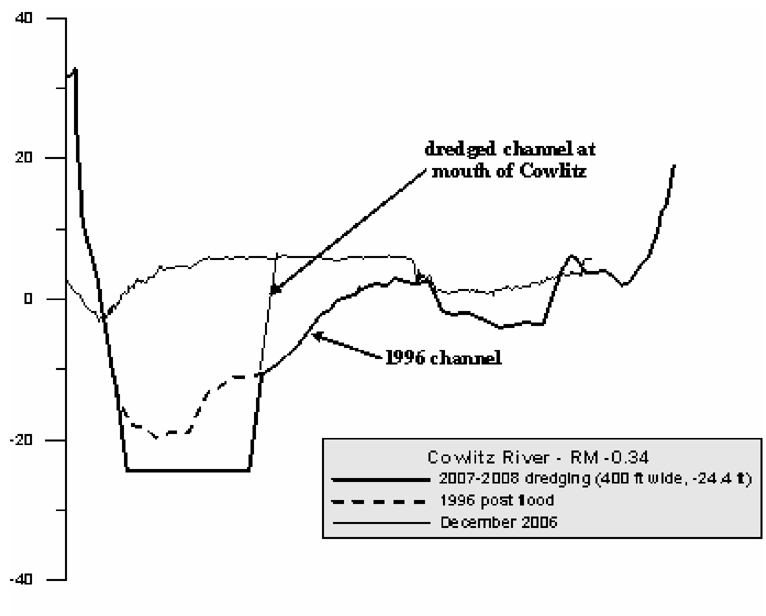


The USGS gage at Castle Rock (#14243000) measures stage and discharge on the Cowlitz River at RM 17.3. The stage discharge relationship at the gage changes as the river bed changes from scour and deposition. The rating for the gage has shifted 0.87 feet for flows below 23,000 cfs. The shift indicates that the water surface has shifted 0.87 feet higher for flows under 23,000 cfs, and suggests increasing sediment deposition at the Castle Rock gage and downstream. Recent measurements of the river channel cross section at the gage location show evidence of significant fill in the left portion of the channel looking upstream from the bridge. This fill occurred from December 15, 2006 to February 1, 2007. Measurements of the river bed at the gage show changes across the river bed from 1 to 5 feet from October 3, 2006 through February 1, 2007. The variation and shifting of the bed surface are indicative of large volumes of sediment moving past Castle Rock as bedload.

Significant deposition is now occurring in the lower Cowlitz River and is affected by backwater and tides from the Columbia River. Comparison of hydrographic surveys made of the Columbia River just below the mouth of the Cowlitz River showed a net increase of 750,000 cy occurring from November 14 and December 5, 2006. The hydrographic survey data showed that the lower 0.5-mile of the Cowlitz River has experienced a massive and rapid amount of sand deposition as a result of the early November flooding.

Comparisons of historical cross sections of the channel at the mouth of the Cowlitz River suggest that a massive loss in channel capacity occurred from April to December 2006. The loss in channel capacity has also further reduced the sediment transport potential of the river. Sediment transport potential is a measure of the ability of the river to move sand sized sediment into the Columbia River. This sediment build-up at the mouth of the Cowlitz has severely degraded its ability to pass the sediments from upstream. The reduced channel capacity at the mouth of the Cowlitz will promote significant sand deposition upstream of the mouth. Figure 7 shows a comparison of the 1996 post flood cross section at the mouth of the Cowlitz with the December 2006 cross section. The proposed dredging in the Lower Cowlitz River is plotted on the same graph, aligned to the 1996 thalweg for comparison.

Figure 7. 1996-2006 Cross Sections at the Mouth of the Cowlitz River



High sediment loads seen during the winter of 2006-2007 are likely to remain high throughout spring 2007 due to the supply of sediment remaining in floodplains and channels of the Toutle River watershed. Through the summer, significant amounts of sand-sized sediment are likely to continue to move as bedload downstream and into the lower Cowlitz River. The current levels of flood protection for the four communities on the lower Cowlitz River have declined as sediment deposition continues on the Cowlitz River due to the loss of channel capacity in the lower Cowlitz River.

The lower Cowlitz will continue to trap sediment and fill, since the supply from the watershed exceeds the current transport capacity of the lower 5 miles of the Cowlitz. Sediment movement into the Columbia now occurs in step wise movements induced by high flows which push sand in bulk into the Columbia River navigation channel from the lower Cowlitz. Regulated flows characteristic of the spring and summer are lower in magnitude, constant and tend to support more deposition upstream of the Columbia – Cowlitz confluence. The dredged channel connection with the Columbia River navigation channel will support a more constant rate of sand transport as bedload into the Columbia River. Follow on dredging will maintain the opening to the Columbia River.

1.2.2. Flood Risk Forecast

Flood risk for areas protected by levees is expressed as an annual exceedance probability for the corresponding Cowlitz River discharge which would cause flooding. This annual exceedance probability is expressed as an average return interval in years for the discharge based on the overall period of record for observed streamflows. The annual exceedance probability is converted to a return period by taking the reciprocal of the probability. On the Cowlitz River, the annual exceedance probability corresponding to the base flood level at Kelso is 0.69% of the 143-year average return interval. The corresponding Cowlitz River flow at Kelso, which has a 0.69% chance of occurring in any year, is 111,000 cfs. The flood risk computation for the Cowlitz River levees, referred to as level of protection, is based on three factors:

- Stage-discharge relationship, a measure of channel capacity.
- Hydrologic risk, the variation of observed streamflow over time.
- Geotechnical risk, the measure of levee reliability.

The forecast level of flood protection with no action for the protected communities is based on the following assumptions: (1) sediment supply from the Toutle River remains at current levels; and (2) decreased sediment transport potential for lower 20 miles of the Cowlitz River. A forecast reflecting conditions with the interim dredging plan is presented for comparison. The assumptions used in the forecast with dredging are:

- Sediment supply from the Toutle River remains at current levels.
- Some scour will occur within the forecast period due to 10- to 100-year flows occurring in the next 5 years. There is a 41% chance of a 10-year flow and a 5% chance of a 100-year flow over this period. The scour will temporarily increase channel capacity until sediment fills the channel again and reduces channel capacity.
- Follow-on dredging will stabilize channel capacity and flood protection levels for the forecast period.

The recent observed trend and a forecast expressed as a percentage of the authorized flood protection levels are shown in Figures 8 to 11.

Figure 8. Observed and Forecast Levels of Flood Protection at Kelso

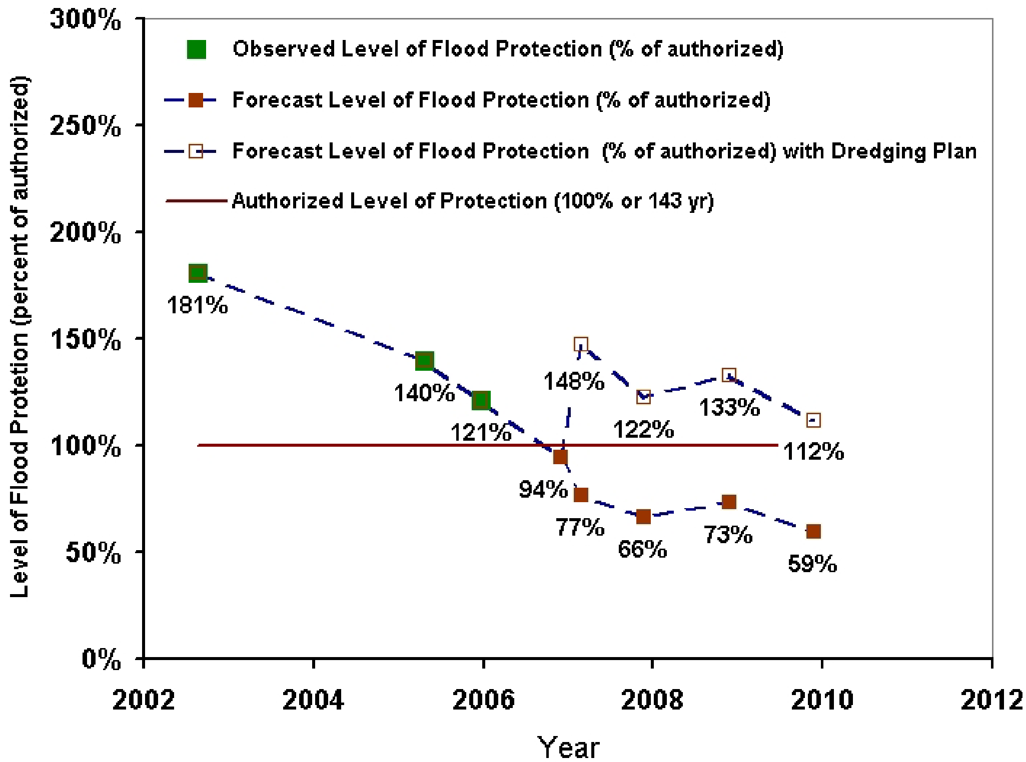


Figure 9. Observed and Forecast Levels of Flood Protection at Longview

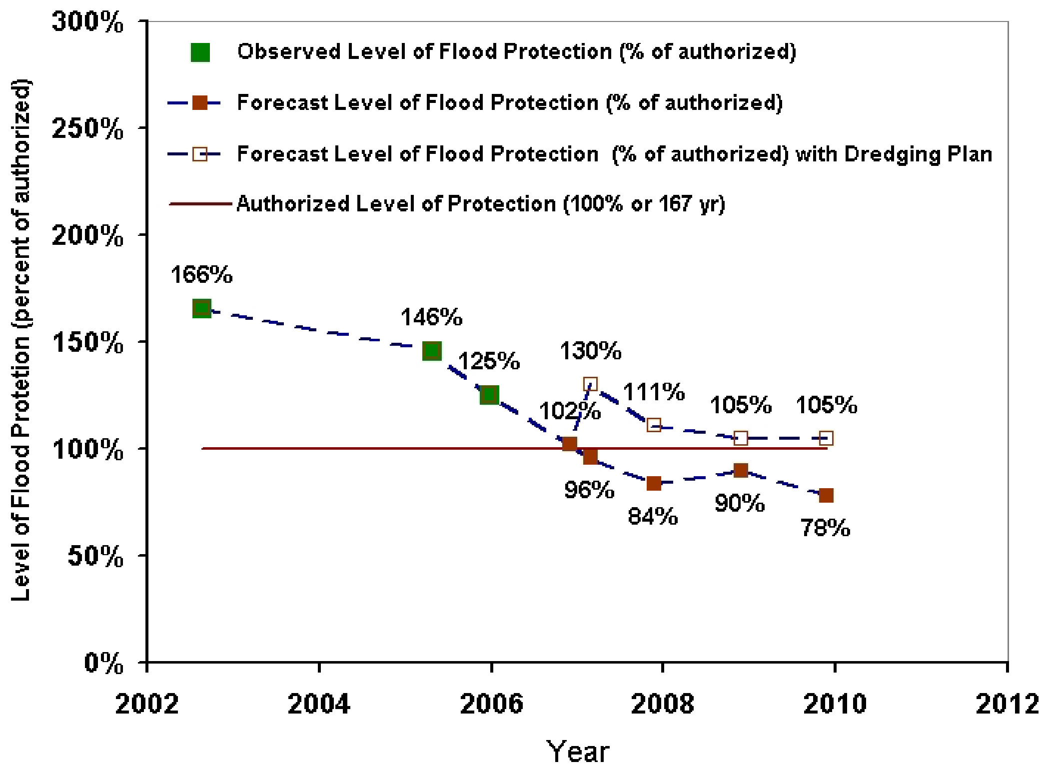


Figure 10. Observed and Forecast Levels of Flood Protection at Lexington

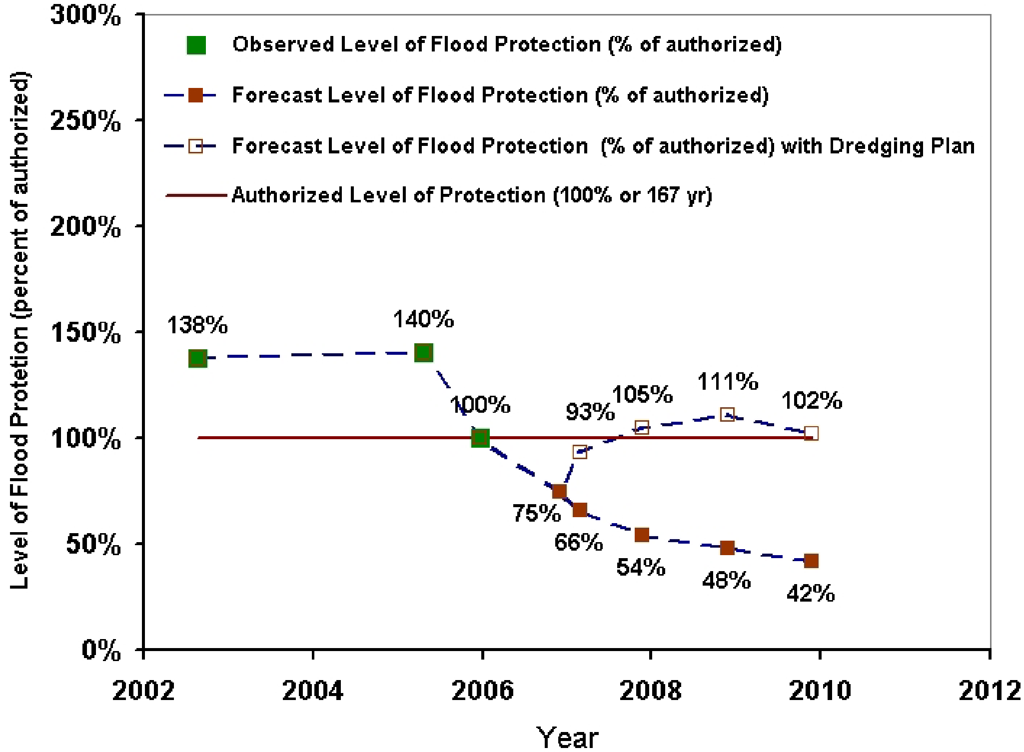
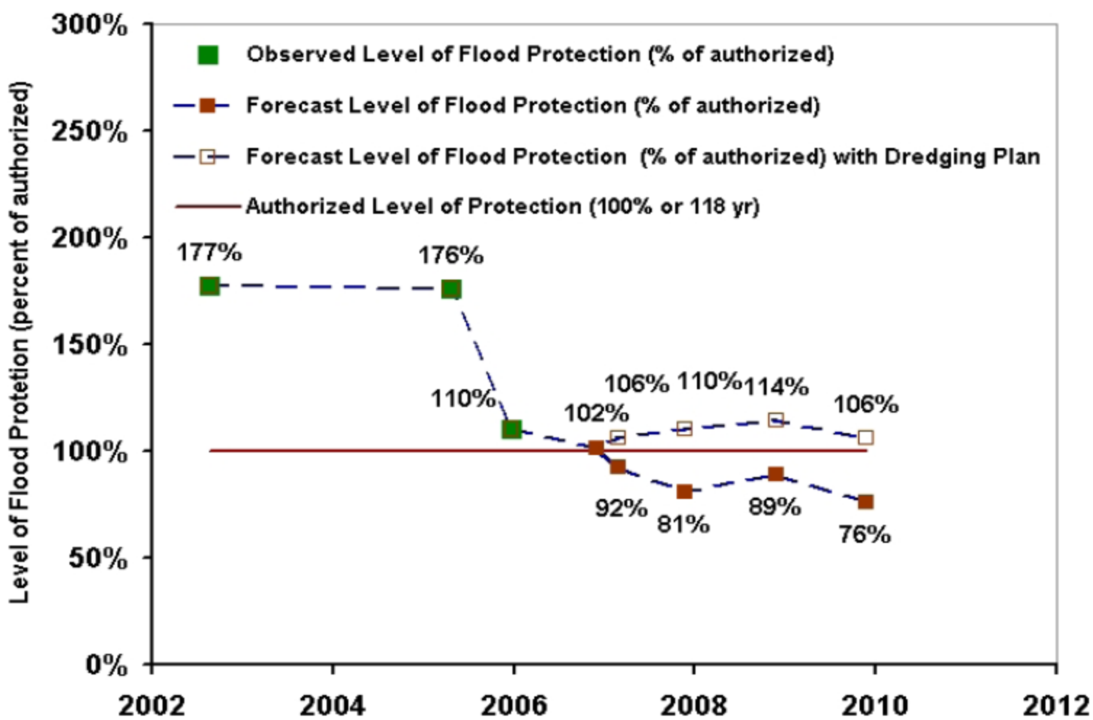


Figure 11. Observed and Forecast Levels of Flood Protection at Castle Rock



The forecasts show that the levels of flood protection are expected to fall below 100% for Kelso, Longview, and Lexington during the winter of 2007-2008 and very close to 100% at Castle Rock. The forecast and current level of flood protection will be updated during the summer 2007 when a new hydrographic survey is scheduled for the Cowlitz River. Sediment is expected to continue to move into the Cowlitz throughout the spring as long as flows remain at normal levels. Frequent updates to the forecast will be made over the duration of the dredging plan as conditions change and will be used to plan follow-on dredging.

1.3. Project Authority

The Mount St. Helens flood protection project was authorized by Congress (Public Law 99-88, the Supplemental Appropriations Act of August 15, 1985) to control the movement of sediment downstream from the debris avalanche resulting from the May 18, 1980 eruption of Mount St. Helens and to maintain an authorized level of flood protection for four communities along the Cowlitz River (see Figures 1 and 2). The three components of the approved Mount St. Helens project are: (1) sediment retention structure (SRS) constructed in 1989 on the North Fork Toutle River; (2) permanent levee improvements in the late 1980s for the communities of Castle Rock, Lexington, Kelso, and Longview in Washington; and (3) dredging of the Cowlitz River in the late 1980s to maintain authorized flood protection levels. The plan also identified additional dredging would be required some time after the year 2000 once the SRS spillway began operating regularly.

1.4. Project Area Description

The project area is located on the lower Cowlitz River, from RM 2.5 downstream to the mouth and including the transition area between the Columbia River FNC and Cowlitz RM 0. The lower Cowlitz River, up to RM 17, provides low quality pool habitat that has been degraded due to channelization (LCFRB 2004). The 1980 Mount St Helens eruption led to an increase in fine sediments in the Cowlitz River that is partially managed by the SRS on the Toutle River. The SRS has filled to the spillway crest and sediments are being passed through the SRS from the Mount St. Helens debris avalanche in greater amounts. This accounts for the some of the increase in sand seen in the Toutle and lower Cowlitz rivers.

2. AFFECTED ENVIRONMENT

2.1. Lower Cowlitz Subbasin Characteristics

The Lower Columbia Fish Recovery Board's (LCFRB) subbasin plan describes the Lower Cowlitz subbasin to include the Cowlitz watershed below Mayfield Dam, not including the Toutle and Coweeman subbasins (LCFRB 2004). The Lower Cowlitz subbasin encompasses approximately 440 square miles in portions of Lewis and Cowlitz counties. The Cowlitz enters the Columbia River at Columbia River mile 68, about 3.5 miles southeast of Longview, Washington. The Coweeman and Toutle rivers are the two largest tributaries. Other significant tributaries include Salmon Creek, Lacamas Creek, Olequa Creek, Delameter Creek, and Ostrander Creek. Mayfield Dam (RM 52), constructed in 1962, blocks all natural passage of anadromous fish to the Upper Cowlitz ssubbasin. The Cowlitz Salmon Hatchery barrier dam (RM 49.5), located below Mayfield Dam, is a collection facility for trapping and hauling fish into the upper subbasin, a practice that has been in effect since 1969. Below the barrier dam, the river flows south through a broad valley. Much of the lower mainstem Cowlitz has been impacted from channelization features related to industrial, agricultural, and urban development.

The Lower Cowlitz subbasin has a typical northwest maritime climate (LCFRB 2004). Summers are dry and warm and winters are cool, wet, and cloudy. Mean monthly precipitation ranges from 1.1 inches (July) to 8.8 inches (November) at Mayfield Dam. Annual precipitation averages 46 inches near Kelso. Most precipitation occurs between October and March. Snow and freezing temperatures are common in the upper elevations while rain predominates in the middle and lower elevations.

Forestry is the dominant land use in the Lower Cowlitz subbasin, and commercial forestland makes up over 80% of the subbasin (LCFRB 2004). Much of the private land in the lower river valleys is agricultural and residential.

2.2. Water and Sediment Quality

The Cowlitz River was listed in 1996 for exceedances of pH, temperature, and fecal coliform. The Coweeman River, a tributary of the Cowlitz River, was listed on the Washington State's Water Quality Assessment [303(d)] list in 1996 for exceedances of pH, dissolved oxygen, and temperature. The 1998 303(d) list for 1998 included only an arsenic exceedance for the Cowlitz River and a temperature exceedance for the Coweeman River (WDOE 1998).

The sediment to be dredged in the project area is primarily gravel and sand (<2% fines) and is expected to have a small turbidity plume of minimal duration. Also, the majority of dredging would be in November through February which is a time when natural increases in sedimentation and turbidity would likely be high. Depending on Toutle River inflow to the Cowlitz River, sand concentrations in the lower Cowlitz River generally range between 300 and 3,000 mg/L during the winter months, increasing from fall to spring. The general pattern of sediment discharge on the Cowlitz River has been that sand concentration and loads increase throughout the winter and begin to decline in the spring. Fall and spring flows tend to contain higher amounts of fine sediments (silt-clay fractions) relative to sand.

2.3. Air Quality/Noise/Light

The Southwest Clean Air Agency (SWCAA) is responsible for enforcing federal, state, and local outdoor air quality standards and regulations in Clark, Cowlitz, Lewis, Skamania, and Wahkiakum counties of southwest Washington. According to the SWCAA (2007), the Longview/Kelso area is highly industrial with several existing pulp and paper mills and several power plants under construction. A high volume of diesel traffic serves the area and woodstove use is prevalent. Cowlitz County ranks consistently high in the state for air releases of total air emissions and recognized carcinogens based on Toxic Release Inventory data (this data are coarse estimates of both industrial fugitive and stack emissions, of which stack emissions generally disperse away from the local area and monitoring site). From 1998 through 2004, the onsite air emission totals for Washington and Cowlitz County have been decreasing; however, Cowlitz County's contribution still represents a significant percentage. In reviewing the 10-year trend, Cowlitz County releases have represented 20% to 30% of total Washington on-site air emissions since 1994 (SWCAA 2007).

The SWCAA conducted air toxics monitoring in Longview from May 2004 through May 2005 (SWCAA 2007). The study found that the air toxics found in Longview were consistent with the type of compounds and concentrations found in other urban areas. In some cases, Longview's ambient air contained several compounds at levels that exceed their respective health risk screening values. This is similar to other urban areas. In Longview, the air toxics that exceeded at least one of the health screening values included acetaldehyde, arsenic, benzene, formaldehyde, and manganese. Many air toxics were detected at their maximum levels during a winter inversion in February 2005. These higher winter readings bear out that air quality can deteriorate during periodic stagnant winter conditions. Sources of acetaldehyde, arsenic, benzene, and formaldehyde are vehicle and engine exhaust, wood burning and other combustion sources. Formaldehyde comes not only from these sources but also pulp, paper or plywood mills, paint and varnishes, foods and cooking and tobacco smoke. Arsenic comes from burning fuel oil, pulp and paper mills, volcanic ash and the burning of treated wood. In addition to engine exhaust and wood burning, another source of benzene is gasoline fueling. Manganese is released from steel, battery and fertilizer production, cutting and welding, and water purification. Diesel emissions and wood smoke were identified as two major sources of a number of air toxics.

Existing noise levels in the project area are heavily influenced by the industrial and urbanized nature of the project area, by trucks and automobiles traveling on roads near the river, and by ship traffic on the river. There are no practices in the project area that substantially affect natural light conditions.

2.4. Vegetation

The forest series in the Cowlitz Basin are typical of those found in the southern Cascades of Washington. These forest zones are based on the climax tree species of the four major plant communities within the basin. 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 (LCFRB 2004).

Riparian forests along the lower 20 miles of the Cowlitz River and within the lower reaches of the smaller tributaries have been severely degraded through industrial and commercial development. Agriculture and forestry activities have also impacted riparian areas. Riparian conditions along the lower mainstem and in lower tributary drainages are expected to continue to trend downward as development pressure around Castle Rock, Longview, and Kelso increase (LCFRB 2004).

The lower 20 miles of the Cowlitz has experienced severe loss of floodplain connectivity due to dikes, riprap, and/or deposited dredge spoils originating from the Mount St. Helens eruption. Only the Sandy River Bend area near Castle Rock retains connected to floodplain habitat. Floodplain loss in the lower reaches of many of the smaller tributaries is a result of Interstate 5, the railroad corridor, and the placement of dredged material (LCFRB 2004).

2.5. Fish

The Cowlitz River historically supported abundant runs of anadromous salmonids including spring and fall Chinook salmon, coho salmon, steelhead trout, and cutthroat trout. The ESA-listed salmonid species are discussed in Section 2.7. Other anadromous fish that occur in the lower Cowlitz River include smelt (eulachon, *Thaleichthys pacificus*), white sturgeon (*Acipenser transmontanus*), and pacific lamprey (*Entophenus tridentatus*).

Spawning runs of eulachon, or Columbia River smelt, occur in the mainstem lower Columbia and Cowlitz Rivers. Adults typically enter the Columbia River in early- to mid-January and ascend the Cowlitz River in mid- to late-January. Commercial landings of eulachon in the Cowlitz River averaged 1,104,500 pounds per year between 1938 and 2001. Landings decreased to an average of 71,200 pounds between 1994 and 2001 (WDFW and ODFW 2001).

White sturgeon (*Acipenser transmontanus*) are abundant in the lower Columbia River below Bonneville Dam. WDFW estimated 139,000 harvestable white sturgeon occupied the lower Columbia River in 2005. The total recreational catch for this reach of the river in 2006 was 24,300 white sturgeon. WFDW reported 8,312 white sturgeon were commercially harvested from the lower Columbia River in 2006.

Pacific lamprey are known to occur in the lower Columbia and Cowlitz Rivers but abundance information is not readily available for the Cowlitz River population (LCFRB 2004). According to Close (2002), adult lamprey migrate from the ocean into freshwater in the late spring to early summer. By September, migration into freshwater steams is complete and spawning occurs the following spring.

Resident endemic fish species in the Cowlitz River include 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 include largemouth and smallmouth bass (*Micropterus salmoides*, *M. dolomieui*), brook trout (*Salvalinus fontinalis*), crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), and brown bullhead (*Ictalurus nebulosus*).

2.6. Wildlife

The Cowlitz River Basin has a wide array of wildlife habitats. The variation in wildlife habitats and abundance of water provides for a wide mix of game and non-game wildlife species. Bald eagles and osprey use the lakes, rivers, and accompanying riparian areas while kestrel and other hawks hunt over the open fields in the valleys. Geese, mallards and other ducks, coot, and grebes are a few of the waterfowl species that may be seen. Beaver, otter, and mink can usually be found along many of the basin's watercourses. Riparian, early successional, wetland, and forested habitats are used by neotropical migrant birds especially during spring and fall migrations. In the forested uplands in the basin, squirrels and woodpeckers may be found along with Rocky Mountain elk and black-tailed deer, cougar, bobcat, and black bear.

2.7. Threatened and Endangered Species

Federally threatened and endangered species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) that may occur in Cowlitz County, Washington are listed in Table 3 and include Columbia white-tailed deer (*Odocoileus virginianus leucurus*, endangered), bald eagle (*Haliaeetus leucocephalus*, threatened), Northern spotted owl (*Strix occidentalis caurina*, threatened), marbled murrelet (*Brachyramphus marmoratus*, threatened), bull trout (*Salvelinus confluentus*, threatened), and Nelson's checker-mallow (*Sidalcea nelsoniana*, threatened). No proposed species are listed for Cowlitz County. A Biological Assessment (BA) has been prepared to address potential effects of the proposed project on these listed species and submitted to USFWS for consultation. Critical habitat was designated by USFWS for northern spotted owl in 1992 (along the Columbia and Cowlitz rivers) and the Columbia River distinct population segment (DPS) of bull trout in 2004 (none in the mainstem Columbia and Cowlitz rivers).

Table 3. USFWS Federally Listed Species

Species Common and Scientific Name	Status	Critical Habitat in Cowlitz Co.	Federal Register (FR) Citation for Listing
Columbian white-tailed deer *Odocoileus virginianus leucurus*	Endangered	No	32 FR 4001, 11 Mar 67
Bald eagle *Haliaeetus leucocephalus*	Threatened (delisting proposed)	No	32 FR 4001, 11 Mar 67
Northern spotted owl *Strix occidentalis caurina*	Threatened	Yes	55 FR 26114, 26 Jun 90
Marbled murrelet *Brachyramphus marmoratus*	Threatened	No	57 FR 45328, 1 Oct 92
Bull trout (Columbia R. DPS) *Salvelinus confluentus*	Threatened	Yes	63 FR 31647, 10 Jun 98
Nelson's checker-mallow *Sidalcea nelsoniana*	Threatened	No	58 FR 8235, 12 Feb 93

Federally threatened and endangered salmonid evolutionary significant units (ESUs) under the jurisdiction of the National Marine Fisheries Service (NMFS) that may occur in the action area are shown in Table 4.

Table 4. Federally Listed Anadromous Salmonid and Sturgeon Species

ESU	Status	Life History Type	Federal Register (FR) Citation
Chinook Salmon (*Oncorhynchus tshawytscha*)			
Snake River	Threatened	Ocean	57 FR 14653; April 22, 1992
Lower Columbia River	**Threatened**	**Stream**	**64 FR 14308; March 24, 1999**
Upper Columbia River	Endangered	Stream	64 FR 14308; March 24, 1999
Upper Willamette River	Threatened	Ocean	64 FR 14308; March 24, 1999
Chum Salmon (*Oncorhynchus keta*)			
Columbia River	**Threatened**	**Ocean**	**64 FR 14508; March 25, 1999**
Sockeye Salmon (*Oncorhynchus nerka*)			

ESU	Status	Life History Type	Federal Register (FR) Citation
Snake River	Endangered	Stream	56 FR 58619; November 20, 1991
Steelhead Trout (*Oncorhynchus mykiss*)			
Snake River Basin	Threatened	Stream	62 FR 43937; August 18, 1997
Lower Columbia River	**Threatened**	**Stream**	**63 FR 13347; March 19, 1998**
Middle Columbia River	Threatened	Stream	64 FR 14517; March 25, 1999
Upper Columbia River	Endangered	Stream	62 FR 43937; August 18, 1997
Upper Willamette River	Threatened	Stream	64 FR 14517; March 25, 1999
Coho Salmon *(Oncorhynchus kisutch)*			
Lower Columbia River	**Threatened**	**Stream**	**60 FR 38011; July 25, 1995**
Green Sturgeon (*Acipenser medirostris)*			
Southern DPS	Threatened		71 FR 17757; April 7, 2006

Note: ESUs shown in bold are specifically listed for the Lower Cowlitz River portion of the action area. The Columbia River portion of the action area is primarily used by the other ESUs as a rearing/migration corridor.

These ESUs have the potential to be present in the action area as juveniles, adults or both. The listed ESUs fall into two juvenile life-history strategies: "ocean-type" that rear in freshwater for only a few weeks to a few months before migrating to the estuary/ocean during their first year of life, and "stream-type" that spend at least a year rearing in freshwater prior to their downstream migration to the ocean. Only four of the salmon and steelhead ESUs are listed as threatened in the lower Cowlitz River: Lower Columbia River Chinook salmon, Columbia River chum salmon, Lower Columbia River steelhead trout, and Lower Columbia River/Southwest Washington coho salmon (shown in bold in Table 1). The Columbia River portion of the action area is used by the other species primarily as a rearing/migration corridor between upstream spawning areas and the Pacific Ocean.

Critical habitat and essential fish habitat (EFH) are also addressed in the BA. In 2005, critical habitat was designated by the NMFS for all Columbia River steelhead trout ESUs and all Columbia River salmon ESUs, with the exception of the lower Columbia River coho salmon ESU (70 FR 52630; September 2, 2005). Table 5 describes critical habitat as currently designated for the listed fish species within the project area. The lower Cowlitz River is specifically listed as critical habitat for Lower Columbia River Chinook salmon, Columbia River chum salmon, and Lower Columbia River steelhead. The project area is designated as EFH for Chinook and coho salmon.

Table 5. Critical Habitat Designations and Descriptions

Species	Date of Critical Habitat Designation	Description of Critical Habitat
Chinook Snake River spring/summer	10/25/99 (64 FR 57399)	Columbia River to confluence with Snake River, Snake River and tributaries
Chinook Snake River fall	12/28/93 (58 FR 68543)	Columbia River to confluence with Snake River, Snake River and tributaries
Chinook Lower Columbia River	9/2/05 (70 FR 52630) effective 2/2/2006	Columbia River to confluence with Hood River and tributaries
Chinook Upper Columbia River	9/2/05 (70 FR 52630) effective 2/2/06	Columbia River to Rock Island Dam and tributaries
Chinook Upper Willamette River	9/2/05 (70 FR 52630) effective 2/2/06	Columbia River to confluence of Clackamas and Willamette Rivers
Chum Columbia River	9/2/05 (70 FR 52630) effective 2/2/06	Columbia River to confluence with Hood River and tributaries

Species	Date of Critical Habitat Designation	Description of Critical Habitat
Sockeye Snake River	12/28/93 (58 FR 68543)	Columbia River to confluence with Snake River, Snake River and tributaries
Steelhead Snake River Basin	9/2/05 (70 FR 52630) effective 2/2/06	Columbia River to confluence with Snake River, Snake River and tributaries
Steelhead Lower Columbia River	9/2/05 (70 FR 52630) effective 2/2/06	Columbia River to confluence with Hood River and tributaries
Steelhead Middle Columbia River	9/2/05 (70 FR 52630) effective 2/2/06	Columbia River to confluence with Yakima River and tributaries
Steelhead Upper Columbia River	9/2/05 (70 FR 52630) effective 2/2/06	Columbia River to Chief Joseph Dam and tributaries
Steelhead Upper Willamette River	9/2/05 (70 FR 52630) effective 2/2/06	Columbia River to confluence of Clackamas and Willamette Rivers

2.7.1. USFWS Species

The following information provides a general overview of the life history and status for each of the ESA-listed species shown in Table 3, and whether the species are likely to occur in the project area.

Columbian White-tailed Deer (Endangered). The Columbian white-tailed deer is one of the approximately 30 subspecies found in North America and is listed as endangered. Columbian white-tailed deer originally occupied the valleys of the Umpqua, Willamette, and lower Columbia Rivers northward in Oregon and into the Cowlitz River bottoms of Washington. There are now two remnant, isolated populations – one in the Roseburg/Umpqua drainage area, and one along the lower Columbia River (Marshall 1996).

The Columbia River population is approximately 600 individuals (personal communication Joel David, Refuge manager) and occupies the lower Columbia River from river mile (RM) 32 to RM 50. Columbian white-tailed deer populations occupy the following areas in Oregon: Tenasillahe Island (part of the Julia Butler Hansen National Wildlife Refuge); Karlson Island (part of the Lewis and Clark National Wildlife Refuge) in Clatsop County; the vicinity of Westport, Clatsop, and Columbia counties; Wallace Island (part of the Julia Butler Hansen National Wildlife Refuge); and adjoining small islands in Columbia County.

Columbian white-tailed deer have been transplanted to Crims Island at RM 57, Hump and Fisher islands at RM 60, and Lord and Walker islands at RM 63 to re-establish historic populations. The habitats used by the Columbia River population include riparian and floodplain areas on both sides of the river and islands within the river. Columbian white-tailed deer graze on herbaceous plants and grasses. The species rarely forage farther than 820 feet from some kind of cover, which includes woody vegetation and tall herbaceous species such as thistles (Marshall 1996).

Occurrence in Project Area. The closest Columbian white-tailed deer population to the lower Cowlitz River project area is about 5 miles downstream on Lord and Walker islands (RM 63). Therefore, the interim dredging action is considered to be outside the current range of this species.

Bald Eagle (Threatened). Bald eagles were listed as endangered in the conterminous United States under the ESA on March 6, 1967 (32 FR 4001). On February 14, 1978, the status of the population in the Pacific Northwest was changed to threatened. Bald eagle populations have rebounded considerably within the last few years, with nearly all recovery goals met for Oregon, Washington, and other regions of the country. On July 6, 1999, the USFWS proposed delisting bald eagles from the ESA. As of April 2007, a final decision concerning the proposed delisting has not been made by USFWS.

The bald eagle occurs throughout the United States and Canada. It winters primarily along rivers south of the Canadian border. The historic decline of the bald eagle has been attributed to the loss of feeding and nesting habitat, organochloride pesticide residues, shooting, poisoning, and electrocution (Snow 1981). Human interference has been shown to adversely affect the distribution and behavior of wintering bald eagles (Stalmaster and Newman 1978). Critical habitat for bald eagles has not been formally designated by USFWS.

The bald eagle is closely associated with freshwater, estuarine, and marine ecosystems that provide abundant prey and suitable habitat for nesting and communal roosting (Watson et al., 1991). Breeding territories are typically located within one mile of permanent water in predominantly coniferous, uneven-aged stands with old-growth structural components (Anthony et al. 1982, Stalmaster 1987, Anthony and Isaacs 1989). Bald eagles over-winter along ice-free lakes, streams, and rivers where food and perch sites are abundant and the level of human disturbance is low (USFS 1977, Steenhof 1978, Stalmaster 1980). Communal night roosts are used by bald eagles primarily during the winter months. In the Pacific Northwest, communal roosts generally occur in multi-layered mature or old-growth conifer stands that provide protection from weather and human disturbance (Stalmaster and Newman 1978).

Home range size for the bald eagle varies greatly according to food abundance and the availability of suitable nest and perch trees (Stalmaster 1987). Favored nest trees are usually the largest tree or snag in a stand that provides an unobstructed view of the surrounding area and a clear flight to and from the nest (Stalmaster 1987). Nests are usually built on limbs just below the crown, with the canopy above providing cover (USFS 1977). Nesting behaviors typically begin in January, followed by egg laying and incubation in February and March (Isaacs and Anthony 2006). Young are reared throughout April, May, and June. Fledging occurs in July and August. Bald eagles are primarily predators but also opportunistic scavengers that feed on a variety of prey including salmon, other fish, small mammals, waterfowl, seabirds, and carrion (Snow 1981). Bald eagles usually forage in large open areas with a wide visual field and with suitable perch trees near the food source (USFS 1985).

<u>Occurrence in Project Area</u>. Wintering bald eagles occur along the Columbia, Cowlitz, and Coweeman rivers. Potential perch trees include cottonwoods and open-crowned conifers scattered along the river banks. Wintering eagles can be sensitive to disturbance from October 31 through March 31 (USFS 2006). There is an active bald eagle nest site at the mouth of the Cowlitz River, located on the southwest side of the Wasser and Winters property (Issacs and Anthony 2007). The location of the nest and its use by a bald eagle nesting pair was confirmed during a Corps' site visit in April 2007. The critical period when human activities could disturb occupied nest sites extends from January 1 until August 15 (USFS 2006). Nest initiation, including courtship and nest building, occurs in January through March. Incubation occurs from March until late May and young are in nests from early April through mid-August. Young usually remain in the nest area throughout August (USFS 2006).

Northern Spotted Owl (Threatened). The northern spotted owl was listed as a threatened species throughout its entire range in June 1990 (55 FR 26114). It ranges from southern British Columbia south to Marion County, California and east to the shrub steppe of the Great Basin in Oregon and California. In the Western Cascades, the northern spotted owl can be found from approximately sea level to 4,000 feet in elevation (57 FR 1796). Most observations of spotted owls habitat use have been made in forests with a component of old-growth and mature forests consisting of western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), and western redcedar (*Thuja plicata*). However, the northern spotted owl has been observed to use a wide variety of habitat types and forest stands, including managed stands for nesting feeding or roosting (57 FR 1796).

In general, northern spotted owls preferentially use forests with greater complexity and structure. In the western cascades, the home range of northern spotted owl pairs ranges from approximately 1,000 to 10,000 acres in size, depending on the amount of old growth forest fragmentation present. The most important habitat characteristic is an uneven-aged, multilayered canopy that offers moderate to high (65% to 80%) cover. Numerous large trees with broken tops, deformed limbs, and cavities are typically used as nest sites by spotted owls. Spotted owls are primarily nocturnal and eat small mammals, birds, and insects. The majority of the prey base is northern flying squirrels (*Glaucomys sabrinus*), red tree voles (*Arborimus longicaudus*), and wood rats (*Neotoma* spp.; 55 FR 26114).

Occurrence in Project Area. There is no suitable habitat for spotted owls present in the project area. It is very unlikely that spotted owls would occur in the project area, except perhaps as dispersing juveniles from other nesting areas. Spotted owls are known to nest on the Gifford Pinchot National Forest, located about 30 miles east of the action area, which contains over 580,000 acres of critical habitat for spotted owls (USFS 2006). Also, the proposed action will not impact any trees (upland disposal sites) in the action area. Consequently, if dispersing juveniles should make their way into the action area, the proposed action is not expected to diminish the value of the upland habitat for the owls or their prey, even on a temporary basis.

Marbled Murrelet (Threatened). The marbled murrelet is a small seabird of the Alcidae family. The species' breeding range extends from Bristol Bay, Alaska, south to the Aleutian Archipelago, northeast to Cook Inlet, Kodiak Island, Kenai Peninsula and Prince William Sound, south along the coast through the Alexander Archipelago of Alaska, British Columbia, Washington, and Oregon to central California. Birds winter throughout the breeding range and also occur in small numbers off southern California. Two components of marbled murrelet habitat are biologically essential: marine foraging habitat and terrestrial nesting habitat and associated forest stands (USFWS 2006). Throughout the forested portion of their range, marbled murrelet habitat use is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low amounts of edge and fragmentation, proximity to the marine environment, and increasing forest age and height (USFWS 2006).

Unlike most auks, murrelets nest solitarily on mossy platforms of large branches in old-forest trees. Nesting season occurs from late March to September. Egg laying, incubation, and hatching occur before August 5, and feeding of young occurs from August 6 to September 15 (USFS 2006). Although they feed on fish and invertebrates primarily in nearshore marine waters, they nest as far as 50 miles inland from the marine environment, on large limbs of mature conifers. Marbled murrelets are mostly pelagic during the winter (USFS 2006).

The USFWS designated critical habitat for the marbled murrelet in 1996. Coastal forests in Washington, Oregon, and northern California contain designated habitat. Critical habitat consists of only suitable nesting habitat and does not include foraging habitat in marine areas.

Occurrence in Project Area. There is no suitable habitat for marbled murrelets present in the action area. It is very unlikely that marbled murrelets would occur in the project area. Marbled murrelets do occur on the Gifford Pinchot National Forest, located about 30 miles east of the action area, which contains over 600 acres of critical habitat for marbled murrelets (USFS 2006).

Columbia River DPS Bull Trout (Threatened). Most of the information provided below was extracted from http://www.fws.gov/idahoes/Section7Guid.htm. Bull trout exhibit resident and migratory life-history strategies through much of the current range (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear from one to four years before migrating to a lake, river, or ocean where they grow to maturity. Growth of resident fish is generally slower than migratory fish. Resident fish tend to be smaller at maturity and less fecund (Fraley and Shepard 1989, Goetz 1989). The size and age of maturity for bull trout is variable depending upon life-history strategy, but they typically reach sexual maturity in 4 to 7 years. Bull trout can live as long as 12 years.

Preferred spawning habitat consists of low gradient streams with loose, clean gravel and water temperatures of 39° to 51°F (Goetz 1989). Spawning occurs in late summer to early fall in the upper reaches of clear streams in areas of flat gradient, uniform flow, and uniform gravel or small cobble. Bull trout typically spawn from August to November during periods of decreasing water temperatures. However, migratory bull trout frequently begin spawning migrations as early as April, and move upstream as far as 155 miles to spawning grounds (Fraley and Shepard 1989). Redds are often constructed in stream reaches fed by springs or other sources of cold groundwater. Depending on water temperature, incubation normally takes from 100 to 145 days and juveniles remain in the substrate after hatching. Time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992, Ratliff and Howell 1992). Fry and juvenile fish are strongly associated with the stream bottom and often found at or near it.

Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, amphipods, mysids, crayfish, and small fish. Adult migratory bull trout are an apex predator that is primarily piscivorous, known to feed on various trout and salmon, whitefish, yellow perch and sculpin. Older individuals are found in deeper and faster water compared to juveniles. Adults are often found in pools sheltered by large, organic debris or clean cobble substrate. Migratory bull trout may use a wide range of habitats ranging from first- to sixth-order streams and varying by season and life stage. Resident populations are generally found in small headwater streams where they spend their entire lives.

Where suitable migratory corridors exist, extensive migrations are characteristic. Retention and recovery of migratory life history forms and maintenance or re-establishment of stream migration corridors is considered crucial to the persistence of bull trout.

Occurrence in Project Area. The Columbia River downstream of Bonneville Dam serves as foraging, over-wintering, and migratory habitat for bull trout. Documentation for this is provided in the *Proposed Designation of Critical Habitat* (67 FR 71235) and the *Bull Trout Recovery Plan* (USFWS 2002).

According to the *Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan* (LCFRB 2004), bull trout do not occur in the lower Cowlitz subbasin. The *Bull Trout Recovery Plan* (USFWS 2002) states that historically bull trout may have inhabited areas within the Cowlitz River, but current distribution is unknown. The Cowlitz River is considered a research need and additional information is required to determine if the system is important for bull trout recovery. Also, the extent to which bull trout currently use the mainstem Columbia River is unknown. The Lower Columbia Recovery Team considers the mainstem Columbia River to contain core habitat which may be important for full recovery of the species to occur. Studies designed to verify bull trout abundance, spatial distribution, and temporal use of the mainstem Columbia River is a primary research need (USFWS 2002). If present, bull trout may utilize the action area as a migratory corridor.

Nelson's Checker-mallow (Threatened). Nelson's checker-mallow (Sidalcea nelsoniana) is a perennial herb which is known to occur in moist, open ground and thickets, as well as on occasion in areas where prairie or grassland remnants persist. It occurs in the Willamette Valley of Oregon and in the Coast Range of Oregon and Washington. Within the Willamette Valley, Nelson's checker-mallow most frequently occurs in swales and meadows with wet depressions, along streams, or in wetlands within remnant prairie grasslands (58 FR 8235).

<u>Occurrence in Project Area</u>. There is no known population of Nelson's checker-mallow in the project area. One small extant population of Nelson's checker-mallow is known in the lower Columbia River-Clatskanine subbasin in Cowlitz County (USFWS 1998).

2.7.2. Anadromous Salmonid Species

The following salmonid ESUs would not be expected to occur in the Lower Cowlitz River portion of the project area. In the Columbia River portion, these species may move through the Columbia River and past the mouth of the Cowlitz River on their upstream (adult) and downstream (juvenile) migrations.

<u>Snake River Chinook Salmon ESU</u>. Adult Snake River fall Chinook are present in the lower Columbia River in August through early October. Fry emergence occurs from late March through June in the Snake River. Some juveniles begin migrating downstream soon after emergence, while others rear near the spawning areas for several weeks before beginning downstream migration.

Adult Snake River spring Chinook migrate upstream in the lower Columbia River in March through May. Summer Chinook adults begin upstream passage during late May/early June through July at Bonneville Dam, with peak passage during the last week of June to the first week of July. Spawning begins in August and extends into late September. Fry of both spring- and summer-run fish emerge from the spawning gravel the following spring (mid-March to mid-May). Juveniles of both groups rear for nearly 1 year before out-migrating to the ocean as yearling fish. Counts at Bonneville Dam show that yearling Chinook generally pass the dam from early April through late June, with a peak typically occurring in late April or early May. However, in some years (e.g., 1992) the peak has occurred in late May.

<u>Upper Columbia River Chinook Salmon ESU</u>. Adult salmon from this ESU migrate upstream through the lower Columbia River in March through May. Spawning occurs in upper river tributaries and begins in August and extends into mid-September.

<u>Upper Willamette River Chinook Salmon ESU</u>. The range for the upper Willamette River Chinook salmon ESU includes the Willamette River Basin upstream from Willamette Falls, the mainstem Willamette River below Willamette Falls, the Columbia River

downstream from the confluence of the Willamette River, and the Pacific Ocean. Based on ladder counts at Willamette Falls, adult spring Chinook salmon migrate through the lower Willamette River from March through May, with a peak in late April.

Snake River Sockeye Salmon ESU. Adult sockeye salmon enter the Columbia River from late May to the middle of August. The peak occurs at Bonneville Dam from late June to the first week of July. Sockeye smolts migrate out of Redfish Lake from late April through May after spending 1 to 2 years in Redfish Lake. Smolts are typically found in the estuarine areas of the lower Columbia River during May and June.

Snake River Basin Steelhead Trout ESU. Snake River Basin steelhead enter freshwater from June to October and spawn during the following spring from March to May. Downstream migration of wild steelhead smolts begins at Lower Granite Dam in mid April, peaks between late April and late May, and is essentially complete by the middle of June. These fish pass Bonneville Dam during the latter half of the steelhead smolt migration (i.e., from mid-May to mid/late June).

Middle Columbia River Steelhead Trout ESU. Adults from this ESU migrate upstream from mid-April through October with a peak during mid July to early September. Some other populations have later runs that continue through October or November. Thus, some adult fish could be present in the vicinity of the action area from April through January. Juvenile downstream migration occurs from late March through June, with peak abundance occurring from late April through the middle of May.

Upper Columbia River Steelhead Trout ESU. Migration for this ESU occurs in fall/winter and spring/summer, and spawning occurs in February and March. Juveniles spend from 1-7 years (average 2 years) in freshwater and outmigrate during spring and early summer. Counts of wild steelhead smolts at Rock Island Dam indicate that downstream migration begins in April, peaks between late April and late May, and declines through mid-June. These fish may pass Bonneville Dam during the second half of the steelhead smolt migration (i.e., between the middle of May and late June).

Upper Willamette River Steelhead Trout ESU. This steelhead ESU occupies the Willamette River and its tributaries, upstream from Willamette Falls, and includes all naturally spawned populations of winter-run steelhead (both early and late). The early winter runs of upper Willamette River steelhead are found in Coastal Range tributaries, while the late winter-run fish are in Cascade Mountain tributaries. Adults of the late-run Willamette River winter steelhead enter the lower Columbia River in the middle of February and March. Spawning usually begins in the tributaries in April and continues through mid May.

The following salmonid ESUs are expected to occur in the Lower Cowlitz River portion and the Columbia River portion of the project area.

Lower Columbia River Chinook Salmon ESU. Spring (stream-type) and fall (ocean-type) chinook salmon are native to the Cowlitz Basin, with fall Chinook being more dominant in the lower Cowlitz River. According to the LCFRB (2004), historical abundance of natural spawning fall Chinook in the Cowlitz River was estimated to have once been 100,000 adults, declining to about 18,000 adults in the 1950s, 12,000 in the 1960s, and recently to less than 2,000. Currently hatchery production accounts for most fall Chinook returning to the Cowlitz River. Adult time of return to the Cowlitz Salmon Hatchery ranges from March through September. Fall chinook salmon adults in the Cowlitz River begin upstream migration in late August, peaking in mid-September. Spawning occurs in October and November below Mayfield Dam (RM 52), and fry emergence occurs from March to April, and juvenile rearing lasts through mid-June. Juvenile emigration peaks in June through August and ends in December. Spring chinook salmon enter the Cowlitz during the winter months and spawn the following August through October between the Cowlitz Trout Hatchery on Blue Creek (near Ethel, WA) and the Cowlitz Salmon Hatchery (RM 50.4). Fry emerge in January to February and typically rear through the summer and migrate downstream in the spring one year after emergence.

Columbia River Chum Salmon ESU. According to the LCFRB (2004), the historical Cowlitz adult population was the largest in the lower Columbia and estimated from 300,000-500,000 fish. This estimate includes production from the mainstem Cowlitz, Toutle, and Coweeman rivers. Current returns are very low, likely less than 150 fish. Typically less than 20 chum are collected annually in the hatchery trap at the Barrier Dam. Natural spawning primarily occurs in the lower Cowlitz River, lower mainstem Toutle River, Ostrander Creek, and the lower Coweeman River. Columbia River chum salmon run from mid-October through November; peak spawner abundance occurs in late November. Fry emerge in early spring and migrate to the Columbia River as age-0 smolts generally from March to May. No hatchery releases of chum have occurred in the Cowlitz Basin.

Lower Columbia River Steelhead Trout ESU. The Cowlitz Basin supports both winter and summer steelhead runs, although historically winter steelhead were the dominant form. According to the LCFRB (2004), the historical lower Cowlitz adult winter steelhead population was estimated from 2,000-28,000 fish. Adult winter steelhead enter the Cowlitz River from mid-November through June. Spawning in the lower Cowlitz primarily occurs in Olequa, Ostrander, Salmon, Arkansas, Delameter, and Stillwater creeks. Spawning time is March to early June. Fry emerge from April through July. Juveniles rear for one year upstream and downstream of the spawning areas before migrating to the Columbia River in April and May. Hatchery winter steelhead have been planted in the Cowlitz Basin since 1957.

Lower Columbia River Coho Salmon ESU. According to the LCFRB (2004), the historical lower Cowlitz adult population of coho salmon is estimated from 20,000-120,000 fish with the majority of returns being late stock which spawn in November. Historically, two separate runs of coho salmon were reported to enter the Cowlitz River. The early run entered the Cowlitz from late August and September, with a spawning peak in late October. The late run entered the Cowlitz from October through March, with a spawning peak in late November. Fry emergence occurs from January through April. Juveniles rear upstream and downstream of the spawning areas for a year before migrating to the Columbia River in the spring. Since 1968, the Cowlitz Salmon Hatchery has maintained the coho salmon population in the Cowlitz River Basin. Natural production is limited, and most coho salmon that do spawn in the Cowlitz River are considered a mixed stock of hatchery origin. Natural spawning occurs primarily in Olequa, Lacamas, Ostrander, Blue, Otter, Mill, Arkansas, Foster, Stillwater, Campbell, and Hill creeks.

2.7.3. Sturgeon Species

The Southern DPS green sturgeon was listed as a threatened species by NMFS on April 7, 2006. According to the Final Rule, the southern DPS includes all spawning populations of green sturgeon south of the Eel River in California.

Green sturgeon enter the Columbia River at the end of spring with their numbers increasing through June and the greatest numbers in the estuary in July through September. WDFW records of commercial harvest in the Columbia River indicate that a total of 210 green sturgeon have been caught in the Columbia River between RMs 52 and 87 since 1981. The majority of green sturgeon are caught in the lower reaches of the Columbia (29,132 from RM 1-20 and 8,086 from RM 20-52). A few green sturgeon may be found as far upriver as Bonneville Dam, but there are no known spawning populations on the Columbia River and its tributaries. In addition, WDFW is not aware of any documented instances of green sturgeon being observed or caught in the Cowlitz River (Brad James, WDFW, personal communication).

2.8. Cultural and Historic Resources

The Portland District, as part of its Section 106 responsibilities under the National Historic Preservation Act, has considered impacts to cultural resources for the area proposed for dredging, from the Cowlitz River mouth to Cowlitz River Mile 2.5, and provided survey information to the Washington State Historic Preservation Office for concurrence or comment. In the mid-1970s Gleeson (1974) and Jermann and Hollenbeck (1974) documented their inventories of dredge disposal sites on the Lower Columbia River. Portland District Staff archaeologists as part of their normal duties and then for the Mt. Saint Helens Emergency operations, inventoried disposal sites from the mouth of the Cowlitz up to its confluence with the Toutle River.

Portland District records include concurrence comments on the two upland disposal sites proposed for this dredging cycle, L[eft]01.1, Wasser and Winters disposal area (formerly the Collins Estate) located on the mainland side of Carroll's Channel and R[ight] 01.6, Swanson's Bark Wood Products Site (formerly the location of a Longview Fiber log holding area). The shoreline of the Wasser and Winters site was first surveyed by Jermann and Hollenbeck (1974) and then the upland area by Portland District Staff (Ellis, nd ca.1980). The Washington SHPO reviewed documentation and concurred with a no effect determination for the Wasser and Winter (as the Collin Estate) and the Swanson's Bark Wood Product site (formerly a Longview Fiber log holding area) on November 4, 1980 (re: Washington SHPO Log Reference 176-F-COE-P-01).

2.9. Socio-economic Resources

2.9.1. Population and Economy

The population trends for Cowlitz County and for the major cities in the project area are shown in Table 6. The population of Kelso and Castle Rock has remained relatively stable since 1970, whereas Longview's population has increased by about 25% since 1970. Cowlitz County's population has increased by about 41% since 1970. As shown in Table 7, Cowlitz County's average annual population growth fell below Washington's average during the 1970s, trailed Washington's average during the 1980s, fell below Washington's average during the 1990s, and is falling below Washington's average over the 5-year period for this decade (2000-2004).

Table 6. Population Trends for Cowlitz County and Cities in the Project Area

Location	1970	1980	1990	2000	April 1, 2006 Estimate
Kelso	10,296	11,129	11,767	11,895	11,840
Longview	28,373	31,052	31,499	34,660	35,570
Castle Rock	1,647	2,162	2,067	2,130	2,135
Cowlitz County	68,616	79,548	82,119	92,948	96,800

Source: Office of Financial Management, State of Washington (http://ofm.wa.gov/pop)

Table 7. Average Annual Percent Change in Population Growth

Location	1970-2004	1970-79	1980-89	1990-99	2000-2004
Cowlitz County	1.01%	1.42%	0.37%	1.37%	0.72%
Washington	1.79%	1.85%	1.70%	2.10%	1.22%
United States	1.08%	1.10%	0.95%	1.23%	1.03%

Source: Western Washington University, 2007.

The major industries in Cowlitz County include manufacturing, retail trade, health care, and local government (Table 8). According to the U.S. Census Bureau (2007), in 2003 the median household income in the county was $40,428 ($48,185 for Washington), and the percent of persons living below the poverty level was 13.7% (11.0% for Washington).

As shown in Table 9, Cowlitz County's average annual employment growth fell below Washington's average during the 1970s, trailed Washington's average during the 1980s, fell below Washington's average during the 1990s, and is falling below Washington's average over the 5-year period for this decade (2000-2004).

Table 8. Employment by Major Industry, Cowlitz County, 2004

Industry	Employment	Percent of Total
Manufacturing	7,633	16.5
Retail Trade	5,836	12.6
Health Care	5.320	11.5
Local Government	4,426	9.6
Accommodation & Food Services	2,967	6.4
Construction	2,884	6.2
Other Services except Public Admin	2,806	6.1
Administrative & Waste Services	1,530	3.3
Professional & Technical Services	1,394	3.0
Finance & Insurance	1,288	2.8
Real Estate & Rental/Leasing	1,254	2.7
State Government	1,146	2.5

Source: Western Washington University, 2007.

Table 9. Average Annual Percent Change in Employment Growth

Location	1970-2004	1970-79	1980-89	1990-99	2000-2004
Cowlitz County	1.38%	2.40%	1.28%	1.55%	-0.76%

Washington	2.50%	3.02%	2.90%	2.41%	0.85%
United States	1.81%	2.22%	1.94%	1.74%	0.87%

Source: Western Washington University, 2007.

2.9.2. Flood Damage Reduction

The 1980 eruption of Mount St. Helens dramatically altered the hydraulic and hydrologic regimes of the Cowlitz and Toutle River Valleys. About 50,000 people and their property are at risk if the flood protection is not maintained. The construction, operation and maintenance of a sediment retention structure (SRS), levee improvements and dredging have maintained flood level protection goals in the lower Cowlitz River through 2006.

3. ALTERNATIVES

Significant sand deposition occurred in 2006 and continues at the mouth of the Cowlitz River, which has severely reduced the capacity of the river channel to transport sand. This sediment build-up at the mouth of the Cowlitz River degrades the river's ability to pass sand from upstream. The authorized levels of flood protection for the communities of Kelso, Longview, Lexington, and Castle Rock will be reduced as sediment deposition continues on the Cowlitz due to the loss of channel capacity at its mouth. Because of this imminent loss in flood protection, a short-term (interim) alternative needs to be implemented to maintain flood protection levels for the next 5 years. In addition, the Corps is proposing a study to investigate long-term dredging and non-dredging alternatives that would maintain the level of flood protection for the communities on the lower Cowlitz River through the year 2035.

The following interim alternatives were considered to maintain the authorized levels of flood protection.

3.1. Increase Flood Storage Capacity on the Cowlitz River

A preliminary investigation was undertaken for increasing the flood storage at Mossyrock Dam to reduce flood flows on the lower Cowlitz River. The computer program ResSim was used to estimate the effect of increasing the flood control storage space behind the dam using the February 1996 flood as an example. The resulting hydrographs showed no difference in the peak regulated flow at Castle Rock. Therefore, this measure was not considered effective as an interim measure.

3.2. Temporary Levee Raises

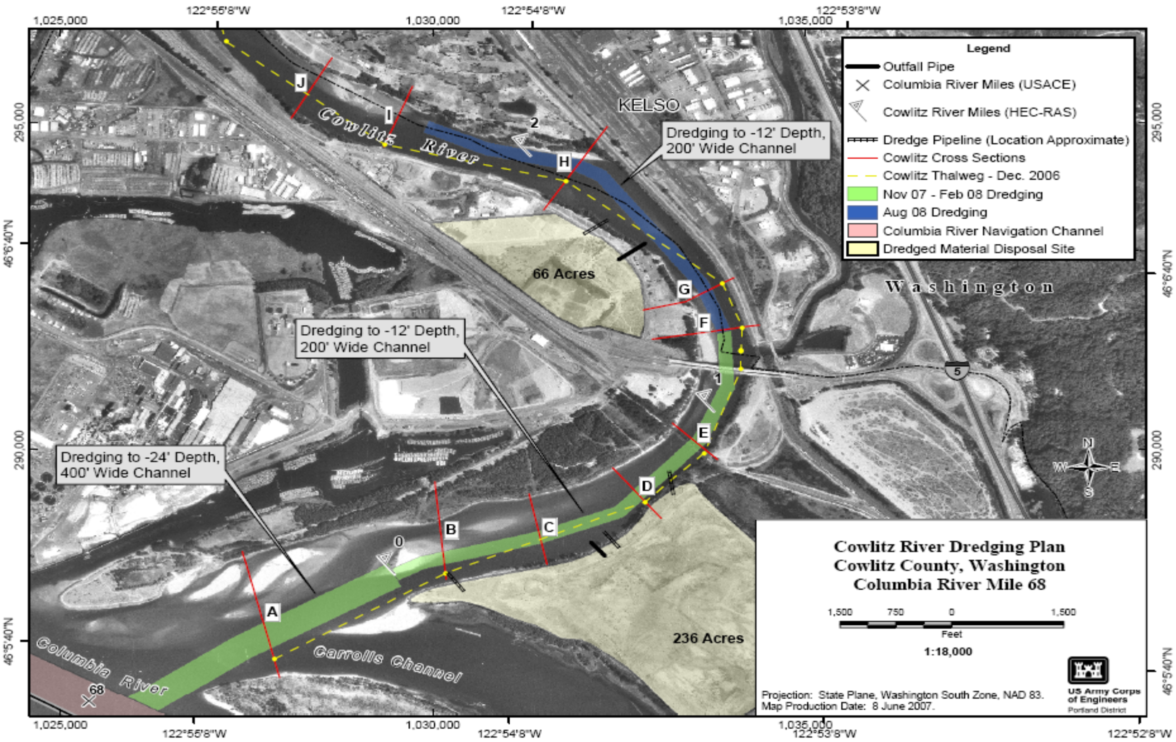
Placing temporary structures on the existing levees to increase the level of flood protection was found not to be viable as an interim measure. Placing temporary structures such as sandbags, Portadams, or soil berms on top of the existing levees would reduce the likelihood of overtopping, but overtopping is not always the critical failure mode. Simply raising the levee heights by using temporary structures would not reduce the probability of seepage-related failure modes, such as seepage-caused erosion or slope instability, before the levees overtop. Several reaches of the Cowlitz levees are more likely to fail due to these seepage-related failure modes before they are overtopped.

3.3. Interim Dredging Alternative (Proposed Action)

Interim dredging of sand from the mouth of the Cowlitz River to RM 2.5 would be effective in restoring the sediment transport potential of the Cowlitz to move sand into the Columbia River, and would maintain the levels of flood protection for the four upstream communities.

The interim dredging action would dredge up to 4.21 mcy of sand from the lower 2.5 miles of the Cowlitz River and in the Columbia River from the mouth of Cowlitz River (Cowlitz RM 0) to the Columbia River FNC, referred to as a transition area (Figure 12).

Figure 12. Cowlitz River Interim Dredging Plan Location Map



Cowlitz River cross section plots showing the proposed dredge channel and the December 2006 bathometry are designated by letters A through J in Figure 12 and are shown in Figures 13 to 18. Actual dredging areas will be determined prior to dredging and will be based on actual sediment accumulation within the project area. Figure 12 is a representation meant to depict the general dredging template, not the actual alignment of a channel.

Pipeline and/or clamshell dredging will be used to remove and place material to the upland disposal sites. The size of the pipeline dredge used may range from 12 to 30 inches depending on the location of dredging. Booster pumps may be used to facilitate longer pumping distances.

A pipeline dredge uses a ‘cutterhead’ on the end of an arm that is buried in the river bottom and swings in an arc in front of the dredge. Dredged material is sucked up through the cutterhead and into the pipes by an onboard pump. It is then pumped to either an upland or in-water disposal site, depending upon the project.

Pipeline Dredge

Upland sites normally have dikes to contain the material and water. The return water is held in settling ponds controlled by weirs to reduce suspended sediment levels and meet state water quality standards for the return water.

Clamshell Dredge

Mechanical dredges remove material by scooping it up with a bucket. They include clamshell, dragline, and backhoe dredges and are well suited for removing cemented sands, gravels, or well-fractured rock outcrops. Mechanical dredges are used for dredging in areas where other forms of dredging may not be effective.

Mechanical dredging is performed using a bucket operated from a crane or derrick that is mounted on a barge or operated from shore. Sediment from the bucket is usually placed on a barge for offloading and disposal to an upland or in-water site. Because mechanical dredges are not self-propelled, they are not typically used in high traffic areas; rather, they are used in tighter spaces such as around docks and piers. Also, because they are usually situated on a barge, clamshell dredges can be used in restricted areas and shallow areas where draft restrictions may limit other choices.

Return water from mechanical dredging comes from the bucket as it is raised above the water surface and from the barge as the material is loaded. Return water from the barge can come from overflow over the sides or through a skimmer if the barge is equipped with one.

Initial dredging will occur during the Columbia River in-water work window of November 1, 2007 to February 28, 2008. Approximately 2.2 mcy of material will be dredged from the transition area, from the Columbia River FNC to Cowlitz RM 0, over a period of 6 to 8 weeks at the beginning of the in-water work window. Approximately 1.015 mcy of material will be dredged from the portion of the river between Cowlitz RM 0 and RM 1.3 over the 4 month period. Approximately 995,000 cy of material will be dredged from RM 1.3 and 2.5 during the Cowlitz River in-water work window of August 1 to 31, 2008. Dredges will work up to 24 hours per day 7 days a week.

The side slopes of the dredged channel will be at 1-foot vertical to 3-foot horizontal, with bottom widths varying from 200 to 400 feet. Table 10 shows the dredged channel specifications and estimated volumes to be dredged. The schedule for the interim dredging action is shown in Table 11.

Annual follow-on dredging from the Columbia River Navigation channel to RM 2.5 to the dredged channel depths and bottom widths will be necessary to maintain flood protection levels for the next 5 years. Dredged volumes may vary widely and are expected to range from 500,000 to 2,200,000 cy annually. Actual volumes will be calculated prior to dredging and will be based on actual sediment accumulation within the project area. Maintaining a connection to the thalweg of the Columbia River, currently the federal navigation channel will assure a constant rate of sediment movement into the Columbia while maintaining flood protection levels upstream.

Table 10. Cowlitz River Dredging Plan

Cowlitz River Mile (RM)	Bottom Width (feet NAVD)	Side Slope	Dredging Depth/Invert (feet NAVD)	Estimated Volume (cy)	Cumulative Volume (cy)
Columbia River FNC to RM -0.340	400	1:3	-24.4	700,000	700,000
RM -0.340 to 0.161	400	1:3	-24.4	1,500,000	2,200,000
RM 0.421 to 0.161	200	1:3	-12.0	475,000	2,675,000
RM 0.681 to 0.421	200	1:3	-12.0	185,000	2,860,000
RM 0.883 to 0.681	200	1:3	-12.0	100,000	2,960,000
RM 1.115 to 0.883	200	1:3	-12.0	125,000	3,085,000
RM 1.149 to 1.115	200	1:3	-12.0	40,000	3,125,000
RM 1.262 to 1.149	200	1:3	-12.0	90,000	3,215,000
RM 1.382 to 1.262	200	1:3	-12.0	100,000	3,315,000
RM 1.879 to 1.382	200	1:3	-12.0	370,000	3,685,000
RM 2.351 to 1.879	200	1:3	-12.0	410,000	4,095,000
RM 2.500 to 2.351	200	1:3	-12.0	115,000	4,210,000

Table 11. Schedule for Cowlitz River Dredging Plan

Cowlitz River Mile	Work Window	Disposal Volume
Columbia River FNC to RM 1.262	November 2007 to February 2008	3,215,000 cy
RM 1.262 to 2.500	August 2008	995,000 cy

Figure 13. Cowlitz River Cross Sections A & B, River Miles -0.340 and 0.161

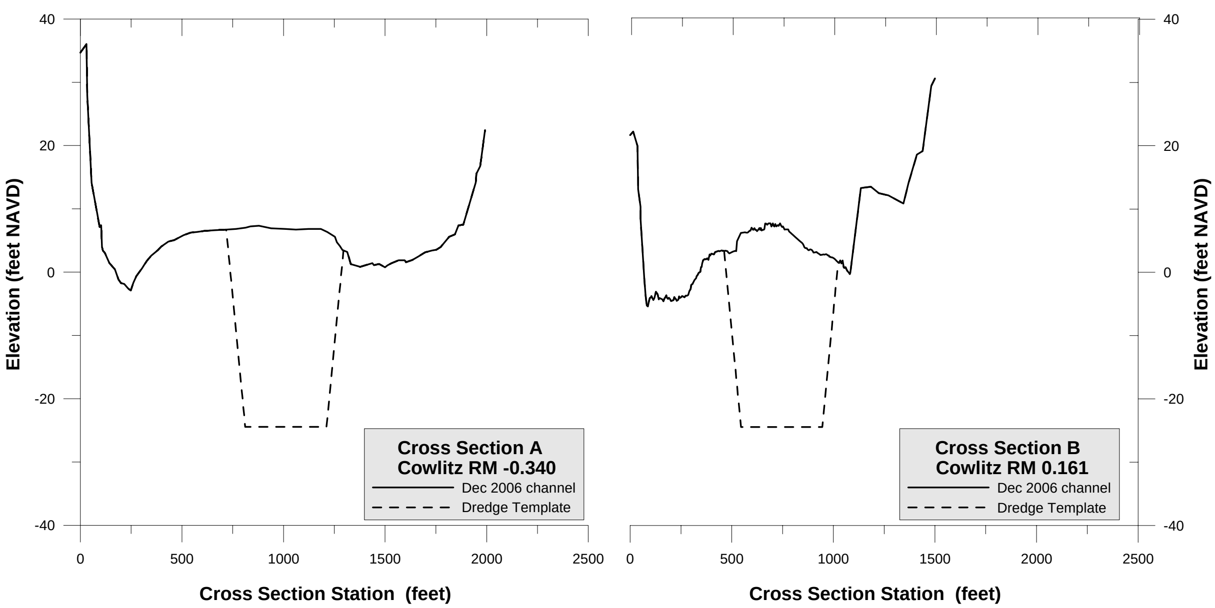


Figure 14. Cowlitz River Cross Sections C & D, River Miles 0.421 and 0.681

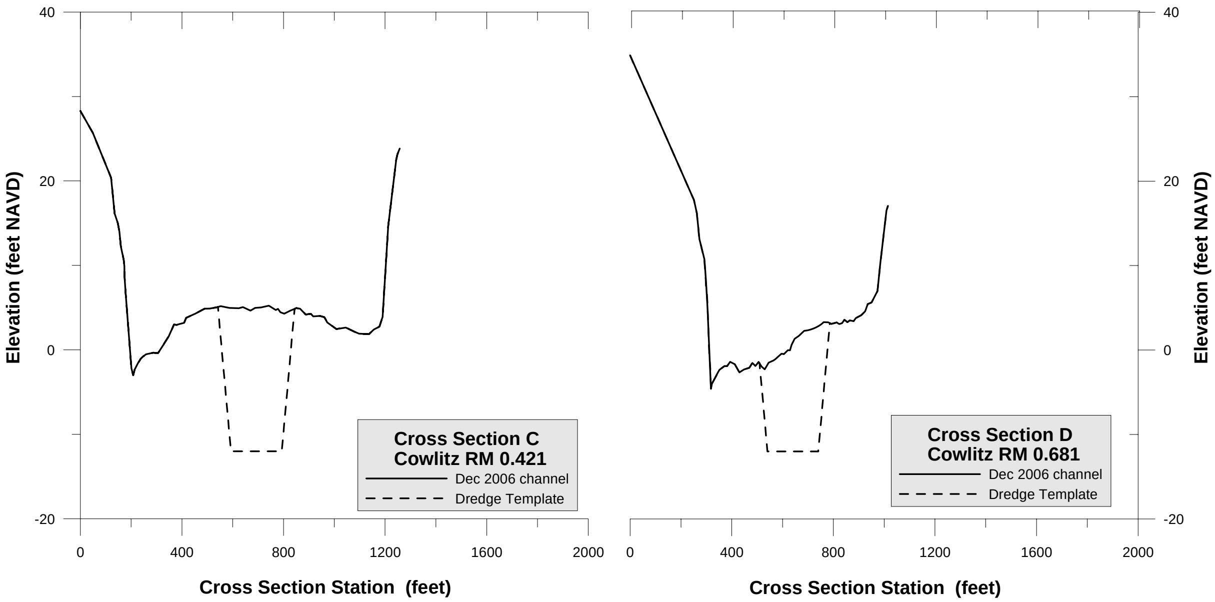


Figure 15. Cowlitz River Cross Sections E & F, River Miles 0.883 and 1.262

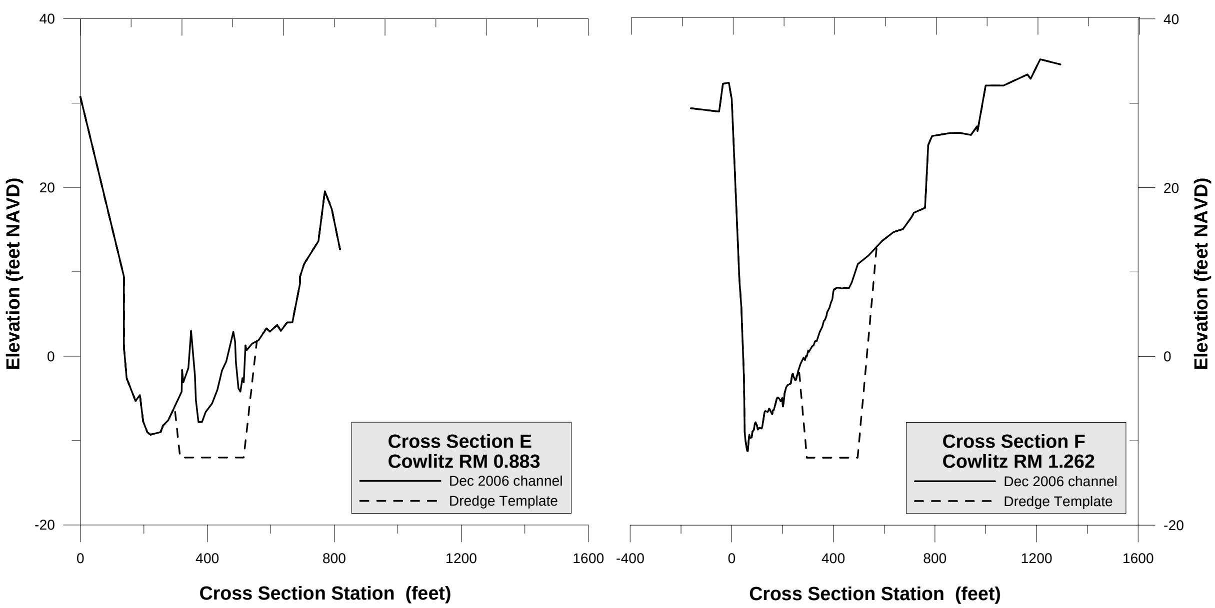


Figure 16. Cowlitz River Cross Sections G & H, River Miles 1.382 and 1.879

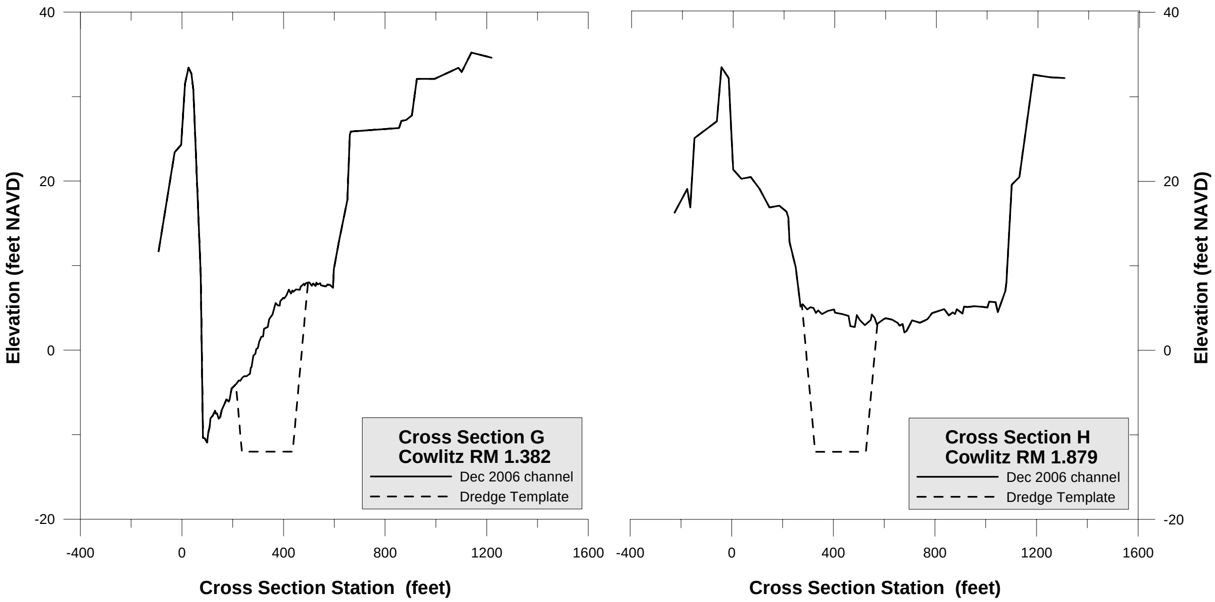


Figure 17. Cowlitz River Cross Sections I & J, River Miles 2.351 and 2.500

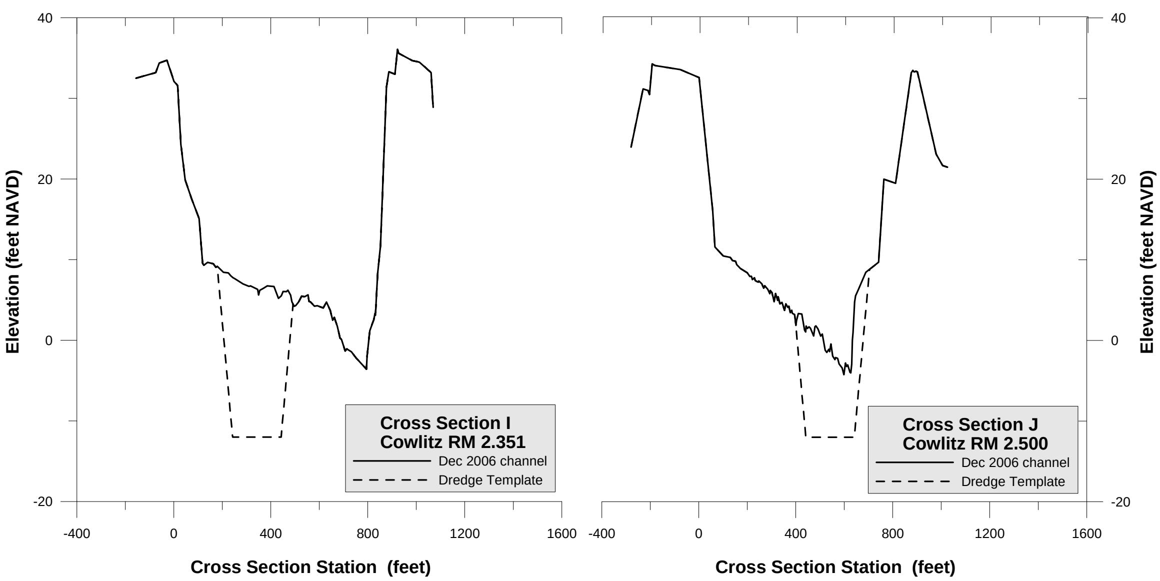
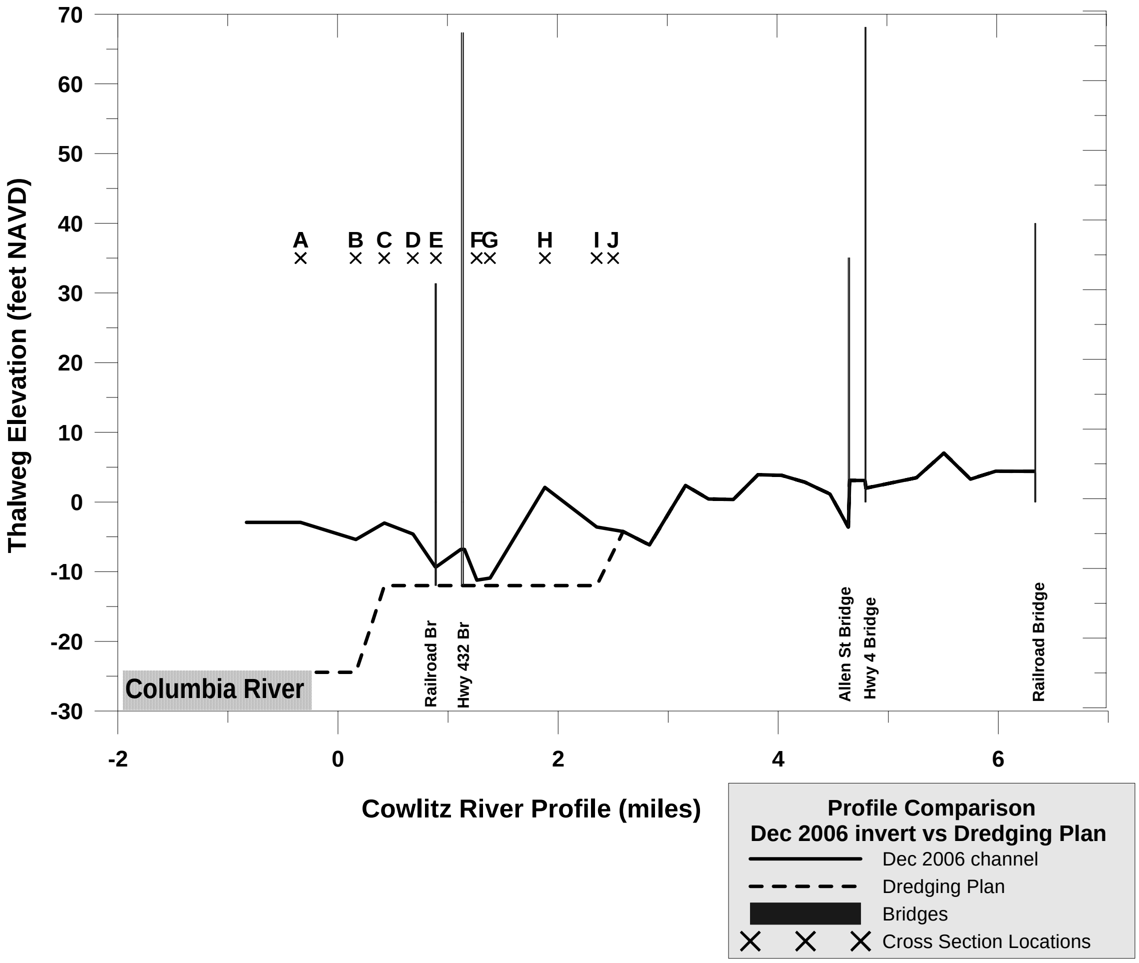


Figure 18. Cowlitz River Thalweg Profile Comparison and Cross Section Locations



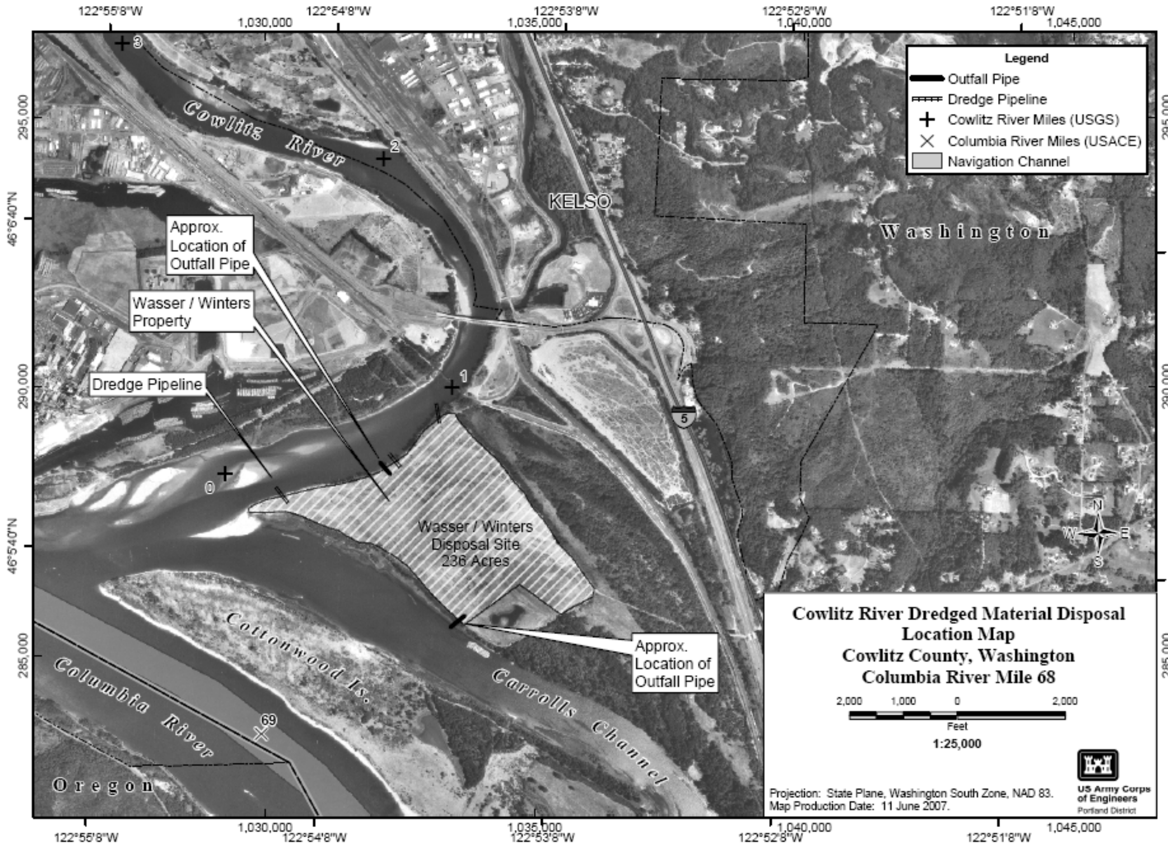
3.3.1. Dredged Material Disposal

Two upland disposal sites for the lower Cowlitz dredge material have been identified and are described in Table 12 and shown on Figure 19. The interim dredging action will place up to 3.215 mcy of material from the transition area and lower 1.3 river miles of the Cowlitz channel on the Wasser and Winters (Collins Estate) property. An additional 995,000 cy of material from Cowlitz RM 1.3 - 2.5 will be placed on the Swanson Bark Wood property.

Table 12. Upland Disposal Sites

Map Letter	Upland Site	Contact	Location	Cowlitz RM	Acres
A	Wasser and Winters (Collins Estate)	Ron Berg	Eastside of Cowlitz River d/s of Tennant Way Bridge	0.5	236
B	Swanson Bark Wood	Swanson Bark Wood Products, Inc	Adjacent to Gearhart Gardens Park	1.5	66

Figure 19. Location of Potential Upland Disposal Sites



The Wasser and Winters property is located on the east side of the Cowlitz River from RM 0-1. The site consists of approximately 236 acres of land characterized by sand and sparse vegetation. The property was used for upland disposal of dredged material during the emergency operations following the eruption of Mount St. Helens in the 1980s. Since the late 1990s, approximately 1.5 mcy of sand has been removed from the property for sale. Structures on the site include a small trailer used as an office for the sand operations. A small settling pond, created during the 1980s disposal activities, is located on the southeast corner of the property and, because of its potential value as habitat, will be avoided during the proposed disposal action. The Corps proposes to place approximately 3.215 mcy of sand at the site between November 2007 and February 2008.

Wasser and Winters Property

The Swanson Bark Wood Property is located on the west side of the Cowlitz River from RM 1-2. The site consists of approximately 66 acres of land. The land is currently used for bark mulch storage by the adjacent mulch production and sales operation. The Corps proposes to place 995,000 cy of sand at the site in August 2008.


Swanson Bark Wood Property

Containment of the upland disposal sites will occur by constructing dikes around the perimeter of the sites. Construction of dikes will be accomplished through the use of material existing on the sites and the newly placed material. Return water will be routed to a settling pond and will then be discharged through a weir back into the Cowlitz River or Carroll's Channel, depending on the disposal site. Construction of internal dikes may be used to route the return water through the disposal site. Additional dredged material may be placed on either or both sites during the next 5 years of follow-on dredging and disposal operations.

3.4. No Action Alternative

The No Action Alternative would not be responsive to maintaining the levels of flood protection for the four communities on the lower Cowlitz River. Flooding would cause long-term adverse and unacceptable economic and social impacts to these communities.

Based on the above considerations, the Corps selected dredging of the Cowlitz River from its mouth to RM 2.5 as the proposed interim alternative to implement.

4. ENVIRONMENTAL EFFECTS

4.1. Sediment Quality

In January 2007, a sediment evaluation was conducted from the mouth of the Cowlitz River to the community of Lexington (Corps 2007). The sediment quality evaluation was conducted according to procedures and screening levels adopted for use in the regional Sediment Evaluation Framework (SEF). A sampling and analysis plan was prepared by the Corps and underwent review and approval by the Regional Sediment Evaluation Team (RSET) prior to sampling. The material to be dredged is coarse sand that has deposited in the river since it was dredged in the late 1980s and there are no known sources of contamination. Due to the grain-size, homogenous nature and difficulty in retrieving core samples in sand, a surface-grab ponar sampler was considered appropriate to characterize the sediment.

A total of 11 samples were collected. Ten samples were collected along the length of the Cowlitz River, approximately one per RM from the mouth to RM 10. One sample was collected in the Coweeman River a couple of hundred feet above the Coweeman-Cowlitz confluence. All samples were submitted for physical analyses including total volatile solids. A total of 6 samples were, also, analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables, and polynuclear aromatic hydrocarbon. The 6 samples submitted for chemical analyses included samples collected in the lower 5 miles of the Cowlitz River and 1 sample collected in the Coweeman River. After sampling and analysis, the Corps' sediment characterization report underwent RSET review and it was concluded that "all of the material within the proposed dredging area was determined suitable for either upland or in-water disposal".

The physical analyses for the Cowlitz River samples resulted in mean values of 2.4% gravel (0.00% to 9.0% range), 96.3% sand (90.7% to 98.9% range), and 1.44% silt/clay (0.14 % to 5.28% range), with 0.37% volatile solids (0.29% to 0.45% range). The material is classified as sand. The physical analyses for the one sample taken in the Coweeman River showed 25.5% gravel, 49.4% sand, and 25.1% silt/clay, with 9.81% volatile solids. The material is classified as sand, with gravel, silt and clay.

The chemical analyses indicated only very low levels of contamination in any of the samples, with all levels below their respective SEF screening levels (SLs). The laboratory report for chlordane indicated that the method detection limit (MDL) for chlordane was above the SEF screening level for this compound. In the current SEF chlordane is reported as "technical" chlordane, which can represent a variety of different commercial preparations. Each of these commercial preparations contains one or more of the chlordane constituents. Because the initial lab report had an elevated MDL for technical chlordane, the lab was requested to look at individual constituents that were present in the chromatogram used to report the technical chlordane. Two chlordane constituents (alpha-chlordane and gamma-chlordane) were identified by the analytical laboratory. Since the laboratory MDL for chlordane is above the SEF screening levels, the MDLs for the constituent analytes are used to evaluate the material. Making use of the chlordane constituents, rather than technical chlordane, all MDLs were sufficiently low to evaluate the material proposed for dredging.

Confirmatory sampling may be proposed to determine if the project area may be ranked "exclusionary", that is, excluded from future testing for the remainder of the interim project. To establish the exclusionary status, three factors are considered: (1) the potential influence of active point sources of contamination on the sediments to be dredged, (2) the grain size of the sediments, and (3) the total organic carbon contents of the sediments. To be ranked as exclusionary the sediment must be at least 80 percent sand with a total organic carbon content of less than 0.5 percent, and be sufficiently removed from potential sources of sediment contamination.

The SEF provides a frequency of dredging guideline that pertains to dredging projects that occur on a frequent basis, such as every year, because of a routine and rapid buildup of relatively homogeneous sediments. To qualify for consideration under the frequency guideline, a project requires full characterization of sediments for two successive dredging events and the conclusion that the sediments are suitable for unconfined aquatic disposal. A SEF exclusionary ranking determination, establishes a 10-year sampling frequency, unless project conditions change or a known contamination source is discovered.

4.2. Water Quality

Temporary increases in turbidity will occur from dredging, but will be limited to the active dredging area and in the subsequent plume that develops. Pipeline dredges generally do not produce large amounts of turbidity or total suspended solids during dredging because of the suction action of the dredge pump and the fact that the cutter head will be buried in the sediment (Table 13). The amount of turbidity produced by mechanical dredging depends on the type of bucket used. An open-bucket dragline can produce the highest amount of turbidity, while a closing bucket generally produces less turbidity. Clamshell dredges produce a concentration of suspended sediment that is up to 2.5 times higher than hydraulic dredges. The sediment to be dredged is primarily gravel and sand (<2% fines) and is expected to have a small turbidity plume of minimal duration. Also, the majority of dredging would be in November through February which is a time when natural levels of suspended sediment and turbidity would likely be high. Depending on Toutle River inflow to the Cowlitz River, sand concentrations in the lower Cowlitz River generally range between 300 and 3,000 mg/L during the winter months, increasing from fall to spring. The general pattern of sediment discharge on the Cowlitz River has been that sand concentration and loads increase throughout the winter and begin to decline in the spring. Fall and spring flows tend to contain higher amounts of fine sediments (silt-clay fractions) relative to sand. The anticipated slight increases in suspended solids will not be of sufficient intensity or nature to cause impacts to bull trout.

Table 13. Best Management Practices (BMPs) for Dredging

Measure	Justification	Duration	Management Decision
Pipeline Dredging			
Maintain cutter head in the substrate or no more than 3 feet above the bottom with the dredge pumps running.	This restriction minimizes or eliminates entrainment of juvenile salmon during normal dredging operations.	Continuous during dredging operations.	Maintain until new information becomes available that would warrant change.
General Provisions for All Dredging			
The contractor shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into the waterway.	Protection of water resources.	Life of contract or action.	If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water release shall be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response.

Measure	Justification	Duration	Management Decision
The contractor, where possible, will use or propose for use materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Disposal of hazardous waste.	Life of contract or action.	If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water release shall be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response.

Although there is evidence that dredging fine sediments can create a situation that decreases dissolved oxygen in the water column, this situation would not occur in the lower Cowlitz River because of the low percentage of fines in the material to be dredged. Suspended sediment plumes associated with dredging have been studied by the Corps. In San Francisco Bay, California, suspended sediments dissipated within 400 m of (closed bucket) dredging (Clark et al 2005). A study in North Carolina (Reine et al 2002) found that hydraulic dredges produce small plumes that dissipate within 300 meters. The material to be dredged is primarily gravel and sand (<2% fines) and it is unlikely that dissolved oxygen will be impacted by the dredging of gravel and sand. Also, contaminants adhere primarily to fine-grained material, not gravel and sand. For this reason, there is no expectation of a resuspension of toxins by the dredging activity in the project area.

Material pumped into the upland disposal sites will be contained by dikes and will be allowed to settle before being discharged through weirs back into the Cowlitz River or Carroll's Channel.

4.3. Air Quality/Noise/Light

There would be a small, localized reduction in air quality during dredging due to emissions from dredging equipment. There also would be localized increases in noise levels from dredging equipment. These impacts would be minor and temporary in nature, and would cease once dredging is completed. The proposed action would not affect natural light conditions.

4.4. Vegetation

Aquatic habitats will be affected in the immediate area of the proposed action. Dredging will occur in open sand habitat and impact to this habitat is expected to be localized. Disposal will occur at upland locations that have historically been used as dredged material disposal sites. The proposed upland sites are characterized by sand and non-native vegetation such as scotch broom. Construction of dikes and weirs prior to placement of dredged material would be carried out by the landowner and is not part of the proposed action. The construction activities will involve the removal of vegetation from the sites but will avoid trees and shoreline vegetation. Very little riparian vegetation exists along the western side of the Wasser and Winters disposal site. Severe bank cutting has eroded the shoreline. During dredged material placement, the discharge pipe will be placed so as to avoid trees and shoreline vegetation. A minimum 300-foot setback from the river would be maintained outside of the levees at the disposal sites, protecting existing riparian habitat. Placement of dredged material in wooded or wetland areas would be avoided.

4.5. Fish

Spawning runs of eulachon, or Columbia River smelt, occur in the mainstem lower Columbia and Cowlitz Rivers. Adults typically enter the Columbia River in early- to mid-January and ascend the Cowlitz River in mid- to late-January. The proposed interim dredging action may affect spawning adults, outmigrating juveniles, and larvae in the water column by entrainment. Eggs may be affected by removing substrate needed to allow egg adhesion for incubation and by covering of incubating eggs by increasing suspended sediment.

Habitat associations of white sturgeon were studied at Columbia River Mile 31 (Parsley and Popoff 2004). This study showed that white sturgeon used a variety of river depths. Density of occurrence was greater from depths of 31 to 90 feet than from depths less than 31 feet, and stayed fairly constant from 31 to 90 feet. Sturgeon showed increased movements during dredging operations and it is speculated that these movements resulted from increased foraging activities. Sturgeon typically moved to shallower water at night. The mean night time depth was 36 feet and the mean day time depth was 57 feet. Although white sturgeon are not expected to be abundant in the shallow water in the lower Cowlitz River, sturgeon are known to feed on spawning runs of eulachon and may be affected by the proposed interim dredging action if present during foraging.

Pacific lamprey are known to occur in the lower Columbia and Cowlitz Rivers but abundance information is not readily available for the Cowlitz River population (LCFRB 2004). According to Close (2002), adult lamprey migrate from the ocean into freshwater in the late spring to early summer. By September, migration into freshwater steams is complete and spawning occurs the following spring. If lamprey are spawning upstream of the project area, downstream migration between October and April may be affected by the proposed interim dredging action.

Other anadromous fish and resident endemic fish may be affected by the proposed dredging action through entrainment, harassment, and loss of habitat.

Entrainment

A slight risk of entrainment may occur when the dragheads or cutterheads of hydraulic dredges are off the bottom. This can occur when the pumps are being primed, the lines and hoppers are being flushed, or when vessels are being maneuvered. Although this risk is expected to be small, BMPs will be implemented to reduce the amount of time and distance the draghead is off the bottom, when the pump is operating (Table 13). The BMPs for dredging operations require that the dredge pump not be operated when the draghead is raised more than 3 feet above the river bottom. Adult fish have sufficient swimming capacity to avoid entrainment by dredging if they are present in the vicinity of dredges and if the draghead is above the riverbed when operating. Mechanical dredging (clamshell) has a lower entrainment rate and a lower mortality rate than hydraulic dredging because underwater velocities and wave front created in the path of this type of dredge would preclude entrainment and other potential direct mortality in the bucket. However, juveniles may become entrained more often than adults during either type of dredging because they are less able to avoid dredging operations.

A total of 391 samples were collected in a 1997-1998 entrainment study during operation of the Corps' hopper dredge *Yaquina* during the spring and early summer at two sites in the Columbia River and five sites along the Oregon Coast (R2 Resource Consultants 1999). A total of 48 samples were collected at RM 71 on the Columbia River, entraining two juvenile Chinook salmon and one white sturgeon during four evenings of sampling. No juvenile salmonids were captured at any other stations during the course of sampling. It was determined that the two Chinook salmon were from hatchery stock and were believed to be the product of a hatchery release that took place within a few days of the entrainment sampling. No fish were entrained in the 106 samples collected at the RM 106-114 station during 7 days of sampling. The study concluded that juvenile salmonids would likely be present at all of the sites sampled, but dredging operations, as currently practiced, pose little risk of entrainment of salmonids.

Entrainment studies in other locations also have shown minimal entrainment of salmonids during dredging. Tegelberg and Arthur (1977) made observations on fish entrained by both hopper and pipeline dredges in the middle and outer estuary of Grays Harbor, Washington (9 species). Bengston and Brown (1976) also made some limited observations of pipeline-dredged material as it was being discharged and observed the entrainment of adult spiny dogfish. Neither study showed that any salmonids were entrained. Armstrong and others (1982) evaluated impacts of dredging on fish as part of a Dungeness crab study in Grays Harbor. Entrainment rates for 15 species of fish ranged from 0.001 to 0.135 fish/cy for pipeline and hopper dredging. Larson and Moehl (1990) calculated entrainment rates for 14 species of fish over the course of a 4-year study on the Columbia River and found entrainment ranged from <0.001 to 0.341 fish/cy. Buell (1992) studied fish entrainment by pipeline dredging in the Columbia River (RM 102). His study found that entrainment only occurred when the fish (sturgeon) were in the immediate vicinity of the dredge pipe (the dredge did not have a cutterhead).

Harassment

Vibration, noise, and turbidity from dredging operations (all dredge types) may displace or otherwise harass (e.g., stress) both adult and juvenile fish. Noise and vibration are expected in and proximal to the dredging operation, and may displace or harass individual fish even if they do not occupy the area being dredged. That is, fish would likely avoid the area if the noise of the dredging activity was disturbing to them. However, the area of disturbance around the dredge is very small relative to each project area, and the impact is expected to be minimal since most fish are able to avoid the impact area and can find ample area for migrating around the dredge.

While dredging, the disturbance is not constant. Dredges only spend approximately 45% to 49% of the time they are working actually dredging. The remainder of the time (45% to 47%) is spent transiting and maintaining the dredge, and 6% to 8% is spent in disposal operations. Based on this, fish in the immediate area are only subjected to dredging impacts approximately 50% of the time and disposal impacts 6% to 8% of the time, which would give them ample opportunity to migrate through the area when the dredge is not present.

Although there is evidence that dredging fine sediments can create a situation that decreases dissolved oxygen in the water column, this situation would not occur in the lower Cowlitz River because of the low percentage of fines in the material to be dredged. The material to be dredged is primarily gravel and sand (<2% fines) and it is unlikely that dissolved oxygen will be impacted by the dredging of gravel and sand. Also, contaminants adhere primarily to fine-grained material, not gravel and sand. For this reason, there is no expectation of a resuspension of toxins by the dredging activity in the project area.

Temporary increases in turbidity will result from dredging operations. Turbidity increases will generally be limited to the active dredging area and in the subsequent plume that develops. The extent and duration of the plume varies depending upon the type of material being dredged. Material that is primarily sand has a small plume with less duration while material containing a higher percentage of fines has a larger plume with a longer duration. The likelihood of increased suspended solids causing impacts to migrating and resident fish depends on a number of factors including:

- Duration of exposure to suspended solids.
- Concentration of suspended solids.
- Particle size of suspended solids.
- Angularity of suspended solids.

Displacement of adult and juvenile fish may result from the increased turbidity from dredging because they will move to avoid areas of high concentrations of suspended sediment. The extent of this potential impact cannot be quantified but should be limited to the size and duration of the plume.

The highest increases in suspended solids concentrations are anticipated to be localized and short-term, and would occur near the dredging operations. The likely exposure of fish will be to the low concentrations (0 to 2 mg/L increases) that will occur downstream from dredging operations. The anticipated slight increases in suspended solids will not be of sufficient intensity or nature to cause impacts to fish.

Loss or Modification of Habitat

In general, the dredging area is used primarily for migration by anadromous salmonids. The shallow water depths of the lower Cowlitz River cause disruption in fish migration routes and sediment accumulation may potentially block access to upstream spawning grounds during low flow periods. Dredging will temporarily disrupt the migratory corridor but will increase the overall depth of water.

4.6. Wildlife

Wildlife use in the lower Cowlitz River is limited due to residential, commercial, and industrial development. Upland disposal will occur on existing former disposal sites. Few wildlife species occur at these locations and these generally at low population levels. Thus disturbance to wildlife at these locations would typically be low. Disturbance offsite at upland dredged material disposal sites, to wildlife present in adjacent habitats, is projected to be minimal. Disposal related activities, with the potential exception of pipeline placement and removal, are restricted to the site footprint. Further, upland disposal actions are proposed behind berms, which once their construction is completed, will serve as a visual and to a lesser extent, a sound barrier.

4.7. Threatened and Endangered Species

Biological Assessments (BAs) were prepared by the Corps for the proposed action; one addressed federally listed species under the jurisdiction of the National Marine Fisheries Service (NMFS) and the other addressed federally listed species under the jurisdiction of the USFWS. The BAs were provided to the respective agencies for their review and consultation.

The Corps has determined that the proposed action ***may affect and is likely to adversely affect*** the listed salmonid ESUs. This determination was based primarily on an unquantifiable risk of temporary and localized effects including increases in turbidity, resuspension of sediments/transport of sediment downcurrent, noise disturbance, and benthic forage disturbance. These temporary and localized effects, however, are not likely to result in significant, adverse affects to the migration of any listed anadromous salmonid ESUs. Very few salmonids, if any, would be exposed to the areas disturbed by dredging due to their habitat preferences and by timing the activity during periods of low abundance.

The Corps has determined that the proposed action ***may affect but is not likely to adversely affect*** bald eagles. This determination for bald eagles was based on the proposed upland disposal plan that minimizes potential disturbance to the nesting pair. Relative to the Cowlitz River Mouth WA territory, those portions of the proposed action (disposal) closest to their nest would be initiated and concluded prior to the onset of the pair's principal breeding activities at this nest location. Disposal actions after January 1 are intended to occur at or greater than 1,500 feet from the nest location to lessen the likelihood for disturbance. Some foraging form the mouth of the Cowlitz in the dredging area may be precluded by dredging activities. Such disturbance is considered minimal in nature given the heavily industrial and urbanized nature of the area and the proclivity of bald eagles to continue to occur in the area. In essence, bald eagles appear to have adapted to the human activity in this general area. Thus dredging and disposal actions are not expected to significantly alter their current use of their territory.

The Corps has determined that the proposed action ***may affect but is not likely to adversely affect*** bull trout. This determination for bull trout effects was based primarily on an unquantifiable risk of temporary and localized effects including increases in turbidity, resuspension of sediments/transport of sediment downcurrent, noise disturbance, and benthic forage disturbance. These temporary and localized effects, however, are not likely to result in significant, adverse affects to the migration of bull trout. Very few bull trout, if any, would be exposed to the areas disturbed by dredging due to their habitat preferences and by timing the activity during periods of low abundance.

The Corps determined that there would be *no effect* to Columbia white-tailed deer, northern spotted owl, marbled murrelet, and Nelson's checker-mallow from the proposed action. These species are either not present or are located in specific upland and/or wet prairie habitats that will not be impacted by the proposed action.

Impact minimization measures for the proposed interim dredging action and follow-on annual dredging include the following.

- BMPs for dredging operations will be used (see Table 13).
- Dredging will occur during in-water work periods for the Columbia and Cowlitz rivers to minimize impacts to fish species.
- Material pumped into the upland disposal sites will be contained by dikes and will be allowed to settle. Return water will be allowed to settle and then discharged through weirs back into the Cowlitz River and Carroll's Channel.

4.8. Cultural and Historic Resources

No impacts to cultural resources are anticipated associated with dredging from the Cowlitz River mouth through Cowlitz River Mile 2.5 and disposal of dredged material. The authorized navigation channel and has been dredged many times in the past. Following the eruption of Mt. St Helens in May 1980, the lower Cowlitz River, including the project area, was intensively dredged to remove ash and debris associated with the eruption. This material was placed on designated disposal sites within the project area including the Wasser and Winter site and the Swanson's Bark Wood Products site. Both of these areas had been used for disposal of dredged material prior to the eruption of Mt. St. Helens and both areas where used to hold large quantities of volcanic sediments as part of the Mt.

Saint Helens recovery efforts. The Washington State Historic Preservation Office concurs with a no effect determination for the two upland disposal sites.

4.9. Socio-economic Resources

Changing hydraulic and hydrologic conditions are impacting downstream deposition and the additional sediment has begun to infringe on the levels of flood protection. There is a possibility that the authorized level of flood protection for Longview, Kelso, Castle Rock and Lexington cannot be maintained through 2007.

Continued sediment accumulation increases the potential for significant flood risk to the people and the property along the lower 20 miles of the Cowlitz River. The October 1985 US Army Corps of Engineers Mount St. Helens, Decision Document estimated that maintaining flood protection levels results in $26.9 million (1985 $) in average annual net benefits. These benefits are attributable to flood damage reduction to property and transportation infrastructure associated with the towns of Kelso, Longview, Castle Rock and Lexington.

4.10. Cumulative Effects

Cumulative effects are defined as, "The impact on the environment which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 *Code of Federal Regulations* Section 1508.7). Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

Myriad efforts have been undertaken by the Corps and other agencies the since the May 18, 1980 eruption of Mount St. Helens related to erosion and sediment management, flood protection, and fish passage/habitat issues. The debris avalanche resulting from the 1980 eruption deposited approximately 3.8 billion cubic yards of silt, sand, gravels, and trees in the upper 17 miles of the North Fork Toutle River. So much of this coarse sandy material and debris was carried from the Toutle River and into the Cowlitz and Columbia rivers that dredging was required to clear the channel before river shipping could be resumed. Over 74 mcy of material had to be removed from the Cowlitz River within the first year after the 1980 eruption to maintain flood capacity. Large scale removal of this volcanic material in the Cowlitz River began at the lower end of the Toutle River and continued down the Cowlitz until the cleared channel could handle expected winter flows without topping dikes and flooding Castle Rock, Longview, and Kelso. Floodplain and wetland habitat along portions of the lower Cowlitz and Toutle rivers was filled with the dredged material. Stream systems have been 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.

The sediment retention structure (SRS) on the North Fork Toutle was constructed 5 years following the 1980 eruption in an attempt to prevent the continuation of severe downstream sedimentation of stream channels, which created flood conveyance, transportation, and habitat degradation concerns. Before the SRS was constructed a temporary sediment retention structure was built across the North Fork Toutle (N1) and dredging of sections of the streambed was initiated as an emergency measure. Once in place, the SRS totally blocked volitional upstream access to as many as 50 miles of habitat for anadromous fish. To mitigate for this effect, the Corps funded habitat enhancements (development of off channel rearing areas) for coho salmon; hatchery supplementation at Green River Hatchery to raise coho, spring Chinook, and fall Chinook; and construction of a fish collection facility below the SRS to trap and haul salmon, steelhead, and coastal cutthroat to tributaries above the SRS.

Erosion and sediment movement into the North Fork Toutle River and downstream into the Cowlitz River continues to be significant and unpredictable. Regional rains and flooding since 2003 have mobilized large amounts of sediment from the Mount St. Helens debris avalanche. The Corps 2002 Mount St. Helens Engineering Reanalysis report estimated as much as 414 mcy of material will erode from the debris avalanche area through the year 2035. In addition, it was estimated that from 2000 to 2035, as much as 27 mcy of this material would be deposited in the lower Cowlitz River and will need to be removed in order to maintain flood protection levels in Kelso, Longview, Castle Rock, and Lexington. This trend is a result of increased sedimentation from the Toutle River watershed from sediments being passed through the SRS in greater amounts. The ability of the SRS to trap sand has decreased since 1998 when the sediment reservoir behind the dam filled in. All flow now passes through the spillway as designed, carrying sediment downstream.

In addition to the proposed interim dredging action, annual follow-on dredging in the lower Cowlitz River will be needed to maintain channel dimensions and flood protection levels for the next 5 years. In the near future, the Corps will investigate long-term dredging and non-dredging alternatives that would maintain the authorized levels of flood protection for the communities on the lower Cowlitz River through the year 2035.

Radio-tagging and tracking adult coho salmon and steelhead is being undertaken as part of a collaborative effort with the Cowlitz Tribe, U.S. Geological Survey, Washington Department of Fish and Wildlife, National Marine Fisheries Service, Corps, Weyerhaeuser, and the U.S. Forest Service to determine how and where to pursue long-term salmon recovery in the North Fork Toutle watershed within the context of Cowlitz Basin-wide salmon recovery efforts. A recent Corps reconnaissance study identified a federal interest in pursuing potential ecosystem restoration actions that could provide benefits to ESA-listed salmonid species in the Toutle River watershed. A variety of ecosystem restoration alternatives were considered including:

- Improve SRS falls/spillway.
- Fix existing fish collection facility.
- New trap-and-haul fish collection facility.
- Remove fish collection facility fish/velocity barrier.
- New fish release site above SRS (volitional movements).
- Improve tributary fish release sites.
- Sediment plain structures to direct flows, stabilize channels, and improve channel connectivity over the fish passage season.
- Tributary plantings/stabilization.
- Restoring side or off-channel habitats for fish downstream of the SRS.

However, there is a risk associated with investing in ecosystem restoration measures due to the instability of the Toutle River drainage and continuing sedimentation effects caused by the 1980 eruption. It is anticipated that near-term work will focus on actions to sustain and improve access to the tributary habitat above the SRS. In the future, the Toutle River system may become stable enough to consider a broader range of ecosystem restoration measures.

5. COORDINATION

The draft Environmental Assessment was issued for a 30-day public review period. Review comments will be requested from federal and state agencies as well as various interested parties. The document was sent to the following agencies and groups:

U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
Washington Department of Ecology
Washington Department of Fish and Wildlife
Washington State Parks and Recreation Commission
Washington Department of Natural Resources
Washington State Historic Preservation Office
Cowlitz County
Cowlitz Indian Tribe
City of Kelso
City of Longview
City of Castle Rock
Port of Longview
Port of Vancouver
Kelso Public Library
Longview Library
Castle Rock Library
Lower Columbia Fish Recovery Board
Lower Columbia River Fish Enhancement Group
Friends of the Cowlitz

6. COMPLIANCE WITH LAWS AND REGULATIONS

6.1. National Environmental Policy Act

This Environmental Assessment satisfies the requirements of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.).

6.2. Endangered Species Act

In accordance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed or proposed threatened or endangered species. Biological Assessments were prepared for the proposed action; one addressed federally listed species under the jurisdiction of the NMFS and the other addressed federally listed species under the jurisdiction of the USFWS. The BAs were provided to the respective agencies for review and consultation.

6.3. Clean Water Act

Section 401 of the Clean Water Act of 1977, as amended, requires certification from the state or interstate water control agencies that a proposed water resources project is in compliance with established effluent limitations and water quality standards. The proposed action will be in compliance with the Clean Water Act via public review of the Environmental Assessment, and with the issuance of a Section 401 Water Quality Certification from WDOE.

6.4. Magnuson-Stevens Fishery Conservation and Management Act

An assessment for Essential Fish Habitat for Chinook and coho salmon has been prepared and provided to NMFS for review and consultation.

6.5. Clean Air Act

The Clean Air Act of 1970, as amended, established a comprehensive program for improving and maintaining air quality throughout the United States. Its goals are achieved through permitting of stationary sources, restricting the emission of toxic substances from stationary and mobile sources, and establishing National Ambient Air Quality Standards (NAAQS). Title IV of the Act includes provisions for complying with noise pollution standards. There would be a small, localized reduction in air quality during dredging due to emissions from dredging equipment. There also would be localized increases in noise levels from dredging equipment. These impacts would be minor and temporary in nature, and would cease once dredging is completed.

6.6. National Historic Preservation Act

Section 106 of the National Historic Preservation Act requires that a federally assisted or federally permitted projects account for the potential effects on sites, districts, buildings, structures, or objects that are included in or eligible for inclusion in the National Register of Historic Places. No cultural resources would be affected by the proposed action.

6.7. Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (NAGPRA) provides for the protection of Native American and Native Hawaiian cultural items, established ownership and control of Native American cultural items, human remains, and associated funerary objects to Native Americans. It also establishes requirements for the treatment of Native American human remains and sacred or cultural objects found on federal land. No cultural items, human remains, and associated objects would be affected by the proposed action.

6.8. Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act of 1934 states that federal agencies involved in water resource development are to consult with the USFWS and state agency administering wildlife resources concerning proposed actions or plans. The proposed action is being coordinated with the USFWS and WDFW in accordance with the Act.

6.9. Comprehensive and Environmental Response, Compensation and Liability Act

The location of the proposed action is not within the boundaries of a site designated by the USEPA or the State of Washington for a response action under Comprehensive and Environmental Response, Compensation and Liability Act, nor is it a part of a National Priority List site.

6.10. Executive Order 11988, Floodplain Management

This executive order requires federal agencies to consider how their actions may encourage future development in floodplains, and to minimize such development. The proposed action would not affect floodplains or the management of floodplains.

6.11. Executive Order 11990, Protection of Wetlands

This executive order requires federal agencies to protect wetland habitats. The proposed action would not affect any wetland habitats.

6.12. Executive Order 12898, Environmental Justice

This executive order requires federal agencies to consider and minimize potential impacts on subsistence, low-income or minority communities. The goal is to ensure that no person or group of people should shoulder a disproportionate share of the negative environmental impacts resulting from the execution of this country's domestic and foreign policy programs. The proposed action will not cause changes in population, economics, or other indicators of social well being. The proposed action will not result in a disproportionately high or adverse effect on minority populations or low-income populations. There are no environmental justice implications from the proposed action.

6.13. Analysis of Impacts on Prime and Unique Farmlands

No impacts to prime and unique farmlands would occur from the proposed action.

7. LITERATURE CITED

Anthony, R.G., R.L. Knight, G.T. Allen, B.R. McClelland, and J.I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. *Trans. N. Amer. Wildl. Nat. Res. Conf.* 47:332-342.

Anthony, R.G. and F.B. Isaacs. 1989. Characteristics of bald eagle nest sites in Oregon. *J. Wildl. Manag.* 53:148-159.

Armstrong, D., Stevens, B., and Hoeman, J. 1982. Distribution and abundance of Dungeness crab and Crangon shrimp, and dredged-related mortality of invertebrates and fish in Grays Harbor, Washington. Technical Report. School of Fisheries, University of Washington, Washington Department of Fisheries, and U.S. Army Corps of Engineers, Seattle WA.

Bengston, C., and Brown, J. 1976. Impact of dredging on the fishes in Grays Harbor, Appendix G: Maintenance dredging and the environment in Grays Harbor, Washington. U.S. Army Corps of Engineers, Seattle WA.

Buell, J. 1992. Fish entrainment monitoring of the western-pacific dredge *R.W. Lofgren* during operations outside the preferred work period. Prepared for the Western-Pacific Dredging Company by Buell and Associates, Portland OR.

Clarke, D., Martin, A., Dickerson, C. and Moore, D. 2005. Suspended Sediment Plumes Associated with Mechanical Dredging at the Port of Oakland, California. Proceedings of WEDA XXV and Texas A&M's 37th Annual Dredging Seminar, New Orleans, LA.

Close, David. "Ecological and Cultural Importance of a Species at Risk of Extinction, Pacific Lamprey", Project No. 1994-02600, 9 electronic pages, (BPA Report DOE/BP-00005455-4).

David, Joel. 2007. Refuge Manager. Julia Butler Hansen National Wildlife Refuge, Cathlamet, Washington. Personal communication with Carolyn Schneider. January 2007

Ellis, D.E. 1980 Cultural Resource Investigation of Activity Areas Related to the Mt. Saint Helens Recovery Operations. Portland District, USACE.

Forest Service (USFS). 1977. Bald Eagle Habitat Management Guidelines. Pacific Southwest Region, San Francisco CA.

Forest Service (USFS). 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. Chapter 13 – Bald Eagles. R6-F&WL-192-1985. Forest Service Pacific Northwest Region, Portland OR.

Fraley, J.J. and B.B. Shepard. 1989. Life history, ecology, and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake River system, Montana. *Northwest Science* 63(4):133-143.

Gleeson, P. F. 1974 Archaeological Survey of Proposed Dredge Spoil Locations on the Columbia River, 1974. Report submitted to U.S. Army Corps of Engineers, Portland District.

Goetz, F. 1989. Biology of the Bull Trout, *Salvelinus confluentus*, A Literature Review. U.S. Department of Agriculture, Forest Service, Willamette National Forest, Eugene OR.

Isaacs, F.B. and R.G. Anthony. 2006. Bald Eagle Nest Locations and History of Use in Oregon and the Washington Portion of the Columbia River Recovery Zone, 1972 through 2005. Oregon Cooperative Wildlife Research Unit, Oregon State University, Corvallis.

Issacs, F.B., R.G. Anthony, and D.P. Anderson. 2007. Bald Eagle Nest Locations and History of Use in Oregon and the Washington Portion of the Columbia River Recovery Zone, 1971 through 2006. Oregon Cooperative Wildlife Research Unit, Oregon State University, Corvallis, Oregon, USA.

Jermann, J.V. and J. Hollenbeck 1976 An archaeological Assessment of fifty-two proposed dredge disposal sites on the Lower Columbia River. Report submitted to U.S. Army Corps of Engineers, Portland District.

Larson, K., and Moehl, C. 1990. Fish entrainment by dredges in Grays Harbor, Washington. *Effects of dredging on anadromous Pacific Coast fishes*. C. A. Simenstad, ed., Washington Sea Grant Program, University of Washington, Seattle, 102-12.

Lower Columbia Fish Recovery Board (LCFRB). December 15, 2004. Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan. Volume II – Subbasin Plan, Chapter E – Cowlitz, Coweeman and Toutle. Available at: http://www.nwcouncil.org/fw/subbasinplanning/lowerColumbia/plan/.

Marshall, D.B. 1996. Sensitive, Threatened, and Endangered Vertebrates of Oregon. Oregon Department of Fish and Wildlife, Portland.

Parsely, M.J. and N.D. Popoff. 2004. Summary of Site Fidelity, Habitat Associations, and Behavior During Dredging Operations of White Sturgeon at Three Tree Point in the Lower Columbia River. U.S. Geological Survey, Western Fisheries Research Center, 140 pp.

Pratt, K.L. 1992. A review of bull trout life history. *In* P.J. Howell and D.B. Buchanan, eds. Proceedings of the Gearhart Mountain Bull Trout Workshop, August 1992, Gearhart Mountain, OR. Oregon Chapter of the American Fisheries Society, Corvallis.

R2 Resource Consultants, Inc. 1999. Entrainment of outmigrating fish by hopper dredge at Columbia River and Oregon coastal sites. Prepared for the U.S. Army Corps of Engineers, Portland OR.

Ratcliff, D.E. and P.J. Howell. 1992. The status of bull trout populations in Oregon. In P.J. Howell and D.B. Buchanan, eds. Proceedings of the Gearhart Mountain Bull Trout Workshop, August 1992, Gearhart Mountain, OR. Oregon Chapter of the American Fisheries Society, Corvallis.

Reiman, B.E. and J.D. McIntyre. 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. Gen. Tech. Rep. INT-302. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Boise ID.

Reine, K. J., Clarke, D. G., and Dickerson, C. (2002). "Acoustic characterization of suspended sediment plumes resulting from barge overflow," *DOER Technical Notes Collection* (ERDC TN-

DOER-E15), U.S. Army Engineer Research and Development Center, Vicksburg, MS. *www.wes.army.mil/el/dots/doer*

Snow, C. 1981. Southern Bald Eagle and Northern Bald Eagle, Habitat Management Services for Endangered Species. Bureau of Land Management Report No. 5.

Southwest Clean Air Agency (SWCAA). March 2007. Longview Air Toxics Monitoring Project, Final Report. Vancouver WA. Available at http://www.swcleanair.org/pdf/LongviewToxicsReport.pdf.

Stalmaster, M.V. 1980. Management strategies for wintering bald eagles in the Pacific Northwest. In R.L. Knight et al., eds. Proceedings of the Washington Bald Eagle Symposium, June 1980, Seattle.

Stalmaster, M.V. 1987. The Bald Eagle. Universe Books, New York, NY.

Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. *J. Wildl. Manage*. 42:506-513.

Steenhof, K. 1978. Management of Wintering Bald Eagles. Eastern Energy and Land Use Team, Office of Biological Service, U.S. Fish and Wildlife Service, FWS/OBS/78/79.

Tegelberg, H., and Arthur, R. 1977. Distribution of Dungeness crabs (*Cancer magister*) in Grays Harbor and some effects of channel maintenance dredging. Appendix N: Maintenance dredging and the environment of Grays Harbor, Washington. Washington Department of Fisheries Report to the U.S. Army Corps of Engineers, Seattle WA.

U.S. Army Corps of Engineers (Corps). March 2007. Cowlitz River Federal Project, Sediment Quality Evaluation Report. Available at: https://www.nwp.usace.army.mil/ec/h/hr.

U.S. Census Bureau. Accessed April 2007. State and County Quick Facts: Cowlitz County, Washington. Available at http://quickfacts.census.gov.

U.S. Fish and Wildlife Service (USFWS). 1986. Recovery Plan for the Pacific Bald Eagle. U.S. Fish and Wildlife Service, Portland, Oregon. 160 pp.

U.S. Fish and Wildlife Service (USFWS). 1998. Recovery Plan for the Threatened Nelson's Checker-mallow (*Sidalcea nelsoniana*). Portland OR.

U.S. Fish and Wildlife Service (USFWS). 2002. Chapter 20, Lower Columbia Recovery Unit, Washington. *In* U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland OR.

U.S. Forest Service (USFS). 1977. Bald Eagle Habitat Management Guidelines. Pacific Southwest Region, San Francisco CA.

U.S. Forest Service (USFS). 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. Chapter 13 – Bald Eagles. R6-F&WL-192-1985. Forest Service Pacific Northwest Region, Portland OR.

U.S. Forest Service (USFS). August 2006. Appendix C, Brief Life History Narratives for Botanical, Wildlife, and Fish, Species of Local Interest, Gifford Pinchot National Forest, Columbia Gorge National Scenic Area, Washington Side, Invasive Plant Treatment Draft Environmental Impact Statement. Pacific Northwest Region.

Washington Department of Ecology (WDOE). 1998. Final 1998 List of Threatened and Impaired Water Bodies - Section 303(d) list. WDOE Water Quality Program. Olympia, WA. Available at: http://www.ecy.wa.gov/programs/wq/303d/1998/1998_by_wrias.html

Washington Department of Fish and Wildlife (WDFW). 2007. SalmonScape website, located at: http://wdfw.wa.gov/mapping/salmonscape/index.html.

Washington Department of Fish and Wildlife (WDFW) and Oregon Department of Fish and Wildlife (ODFW). November 2001. Washington and Oregon Eulachon Management Plan.

Watson, J.W., M.G. Garrett, and R.G. Anthony. 1991. Foraging ecology of bald eagles in the Columbia River estuary. *J. Wildl. Manage*. 55:492-499.

Western Washington University. Accessed April 2007. Pacific Northwest Regional Economic Analysis Project. Center for Economic and Business Research. Available at http://www.pnreap.org/washington.