U.S. Army Corps
of Engineers
Seattle District

Centralia Flood Damage Reduction Project
Chehalis River, Washington

FINAL ENVIRONMENTAL IMPACT STATEMENT

Appendix E:

Biological Assessment

June 2003

FINAL BIOLOGICAL ASSESSMENT

CHEHALIS RIVER FLOOD HAZARD REDUCTION PROJECT

U.S. Army Corps of Engineers
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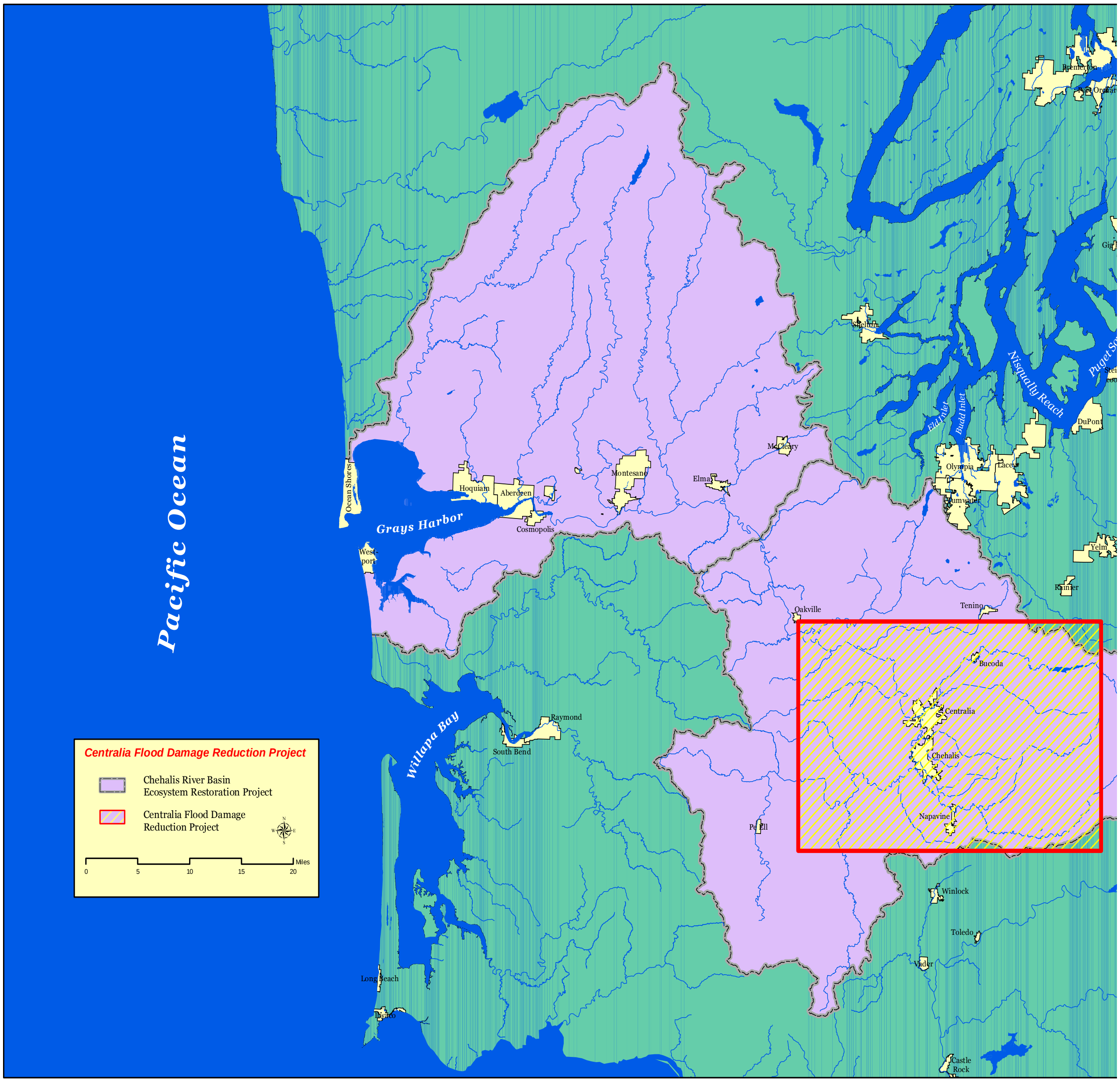
1. INTRODUCTION

The Centralia Flood Hazard Reduction project is an effort to reduce flood hazards to the project area, which include the Cities of Centralia and Chehalis and the urbanizing areas immediately adjacent, and to incorporate appropriate fish and wildlife habitat improvements. The Chehalis River runs in a northern direction through the cities of Chehalis and Centralia, then turns westerly, entering Grays Harbor and then the Pacific Ocean. Figure 1-1 shows the Chehalis River basin.

1.1. ***Need.*** The Cities of Centralia and Chehalis have been subject to repeated flooding for many years. This flooding has caused extensive damage to private and public property and periodic closure of critical transportation routes resulting in significant economic losses. In closing transportation routes, the flooding also significantly disrupts emergency response by local governments, adversely impacting public safety. Without implementation of flood hazard reduction measures, actions, or projects, the area will continue to suffer from damaging floods. The local economy will continue to experience depressing economic effects due to the damages and uncertainty associated with future floods. In addition, stream habitat functions of the Chehalis River and its tributaries have been damaged in the past due to development throughout much of the Chehalis Basin. This has resulted in the diminishment of the remaining habitat resources to adequately support sustainable fish and wildlife resources. Loss of wetlands, riparian areas, and back channels has also contributed to increased flooding in the area. The improvement of degraded areas along the Chehalis River or its tributaries can be a significant factor in sustaining and improving existing fish and wildlife resources in the Chehalis basin.

1.2. ***Description.*** The flood hazard reduction project would consist of three primary components. The first component consists of modifications to Skookumchuck Dam to provide additional flood control storage; this would affect flows in the river during the winter flood season (November—February), but flows during the remainder of the year would remain unchanged from current operations. The second component consists of a levee system located near the mainstem of the Chehalis River through the city of Centralia. Portions of the levee would also follow the lowest stream reaches of the Skookumchuck River, Dillenbaugh Creek, and Salzer Creek. The third component consists of floodplain modifications near Chehalis/SR-6 to provide flood flow bypass and storage in the area near Claquato (east of Scheuber Road).



Pacific Ocean
Grays Harbor
Willapa Bay
Nisqually Reach
Eld Inlet
Budd Inlet
Ocean Shores
Hoquiam
Aberdeen
Cosmopolis
Montesano
McCleary
Elma
Olympia
Lacey
Tumwater
DuPont
Yelm
Rainier
Tenino
Oakville
Bucoda
Centralia
Chehalis
Napavine
Raymond
South Bend
Winlock
Toledo
Vader
Long Beach
Castle Rock
Centralia Flood Damage Reduction Project
Chehalis River Basin Ecosystem Restoration Project
Centralia Flood Damage Reduction Project
Miles
0
5
10
15
20

Figure1 1

2. DESCRIPTION OF PROJECT AREA AND ACTION AREA

2.1. Project Area. The project area includes the mainstem Chehalis River, its floodplain and tributaries from the South Fork Chehalis River confluence north to Grand Mound, and includes the Cities of Centralia and Chehalis, in Lewis County, Wa. Tributaries entering and included within the project area include the Skookumchuck and Newaukum Rivers, Salzer, China, Dillenbaugh, Coal, Bunker, and Lincoln Creeks, among others. The project area includes an area west of the Chehalis and north of State Route 6 (SR-6). The project area also includes Skookumchuck Dam and reservoir in Thurston County. See Figure 2-1 for the location of the project area.

2.2. Action Area. The action area includes all of the project area and the mainstem Chehalis River downstream to the mouth of the Chehalis River where it enters Grays Harbor at Aberdeen. However, it does not include any tributaries downstream from the confluence with the Skookumchuck River, as these would not be affected by the project. The action area also includes potential mitigation and restoration sites, some of which are upstream from the project area on the Chehalis and Newaukum Rivers, and along Salzer Creek.

2.3. Land Use of Action Area. Land uses in the action area are primarily commercial forestry and logging, agriculture, commercial, and residential. The action area is predominantly rural, but has centers of population in the twin cities of Centralia and Chehalis in the middle part of the Chehalis River basin and Aberdeen, Hoquiam and Cosmopolis at the mouth of the river near Gray’s Harbor.

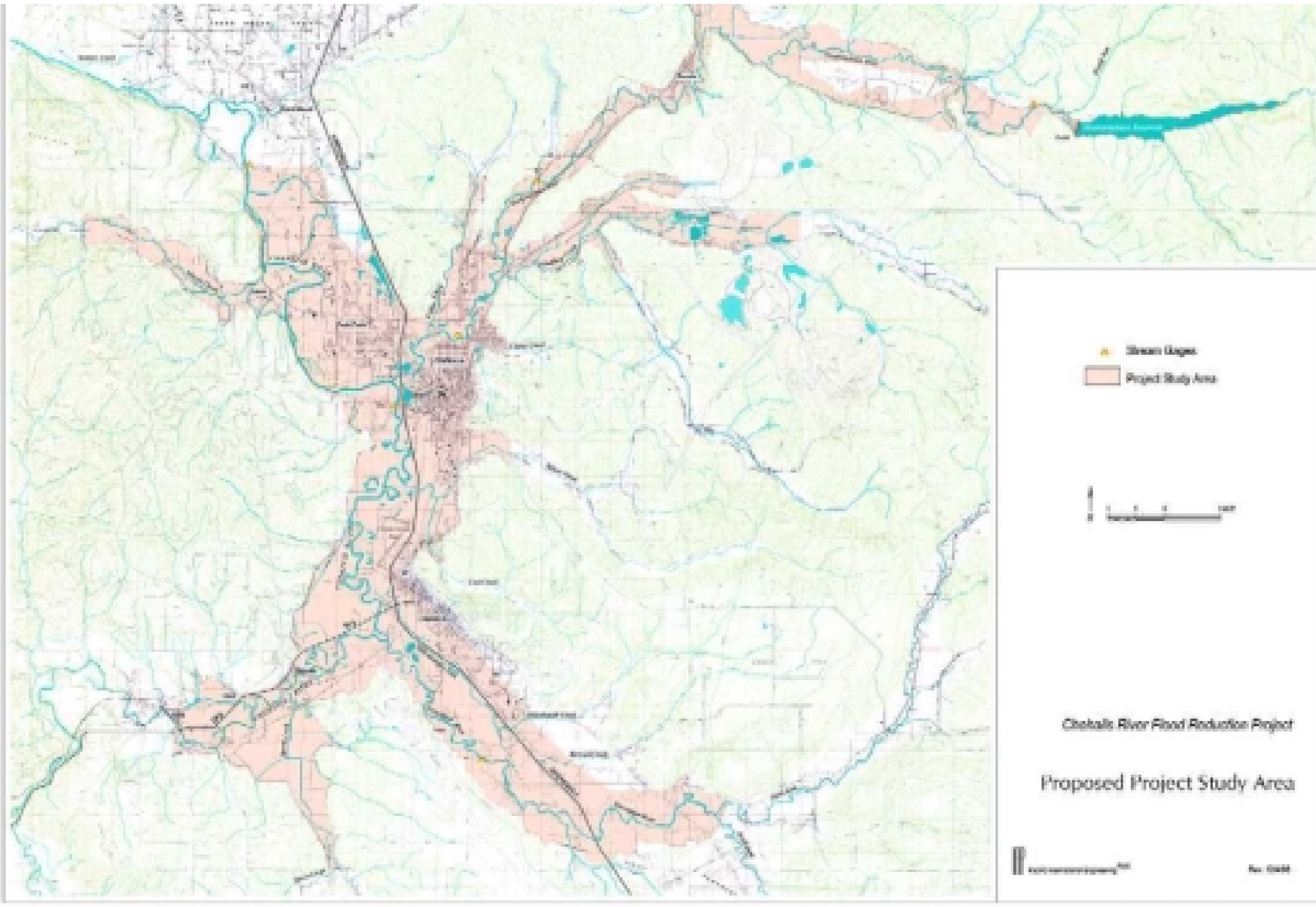


Figure 2.1

3. PROJECT DESCRIPTION.

The city of Centralia has a long history of flooding and suffering flood damages. These problems have been acknowledged and studied for many years, beginning in the 1940s. Many potential solutions have been explored, through levees, flood ways, and non-structural. More recently, heightened environmental awareness and the listing of area aquatic species as threatened and endangered have resulted in a need for increased focus on development of flood control alternatives that minimize environmental impacts and incorporate ecosystem restoration features to protect and restore impacted habitats for fish and wildlife communities.

The alternative selected, and described in this biological evaluation, is a levee in Centralia, combined with structural modification of the Skookumchuck Dam and its winter operation, and including floodplain modification in the area of SR-6. Following are brief descriptions of the levee system, the Skookumchuck Dam modifications, the modification to the SR-6 floodplain, as well as mitigation opportunities.

3.1. Levee System.

3.1.1. *__Objective__*. The levee would reduce flood damages associated with the Chehalis and Skookumchuck Rivers primarily in the city of Centralia and along I-5. It also addresses flooding along Salzer Creek, Dillenbaugh Creek, and the Newaukum River. The levee would reduce damages to structures and would allow for I-5 to stay open for transportation even during a 100-year flood.

3.1.2. Description. A system of levees to protect flood-prone areas near Chehalis and Centralia would be constructed at selected locations along the Chehalis and Skookumchuck Rivers as well as along several tributaries (i.e., Salzer, Dillenbaugh, and China Creeks).

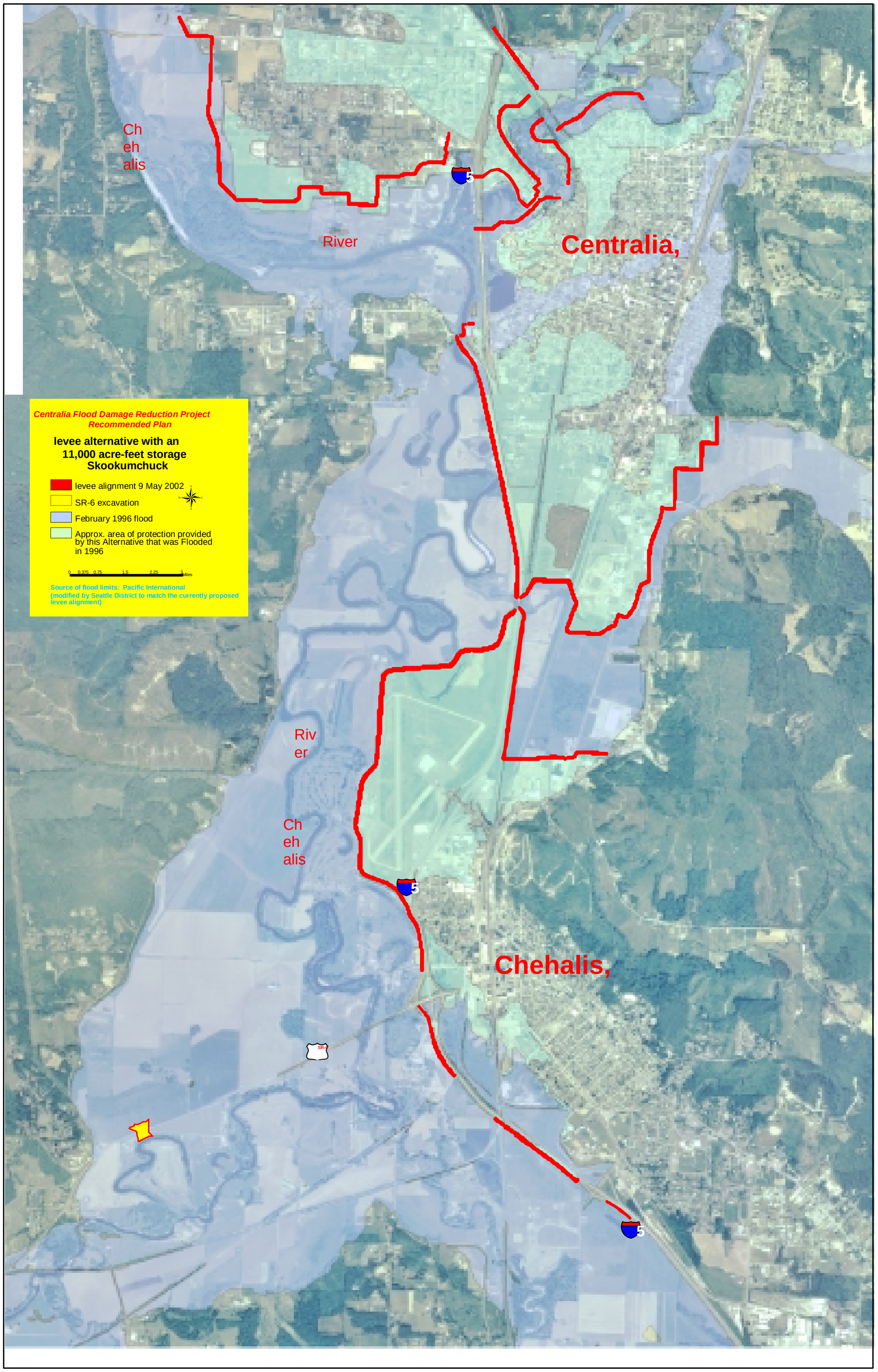
3.1.3. Design Objectives. The following list of objectives would be incorporated into design and construction to the extent feasible. For example, in some cases, a 50-foot buffer zone would not be possible due to the constricted areas through which the levee must pass.

- Develop the most environmentally friendly levee as possible (e.g., set-backs, smaller footprint, floodwalls in tight spaces).
- Contain the 100-year flood event within the levee system.
- Incorporate Skookumchuck Dam modifications into the assumed existing conditions.
- Avoid all hazardous material (super fund sites) by not inundating them or building structures at sites.
- Use the existing levee system as much as possible.
- Use existing roads for levees when possible.
- Set back levees away from river as far as possible.
- Meet all Washington State Department of Transportation (WSDOT) requirements when tying into freeway.
- Protect major transportation infrastructure.
- Avoid historic areas to extent possible.
- Incorporate a minimum 50’ buffer zone from water edge to levee toe where setback not possible (if 50 feet is available).
- Minimize in-water work.
- Avoid relocation of structures and residential areas.

3.1.4. Levee Alignment. The levee alignment would protect existing residential and commercial structures in Centralia and Chehalis, as well as I-5 and SR-6 from flooding. Flood protection would extend along the Chehalis River from approximately River Mile 75 to River Mile 64, along the Skookumchuck River from approximately River Mile 5 to near the mouth, as well as along most of the lower two miles of both Dillenbaugh Creek and Salzer Creek. The proposed levee alignment is displayed in Figure 3-1.

The levee would be set back to the maximum extent possible throughout its length. This means that in most locations the levee will be adjacent to roads, freeways, and other existing structures. Landward of the levee alignment are built-up areas that receive flood waters but have no habitat value. An exception to this is at Salzer Creek. In this area protecting all of the wetlands would add over 2 miles of levee to the system; as no structures would be protected, it was determined that a more cost-effective route would be through the wetlands. Impacts are relatively minor, however (see discussion in 8.1).

Figure 3.1


Ch
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River
Centralia,
Centralia Flood Damage Reduction Project
Recommended Plan
levee alternative with an
11,000 acre-feet storage
Skookumchuck
levee alignment 9 May 2002
SR-6 excavation
February 1996 flood
Approx. area of protection provided by this Alternative that was Flooded in 1996
0 0.375 0.75 1.5 2.25 3 Miles
Source of flood limits: Pacific International
(modified by Seattle District to match the currently proposed levee alignment)
Riv
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Chehalis,

The levee will generally be a typical trapezoidal design, with a 12-foot top width, and 2:1 side slopes (2 feet horizontal distance for every vertical foot). In most places the levee will be about 4 feet high, resulting in a bottom width (footprint) of about 28 feet (8 feet on each side plus 12-foot top width). Levee side slopes would be seeded with grasses and herbaceous plants. Shrubs and trees would be controlled to protect the structural integrity of the levee.

Along much of I-5, Dillenbaugh Creek, and a few other locations a concrete wall would be constructed in conjunction with a levee. The wall would be 2-3 feet high and about 1 foot wide (thick), and would be placed where the flood protection requires less than three feet of structure (a wall is more cost-effective than a levee in these cases).

3.1.5. Construction. Levees would be compacted earthen structures. Through about 10% of the length, a 3-ft blanket of rock (30" diameter and less) would be required to prevent erosion. In areas where rock would be necessary, a one-foot thick blanket of quarry spalls (4"-8" diameter rocks) would be placed between the rock and the levee. It would take approximately two years to construct the entire levee system.

To build the levees, 10-c.y. dump trucks for short distance hauling and 20-c.y. dump trucks for long-distance hauling would be utilized to haul the material from approved sources. Bull dozers would be used to smooth and shape the earthen material, while tracked excavators with bucket and thumb would be used to place the rock. There are at least five sources for materials in the local area. Through areas where there is currently no levee, an access road will be built along the levee alignment, and the levee built over the top of the access road. Where a levee already exists, the existing levee will be utilized for construction of the new levee. Otherwise, existing county roads would be utilized.

Detailed sequencing has not been worked out, though at this time it is likely that the concrete walls would be constructed first. The wall would be constructed by first digging a trench approximately 4 feet deep. Forms would be constructed in the trench and to the required height of the wall at each location. Cement mixer trucks would deliver the concrete and poured in place. Along I-5 this would require trucks to drive across planted lawn strips within the DOT right-of-way; any damage done to the lawns would be repaired following completion of the work. Along Dillenbaugh Creek there is a very narrow strip of land between the creek and the road where the wall will be constructed. Silt curtains will be placed to minimize the movement of sediments into the creek.

3.1.6 Staging Areas. At this time staging area locations have not been identified. Every effort will be made to locate staging areas in existing built-up areas. Where this will not be possible, staging areas will be located so as to cause the least impact to the environment. Following construction of the levees, the staging areas will be restored to their pre-existing condition.

3.2. Skookumchuck Dam Modifications.
This element is intended to provide reductions in flooding along the Skookumchuck River, addressing flooding problems in the Town of Bucoda and the City of Centralia. This action may also provide some reduction in discharge in the Chehalis River downstream of the confluence with the Skookumchuck River during certain flood events, though this benefit is expected to be limited.

3.2.1. Existing Structure and Operation. Skookumchuck Dam is located on the Skookumchuck River at approximately RM 22. The dam was constructed in 1970 to supply water for the Centralia steam generating plant. The dam is an earth fill structure approximately 190 feet high with the top of the dam at elevation 497 feet. The dam has a 130-foot wide uncontrolled spillway, on the left abutment, with a crest at elevation 477 feet. The dam has a multi-level intake system located at elevations 449, 420 and 378 feet that allows water temperature below the dam to be maintained at less than 60^{o} F for fish resources. A portion of the water is used by the Washington Department of Fish and Wildlife (WDFW) for a fish rearing facility approximately 0.5 miles downstream of the dam. The outlet works consist of two concrete encased steel pipes cut in rock under the dam, and include two 24-inch Howell-Bunger valves with a combined discharge capacity of 220 cubic feet per second (cfs).

Water discharge from the outlet tunnel is dependent on reservoir elevation. As the reservoir rises and reaches each intake, the corresponding outflows adjust on a continuum from 95cfs with one outlet submerged, 140 cfs with two outlets submerged and as much as 220 cfs with all 3 outlets submerged. After the reservoir fills, discharge is passed both through the sluiceways and over the spillway. Although it varies each year, monthly outflow averages generally range between 95 cfs and 1200 cfs depending on the month. During high flow conditions, discharge from the dam can greatly exceed monthly averages with a 5-yr event passing 4,000 cfs and a 100-yr event passing 7,425 cfs.

The existing dam has a limited capacity to release water from the reservoir when the pool is lower than elevation 477 feet. As a result, the current project configuration provides little flood control benefit since most incoming flow is passed through the reservoir with little attenuation. Yet the reservoir contains nearly 12,000 acre-feet of storage space, which the current action intends to utilize to reduce the downstream flooding effects.

3.2.2. Short Tunnel with Gates and Rubber Crest Weir. This design would consist of constructing an intake structure just upstream of the right abutment of the existing spillway bridge (see figure 3-2). The intake would lead to a short tunnel constructed in the rock forming the left abutment of the embankment dam. The intake would have two 8-foot by 11-foot slide gates. The tunnel would vary in shape from a 16-foot diameter horseshoe to a 10-foot diameter conduit. Flow would discharge through the tunnel into the existing spillway chute.

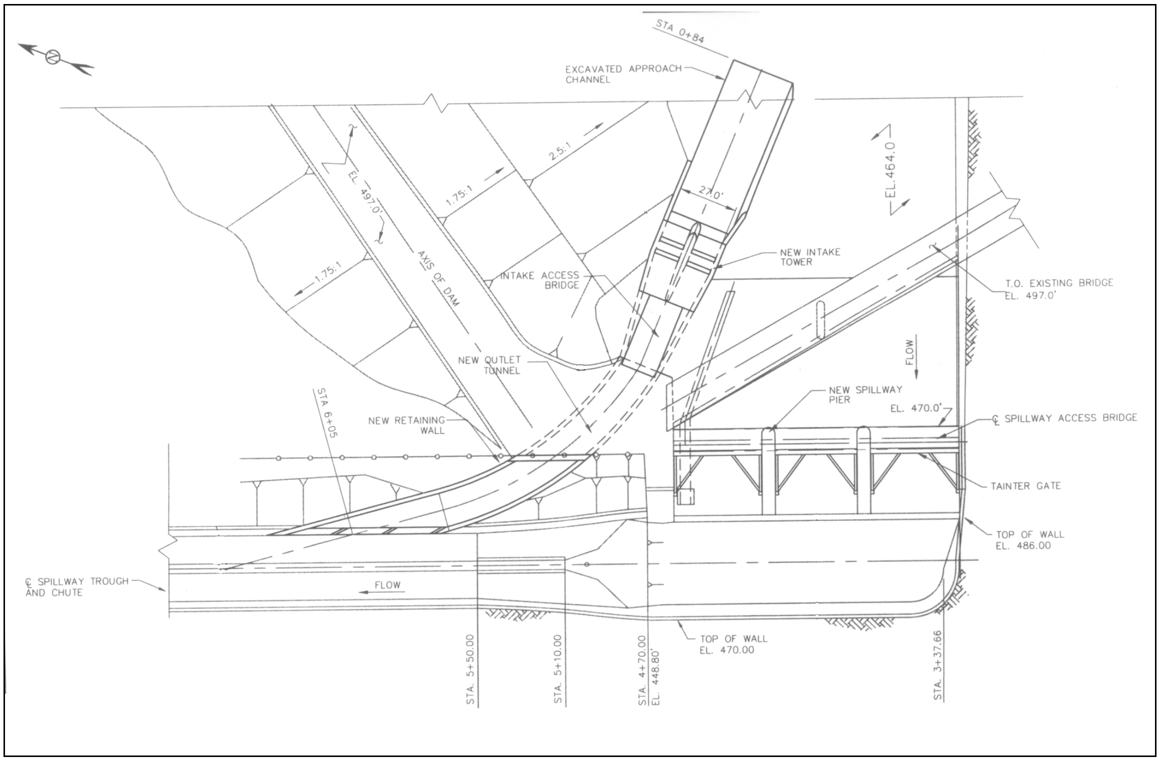

Figure 3-2. Proposed Skookumchuck Dam Outlet Structure and Spillway Modifications

Due to concerns that the left abutment rock may be highly weathered or fractured, and thus not very suitable for tunneling, it was assumed that the tunnel would be constructed as a cut and cover structure. A trench would be cut down in stages, with rock anchors being placed prior to the next excavation cut. A cast-in-place concrete tunnel would then be constructed at the bottom of the trench. Approximately 12,600 cubic yards of rock would have to be excavated for the tunnel construction. Concrete walls would be constructed at both the upstream and downstream ends of the trench, and the space between backfilled. New grout curtain holes would be drilled to prevent the flow of water through the dam embankment.

The intake structure would be a freestanding tower with an invert elevation of 438 feet, and a top deck at elevation 497 feet. The tower would be cast-in-place concrete, and a precast concrete bridge would provide access. The tower would be approximately 28 by 30 feet in plan, and would contain the two control gates, two guard gates, and all the necessary hydraulic control equipment. An inclined trashrack would be provided at the tunnel entrance, as would bulkhead slots. See Technical Report #2—Skookumchuck Dam Modifications, for more detailed information on the project design.

The existing uncontrolled overflow spillway would be modified, and a 15-foot high inflatable rubber weir would be constructed on top. The outlet tunnel would be designed to discharge up to 8000 cfs during PMF with the remaining 24,500 cfs passing over the overflow spillway.

3.2.3. *Reservoir Regulation Considerations*. Post-Project reservoir operations will be tied primarily to flood control where a requirement will be in place to ensure the reservoir elevation is at or below 455 prior to the onset of flood control season in early December. During the summer to fall drawdown period, flows from the project will be passed through the outlet structures such that the reservoir lowers to elevation 455. When drawdown is complete, inflow will be passed through the outlet works to maintain reservoir elevation so long as flows at Pearl Street in Centralia remain under 5,000 cfs. It is expected that project discharges would meet or exceed the minimum instream flows of 90 cfs except if reservoir inflow fell below 90 cfs. The reservoir should remain relatively constant throughout the late spring, summer and early fall. In winter, larger reservoir fluctuations may occur as the project reacts to flood events and the reservoir fluctuates between elevations 492 and 455.

Discharge from the project would be via two new 8-foot by 11-foot slide gates located on the dam with a bottom elevation of el: 436 and a common discharge tunnel entering into the existing spillway on the right bank (Figure 3-2). The gates purpose will be to pass flood flows through the flood season. The maximum storage pool elevation will be 492 and would require the use of a 15-foot high rubber or steel weir added to the spillway crest. The 15 foot high spillway structure would be inflated or dropped into place only during events that would require use of the additional flood control storage. This additional storage would be reserved for flood above the 70-yr event and not fully utilized until around the 100 yr event..

3.2.4. *Downstream Changes to Fl*ow. Flow operations from Skookumchuck Dam during non-flood events will be similar to the operation that is in place today. Except for flood events, post-project outflows should continue to follow historic outflows as recorded by the Bloody Run gage located slightly downstream of the dam (Table 1). In the absence of a flood, Skookumchuck Dam is expected to operate for the benefit of both PacificCorp and the natural resources of the River (see Table 2). However in the existing operations guidance, not all areas of routine operation are clearly described. For instance, there is little discussion of proper ramping rates. The WDFW/PacifiCorp agreement of May 1998 simply states: “Flow reductions under this Agreement shall be accomplished in a manner that minimizes the stranding of juvenile fish”. Specific criteria were not provided initially because the bypass reach between the dam and its hydropower unit was so short and no other opportunities to significantly modify flows existed at the dam. With the installation of flood control capability however, large changes in river stage will become possible.

The Bloody Run gage shows wide flow variations through the years. In general, daily discharge trends show flow increasing from a low of about 100 cfs in the late summer (August) to a mean monthly flow in January and February around or exceeding 1000 cfs. This pattern can vary widely by year although the summer month regimes are quite consistent.

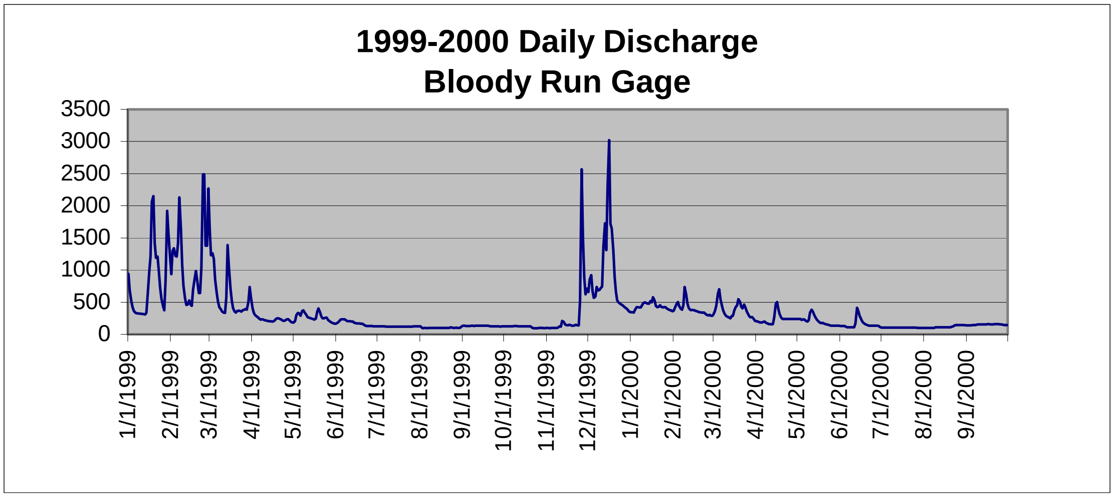

Table 1. Daily Discharge at Bloody Run for 1999 and 2000.

Maximum flows can be much higher than the average mean of around 1000 cfs. During flood season, high water releases of between 2000 and 3500 cfs are not uncommon. These events tend to be relatively short in duration lasting around 4-6 days. Bankfull flows in the upper reaches but below the dam occur at discharges of 3,000 cfs.

September 1 through October 31	Minimum instream flow of 140 cfs for spawning fish
November 1 through March 31	Minimum flow of 95 cfs for incubation period
April 1 through August 31	Maximum flow of 95 cfs or natural flow plus 50 cfs, whichever is less.
Water temperatures must be maintained at 50°-55° F to the maximum extent possible.	

Table 2. Existing Dam Operations Guidelines

During a flood event, outflows from the dam will be reduced in order to prevent flow at Pearl Street from exceeding 5000 cfs. Depending on the magnitude of the event, discharge will be limited to no more than 3,000 cfs. After the event passes, water stored in the reservoir will be released at volumes high enough to reach but not exceed 5,000 cfs at the Pearl Street river gage in Centralia.

3.3. Chehalis/SR-6 Area Floodplain Modifications.

3.3.1. Design Objectives.

The original intent of the SR-6 modifications was to ameliorate increased flooding in this area caused by construction of the levee system. The levees would cause extreme floods to back up into the low-lying area north of SR-6 in the vicinity of Claquato approximately 6”-10”. The modifications would offset this increased flooding in this discrete area and maintain flooding at existing levels. Since the time of the original plan, mitigation benefits are also seen from this action, particularly by restoring flows to an abandoned oxbow between SR-6 and the Chehalis River.

3.3.2. Description. The Scheuber Ditch/SR-6 alternatives were developed as different combinations of has been divided into 6 major features, including the SR-6 Oxbow, SR-6 Causeway, Scheuber Ditch, and North Wetland. The components are described below.

Oxbow

The oxbow immediately south of SR-6 would be reconnected to the Chehalis River via a 1,075-foot long channel excavated from the Chehalis River westward to the southern Oxbow arm. This reconnection would provide surface flows to the oxbow at most flows above base flows. Invasive plants would be removed and a 100-ft wide riparian zone would be planted around the oxbow.

Scheuber Dit*ch*

The Scheuber Ditch channel would be reconnected to the Chehalis River mainstem both up and downstream. The downstream connection would be made to the Oxbow, which will already be connected to the mainstem. A berm or high spot would be provided to allow the oxbow to drain back to the south at flows below the 2-year flow. The channel would carry flows at flows above the 2-5 year flood stage. Invasive species would be removed and riparian species would be planted. A 400-ft wide riparian area (200 feet on each side) will be planted along both banks of Scheuber Ditch along its entire length of just over two miles. The ditch would be reconfigured to add meanders, which will facilitate the return of more natural hydraulics to the system, introducing cover and complexity.

SR-6 Causeway

The state highway present between the Oxbow and Scheuber Ditch would be elevated to allow construction of the new channel and the passage of overbank flows from the Chehalis River under SR-6 and into the restoration areas proposed with the other features (Scheuber Ditch, South Wetland, North Wetland, and Middle Wetland). The channel would be excavated from the northern edge of the Oxbow to SR-6. A section of SR-6 will be elevated onto a causeway with the shallow channel continuing beneath. It is assumed that the causeway will be raised an elevation of 7 feet for a total length of 400 feet.

North Wetland

A 40-acre wetland will be created at the outlet of Scheuber Ditch. This area would be excavated and graded with a configuration similar to the complex at the south end and designed to provide similar functions. The complex would receive inflow from Coal Creek and Scheuber ditch from the south. These would provide flow through the wetland into the Chehalis River. The wetland would also receive backwater from the Chehalis River at annual high flows, which would provide refuge from high velocities for coho, chum and chinook. Shrubs and small trees such as alders, willows and dogwoods would be planted along the borders of the ponds and on the small islands within the complex to offer shading of aquatic habitat and foraging opportunities for terrestrial wildlife. An understory of shrubs and small trees as well as native grasses and forbs would be planted on the outer margins of the complex. LWD would be placed in the new channels and wetlands.

Excavated material for this work will be disposed at regional landfills.

This action is expected to fully compensate for the approximately 30-40 acres of wetland losses associated with the flood hazard reduction project.

3.4. Environmental Mitigation Measures.

The Corps has developed conceptual alternative environmental mitigation designs that maximize the restoration potential of the Centralia and Chehalis project area. The Corps also developed an evaluation methodology to quantify the habitat outputs of the mitigation alternatives.

An incremental cost analysis was performed to assist with development of mitigation plans. The purposes of the incremental cost analysis were to determine and show variations in costs and to develop and describe the most cost effective plan. Mitigation analyses are presented in an analytical framework similar to other project benefits and costs so that rational decisions regarding mitigation can be made. It is likely that other considerations will be included when developing a final mitigation plan for the recommended alternative, including the need to provide compensatory mitigation and to provide ratios of mitigation greater than 1:1.

3. AFFECTED SPECIES.

Several species protected under the Endangered Species Act of 1973 (16 USC 1531-1544) potentially occur in the project vicinity. The US Fish and Wildlife Service in their letter of May 11, 2000 provided the following list. Additional species of concern were added in the FWS Planning Aid Letter of April 12, 2001; these are included in the list below. Finally, the species list was re-visited in March 2001, at which time Kincaid's lupine was added to the list.

4.1. Species Lists

4.1.1. Listed species:

- Bald Eagle (*Haliaeetus leucocephalus*) (threatened)
- Marbled Murrelet (*Brachyramphus marmoratus*) and designated critical habitat (threatened)
- Northern Spotted Owl (*Strix occidentalis caurina*) and designated critical habitat (threatened)
- Coastal/Puget Sound Population Segment Bull Trout (*Salvelinus confluentus*) (threatened)
- Canada Lynx (*Lynx canadensis*) (threatened)
- Gray Wolf (*Canis lupus*) (endangered)
- Grizzly Bear (*Ursus arctos*) (threatened)
- Kincaid's Lupine (*Lupinus sulphureus kincaidii*) (threatened)
- Golden Paintbrush (*Castilleja levisecta*)

4.1.2. Proposed species:

- Southwest Washington/Columbia River ESU Coastal Cutthroat Trout (*Salmo clarki clarki*)

*4.1.3. Candidate speci*es:

- Oregon Spotted Frog (*Rana pretiosa*)
- Whulge's Checkerspot (*Euphydryas editha taylori*)
- Mardon Skipper (*Polites mardon*)

4.1.4. Federal Species of Concern. Federal species of concern include California wolverine (*Gulo gulo luteus*), Pacific fisher (*Martes pennanti pacifica*), western pocket gopher (*Thomomys mazama*), Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*), long-eared myotis (*Myotis evotis*), long-legged myotis (*M. volans*), western gray squirrel (*Sciurus griseus*), Northern goshawk (*Accipiter gentilis*), peregrine falcon (*Falco peregrinus*), olive-sided flycatcher (*Contopus cooperi*), Pacific lamprey (*Lampetra tridentata*), river lamprey (*L. ayresi*), Columbia torrent salamander (*Rhyacotriton kezeri*), Van Dyke's salamander (*Plethodon vandykei*), Larch Mountain salamander (*Plethodon larselli*), Cascades frog (*Rana cascadae*), tailed frog (*Ascaphus truei*), western toad (*Bufo boreas*), valley silverspot (*Speyeria zerene bremeri*), tall bugbane (*Cimicifuga elata*), white-top aster (*Aster curtus*), and pale larkspur (*Delphinium leucophaeum*).

*4.1.5. State Species of Concern***.** Finally, several state-listed species of concern include the great blue heron (*Ardea herodias*), bufflehead (*Bucephala albeola*), wood duck (*Aix sponsa*), osprey (*Pandion haliaetus*), band-tailed pigeon (*Columba fasciata*), and western pond turtle (*Clemmys marmorata*). The Olympic mud minnow (*Novumbra hubbsi*) is a state candidate species.

*4.2. No Effect Determinations***.** The listed and proposed species are discussed in detail in Section 9. Following is a brief assessment of the expected effects of the project on candidate species.

The Whulge's checkerspot, Mardon skipper, western pocket gopher, western gray squirrel, valley silverspot, white-top aster, pale larkspur, and western pond turtle, are all restricted to prairie habitats. Of particular interest relative to this project (since these are the closest prairies) are the Grand Mound Prairie, north of the project area, and the Boistfort Prairie, about 5 miles southwest of the project area. Most of these species are still found in both prairies. This project would not affect prairie habitats, as the levee system will not be constructed in prairies, and the limits of flood control effects would not reach prairie habitats. Note that Violet Prairie, north of the Skookumchuck River, has been virtually converted to agriculture and no longer supports these native species (though a remnant population of Olympic mudminnow still exists in a wetland at the very northwestern terminus of the valley).

The amphibians and fish listed as candidates are found either in isolated wetlands (Oregon spotted frog), in slow-moving streams where freshets are rare (Olympic mudminnow, Pacific lamprey, river lamprey, Cascades frog), or in steep-gradient, cold-water streams and/or associated talus (Columbia torrent salamander, Larch Mountain salamander, Van Dyke's salamander, tailed frog). None of these habitats would be affected by the project (though lampreys do migrate through the Chehalis River, the infrequent changes to river flows would be indistinguishable to lampreys).

Other species restricted to forested landscapes (California wolverine, Pacific fisher, Pacific Townsend's big-eared bat, long-eared myotis, long-legged myotis, northern goshawk, olive-sided flycatcher, tall bugbane, and band-tailed pigeon) would not be affected by the project as no forested habitats would be affected. Note that the bats may also be found in prairie habitats, which, as explained earlier, would also not be affected by the project. A California wolverine was sighted in the action area several years ago. However, this occurrence is regarded as highly unusual, since the normal habitat for wolverine is high elevation forests.

The peregrine falcon nests on cliffs, or tall man-made structures, including high bridges, and typically forages over open spaces. Open spaces where peregrines typically hunt will remain intact with this project; however, no nests of peregrines are known in the action area (WDFW, 2002).

Four species of State-listed candidate species are found in riparian habitats: great blue heron, bufflehead, wood duck, and osprey. While the project will affect riparian habitats in subtle ways, no direct losses of riparian trees would occur, with the exception of three short stretches along the Chehalis River. One of these locations is approximately 1/8 mile in length; just a few trees would be lost from another site (near Mellen Street); and a number of trees would be lost from the SR-6 restoration effort to reconnect the oxbow to the river. It is likely that some nest trees for all of these species could be lost (buffleheads and wood ducks are cavity nesters; ospreys place a nest in the top of a large, broken-top snag or on top of a transmission line pole; great blue herons build nests in colonies in various kinds of trees—however, no great blue heron colonies are found within the action area (WDFW, 2002)). The loss of these few trees is not expected to be significant to these species.

As the project will either not affect these candidate species, or would result in insignificant or discountable affects, they will not be discussed further in this BA.

4. DETERMINATION SUMMARY.

Below is a table summarizing the status and effect determinations made for each of the species listed above. Also included are the page numbers where detailed descriptions of the forecasted effects of the proposed action on these species can be found.

Table 3. Determination Summary Table

Species	Listing Status	Effect Determination	Page
Bald Eagle	Listed Threatened	Not Likely to Adversely Affect	26
Marbled Murrelet	Listed Threatened	No Effect	28
Spotted Owl	Listed Threatened	No Effect	29
Bull Trout	Listed Threatened	Not Likely to Adversely Affect	33
Gray Wolf	Listed Endangered	No Effect	31
Grizzly Bear	Listed Threatened	No Effect	31
Canada Lynx	Listed Threatened	No Effect	32
Kincaid’s Lupine	Listed Threatened	No Effect	37
Golden Paintbrush	Listed Threatened	No Effect	37
Coastal Cutthroat Trout	Proposed	Not Likely to Jeopardize	35

5. METHODS USED IN PREPARATION OF THIS BA.

Information has been gathered by the Corps and contractors regarding hydrology and the local environment, including information on fish and wildlife and their habitats, which was used in preparation of this BA. In-house expertise provided additional bases for evaluation. The Washington Department of Natural Resource's Natural Heritage Database and the Washington Department of Fish and Wildlife's Priority Habitats and Species Database were consulted for observations and descriptions of behavioral activity of species in the action area. In addition, scientific literature was reviewed and local experts were interviewed to provide a basis for the affect determinations. References are named in the text and are listed in Section 13.

6. EXISTING ENVIRONMENT.

7.1. Historical Perspective. Coupled with the serious flooding problems in the basin, the natural aquatic ecosystem has been degraded and populations of many species of fish and wildlife are in decline. Habitat conditions in the basin were significantly altered during the 1920's, 1930's and 1940's when logging activities were most active. Railroads, roads and residential development also contributed to the decline of ecosystem health in the basin. The diversion, channeling and straightening of streams within the watershed and clearing of riparian corridors mainly for agricultural uses has increased flooding danger in the basin and has contributed to degraded aquatic and riparian ecosystems. Degradation of aquatic ecosystem health and many of the flooding problems in the Chehalis River basin are the result of altered natural functions in the basin.

Incidences of flooding in the basin have steadily risen over time while aquatic ecosystem health has declined. Basin-wide flooding problems and declining aquatic ecosystem health appear directly related. Merging efforts for both flood damage reduction and aquatic ecosystem restoration would likely diminish both problems.

7.2. Description of Environment. The land use in the vicinity of the project is primarily timber production above Skookumchuck Dam, and agriculture below the dam. The land surrounding the dam and reservoir are all in private ownership and have been clearcut within the past 70 years, resulting in a mosaic of primarily Douglas fir forest patches of 5 to 70 years in age. Upstream from the dam the land is characterized by steep-sided hills, while below the dam the land quickly becomes a broad, flat floodplain. In this area agriculture has replaced timber production as the primary economic activity. The river through this agricultural land has retained a significant proportion of its riparian vegetation, consisting of Oregon ash (*Fraxinus latifolia*), willow (*Salix spp.*), red alder (*Alnus rubra*), and black cottonwood (*Populus balsamifera*).

7.3. Altered Hydrologic Regime.

The Chehalis River originates in the Willapa Hills southeast of Aberdeen, and flows 125 miles before emptying into Grays Harbor estuary on the Pacific Coast. Major tributaries to the Chehalis River include the Wishkah, Newaukum, Skookumchuck, Wynoochee, and Satsop Rivers. Major flooding occurs during the winter season, from November through February, mainly as a result of heavy rainfall. Flooding may be widespread throughout the basin or localized in sub-basins, depending upon the areal extent and uniformity of the precipitation causing the runoff. Precipitation and timing of the mainstem and tributary flows are the major factor in determining the magnitude of floods on the Chehalis River. There is a direct correlation between the amount of precipitation with ten of the largest floods on the Chehalis River. In most cases, the recent large floods of record have the greatest precipitation totals for all temporal duration.

The Corps has data on nine of the largest floods that have occurred on the Chehalis River from several representative streamgages since 1971. Three of the largest floods occurred since publication of the most recent FEMA FIS reports in the basin, the latest being in 1982. The number of large recent events has caused a significant increase in the frequency curves at most of the streamgaging stations.

The flows for set flood frequencies for the Upper Chehalis River Basin have increased dramatically in the last 30 years due to the many large events hitting the basin since 1972. In 1969, the Chehalis River at Grand Mound had an expected 100-year flow of 54,000 cfs. The latest frequency curve for this gage (through water year 1998) has an expected 100-year flow of 74,100 cfs. This is an increase of 37 percent.

For the Lower Chehalis River Basin, the peak flows have also increased. In 1990, the Wynoochee River at Black Creek had an expected 100-year flow of 35,500 cfs. In a frequency curve updated to 2000, the expected 100-year flow is 40,800 cfs. This is an increase of 15 percent.

In the Upper Chehalis River Basin, there have been at least thirty-one flood events on the Chehalis River at the Centralia gage (Mellen St.) since 1971. Of those events, nine have resulted in river crests of greater than 70 feet. Of the nine flood events, two (January 1990 and February 1996) have resulted in the closure of Interstate 5 for several days. These flood events also resulted in the two highest readings on the Skookumchuck River at Centralia in the last 25 years.

7.4. Limiting Factors. The primary limiting factors to aquatic ecosystem health in the Chehalis River basin are physical barriers, floodplain connectivity, streambed/sediment conditions, riparian conditions and water quality. Flooding problems—and an altered hydrologic regime—in the basin are usually tied directly to these limiting factors.

7.4.1. Physical Barriers. Physical barriers include flowage barriers or constrictors and fish passage barriers. The Skookumchuck Dam is the largest barrier in the Chehalis River basin. It currently blocks passage to all anadromous fish in the headwaters of the basin and has altered historic flows and gravel replenishment in the lower reach. Road culverts make up the majority of the remaining barriers. Fish passage barriers also include velocity impediments, degraded water quality conditions such as high temperatures, or low dissolved oxygen barriers. Other barriers and constrictors include railroad and highway bridges, small agricultural diversions, dams, and road and highway embankments near or next to streams. While some of these structures are not necessarily a full blockage for fish, they serve as an impediment to natural flows and can exacerbate flooding problems, upsetting the equilibrium of natural flows and the river's hydrology.

7.4.2. Floodplain Connectivity. Floodplain connectivity refers to conditions affecting overall flows of a watercourse through a floodplain. Floodplains with open connectivity are connected directly to the river at many points, allowing wetlands and other off channel areas to store flood water and later discharge this storage back to the river during lower flows. In floodplains with constrained connectivity, such as in a canyon, flood flows rise and fall quickly. Historic conditions of the Chehalis River included large, broad floodplains with very open conditions. Floodplain connectivity in the Chehalis basin has been altered from natural conditions resulting in peak flows well above historic flows, thereby increasing the frequency of flooding. Elders of the Federated Tribes of the Chehalis contrast historic conditions with today's condition, reporting that during and following heavy rains, the Chehalis River in the middle basin rose and fell slowly, whereas now it quickly rises much higher and then falls; they also report that the river used to be clear and deep green during high flows and that now it is like "latte" (murky brown). Examples of alterations include bank hardening using riprap or dikes, channel realignments, and the existence of a high number of roads, railroads and levees. The conversion of active channels to inaccessible ponds has occurred in several areas because of agricultural ditching and pond construction for settlement of mine tailings. Residential, commercial and industrial development has also filled in floodplains.

Altered and degraded floodplain connectivity in the Chehalis basin has contributed significantly to degraded aquatic ecosystems, increased flow velocities, greater bank erosion and sediment deposition, and channel incision. During high flows, salmonids will normally take refuge in off-channel areas, but riprap and channeled watercourses have prevented development and perpetuation of off-channel habitats. Channelization has contributed to increased bed scour, which destroys spawning areas and these degraded habitat functions have further reduced floodplain interactions by severe channel incision. Overall floodplain connectivity alterations in the Chehalis River basin have exacerbated flooding and degraded aquatic ecosystem health.

7.4.3. <u>*Streambed/Sediment Conditions*</u>. The causes of degraded sediment and streambed conditions in the Chehalis River basin include the Skookumchuck Dam, a lack of large woody material to maintain coarse sediment, bank and surface erosion, channelization of the river, and landslides. Bank erosion is a source of fine sediments into basin streams, which can suffocate salmonid eggs and decrease size and availability of interstitial spaces used by small juveniles for rearing. Debris torrents and dam-break floods have scoured channels and contributed to a decrease in large woody material. Most non-natural surface erosion (including landslides) comes from dirt and gravel roads and forestry/agricultural lands. Increased river velocities and volumes from altered floodplain connectivity in the upper basin has also caused high levels of deposition in the middle and lower basin, displacing flows outside of historical channels and causing increased flooding.

7.4.4. <u>*Riparian Condition*</u>s. Degraded riparian conditions currently exist in the Chehalis River basin as a result of riparian harvest, dam break floods, fires, agriculture, and development. Areas with no vegetation, little vegetation, or vegetation that is composed primarily of young deciduous trees characterize the degraded riparian conditions. Further, invasive exotic species such as Himalayan blackberry have replaced native trees and shrubs along much of the stream length in the basin. Areas with little or no vegetation do not provide adequate shade and those areas may experience increased water temperatures, which limit fish survival and reproduction. They also do not provide large woody material recruitment, or cover to the streams and do not provide a buffer for stormwater runoff or other human activities. Remnant riparian forests in the basin are unable to provide adequate large woody material recruitment (especially since most of these forests are also young), which leads to increased sediment transport, decreased pool habitat, and increased scour.

Along the Skookumchuck and Newaukum Rivers, there remain some healthy reaches of riparian habitat, though generally in relatively narrow bands along the shoreline. These habitats still provide organic inputs to the river system, and provide adequate shade to the aquatic environment. Native species still dominate these forests. The primary factor reducing the functional capacity of these habitats is the lack of width, generally only about 30-50 feet.

7.4.5. *Water Quality*. The primary water quality problem in the Chehalis River basin is high water temperatures, although pH and fecal coliform are also an issue in some areas of the watershed. Cleared or degraded riparian forests no longer provide shade along stream banks and calving and eroding banks have made low flow channels wider and shallower, thereby exposing more water to direct sunlight. Longtime residents of the middle basin frequently report that the river is much shallower and wider than in the past. Animal waste from pastures, dairies and farms has affected water quality, adding nutrients to the water and increasing coliform.

7. IMPACTS OF THE PROPOSED PROJECT

8.1. Levee System. The levee would cause a relatively significant reduction in the areal extent of flooding in the Chehalis River valley in the Chehalis-Centralia reach. Although the levees would cause relatively small (less than 1 foot up to a 100-year event) increases in peak stage within the Chehalis River channel, water levels would be reduced in targeted areas of the floodplain where damages to structures and roads are most likely to occur. Slight increases in the peak stage within the Chehalis River channel would occur as a result of the levees keeping a higher proportion of the flow confined to a smaller floodplain area (i.e., less out of channel flow entering the floodplain due to the levees).

The levee would cause a slight increase in the peak stage of the Chehalis River downstream of RM 77 (which would be reduced by the SR-6 flow bypass measure). Peak stage downstream of RM 77 could increase by about 0.1 during a 10-year event and could increase by up to 0.15 feet during a 100-year peak. Slight downstream increases in peak stage are attributed to a more efficient routing of flood flows through the Chehalis-Centralia reach due to the levee system.

The levee would cause a relatively significant reduction in the areal extent of flooding in the lower Skookumchuck River valley in the Centralia area. However, increases in the peak stage within the Skookumchuck River channel would occur as a result of the levees keeping a higher proportion of the flow confined to a smaller floodplain area (i.e., less out of channel flow entering the floodplain due to the levees).

The alteration in duration and frequency of flooding in the floodplain results in adverse effects to the floodplain habitats, including the riparian areas and adjacent wetlands. These effects can result in loss of native plant seed dispersal and seedling dessication, as well as allow invasion of exotic invasive species (Duncan, 1993; Nilsson, 1982; Meffe, 1984; Moyle, 1986—all in Poff, et al, 1997). The riparian plant community may lose the ability to sustain itself, resulting in a long-term decay and turnover to a less desirable plant community (Bren, 1992—in Poff, et al, 1997). Aquatic species which have adapted to the natural variation of a free-flowing river will lose their ecological advantage over less variable-tolerant species, and result in a change in the overall dynamic of the aquatic ecology (Cushman, 1985; Petts, 1984; Travnichek, et al, 1995—all in Poff, et al, 1997). Wetlands may not be maintained if not frequently flooded.

Having acknowledged these potential effects from altered hydrologic regimes, it must be said that these effects will scarcely be noticeable in the Chehalis and Skookumchuck Basins. The levee system is designed to contain the 100-year flood. While this means that lesser flood flows will be contained within the levees and not be allowed to enter the larger floodplain, for the most part very little habitat would be affected. The levee system will remove flooding from built-up areas. It is designed to have minimal environmental effects, by virtue of being set back as far as possible in every location (see figure 3-1). What this means is that the levee would be built against road shoulders; along fence lines; along residential back yards. In a few cases, structures will be sacrificed in order to preserve additional habitat. The primary area of impact to wetland habitat would be along the lower two miles of Salzer Creek; the levee in this location would cut across approximately twenty acres of wet pasture, removing about half of it from flooding. However, investigations of groundwater in the basin indicate that groundwater is fed and recharged primarily by rainfall, not by flooding. Thus the wetland in this area (and elsewhere in the project area where wetlands would be cut off from flooding) are expected to remain functional (COE, 2002). These impacted wetlands are considered to have limited functional value for aquatic life because they are all wet pasturelands, and well removed from the streams due to the levees being set back (though certainly some loss of function will result by removing floods—seed dispersal, organic/detrital inputs, flood storage, water quality improvement, wildlife habitat (refuge during floods); on a basin-wide basis, these minor losses of function are considered to be insignificant. This is especially so when the mitigation plans are factored in, which are expected to fully compensate for the lost function caused by levee construction.

In only a couple of locations will the levee be constructed in close proximity to a stream (along the mainstem Chehalis, and along the Skookumchuck, as well as along Dillenbaugh Creek. In these areas extreme care will be taken to avoid excessive sediment inputs into the streams, by use of silt curtains, constructing during the fish work windows, and with other best management practices.

8.2. Skookumchuck Dam Modifications.

8.2.1. Existing Operations. During the fall, inflow from increased precipitation surpasses the ability of the sluice gates to pass water causing the reservoir to fill to the spillway elevation of 477 within a period of 2-4 weeks. When the reservoir is full, all inflow in excess of the sluice gates discharge capacity (approx 220 cfs) spills uncontrolled over the spillway. This “fill- and-spill” operation offers limited flood control capacity since the reservoir is typically full prior to the big flood events of winter. However, allowing the spill to occur provides a nearly natural hydrograph for spawning, incubating and rearing salmonids in the river. Some off-channel habitats dependant upon higher flows may remain unavailable until after refill is complete. When the winter floods occur after refill, they are passed down the Skookumchuck River to meet the floodwaters of the Chehalis River. During the refill period, increased flow from moderate freshets in the upper Skookumchuck is absorbed by dam storage and do not reach the lower river during salmon migration. The winter fill-and-spill regime continues for as long as inflow exceeds the sluice gate capacity.

Under current operations, the reservoir typically fills prior to the onset of winter high flows. Therefore capacity is full when the high flows begin causing all inflows to be passed over the spillway into the downstream reaches of the Skookumchuck River. Flooding impacts from existing operations on aquatic resources are similar to those of unregulated streams including the potential for excessive redd scour as bed load is eroded from confined or steep sections of the river. The existing operations cause high flows on the Skookumchuck River to frequently overtop its banks with mixed impacts to adult and juvenile salmon. Overbank flooding in areas of extensive mainstem connectivity (as evidenced by the presence of side channels, unconfined banks, wetlands and creeks) increases the potential for over wintering use by salmonids and the probability that salmonids can return to the mainstem on the descending hydrograph. Overbank flooding in areas of limited mainstem connectivity (as evidenced by levees, human development and agriculture) may provide overwintering habitat but lowers the probability of salmon returning to the mainstem on a descending hydrograph, which then raises a concern for stranding.

8.2.2. Proposed Operation for Flood Control.

8.2.2.1. Reservoir Effects. The flood control project proposes a 15-foot high weir or gate structure to be used only during floods approaching the 100 yr event. The control structure would engage for flood protection only and cause the reservoir to rise above the historic full pool elevation of 477 towards a new elevation of 492. This would cause floodwaters to inundate a variety of upland and wetland habitats including basalt cliffs, talus slope, steep brush and timber slopes, shallow slopes and vegetated lowlands. Depending on the magnitude of the flood, the additional pool would increase between 1 and 15 feet above the existing full pool and remain above elevation 477 between 1 and 3 days (28-69 hours). The operations would occur in winter, when vegetation is dormant. The infrequent occurrence should allow inundated vegetation to survive and keep the varial zone within its current elevations. It is anticipated that the timber and underbrush between elevations 477 and 492 will remain intact although an increase in woody debris recruitment would occur as a result of the higher pool (adding diversity to the habitat structure). This effect would only occur in years of catastrophic floods—between 70- and 100-year events. Thus the effect is so infrequent; occurs only in the non-growing season, and would likely be at this higher elevation for no more than two weeks. Thus, effects in the upper 15 feet of the reservoir are discountable and insignificant.

Flood operations under the proposed project would produce more frequent fluctuations of the winter reservoir. The proposed project calls for the reservoir to be evacuated through the new outlet gates after each flood event to reclaim flood storage. Under existing conditions, the reservoir is allowed to fill and remain relatively stable until inflows recede in spring. The proposed project would strive to keep a winter pool at elevation 455 until February, when the pool would be allowed to refill. Pool fluctuations during winter would expose an incremental area of reservoir edge, exposing sediments to rain and other weather events. To the extent that these sediments enter the reservoir, some degree of increased turbidity could be expected. Any incremental increase in turbidity would likely be passed downstream but it seems unlikely that major turbidity events would occur in the reservoir that would raise suspended sediments in the Skookumchuck River over the normally low background levels.

8.2.2.2. Construction Effects. Modifications to the dam under the flood control project include a multitude of small structural changes as well as the addition of a weir structure and additional low level outlet gates. Impact from structural modifications would be limited to concrete work in and around the dam. Concrete pouring, drilling and mixing can have impacts to fisheries and wildlife by raising pH levels of water if conducted in small poorly circulated aquatic environments or if the mixing components are allowed to enter the water in large quantities. Since most of the construction is conducted upland and the Skookumchuck River is large enough to ameliorate the effects of curing small concrete projects, the likelihood of experiencing harmful levels of elevated pH is very low. The weir and sluiceway construction would have similarly low levels of direct harm related to their construction.

8.2.2.3. Downstream River Effects.

8.2.2.3.1. Summer Flow.
The summer flows and temperature requirements under the flood control agreement will continue as outlined in the existing WDFW agreement. After the flood control season, there are no current plans to actively manage inflow for summer flow augmentation. Summer water quality will remain similar to the existing condition. A rule curve for summer augmentation flows has not been developed and falls outside the scope of this effort.

8.2.2.3.2. Flood Flows. Flood events under the proposed project will represent a change from the current condition. Existing operations do not mitigate downstream flooding once the reservoir is full, causing frequent overbank flows. The proposed project will store the peak of flood flows behind the reservoir and release water to maintain flows of less than 5,000 cfs at Pearl Street in Centralia. The result will be the elimination of large overtopping events (greater than 2-yr) as they are replaced with smaller events of greater frequency and duration. Sediment routing and timing may also change with this project.

In most urbanized and altered river systems, overbank flooding does not allow for adequate return pathways to the river. The result is often juvenile and adult salmon stranded in pasturelands, roadside ditches and suburban neighborhoods with no mechanism for reentry to the river. Under natural conditions, where reaches have good connectivity by way of small tributaries, extensive side channel habitats or wetlands, overtopping events represent rearing opportunities for juvenile salmon and provide refuge for adults to escape the turbulent, debris filled mainstem. Field investigations along the Skookumchuck found most tributaries had good connectivity to the mainstem but there were few mainstem reaches with connected side channel habitat and floodplain connectivity (PIE, 2000).

In reviewing the differences between the large system characteristics of the Chehalis to the smaller Skookumchuck River, it appears that overbank flooding on the Skookumchuck River has not been an important factor in the maintenance of its sub-basin. The large volume of tributary input, frequency of local flooding and location of most adjacent wetlands, appear to indicate that the sub-basin approaches or exceeds groundwater saturation without the addition of winter and early spring flooding events. As such, the role of additional floodwaters during these months does not appear to significantly add to the ability of the sub-basin to absorb water and add additional water volume to the sub-basins' surface and groundwater resources.

Potential effects to river channel vegetation are primarily due to the lack of overbank flooding at flows above 3000 cfs at the dam and 5000 cfs at the mouth. Vegetation reliant upon flows under these levels should continue without harm and may even increase as high flows are moderated during floods. Thus the primary impact of the project is the loss of the larger overbank events and their effects on future woody debris recruitment. Much of the river length would still be overtopped by a 2-yr event (see Appendix B of Dillon, 2002). Therefore, riparian habitat recruitment is expected to continue, helping to maintain a supply of LWD, and other organic materials to the river.

The reduction in overbank flooding above the 2 yr event could cause the river channel to become more reliant upon the riparian corridor for sources of woody debris and terrestrial inputs as well as potentially slow the creation of additional side channel habitats. In addition, there are several stretches of the river and within the tributaries where the riparian corridor has been removed by human disturbance and agriculture or limited by heavy invasive growth or vegetation maintenance. The proposed project would not change the way people manage their properties along the Skookumchuck River.

Aside from the elimination of peak flows, the proposed project could alter flows in other ways, including increasing the frequency and duration of one- and two-year flow events. This somewhat more stabilized flow regime could lead to invasion by exotic species, at the expense of native species. While in most rivers elimination of flows greater than two-year events may lead to the stabilization of channels, and cause gravel bars to become vegetated, in the Skookumchuck River, the two-year event is the channel forming flow. Since, in effect, this flow would occur more frequently, it is possible that the channel could be more active than it is today. At the very least, it seems unlikely that gravel bars would become vegetated because of the greater frequency of flood-flows. Invertebrate populations could be adversely affected as the greater frequency of flood flows could disrupt their life cycles. As of this writing, the severity of these effects can only be formed through speculation, since the flood control operation has not been implemented, and there is nothing to compare it against. On the plus side, since the flood control operation would end in March—prior to the growing season—effects on vegetation, and perhaps even on most invertebrate populations, can be expected to be minimal.

8.3. Dam Modifications plus Levee System. Up to this point in this BA the levee system and Skookumchuck Dam modifications have been discussed separately. In reality, the two measures will work together to control floods, and the sum total of this combined effect is slightly greater, in terms of higher water between the levees during floods, than would happen with the levee system alone. But this effect is contained within the levees, and is held for only a short duration. The footprint of the levee system is approximately 80 acres; however, much of this is already under existing levees, so the actual impact of the new levee footprint over wetlands is between 18 and 34 acres—the range is a result of unclear definition of existing levees, and therefore, uncertainty about the actual amount of new levee that would cover virgin ground.

8.3.1. Mitigation. The recommended mitigation plan is that described for the SR-6 channel through Scheuber Ditch, the associated 40-acre wetland, and the reconnection of the oxbow. The mitigation value is expected to exceed the loss due to the project.

8.4. SR-6 Excavation and Flowway Bypass.

While construction of the mitigation plans at SR-6 will result in the loss of numerous riparian trees and shrubs, some of which likely provide nesting cavities for species such as wood ducks and hooded mergansers, this is a necessary impact in order to accomplish the mitigation. Wood that is removed will be used as LWD in the mitigation plan. Thousands of trees and shrubs will be planted along the newly excavated oxbow connections, as well as along the Scheuber Ditch overflow channel, though of course it will be many years before these trees reach maturity. On the other hand, the restoration of annual flows into the oxbow will provide immediate benefits to anadromous salmonids, including coastal cutthroat trout.

As the excavated material will be disposed at regional landfills, no impact from disposal of this material is expected.

9. SPECIES DESCRIPTIONS AND EFFECTS OF PROJECT.

9.1. Bald Eagle.

The Washington State bald eagle population was listed as threatened under the Endangered Species Act of 1973, as amended (64 FR 16397), in February 1978. Since DDT was banned in 1972, bald eagle populations have rebounded. The bald eagle was proposed for de-listing in July 1999.

The bald eagle is found only in North America and ranges over much of the continent, from the northern reaches of Alaska and Canada to northern Mexico. Bald eagles in Washington State are most commonly found along lakes, rivers, marshes, or other wetland areas west of the Cascades, with an occasional occurrence along major rivers in eastern Washington.

9.1.1. Known Occurrences in the Action Area.

Over twenty bald eagle territories are known to be in the action area (WDFW, 2002), and individuals are often observed throughout the action area during the winter. The primary prey base of bald eagles is not known, but very likely includes anadromous fish returning to spawn, and waterfowl. It is possible that bald eagles in Lewis County might supplement their diet with resident fish, carrion, rabbits, and other small mammals, as these are known food items in places where anadromous fish spawn and waterfowl flock are scarce (especially during the eagle nesting season). No communal night roosts are known in Lewis County (WDFW, 2002) .

The nearest nest location to Skookumchuck Dam is about four miles upstream from the dam at the upper end of the reservoir (WDFW, 2002). No other bald eagle nests are on the Skookumchuck River. There are two bald eagle nests in close proximity to one another near the Newaukum River about 5 air miles upstream (south) from its confluence with the Chehalis River. It is likely these belong to the same pair, as both nests have not been occupied in the same year (WDFW, 2002). In addition, there are six bald eagle nests along the Chehalis River within the action area. The approximate locations are summarized below:

- Four air miles west (upstream) of the proposed SR-6 modifications (about RM.83).
- One air mile southeast of the proposed SR-6 modifications (about RM77), and about ¼ mile north of highway 603. This nest is about ½ mile south of the river.
- About two river miles downstream from the confluence with the Skookumchuck River (about RM65), on a hillside west of the river. This nest is the nearest nest to the levee system, a little more than ½ mile to the west of Fords Prairie levee section.
- About 4 miles downstream from the confluence with the Skookumchuck River (RM63), west of the river. This nest is about ¾ mile due north of the northern terminus of the Fords Prairie levee section.
- About 9 ½ river miles downstream from the confluence with the Skookumchuck River (RM57.5).
- About 15 ½ miles downstream from the confluence with the Skookumchuck River (RM51.5).

All of the nests are placed in cottonwood trees.

In addition, at least 10 nests are found between RM51 and the mouth of the Chehalis River, mostly in cottonwood trees, but at least three are in spruce trees.

The forests surrounding Skookumchuck reservoir provide suitable perches. Although bald eagle behavior in the area is not documented, the species most likely feeds on waterfowl that winter on the lake, though they may also prey on resident fish such as cutthroat trout; ducks may be on the reservoir at any one time, providing a readily available food source for bald eagles. Food may be a limiting resource. Suitable nest trees are also likely limiting, given the intensive timber harvest in the basin, which eliminates potential large nest trees. These two limiting factors likely limit the total number bald eagles in the vicinity of the project throughout the year. Anadromous salmonids historically were probably a more important food source in the Skookumchuck River watershed for bald eagles prior to construction of Skookumchuck Dam than they are now. The dam blocked upstream passage and ended spawning above the dam. However, spring and fall chinook, and coho salmon spawn just below the dam all the way downstream to the confluence with the Chehalis River (SASSI, Coastal Stocks, 1992). Skookumchuck River winter steelhead also spawn below the dam, and hatchery fish are released upstream of the dam; ninety percent of the steelhead returning to spawn in the Skookumchuck are of hatchery origin (SASSI, Coastal Stocks, 1992). Resident fish, such as cutthroat trout, are also found in the reservoir and the upper Skookumchuck basin (IFR/EIS, 1982). The Skookumchuck River below the dam is lined with a thriving riparian zone that protects the river from intense summer sun, and also provides shade and woody debris for hiding cover, and provides food for fish in the form of invertebrates. The ample vegetation also provides perches for bald eagles, though hunting along the river may be restricted because many stretches are 100% or nearly 100% covered by trees arching over the river.

Riparian habitat along the Chehalis River is not as extensive as along the Skookumchuck River. Prey resources for the nesting pairs along the Chehalis River probably include anadromous salmonids, cutthroat trout, resident fish, waterfowl, and perhaps small mammals.

The Washington Department of Fish and Wildlife Priority Habitats and Species database shows no communal roosts of bald eagles in the action area.

9.1.2. Effects of the Action.

No communal night roosts or perch trees would be affected, as none are present near the site.

Reservoir operations for flood control at Skookumchuck Dam are not expected to adversely affect the nesting pair near the reservoir. As discussed in Section 8, flood control effects on the reservoir would only occur in yeas of catastrophic floods (70- to 100-year events). Thus, in the long term, as well as in the short term, food resources, perch trees, and nest trees would not be affected by the proposed flood control operation. Therefore, the nesting pair at Skookumchuck Reservoir would not be affected by the change in operation.

Foraging bald eagles may be displaced by the noise of heavy equipment, but the availability of prey will not be significantly disrupted by project construction. Furthermore, the noise will tend to be a consistent drone from where the eagles will be positioned relative to the project area, as opposed to loud, staccato-like pulses which tend to be more disruptive. The local eagles should not be disturbed by this consistent, low-level noise. Eagles tend to tolerate more disturbance at feeding sites than in roosting areas (Steenhof 1978), and also in areas where they become acclimated to frequent human activity. As much of the levee construction would occur in areas of human population and activity, the construction activity is not expected to significantly affect bald eagle behavior. In every case where a nest is located near the project area, the nest is on the opposite side of the river from project construction activities. No bald eagle nest trees would be lost as a result of project construction, nor would any trees adjacent to a nesting territory. In the case of the nest tree across the river from the SR-6, the nest is roughly one mile from the project site, well within the potential home range of a nesting pair of bald eagles. It is possible that the project could eliminate potential perch trees. However, this loss, if real, would be insignificant and discountable due to the small number of trees of any size that will be removed as a result of this project, compared to the large number of potential perch trees in this vicinity. In addition the loss of trees is not permanent, as new trees will be planted along the new channel after excavation has been completed. In the long term, river resources (i.e., potential prey) are not expected to be diminished as a result of the flood reduction project (also see discussion under coastal cutthroat trout).

9.1.3. Determination of Effect.

The Chehalis River Flood Damage Reduction project **is not likely to adversely affect** the bald eagle.

9.2. Marbled Murrelet.

The marbled murrelet was listed as a threatened species under the Endangered Species Act of 1973, as amended in October 1992. Primary causes of population decline include the loss of nesting habitat, and direct mortality from gillnet fisheries and oil spills.

The subspecies occurring in North America ranges from Alaska's Aleutian Archipelago to central California. Marbled murrelets forage in the near-shore marine environment and nest in inland old-growth coniferous forests of at least seven acres in size. Marbled murrelets nest in low-elevation forests with multi-layered canopies; they select large trees with horizontal branches of at least seven inches in diameter and heavy moss growth. Of 95 murrelet nests in North America during 1995, nine were located in Washington. Additional nesting locations are being discovered annually. The nesting season occurs from May 26 and August 27 (USFWS 1999). Adults with nestlings fly between terrestrial nest sites and marine feeding areas to obtain food for the nestlings. In general, the adults leave the nest at dawn to feed, and return to the nest at dusk.

Marbled murrelets spend most of their lives in the marine environment, where they forage in areas 0.3 to 2 km from shore. Murrelets often aggregate near localized food sources, resulting in a clumped distribution. Prey species include herring, sand lance, anchovy, osmerids, seaperch, sardines, rockfish, capelin, smelt, as well as euphasiids, mysids, and gammarid amphipods. Marbled murrelets also aggregate, loaf, preen, and exihibit wing-stretching behaviors on the water.

Although marine habitat is critical to marbled murrelet survival, USFWS' primary concern with respect to declining marbled murrelet populations is loss of terrestrial nesting habitat. In the marine environment, USFWS is primarily concerned with direct mortality from gillnets and spills of oil and other pollutants (USFWS 1996).

9.2.1. Known Occurrences in the Action Area.

A search of the WDFW Priority Habitats and Species Database (2002) revealed 4 observations of marbled murrelet flights within the action area. These do not necessarily reflect a nest location, but probably do indicate nesting activity somewhere nearby. All of these are several miles west of the project area, and several miles south of the Chehalis River, and outside of the action area. There are no observations from the Skookumchuck River basin.

Critical habitat was designated for the marbled murrelet on May 24, 1996 (61FR26255). The nearest location of critical habitat is about 15 miles west and south of the project area, which is also upstream from the project area. Thus the project will have no effect on marbled murrelet critical habitat.

9.2.2. Effects of the Action.

Construction activities would have no effect on murrelet nests, nesting habitat, or nesting season foraging behaviors. The nearest known potential nest is at least four miles south of the Chehalis River, and at least 15 miles west of the project area (WDFW, 2002). Since murrelets feed in marine waters (which are unaffected by the project), and no potential nesting habitat for marbled murrelets would be affected by the project, there is no likelihood that the flood reduction project would affect marbled murrelets.

9.2.3. Determination of Effect.

The proposed project would have **no effect** on the marbled murrelet since the project would not effect nests or nesting habitat, nor on critical habitat.

9.3. Northern Spotted Owl.

The northern spotted owl was federally listed in July 1990 as threatened throughout its entire range in Washington, Oregon and Northern California. The principal cause for the listing was the on-going loss of habitat resulting from the harvest of old-growth forest and conversion to young forest or non-forest (55 FR 26114).

On the west slope of the Washington Cascades, the species can be found in forested areas below elevations of 4,200 feet. Preferred habitat is closed-canopy coniferous forests with multi-layered, multi-species canopies dominated by mature and/or old-growth trees (Thomas et al. 1990; Lujan et al. 1992). Nesting and roosting habitat are characterized by moderate to high canopy closure (60-80%), large (>30" dbh) overstory trees, substantial amounts of standing snags, other in-stand decadence (e.g., deformities, cavities, broken tops and dwarf mistletoe infections), and coarse woody debris of various sizes and decay classes on the ground (USFWS 1987; 54 FR 26666; Thomas et al. 1990). Foraging occurs in nesting and roosting habitat, as well as in coniferous forest with smaller trees and less structural diversity if prey such as the northern flying squirrel (*Glaucomys sabrinus*) are present (Hanson et al. 1993).

Spotted owls do not build their own nests. Most nesting occurs within naturally formed cavities in live trees or snags, but abandoned platform nests of the northern goshawk (*Accipiter gentilis*) and common raven (*Corvus corax*) have also been used (Buchanan et al. 1993; Forsman and Giese 1997). Trees and snags supporting cavity nests are typically large (mean = 55.8 inches on the Olympic Peninsula; Forsman and Giese 1997), and this is often cited as one of the reasons spotted owls are strongly associated with mature and old growth forest. The principal prey of the northern spotted owl over much of its range (the northern flying squirrel) also dens in cavities within large trees, further strengthening the spotted owl's dependence on older forest. Where spotted owls have been found nesting in young forest, such occurrences have been attributed to the presence of large residual trees with cavities (Buchanan et al. 1998), climatic conditions conducive to the use of platform nests (Forsman and Giese 1997), and/or alternate sources of prey that do not rely on cavities for reproduction (Zabel et al. 1995).

9.3.1. Known Occurrences in the Action Area. Suitable spotted owl habitat within the project area is limited due to extensive recent logging activities. The Federal Register (54 FR 26666) points out that recorded home range sizes used by adult spotted owls vary from 300 acres to more than 19,000 acres. Ecological theory suggests that the 300 acre home range(s) as likely ideal habitat, requiring little foraging effort, while the 19,000 acre home range would certainly be marginal habitat, as the pair was required to search far and wide for food. Further, in order to nest, the presence of some mature forest is requisite to attract a pair to the area. There is no mature forest within several miles of Skookumchuck Dam. In fact, the WDFW Priority Habitats and Species Database indicate no spotted owl observations in the Skookumchuck basin. There are only two observations near the action area, both several miles south and west of the action area.

No designated critical habitat for the spotted owl is found near the action area.

9.3.2. Effects of the Action.

Construction activities would have no effect on spotted owl nests, nesting habitat, critical habitat, or nesting season foraging behaviors. The nearest known potential nest is at least ten miles south of the Chehalis River, and at least 15 miles west of the project area (WDFW, 2002). The project also would not affect any potential recruitment habitat, that is, young forest that would be allowed to grow into suitable nesting habitat.

9.3.3. Determination of Effect.

The proposed project would have **no effect** on the spotted owl since the project would not affect nests or nesting habitat, prey base, critical habitat, or future habitat.

9.4. Gray Wolf.

The gray wolf is listed as endangered at both the federal and state levels in Washington. Gray wolves had apparently disappeared from Washington by 1920 (Ingles 1965). Although, between 1992 and 1997, two reliable sightings of wolves feeding pups were recorded in the North Cascades, the occurrence of the gray wolf in Washington remains questionable (Johnson and Cassidy 1997).

Gray wolves are habitat generalists. The availability of prey may be the primary factor in determining habitat suitability (Stevens and Lofts 1988). Whitaker (1980) lists gray wolf habitat in North America as open tundra and forest. Human disturbance plays a roll in determining gray wolf distribution. In Alaska, Thurber et al. (1994) found that wolves avoided areas of human activity, including roads. In studying historic population changes of wolves in Wisconsin, Thiel (1985) found that wolf populations decreased when road densities exceeded 0.93 mile per square mile. Gray wolves often maintain very large home ranges; 40 to 47 square miles on Vancouver Island and 93 to 248 square miles in northern British Columbia (Scott 1979). Den sites are most commonly burrows in sandy soils, but can be located in a variety of settings, from downed logs and hollow trees to rock caves. Rendezvous sites tend to be near sources of open water in small meadows with limited visibility.

9.4.1. Known Occurrences in the Action Area. Although gray wolves have a very large home range, nevertheless they are more or less restricted to the northern Cascade Mountains in Washington. No sightings from the action area are indicated by the WDFW Priority Habitats and Species database (2002).

9.4.2. Effects of the Project. The project would not affect gray wolf habitat. Gray wolves are also highly unlikely to occur in the action area.

9.4.3. Determination of Effect. The Chehalis River Flood Reduction Project would have **no effect** on gray wolves.

9.5. Grizzly Bear.

The grizzly bear is federally listed as threatened and state listed as endangered in Washington. The USFWS established six recovery zones within the conterminous 48 states, including the North Cascades Recovery Zone (north of Interstate Highway 90) (USFWS 1993). The grizzly bear population in the North Cascades ecosystem is estimated to number at least 10 to 20 bears (Johnson and Cassidy 1997).

The grizzly bear is able to utilize a wide variety of habitat conditions, from open dry prairie to wet montane forest. Whitaker (1980) describes a general habitat condition of semi-open country, usually in mountainous areas. Population size and distribution have been limited by human intrusion (USFWS 1997b). Grizzly bears will avoid areas of human use, including areas containing roads and signs of timber cutting (USFWS 1997b).

The grizzly bear is a free-ranging animal that requires a large home range, with males having larger home ranges (200 to 500 square miles) than females (50 to 300 square miles) (USFWS 1995b). It is an opportunistic omnivore; however, 80 to 90 percent of the grizzly bears diet is green vegetation, wild fruits and berries, nuts, and bulbs or roots. The majority of the meat in its diet comes from carrion (USFWS 1995b). Grizzly bears may travel extensively to find suitable den locations, which are generally located on remote mountain slopes where snow will last until late spring. They usually move down to lower elevations after emerging from their dens in the spring.

9.5.1. Known Occurrences in the Action Area. Like gray wolves, grizzly bears are largely restricted to the northern Cascades in Washington. The WDFW Priority Habitats and Species Database shows no sightings of grizzly bears from the action area.

9.5.2. Effects of the Project. The project would not affect any habitat of grizzly bears in the action area. Further, grizzly bears are highly unlikely to occur in the action area.

9.5.3. Determination of Effect. The Chehalis River Flood Reduction Project would have **no effect** on grizzly bears.

9.6. Canada Lynx.

In Washington, where its population is estimated to be between 91 and 196 individuals, the Canada lynx is listed by the state as threatened (WDFW 1993c). It has been proposed for federal listing as threatened throughout the lower 48 states (63 FR 36994). The listing proposal states that, "...the Canada lynx is threatened by human alteration of forests, low numbers as a result of past over-exploitation, expansion of the range of competitors (bobcats; *Felis rufus*) and coyotes (*Canis latrans*), and elevated levels of human access into lynx habitat," (63 FR 36994). The current projected range of the lynx in Washington does not extend west of the Cascade crest (WDFW 1993c).

In Washington, lynx are known to occur above 4,000 feet in elevation (McKelvey et al. 1999; WDFW 1993c). The Canada lynx requires a matrix of two important habitat types. For thermal and security cover and for denning it uses mature, closed-canopy, boreal forest that contains a high density of large logs and stumps and is near hunting habitat. For hunting, it uses early successional forest with high densities of snowshoe hare *(Lepus americanus)*. Additionally, lynx avoid large open spaces and tend not to cross openings greater than 330 feet (Koehler and Aubry 1994). The abundance of Canada lynx is correlated with the population cycle of its primary prey the snowshoe hare (Ingles 1965; Koehler and Aubry 1994; Johnson and Cassidy 1997).

9.6.1. Known Occurrences in the Action Area. As Canada lynx are restricted to mountains above 4000 feet in elevation, and are not expected to be found west of the Cascade crest, they are highly unlikely to be found in the action area.

9.6.2. Effects of the Project. The project would not affect any habitat of Canada lynx in the action area. Further, Canada lynx are highly unlikely to occur in the action area.

9.6.3. Determination of Effect. The Chehalis River Flood Reduction Project would have **no effect** on Canada lynx.

9.7. Coastal/Puget Sound Bull Trout.

The Coastal/Puget Sound bull trout population segment was listed as a threatened species under the Endangered Species Act of 1973, as amended in October 1999. Bull trout populations have declined through much of the species' range; some local populations are extinct, and many other stocks are isolated and may be at risk (Rieman and McIntyre 1993). A combination of factors including habitat degradation, expansion of exotic species, and exploitation have contributed to the decline and fragmentation of indigenous bull trout populations.

Bull trout are known to exhibit four types of life history strategies. The three freshwater forms include adfluvial forms, which migrate between lakes and streams; fluvial forms, which migrate within river systems; and resident forms, which are non-migratory. The fourth strategy, anadromy, occurs when the fish spawn in fresh water after rearing for some portion of their life in the ocean.

Bull trout spawning usually takes place in the fall during September and October. Initiation of breeding appears to be related to declining water temperatures. In Washington, Wydoski and Whitney (1979) reported spawning activity was most intense at 5 to 6^{o}C. Spawning occurs primarily at night. Groundwater influence and proximity to cover are reported as important factors in spawning site selection. Bull trout characteristically occupy high quality habitat, often in less disturbed portions of a drainage. Necessary key habitat features include channel stability, clean spawning substrate, abundant and complex cover, cold temperatures, and lack of barriers which inhibit movement and habitat connectivity (Reiman and McIntyre, 1993).

Juvenile bull trout, particularly young of year (YOY), have very specific habitat requirements. Small bull trout are primarily bottom-dwellers, occupying positions above, on or below the stream bottom. Bull trout fry are found in shallow, slow backwater side channels or eddies. The adult bull trout, like its young, is a bottom dweller, showing preference for deep pools of cold water rivers, lakes and reservoirs (Moyle 1976).

9.7.1. Known Occurrences in the Action Area.

As of 1998, the WDFW identified a distinct subpopulation of bull trout/Dolly Varden in the Chehalis River/Grays Harbor system. This native char was believed to occur in tributaries west of and including the Satsop River and may include the anadromous, fluvial and resident life histories (USFWS 1998). Adult char have been found in the estuary and lower tributaries of

Grays Harbor, however a recent review of 11 years of records from downstream migrant traps, beach seining, and adult traps found no confirmed native char in the Chehalis River Basin (USFWS 2000a). Little historical and current information is available on potential causes of population declines, though habitat degradation has adversely affected other salmonids in the system and is assumed to have similarly affected bull trout (USFWS 1999). The upper Chehalis Basin is relatively low gradient, which is not ideal for native char (WDFW 1998). The Chehalis Basin and Columbia Rivers probably represent the southern end of the range of anadromous char on the west coast (WDFW 1998).

The only information regarding bull trout in the Chehalis River basin is anecdotal accounts from sport fishers (Mongillo, 1993, in Bull Trout SASSI, 1998). Bull trout have been caught in the anadromous zone, and a single juvenile was caught in a downstream migrant trap at RM50 in 1997 (Ackley, in Bull Trout SASSI, 1998), which is seventeen river miles downstream of the confluence of the Skookumchuck with the Chehalis (at RM67.0). Bull trout are probably not common in the Chehalis River Basin, as it is relatively low gradient and at the southern end of the range of anadromous char on the west coast (Bull Trout SASSI, 1998). The stock in the basin is entirely native and maintained by wild production. The elevation of Skookumchuck Dam is only about 500 feet above sea level. In Washington streams, the lowest spawning elevation occurs in the most northerly streams, as the bull trout is a cold water fish. The lowest spawning elevation in Washington is about 1000 ft elevation in the Skagit River basin (Goetz, personal communication, 2000). Thus, it is highly unlikely bull trout would occur in the Skookumchuck River below the dam. However, there is a possibility that fluvial and adfluvial forms of bull trout may exist in the upper Skookumchuck basin.

9.7.2. Effects of the Project.

9.7.2.1. Levee System. Levee construction will in most places be on uplands; in particular, the levee alignment will follow existing levees to the maximum extent possible. Because this is a very large project, work will be continuous for approximately two years. An in-water work closure window of October 1st through June 30th of any given year has been established to avoid impacts to fish resources in the Chehalis River (from the South Fork confluence downstream to Grays Harbor) (WDFW, 2002). Work closure for the Skookumchuck and Newaukum Rivers is slightly different: September 1st through June 30th. In-water work associated with construction of this project will avoid this closure periods to the extent possible. There is a potential for sediments to escape into streams at five locations: Airport Road (next to I-5); Mellen Street; Dillenbaugh Creek; Salzer Creek; the mouth of the Skookumchuck River; and SR-6 oxbow connection. BMPs, such as silt curtains, will be used to minimize the escape of sediments into wetlands and streams. Timing of work at these specific locations will be restricted to the authorized work windows for the Chehalis River (July 1—September 30), and the two tributaries mentioned (July 1—August 31).

On the other hand, in-water work will not result in significant impacts to the aquatic environment because the levee is setback to the maximum extent possible throughout the alignment. A total of 18-34 acres of wetlands will be affected by the levee footprint. These wetlands are all wet pastures, with relatively unimportant function relative to bull trout life requirements. See discussion in Section 8.1.

9.7.2.2. Skookumchuck Dam. The primary concern from construction of Skookumchuck Dam is from pH alteration near the dam as a result of pouring of cement to construct the new outlet works. The phase of the project involving cement pouring in the water will be timed to occur during the specified aquatic work window to minimize effects on anadromous fish. In addition, water chemistry will be closely monitored throughout the cement work to assure that there are no unacceptable pH levels. BMPs, such as silt curtains, will be utilized to minimize environmental effects during construction. No other effects on the aquatic environment are expected as a result of construction of the dam modifications.

Reservoir and downstream effects are described in detail in Sections 8.2.2.1 and 8.2.2.3. While catastrophic floods could result in minor sloughing effects in the reservoir, these will be so rare (70- to 100-year events) that effects to bull trout would be discountable. Downstream flows would be altered from the existing condition between November 1 and March 1 by the elimination of flood flows greater than the 2-year event. As described in Section 8.2.2.3 these effects will be minimal as the 2-year flow in the Skookumchuck River still overtops the banks of the river, reconnecting side-channels and wetland and riparian habitats. Ironically, the change in operation may actually result in increased overbank flooding since during relatively major flood events stored water in the reservoir will be released slowly, so that the 2-year flow released from the dam may last many days longer than a normal 2-year event. Riparian and wetland habitats are therefore expected to continue to be maintained. Channel processes likewise will be maintained as the 2-year flow in the Skookumchuck is the primary mover of gravels and sediment. Therefore, the revised operation of Skookumchuck Dam is not expected to significantly impact bull trout.

9.7.2.3. SR-6 Modifications. The excavation for SR-6 channel creation will result in the loss of riparian trees and shrubs, but will also restore access to an isolated oxbow. This latter result is expected to outweigh the impacts of the temporary loss of vegetation, as it will provide approximately ½ mile of excellent rearing habitat for anadromous salmonids. In addition, the oxbow will be connected to the Heuber Ditch overflow channel, which will provide additional off-channel habitat.

9.7.3. Determination of Effect. The Corps has determined that the proposed project is **not likely to adversely affect** the bull trout since the proposed work will take place outside the suggested closure window. Potential effects of any disruptions to feeding would be discountable.

9.8. Coastal Cutthroat Trout.

The Southwest Washington/Columbia River ESU coastal cutthroat trout was proposed as a threatened species under the Endangered Species Act of 1973, as amended in April 1999. Grays Harbor and the Chehalis Basin are included in this ESU. A decision to list (or not) will be made by USFWS on June 19, 2002.

Coastal cutthroat trout exhibit a complex life history pattern with respect to reproductive and migratory behaviors. Multiple life-history forms frequently coexist within the same watershed and even the same stream (June 1981). Although all coastal cutthroat trout populations with access to the sea are believed to have an anadromous component, not all members migrate to the sea. Most cutthroat trout that enter seawater do so as 2 or 3-year-olds, but some remain in freshwater for up to 5 years before entering the sea (Giger 1972).

Coastal cutthroat spawn in small tributaries of large or small streams with a drainage area of less than 13 km^2; they are known to spawn in numerous river systems throughout Western Washington. Adult returns are associated with stream size and marine access (Johnston 1982). Spawning usually occurs upstream of coho salmon and steelhead spawning zones, although some overlap may occur (Lowry 1965). Cutthroat trout are iteroparous, able to spawn multiple years, and some fish have been documented to spawn for at least 5 years, although some do not spawn every year and some do not return to seawater but instead remain in freshwater for at least a year (Giger 1972, Tomasson 1978).

Coastal cutthroat enter natal streams to feed and spawn from July to February—generally September to October for larger rivers, and January to February for small streams. Spawning occurs from December through May, and alevins emerge from gravel during June and July (Johnston 1982). In Washington and Oregon, the return of spawned-out adults to salt water peaks in late March and early April (Trotter 1997). Juveniles rear in freshwater for 2 to 3 years, then migrate to estuaries and nearshore marine waters to feed during April and May. Juveniles and adults usually remain close to their natal estuary, and sometimes overwinter in freshwater streams.

9.8.1. Known Occurrences in the Action Area.

The southwestern Washington-lower Columbia River region, which includes the Chehalis Basin, historically supported healthy, highly productive populations of coastal cutthroat trout. Coastal cutthroat trout are present in nearly all tributaries and main stem reaches in one or more life history forms. Anadromous forms and fluvial forms inhabit main stem and accessible tributary reaches. Resident life history forms exist above fish barriers, such as the Skookumchuck Dam. Adfluvial forms live in most lakes throughout the basin (WDFW 2000). Hatchery releases of cutthroat have been made throughout the basin, however most hatchery programs for cutthroat have been discontinued (WDFW 2000).

Although in some areas freshwater forms of coastal cutthroat remain healthy, rapidly declining numbers of the anadromous life form are considered a risk factor for coastal cutthroat trout in the Southwestern Washington/Columbia River ESU (NOAA 1999). Anadromous fish are important in maintaining genetic connectivity and reducing risk of extirpation of isolated populations. Freshwater, resident forms may be abundant in many streams, and may produce smolts that migrate downstream and become anadromous, provided habitat conditions allow their survival in the lower reaches of streams and near shore marine environments. However, this type of production has not successfully increased populations of anadromous forms (NOAA 1999).

This DPS includes the Skookumchuck River, and the species does occur in the river (IFR/EIS, 1982). However, there is very little information on cutthroat trout in the Chehalis River basin (64 FR 16397). Reeves and Gregory (1997) indicate that cutthroat trout are extremely sensitive to habitat changes. They single out logging activities as especially damaging to cutthroat populations. Given the regular logging activities in the upper Skookumchuck River, and the implication that cutthroat trout have never been particularly common in the Chehalis River basin, it is unlikely that cutthroat trout are present in large numbers in the Skookumchuck River. The one positive note for cutthroat is that the riparian habitat of the lower Skookumchuck River is in relatively good condition, and the cutthroat population in that section of the river may be healthy as a result.

9.8.2. Effects of the Action.

As coastal cutthroat display various forms of life stages such as anadromous, adfluvial, fluvial, and resident and with little quantitative data available, effects of this action will be based on research that has been accomplished on salmon.

The proposed action may result in temporary effects on water quality. These include increased turbidity and associated decreases in dissolved oxygen in the immediate dredging area. Temporary increases in turbidity (suspended solids) are expected in the dredging area. This could affect juvenile cutthroat occurring in the immediate dredging area through decreased visibility for foraging activities, and impaired oxygen exchange due to clogged or lacerated gills. However, the available evidence indicates that total suspended solids (TSS) levels sufficient to cause such effects would be limited in extent. LeGore and Des Voigne (1973) conducted 96-hour bioassays on juvenile coho salmon using re-suspended Duwamish River sediments from five locations from Kellogg Island to the head of the navigation channel. Up to 5 percent sediment in suspension (28,800 mg/l dry weight), well above levels expected to be suspended during project construction, had no acute effects. Another biologist (Willis, 2002) reported that it takes prolonged exposure to turbidity levels of 700-1000 NTUs to cause damage to fish. Turbidity levels resulting from project construction are expected to be far below 700 NTUs.

See Section 9.7.2 on effects to bull trout from the proposed project. That discussion is also pertinent to coastal cutthroat. As for bull trout, effects to coastal cutthroat habitat are expected to be insignificant and discountable.

9.8.3. Determination of Effect.

The Corps believes this project **will not jeopardize the continued existence** of the Lower Columbia River/Southwest Washington DPS of coastal cutthroat trout.

For these same reasons, we would also determine that the project is **not likely to adversely affect** the species, should it be listed. In the case of a listing, dredging schedules would be modified in order to abide by any timing restrictions determined by USFWS.

9.9. Kincaid's Lupine. The Boistfort Prairie, about 10 miles southwest of the project area, also supports Kincaid's lupine and pale larkspur (WDNR Natural Heritage database). These habitats will not be affected by the project. No other observations within the action area are reported from the database, so the project will have **no effect** on Kincaid's lupine.

9.10. Golden Paintbrush. The golden paintbrush was known from only five sites in 1981 (WDNR, 1981). Only one of these sites was near the project area, from Thurston County, presumably on Grand Mound Prairie. In the current Natural Heritage Database, the only extant population listed is for the Deception Pass area (Skagit County) (WDNR, 2002). The project will not affect any of these areas; thus, the project will have **no effect** on the golden paintbrush.

10. INTERRELATED AND INTERDEPENDENT ACTIONS.

No associated activities are known relative to the Chehalis River Flood Hazard Reduction Project.

11. CUMULATIVE AND SECONDARY EFFECTS.

Completion and operation of the Chehalis River Flood Hazard Reduction Project is not expected to result in changed uses of the floodplain, on either side of the levee, or below Skookumchuck Dam. This is because the levee is set back to the maximum extent possible, leaving no room for additional development outside the levee. However, small, undeveloped parcels of land do exist within the built-up area which may make these parcels more marketable. Furthermore, nearly the entire length of the levee system is adjacent to an existing road. Therefore, no new road construction is anticipated.

The altered operation of Skookumchuck Dam would actually result in more frequent overbank flooding along some reaches of the Skookumchuck River, which should effectively discourage development. On the other hand, some reaches may not flood as often, or may never flood. It would take many years before this kind of information could be reliably identified, since it will remain to be seen where the overbank flooding will occur. Thus it is highly unlikely that a developer would speculate that land would be free from flooding, when in reality the overbank flooding frequency of the Skookumchuck River will be increased under the new operation.

12. CONSERVATION MEASURES.

The following design objectives will be followed to minimize the effects on the environment:

- Incorporate Skookumchuck Dam modifications into the assumed existing conditions.
- Avoid all hazardous material (super fund sites) by not inundating them or building structures at sites.
- Use the existing levee system as much as possible.
- Use existing roads for levees when possible.
- Set back levees away from river as far as possible.
- Incorporate a minimum 50' buffer zone from water edge to levee toe where setback not possible (if 50 feet is available).
- Minimize in-water work.

Construction conditions will be included in project contracting specification documents, including BMPs. A Corps inspector would be on-site to ensure that contractors abide by these requirements.

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