

SECTION 3. EXISTING CONDITIONS

3.1 Water Quantity. The Columbia Slough Watershed is typically broken into four reaches (Figure 2): the Lower, Middle, and Upper Sloughs and the Fairview Creek watershed. The Lower Slough extends from the mouth at the Willamette River to Multnomah County Drainage District Pump Station No.1 (MCDD#1). The Lower Slough is tidally influenced and subject to stormwater discharges. Between the months of December and July, the water levels in the lower slough are generally several feet higher than in the Middle Slough. When Lower Slough water levels exceed those in the Middle Slough, flow is prevented from entering the Middle Slough by tide gates through the levee at MCDD pumps station #1. The bulk of flow to the Lower Slough is derived from the pumped flows from Peninsula Drainage Districts Nos.1 and 2 and the stormwater from North and Northeast Portland. The Lower Slough is also hydraulically connected to Smith and Bybee Lakes. Projects to virtually eliminate combined sewer overflows to the Lower Slough have been implemented.

The Middle and Upper Sloughs flow primarily west through a series of parallel channels, which are broken up into several narrow ponded segments separated by road crossings and culverts. The Middle Slough extends from MCDD#1 to the Mid-Dike levee just west of NE 142nd Avenue, and receives stormwater and the bulk of groundwater flows into the slough. The Upper Slough extends from the Mid-Dike to Fairview Lake and receives stormwater and flows from Fairview Lake. During flood events, flood waters drain to two existing pumping stations (pump station #1 on the west and pump station #4 on the east, near NE 185th Avenue). The cross-levee provides additional protection for Portland International Airport (on the west) from the principal flood waters originating from the Upper Slough and Fairview Lake. The cross levee has positive closure structures that allow control of the interchange of flows. The Middle Slough also has a south arm system of sloughs (Buffalo and Whitaker Sloughs) which interconnect with the main north arm. Fairview Creek and Lake watershed is usually considered the fourth reach in the slough system.

Most of the groundwater comes from regional aquifers that are recharged from upland areas south of the Slough. Groundwater is the primary source of flows to the slough during the summer months.

3.2 Flow Management. Flow control and maintenance of the drainage system and facilities in the Columbia Slough mainly fall to the Multnomah County Drainage District (MCDD), the City of Portland, the City of Gresham, and the Village of Fairview. MCDD is responsible for drainage on the south shore of the Columbia River between the river and (generally) Columbia Boulevard and between MCDD#1 to Fairview Lake, including Portland International Airport and Blue Lake Park. The City of Gresham and the Village of Fairview have jurisdiction over stormwater flow in the Fairview Lake watershed. The City of Portland has jurisdiction over stormwater originating in areas of the watershed generally south of Columbia Boulevard, in the combined sewer area, and in newly separated areas (from the combined sewers in the Lower Slough reach). The Metropolitan

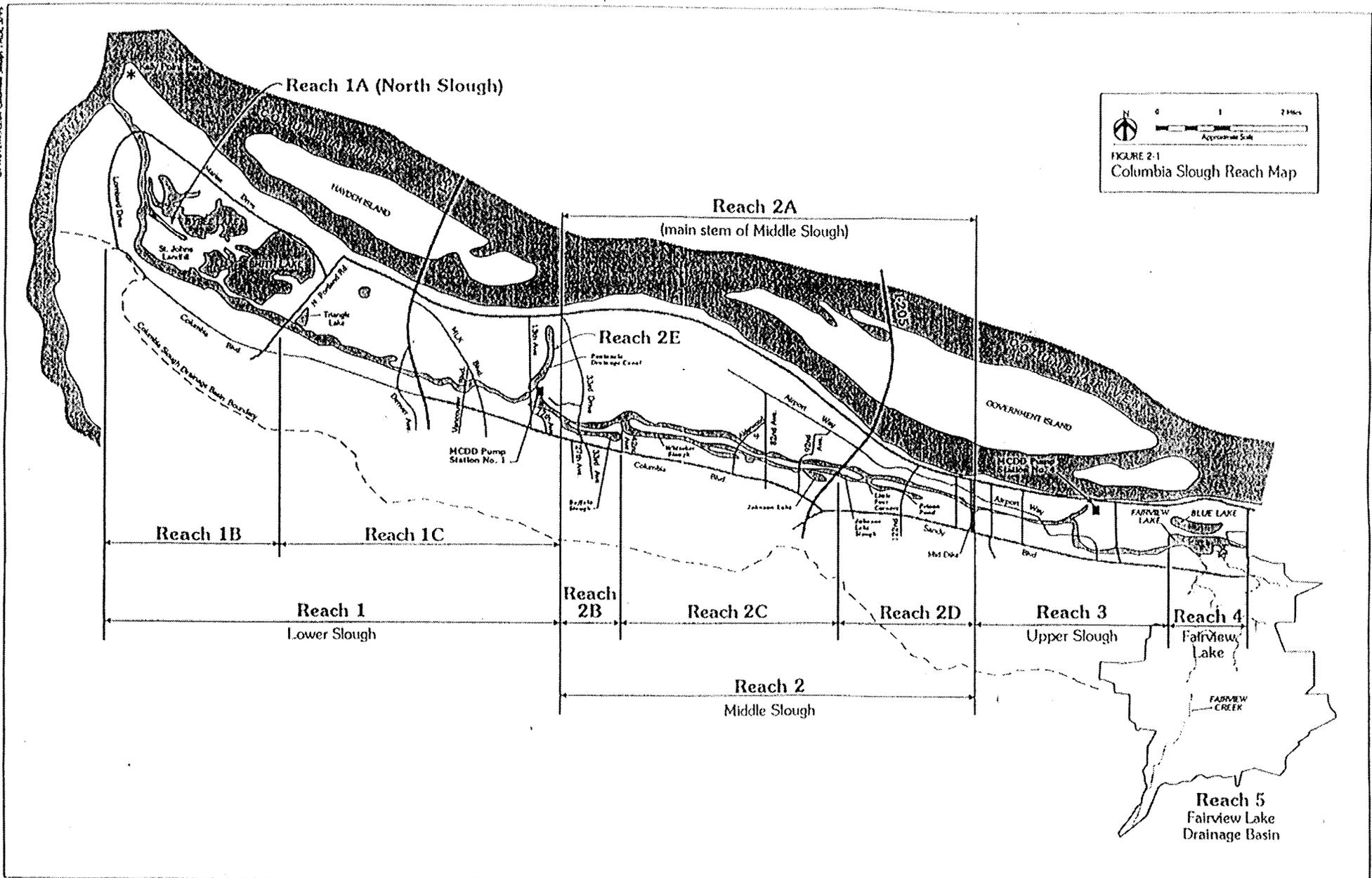


FIGURE 2-1
 Columbia Slough Reach Map

Service District (Metro) has jurisdiction over management of Smith and Bybee Lakes in the Lower Slough. The City of Portland has primary responsibility for the water quality management of the Columbia Slough within the city limits.

3.2.1 Summer. Gate structures at the cross-dike levee are used to separate the middle and upper slough areas into separate hydrologic basins during the summer months, typically June to mid-October. The water elevations are maintained around 8.0' to 9.0' NGVD in the upper slough. MCDD typically maintains these elevations by pumping at pump station #4, and also has the option to meter the flows at the cross levee by partially opening the slide gates and allowing the water to go to pump station #1. The higher water elevations are necessary for irrigation and wetlands.

The water elevation in the middle slough is typically maintained between 5.0' to 6.0' NGVD by pumping at pump station #1. When the Columbia River elevation drops below elevation 4.5', flow can enter the lower slough by gravity flow.

The control structure at Fairview Lake is closed in early May to fill the lake for recreational use. The water elevation in the lake will reach elevation 11.2' before it flows over the weir dam. The control structures are re-opened in early October to drain the lake back to its winter elevations of 8.5' to 11.0'.

3.2.2 Winter. The cross levee typically remains open during the winter months unless pumping problems occur at Pump Station #1. The slough is pumped down to elevation 5.5' to 6.5' at Pump Station #1 and 7.0' to 8.0' at Pump Station #4 prior to a large storm. This is normal operating procedure for the MCDD, as it frequently loses power during heavy rain and wind events. The drawdown allows MCDD to have storage room in the slough during the outage. During a storm, water elevation is maintained between 6.0' to 8.0' at Pump Station #1 and 8.0' to 10.0' at Pump Station #4.

The pumping capacities and lowest operating elevations for each pump are shown below:

	<u>Pump Station #1</u>		<u>Pump Station #4</u>	
Pump #1	71 cfs	4.5'	150 cfs	7.0'
Pump #2	150 cfs	6.0'	150 cfs	7.0'
Pump #3	104 cfs	5.0'	150 cfs	7.0'
Pump #4	150 cfs	6.0'	150 cfs	7.0'
Pump #5	73 cfs	4.5'	---	---

3.3 Water Quality

Water quality in the Columbia Slough is a concern both for aquatic life and for human health and recreation. Unlike other free-flowing water bodies in the City of Portland, the Columbia Slough is highly managed. The upper slough is isolated by a series of dikes whose water levels are controlled by pumps and weirs. The lack of natural flushing

results in accumulated sediments and raised levels of pollutants associated with the sediments.

Water Quality Limited Status

The State of Oregon, Department of Environmental Quality (DEQ) has listed the Columbia Slough as water quality limited for salmonid fish rearing, resident fish and aquatic life, wildlife and hunting, fishing, boating, water quality recreation, and aesthetic quality. Columbia Slough is considered water quality limited for the following parameters:

- Chlorophyll a, pH, and phosphorus from spring through fall when algae blooms are greatest
- Temperatures from spring to fall
- Dissolved oxygen criteria for cool water aquatic life throughout the year
- Bacteria throughout the year
- DDE, DDT, PCBs, and dioxin due to elevated levels found in fish tissue, impairing the use of the Slough for fishing
- Lead in the water column

These parameters affect aquatic life, human health, safety, and recreation as well as aesthetics. Sources of water quality problems in the Columbia Slough include groundwater, landfill leachate, airport deicing discharges, urban runoff, past practices, and industrial runoff.

DEQ has developed Total Maximum Daily Loads (TMDLs) for the Columbia Slough for the above parameters (except water temperature).

The following subsections outline pollutant sources as they relate to key water quality parameters:

Nutrients (Phosphorus). Septic systems in the eastern portion of the Columbia Slough watershed have increased nutrient levels in groundwater. Although properties are being connected to public sewers, the groundwater will continue to transport residual nutrient loads for an estimated 20 to 40 years. Nutrients are a particular problem in the summer when nutrient-rich groundwater makes up the primary flow in the middle slough and contributes to algal blooms and macrophyte growth.

Temperature. Temperature in the Slough is high in the spring, summer, and fall, with highest temperatures occurring during the summer months. Flood control levees and development have reduced riparian vegetation, reducing shading. This, combined with the low flows and shallow depths, results in higher water temperatures. Groundwater influx appears to help reduce temperatures in the southern arms of the middle slough, but has little effect on the lower slough.

Dissolved Oxygen (DO). The primary causes of low dissolved oxygen levels in Columbia Slough have been winter deicing activities and summer algae growth. In the past, airport crews at Portland International Airport, located adjacent to the Columbia Slough, have deiced airplanes when necessary; the deicing material mixed with stormwater and discharged the wastewater to the slough. The diluted deicers start to biodegrade and affect the levels of DO within the slough. (The Port has modified its operations to minimize this problem, implementing Best Management Practices to reduce the discharge of deicing materials. The Port is also in the process of constructing temporary storage tanks and detention basins.) In summer, algae growth contributes to large DO fluctuations, as algae photosynthesize and produce oxygen during the day and respire and give off carbon dioxide during the night. However, dissolved oxygen levels are not completely depleted in the summer months.

pH. Low pH levels can result in increased solubility of some constituents, particularly metals, and are generally unfavorable to aquatic organisms. High pH levels can increase the toxicity of ammonia to fish and result in other negative impacts to biota. The allowable pH level is 6.5 to 8.5. During the summer, high pH seems to be a function of eutrophication and photosynthesis. pH is primarily a problem in the upper slough in spring, summer, and fall.

Toxics (DDE, DDT, PCBs, Dieldrin, Dioxin). A variety of toxic substances are found in the Columbia Slough, including: DDT and dieldrin, pesticides widely used and dispersed years ago; dioxins, a by-product of many manufacturing processes, and also found in sludge from municipal sewage treatment plants; and PCBs, once used in insulating fluids in electrical equipment, as well as in plasticizers, lubricants, and hydraulic fluids. Although the use of DDT, dieldrin, and PCBs has been banned for decades, these compounds are highly persistent and are still present in water, soil, sediment, biota, and the atmosphere. In the Columbia Slough they are most concentrated in fish tissues, presenting significant human health risks. They will probably continue to enter water bodies as contaminant-laden soils that are eroded and washed into surface waters with each storm. In addition, aquatic sediments represent a historical reservoir that continues to supply contaminants to surface waters and biota.

Metals: Stormwater is the largest contributor of lead, the primary heavy metal of concern in the Columbia Slough Watershed. Other sources include industrial discharges, historic combined sewer overflows (CSOs) in the lower slough (outside the project area), contaminated sites, contaminated sediments, air emissions, and St. Johns Landfill.

Bacteria (Fecal Coliform). The highest bacteria concentrations recorded have been found in the lower slough during winter months and are associated with CSOs. However, the CSOs are being rerouted so that they do not flow into the slough, so this problem will be minimized. Bacterial contamination in the middle slough occurs in summer, fall and winter, possibly due to failing septic systems and illicit connections to the storm system. In the upper slough, stormwater appears to be the main source of bacteria.

3.4 Sediment Quality

The Columbia Slough has received untreated sewage, industrial waste, untreated stormwater, contaminated groundwater, and agricultural runoff containing pesticides for decades. As a result, harmful pollutants have accumulated in sediments on the Slough bottom. A Screening Level Risk Assessment (SLRA) was completed in response to the October 1993 consent order between DEQ and the City of Portland that required investigation of sediment contamination in the Columbia Slough. The SLRA was a comprehensive investigation of the sediments throughout the entire Columbia Slough, with the goal to rank sites according to their potential risks to human health and the environment, identify the highest priority sites, and remove from consideration those contaminants and exposure pathways (e.g., dermal contact) that clearly do not pose risks.

Follow-up investigations at Buffalo Slough found that significant risks to human health were found from PCBs, chlordane, arsenic, and DDT in fish tissues. The study also found significant risks to benthic organisms, primarily from copper and lead in sediments. No significant risks to wildlife were found. At Whitaker Slough, significant risks to benthic organisms were found due to pesticides in sediments. Because no fish of catchable size are present in this portion of the slough, there is no possibility for human exposure to fish tissues contaminants, and therefore there is no risk to humans.

Historical data from the main Slough were reviewed to evaluate potential sediment issues related to in-water disposal (side casting) of Slough sediments. Numerous surface samples had been taken in the Slough mainstem on various dates and at numerous locations. Most of the analyses were below the screening levels (SLs) of the regional Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF). Table 1 in Appendix A shows the exceedances of the SLs. Those analyses exceeding the SLs were four heavy metals, three phenol groups, two phthalate groups, one alcohol and two pesticides.

After the review was conducted, additional sampling was conducted by the Corps of Engineers to characterize the sediment of portions of the middle and upper Columbia Slough mainstem (Appendix A). The chemical testing indicated that the only contaminant exceeding the DMEF screening levels was DDT. DDT levels were highest upstream of the 'Four Corners' area near MCDD Pump Station #4. Subsequent biological testing indicated no risk for bioaccumulation in wildlife or humans. This information was presented at a meeting of the Dredged Material Management Team (DMMT) on 18 February 2000. The DMMT indicated its belief that placement of dredged material within the channel boundaries would be acceptable in the reaches downstream of the Four Corners area. The wetland benches were proposed to end at NE 158th, downstream of this area.

3.5 Vegetation. The variety and abundance of wildlife resources in an area is highly dependent on the type and distribution of vegetation. Historically, the Columbia Slough was thickly forested along the shores and low-lying areas. It contained expanses of wetland prairie and oak savanna.

Along the 60 miles of stream bank in the Slough, one-third is used for residential, about one-half is commercial/industrial, and the remainder is vacant, parks and open space. During the last 60 years, habitat areas (open water, tree/thicket cover, marsh/wetlands) have been reduced from almost 50 percent of the vegetation cover in the watershed to less than 20 percent. The remaining habitat is primarily in the riparian areas and consists of reed canarygrass adjacent to the Slough or in the Slough itself.

Species such as willow, ash, cottonwood, alder, dogwood, rushes, sedges, wapato, iris, and elodea are common native plants in wetland areas. Invasive species, including Himalayan blackberry, reed canarygrass, smartweed, curly dock, cattail, and duckweed are common non-native competitors. Upland species include cottonwood, red alder, hawthorn, dogwood, oak, snowberry, nettles, Oregon grape, oceanspray, and sword fern. Invasive species include blackberry, thistle, fireweed, chickory, ragwort, and several species of mustard.

In most areas, the riparian corridor is a continuous but narrow strip of land immediately adjacent to the Slough itself. Much of the riparian area contains buildings or paved surfaces. Since 1995, BES has undertaken an aggressive program to restore and replant the riparian area with native vegetation.

3.6 Wetlands

Historic wetlands have been diminished by agriculture, flood protection, and urban/industrial development. The types that remain are forested wetlands dominated by cottonwood and ash; diked agricultural fields that flood seasonally; and more traditional emergent wetlands containing rush, sedge, and cattail. Smith and Bybee Lakes (2,000 acres) in the lower slough reach form the best habitat area in the Slough and are the most significant wetland complex in the City. Mitigation wetlands have been developed, primarily in the upper and lower slough.

3.7 Fish and Wildlife.

Most of the wildlife associated with the Columbia Slough occurs in riparian wooded habitats, in and around the reed canarygrass, or in the Slough itself.

Waterfowl species, such as ruddy duck, scaup, mallard, American widgeon, cinnamon teal, green-winged teal, wood duck, canvasback, gadwall, hooded merganser, common merganser, northern shoveler, and shoveler, are common users of the slough habitat, particularly in winter. In spring, some waterfowl nesting also occurs. American bitterns, green herons, and black-crowned night herons are also. In general, waterfowl populations are declining as a result of habitat loss. Shorebirds, such as western sandpiper, least sandpiper, spotted sandpiper, killdeer, great blue heron, and greater yellowlegs, are found along the shoreline of the lakes and ponds in the area.

A variety of songbirds inhabit the forested and reed canarygrass riparian areas. Among them are the cedar waxwing, common yellowthroat, orange-crowned warbler, and the American goldfinch. Other species include oriole, warbler, peewee, sparrow, towhee, wren, jay, thrush, yellowthroat, swift, swallow, finch, waxwing, blackbird, snipe, flycatcher, harrier, kestrel, kingfisher, owl, and hawk. Bald eagle (threatened) and peregrine falcon forage in the slough. Tricolor blackbird and willow flycatcher are candidates for listing under ESA regulations. Upland birds include valley quail, ring-necked pheasant, and mourning dove.

Historically, the Slough was populated by elk, deer, river otter, and other small mammals. Elk have since disappeared. All remaining wildlife exhibits considerable adaptation to human presence. The Slough provides habitat for populations of muskrat, nutria, beaver, gray squirrel, chipmunk, fox, skunk, rabbit, opossum, weasel, raccoon, and other rodents. Shrews and moles are also likely.

Tree frogs, bull frogs, newts, yellow racers, alligator lizards, garter snakes, and pond and painted turtles are common in the Slough.

Aquatic invertebrates include varieties of cladocerane, rotifers, oligochaete worms, chironomid larvae, clams, and a few midge fly larvae. The existing habitat for macroinvertebrates/benthic organisms is poor because of the silty nature of the Slough's sediments. The silts are often devoid of oxygen and do not offer a suitable habitat for many benthic organisms. Consequently, benthic organisms are not very abundant.

Macrophytes, or water weeds, have flourished in the middle slough during the past few years. In 1994 and 1995, MCDD #1 maintained low water surface elevations in the middle slough to reduce residence time in the slough, thereby reducing summer algal blooms. Initially, the low water level resulted in significantly clearer water in the slough, which enabled water weeds to grow. The weeds have nearly choked flow in the middle slough, raising concerns about flood control and BOD loading in the fall season when the weeds break off and float downstream.

The Columbia Slough is riverine, with unconsolidated mud substrate. Some sandy bottom sections exist in the lower slough near the Willamette River. These substrates, together with slow flows and elevated water temperature and pollutant levels, translate to limited habitat for cold water fish. Juvenile salmonids have been found in the lower slough during the spring but not during the summer or fall. Salmonid spawning in the Slough has not been observed or documented and probably could not occur because of the lack of suitable spawning habitat, which requires gravel substrate. There are no traditional pools and riffles in the Slough because of its limited gradient. Currently, fish passage through the Slough is blocked by flood control structures in the middle and upper sloughs.

A report titled *Columbia Slough Master Plan, Task Report, Fish and Biological Studies, Fish and Fish Habitat* (Fishman Environmental Services, 1988) characterizes fish population and maps fish habitat along the Columbia Slough and describes the effects of

water quality on this resource. The report documented the presence of at least 17 species of fish that had been identified in the Columbia Slough system. Game fish found in the Slough included black and white crappie, blue gill, yellow perch, brown bullhead, warmouth, large mouth bass, chinook salmon, and white sturgeon. Non-game species included large-scale sucker, carp, goldfish, three-spined stickleback, peamouth, and cottid (sculpin). Other fish species noted included squawfish, catfish, and pumpkinseed. Recreational anglers are known to fish for several species, including crappie, bass, catfish, perch, and carp.

3.8 Threatened and Endangered Species. The proposed plan includes actions along 7 miles of Columbia Slough, its side sloughs, and the surrounding riparian area. The affected area of Columbia Slough is upstream of the Peninsula Drainage Canal and MCDD pump station #1. This segment of Columbia Slough is not connected directly to the Columbia River or the Willamette River, except by pumping from the slough at MCDD Pump Station #1 (to lower Columbia Slough, which connects to the Willamette River) and from MCDD Pump Station #4 (to the Columbia River, west of NE 185th). The area is heavily industrialized, with industrial developments lining both sides of the slough. The last remaining agricultural areas in the upper slough are converting to commercial properties. Water levels in the slough are managed with a system of levees, dikes, slide gates, and pumps. Thirteen combined sewer overflows formerly discharged into the lower slough, until the 12-ft diameter interceptor pipe project was completed in 2000. Over 100 stormwater outfalls (many of them municipal) discharge into the slough. The waterway receives stormwater from urban areas south of Columbia Boulevard. This segment of Columbia Slough is considered ecologically stressed, with fragmented habitat, high levels of macrophytes and poor benthic invertebrate species diversity. The Columbia Slough is a designated water quality limited waterbody under the Federal Clean Water Act and Oregon Revised Statutes (ORS 468.730).

The aim of the project is to increase channel complexity, provide a hydrologic period that more closely mimics historic off-channel sloughs, and restore riparian, shrub-scrub, emergent, and aquatic bottom habitats. The actions would create conditions favorable to native emergent wetland vegetation and native fauna, and would improve floodplain wetland and upland forested habitat that would provide feeding, perching, and nesting habitat for wildlife.

The project area was evaluated for potential effects to ESA-listed wildlife, plant and fish species. There is no suitable habitat in the project area for any threatened or endangered plants historically known to occur in this portion of the Willamette Valley, i.e., golden Indian paintbrush (*Castilleja levisecta*), Bradshaw's lomatium (*Lomatium bradshawii*), Nelson's checker-mallow (*Sidalcea nelsoniana*), Willamette daisy (*Erigeron decumbens* var. *decumbens*), and Kincaid's lupine (*Lupinus sulphureus* var. *kincaidii*). The area is severely modified from natural conditions and is highly developed and occupied by dense industrial or other establishments. Undeveloped areas are occupied by reed canarygrass (*Phalaris arundinacea*), Himalayan blackberry (*Rubus discolor*), and other invasive weedy species.

Bald eagles (*Haliaeetus leucocephalus*) are occasionally seen along the Columbia River, but the Columbia Slough does not provide suitable foraging, breeding, nor wintering habitat for the species. The only bald eagle nest site within 5 miles of the proposed project area is on Government Island, greater than 0.75 mile (1.2 km) north of Columbia Slough. It is highly unlikely that bald eagles forage on Columbia Slough due to the lack of potential perch trees and the high level of industrial and other development. The Columbia River, as well as the sloughs, lakes, and ponds on Government Island, provide favorable foraging habitat for the birds occupying the nesting territory. In addition, there are no documented bald eagle winter roosts within the vicinity of Columbia Slough.

The area is not occupied by threatened or endangered Columbia River salmonids. While such species have been documented downstream near Smith and Bybee Lakes, the reach of Columbia Slough upstream of MCDD Pump Station #1 is inaccessible to salmon. Discussions with the National Marine Fisheries Service (NMFS) indicated that NMFS did not have concerns with the proposed actions in Columbia Slough, as long as the actions did not affect the reach downstream of MCDD Pump Station #1.

The project site was visited by staff from the Oregon Department of Fish and Wildlife (ODFW) to determine the potential impacts on native turtle populations in the area. Ideally, native turtles (western pond turtle, painted turtle) prefer slow moving streams and backwater ponds that provide adequate food, cover, basking sites and nearby adjacent upland nesting habitat for their life requirements. They are listed as Sensitive Critical in Oregon. The enhancements in Columbia Slough should improve the aquatic habitat for native turtles by increasing the native vegetation component, thus improving food availability; providing and increase in the number of basking structures (logs and sparsely vegetated banks); and providing open, sparsely vegetated banks in some areas for nesting habitat and for adequate incubation of eggs. The project enhancements should improve both the quantity and quality of available habitat for turtles.

Based on this information, it is determined that the proposed water resource project on the Columbia Slough would have no effect on any listed or proposed threatened or endangered species.

3.9 Cultural Resources. Historically, the Fall 1805 and Spring 1806 visits by Lewis and Clark identified two active Native American villages near the existing Airport Way Urban Renewal Area. One is at the present airport location, and the other is near Blue Lake Park. Fishing and gathering of cattail, wapato, and rushes were common historical activities. Since the late 1800s, the Columbia Slough was predominantly flood plain agriculture, with levees and cross dikes constructed in the early 1900s. By the mid-1900s, crop farming succeeded dairy farming as the dominant use of the flood plain.

Most of the area along the middle and upper Columbia Slough has been zoned industrial, with various environmental overlays: scenic, preservation, and conservation. Several zoning restrictions apply to development within this zone/overlay designation. Portions of the Columbia Slough embankment area have been included in the city's 40-Mile Loop trail system, though portions remain undeveloped.

Recreation along the middle and upper slough is limited by difficult access, poor water quality and commercial and industrial development. Activities include fishing, wildlife viewing and canoeing. Some swimming has been reported in Whitaker and Buffalo Sloughs and the lower Columbia Slough, although water quality is such that swimming has not been recommended, primarily due to historic CSOs. Some fishing occurs, primarily for warm-water species such as bass, crappie, catfish and carp. Poor water quality and water level fluctuations limit fishing opportunities. Hiking and bird-watching occur along the slough on both private and public property (Portland BES, 1995).

Smith and Bybee Lakes also provide opportunities for bird watching, fishing, and boating. Delta Park, located east of Interstate 5, provides extensive recreational opportunities, including, softball, volleyball, and soccer playing areas. The Ramsey Lake Constructed Wetland offers bird-watching activities, as well as educational opportunities. Other developed public recreational sites include Kelley Point Park, Pier Park, Johnsonwood Park, East and West Delta Parks, Whitaker Ponds, Blue Lake, and the Expo center. Private facilities include Portland Meadows, Portland International Raceway, and five golf courses: Broadmoor, Colwood, Columbia Edgewater, Riverside, and Heron Lakes (the first four are private and the fifth is a public course). Marine Drive is a scenic route, and the cross-dike at NE Sandy Boulevard and NE Marine Drive is recognized for its outstanding views.

The project area was inventoried for cultural resources by Heritage Research Associates (HRA) of Eugene, Oregon, under contract with the Corps. The inventory involved an intensive literature search to identify known and expected cultural resources within the project area and an intensive surface and subsurface examination along the interior of the dikes bounding the north side of Columbia Slough.

The area bounding the Columbia River Slough is noted for its dense concentration of prehistoric archeological sites. These sites are frequently associated with the high ground surrounding low marshy ponds. The association of archeological sites with high ground is a result of the repeated use of certain areas by Native Americans to procure resources associated with marshy habitat including plants (such as wapato), migratory waterfowl and other animals. (Butchard, February 1990:15; Musil and Toepel, September 3, 1993:3) Low marshy ground is also associated with stream courses that provided access to this area by canoe, a favored method of Native American transportation along the lower Columbia River.

Butchard estimates that over 70 percent of the archeological sites within the Columbia South Shore area (roughly the area bounded by the Columbia River on the north, the Columbia Slough on the south extending from the Willamette River to the Sandy River) are within 50 feet of water. He also finds that at least 20% of known sites are associated with marshy habitat. (Burtchard, February 1990:32)

Archeological surveys have been conducted in the South Shore area but the area proposed for the Galitzki Flats restoration has not been surveyed. Archeological sites are

found in the immediate vicinity of the project area and relatively close to Galitzki Flats. Eastward of Galitzki Flats more than 10 prehistoric sites have been identified. (The high site density to the east of the project is a result of intensive cultural resource investigations in this location.) The high site density bounding the project area indicates intensive Native American settlement and resource procurement. Thus, it is reasonable to expect additional cultural resources within or immediately adjacent to Galitzki Flats. Prior to restoration activities, Galitzki Flats area would be surveyed for cultural resources by a professional archaeologist who is familiar with the cultural resources of the South shore area. Based on the results of this survey, additional cultural resource efforts may be necessary to preserve or mitigate project impacts to important cultural resources within the project area.

3.10 Social and Economic Setting. Columbia Slough is located in Multnomah County in northwest Oregon. Portland, the largest city in the state, is located in Multnomah County. Multnomah County has the highest population density in Oregon.

Since 1984, growth patterns in the City of Portland have been molded by the policies of the Oregon Land Conservation and Development Commission, resulting in the establishment of an urban growth boundary (UGB). Metro, the regional planning agency, has worked with represented jurisdictions to plan, contain, and provide services for this future growth within the UGB. As a result, significant infill is projected within the City's USB.

Development in the western and central portions of the Columbia Slough Watershed has been significantly influenced by to the presence of the Port of Portland's shipping terminals and Portland International Airport, an area that is now almost exclusively commercial and light industrial. This area has undergone significant recent growth, which is likely to continue in the future. Vacant land available in the Peninsula/Rivergate areas is expected to be developed for commercial use.

The southern portion of the watershed, particularly south of Columbia Boulevard, is mainly residential, with commercial development along the major transportation corridors. The eastern portion of the watershed west of Fairview Lake and Blue Lake was primarily agricultural, but it also has been rapidly converting to commercial and industrial uses in recent years.

The Columbia Slough watershed within the City of Portland is approximately one-third industrial, one-third single-family residential, and one-third mixed development. Although the Slough area will undergo a great deal of redevelopment in the future, the overall division of land uses is not anticipated to change significantly.

Population is projected to grow from 148,054 in 1995 to about 164,000 in 2015 and to about 172,500 in 2040. Significant growth is expected in the central and western areas of the watershed, while other areas should remain relatively stable. The highest growth is expected in recently seweraged areas that were part of the city's Mid-Multnomah County Sewerage Project.