Environmental Assessment
Southwest Washington Littoral Drift Restoration at Benson Beach,
Regional Sediment Management Demonstration

1. <u>Introduction</u>

The purpose of this Environmental Assessment (EA) is to evaluate alternative methods to accomplish littoral drift restoration. It does not evaluate the effects of dredging the mouth of the Columbia River (MCR) or disposal at alternative sites. Those activities have been addressed in previous environmental documents. Unlike most EAs, a single preferred alternative has not been selected since an array of placement activities can occur under Regional Sediment Management as authorities and funding sources are obtained for actions. The most likely scenarios for littoral drift restoration are being presented within this document based on current information.

Since the mid 1990s, state and local interests have expressed interest in placing sand dredged from the MCR Federal navigation channel directly onto Benson Beach to offset beach erosion and to supply sand to the littoral system of Long Beach peninsula. To address this issue, the Southwest Washington Littoral Drift Restoration (LDR) was initiated.

The LDR is funded as part of the U.S. Army Corps of Engineers' Regional Sediment Management (RSM) Program. The purpose of the LDR is to develop a long-term strategy for placing dredged material in the littoral drift zone on the SW Washington coast, just north of the MCR. This proposed demonstration is part of the LDR and is consistent with the objectives, and intent of the RSM program. The purpose of the RSM program is to coordinate coastal dredging activities for the purpose of retaining sand in the littoral zone in order to foster more balanced, natural system processes, and potentially reduce dredging costs. The proposed LDR is intended to promote sustainability principles through an approach that considers competing demands for sediment resources, accommodates multiple objectives, and adopts a long term perspective to develop, demonstrate, and implement a dredging and placement program and achieve acceptable cost efficiencies.

Authority for the initial development and planning process was given to the Corps by Congress as Section 516 of the Water Resources Development Act (WRDA) of 2000. This authority allows the Corps to conduct planning processes, studies, and stakeholder consultations in order to manage sediments across regional scales. The WRDA 2000 authority for RSM demonstrations does not allow actual construction of projects (including material placement) – rather, it relies on other existing authorities and Congressional authorization mechanisms to direct implementation activities. Long-term implementation of the LDR would have to come from additional authorizations granted either in a subsequent WRDA or within the Corps appropriations.

In 2002 the Corps placed sand directly on Benson Beach for the first time. Funding of $200,000 was provided under the Energy and Water Development Appropriation Bill (S.1171) as reported by Conference Committee on Appropriations, 107th Congress, 1st Session. The Committee provided $200,000 over the budget request under the Mouth of the Columbia River Project to study the impacts of alternative dredged material disposal methods. Specifically, the Corps was urged to examine the impacts of disposing dredged material at Benson Beach. Strong local support for the Benson Beach pilot study resulted in a $575,000 contribution to the Congressional appropriation making the pilot study possible by funding the incremental cost over the normal cost of the project disposal activity. During 16-19 July 2002, approximately 43,700 cubic yards of sand were placed on Benson beach by a contract hopper dredge using the pump-ashore method described in this EA. The placement of material was 1,000 ft north of the north jetty. In a report to the Energy and Water Development Congressional Committee, in September 2002 (USACE 2002), the Corps reported preliminary results and interim recommendations regarding placement of dredged material on Benson Beach. Among the recommendations of that report were that the material should be placed further north (more than 1,500 ft north of the jetty) so that the material would not migrate southward toward the jetty. The report also recommended that in order to be more cost effective, significantly more material than the 43,727 cubic yards of material would need to be placed at the disposal site.

2. Purpose of and Need for Action

The purpose of the demonstration is to determine the most effective means for returning sand to the littoral drift zone along the southwest Washington coastline by evaluating three disposal options:

1. Direct Pump Ashore
2. Sump and Pump Ashore
3. Nearshore Placement

3. Proposed Action and Alternatives

The demonstration will be conducted concurrently with the Corps' dredging and disposal operations at the MCR, which typically occurs annually between June 1st and November 1st. Two alternatives propose placement of material on Benson Beach within the intertidal zone. A third alternative calls for the placement of material in the near-shore area below the intertidal zone. Alternative using the Benson Beach area for placement would not start until after July 15th to minimize impacts to salmonids. All action alternatives using the area south of the north jetty would require that the work take place before September 15th each year due to concerns with age 1+ Dungeness crabs migrating through the demonstration area. In order to determine the best long term strategy, environmental clearances are being requested that would have a 5-year horizon for the demonstration (up to 1,000,000 cubic yards (cy) placed annually to the north of the north jetty) as well as address both pipeline methods of placing material into the littoral drift. The quantity of material to be placed within the intertidal site is currently unknown and would most likely be substantially less that the 1,000,000 cy annual maximum.

Alternative 1 – Direct Pump Ashore

This alternative is the same method used in 2002 to add sand to the littoral drift zone (See Corps MCR website for report https://www.nwp.usace.army.mil/op/n/projects/mcr/docs/reports/bbreport.pdf). Sand would be dredged in the MCR project using a hopper dredge. The dredge would then be maneuvered near the south side of the north jetty and sediment pumped through a 16- to 30-inch pipe from the dredge over the top of the jetty onto Benson Beach to the north. The hopper dredge would pump sediment from the dredge through a several-thousand-foot-long disposal pipe to the disposal site. The disposal pipe would extend from the dredge, across the north jetty, and along the beach parallel to the shore.

Sediment placement on the beach consists of introducing dredged material (>98% sand) from the MCR directly into the intertidal zone between +14 and -10 Mean Lower Low Water (MLLW) on Benson Beach on the north side of the north jetty. A vicinity map is shown in Figure 1. The area for placement of sand extends from approximately 1,500 ft north of the north jetty, to a point approximately 4,500 ft. north of the jetty (Figure 2). Placement within this zone increases the likelihood that sands will be transported northward and enter the littoral drift cell of the Long Beach peninsula, rather than return to the ebb tidal shoal adjacent to the north jetty. Direct pump ashore could provide up to 700,000 cubic yards of material per year before the present MCR dredging operation would be adversely impacted (requiring additional time or mobilization of additional dredging equipment). It takes longer to pump material out of the hopper than it does to unload (bottom dump) it. A pump-out operation takes 50 to 100 minutes as opposed to bottom dumping a load which takes 5 to 20 minutes. The increased time to offload the sand would cut into the available time for dredging (roughly double the time required to dredge and place a given quantity), resulting in an increased cost and/or requiring additional dredging equipment or impacting the extent of maintenance dredging that can be accomplished within the allowable time (USACE 1999).

At the disposal end of the pipe, the material would be placed along shore in parallel “strips” measuring approximately 150 ft (x-shore) by 2,000 ft. (along-shore). The strips would be placed beginning at the southern end and moving to the north by incrementally extending the pipeline. The process would then be repeated until all the material has been placed. The pipeline route would extend along the edge of the upper beach scarp, or below the seaward edge of the vegetation in areas where there is no scarp, to the point of deposition. The pipeline may be buried in some locations to minimize risks to beach users. Up to 3-foot of elevation for the pipeline may be required with the material used to support the elevated pipe to be obtained by re-working material from the beach area prior to the initiation of the disposal activity. Heavy earth-moving equipment will be used to move some of the disposal material in order to limit the vertical accumulation on the beach and achieve the desired placement template. The constructed profile will be relatively flat with a front slope on the order of 20:1 from approximately +14 to -10 ft MLLW. Conceptual illustrations of the sand placement are shown in Figures 2-3.

After the discharge event, as the newly deposited surface substrate is dispersed by wind, waves, and currents, the disposal sand it will quickly become saturated and compacted like the substrate typically found in the Benson Beach area.

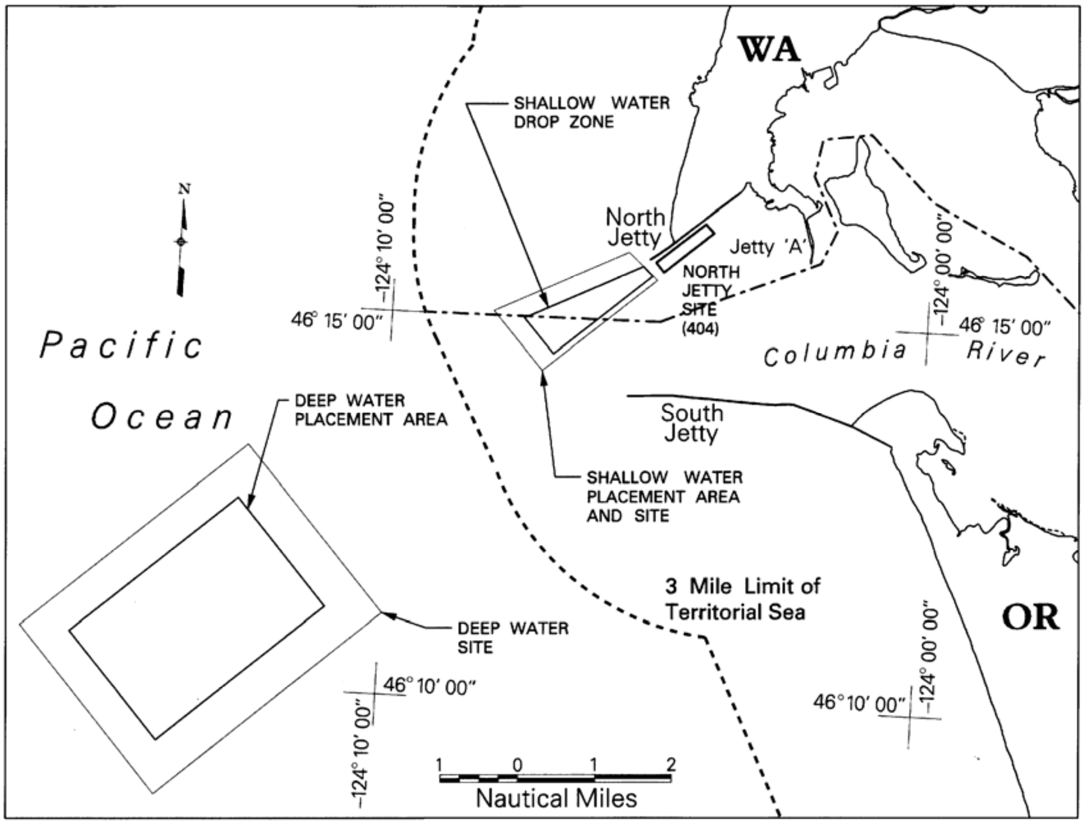

Figure 1. Vicinity map.

Alternative 2 - Sump and Pump Ashore

This alternative would involve the removal of approximately 500,000 cubic yards of sand from the seabed at an area south of the north jetty and north of the MCR channel. The sediment would be removed by a cutterhead pipeline dredge and form a depression (sump) on the present seabed. The pipeline dredge would hydraulically discharge the dredged material (sand) within the intertidal zone of Benson Beach, between MHHW and MLLW. The actual volume of material to be re-handled will depend on placement authority, available funds and the actual construction bids. For the sump area, a sump zone has been defined by considering navigation and operations, aquatic species and habitats, and sump and jetty stability. The identified sump zone and a potential sump location are shown in Figure 4. The potential sump footprint measures 3,000 ft x 600 ft; the depth of the sump will be limited by the choice of dredging equipment and the desired volume of material from a given footprint, and is expected to be 10-15 feet deeper than the current bottom depth of 35 to 40 feet. The sump would initially be cut with a vertical side slope, as an initial condition. It is anticipated that the sump side slopes will adjust to a slope of 1v:5h. The adjusted side slopes would result after the near vertical sides of the experience slumping and infilling from the adjacent perimeter. As depicted, the sump could provide up to 1,000,000 cubic yards of dredged material. One restriction that will be placed on the sump construction within the zone is that it must form a continuous area (i.e., the sump cannot be composed of several separate excavations).

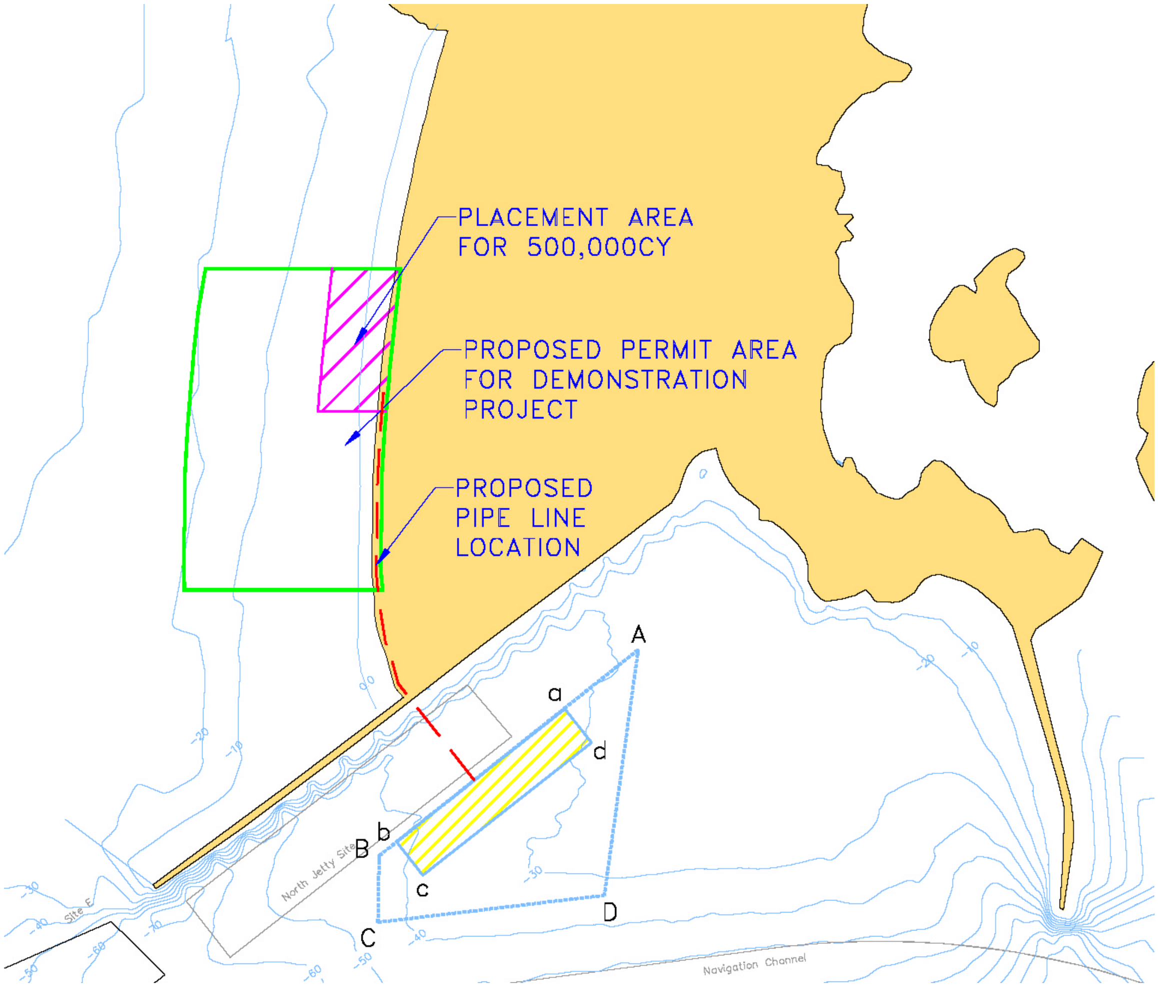

Figure 2. Plan view – Benson Beach placement area.

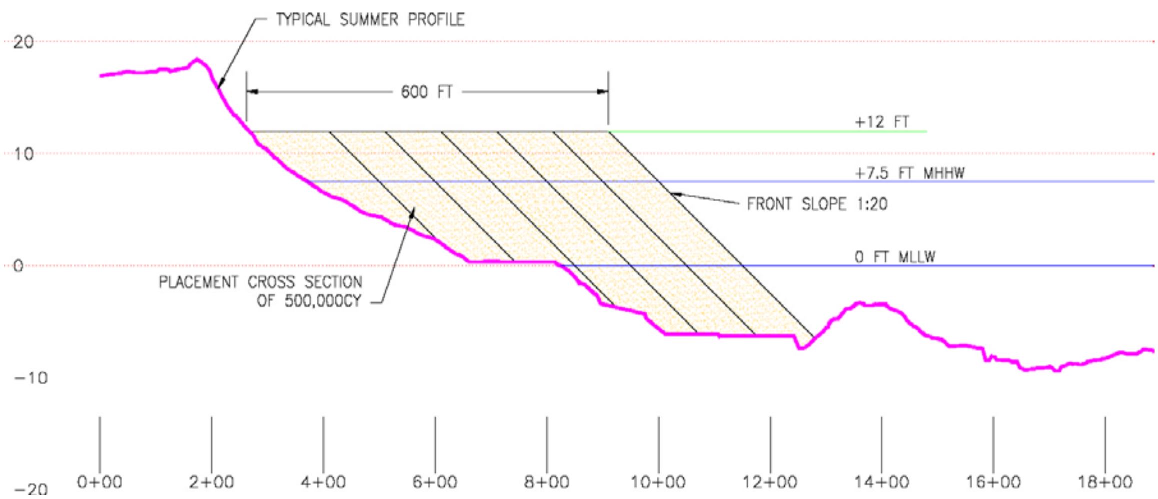

Figure 3. Typical section – Benson Beach placement area

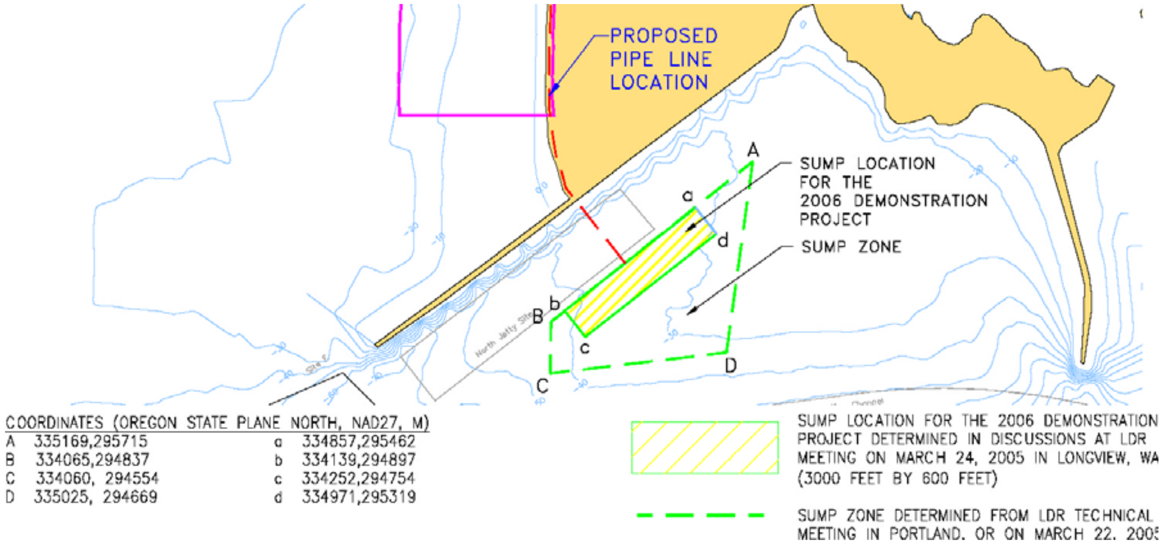

Figure 4. Sump zone and potential sump location.

A pipeline dredge will be deployed to dredge sand from the sump area and the dredged material will be pumped through a 16- to 30-inch diameter pipeline over the top of the north jetty onto Benson Beach. Refilling of the sump will be achieved by bottom dumping from hopper dredges. This refilling will be performed following the excavation of the sump and prior to the end of the dredging season. The timeframe for excavating the sump and placing the material will likely range from 1 to 2 months, depending on the equipment used and weather and wave conditions encountered during operations. During periods of bad weather, the pipeline dredge may need to be withdrawn from the sump area to the more sheltered area in the northeast corner south of the north jetty or to a location east of Jetty A. It is likely that the pipeline dredge will be anchored to the seabed in the sump area using a four-point anchoring system.

Placement of the material from the sump onto Benson Beach would be the same as described above for the direct pump-ashore alternative except that the placement would be more continuous and subsequently for a shorter duration (fewer number of calendar days) and would not require the movement of the hopper dredge(s) back and forth from the MCR channel dredging location to the disposal pipe hook-up during the beach placement of sand. Refilling of the sump would require the hopper dredge to repeatedly place dredged material back into the sump. For the sump alternative, disposal on Benson Beach disposal would not be affected by the activity of the sump refilling by the hopper dredges(s).

Alternative 3 - Nearshore Littoral Zone Placement

Nearshore placement would consist of deposition of dredged materials by bottom-dump hopper dredges within a nearshore deposition zone. The placement would occur within the littoral drift cell. Placement boundaries would be 9,730 ft (north side), 10,100 ft (south side), and 8,330 ft (east and west sides) between the -40 and -60 ft. contours north of North Head (Figure 5). No pumping to the intertidal zone or re-handling of material following placement would occur. This nearshore placement site was previously proposed for beneficial disposal of MCR sediments by the Portland District in 1999 (USACE 1999), but was not evaluated further due to lack of support from the State of Washington.

Alternative 4 - No Action

For the No Action Alternative, it is assumed that no beneficial placement would occur within the Littoral Drift Cell north of the MCR. Dredge sediments would continue to be placed within existing approved disposal sites including the Deep Water site 6 to 8 miles offshore. The result would be that a significant quantity of material would be placed outside of the littoral drift cell.

4. Affected Environment

The Benson Beach and nearshore disposal areas are located in the littoral drift transport zone. Both are in areas of high wave energy. Sediments in these areas are similar to the dredged material. The material placed in these locations would disperse and contribute to nourishing the SW Washington Littoral Drift System if placed in less than 60 feet of water.

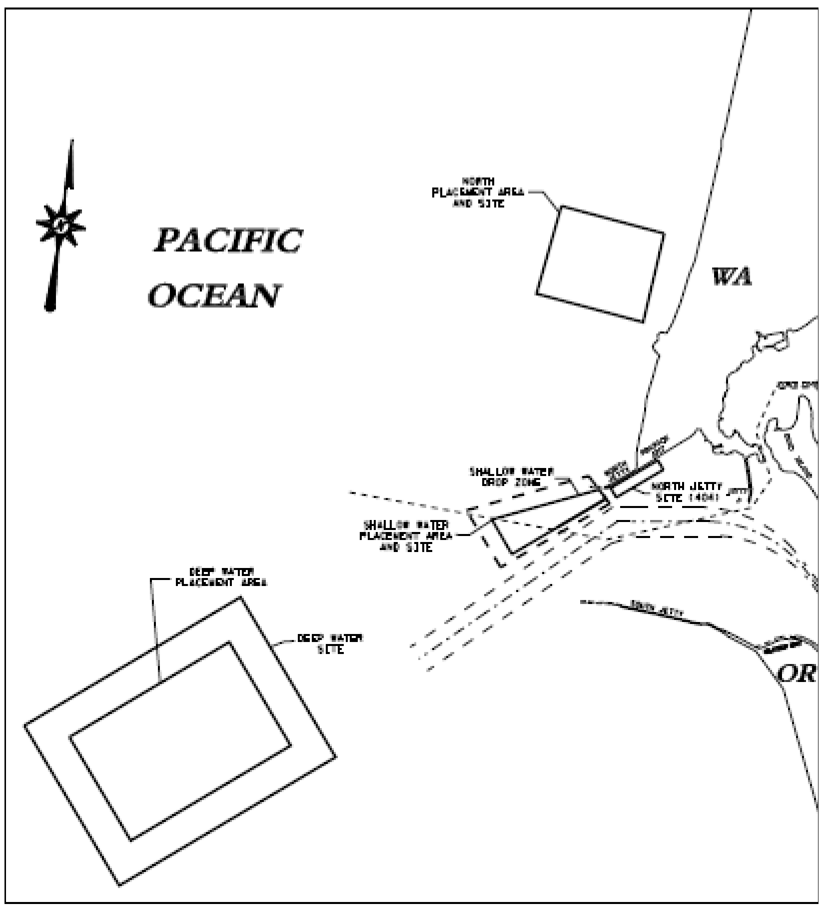

Figure 5. Nearshore Placement Zone.

Safety

To ensure safety for citizens using Benson Beach, the area around the disposal pipe, pump head, and where the earth-moving equipment will be working will be cordoned off. Contract personnel will be present at the disposal location to be sure that no unauthorized persons cross the construction fencing into the disposal and construction zone. All standard Best Management Practices (BMPs) for dredge and disposal operational safety will be applied to the activity (see Appendix A). Dredge safety is a concern when working in close proximity to the jetty within MCR. The Sump Alternative and the Direct Pump Ashore Alternative would require the dredge to work near the jetty and various buoys while in operation.

Littoral Transport and Morphology

Along the nearshore waters of the Pacific Northwest coast (in water depths less than 200 ft), currents induced by wind, waves, and tides are primarily responsible for sediment transport through the water column and on the seafloor. Wave-induced currents tend to diminish with increasing water depth. The closer one moves toward shore (the shallower the water depths), the more energetic the effects of wave shoaling will be throughout the water column. Increased wave shoaling accompanied by an ambient current can produce a high sediment transport potential. In water depths less than 60 ft along the Washington and Oregon coasts, wind- and wave-induced currents dominate the transport of sediment along the seabed. This area is called the ***littoral*** (or nearshore) ***zone***, and includes the inter-tidal area along shore (between MLLW and MHHW***)***. The transport of bottom sediment within the littoral zone, due to waves and currents, is called ***littoral transport***. In general, littoral transport is a function of wave height and period, bottom sediment size, and strength of ambient current. Within the littoral zone of Washington and Oregon, the seabed sediment is primarily composed of sand, gravel, and cobbles. Sediment smaller than sand (silt and clay) generally does not reside within the littoral zone of the Pacific NW due to the high mobility of fine-grain sediment. Near MCR, littoral sediments are composed of fine-medium sand and littoral transport (magnitude and direction) is highly variable due to the complex morphology and processes associated with a major estuary inlet.

The ocean entrance at MCR is characterized by large waves and strong currents interacting with spatially variable bathymetry. The MCR entrance is considered one of the world's most dangerous coastal inlets. Approximately seventy percent (70%) of all waves approaching the MCR are from the west-northwest (Moritz and Moritz 2004). The sea state offshore of the jettied river entrance during winter storm conditions is characterized by high swells approaching from the northwest to southwest combined with locally generated wind waves from the south to southwest. During October-April average offshore wave height and period is 2.7 m and 12 seconds, respectively. During May-September, average offshore wave height and period is 1.5 m and 9 seconds, respectively and waves approach mostly from the west-northwest. Occasional, summer storms produce waves approaching MCR from the south-southwest with wave height 2-4 meters and wave period of 7-12 seconds. Astronomical tides at the MCR are mixed semi-diurnal with a diurnal range of 2.6m. The instantaneous flow rate of estuarine water through the MCR inlet during ebb tide can reach 51,000 m3/sec. Tidally dominated currents within the MCR can exceed 2.5 meter/sec. A large clockwise rotating eddy current has been observed to form within the proposed sump area (between the north jetty, the navigation channel, and jetty "A") during ebb tide. A less pronounced counter-clockwise eddy forms in response to flood tide. The north jetty eddy has varying strength and direction (based on location and timing of tide) ranging between 0.1 and 1.0 meters/sec.

As waves propagate shoreward toward the MCR inlet, the waves are modified (waves begin to shoal and refract) by the asymmetry of the inlet's underwater morphology. Nearshore currents and tidal currents are also modified by the inlet's morphology. These modified currents interact with the shoaling waves to produce a complex and agitated wave environment within the inlet. The asymmetric configuration of the MCR inlet and its morphology is characterized by the significant offshore extent of Peacock Spit on the north side of the inlet, southwesterly alignment of the north/south jetties and channel, and absence of a large shoal on the south side of the inlet. The asymmetry of the MCR inlet causes incoming waves to be focused onto areas which would not otherwise be exposed to direct wave action. An example of this wave-focusing effect is the area along the south side of the north jetty, which includes the proposed sump location. Upon initial inspection, it would appear that this area is most susceptible to wave action approaching the MCR inlet from the southwest. This is not the case; in fact the opposite is what occurs. The area located between the north jetty, the navigation channel, and jetty "A" (south side of the north jetty) is affected by wave action during conditions when the offshore wave direction is from the west-northwest, due to the refractive nature of Peacock Spit. Waves passing over Peacock Spit (approaching from the northwest) are focused to enter the inlet along the south side of the north jetty. Conversely, large waves approaching the inlet from the southwest are refracted/diffracted around the south jetty and over Clatsop Spit, protecting the south side of the north jetty from large southerly waves. Recall that 70% of all offshore waves approach the MCR from the west-northwest.

The stability of the MCR channel is related to the jetties and the morphology of Peacock Spit and Clatsop Spit (Moritz et al. 2003a). Through phased jetty construction during 1885-1939 and the associated response of MCR morphology, the project features at MCR and the resultant morphology are now mutually dependent; both in terms of structural integrity and project feature functional performance.

As noted, the MCR jetties were constructed on underwater shoals. These shoals are now considered to be crucial project elements, yet the shoals are receding. As the shoals recede, the sediment budget affecting the adjacent littoral zones north and south of MCR will be diminished. As the morphology near the MCR jetties experiences significant recession (erosion), the jetties will be undermined by waves and currents. If the morphology can be maintained by prudent use of dredged material, then the longterm stability of the jetties will be improved from the present condition of progressive scour and the sediment budget for the littoral zones can be augmented (Moritz et al. 2003b).

The shoals at MCR are composed of marine, estuarine, and riverine sand. The average grain size on the exposed surface of the surrounding seabed varies between 0.17 to 0.27 mm and fines content ranges between 0 and 10%. The sand gradation (and fines content) of the seabed varies depending on location and season. Kaminsky and Ferland (November 2003) conducted vibracore sampling at the MCR near the proposed sump site. The results of that study indicated that the samples taken as deep as 12 feet below the seafloor consisted of sand with an occasional layer of laminated mud/sand or pebbles/shell. These Vibracore samples were used to field verify a geophysical investigation of the area done by David Evans and Associates (DEA, August 1993). In the DEA study, seismic surveys were done to determine the subsurface material at the proposed sump site. The conclusion drawn from the two reports is that the proposed sump area is composed of sandy material down to as deep as 175 feet below the bottom surface.

The objective for this RSM demonstration is to maintain (restore) the sediment budget of the littoral zone along the SW Washington shore, north of the MCR, by judicious placement of dredged material. In a geomorphic context, the objective can be viewed as maintaining the sediment budget of Peacock Spit. By maintaining the sediment budget of Peacock Spit, littoral transport northward from the MCR will be sustained. Viewed from the context of jetty stability, maintaining the sediment budget of Peacock Spit will stabilize the morphology on which the north jetty is founded, and forestall additional jetty deterioration (due to scour). There are two general (disposal) locations to augment the sediment budget of Peacock Spit using dredged sand:

1) Directly placing dredged material along the intertidal area 1,500-4,000 ft north of where the north jetty meets Benson Beach. This will maintain or accrete the beachline (and underwater beach slope) and augment the littoral zone of Benson Beach and points north. It is assumed that the direction of littoral transport is northward from the point of inter tidal disposal. An added benefit of inter-tidal placement would be the protection of the north jetty root from additional scour/wave attack along its north side, should the beachline accrete or remain stationary. Placing dredged material on Benson Beach can directly benefit the littoral transport of sand to the WA shoreline near the MCR. Depending upon the location along Benson Beach, dredged material placement could directly benefit the north jetty. It may be possible to achieve direct benefits to both the littoral budget and the north jetty, if the optimal location of dredged material placement is selected.

2) Placing dredged material nearshore along the seaward terrace of Peacock Spit or at areas along the northern flank of Peacock Spit. Dredged material placed within the littoral zone of Peacock Spit (depths 40-60 ft) would be transported in accordance with the local processes acting on the sediment. If placed along the northwestern edge of the spit, the dredged material would likely be dispersed landward and northward from the point of disposal; some material may be transported toward the south, and some offshore. If dredged material were placed along the northern flank of Peacock Spit, the potential for northward/landward transport is believed to be greater than for disposal locations located further south. If the dredged material is dispersed by littoral processes as intended, nearshore disposal on Peacock Spit will sustain the sediment budget of the shoal while maintaining much of the littoral transport onto the shores of Benson Beach and Long Beach peninsula. Maintaining the sediment budget of Peacock Spit will also maintain the configuration of the shoal and reduce the related effects of increased wave action or scour along the north jetty. Depending upon the location, nearshore placement of dredged material on Peacock Spit can directly benefit the littoral budget of the WA shoreline near the MCR and indirectly benefit the stability of the north jetty.

Monitoring, field data collection, and assessment activities will be needed to evaluate (verify) the stated benefits or other effects of the enacted alternative. The principal aim of these actions would be to determine the fate of placed dredged material and compare with intended objectives. If the nearshore disposal alternative is enacted, a series of bathymetry surveys should be executed to measure the displacement of the dredged material after disposal; to determine the dispersion rate and direction. It may be desirable to deploy a wave/current meter prior to and during the nearshore placement operation (if enacted) to measure the littoral processes. If an inter-tidal (beach) disposal alternative is enacted, the inter-tidal and nearshore area of Benson Beach should be monitored to track the rate and direction of movement of the placed dredged material. An Argus Beach Monitoring System (ABMS) has been installed within the North Head lighthouse, for the purpose of: A) monitoring geomorphic change along the inter-tidal area of Benson Beach, and, B) monitoring sand bar movement and nearshore wave breaking along Benson Beach and the SWS. The ABMS can be used to monitor the fate of dredged material placed along Benson Beach (http://zuma.nwra.com/north_head/). Periodic topographic and bathymetric surveys can be conducted to augment the ABMS.

If the Sump and Pump Ashore Alternative is enacted, monitoring of the sump will be needed to verify that the sump does not negatively affect the surrounding bathymetry or the foundation of the north jetty. Sump monitoring will also be needed to verify that hopper dredges fill the sump after the pump ashore activity is completed. Monitoring may consist of periodic bathymetry surveys and wave/current measurements.

Vegetation

Grasses and small shrub species occur on the jetty face above MHHW; however, no attached macroalgae is present. Beach vegetation along the most seaward dune line consists primarily of European Beach Grass and Beach Sagebrush. The dune line will not be impacted by beach disposal work as the pipeline will be placed seaward of the dune line and all beach vegetation. The location of the pipe across the jetty is also expected to be seaward of the vegetation found along the jetty's north face.

Fish and Wildlife

WDFW (Burkle 2002) indicates that no surfsmelt or other baitfish spawning beds are present in the area of Benson Beach because of the unstable nature of the environment. The nearest surfsmelt spawning bed is located just south of the Westport South Jetty, many miles north of the Benson Beach disposal site. There are also no known sandlance or herring spawning areas at Benson Beach. Disposal on Benson Beach would temporarily displace shorebirds, although they would not have to move far to avoid the active construction zone. At the dredge end of the discharge pipe in the Direct Pump Ashore Alternative there would be no effect to ground fish in the area. The Nearshore Disposal Alternative would have no impact on shorebirds and little or no impact on forage fish, surf perch, and clams.

The MCR jetties are designated EFH for several species of salmon, groundfish, and coastal pelagic species (see Table 1). Some use the MCR as a migratory corridor to rearing areas in the bays and intertidal areas that have large concentrations of food organisms. The Sump and Pump Ashore Alternative is likely to have the largest impact on groundfish species as it will impact the substrate in the area twice. In a 2004 study by William et al., over 11,500 fish representing 26 taxa were collected in the vicinity of the proposed sump site using trawling. The dominant species found in this study included Pacific tomcod, whitebait smelt, northern anchovy, staghorn sculpin, and English sole. No ESA listed species were collected. The dredging of the sump will likely entrain groundfish in the area unless they move as the disturbance of the cutterhead approaches. The refilling of the sump could also impact groundfish that move into the area after the dredging is complete. Groundfish in the immediate disposal area could be buried by the disposal material, though possibly not deep enough to cause mortality, depending on the thickness of the disposal mound. The disposal on Benson Beach should have little effect since the material will be deposited up on the beach or in very shallow water where few of these species are likely to be present.

The Nearshore Placement Alternative could cause some impact to groundfish and coastal pelagic species. The STFATE model has been used to predict the mound thickness from hopper disposal using various vessel speeds, load capacities, and water depths (Pearson et al. 2005). The results of that study showed that even in the worst-case scenario which was modeled (slow vessel speed, large hopper load, and shallowest disposal depth of 45 feet) the disposal would create a mound 11cm or less in thickness over an area approximately 600m by 100m. It also demonstrated that most of the impact area would have far less than the maximum 11cm of sediment. Disposal would be intermittent, as the fill/dispose cycle takes several hours. The disposal could bury groundfish and coastal pelagics, though it is unlikely that the overall population levels of fish would be greatly impacted.

In addition to the direct impacts to groundfish and coastal pelagic species, there could be impacts to Essential Fish Habitat. Many of these species use the proposed nearshore placement area for spawning, migration, feeding, and rearing. The overall impact is expected to be small, but there is likely to be some negative impact of EFH for these species.

Benthic Organism and Dungeness crab impacts
The intensity of waves and currents north of the north jetty severely limits the extent of colonization by benthic and epibenthic organisms. According to WDFW, there are no razor clam beds for several miles from Benson Beach due to its unstable nature. WDFW also stated that Dungeness crab are rarely, if ever found in the surf zone on this beach (B. Burkle, WDFW, personal communication).

Dan Ayres, WDFW Razor Clam Manager for the Washington Coast, said that to his knowledge, spanning close to 30 years, no formal assessments of benthic invertebrates have been conducted along Benson Beach, including razor clam surveys, which are regularly done several times a year at several points north of North Head on the Washington shore. It was determined long ago that there are too few razor clams at Benson Beach to manage, and although the area is open for digging, and a few people do dig there, there are too few harvested to necessitate a resource management inventory of them. The area was visually assessed by WDFW personnel during the barge Nestucca oil spill, which occurred in 1988. At that time they found virtually no razor clams or other invertebrates or fish. Even at that time the area was eroding rapidly and depauperate of resources. This assessment was not published. According to WDFW, it is probable that this location is a good location to conduct beach nourishment if the goal is to avoid harming natural resources at the point of disposal while enhancing conditions where there are abundant and productive razor clam beds that would eventually be lost without a source of sand.

The Direct Pump Ashore Alternative would have no effect on benthic organisms at the dredge end of the disposal pipe. It is possible that the two water intake openings (through which water is drawn to create the sand/water slurry necessary to pump the material to shore) would entrain

Table 1. Summary of EFH species and potential life stage use in the vicinity of the proposed demonstration (species with potential EFH impacts are indicated in bold type).

Salmon	Egg	Larvae	Young Juvenile	Juvenile	Adult	Spawning
Coho salmon				X	X	
Chinook salmon			X	X	X	
Coastal Pelagic Species	Egg	Larvae	Young Juvenile	Juvenile	Adult	Spawning
Northern anchovy	X	X		X	X	
Pacific sardine	X	X		X	X	
Pacific mackerel	X	X		X	X	
Jack mackerel					X	
Market squid	?	?	?		X	?
Groundfish Species	Egg	Larvae	Young Juvenile	Juvenile	Adult	Spawning
California Skate	X		X		X	X
Soupfin Shark	X		X		X	X
Spiny Dogfish	X		X	X	X	
Ratfish			X		X	X
Lingcod	X	X	X	X	X	X
Cabezon	X	X	X	X	X	X
Kelp Greenling	X	X	X	X	X	X
Pacific Cod	X	X	X		X	X
Pacific Whiting (Hake)	X	X	X		X	
Sablefish				X		
Butter Sole					X	X
Curlfin Sole					X	X
English Sole	X	X	X		X	X
Flathead Sole			X			
Pacific Sanddab	X	X	X		X	
Petrale Sole			X		X	
Rex Sole			X		X	
Rock Sole	X		X		X	X
Sand Sole			X		X	X
Starry Flounder	X	X	X		X	X
Black Rockfish			X		X	
Brown Rockfish	X	X	X		X	X
China Rockfish						
Copper Rockfish	X	X	X	X	X	X
Quillback Rockfish	X	X	X	X	X	X
Vermilion Rockfish			X			

any crabs moving through the water column within the vicinity of the intake grate. This water intake occurs near the bottom of the hopper which, when full, is located in 28-22 feet of water, depending on which dredge is used. The intake openings rise with the emptying hopper dredge as the sand/water slurry is pumped ashore.

The Sump and Pump Ashore Alternative would cause a loss of benthic organisms and crabs by entrainment during the sump excavation. The suction action of the dredge would entrain all benthic organism and crabs found in or on the bottom surface at the point of uptake.

It is not known whether the sump, after excavation and before it is refilled, will adversely impact the crab population. Even thought the refilling will begin quickly after the excavation process, there will still be some period of time when the excavation hole will be available for crabs to migrate into. It is possible the crabs may migrate into and out of the sump in the same way that they would cross that area if the sump was not there. Or, the sump may act as an attractant for crabs that move into the area after sump excavation is complete. If the sump acts to accumulate organic matter, crabs could be attracted to that area. It is also possible that the sump would act as a sink for crabs. If the crabs crawl or fall into the sump and then are not able to climb out and continue their migratory movement, the crabs may accumulate in the sump and then be buried when the hopper disposes sand to refill the sump.

The Nearshore Placement Alternative would also likely cause some loss of benthic organisms and crabs due to the hopper disposal. The STFATE model has been used to predict the mound thickness from hopper disposal using various vessel speeds, load capacities, and water depths (Pearson et al. 2005). The results of that study showed that the worst case scenario (slow vessel speed, large hopper load, and shallowest disposal depth of 45 feet) would create a mound of 11cm or less in thickness over an area approximately 600m by 100m. However, this mounding would likely result in the loss of benthic organisms and some crabs.

Two recent studies conducted by researchers at the Pacific Northwest National Laboratory and funded by the Corps addressed potential crab impacts as a result of using the sump and pump out alternative. The first study, “Benson Beach Demonstration Project: Composition and Abundance of Biota at Three Alternative Sump Sites” (Williams et al. 2004), documents the species composition and relative abundance of crabs and fish associated with three proposed sump areas. The study showed that crab were abundant throughout the area with the highest abundance in the sump area nearest to shore that was also the shallowest. The study also showed that crab numbers increased significantly in mid September associated with a migration of Age 1+ crab out of the estuary. For this reason, use of the sump area would occur prior to September 15^{th}.

The second study, “Impacts to Dungeness Crab from the Southwest Washington Littoral Drift Restoration Project” (Williams et al. 2005), estimates impacts to the crab population from use of the sumps. Since there are no direct measurements of crab entrainment by pipeline dredge operating outside the Columbia River navigation channel, the study used the Dredge Impact Model developed by PNNL to estimate adult equivalent loss (AEL) and loss to the fishery. Using a range of assumptions about crab density, dredging scenarios, and entrainment functions, the study determined that the AEL could range from 20 to 3,281. Reference scenario results demonstrated that losses to the fishery would probably be less than 2,000 crabs and more likely less than 1,500 crabs.

Threatened and Endangered Species

Federally listed populations [or Evolutionarily Significant Units (ESUs)] of fish, marine mammals, and marine reptiles under the Endangered Species Act (ESA) are known to occur in the general vicinity of the proposed demonstration site (Table 2).

The Corps has completed two Biological Assessments (BAs) and an EFH report for the proposed demonstration, and is conducting Section 7 ESA consultations with the U.S. Fish and Wildlife

Service and National Marine Fisheries Service. The BAs describe the impacts to species listed on the federal Endangered Species List in more detail and also include a discussion of Critical Habitat.

The Corps anticipates **No Effect** for Steller sea lion, blue whale, finback whale, Sei whale, sperm whale, humpback whale, right whale, loggerhead sea turtle, green sea turtle, leatherback sea turtle, Pacific Ridley sea turtle, bald eagle, brown pelican, western snowy plover, Columbian white-tailed deer, Oregon silverspot butterfly, or the marbled murrelet. These species are either highly mobile, geographically separate from the impact area but within Pacific or Waikaikum Counties, or in habitats adjacent to but not within the proposed footprint which will be disturbed by the proposed action.

Adult salmonids use the lower river principally as a migration corridor to spawning areas in the upper basin and tributaries. They are actively migrating and normally do not spend any time in the lower river resting or feeding. Chum salmon (Columbia River) and steelhead (Lower Columbia River) populations spawn in tributaries to the Columbia River, and chinook

Table 2. Summary of federally listed species or ESUs, critical habitat, listing status, and effects determination.

Run or Species	Scientific Name	Status	Effect	CH	CH Effect
Chinook salmon (Upper Col. R. Spr.)	*Oncorhynchus tshawytscha*	E	L	Yes	L
Chinook salmon (Snake River Fall)	*Oncorhynchus tshawytscha*	T	L	Yes	L
Chinook salmon (Snake R. Spr. and Sum.)	*Oncorhynchus tshawytscha*	T	L	Yes	L
Chinook salmon (Upper Willamette River)	*Oncorhynchus tshawytscha*	E	L	Yes	L
Chinook salmon (Lower Columbia River)	*Oncorhynchus tshawytscha*	E	L	Yes	L
Steelhead (Snake River Basin)	*Oncorhynchus mykiss*	T	L	Yes	L
Steelhead (Middle Columbia River)	*Oncorhynchus mykiss*	T	L	Yes	L
Steelhead (Upper Willamette River)	*Oncorhynchus mykiss*	T	L	Yes	L
Steelhead (Lower Columbia River)	*Oncorhynchus mykiss*	T	L	Yes	L
Steelhead (Upper Columbia River)	*Oncorhynchus mykiss*	T	L	Yes	L
Chum salmon (Columbia River)	*Oncorhynchus keta*	T	NL	Yes	L
Sockeye salmon (Snake River)	*Oncorhynchus nerka*	E	L	Yes	L
Coho salmon (Lower Columbia River)	*Oncorhynchus kisutch*	T	L	No	
Steller sea lion	*Eumetopias jubatus*	T	NE		
Blue whale	*Balaenopter musculus*	E	NE		
Finback whale	*Balaenoptera physalus*	E	NE		
Sei whale	*Balaenoptera borealis*	E	NE		
Sperm whale	*Physeter macrocephalus*	E	NE		
Humpback whale	*Megaptera novaeangliae*	E	NE		
Right whale	*Balaena glacialis*	E	NE		
Loggerhead sea turtle	*Caretta caretta*	T	NE		
Green sea turtle	*Chelonia mydas*	T	NE		
Leatherback sea turtle	*Dermochelys coriacea*	E	NE		
Pacific Ridley sea turtle	*Lepidochelys olivacea*	T	NE		
Brown pelican	*Pelicanus occidentalis*	T	NE		
Western snowy plover	*Charadrius alexandrinus nivosus*	T	NE		
Bald eagle	*Haliaeetus leucocephalus*	T	NE		
Marbled murrelet	*Brachyramphus marmoratus m.*	T	NE		
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	E	NE		
Oregon silverspot butterfly	*Speyeria zerene hippolyta*	T	NE		

T = Threatened E = Endangered L = Likely to adversely affect NL = Not likely to adversely affect NE = No Affect

salmon (Lower Columbia River) spawn in the mainstem Columbia River in gravel of appropriate size. No spawning would occur in the vicinity of the proposed demonstration activities because of lack of tributaries and appropriate sized gravels.

Juvenile salmonids occur in the lower river during their out-migration to the ocean. Juveniles that have already become smolts are present in the lower river for only a short time period. Juveniles that have not become smolts such as chinook sub-yearlings spend extended periods of time rearing in the lower river. They normally remain in the lower river or estuary until fall or the following spring when they become smolts and then migrate to the ocean. Rearing occurs primarily in the shallow backwater areas.

The demonstration would start on or after July 15th and all work would be completed by September 15th. Migratory adults that could be entering the Columbia River in the vicinity of the work during this time include chinook salmon (Snake River fall run and Lower Columbia River), and sockeye salmon (Snake River).

Juvenile stages of all fish ESUs listed above with the exception of chum salmon (Columbia River) could occur in the vicinity of the work during the work window (July 15th through September 15th). Juvenile chum salmon out-migrate during spring, earlier than the start date of the proposed demonstration, and are not expected to be in the vicinity during the timeframe of the work.

A number of entrainment studies have been conducted to assess the potential for entrainment of salmonids during the dredging process. The only documented entrainment of salmonids occurred during a study in which the dredge draghead was operated while elevated in the water column instead of on the channel bottom. Only three individuals were collected and they were hatchery fish from the lower river (R2 Resource Consultants 1999). In a study done by Larson and Moehl (1990) at the MCR over a 4-year period, no juvenile or adult salmonids were entrained during normal dredging operations. Pearson et al. (2003) also found that no juvenile salmonids were entrained. The consensus of these and other studies (McGraw and Armstrong 1990, Buell 1992) is that dredging will occur below the depth where salmonids migrate. Although salmonids can occur throughout the water column, most migrate in the upper 20 feet of the water column (Bottom et al. 2001). Juvenile ocean-type salmon, in particular, tend to stay in the channel margins or shallow, shoreline areas.

The Corps' dredging procedures call for the draghead to be buried in the sediment of the riverbed during dredging operations or raised no more than 3 feet off the bottom when the pumps are running to further reduce the potential for fish entrainment. Adult salmonids have sufficient swimming capacity to avoid entrainment by dredging if they are present in the vicinity of dredges and if the draghead is above the riverbed when operating

Excavation of the sump in the Sump and Pump Ashore Alternative is not expected to impact migrating adult fish that could occur in the vicinity of the demonstration during the time of the work. However, the excavation could potentially entrain juvenile salmonids, although they are typically expected to occur higher in the water column and would be entrained only infrequently, if at all. Juvenile chinook salmon would likely be the most affected because they rear extensively in the Columbia River Estuary as juveniles before smolting in the estuary and then entering the ocean. Healey 1982 (cited in Bottom et al. 2001) proposed that chinook salmon is the most estuarine dependent of the salmonid species. Steelhead, coho, and sockeye salmon enter the estuary as smolts and do not rear there extensively before entering the ocean. Chances of entrainment of steelhead, coho, and sockeye salmon are less than chinook salmon, but is possible since they may be holding in this area waiting for an outgoing tide to carry them to the ocean.

As with excavation of the sump, filling of the sump is not expected to impact migrating adult fish that could occur in the vicinity of the work. The STFATE model (Johnson 1990) has been used by the Corps to estimate various parameters that describe dredged material dynamics during placement in open water using a split-hull hopper dredge (Corps 2005b). For ocean disposal, it has been estimated that disposal impacts on a 6-inch fish would primarily be the drag force or downward force of the disposal plume. The fish would sustain this force if it resists being entrained by the plume. If the fish does not resist the force, it would most likely be displaced by the leading edge (boundary layer) of the plume. Boundary layer effects of the plume would be expected to keep such a fish from being pulled into the plume. If the fish was entrained within the plume, however, the boundary layer established as the plume hits bottom would likely keep the fish from impacting directly on the bottom; the fish would be displaced laterally, parallel to the bottom. Effects would likely be more severe for smaller fish, such as sub-yearling juvenile chinook salmon, as they may be more susceptible to injury from forces resulting from disposal.

The disposal of sand on Benson Beach for the Direct Pump Ashore and the Sump and Pump Ashore Alternatives is expected to have no impact on listed salmonids as they are not typically found in the surf zone as adults or juveniles and because they are very mobile and would be expected to avoid the area during disposal.

The Direct Pump Ashore Alternative has the potential to have some impact on ESA-listed juvenile salmonids because of the 2 water intake openings which draw in water to create a slurry of sand and water for the pump ashore activity. The intakes for the hopper dredges are located, one on each side, near the bottom of the dredge. When the dredge is fully loaded, the intake openings are located between 20 and 28 feet deep depending on which hopper dredge is used. The water intakes draw water at a speed of 0.5 to 1.0 ft per second. There is expected to be a crossing flow (motion of ambient water column passing the intake) of 0.5 to 2.0 ft/sec. Adult salmonids would most likely be able to avoid or resist the force of the intake suction. The dredge rises in the water as the hopper is emptied. Depth of the empty dredge is from 13 to 20 feet deep. The intake openings on each side of the hopper are 24 to 36 inched in diameter. It should be noted that the duration of pumping for the pump-ashore operation for each hopper dredge load is approximately 30 to 60 minutes and would occur at intermittent intervals up to 6 times a day.

The Nearshore Placement Alternative would have little to no impact on salmonids, as juveniles are most likely to be nearer the surface than the bottom of the hopper when it begins its disposal.

Within the vicinity of the proposed demonstration, Critical Habitat for salmonids includes the Columbia River from a straight line connecting the west end of the MCR South Jetty and the west end of the MCR north jetty upriver, and including the location of the proposed sump.

The only alternative that would potentially impact Critical Habitat for salmonids is the Sump and Pump Ashore Alternative. Dredging and the subsequent discharge of material to refill the sump could cause temporary increases in turbidity and could disturb or result in death of some prey items, such as zooplankton, that juvenile salmonids utilize. This activity could result in direct impacts to juvenile salmonids but more likely would result in indirect impacts by causing temporary water quality disturbance, forced movement into adjacent waters, and negative impacts to food resources.

Cultural Resources

There are no recorded historic properties within the immediate vicinity of the work. The area has been so extensively modified by modern development that little likelihood exists for the proposed work to impact any undisturbed historic property.

Adjacent to the disposal site is the Cape Disappointment State Park. A May 2003 Cultural Landscape Report for the Cape Disappointment State Park area provides a broad overview of the wide array of historical resources at the Park, including military structures, lighthouses and cultural landscapes. It identifies four categories of cultural landscapes: Historic Sites, Historic Designed Landscapes, Historic Vernacular Landscapes, and Ethnographic Landscapes. It also identifies the Park as a single cultural landscape with multiple periods of significance and component landscapes (Washington State Parks & Recreation Commission 2005). However the only portion of the proposed work that will be conducted in or near the park is the beach disposal. The disposal activity should have no impact on the cultural resources in the adjacent park. The placement of sand on the beach would not disturb anything below the existing substrate. The only disturbance to the existing substrate would be to support the disposal pipe and/or bury it when it is put in place. However, the entire length of the pipe will be on the highly erosive beach and not near any known cultural resource sites.

Water Quality

The excavation of the sump should have minimal effect on water quality at the site of sump excavation. The dredging technique used to create the sump would be cutter head dredging which uses a suction action that will minimizes the introduction of sediment into the water column. The discharge of material to refill the sump would be the most likely to cause some turbidity. The refilling will be done with a hopper dredge. The disposal of material from the hopper creates a diffusive plume near the bottom. However, the material to be disposed of is primarily sand with only a small percentage of fines, so the plume will dissipate very quickly. The impact to water quality of each hopper discharge is highly localized and of a short duration. The cumulative impact of the complete refill of the sump would be minimal in that the water quality impacts of each discharge would be completely ended before the hopper returns with its next load for discharge. It should also be noted that the hopper does not go to the exact same location for subsequent discharges. During the sump refill process, every effort will be made to prevent an uneven buildup of disposal material at any portion of a disposal area.

The Direct Pump Ashore Alternative would only cause water quality impacts where the material is discharged onto Benson Beach. This discharge will increase turbidity in the surf zone as sand is deposited both directly into the water and/or subsequently moved by large earth-moving equipment into the water. The turbidity plume is not expected to extend outside of the immediate discharge area because the material is sand with only a small amount of fines, which settles to the bottom very quickly where it is subsequently moved with the waves and currents like all beach sand. This impact to water quality would be for the beach disposal portion of both the Sump Alternative and the Direct Pump Ashore Alternative.

The Nearshore Placement Alternative calls for the use of a hopper dredge to dispose of material offshore in water between 40 and 60 feet deep in the nearshore placement zone. As stated above, the disposal of any dredged material from the hopper dredge creates a diffusive plume near the bottom. However, when the material dropped is sand, the plume falls very quickly and is not immediately dispersed away from the disposal site with the currents in the way that finer sediments may be. The impact to water quality of each hopper discharge of sand is highly localized and of a short duration. The cumulative impact to the nearshore disposal area would be minimal, in that the WQ effects of each discharge would be dissipated before the hopper returns with its next load for the next discharge. As with the Sump Alternative described above, the hopper would not go to the same location within the discharge area for subsequent discharges.

Air Quality and Noise

The Benson Beach disposal activity would introduce noise near the discharge end of the pipe due to the discharge spray and the use of heavy earth-moving equipment (especially the backup beepers) to spread the sand. It is likely that the noise would be muted by the sound of the surf. There would also be noise associated with the operation of the dredge at the sump site which is closer to the jetty than the navigation channel, however, there would be no more noise than is commonly associated with dredging. The only difference is that it would be closer to human activity than the already approved dredging operation. With the restricted access near the disposal pipe, there should be little or no human activity in the vicinity of the work.

There would be a temporary and localized reduction in air quality during construction of the proposed action due to emissions from the dredge and from the earth-moving equipment at Benson Beach. There also would be temporary and localized increases in noise levels from this equipment. These impacts would be minor and temporary in nature, and would cease once the dredging/disposal activity is completed. The nearshore disposal operation would not impact air quality or noise levels above the current practice.

Utilities and Public Services

NO EFFECT

Land Use

NO CHANGE

Recreation

During the process of disposal on Benson Beach there will be no access to the water's edge for the entire length of the disposal pipe. The area will be only temporarily closed to public use. The length of time the beach and jetty will be inaccessible to the public will depend on which alternative is selected. The Sump Alternative would allow the beach placement to be done most quickly (2-3 weeks). The direct pump-ashore would require that the beach placement pipeline be in place for a longer period of time (4-8 weeks). The Nearshore Placement Alternative will cause little or no impact to recreation. The sump creation/refill and direct pump ashore activities would not impact recreation at the dredge end of the disposal pipe except for the temporary displacement of fishermen and/or crab traps in the immediate vicinity of the dredge while the operation is taking place. The placement of material on Benson Beach could become an annual event which would impact recreation in this area each summer for a period from several weeks to as long as two month.

Hazardous, Toxic, and Radioactive Waste

NO EFFECT

Aesthetics

The impacts to aesthetics are similar to those for recreation. The beach placement pipe and construction activity related to the management of the discharged material will have the most significant effect on aesthetics. The Sump Alternative will allow the removal of the disposal pipe sooner than would be possible with the Direct Pump Ashore Alternative, thus causing a shorter duration of aesthetic impacts at the disposal location. The Nearshore Placement Alternative would have no adverse aesthetic effects. This alternative is not likely to increase turbidity close to shore as the hopper load will quickly fall out of the water column at the disposal site no closer that ½ mile from shore. The dredging and disposal activity at the sump would have little to no aesthetic impact. The Direct Pump Ashore Alternative would also have little to no aesthetic impact at the dredge end of the placement pipeline.

5. Environmental Effects

Table 3. Effects decision matrix for demonstration alternatives

Option	**Beach/Sand**	**Dungeness crab**	**ESA Species**	**Cost**	**Safety**	**Water Quality**
No Action	No change	No change	No change	No change	No change	No change
Sump & Pump	4500' pipe with partial burial	No change	No change except for hopper disposal in sump	Estimated to be $4.3 million for one year	Danger of dredge operating near jetties and weather related conditions	Impact in surf zone as well as during sump refill
Direct Pump Ashore	4500' pipe with partial burial	No change	Impact due to water intake to create slurry.	Estimated to be $2.8 million for one year	Danger of dredge operating near jetties	Impact in surf zone only
Nearshore Disposal	No impact	Impacts at disposal	Little to no effect	Same as Deep Water Site		Impact at disposal site is minimal

Direct Pump Ashore – This method of feeding the SW Washington Littoral Drift with additional sand would cause environmental impacts to the Benson Beach disposal area as well as some impacts at the dredge end of the disposal pipe. One of the most significant impacts at the beach disposal site is the aesthetic/recreational impact during the disposal. Another impact is to the surf zone benthic community located adjacent to the intertidal discharge area of Benson Beach, although this impact is expected to be small because it is a low-density benthic community that populates this high energy environment. Most other species found in the disposal area would be able to avoid the disposal activity. The water intake into the dredge, which is needed in order to resuspend the sand into a slurry so that it can be pumped ashore, is also a possible source of adverse impact. The water intake is located along the bottom of the hopper dredge. For a fully loaded hopper dredge, the depth of the intake would be located about 28 to 22 ft below the water surface, depending on which dredge is used. As the hopper dredge load is pumped ashore, the draft of the hopper dredge decreases: The hopper dredge intake would rise to about 20 to 13 ft below the water surface over the duration of the pump-ashore operation (a period of 30 to 60 minutes per load). There is the potential to entrain fish in the hopper through water intake during the direct pump-ashore activity.

Sump and Pump Ashore – As with the Direct Pump Ashore Alternative, this alternative would impact the aesthetics and recreation at Benson Beach as well as the surf zone benthic community, adjacent to the inter-tidal discharge location. However, these impacts would be for a shorter continuous duration because the beach disposal would only take place during the sump excavation process and would not be on-going during the sump refill process. The impacts at the dredge end of the disposal pipe would primarily be related to the possible entrainment of crabs and ground fish as the sump is excavated, and possible burial of those same species when the hopper dredge is used to refill the sump.

Nearshore Placement – This placement method would have none of the aesthetic effects of the Benson Beach Placement. The primary impact would be to crabs and groundfish found in the disposal area. There would also be some impact to recreational and commercial crabbing in the area in that traps/pots would need to be moved for the duration of the activity.

No Action – This alternative would mean no change to the current practice of dredge disposal for the MCR. Current practice is to place some portion of the sand dredged into the Deep Water Site which means that some sand is lost to the Littoral Drift systems found at the MCR.

6. Consultation Requirements

National Environmental Policy Act

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

Endangered Species Act

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

Clean Water Act
Section 401 of the Clean Water Act of 1977, as amended, requires certification from the state or interstate water control agencies that a proposed water resources project is in compliance with established effluent limitations and water quality standards. The proposed action is expected to be in compliance with the Clean Water Act and will undergo public review under both Sections 404 and 401 with the review process required for issuance of a Section 401 Water Quality Certification from Washington Department of Ecology. A Section 404(b)(1) evaluation is being prepared for the proposed action and will be provided to WDOE. In addition, a NPDES permit will be obtained for the proposed action from EPA.

Clean Air Act
The Clean Air Act of 1970, as amended, established a comprehensive program for improving and maintaining air quality throughout the United States. Its goals are achieved through permitting of stationary sources, restricting the emission of toxic substances from stationary and mobile sources, and establishing National Ambient Air Quality Standards (NAAQS). Title IV of the Act includes provisions for complying with noise pollution standards. As discussed in Section 4, there would be a temporary and localized reduction in air quality during construction of the proposed action due to emissions from construction equipment. There also would be temporary and localized increases in noise levels from construction equipment. These impacts would be minor and temporary in nature, and would cease once the dredging/disposal is completed.

National Historic Preservation Act
Section 106 of the National Historic Preservation Act requires that a federally assisted or federally permitted projects account for the potential effects on sites, districts, buildings, structures, or objects that are included in or eligible for inclusion in the National Register of Historic Places. This demonstration is being conducted in an area that is highly erosive and has previously been disturbed by jetty construction and prior dredging. There are no recorded historic properties within the immediate vicinity of the work. However, the proposed action will be coordinated with the Washington SHPO in order to obtain a Section 106 evaluation in accordance with the act.

Native American Graves Protection and Repatriation Act
The Native American Graves Protection and Repatriation Act (NAGPRA) provides for the protection of Native American and Native Hawaiian cultural items, established ownership and control of Native American cultural items, human remains, and associated funerary objects to Native Americans. It also establishes requirements for the treatment of Native American human remains and sacred or cultural objects found on federal land. This Act also provides for the protection, inventory, and repatriation of Native American cultural items, human remains, and associated funerary objects. This work is being conducted in an area that is highly erosive and has previously been disturbed by jetty construction and prior dredging. There are no recorded historic properties within the immediate vicinity and the probability of locating human remains

in this area is very low. However, if human remains are inadvertently discovered during the activity, the Corps and/or contractor will be responsible for following all NAGPRA requirements.

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

Comprehensive and Environmental Response, Compensation and Liability Act
The location of the proposed work is not within the boundaries of a site designated by the USEPA or the State of Washington for a response action under Comprehensive and Environmental Response, Compensation and Liability Act (CERCLA), nor is it a part of a National Priority List site under CERCLA. Should any hazardous or toxic waste material be discovered during the proposed activity, its presence will be responded to within the requirements of the law and Corps' regulations and guidance.

Executive Order 11988, Floodplain Management
This executive order requires federal agencies to consider how their actions may encourage future development in floodplains, and to minimize such development. The proposed action would have no effect on floodplains.

Executive Order 11990, Protection of Wetlands
This executive order requires federal agencies to protect wetland habitats. The proposed action would have no effect on wetlands.

Executive Order 12898, Environmental Justice
This executive order requires federal agencies to consider and minimize potential impacts on subsistence, low-income or minority communities. The goal is to ensure that no person or group of people should shoulder a disproportionate share of the negative environmental impacts resulting from the execution of this country's domestic and foreign policy programs. This proposed action is in compliance with Executive Order 12898.

Analysis of Impacts on Prime and Unique Farmlands
No change to prime and unique farmlands would occur from the proposed action.

Migratory Bird Treaty Act and Migratory Bird Conservation Act
These acts require that that migratory birds not be harmed or harassed. This work may temporarily displace birds from the disposal area at Benson Beach, but the activity will be short-term and very localized in nature and would not rise to the level of harassment or harm. The impact to migratory birds is expected to be very minimal.

Marine Mammal Protection Act
This act prohibits the take or harassment of marine mammals. This work is not expected to impact marine mammals.

Coastal Zone Management Act
This act requires federal agencies to comply with state and local plans to protect and enhance coastal zones and shorelines. The activity will be coordinated with the state and local entities in accordance with the act.

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Appendix A:

Best Management Practices

(BMPs)

for Dredging and Disposal

Impact Minimization Practices and Best Management Practices for Dredging			
Measure	**Justification**	**Duration**	**Management Decision**
Hopper Dredging			
Maintain dragheads in the substrate or no more than 3 feet above the bottom with the dredge pumps running.	This restriction minimizes or eliminates entrainment of juvenile salmon during normal dredging operations.	Continuous during dredging operations.	Maintain until new information becomes available that would warrant change.
No dredging will be done in shallow water areas (less than 20 feet).	Areas less than 20 feet deep are considered salmon migratory habitat. Dredging or disposal in these areas could delay migration or reduce or eliminate food sources.	Continuous during dredging and disposal operations.	Maintain until new information becomes available that would warrant change.
Pipeline Dredging			
Maintain cutter head in the substrate or no more than 3 feet above the bottom with the dredge pumps running.	This restriction minimizes or eliminates entrainment of juvenile salmon during normal dredging operations.	Continuous during dredging operations.	Maintain until new information becomes available that would warrant change.
No dredging will be done in shallow water areas (less than 20 feet.	Areas less than 20 feet deep are considered salmon migratory habitat, Dredging or disposal in these areas could delay migration or reduce or eliminate food sources.	Continuous during dredging and disposal operations.	Maintain until new information becomes available that would warrant change.
General Provisions for All Dredging			
The contractor shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into the waterway.	Protection of water resources.	Life of contract or action.	If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water release shall be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response.
The contractor, where possible, will use or propose for use materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Disposal of hazardous waste.	Life of contract or action.	If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water release shall be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response.

Best Management Practices Used for Disposal

Measure	Justification	Duration	Management Decision
Shoreline Disposal			
Grade disposal site to a slope of 1:20 (5 percent) to facilitate movement of sand into the littoral drift system.	The objective of placement in this area is to provide sand for the littoral drift system that will nourish beaches along the SW Washington coast.	Continuous during disposal operations.	No maintenance necessary once disposal and grading of disposal material is complete.
General Provisions For All Disposal			
Dispose of hazardous waste.	The contractor, where possible, will use or propose for use materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal of this material will be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Life of contract or action.	If material is released, it will immediately be removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground will be excavated and removed, and the area restored as directed. Any in-water discharge will be immediately reported the nearest U.S. Coast Guard Unit for appropriate response.