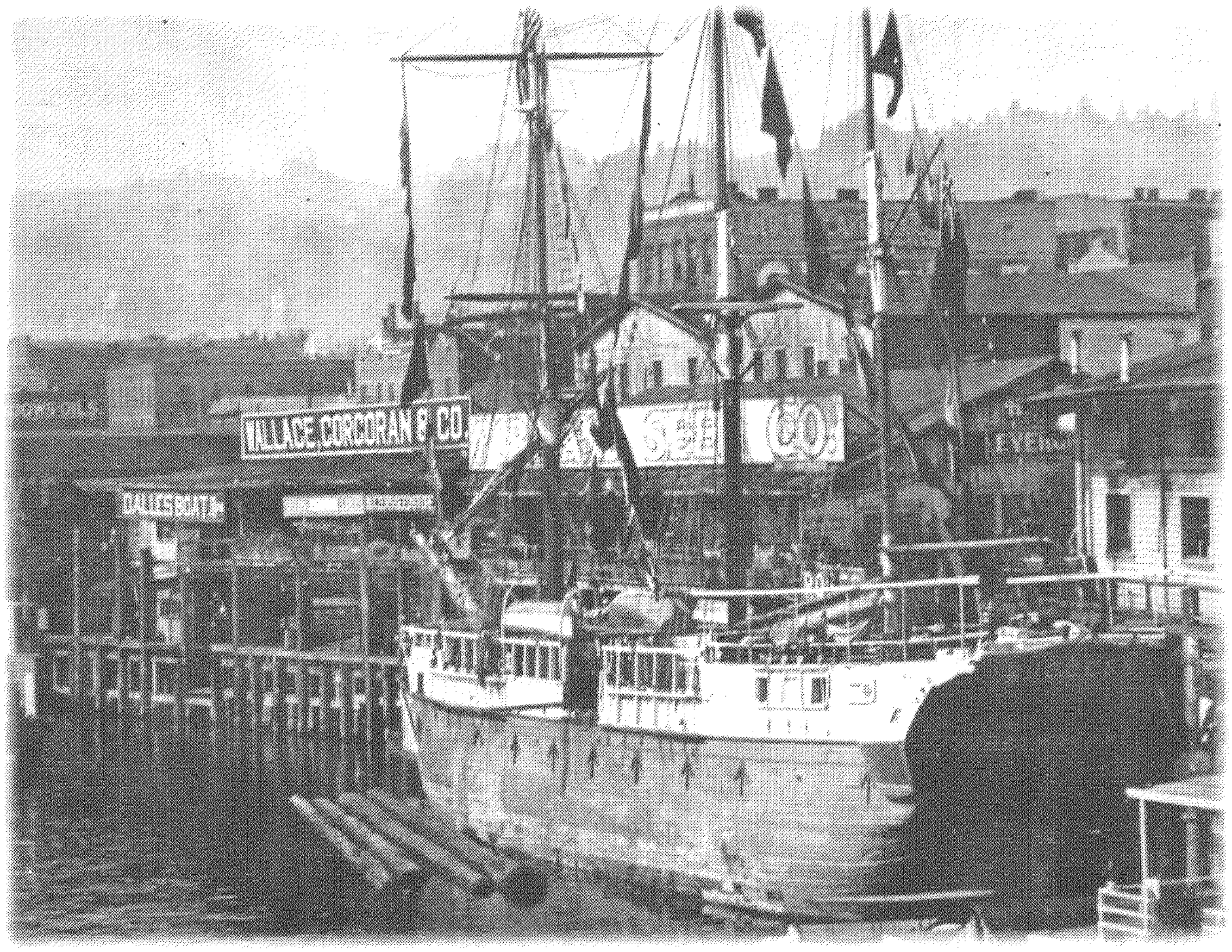
US Army Corps of Engineers®
Portland District

Appendix H, Volume I: Ocean Dredged Material Disposal Sites Main Report and Technical Exhibits

Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement

Columbia & Lower Willamette River Federal Navigation Channel



Portland Waterfront Circa 1900
Photo Courtesy of Port of Portland

August 1999

APPENDIX H
COLUMBIA RIVER
OCEAN DREDGED MATERIAL
DISPOSAL SITES

Volume I
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PURPOSE

This Ocean Dredged Material Disposal Site (ODMDS) appendix has been jointly prepared by the U.S. Army Corps of Engineers (Corps) and U.S. Environmental Protection Agency (EPA) as part of the *Columbia River Channel Improvement Feasibility Study with Integrated Environmental Impact Statement* (CRCIS). This CRCIS and especially this appendix proposes for final designation by EPA two ODMDSs needed for long-term use by the authorized Columbia River navigation projects. These federally-authorized navigation projects include maintenance of the 5 mile long [river mile (RM) +3 to RM -2] Mouth of the Columbia River (MCR) project; maintenance of the existing 40-foot navigation channel (RM +3 to Portland) as described in the *final Dredged Material Management Plan and Supplemental Environmental Impact Statement* (USACE, 1998); and the potential construction and maintenance of the proposed navigation channel improvements as described in the CRCIS. The ODMDSs also would be available for material dredged from non-Corps dredging projects by obtaining the appropriate permits through the Corps' Regulatory program.

Currently, there are four EPA-designated MCR Sites (A, B, E, and F shown in Figure 1) which were formally designated by EPA in 1986 following publication of a final Environmental Impact Statement (EIS) in 1983 and draft and final Rules in the Federal Register. Mounding at Sites A and B were determined to constitute unacceptably adverse and potentially hazardous conditions by both the Corps and EPA and disposal at those two designated sites was ceased. Studies and other evaluations were initiated to develop a comprehensive dredged material management plan that included consideration of designation of new ODMDSs. As an interim measure specifically intended to maintain navigability to and from the Columbia River channel via the MCR project, all four sites were expanded in 1993 and/or 1997 (Corps/EPA Environmental Assessments (EA) 1993 and 1997) under the Corps' Section 103 site identification authority while the Corps and EPA pursued the process described in the CRCIS and this appendix which will ultimately result in formal designation of new ODMDSs with a site management and monitoring plan offshore of the MCR. The four existing sites would be de-designated by EPA and the Corps' Section 103 expansions allowed to expire.

Nearly all dredged material placed in the four existing sites, which has averaged about 4.5 mcy per year during the years 1992 to 1996, has been from the MCR project. Because of the historic and predominate use of the ODMDSs for placement of dredged material from the MCR project the information presented in this appendix focuses on this project. However, Columbia River estuary dredged material from either the existing or the proposed deeper navigation channel downstream of RM 30 will need to be transported to and disposed in

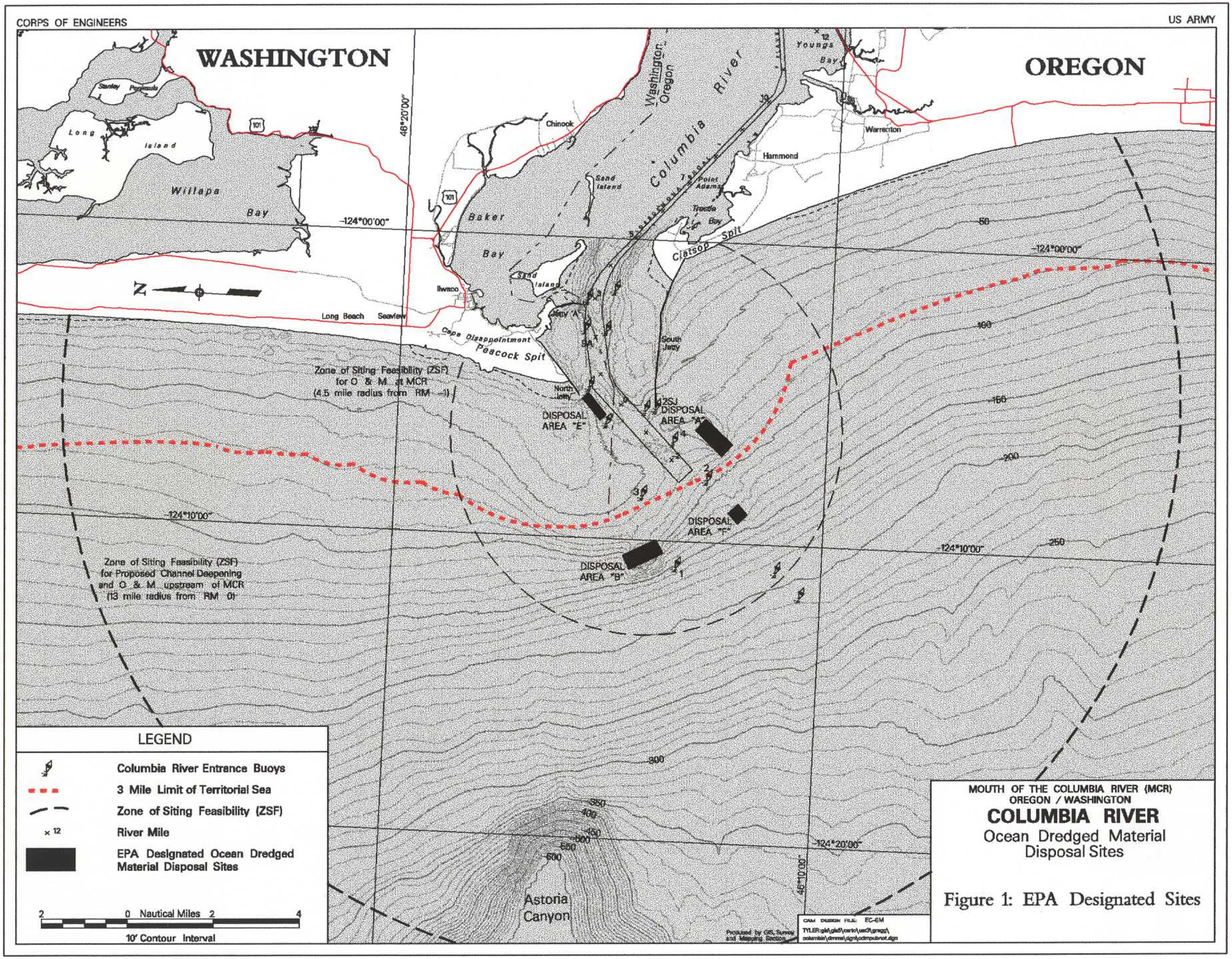


Figure 1: EPA Designated Sites

the ocean as existing estuarine disposal sites reach capacity. Non-Corps dredged material, which requires specific permitting, also may be disposed in the ocean. Final site designation by EPA creates permanent ODMDSs for the placement of dredged material from various dredging activities including federal and private sources. Designation in itself does not result in disposal of dredged material. A site designated for continued use is subject to restrictions listed in the site-designation document and subsequent designation regulations, permit, or site management and monitoring plan (Exhibit H). Actual site use may be limited by restricting placement methods, area of the site used, timing of placement, or quantity and type of material to be placed at the ODMDSs. Sites may be de-designated by EPA.

STATUTORY AND REGULATORY REQUIREMENTS

The Marine Protection, Research and Sanctuaries Act of 1972, as amended (MPRSA), also known as the Ocean Dumping Act, was passed in recognition of the fact that the disposal of material into ocean waters could potentially result in unacceptable adverse environmental effects. Under Title I of the MPRSA, the EPA and the Corps were assigned responsibility for developing and implementing regulatory programs to ensure that ocean disposal would not "... unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."

The EPA administers and enforces the overall program for ocean disposal. Under Section 102 of the MPRSA, the EPA in consultation with the Corps, established environmental criteria that are to be addressed before an ocean dredged material disposal permit can be granted. The Corps issues permits for the transportation of dredged material for the purpose of ocean disposal, after consultation with the EPA, that is in compliance with these criteria. While the Corps does not administratively issue itself a permit, the requirements that must be met before dredged material derived from Corps projects can be discharged into ocean waters are the same as those where a permit would be issued.

The MPRSA Criteria (40 CFR, Part 228) states that final site designation under Section 102(c) must be based on environmental studies of each site and on historical knowledge of the impact of dredged material disposal on areas similar to such sites in physical, chemical, and biological characteristics. General criteria (40 CFR 228.5) and specific factors (40 CFR 228.6) that must be considered prior to site designation are described and evaluated in this appendix. Related federal statutes applicable to the site designation process include the National Environmental Policy Act of 1969, as amended; the Coastal Zone Management Act of 1972 as amended; the National Historic Preservation Act and the Endangered Species Act of 1973, as amended. As required by Section 104(a)(3) of the MPRSA, ocean disposal of dredged material can occur only at a site that has been designated to receive dredged material. Pursuant to Section 102(c), the EPA has the responsibility for site designation. Section 103(b), while encouraging use of EPA-designated sites where feasible, does provide for alternative site selection by the Corps when a suitable EPA-designated site is not available. However, the same Ocean Dumping Criteria (40 CFR 228.5 -6) are used in the evaluation process that leads to alternative site selection and the EPA must concur with the selection.

An EPA-designated site requires a site management and monitoring plan. Use of the designated site is subject to any restrictions included in the management and monitoring plan and EPA's designation regulations. These restrictions are based on an in-depth evaluation of the site pursuant to the regulations (40 CFR 220-229) and potential disposal activity as well as public review and comment. Designation of an ODMDS in itself does not result in disposal of dredged material. A separate evaluation of the suitability of dredged material for ocean disposal must be undertaken for each proposed use of the site by either the Corps or non-Corps permit applicant. Typically this involves evaluation of the specific disposal activity under the Criteria, circulation of a *Public Notice* (which can include multiple years of use), and specific coordination with stakeholders as well as concurrence by the appropriate EPA Region.

The process followed by the Corps and EPA complies with the procedures required in 40 CFR, Parts 228.4(e), 228.5, 228.6, and 228.9. Technical information used to demonstrate compliance with these criteria and factors are contained in this and other appendices to the EIS and their exhibits. The CRCIS EIS and appendices provides sufficient information to determine compliance with the Coastal Zone Management Act, the Endangered Species Act, the National Environmental Policy Act, and the National Historic Preservation Act of 1966, as amended, with regard to ODMDS designation.

NEED

The basis for determination of need for ocean dumping is found in 40 CFR 227 subpart C of the implementing regulations (40 CFR 227.14-16). A need for ocean dumping is considered to have been demonstrated when a thorough evaluation of factors listed in Section 227.15 has been made and when there exist no practicable improvements in technology or treatment, and there are no practicable alternative locations and methods of disposal or recycling available. Notwithstanding compliance with other subparts of the regulations (e.g., the Criteria) ocean dumping may be denied or terminated on the basis of available alternatives and lack of need for the dumping. An initial finding of need for ocean dumping of dredged material from the MCR project was made as part of the EIS and rulemaking that designated the original four ODMDSs. In the intervening years since that initial determination there has been no substantial change in technology or treatment for the material itself or identification of practicable alternative locations or methods of disposal that alter the original conclusion.

The availability of ODMDSs in the vicinity of the MCR are necessary to maintain deep-draft, international commerce and navigation through authorized federal channels and permitted actions. Existing ODMDSs designated by EPA in 1986 have experienced mounding, generating a potentially hazardous navigation safety condition, and have limited site capacity to receive future dredge material disposals. The developing mounds at Sites A, B and F threatened to create a hazardous condition for large ships and small craft due to waves refracting from and breaking over the mounds. Commercial shippers, crab fishermen, and the US Coast Guard expressed concern over this situation to both the Corps and EPA. As stated in the Corps/EPA 1993 EA: "While the current situation does not constitute an imminent hazard to life and property which would warrant an emergency, the EPA and the Corps are in agreement that prudent management action is required in order to prevent a situation from developing." Efforts were undertaken by the federal government to temporarily expand existing sites in 1993 and 1997 and to manage distribution of the maintenance dredged material within the available site capacities while seeking a more permanent management solution. That management solution and the process by which it emerged are described in the CRCIS and this appendix. The need for ocean dumping and implementation of the Corps' and EPA's management solution are at a point where the ability to maintain the MCR project is at risk and, by extension, all deep-draft navigation commerce into and out of the existing Columbia River Channel. Unless the MCR project can be maintained, continued commercial use of the existing navigation channel at its authorized depth would not be possible.

The MCR federal navigation project was authorized for the following purposes:

- Provide an entrance channel, which would allow the upriver channel to be fully utilized.
- Decrease tide-caused delays for commercial ships crossing the bar.
- Provide improved safety by reducing the possibility of commercial ship grounding and a channel that allows for compatible use by commercial and noncommercial vessels.

The purposes of the Columbia and Lower Willamette Rivers federal navigation project are to:

- Provide a deep-draft navigation channel on the Columbia and lower Willamette Rivers between the Pacific Ocean and Portland Oregon.
- Provide deep-draft turning basins at various locations.
- Provide side channels at various locations.

Maintenance of the federal navigation projects to their authorized depths is critical to keeping the entrance, river, and harbor open and sustaining vital components of the national and regional economies. Ocean placement of dredged materials, principally from the MCR and lower estuarine portion of the river channel is required for the continued maintenance of these projects. The rough seas encountered at the MCR entrance preclude the safe and efficient operation of any dredge other than a hopper dredge. Upland disposal of dredged material from a hopper dredge operation is not economical due to the need to double handle the material and sufficient upland capacity is unavailable near the MCR. Disposal of material dredged from the MCR, therefore, must occur at an in-water site. Columbia and Lower Willamette Rivers (or River Channel) dredging has traditionally been accomplished by hopper and pipeline dredges and dredged material has been disposed of in-water, in the ocean, and at upland locations along the river.

While it is possible to dredge and transport material from the MCR back into the Columbia River estuary for disposal, there is an increasing lack of suitable estuarine and upland disposal sites as existing sites reach or have reached capacity from material dredged from the river channel. Further, estuarine habitats are unique and far less extensive than are nearshore oceanic habitats. Estuarine disposal would cause greater adverse environmental impacts than would ocean disposal.

Table 1 provides dredged material volumes estimated for the MCR project, and estimated total disposal quantity for the long-term maintenance dredging of the 40-foot Columbia River navigation channel, and an estimated quantity for the proposed 43-foot navigation improvement project over a 50-year evaluation period. The total estimated volume for ocean disposal would depend on whether the channel improvements are constructed. For the existing condition the total estimated volume would equal 245 million cubic yards [(mcy); 225 mcy for MCR plus 20 mcy for the 40-foot channel]. If the channel improvements were constructed the total estimated volume would equal 262 mcy (225 mcy for MCR plus 37 mcy for the 43-foot channel). The average annual volume estimate for each option results from dividing 50 into the total and is 4.9 mcy and 5.24 mcy, respectively.

Table 1. Estimated Ocean Disposal Volumes

MCR O&M	
Annual	**50 Years**
4.5 mcy	225 mcy

40-foot O&M		Total 40-foot Channel
1-20 years	**21-50 Years**	
8 mcy	12 mcy	20 mcy

Construction 1/	43-foot O&M		Total 43-foot Channel
	1-20 years	**21-50 Years**	
7 mcy	9 mcy	21 mcy	37 mcy

1/ Includes 40 foot maintenance volume

Though the volume is expected to be minor compared to the federal dredging volumes, the designated sites may receive material dredged by non-Corps entities and disposed under specific permits issued by the Corps. With the fundamental need for ocean dumping having been demonstrated, the Corps and EPA had to consider the needed disposal capacity which influences the number and/or size of site(s). This evaluation was iterative and was revised several times by the federal government through the site designation work group process.

Total capacity of the three sites is undefined, as Site E and the North Jetty Site are dispersive. Dredged material placed at these locations is expected to move out of the site and feed the littoral system. Actual annual capacities at these sites will vary depending on the volumes of material placed the previous dredging year and the erosive force of the Columbia River and Pacific Ocean currents and tides. Under a best case scenario, all material placed into these two sites each year would be eroded away. In the past, over 4 mcy of material was placed in a much smaller Site E in one instance during a single year. Accordingly, it is possible that the majority (and perhaps all) of the average annual volume of material could be placed in the North Jetty Site and Site E.

However, because the MCR is so dynamic, two scenarios present themselves which could limit use of these sites in any year: (1) dredge volumes necessary to maintain the two federal channels projects substantially exceed the planning estimate, or (2) dredge volumes do not erode sufficiently from one or both of the sites to provide sufficient capacity or only move a short distance from the sites, perhaps forming small mounds. Under such circumstances, use of the site(s) would be curtailed and the material must be placed elsewhere, demonstrating the need for at least one more ODMDS at the mouth of the Columbia River. For contingency planning purposes, an average annual volume of dredged material was estimated to be 4.5 mcy as a worst case that could not be disposed at the Site E and North Jetty Site.

In the draft EIS (DEIS) two large sites, the North Site and the South Site, were proposed where dredged sediments still could be placed within the more dynamic littoral zone nearshore [-60 to -40 feet Mean Lower Low Water (MLLW)] or dumped into deeper water. Due to their size, disposal capacity was considered unlimited. As a result of comments received on the DEIS and subsequent work group meetings, a single Deep Water Site was located and sized to accommodate almost a 50-year disposal capacity (225 mcy). This proposed Deep Water Site replaces the previously proposed North Site and South Site in the federal government's preferred action for management of dredged material at the mouth of the Columbia River. The need for designation of this site pursuant to 40 CFR 227 Subpart C is considered demonstrated.

OCEAN DISPOSAL AND LOWER COLUMBIA RIVER NAVIGATION

Background

The Columbia River flows into the Pacific Ocean at the boundary between Oregon and Washington. It is the second largest river in the United States in terms of river discharge. The river constitutes a navigable waterway for barge and deep-draft vessels transporting goods to and from Columbia River ports.

The course of the Columbia is 1,210 miles long, dropping over 2,600 feet from its Canadian headwaters to the sea, and drains about 250,000 square miles. The river is tidally influenced for 148 miles upriver to Bonneville Dam on the Columbia River mainstem and on the Willamette River to Willamette Falls at Oregon City, Oregon. Flow reversals can occur as far upriver as RM 76 near Kalama, Washington. The river's annual discharge is marked by a high seasonal variability, typically ranging from 100,000 to 400,000 cubic feet per second (cfs). The highest discharges occur during May through July due to snowmelt and rain runoff. Lowest flows occur during late summer and early fall.

The Columbia River entrance is characterized by exceptionally strong wave-current interactions. As a consequence, the river entrance has been recognized as one of the most dangerous coastal inlets in the world. The sea state at the river entrance during storm conditions can be characterized by high swells from the northwest to southwest combined with locally generated wind waves from the south to southwest. Such combined seas at the river mouth can be particularly dangerous to the mariner, especially when opposing ebb currents cause dramatic wave growth, steepening, and breaking incoming waves. The continental shelf break lies generally 20 miles offshore, except in the proximity of Astoria Canyon, which lies within 11 miles of the mouth of the Columbia River.

Historic Offshore Disposal (pre-1977)

Prior to 1885, the natural channel at the MCR averaged about 25 feet deep and shifted frequently. In order to maintain the 30-foot channel, (all project depths in MLLW) across the bar, the south side of the river entrance was jettied between 1885 and 1889. Hopper dredging was first conducted at the MCR in 1904 to maintain the authorized 30-foot channel. Dredging was performed on an intermittent basis, being a function of shoaling severity, bar conditions, and hopper dredge availability. Between 1905 and 1940, about 8.2 mcy of material had been dredged from the entrance and placed into open water by hopper dredge.

Consistent annual maintenance dredging and the use of specific ocean sites for the disposal of dredged sediment began in 1945. The need for annual dredging was based upon deeper draft requirements of ocean vessels and the need for reliable channel dimensions conforming to the authorized project. Between 1945 and 1955, approximately 13 mcy (average of 1.2 mcy per year) was dredged at the Columbia River Bar and placed in ocean or estuarine disposal sites. To address the needs of ocean navigation, the entrance channel was deepened to 48 feet in 1956. In 1984, the channel was deepened to its present authorized depth of 55 feet, with the southern 640 feet maintained to 48 feet. In its present configuration, the MCR project requires average annual dredging of 4 to 5 mcy of shoaled material (4.5 mcy is used throughout this document for estimation purposes) to maintain the authorized depth. The material dredged is sand, and most is transported into the navigation channel from the ocean.

From 1904 until 1958, dredged material was placed primarily offshore at an area one to two miles southwest of the south jetty in water depths of 60 feet (near the existing Site A). This area had historically been the primary location of dredged material disposal because of its location beyond the navigation channel in deep water where wind and wave conditions were favorable for hopper dredges to transit.

In 1958, the area near disposal Site A was discontinued based on recommendations of the Corps Committee on Tidal Hydraulics. These recommendations were based on field observations of bottom current in vicinity of Site A indicating a bottom flow predominately toward the navigation channel, and an assumption that shoaling on the outer bar was due to the return of dredged material placed in the site. From 1958 to 1971, the area near disposal Site A was not used for disposal. Disposal areas located further offshore in the vicinity of Sites B and F, were used more extensively. The area near disposal Site A was used intermittently for disposal from 1971 to 1977. From 1978 to 1994 Site A was used.

Current Offshore Disposal (post-1977)

In January 1977, ocean disposal Sites A, B, E, and F received interim designations when EPA issued the final Ocean Dumping Regulations (40 CFR 228). At this time, the boundaries for these rectangular disposal sites were fixed geographically in terms of corner coordinates. The interim sites were "sized" based on the objective to minimize the areal extent over which dredged sediments would affect the receiving water column and seabed during disposal.

The EPA completed an environmental impact statement (EPA, 1983) recommending the final designation of the four interim sites in February 1983. The 1983 EIS stated that "mounds of accumulated dredged sediment tend to spread laterally and flatten under the influence of bottom currents and wave-induced turbulence." The EIS acknowledged that the "loading-up" of disposal Site A during 1956 (12 mcy was placed in one year) did create a mounding problem and that concentrating dumping in one disposal site may aggravate sediment accumulation. The EIS concluded that continuation of ocean disposal of sediment dredged from the MCR project (about 6 mcy per year estimated in the 1983 EIS) would not have significant adverse impacts, as long as dredged material disposal was not limited to one disposal site (1983 EIS, p 2-23). Consequently, the areal extent of the final designated sites was the same as for the interim sites.

Sites A, B, E, and F received final designation in August 1986 (51 *Federal Register* 29923-29927). The size of the designated ODMDSs was based on the objective to minimize the area of potential benthic impacts. The coordinates of the 1986 EPA designated sites are as follows (North American Datum, 1983):

Site A
Corner Coordinates:
46° 13' 03" N, 124° 06' 17" W
46° 12' 50" N, 124° 05' 55" W
46° 12' 13" N, 124° 06' 43" W
46° 12' 26" N, 124° 07' 05" W

Dimensions: 5,000' x 2,000'
Azimuth (long axis): 225° T
Average Depth: 65'

Site B
Corner Coordinates:
46° 14' 37" N, 124° 10' 34" W
46° 13' 53" N, 124° 10' 01" W
46° 13' 43" N, 124° 10, 26" W
46° 14' 28" N, 124° 10' 59" W

Dimensions: 5,000' x 2,000'
Azimuth (long axis): 332° T
Average Depth: 110'

Site E
Corner Coordinates:
46° 15' 43" N, 124° 05' 21" W
46° 15' 36" N, 124° 05' 11" W
46° 15' 11" N, 124° 05' 53" W
46° 15' 18" N, 124° 06' 03" W

Dimensions: 4,000' x 1,000'
Azimuth (long axis): 229° T
Average Depth: 60'

Site F
Corner Coordinates:
46° 12' 12" N, 124° 09' 00" W
46° 12' 00" N, 124° 08' 42" W
46° 11' 48" N, 124° 09' 00" W
46° 12' 00" N, 124° 09' 18" W

Dimensions: 1,800' x 1,800'
Average Depth: 125'

Since 1977, Sites A, B, E and F have been the primary locations where MCR dredged material (sand) has been placed. Between 1977 and 1987, most of the sediment dredged was placed in Sites A and E. Beginning in 1984, use of Site B was increased. In 1988 the Corps voluntarily restricted the volume of dredged material placed in Site E to one mcy per year to limit possible transport of material eastward back into the estuary or southward into the channel. The increase in use of Site E since 1997 is partially in response to a request from the Washington Department of Ecology to retain sand in the nearshore littoral system and retard erosion of the coastal beaches to the north.

From 1991 to 1996, Site B received most of the dredged material from MCR. Use of Site F began in 1989, motivated by the need to dispose of sediments dredged from locations other than MCR and to meet MCR disposal site capacity requirements for maintenance dredging without overloading Sites A, B, and E. In 1993, Sites A, B, and F were expanded in size for a period of five years (Figure 2) to meet dredged material disposal capacity needs (see 1993 EA). The 1993 expansions of Sites A and F were extended to meet dredged material disposal capacity needs until this site designation and management plan process could be completed. In 1997 Site E was expanded and Site B was further expanded in size (see 1997 EA).

The Columbia River Crab Fisherman's Association, et al, sued the Corps and EPA in March 1998 over the 1997 expansion of ocean disposal Sites B and E. A settlement agreement was reached in this lawsuit in October 1998. The points of that agreement are summarized below. The following restrictions apply to actions taken under authority of the 1997 expansion:

- The Corps agrees that it will not dispose of any dredged material anywhere within the 1997 expanded boundaries of Site B.
- The Corps agrees that it will not dispose or allow the disposal of dredged material anywhere within the western 5,000 feet of Expanded Sites E after August 15 in any dredging year.

ANALYSIS OF ALTERNATIVES

Overview of Dredge Types

Three basic types of dredges exist: mechanical dredges, (which include clamshell), pipeline or suction dredges, and hopper dredges. Hopper dredges are self-propelled, seagoing vessels and are the only type of dredge that can work effectively in rough open water. Larger hopper dredges can work in sea swell conditions to about 10 feet. Hopper dredges are very mobile and can move quickly to minimize interference with navigation traffic and can adjust to rapidly changing weather and sea conditions. Pipeline and clamshell dredges are typically not self-propelled and cannot operate safely and effectively in conditions where the waves are greater than 3 to 4 feet. They also are unable to handle strong currents such as occur during tidal shifts. Both pipeline and clamshell dredges employ spuds and/or anchors to station themselves in the work area and so they can not be as quickly moved to accommodate traffic or changing weather or sea conditions. The different dredge types do not necessarily foreclose any of the different disposal options. For example, sediments removed by a pipeline dredge can be placed into a barge and the material dumped into the ocean. However, greater efficiencies can be realized by matching the dredge type to the disposal option [see also Defining a Zone of Siting Feasibility (ZSF)].

The typically rough seas and strong currents encountered at the MCR project are too dangerous for safe operation of pipeline or mechanical dredges so hopper dredges must be used. Pipeline and mechanical dredges operate within the estuary to maintain the main and smaller navigation channels as well as harbor or marina areas. Hopper dredges also have been used historically to maintain the Columbia River and some of the smaller navigation channels.

It is expected that construction and maintenance volumes from channel deepening in the estuary that would be disposed in the ocean would be dredged and transported using a clamshell and multiple barge operation. Dredging for the Columbia and Lower Willamette Rivers navigation channel throughout its length likely will be conducted by a combination of hopper, clamshell, and pipeline dredges.

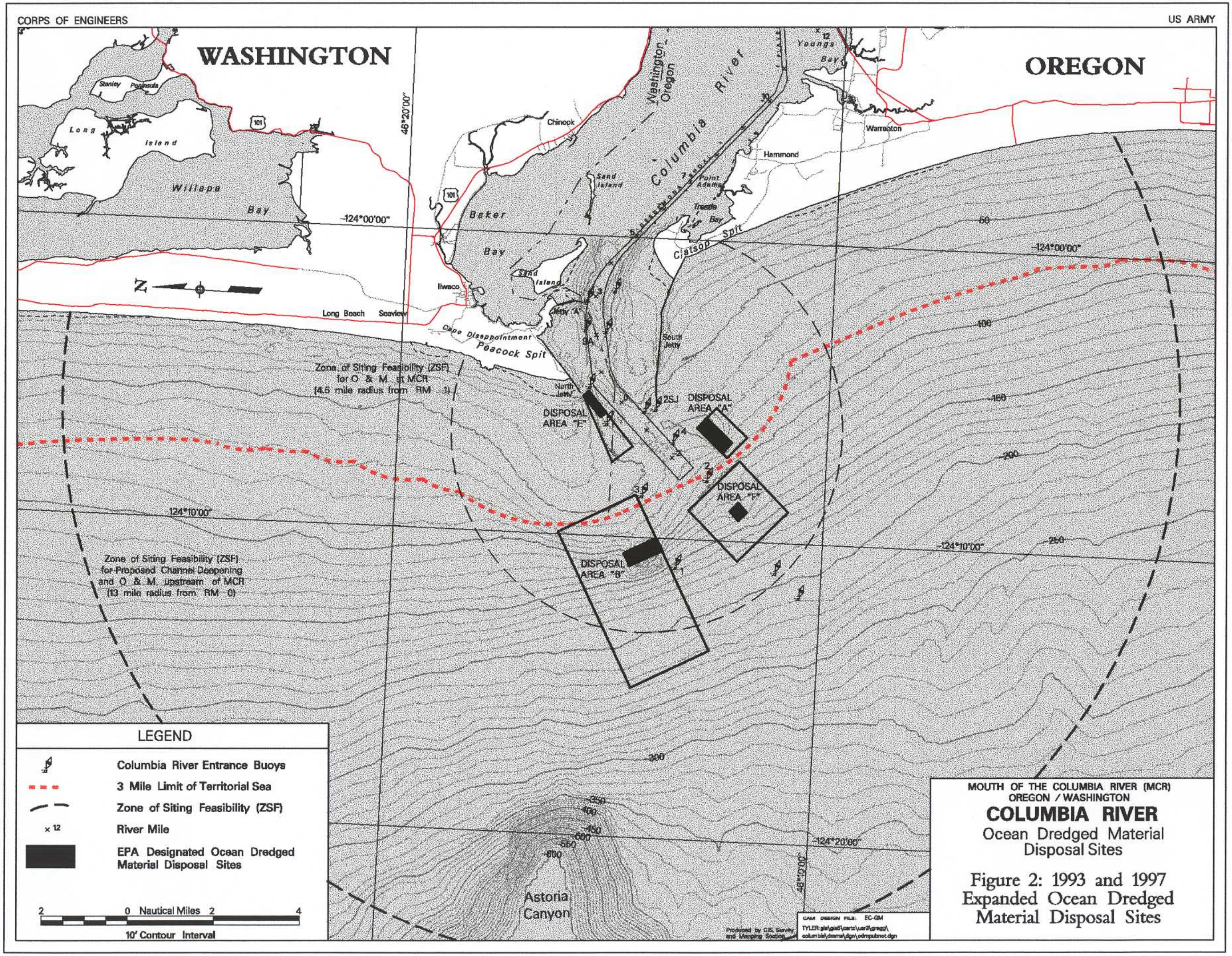


Figure 2: 1993 and 1997 Expanded Ocean Dredged Material Disposal Sites

Overview of Disposal Options

The alternatives for ocean dumping of dredged material from the MCR and River Channel projects that were considered by the EPA and Corps are no action, upland/beach disposal, and estuarine disposal. Alternatives considered under the ocean disposal option include disposal off the continental shelf, continued use of existing sites, and designation of new ocean disposal sites.

No Action Alternative

Within the context of Ocean Dumping alone, the no action alternative would be for EPA to refrain from designating new ODMDSs for the placement of dredged material. One option under this alternative would include continuing use of the existing EPA designated sites. Two of the sites (Site A and Site B) are already mounded and their further use restricted by EPA. The remaining two sites (Site E and Site F) are inadequate to contain the volume of dredged material routinely removed each year. By regulation, if there are no suitable EPA designated sites the Corps has the authority to select alternate sites under its MPRSA section 103 authority; although the selection would still be subject to meeting the "criteria" and would have to receive the concurrence of EPA. As the substantive requirements for information and evaluation of a section 103 action are similar to those of an EPA formal designation under section 102, these Corps actions are typically done only for one-time or "temporary" activities that do not regularly or routinely occur. These "selections" by the Corps are therefore limited and offer only a stopgap solution. Management of dredged material at the MCR project since 1990 has utilized temporary 103 sites, culminating in a lawsuit concerning the most recent 103 actions in 1997.

The most plausible outcome of the no action alternative is that existing and proposed navigation projects may be terminated. The two EPA sites with remaining capacity (Site E and Site F) do not have capacity to meet the current and anticipated disposal needs without creating hazardous navigation conditions. Future "temporary" actions by the Corps are not seen as desirable by government or the private sector. None of the disposal options under the no action alternative meet the needs for long-term maintenance of the MCR project. Terminating maintenance dredging would reduce the safety of the channel for large ships and have an adverse economic impact to the Pacific Northwest and the Nation. For these reasons, the no action alternative is judged by both the Corps and EPA to be an unacceptable alternative and has been dropped from further evaluation.

Upland/Beach Disposal

Upland disposal for the MCR project maintenance material is not feasible for operational, economic, and environmental reasons. The 1983 EIS evaluated the availability of upland sites, considering the Estuary Plan, and determined that upland disposal was not a viable alternative at that time. The availability of upland sites has been periodically reviewed by the Corps and EPA, including recent review of U.S. Geological Survey and national wetland inventory maps and the fundamental conclusion that upland disposal of MCR material is not feasible has not changed. There are no known suitable upland areas in the immediate vicinity of the estuary with sufficient capacity to meet long-term disposal needs. It is estimated that an upland site would need to occupy 5 square miles and material would have to be placed over 40 feet high on such a site in order to accommodate the estimated 225 mcy of dredged marine sediment that would come from the MCR over a fifty year project life. Most of the lands adjacent to the ocean and estuary are wetlands, too steep, or are already developed (including state park lands). The local Estuary Plan does not identify any suitable upland areas that could be accessed by a hopper dredge. Stockpiling of material and re-dredging and transporting of the material to upland sites is not considered economical.

Placement of dredged material directly on ocean beaches has been proposed repeatedly in the past. Potential placement areas have included Clatsop Spit in Oregon and Benson Beach in Washington. Recent interest has been expressed by the State of Washington and others for the direct placement of dredged material on Benson Beach to the north of the north jetty during this site evaluation process. However, no formal request or willingness has been expressed by a local sponsor to initiate a direct beach placement study and assume local sponsorship responsibilities. A detailed discussion on direct beach placement of dredged material can be found in Appendix A. Because of the need to dredge the MCR project with a hopper dredge, the lack of sufficient upland disposal sites for either the MCR or river channel projects, and no identified local sponsorship for a beneficial use option, upland disposal as an alternative to ocean disposal is not considered to be practicable.

Estuarine Disposal

In 1998, the Corps proposed use of an estuarine site located along the north jetty (*Public Notice* NWP-CO-CRA-FY98-005). The entrance channel was migrating north and there was concern that its continued movement northward would compromise the structural integrity of the north jetty by undermining it. Approvals were given to the North Jetty Site as a Section 404 CWA site. The North Jetty Site was first used in June 1999 for the MCR maintenance material. The site capacity of this site is 0.5 to 1 mcy per year, much less than the volume required to be removed from the federal navigation projects. Additional capacity could become available if erosion of material from this site continues or increases. It is also possible that dredged material placed at this North Jetty Site could move back into the entrance channel where it will have to be re-dredged and transported to the ocean. Hydrographic surveys will be conducted to determine the site capacity for future use. Though not an ODMDS, the North Jetty Site will be used in conjunction with the designated ocean sites off the Columbia River for material from the MCR and Columbia River channel and will be included in the site *Management and Monitoring Plan* (Exhibit H) for this geographic area.

Estuarine disposal of Columbia River channel material occurs or has occurred at several existing in-water sites and dredged material islands. Existing islands created with dredged material have limited capacity and no new or expanded sites with sufficient capacity are likely to be sited in this area due to concerns and uncertainty of potential affects to various species listed under the Endangered Species Act. Efforts to site new disposal islands or expand existing islands within the estuary have met strong resistance from regulatory and resource agencies in the past. Options to "fill up" the existing islands capacity with dredged material from construction of the deeper channel and then close them out to avoid concentrated use by fish-eating birds (e.g., Caspian terns) are under consideration, but this would simply exchange future capacity and force maintenance material from the river channel to be taken to the ocean sooner than is presently predicted. Under this alternative, the need for ocean dumping is not reduced, but in the long term only made more acute.

Ocean Disposal

Accordingly, based on evaluation of the alternative solutions previously discussed, continued disposal of dredged material from at least the MCR project into the ocean is unavoidable and necessary. Options include disposal of the material off the continental shelf, continued use of existing sites (including expansions of those sites), and designation of new ODMDSs.

Off the Continental Shelf

The direction for EPA to locate dump sites off the continental shelf is one of the five general criteria (40 CFR 228.5(e)); however, that direction is subject to a determination of feasibility. At the Columbia River, potential disposal areas located off the continental shelf would be at least 20 nautical miles offshore in water depths of 600 feet or greater, with the exception of the Astoria Canyon, the closest incursion of which is 11 nautical miles offshore (Figure 1). This distance is well beyond the economical haul distance for hopper dredges working the MCR project given the size of the west coast hopper fleet (see section describing development of the Zone of Siting Feasibility). Material from the river channel may be economically transported as far as 13 nautical miles by use of clamshell and ocean-going barges.

Transporting dredged material off the continental shelf presents potentially significant environmental concerns. Benthic and pelagic ecosystems near the shelf contain important fishery resources and the effects of disposal operations on them are not well understood. Fine-grain sediment and rocky habitats would be directly impacted by disposal. These deep-water areas are stable and generally not disturbed by wave action or sediment movement. Consequently, the benthic invertebrate communities in these deep, offshore environments are adapted to very stable conditions and would be less able to survive disturbance from the immediate impact of disposal and the long-term alteration of substrate type. Little is known of the ecology of benthic communities on the continental slope; however, disposal onto those communities would cause severe and long-term impacts. Bottom gradients can be 5 to 25 percent on the continental slope, making accumulated unconsolidated sediments susceptible to slumping. Deposited sediments could be transported long distances downslope as turbidity currents and offshore by near-bottom currents, potentially affecting organisms outside of any designated site.

The cost for site evaluation necessary to designate a site and subsequent baseline and monitoring, along with unanswered environmental concerns about the effects of disposal in such areas, makes off-shelf disposal undesirable as well as infeasible. Further, disposal off the continental shelf would remove natural sediments from the nearshore littoral transport system, a system that functions with largely non-renewable quantities of sand in Oregon and Washington. While the loss of the present volumes of Corps dredged material are unlikely to result in disruption of the mass balance of the littoral system, the States of Washington and Oregon are already experiencing erosion/accretion patterns that are adversely impacting beaches, spits, wetlands, and other shoreline habitats. The State of Washington has consistently expressed their preference to keep as much of the material as feasible in the nearshore, littoral system.

Continued Use of Existing Sites

The small size of the EPA-designated sites and the large quantity of material requiring ocean disposal have resulted in mounding of material and potential navigation hazards (see the evaluation of No Action above). This situation would persist and become worse with continued use of the existing sites at their present size. Mounding has affected the wave climate at EPA-designated Sites A and B. The dredged material mounds already exceed the original 102-designated site boundaries. This mounding had begun to adversely affect navigation safety at the MCR entrance for smaller boats culminating in restriction by EPA of any further use of Sites A and B. Reopening either site for continued use without significant expansion would definitely result in further growth of the existing mounds and worsen a potentially hazardous condition to navigation.

Expansion of the sites in 1993 and especially in 1997 as a temporary management measure by the Corps with the concurrence of EPA met with strong opposition. Local crab fishermen had repeatedly expressed strong opposition to the use of Expanded Site B and its surrounding area (see Volume II of this appendix). A lawsuit was filed in 1998 to this effect by Earth Justice Legal Defense Fund for the Columbia River Crab Fishermen's Association and other commercial fishery interests. The result of that litigation is discussed in the section on Ocean Dumping and Columbia River Navigation.

Continued use of Site E as expanded in 1997 was generally supported by the states, especially the State of Washington, and the public. The proposed site was carried over and evaluated throughout the ocean dumping site designation study process described following and is still being proposed for formal designation. This expanded site was the result of the Corps' 103 action in 1997, which will expire in 2002. In effect, formal designation of the expanded Site E by EPA constitutes a new ODMDS. Continued use of Site F was also carried into the designation process. Most of Site F (both the original 102-designation and subsequent 103 expansions) fell within the dimensions of the large proposed South Site in the DEIS. Continued use of Sites A and B were dropped from further consideration early in the designation process.

New Ocean Dredged Material Disposal Sites

Based upon the discussions for the above alternatives, both the Corps and EPA concluded that the designation of new ODMDSs was necessary to meet the long-term disposal needs of the MCR project and the Columbia River channel project. The federal agencies initiated the ocean dumping site designation process as part of the Columbia River Deepening study. That process is explained in detail in the following section.

OCEAN DUMPING SITE DESIGNATION PROCESS

Overview

The dumping of "material" (including dredged sediments) into the ocean is permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment. Formal designation of ocean dumping sites is the responsibility of EPA as stated in 40 CFR part 228 of the ocean dumping regulations. The process followed by the EPA, Region 10, and Portland District, Corps for the Columbia River projects generally follows the site designation procedures developed by a joint task force of EPA and Corps personnel and titled, *General Approach to Designation Studies for Ocean Dredged Material Disposal Sites* (May 1984). The procedures utilize a hierarchical framework that initially establishes the broadest economically and operationally feasible area of consideration for site location. A step-by-step sequence of activities is then conducted to eliminate critical and/or unsuitable subareas. Further evaluation of alternative sites (candidate sites) within this area entails various levels of assessment as suggested by the sensitivity and value of critical resources or uses at risk, and potential for unreasonable adverse impact presented by the dredged material to be disposed. The site-designation criteria at sections 228.5 and 228.6 are applied to the information assembled through this process, and a final site or sites are selected and proposed for formal designation.

The site-designation process is structured into three major phases (Figure 3). Phase I includes the delineation of the general area being considered for locating a site and the identification and collection of the necessary information on critical resources and uses and on the physical and environmental processes for the area. Reasonable distance of haul is the determining factor and will be affected by considerations such as available dredging equipment, energy use constraints, costs, and safety considerations. Then a preliminary analysis, based on available data, is applied to identify and map reach boundaries for critical resources as well as areas of incompatibility. Such critical areas and resources may include clustered areas of geographically limited habitats, fisheries and shell fisheries, navigation lanes, beaches, and marine sanctuaries.

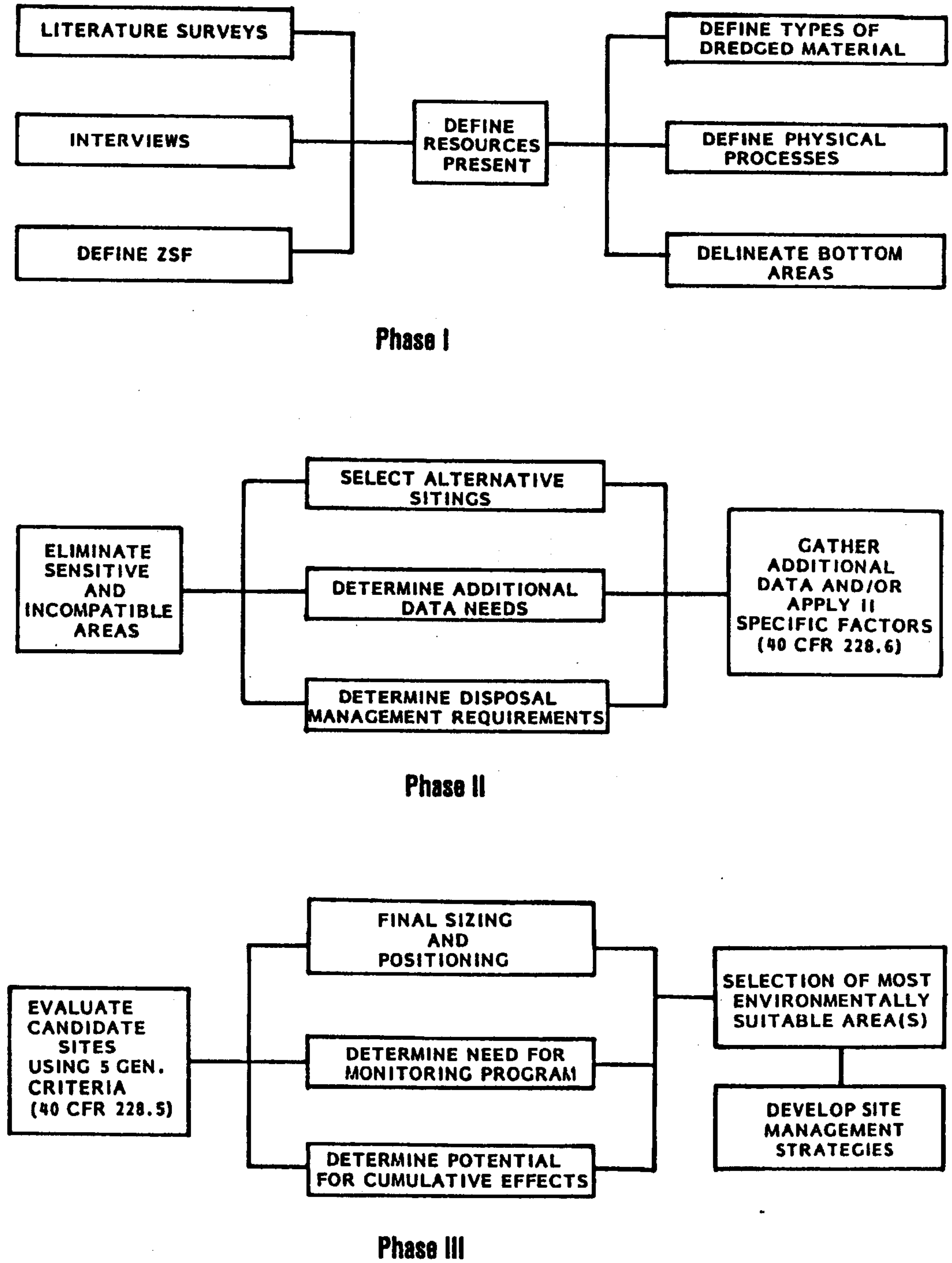
Phase II primarily involves the elimination of sensitive and incompatible areas, determining additional data needs, and identification of candidate sites within the area based on the information collected and processed in Phase I. Phase III primarily involves the evaluation of candidate sites, selection of a proposed site or sites for designation, and the development of management strategies.

Ocean Dumping Site Designation Work Group

The Corps and EPA convened a facilitated Ocean Disposal Site Designation Working Group (Working Group) to provide input the federal agencies in evaluating ocean disposal options for the MCR and the existing Columbia River channel and proposed channel deepening projects. The purpose of the Working Group was to assist in identifying and evaluating the best long-term ocean disposal option for the two projects. Representatives from state, local, and federal agencies participated in the Working Group as well as individuals representing the crab fishing industry. Association and agencies that substantively participated are shown as follows:

Columbia River Crab Fisherman's Association
U.S. Environmental Protection Agency, Region 10
Washington Department of Fish and Wildlife
Oregon Dungeness Crab Commission
Oregon Department of Fish and Wildlife
Oregon Department of Land Conservation and Development
Columbia River Estuary Study Taskforce
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service
Washington Department of Ecology
National Marine Fisheries Service

Figure 3. Phases of the Site Designation Process



The Working Group convened a series of meetings that were held in Portland and Astoria, Oregon; the dates of the meetings are shown below. The proceedings from these meetings as well as a complete listing of participants by meeting are provided in Appendix H, Volume II.

July 10, 1997
July 23, 1997
August 20, 1997
October 1-2 1997
October 8, 1997
October 23-23, 1997
February 19, 1998
August 19,1998
March 14, 1999
May 12, 1999

Defining a Zone of Siting Feasibility

Joint EPA/Corps guidance for site designation suggests establishing a zone of siting feasibility (ZSF), as ocean disposal sites must be located within an operationally and economically feasible distance from the point of dredging (Corps/EPA, 1984). Therefore, study efforts can be focused on areas that will actually meet project needs.

Presently, the availability of dredging equipment is a major constraint that must be considered in the determination of a ZSF for any navigation project, but particularly so for ocean entrance projects on the west coast of the United States. The Jones Act precludes the Corps from contracting with foreign-owned vessels, limiting the accessible pool to U.S. Government or privately owned equipment. The Corps evaluates the availability of Government equipment annually and allocates the use of government dredges for the nation. As described previously, hopper dredges are the only feasible equipment for dredging most ocean entrance channel/bar situations. There are typically only two hopper dredges, one Government-owned and one contractor-owned, working the west coast that are large enough to work effectively at the MCR. This equipment must also be used to maintain other projects on the West Coast and Hawaii. The Congress sets the total number of days per year that the Government dredge can work. Accordingly, that allowed time must be allocated between several large projects on the West Coast, including San Francisco Bay, Grays Harbor, in addition to the Columbia River projects, and occasionally Coos Bay and different projects for the Los Angeles and Hawaii Corps Districts. The Corps meets annually to review the anticipated dredging schedule and needs for the West Coast and more frequently to review the national need. Generally one medium class privately owned dredge is available on the West Coast for contracting to handle all the remaining dredging required to maintain these and all smaller projects.

Other hopper dredges working in the U.S. are committed to maintaining projects on the Atlantic and Gulf of Mexico coasts and are not available to be used elsewhere, except perhaps on an emergency basis. Additional capability could occur through construction of new dredges by the U.S. Government or private industry.

Weather is also a significant limiting factor for dredging and ocean dumping of material along the West Coast that must be considered in development of the ZSF. Typically, hopper dredges are able to work safely in Pacific Northwest coastal waters, including at the MCR project, from May to mid-October, with a very high and consistent probability of down time due to rough seas or other adverse weather conditions at either end of that period. During this same May through October window, all other West Coast entrance dredging also must occur.

In a normal year, MCR requires the two dredges for 50 to 60 days, 24 hours a day. Other West Coast projects have similar, typical work requirements. The amount of time necessary to maintain a coastal project like the MCR (exclusive of weather downtime) is a function of dredging a hopper full of material (loading), then transporting that material to, and placing it at, the disposal site(s). This is called "cycle time" and the cycle time can be different for each dredge. Loading time is fixed based on the characteristics of the sediments being dredged, the dredge itself (i.e., pumps, size of hopper, drag arms, etc.) and the dredging site conditions. The time to discharge material also is basically fixed for a given dredge and the type of material. Transport time depends primarily on the haul distance to the disposal site as the speed of different hopper dredges when full are similar. Thus the critical element for new construction or maintenance dredging is the haul distance between the dredging site and the disposal site from both a time and cost perspective. A significant haul distance will affect the ability to construct or maintain the individual project, such as MCR, and very probably would have repercussions on the Corps' ability to maintain other West Coast projects.

Columbia River Zone of Siting Feasibility

Separate ZSFs were established for the two projects, the MCR and the Columbia River Navigation Channel (river channel) for long-term maintenance dredging. As described in following paragraphs, the need for new ocean disposal sites off of the Columbia River is primarily driven by maintenance of the existing MCR project. The MCR channel permits safe entrance and egress to the existing or proposed deeper river channel. A separate ZSF focussed specifically on the initial construction of the proposed deeper channel could be larger than the two "maintenance dredging" ZSFs established. This larger "construction phase" ZSF was not developed because it would only be applicable once and would only account for an estimated 7 mcy of initial construction material. The Corps and EPA concurred that it was appropriate to use the river channel operations and maintenance ZSF to meet the proposed initial construction and long-term river channel operation and maintenance needs.

The MCR ZSF was generally identified as the area within an arc 4.5 nautical miles (nmi) seaward from RM -1.0 (Figure 4). The determination of a 4.5 nautical mile limit was based on the amount of dredging necessary to maintain the MCR entrance channel to the authorized depth, the availability of dredging equipment that can accomplish the work, the amount of time available annually (anticipating weather delays and equipment failure) to accomplish the necessary maintenance dredging, and the time required to dredge and haul the material to the disposal area. Presently, the major constraint on the MCR ZSF is the amount of time dredging equipment is available, as the same dredges must also maintain other projects on the West Coast and Hawaii. In addition to adverse weather considerations, much of the shoaling at MCR occurs during the summer months when river flows decrease. Accordingly, most of the MCR dredging occurs after July 1 as the heavier shoaling occurs. This results in a much narrower window (July to October) in which the two dredges must remove sufficient material to ensure safe navigation passage through the MCR entrance channel into the Columbia River navigation channel through the winter months.

The Columbia River Navigation Channel ZSF is generally the area within 13 nmi seaward from RM 0+0 (Figure 4). Determination of a ZSF for the river channel was based on using one clamshell dredge, a minimum of two scows, and one ocean-going tugboat. This assumed the minimum equipment required for a one-way haul of 41 miles from RM 28 to the ocean (13 miles) offshore. Beyond this distance, a third scow would be required for the dredging cycle time to remain productive and cost efficient (for example, continue filling one barge while the others are being transported to and from disposal). Some of the variables that control the cycle time for a clamshell dredge are the type of material to be dredged, the size of the clamshell bucket, the size and number of scows and tugs, and the haul distance. As one variable is changed, the time required and cost per cubic yard changes. However, there are currently only a few large bottom-dumping scows suitable to do this work, so the third scow may not be available. Accordingly, the three-scow option was not used as the basis for ZSF determination. There is no government-owned clamshell dredge and barge equipment on the West Coast capable of performing this work.

Ocean Environment

The following sections summarize the resources and features within the zone of siting feasibility. More detailed information can be found in the indicated technical exhibit.

Biological (Living) Resources (Exhibit A)

The ocean offshore of the Columbia River is a highly productive biological environment. Results of studies over the years indicate that the benthic assemblages area off the Columbia River consist of two community types. An offshore community, which occurs in deep water usually greater than 200 feet, is not subjected to high wave and current action. This deep-water area has finer grain substrate and is generally a more stable environment than the inshore area. The offshore benthic community shows a consistently higher diversity of species with greater densities than the inshore benthic community. The inshore benthic community is adapted to high-energy conditions and tends to consist of rapid colonizers, tube dwellers, and rapid burrowers. Diversity and densities are generally lower in the inshore communities. Both communities exhibit high year-to-year variations in density and species composition, as well as wide seasonal variability. Such characteristics of the benthic infauna are consistent with other Oregon and Washington offshore areas.

A variety of anadromous and resident fish species occur offshore throughout the ZSF in both the adult and juvenile life stages. Anadromous species such as salmon, steelhead, shad, lamprey, smelt, herring and sturgeon are present offshore as adults prior to migrating to spawning grounds in the estuary or upstream into the Columbia River system. Juveniles of these species also are present in the ZSF following their migration out of the river or estuary into the ocean. Some remain in the near inshore area feeding and rearing, while others move directly offshore. Resident species (including various species of flatfish, rockfish, and other demersal species) occur in the offshore area throughout the year with many resident species

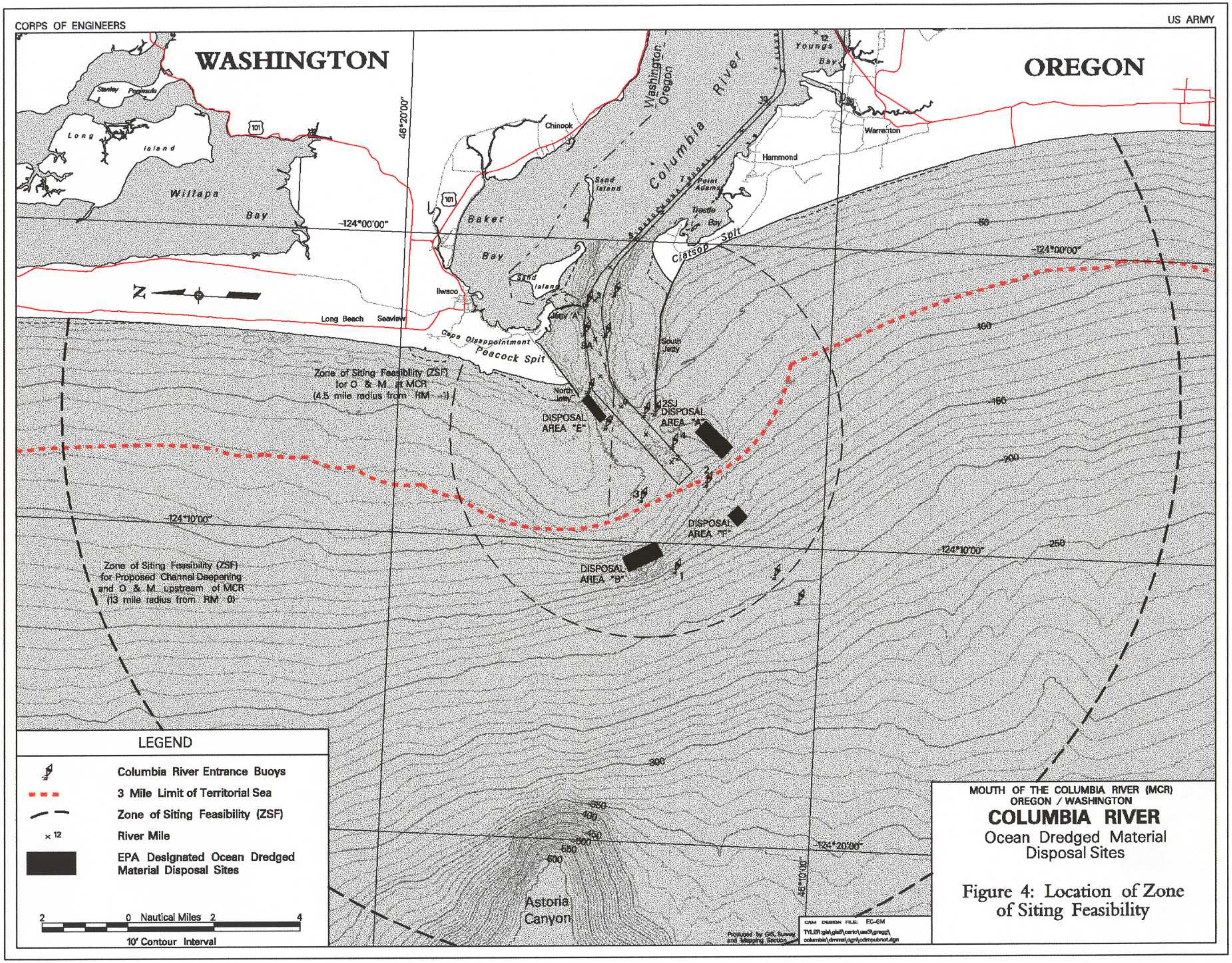


Figure 4: Location of Zone of Siting Feasibility

using the estuary as rearing and/or nursery habitat. Juvenile flatfish, in particular, rear in the ocean off of the Columbia River during the spring and summer.
Potentially 30 cetacean (whales and porpoises) species occur in ocean waters along the coast of the Pacific Northwest at different times of the year; although their individual numbers are generally limited. Harbor porpoises and gray whales were prevalent in shelf waters less than 600 feet deep. The larger cetaceans, such as the California gray whale, typically occur as migrants in the spring and fall. Smaller cetaceans, principally dolphins, porpoises, and some small whales are also present in these same waters.

Four species of marine turtles (loggerhead, green, Pacific ridley, and Pacific leatherback) have been recorded from strandings along the coastline since 1982. Marine turtles are unusual in their occurrence along the Pacific Coast and are typically associated with warmer marine waters. Five species of pinnipeds are known to occur along the coast: northern sea lion, California sea lion, harbor seal, northern elephant seal and northern fur seal. Harbor seals are resident whereas the four other species of pinnipeds are more transient in nature. Harbor seals and California/northern sea lions are the principal species observed in the estuary. All three species are known to forage within the estuary and adjacent ocean waters.

Pelagic birds are extremely numerous in the offshore area. Studies have found that seabird populations were most densely concentrated over the continental shelf (less than 600 feet in depth). Shearwaters, storm petrels, gulls, common murres and Cassin's auklets numerically dominated the pelagic bird fauna from late spring through late summer. Phalaropes, fulmars and California gulls are important constituents of the fall pelagic bird flocks. The principal species in the winter are phalaropes, California gulls, fulmars, other gulls, murres, auklets, and kittiwakes. Red-throated, Pacific and common loons occur as spring and fall migrants. Western, red-necked horned, and eared grebes also occur in the area. Brown pelicans occur from late spring to mid-fall along the coast. This species forages in nearshore waters of the Pacific Ocean and estuarine waters of the Columbia River. Concentrations up to 1,000 birds have been reported. Three species of cormorants and three species of terns occur and forage in nearshore Pacific Ocean waters and the estuary.

The federally listed threatened and endangered species which may occur within the ZSF include: blue, finback, sei, right, hump-backed and sperm whales; loggerhead, green, Pacific ridley, and Pacific leatherback sea turtles; northern (Steller) sea lion; marbled murrelet; bald eagle; Aleutian Canada goose; peregrine falcon; and brown pelicans. These species vary by season and location in the offshore area.

Physical Processes and Geological Resources (Exhibit B)

The Columbia River flows into the Pacific Ocean through a jettied entrance at the boundary between Oregon and Washington and is the second largest river in the United States in terms of annual discharge. The course of the Columbia River is 1,210 miles long, dropping over 2,600 feet from its Canadian headwaters to the sea, draining an area of approximately 250,000 square miles. The Columbia River accounts for 60 percent (winter) to 90 percent (summer) of the total freshwater discharge into the ocean between the Canadian border and San Francisco. Riverine discharge is marked by a high seasonal variability, typically ranging from summer-fall flows of 100,000 cfs to spring freshets of 400,000 cfs (under regulated flow conditions). The annualized-average (regulated) river discharge is about 265,000 cfs.

The Columbia River estuary is the largest fluvially dominated estuary in the Pacific Northwest and its tidal prism is about 1,390 square miles per foot. Astronomical tides at the mouth of the Columbia River (MCR) have diurnal inequality with a long ebb, from higher high to lower low water. The mean tidal range at MCR is 6.5 feet; the range from mean lower low water (MLLW) to mean higher high water (MHHW) is 8.5 feet. Extreme tide ranges from –2.5 feet MLLW to +11.5 feet MLLW. The average water depth through the throat of the MCR entrance is about 50 feet, with local excursions to 110 feet. During the peak of ebb tide, the combination of riverine and estuarine flow through the 2.3 mile-wide entrance of MCR can produce currents greater than 8 feet per second and instantaneous flow rates that exceed 1.5 million cfs. At MCR and adjacent coastal waters, tidal currents are believed to account for more than half of the water motion over periods of several days.

The MCR entrance is characterized by exceptionally strong wave-current interactions. As a consequence, the MCR has been recognized as one of the most dangerous coastal inlets in the world. During storm conditions, the sea state at the river entrance is characterized by high swell incident from the northwest to southwest combined with locally generated wind waves from the south to southwest. Based on wave data observed 30 kilometers offshore MCR (depth = 370 feet) during 1984-1993, the annual average wave height and period as 7.2 feet and 10.5 seconds, respectively. During intense winter storms, waves can exceed 30 feet.

Oceanographic Circulation. Circulation of the coastal waters on the continental shelf (near MCR) results from an interaction of regional oceanic circulation, astronomical tides, local wind-generated surface waves and current, swell, and Columbia River flow as affected by inland meteorological events. Time scales for MCR coastal circulation processes range from seconds for wind generated waves to months for seasonal weather patterns to years for large-scale events such as El Nino. A complete discussion of current data and related oceanographic topics is presented in Exhibit B.

A generalized model for the seasonal changes in the along shore and offshore circulation along the Pacific Coast of Washington and Oregon has been developed. The summer circulation of surface water on the continental shelf is influenced by the southward flowing California current which attains maximum strength during the summer when surface winds are consistently from the north-northwest. Winter circulation of shelf waters is dominated by the northward flowing Davidson current which attains maximum strength due to winter storm (wind stress) patterns. The subsurface part of the Davidson current (below 300 feet of depth) is believed to flow northward throughout the year, although the surface waters respond to seasonally varying wind stress patterns (reversals). Thus, the net direction of bottom currents on the mid- and outer continental shelf (120-600 feet in depth) is believed to be northward and along shore.

The time-varying circulation of MCR coastal waters controls the transport and seasonal distribution of bottom sediments and suspended material within the water column. Circulation which is consistent through time (flow through the MCR jetties) tends to produce identifiable and relatively constant bathymetry features. Circulation which is highly variable (typically, flow along the open coast) tends to produce homogenous bathymetry having ephemeral features.

MCR Entrance. Within the jettied entrance to the Columbia River estuary, circulation of surface and bottom water is generally bi-directional. Ebb flow in the northern side of the river entrance (near Jetty "A") is seaward, both at the surface and seabed. During flood tide, saltwater tends to intrude into the estuary along the southern side of the river channel (along the south jetty and Clatsop spit).

Inner Continental Shelf. The most active region along the continental shelf is the inner shelf (depth less than 120 feet), over which shoaling wind waves and swell, shelf-modified tidal currents, and estuarine-induced currents are at least as important as wind-driven currents for promoting the transport of bottom sediments. These variable processes act on ebb tidal shoal sediments at MCR (depths less than 120 feet) to produce the bathymetric condition observed at any particular time. Circulation of coastal (inner shelf) waters is subject to seasonal reversal, generally being northward during winter and southward during summer. Bottom currents along the inner-shelf often reach speeds high enough to transport sand-sized sediment.

Middle and Outer Shelf. Circulation along the middle-shelf (120-300 feet in depth) is governed mainly by wind-driven currents. Circulation along the outer shelf (300-600 feet in depth) is affected by shoaling internal waves and seasonally modified regional currents. Bottom currents along the middle and outer shelf generally do not reach speeds high enough to transport sand-sized sediment, but are capable of transporting fine-grain sediments (silt-size and smaller).

Bottom Sediment at MCR. Between 80 to 90 percent of the Lower Columbia River's sediment throughflow is composed of suspended sediment, yet relatively little suspended sediment is retained in the main stem of the estuary or at the MCR. The predominate sediment in the main channels of the estuary is sand which is transported as bedload, with silts and clays prevalent only in the upper estuary and peripheral bays. In terms of the overall estuary, average bottom sediments have been characterized as having 1 percent gravel, 84 percent sand, 13 percent silt, and 2 percent clay. Approximately 67 percent of the suspended sediment (generally, silt-size and finer) discharged from the Columbia River is estimated to be transported to the continental shelf of Washington, 17 percent of which is estimated to be transported beyond the shelf break, down into submarine canyons.

On the ocean side of the MCR, marine sand is transported to the MCR by the north and southbound littoral currents. The net direction of littoral transport is believed to be toward the north, with significant excursions toward the south. The seasonal variation in bottom sediment texture at MCR and adjacent offshore areas has been described in numerous reports. Fine-medium sand [0.13-0.28 millimeters (mm)] is present at the Columbia River entrance during all oceanographic seasons. Although very fine (0.063-0.12 mm) sand is often observed at MCR, these sediments are transitory and more common during the summer than winter. The grain size associated with sand smaller than 0.18 mm is characteristic of native sediment observed along the inner-shelf at MCR.

The coarser ebb-tidal shoal sediments associated with the Columbia River are generally larger than 0.2 mm. It has been observed that winter storms winnow the silt fraction (>0.0625 mm), from sediments between the MCR entrance and the outer edge of the ebb-tidal shoal (120 feet in depth). The seaward advance, or uncovering, of medium-fine sand has been observed to occur with onset of the spring freshet (high river discharge). The silt size fraction returns to the MCR sediment regime in the spring and increases markedly through the summer in the form of intermittent ephemeral patches. The area offshore of the MCR ebb-tidal shoal (deeper than 120 feet) is believed to receive sediments from adjacent inner-shelf areas during the summer.

Previous studies indicate that some of the sand-sized sediments within the Columbia River estuary may have been transported through the MCR and into the estuary from adjacent nearshore and shelf regions of the Washington and Oregon coasts. The Columbia River estuary is being filled not only by river transported sediment, but also by marine sediment entering the MCR by tidally-induced movements of bottom water entering the estuary from the ocean. Sandy sediment dredged from the MCR entrance channel is characteristic of the estuarine and marine environment.

Within 6 miles west-northwest (offshore) from MCR, significant amounts of fine-grain sediment ($D_{50} \leq 0.0625$mm) has been consistently observed on the seabed. This area of fine grain sediment forms a northwest trending deposit (or "mud hole") on the seabed that is bordered on the east, south and west by coarser material. The "mud hole" believed to be the result of deposition of suspended sediments and detritus from the Columbia River (plume) discharging into the ocean. The interaction (mixing) of surface water from the Columbia River plume with the ambient coastal currents promotes the rapid deposition of suspended sediments and detritus from the Columbia River plume. Apparently, the onset of enhanced mixing between the MCR plume and coastal waters is 5-6 west-northwest of MCR. A convergence of bottom current may also aid facilitate deposition of fine-grain sediment near the "mud-hole."

Recent monitoring results obtained for several bathymetry locations near MCR strongly indicate that the response of the seabed is affected primarily by wave processes and secondarily by bottom current processes. The bathymetry of Peacock Spit (60 feet in depth) is presently subjected to "natural" modification by waves and currents, producing seabed change which may exceed a 5-foot vertical (deposition or erosion by waves-currents) during any given year. Short-term (during a ½ hour period) "natural" seabed change has been observed to exceed 4 inches. The bathymetry 3 miles offshore of MCR (120 feet in depth) is presently subjected to "natural" modification by waves and currents, producing seabed change which may exceed a 3-foot vertical (deposition or erosion by waves-currents) during any given year. Short-term "natural" seabed change has been observed to exceed 4 inches.

Geological Resources. The coastal area of Oregon has been influenced by a combination of tectonic forces and glacial effects during the past few million years. Regional uplift, coupled with a fluctuating sea level, are evidenced by marine terraces up to 100 feet above present sea level and Astoria Canyon, more than 300 feet below sea level. Beneath deposits of recent sands are rocks up to 40 million years old. At the maximum extent of the continental glaciers sea level was as much as 400 feet below present and the mouth of the Columbia River was up to 10 miles offshore. During this time a series of shelf-edge canyons were formed, including Astoria Canyon, which channeled sediments into deeper water. Delta-like features formed from massive amounts of sediments, estimated up to 10 times present volumes. The Astoria fan is one such feature. As the glaciers retreated, sea level rose up to 100 feet above its present elevation. Coastal forces extensively reworked unconsolidated sediments and formed marine terraces during relative still-stands. The last episode of glacial retreat began less than 20,000 years ago with sea level rising rapidly until 5,000 to 6,000 years ago. Estuaries at the mouth of the Columbia River and elsewhere are "drowned" river valleys, and coastal features such as extensive sand spits and dune complexes resulted from marine forces reworking sediments relict from earlier times.

Filling the valley bottoms and the estuary are modern river sediments. These grade into marine sands near the river mouth, which continue offshore. Extensive coastal dunes and beaches have been formed in modern times by wind forces acting upon river/marine sands. The extent of the sediment layer above bedrock averages over 200 feet at the mouth of the Columbia River.

Side scan data from 1985 and 1996 revealed a general uniformity of the sea floor in vicinity of MCR, which appears to be composed of silty sand to sandy silt. No rock outcrop exposures were found in the area surveyed. Small east-west trending ripple marks were consistently apparent over the entire area surveyed, decreasing somewhat north of the river mouth. The extreme northern portion of the study area showed a notable increase in bottom debris and bottom growth. At and south of the river mouth there was a marked absence of typical sea floor growth and debris. Sand waves were noted south of the MCR south jetty. Long period sand waves with wave lengths of up to 500 feet, crest to crest, and heights of up to five feet, trough to crest, were located immediately offshore of the MCR jetties.

Sediment and Water Quality (Exhibit C)

Material dredged from the federal projects typically consists of medium to fine sands from recurring shoals. These are deposited on slightly finer continental shelf sands. Because of their coarse nature, similarity to disposal site sediments, isolation from known existing or historical contaminant sources, and the presence of strong hydraulic regimes, dredged sands from the shoals meet criteria for exemption from further testing according to provisions of 40 CFR 227.13 (b).

In June 1990, three sediment samples were collected from Clatsop Spit for physical analyses. The physical nature of the material had not changed from previous studies. The material was determined to be suitable for unconfined in-water disposal without further testing. In June 1997, 18 sediment samples were collected for analysis from the Columbia River navigation channel, RMs 6 to 28.3. Average median grain size was 0.32 mm, average percent silt/clay was 5.9 percent, and average volatile solids were 0.8 percent for all samples. The chemical analyses did not indicate any areas of concern as contaminant concentrations were well below screening levels.

Samples collected from the ocean near the Columbia River mouth consistently have shown low to no detectable levels of contaminants. Levels of metals, pesticides, herbicides, and nutrients in Pacific Ocean native water samples collected by US Geological Survey west and south of the mouth of the Columbia River were low. Some ocean water samples have shown slightly elevated levels of iron, manganese, and nickel, but these chemicals and elevations are generally related to river discharges. Water quality parameters for samples taken near the mouth are within normal ranges for coastal ocean waters in the Pacific Northwest region.

Cultural Resources (Exhibit D)

Prehistoric cultural resources are unlikely to be found within the offshore area. Any prehistoric sites present on former shorelines are now inundated by ocean levels and buried under substantial amounts of sand deposited during recent geological times. In addition, the current landscape has been altered by jetty construction. Shipwrecks are the most probable cultural resources expected to exist within the ZSF. An analysis of the area shows that the least likely location for shipwrecks is offshore beyond the 40-foot contour. Any material placed directly or indirectly on a known shipwreck would be considered a beneficial use, as it would help to protect it.

Recreational Uses (Exhibit E)

Two major state parks are located at the mouth, one on each side of the river: Fort Stevens State Park in Oregon and Fort Canby State Park in Washington. Both parks have large ocean beach areas with beach access facilities and receive extensive use. Also, both the north and south jetties at the mouth are used for fishing and sightseeing. Recreational fishing for salmon by both private parties and charter boats occurs within the area of the mouth and offshore. Severe erosion is a concern at Fort Canby State Park. Dredged material placed at Site E could help to off set this erosion. There have been requests for dredged material to be placed directly on the beach at the park. Information on Benson Beach can be found in Appendix A.

Commercial Uses (Exhibit G)

The offshore area of the Columbia River supports a number of valuable commercial fisheries. The major offshore fisheries include Dungeness crab, salmon and bottom fish. Fishing for salmon and bottom fish, however, has declined in the last several years because of declining stocks of these species. There has been a shift to other fisheries such as crabs, tuna, and halibut. Tuna and halibut fishing are predominately in the offshore area beyond the ZSF. A good halibut fishing area, however, occurs inshore in the vicinity of a shale pile area to the northwest at a depth of +300 feet. Black cod and redrock fishing is done using longlines at the mouth of Astoria canyon. A description of the major fisheries is provided below. Fishing occurs throughout the offshore area except in the towboat lanes. These areas are the result of a negotiated agreement between the fisherman and the towboat operates to avoid navigation and gear conflicts.

Dungeness crabs are fished commercially along the West Coast from Central California north to Alaska. Most fishing is done in boats less than 80 feet in length that go out on daily or up to several weeks trips. Crabs are fished using pots that are 3 to 4 feet in diameter and are individually buoyed to the surface. Only male crabs 6 ¼ inches or larger are allowed to be commercially harvested in both Oregon and Washington and all pots are equipped with 4¼ inch escape ports to allow undersized crabs to leave the pots. Pots are laid out on the bottom in long strings and baited with dead fish, squid or clams. They are usually left for one to several days before being retrieved. Legal size male crabs are retained and sub-legal males and all females are released.

The crab season extends from December1 to August15 in Oregon and from December 1 to September 15 in Washington. Both states can delay the opening of the season if the preseason sampling of the crab population by the states show too large a percentage of soft-shell crabs. Both states allow fisherman to set their gear 64 hours prior to the opening of the season. The pots can not be pulled, however, until the start of the season. The State of Washington recently restricted crab fishing to inside four miles later in the season to protect soft-shell crabs.

The State of Washington issued 232 permanent and 16 temporary Dungeness crab commercial fishing licenses for coastal Washington in 1995. The State of Oregon issued 441 Dungeness crab permits in 1995 and 461 in 1996 for the entire coastal Oregon area. The landed value of crabs to fisherman was $10,387,617 in Astoria for 1996 and $36,318,000 for coastal Washington 1995. The Washington landings value was the highest ex-vessel value to date.

Commercial salmon fishing also occurs over much of the offshore area. Chinook, coho, and to a lesser extent pink salmon, are fished commercially using troll boats. Trolling is done by pulling through the water large strings of baited hooks that are spaced apart at various depths. The lines are reeled in periodically and the fish removed. Troll fishing has declined dramatically in the last several years with the reduction in salmon population. Seasons and catch limits are negotiated each year based on predicted salmon returns. The season is normally closed when the limit is reached. Salmon sport fishing also occurs throughout the offshore area.

Groundfish trawling occurs year around throughout the area offshore of the MCR. Trawling is done predominantly for various flatfish and rockfish species as well as pink shrimp. Boats used in the fishery range up to a couple of hundred feet in length. They use large trawl nets that are dragged along the bottom. Some of the nets have large doors that are rigged on either side of the net and help hold the net open. The nets may also have rollers along the leading edge that help the nets move over rough bottoms. They may also have chains along the leading edge that cause bottom dwelling organisms to move up into the water column so they can be more easily caught by the net. Trawling in different locations is seasonal and depends upon the species that the fishermen are targeting. The inshore area is usually fished in the summer months, which unfortunately is also when large concentration of juvenile flatfish and soft-shell crabs are present. Mortality rates of the nontarget species can be high especially for the soft-shell crabs. Estimates of up to 57 percent mortality have been determined in several studies (PFMC, 1987). The area off shore of the Columbia River has been designated as Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act for ground fish. The requirements of EFH were fully considered in the selection of the proposed disposal sites.

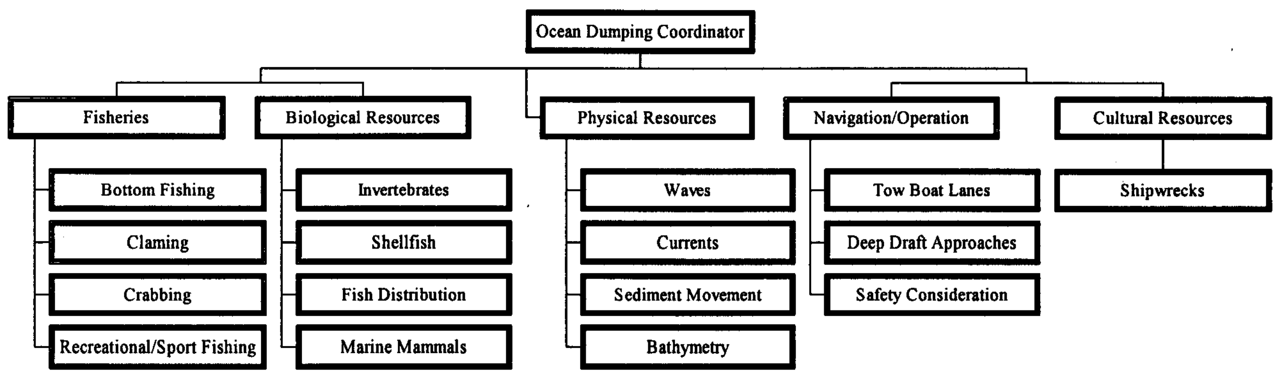
In addition to by-catch moralities there has also considerable concerns in recent years that bottom trawling can have devastating affects on the bottom habitat and community structure. A symposium was held in June 1996 to discuss the problem. The conclusion reached was that bottom trawling was akin to clear cutting forest and had a devastating impact on habitat community structure, and species abundance. Recovery times ranged from 2 to 14 months in some of the studies (Watling and Norse, 1998).

Commercial shellfish fishing, other than crab, is for clams and scallops. Scallops are dredged off the bottom in deeper water near the offshore limits of the area. Clams are harvested by hand along the beaches north and south of the estuary. Subtidal beds generally are not harvested but provide recruitment to inshore areas.

Overlays

The Working Group agreed that the creation of overlays to depict resource of concern was an acceptable methodology. It was further agreed that subgroups would be created to address issue areas (and sub-issues) displayed in Figure 5, these issue areas eventually developed into the overlays.

Figure 5. Issue Areas



The list of overlays agreed upon by the Working Group consisted of:

1) Benthic Sampling 1992 (Figure A-5): this overlay depicts the sampling stations collected by NMFS in 1992 for the Corps. Documents the geographical coverage of sampling.

2) Benthic Sampling 1993 and 1994 (Figure A-6): this overlay depicts the sampling stations collected by NMFS in 1993 and 1994 for the Corps. Documents the geographical coverage of sampling.

3) Benthic Sampling 1995 and 1996 (Figure A-7): this overlay depicts the sampling stations collected by NMFS in 1996 for the Corps. Documents the geographical coverage of sampling.

4) Benthic Infauna per square meter (Figure A-8): this overlay depicts the composite of all benthic information available or obtained by the Corps.

5) Juvenile Flatfish (Figure A-12): this overlay was created depicting three different zones of concentration for juvenile flatfish, based on fishermen personal information. Juvenile flatfish are important to long-term population.

6) Sediment Characteristics (Figure B-34): this overlay was based on composite information obtained from benthic invertebrate and sediment sampling conducted by the Corps since the mid-1970.

7) Sediment Contours (Figure B-35): this overlay depicts the percent fines as a result of 1992 and 1996 averages. This is important because it provides an indication of areas of fine gain material, which could indicate higher productivity. It provides an indication of the location of the "mud hole".

8) Shipwrecks (Figure D-2): this overlay was developed using archeological information of know or suspected shipwreck. Archeologists consulted would like the to see these areas buried to preserve them from poachers and further deterioration. Shipwrecks and other cultural resources must be considered, in accordance with the Cultural Resource Act.

9) Recreational Fishing (Figure E-2): this overlay depicts the regulated and closed salmon fishing by state authority.

10) Black Cod/Red Rock Fish (Figure G-1): this overlays depicts black cod and red rock fishing areas near Astoria Canyon.

11) Towboat Lanes, (Figure G-2), information depicted on this overlay was obtained from the Northwest Towboat Association and fishermen. These navigation lanes are important to safe navigation for ocean going towboats.

12) Fishing Navigation Routes (Figure G-3): this overlay was developed deferring to the judgement and expertise of local fishermen, four separate northern routes and two southern routes crucial to commercial fishery navigation are shown. These established navigation routes are important to continued fisheries.

13) Commercial Crab Fishing (Figure G-5): this overlay was developed using input from local crab fishermen. Crab fishing is an important component of the local economy.

14) Percent Crab Fishing by Income (Figure G-6): this overlay was developed with interviews/surveys conducted with the crab fishermen and depicts the areas of highest income for crab fishing. This information is helpful in trying to avoid areas of highest use and minimize interference with commercial fisheries.

15) Soft-shell Crab (Figure G-7): this overlay was developed deferring to the judgement and expertise of the crab fishermen and indicate where they feel soft shell crab are abundant at certain times. Soft-shell crabs were considered especially vulnerable to impacts from disposal/burial.

16) Groundfish Trawls (Figure G-9): this overlay depicted the starting points of individual trawl fishing boats from ground fish species caught between June-August and September-November in the years 1994 to 1996. Bands of gray were drawn to represent areas where trawls caught greater than 200 pounds of fish. Information provided by the Oregon

Department of Fish and Wildlife (ODFW). The data is thought to provide an indicator of highest fishing effort.

17) Razor Clams (Figure G-10): this overlay shows two areas in varying shades of gray; the highest concentration of clams are inshore but decreasing numbers are observed with greater distance from shore. The data ended at depths of approximately 200 feet. Razor clams are an important resource in coastal areas, but were determined by the Working Group not to be critical or likely to be impacted.

Each overlay was produced using available information drawing on the experience and expertise of the participants of the Working Group. Each Working Group participant evaluated the overlays. The results of that process are displayed in Table 2.

Table 2. Results from Overlay Ranking Process (number of responses)

Overlay	Relative Importance		
	Low	**Medium**	**High**
1) Benthic Sampling 1992	5	1	0
2) Benthic Sampling 1993 & 1994	5	1	0
3) Benthic Sampling 1995 & 1996	4	1	0
4) Benthic Infauna/sq meter	0	0	9
5) Juvenile Flatfish	3	1	4
6) Sediment Characteristics	0	0	10
7) Sediment Contours	0	0	9
8) Shipwrecks	8	0	0
9) Recreational Fishing	5	0	3
10) Black Cod/Red Rock Fish	4	0	5
11) Towboat Lanes	0	0	6
12) Fishing Navigation Routes	0	1	8
13) Commercial Crab Fishing	0	2	7
14) Percent Crab Fishing by Income	0	0	4
15) Soft-shell Crab	0	1	7
16) Groundfish Trawls	0	1	5
17) Razor Clams	7	0	0

Candidate Sites

It is usually not possible to identify locations that have absolutely no conflicts with environmental resources and amenities or human use. Typically candidate sites are identified based on "least' conflicts, or to represent combinations to avoid different types of conflicts, that were captured during formulation of the overlays. The work group developed 10 candidate sites. The work group or individual members of the work group developed the candidate sites. The candidate sites used the overlays, which represented issue areas that the individual thought was important.
Candidate Site 1 (Figure 6) was referred to as the "skirt" site. This site was developed with consideration of the commercial crab fishermen concerns. The site occupies sea floor outside of the major soft-shell concentration areas and outside of fishing transportation routes. It was based on the towboat lanes and the areas that are not heavily fished by commercial fishermen.

Candidate Site 2 (Figure 7). Expanded Site E consists of the original EPA-designated Site E and the western expansion selected by the Corps' 103 action in 1997. It is the only "existing" site that specifically was carried over into the site selection/designation process. The site is considered to be highly dispersive and is thought that material placed here stay in the littoral system, feeding Peacock Spit and the Long Beach peninsula. The group agreed to consider this as a candidate, as long as monitoring and management actions were taken to assure the material did not mound and affect small boat safety.

Candidate Site 3 (Figure 8). The shale site is an outcropping of exposed area of soft shale stone. It is a unique a geological feature from the Astoria Formation. Nevertheless, commercial fishermen do not fish the site.

Candidate Site 4 (Figure 9). Benson Beach was brought up numerous times in the work group as a disposal option that might help offset the erosion at Benson Beach/Peacock Spit. This site is envisioned as either an upland site or with direct placement of material on the beach. It is not an ocean site under the regulations and was dropped from consideration as a candidate ODMDS. The site may be a candidate as a beneficial use project and therefore an alternative to ocean dumping. This option is discussed further in Appendix A.

Candidate Site 5 (Figure 10) was identified to provide an offshore site to compliment the short haul distance to Candidate Site 2.

Candidate Site 6 (Figure 11) was drawn completely inside of the -80-foot contour to minimize the possibility of mounding and configured to avoid the "mudhole." Material placed here was expected to still provide some benefit to feeding the littoral system. At the time the site was drawn, the work group was waiting for the results of the soft-shell crab studies (Exhibit F).

Candidate Site 7 (Figure 12) is a large, amorphous site overlapping with candidate Site 6. It was envisioned that this site would have both nearshore and offshore disposal components with a large capability for maximum operational flexibility. Disposal in the nearshore area was expected to retain material in the littoral system.

Candidate Site 8 (Figure 13) was located in deep water so that navigation safety problems from deliberate mounding would not occur. As the area is in the towboat lanes, crab fishermen do not use it, as the risk of lost gear from towboats and other vessel traffic is high and they would not receive any compensation for the losses. While a few may fish in towboat lanes, they do so at their own risk. This site was not known to be used by other user groups.

Candidate Site 9 (Figure 14), Astoria Canyon, is located off the continental shelf. Crab fishermen do not use this location. The site lies beyond the ZSF for the MCR project.

Candidate Site 10 (Figure 15), Expanded Site F, had been used under Section 103 authority. The site had only limited capacity remaining and several resource and use conflicts.

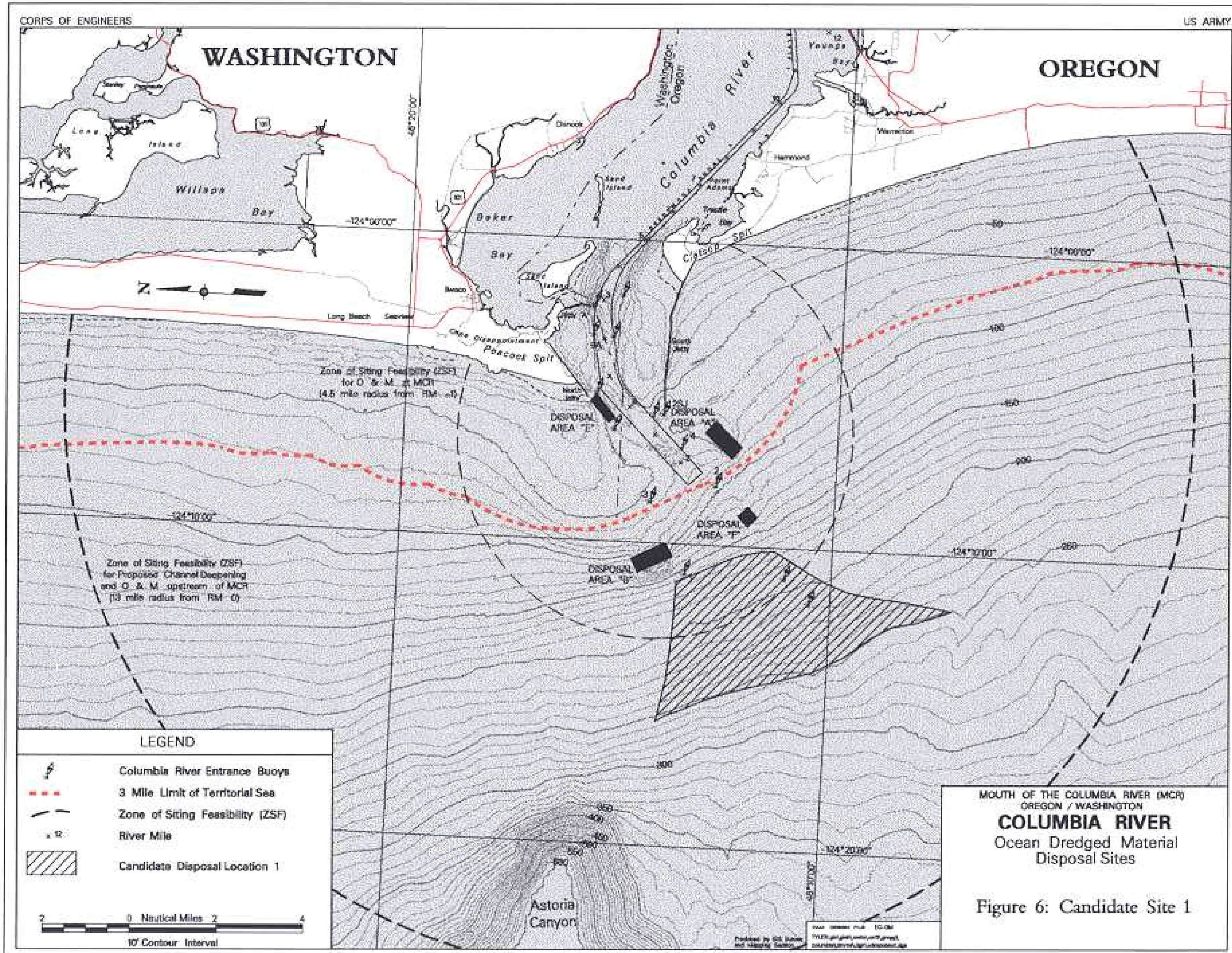


Figure 6: Candidate Site 1

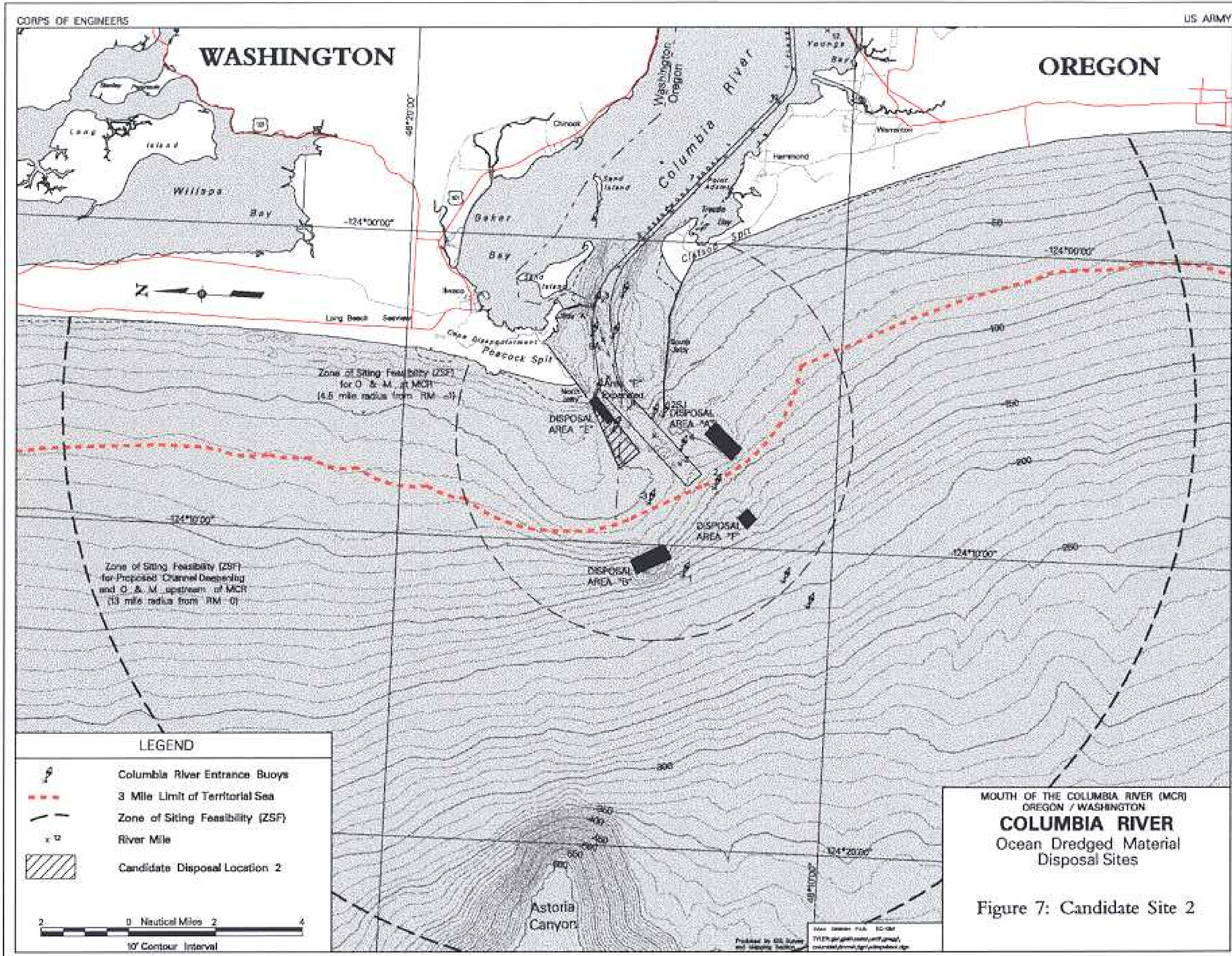


Figure 7: Candidate Site 2

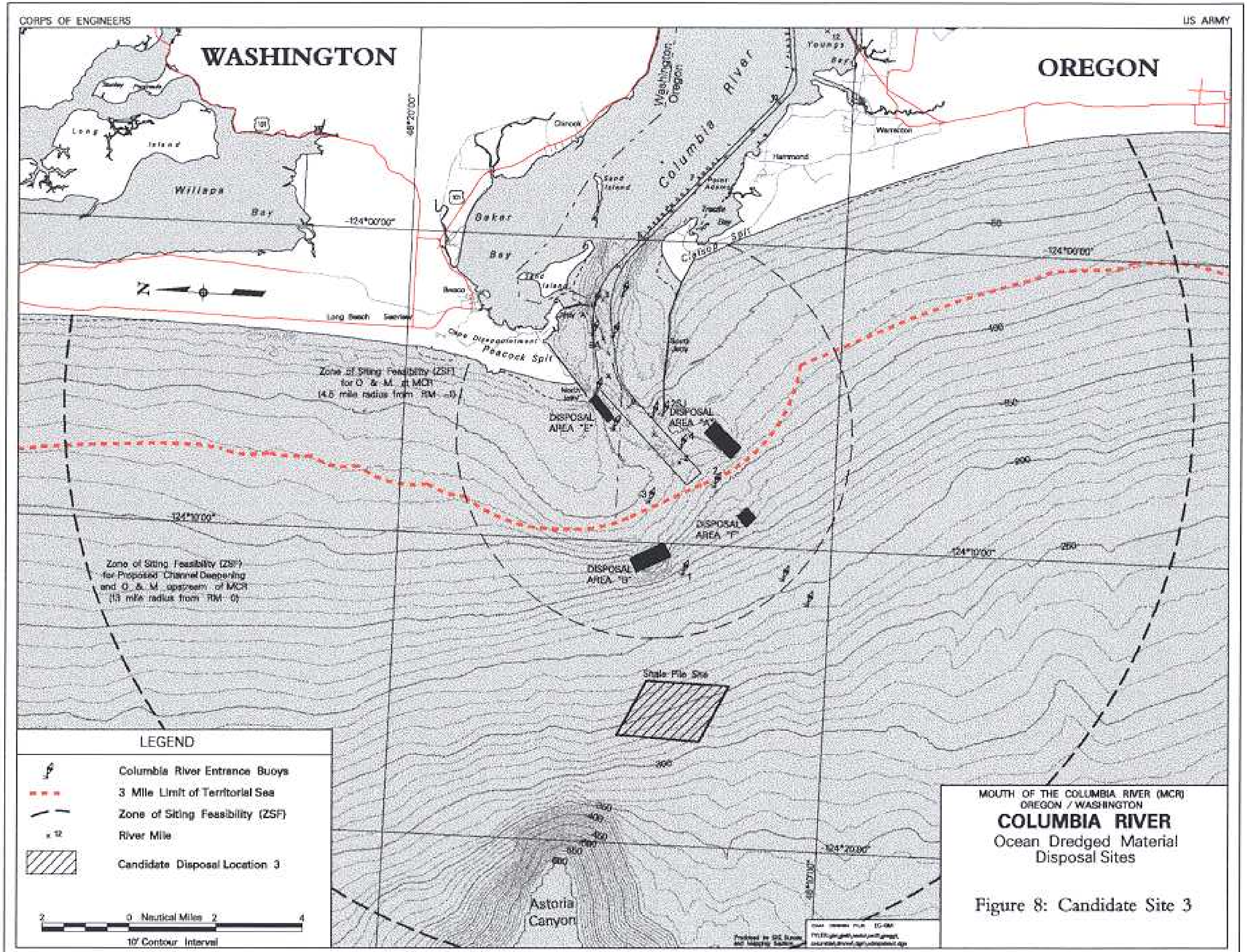


Figure 8: Candidate Site 3

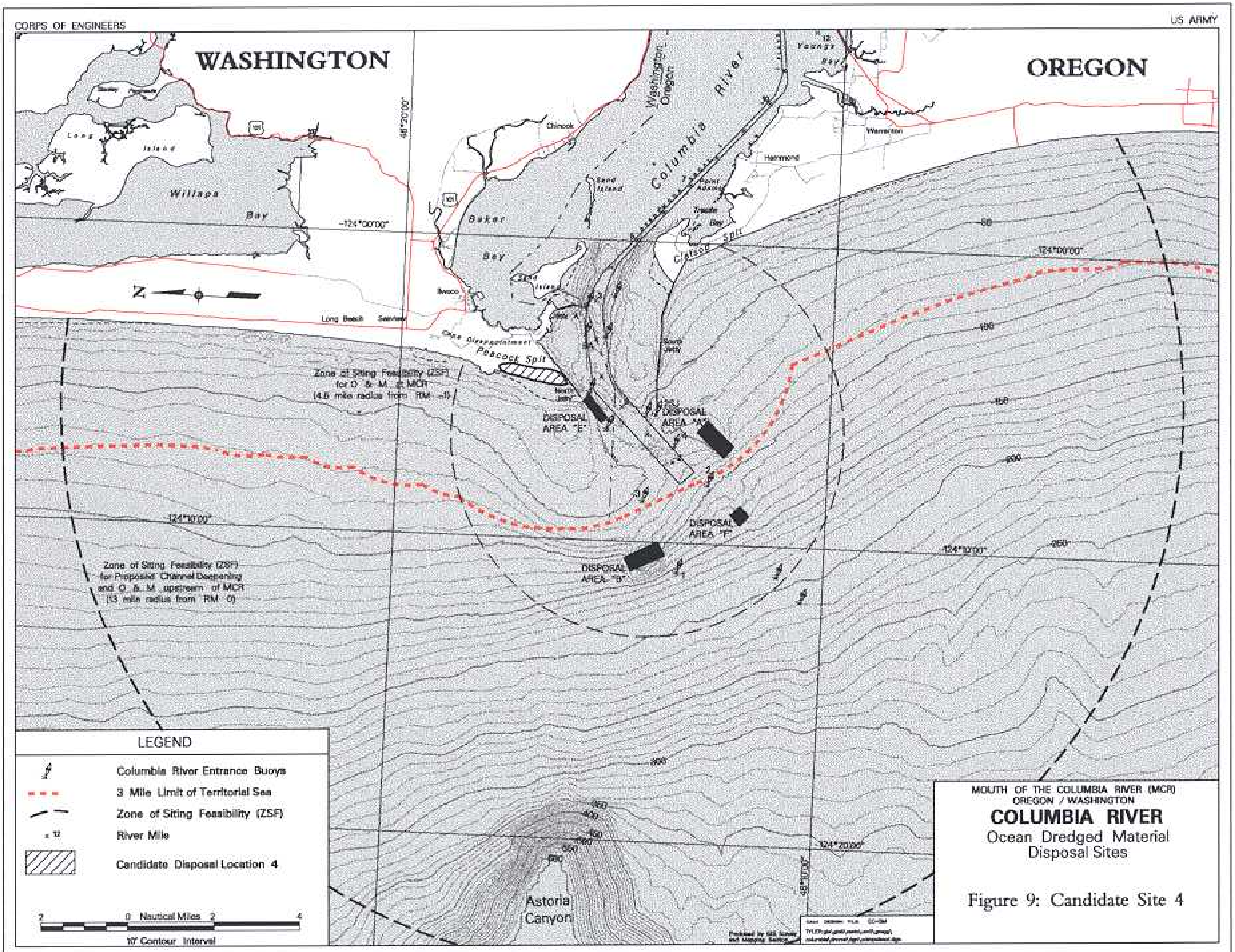


Figure 9: Candidate Site 4

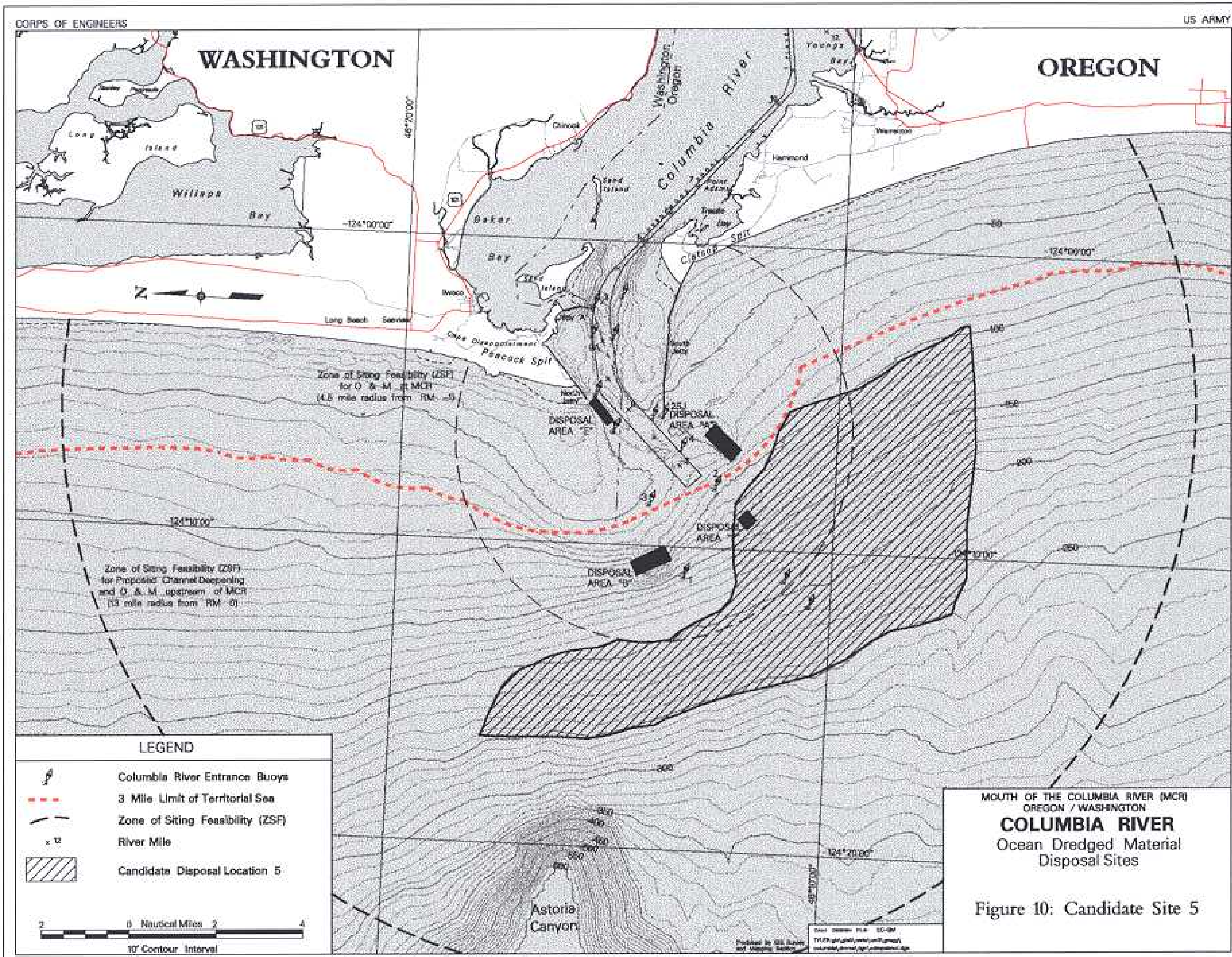


Figure 10: Candidate Site 5

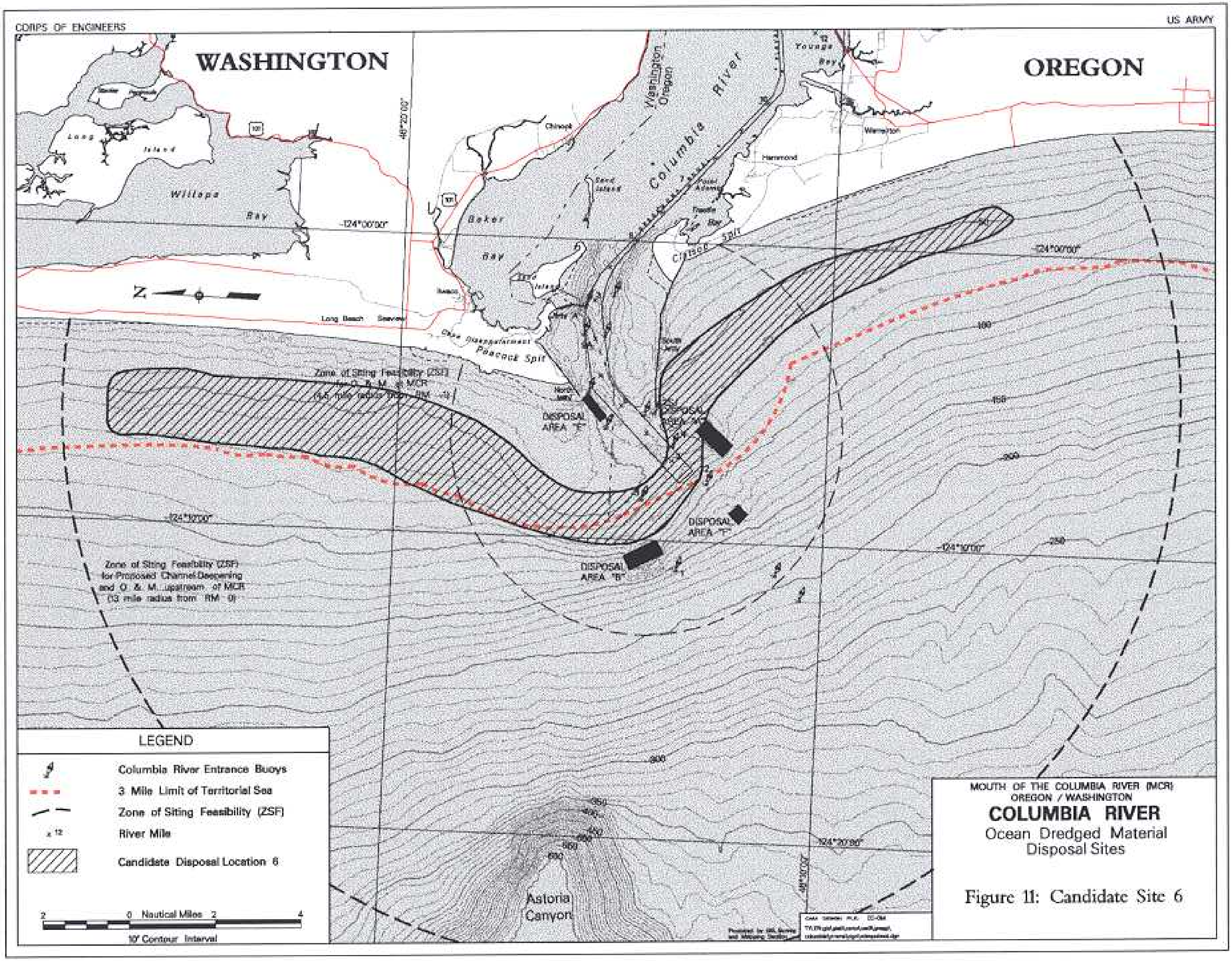


Figure 11: Candidate Site 6

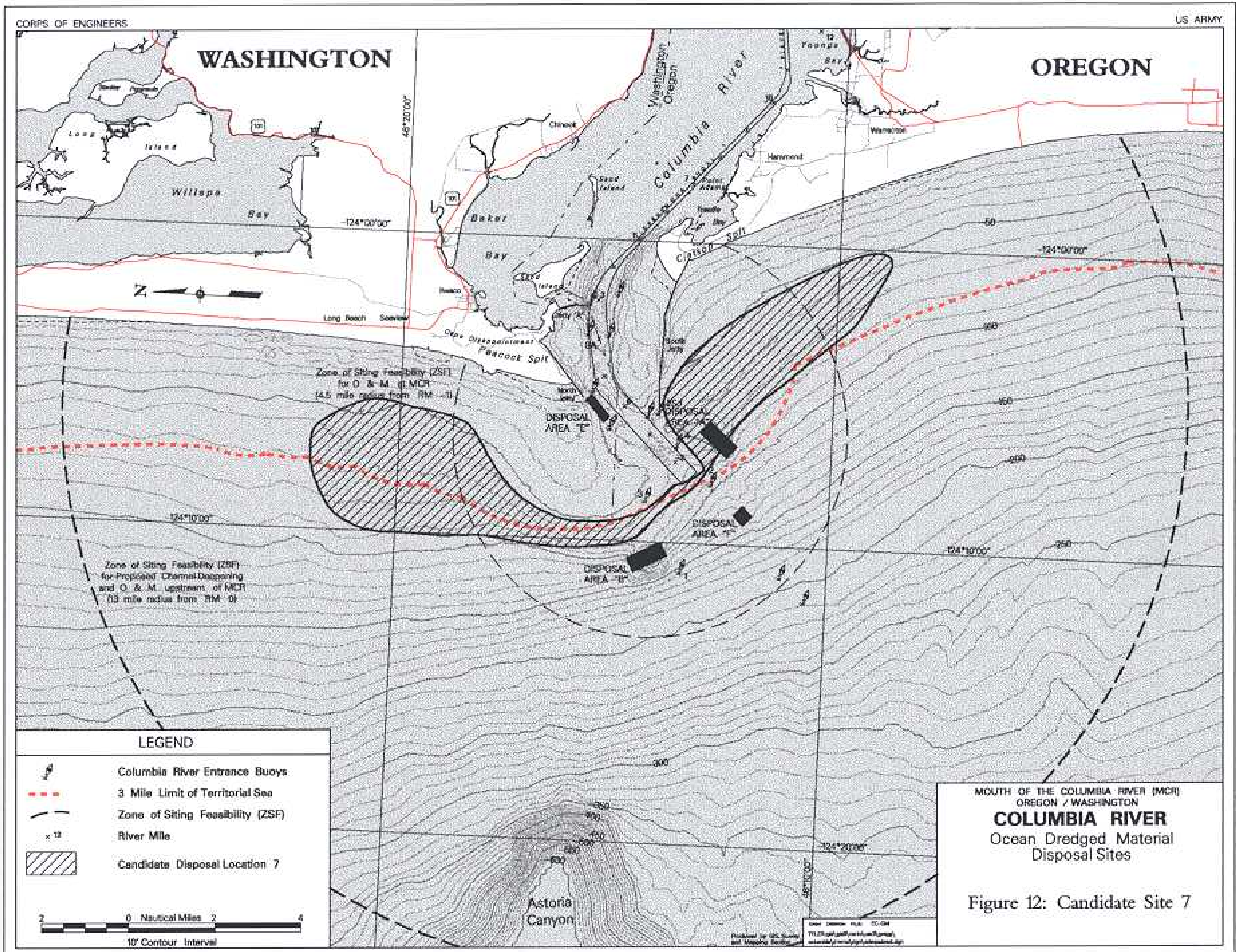


Figure 12: Candidate Site 7

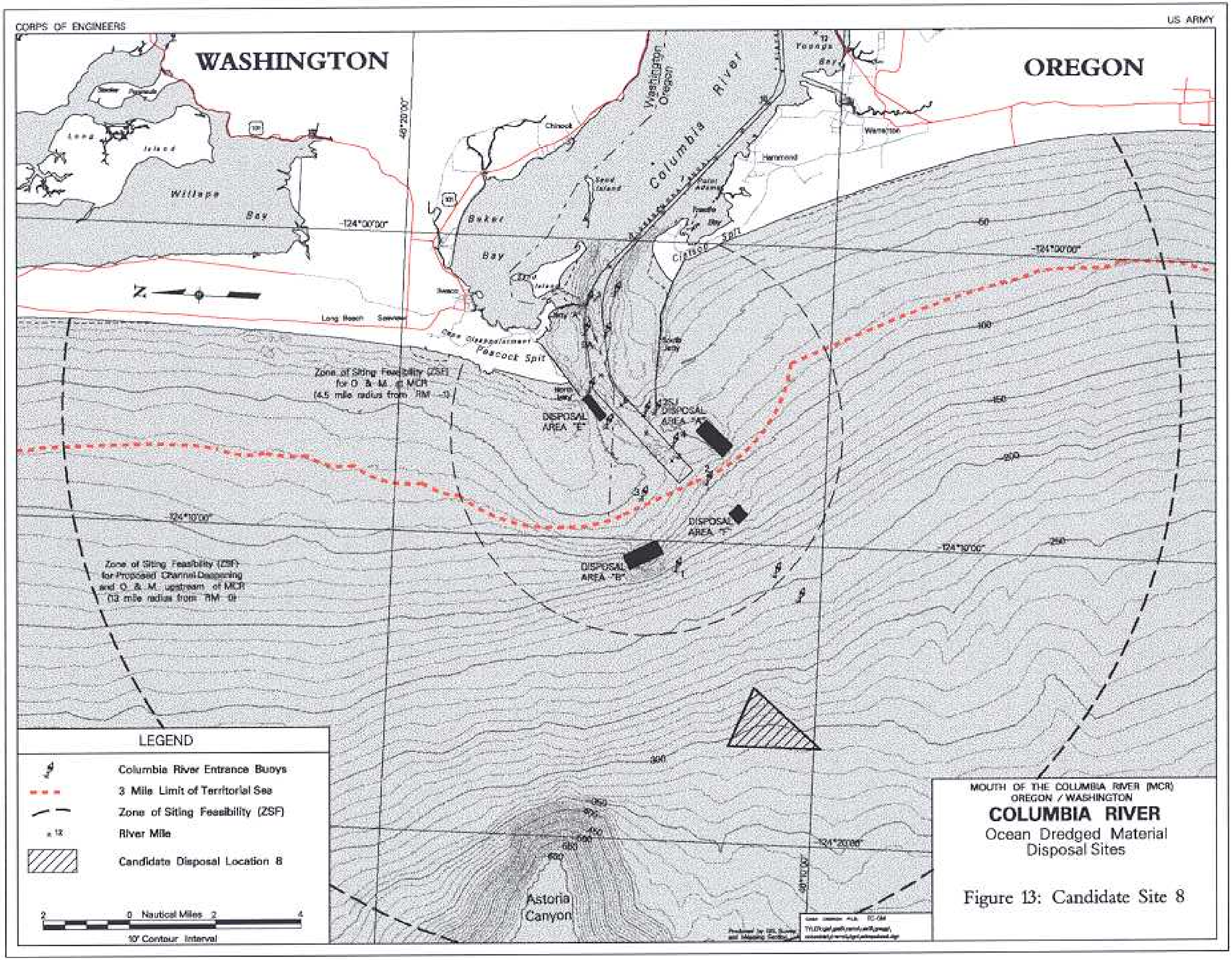


Figure 13: Candidate Site 8

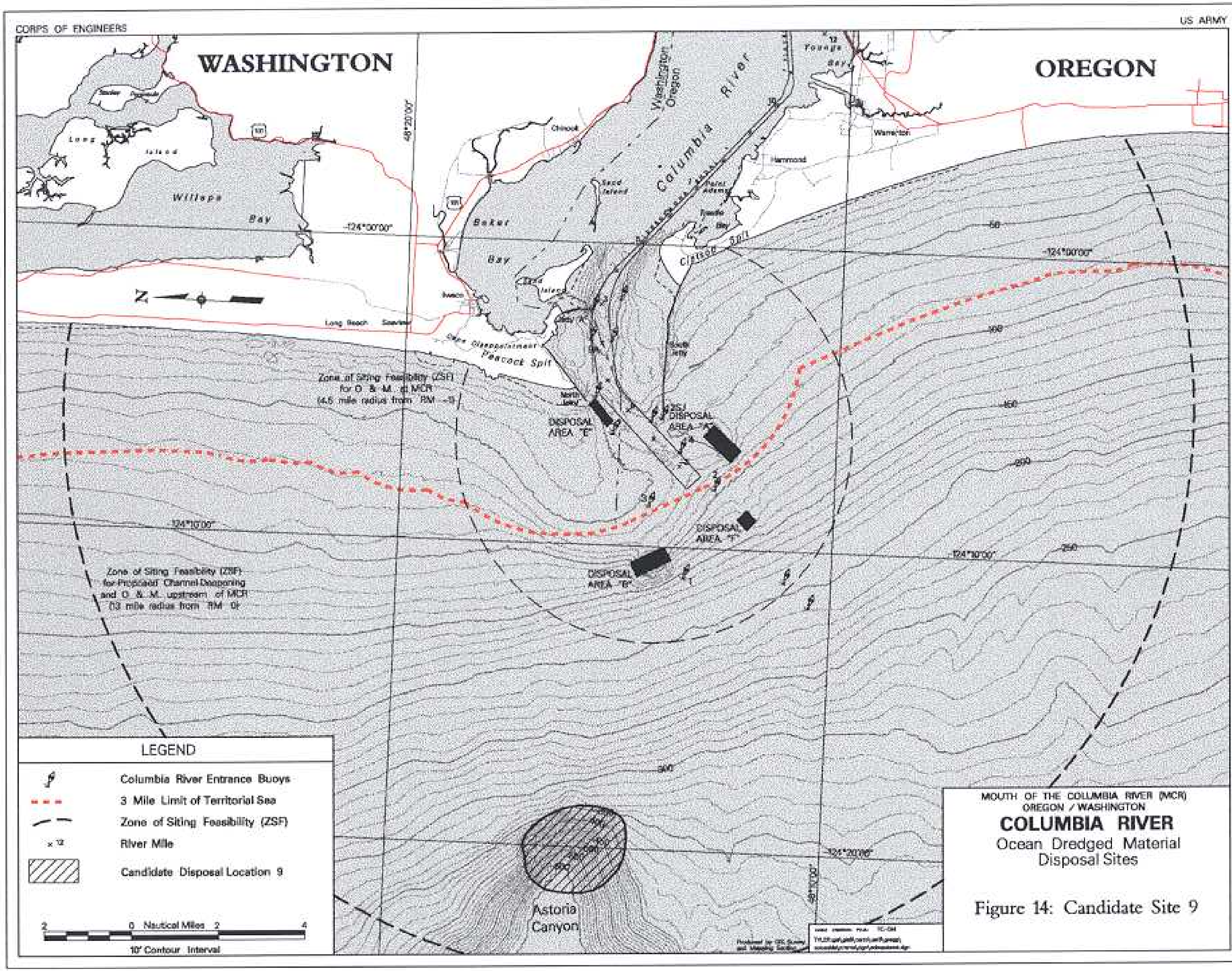


Figure 14: Candidate Site 9

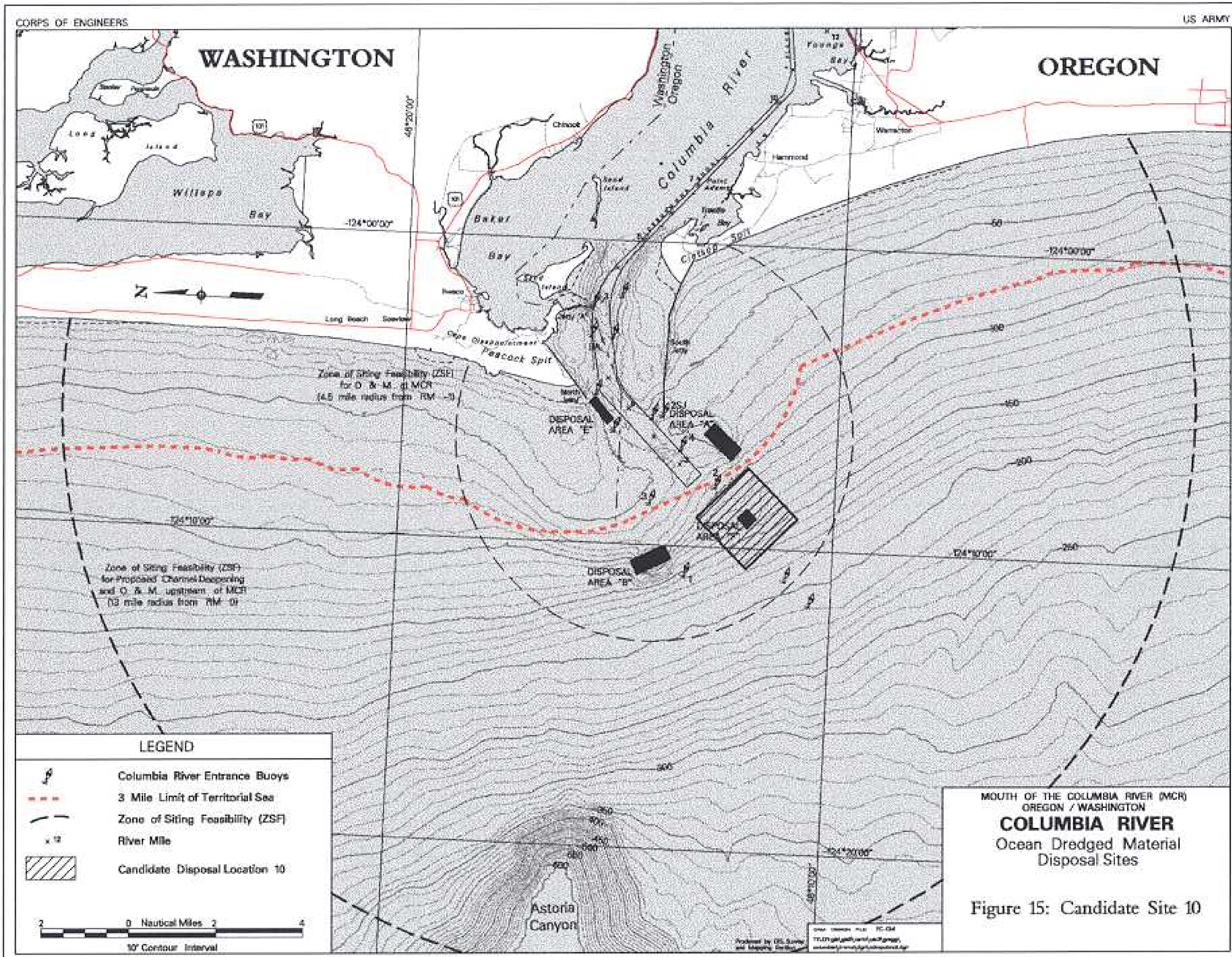


Figure 15: Candidate Site 10

The work group identified the "pluses and minuses" of each candidate disposal site. No attempt was made to achieve unanimity before a plus or minus was recorded, in fact, a plus or minus was recorded even if it was suggested by only one participant. A more detailed record of the discussions is contained in the work group record (Appendix H, Volume II). A summary of the results of this effort is presented in Table 3.

Table 3. Plus and Minus for each Candidate Disposal Site

Group Site #	Minuses	Pluses
Site 1	• juvenile flatfish rearing • lower productivity by disposal • take sand out of littoral drift • navigational concerns • covers habitat • extends into Site B • sediment grain size (not like on like)	• does not create a navigational hazard for small boat fishing • small disposal area • does not cover as much habitat
Site 2 (Expanded Site E)	• navigation problems for small boats • interferes with crab fishing • causes soft spots in fishing areas • requires monitoring to avoid wave amplification • redistribution of sediment (?) • soft shell crab fisheries after Aug 1 • erosion timing may create mounding & navigation issues	• sand stays in littoral drift system • like on like • erosive site • small size
Site 3	• not like on like • halibut and rockfish habitat • unique geological features • don't know where shale pile is • sand out of littoral system	• none
Site 4	• not "Ocean" • costs uncertain (costs and feasibility require further investigation) • works in combination w/ jetty disposal site	• beneficial use/solves Benson Beach problem • negligible impacts to resources and fisheries *Comment: good in combination with 404 site*
Site 5	• takes material out of littoral zone • within high benthic productivity in portions • shale pile site • juvenile flatfish and crab habitat	• very large site for "pruning" to minimize impacts
Site 6	• potential impacts to crabs • big crab fishing area • conflict w/ soft shell crab after Aug 14 • conflicts with crab fishing in OR and WA • threat to crab resources and crab fisheries • concerns about migration to mud hole	• some like on like • near shore transport zone • high energy area • organisms likely to be adapted to moving sand
Site 7	• potential impacts to crabs • big crab fishing area • conflict w/ soft shell crab after Aug 14 • conflicts with crab fishing in OR and WA • threat to crab resources and crab fisheries • concerns about migration to mud hole	• some like on like • near shore transport zone • high energy area • organisms likely to be adapted to moving sand

Table 3 (Continued). Plus and Minus for each Candidate Disposal Site

Group Site #	Minuses	Pluses
Site 8	• area of huge benthic productivity • concern with tow boat lanes • some overlap w/ ground fish area but not big concern to OR • not like on like • close proximity to shale pile (maybe) • outside littoral system	• away from best use resources • small area, therefore less impact to habitat • minimal interference with commercial & recreational fisheries and navigation • minimal impact to local economy • seems to have a 20-year capacity • in tow lanes but bar pilots say ok, no problem if no change in sea conditions
Site 9	• do not know what is there • in tow boat lanes • loss of sand from littoral system • risk of sand slides & slope failure • unique areas • never been disposed on before • monitoring would be difficult • may be a productive area with specific resources not adapted to sand movement	• least impact on resources • would not need large area due to depth • could be a target site *Comment: would not consider unless coupled with Benson Beach*
Site 10 (Expanded Site F)	• limited capacity and mounding problems; wave amplification • ground fishery • soft shell crab concerns • potential conflicts w/ deep draft navigation • loss of sand to littoral zone • high benthic productivity	• already impacted (previously used site) *Comment: crab fishermen would not be impacted if broad disposal; crab fishermen neutral on site*

Conflict Matrix Analysis

Following discussion of the plus and minus rankings, work group participants were encouraged to fill out a conflict matrix for each site being considered. Copies of the conflict matrix, returned by participants as well as overall composite of all responses can be found in Volume II, *Comments and Coordination.* The Portland District of the Corps developed this conflict matrix format to simplify and consolidate scoring of the general and specific site criteria review process. The Corps and EPA have employed the conflict matrix method since 1984. Each area of consideration on the conflict matrix addresses at least one general or specific criterion. The Corps and EPA using input from the work group prepared conflict matrixes for each of the 10 candidate sites (Tables 4 through 12). A legend defining the matrix categories follows the tables (Figure 16).

Candidate Site 1

Ocean Dredged Material Disposal Site Conflict Matrix for Evaluating Potential for Conflict with Required Considerations of the Marine Protection Research and Sanctuaries Act

AREA OF CONSIDERATION[1/]	CONFLICT[2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features		✔			Could overlap shale site	1, 6, 8, 11	a
2. Physical Sediment Compatibility		✔			Could overlap shale site, benthic communities similar	3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✔			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal			✔			5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution			✔			2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		✔			Halibut fishery could be affected	2, 8	a, b
7. Recreational Fisheries		✔			Recreational fishery could be affected	2, 8	a, b
8.Breeding/Spawning Areas		✔			Breeding/spawning grounds could be affected	2, 8	a, b
9. Nursery Areas		✔			Nursery area could be affected	2, 8	a, b
10. Feeding Areas		✔			Feeding areas could be affected	2, 8	a, b
11. Migration Routes			✔			2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✔			2, 8	a, b
13. Spatial Distribution of Benthos		✔			Could affect benthos beyond 200 foot contour	2, 8, 10	a, b
14. Marine Mammals			✔			2, 8	a, b
15. Mineral Deposits			✔			1, 8	a, b, c
16. Navigation Hazard		✔			Management of site important as to not affect towboat lanes	1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)		✔			Management of site important as to not affect towboat lanes	8	a, b, d
18. Degraded Areas			✔			4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✔			4, 6, 9	a, b, d
20. Recreational Uses			✔			2, 8, 11	a, b, c, d
21. Cultural/Historic Sites			✔			11	b
22. Physical Oceanography: Waves/Circulation		✔			Site management important	1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement			✔			1, 3, 6, 7	a, b, d
24. Monitoring			✔			5	c
25. Shape/size of Candidate Site			✔			1, 4, 7	d
26. Size of Buffer Zone	✔				Size of site may need to be reduced to produce a buffer zone form the shale pile	2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✔			Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Candidate Site 2

Ocean Dredged Material Disposal Site Conflict Matrix for Evaluating Potential for Conflict with Required Considerations of the Marine Protection Research and Sanctuaries Act

AREA OF CONSIDERATION[1/]	CONFLICT[2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features			✓			1, 6, 8, 11	a
2. Physical Sediment Compatibility			✓			3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✓			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal		✓			Possible Mounding	5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution			✓			2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		✓			Could affect crab fishing	2, 8	a, b
7. Recreational Fisheries			✓			2, 8	a, b
8.Breeding/Spawning Areas			✓			2, 8	a, b
9. Nursery Areas			✓			2, 8	a, b
10. Feeding Areas		✓			Could affect feeding of soft shell crab	2, 8	a, b
11. Migration Routes		✓			Could affect crab and fish migration routes	2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✓			2, 8	a, b
13. Spatial Distribution of Benthos			✓			2, 8, 10	a, b
14. Marine Mammals			✓			2, 8	a, b
15. Mineral Deposits			✓			1, 8	a, b, c
16. Navigation Hazard		✓			Possible mounding; affect to small crafts	1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)			✓			8	a, b, d
18. Degraded Areas				✓	Beach nourishment	4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✓			4, 6, 9	a, b, d
20. Recreational Uses		✓			Mounding/encountering dredge	2, 8, 11	a, b, c, d
21. Cultural/Historic Sites				✓	Cover identified ship wrecks	11	b
22. Physical Oceanography: Waves/Circulation		✓			Could affect wave heights based on volume	1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement		✓			Could affect sediment transport	1, 3, 6, 7	a, b, d
24. Monitoring			✓			5	c
25. Shape/size of Candidate Site			✓			1, 4, 7	d
26. Size of Buffer Zone			✓			2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✓			Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Candidate Site 3

Ocean Dredged Material Disposal Site Conflict Matrix for Evaluating Potential for Conflict with Required Considerations of the Marine Protection Research and Sanctuaries Act

AREA OF CONSIDERATION[1/]	CONFLICT[2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features	✓				Unique feature of limited extent	1, 6, 8, 11	a
2. Physical Sediment Compatibility	✓				Placing sand on a hard surface	3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✓			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal			✓			5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution		✓			Unknown resources	2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		✓			Potential affect to halibut	2, 8	a, b
7. Recreational Fisheries			✓			2, 8	a, b
8.Breeding/Spawning Areas		✓			Unknown resources	2, 8	a, b
9. Nursery Areas		✓			Unknown resources	2, 8	a, b
10. Feeding Areas		✓			Unknown resources	2, 8	a, b
11. Migration Routes			✓			2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✓			2, 8	a, b
13. Spatial Distribution of Benthos		✓			Unknown resources	2, 8, 10	a, b
14. Marine Mammals			✓			2, 8	a, b
15. Mineral Deposits		✓			Unknown resources	1, 8	a, b, c
16. Navigation Hazard			✓			1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)		✓			Could affect tow boat lanes	8	a, b, d
18. Degraded Areas			✓			4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✓			4, 6, 9	a, b, d
20. Recreational Uses			✓			2, 8, 11	a, b, c, d
21. Cultural/Historic Sites			✓			11	b
22. Physical Oceanography: Waves/Circulation			✓			1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement			✓ ✓			1, 3, 6, 7	a, b, d
24. Monitoring			✓			5	c
25. Shape/size of Candidate Site			✓			1, 4, 7	d
26. Size of Buffer Zone			✓			2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✓			Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Candidate Site 4

Ocean Dredged Material Disposal Site Conflict Matrix for Evaluating Potential for Conflict with Required Considerations of the Marine Protection Research and Sanctuaries Act

AREA OF CONSIDERATION[1/]	CONFLICT[2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features						1, 6, 8, 11	a
2. Physical Sediment Compatibility						3, 4, 9	b, c, d
3. Chemical Sediment Compatibility						3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal						5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution						2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries						2, 8	a, b
7. Recreational Fisheries						2, 8	a, b
8.Breeding/Spawning Areas						2, 8	a, b
9. Nursery Areas						2, 8	a, b
10. Feeding Areas						2, 8	a, b
11. Migration Routes						2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species						2, 8	a, b
13. Spatial Distribution of Benthos						2, 8, 10	a, b
14. Marine Mammals						2, 8	a, b
15. Mineral Deposits						1, 8	a, b, c
16. Navigation Hazard						1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)						8	a, b, d
18. Degraded Areas						4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics						4, 6, 9	a, b, d
20. Recreational Uses						2, 8, 11	a, b, c, d
21. Cultural/Historic Sites						11	b
22. Physical Oceanography: Waves/Circulation						1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement						1, 3, 6, 7	a, b, d
24. Monitoring						5	c
25. Shape/size of Candidate Site						1, 4, 7	d
26. Size of Buffer Zone						2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects					Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Candidate Site 5

Ocean Dredged Material Disposal Site Conflict Matrix for Evaluating Potential for Conflict with Required Considerations of the Marine Protection Research and Sanctuaries Act

AREA OF CONSIDERATION[1/]	CONFLICT [2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features		✓			Could overlap shale site	1, 6, 8, 11	a
2. Physical Sediment Compatibility		✓			Could overlap shale site, benthic communities similar	3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✓			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal		✓			Past disposal at Site F	5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution			✓			2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		✓			Halibut fishery could be affected	2, 8	a, b
7. Recreational Fisheries		✓			Recreational fishery could be affected	2, 8	a, b
8.Breeding/Spawning Areas		✓			Breeding/spawning grounds could be affected	2, 8	a, b
9. Nursery Areas		✓			Nursery area could be affected	2, 8	a, b
10. Feeding Areas		✓			Feeding areas could be affected	2, 8	a, b
11. Migration Routes			✓			2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✓			2, 8	a, b
13. Spatial Distribution of Benthos		✓			Could affect benthos beyond 200 foot contour	2, 8, 10	a, b
14. Marine Mammals			✓			2, 8	a, b
15. Mineral Deposits			✓			1, 8	a, b, c
16. Navigation Hazard		✓			Management of site important as to not affect towboat lanes	1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)		✓			Management of site important as to not affect towboat lanes	8	a, b, d
18. Degraded Areas			✓			4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✓			4, 6, 9	a, b, d
20. Recreational Uses			✓			2, 8, 11	a, b, c, d
21. Cultural/Historic Sites			✓			11	b
22. Physical Oceanography: Waves/Circulation		✓			Site management important	1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement			✓			1, 3, 6, 7	a, b, d
24. Monitoring			✓			5	c
25. Shape/size of Candidate Site			✓			1, 4, 7	d
26. Size of Buffer Zone	✓				Size of site may need to be reduced to produce a buffer zone form the shale pile	2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✓			Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Candidate Site 6 & 7

Ocean Dredged Material Disposal Site Conflict Matrix for Evaluating Potential for Conflict with Required Considerations of the Marine Protection Research and Sanctuaries Act

AREA OF CONSIDERATION[1/]	CONFLICT [2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features			✓			1, 6, 8, 11	a
2. Physical Sediment Compatibility			✓			3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✓			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal		✓			Overlap with Site A	5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution			✓			2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		✓			Could affect crabbing and trawling	2, 8	a, b
7. Recreational Fisheries		✓			Could affect salmon fishing	2, 8	a, b
8.Breeding/Spawning Areas		✓			Could affect crab and small bottom fish breeding/spawning areas	2, 8	a, b
9. Nursery Areas		✓			Could affect nursery areas	2, 8	a, b
10. Feeding Areas		✓			Could affect feeding areas	2, 8	a, b
11. Migration Routes			✓			2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✓ ✓			2, 8	a, b
13. Spatial Distribution of Benthos			✓			2, 8, 10	a, b
14. Marine Mammals			✓			2, 8	a, b
15. Mineral Deposits			✓			1, 8	a, b, c
16. Navigation Hazard		✓			Mounding	1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)			✓			8	a, b, d
18. Degraded Areas				✓	Beach Nourishment	4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✓			4, 6, 9	a, b, d
20. Recreational Uses		✓		✓	Could affect beach use	2, 8, 11	a, b, c, d
21. Cultural/Historic Sites				✓	Covering cultural resource site	11	b
22. Physical Oceanography: Waves/Circulation		✓			Mounding	1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement		✓		✓	Could feed beaches	1, 3, 6, 7	a, b, d
24. Monitoring			✓			5	c
25. Shape/size of Candidate Site			✓			1, 4, 7	d
26. Size of Buffer Zone			✓			2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✓			Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Candidate Site 8

Ocean Dredged Material Disposal Site Conflict Matrix for Evaluating Potential for Conflict with Required Considerations of the Marine Protection Research and Sanctuaries Act

AREA OF CONSIDERATION[1/]	CONFLICT [2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features		✓			Close proximity to unique feature; shale pile	1, 6, 8, 11	a
2. Physical Sediment Compatibility		✓			Shale pile	3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✓			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal			✓			5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution		✓			Unknown resources	2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		✓			Could affect halibut and trawling	2, 8	a, b
7. Recreational Fisheries			✓			2, 8	a, b
8.Breeding/Spawning Areas		✓			Unknown resources	2, 8	a, b
9. Nursery Areas		✓			Unknown resources	2, 8	a, b
10. Feeding Areas		✓			Unknown resources	2, 8	a, b
11. Migration Routes			✓			2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✓			2, 8	a, b
13. Spatial Distribution of Benthos		✓			Unknown resources	2, 8, 10	a, b
14. Marine Mammals			✓			2, 8	a, b
15. Mineral Deposits		✓			Unknown resources	1, 8	a, b, c
16. Navigation Hazard			✓			1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)		✓			Could affect tow boat lanes	8	a, b, d
18. Degraded Areas			✓			4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✓			4, 6, 9	a, b, d
20. Recreational Uses			✓			2, 8, 11	a, b, c, d
21. Cultural/Historic Sites			✓			11	b
22. Physical Oceanography: Waves/Circulation			✓			1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement			✓ ✓			1, 3, 6, 7	a, b, d
24. Monitoring			✓			5	c
25. Shape/size of Candidate Site			✓			1, 4, 7	d
26. Size of Buffer Zone			✓			2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✓			Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Candidate Site 9

Ocean Dredged Material Disposal Site Conflict Matrix for Evaluating Potential for Conflict with Required Considerations of the Marine Protection Research and Sanctuaries Act

AREA OF CONSIDERATION[1/]	CONFLICT[2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features	✓				Affect unique fragile area	1, 6, 8, 11	a
2. Physical Sediment Compatibility	✓				Completely change the substrate	3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✓			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal			✓			5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution		✓			Unknown resources	2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		✓			Could affect rock fish	2, 8	a, b
7. Recreational Fisheries			✓			2, 8	a, b
8.Breeding/Spawning Areas		✓			Could affect breeding/spawning areas	2, 8	a, b
9. Nursery Areas		✓			Could affect nursery areas	2, 8	a, b
10. Feeding Areas		✓			Could affect feeding areas	2, 8	a, b
11. Migration Routes			✓			2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✓			2, 8	a, b
13. Spatial Distribution of Benthos	✓				Change in benthic communities	2, 8, 10	a, b
14. Marine Mammals			✓			2, 8	a, b
15. Mineral Deposits		✓			Unknown resources	1, 8	a, b, c
16. Navigation Hazard			✓			1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)			✓			8	a, b, d
18. Degraded Areas			✓			4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✓			4, 6, 9	a, b, d
20. Recreational Uses			✓			2, 8, 11	a, b, c, d
21. Cultural/Historic Sites			✓			11	b
22. Physical Oceanography: Waves/Circulation			✓			1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement			✓			1, 3, 6, 7	a, b, d
24. Monitoring		✓			Difficult to monitor	5	c
25. Shape/size of Candidate Site			✓			1, 4, 7	d
26. Size of Buffer Zone		✓			Unknown resources	2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✓			Potential affect from fishing as well as disposal	4, 7	c, d

Candidate Site 10

Ocean Dredged Material Disposal Site Conflict Matrix for Evaluating Potential for Conflict with Required Considerations of the Marine Protection Research and Sanctuaries Act

AREA OF CONSIDERATION[1/]	CONFLICT [2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features			✓			1, 6, 8, 11	a
2. Physical Sediment Compatibility			✓			3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✓			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal		✓			Mounding/limited capacity	5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution			✓			2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		✓			Could affect crab and trawl fishing	2, 8	a, b
7. Recreational Fisheries		✓			Could affect salmon fishing	2, 8	a, b
8.Breeding/Spawning Areas		✓			Could affect breeding/spawning areas	2, 8	a, b
9. Nursery Areas		✓			Could affect nursery areas	2, 8	a, b
10. Feeding Areas		✓			Could affect feeding areas	2, 8	a, b
11. Migration Routes			✓			2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✓			2, 8	a, b
13. Spatial Distribution of Benthos			✓			2, 8, 10	a, b
14. Marine Mammals			✓			2, 8	a, b
15. Mineral Deposits			✓			1, 8	a, b, c
16. Navigation Hazard		✓			Mounding	1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)		✓			Could affect pilot transfer area and tow boat lanes	8	a, b, d
18. Degraded Areas			✓			4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✓			4, 6, 9	a, b, d
20. Recreational Uses			✓			2, 8, 11	a, b, c, d
21. Cultural/Historic Sites				✓	Covers a cultural resource site	11	b
22. Physical Oceanography: Waves/Circulation		✓			Could increase wave height	1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement		✓			Mounding	1, 3, 6, 7	a, b, d
24. Monitoring			✓			5	c
25. Shape/size of Candidate Site			✓			1, 4, 7	d
26. Size of Buffer Zone			✓			2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✓			Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Figure 16. Conflict Matrix Legend

1/ Definition of "Areas of Consideration"

1. Unusual Topography/Unique Bottom Features: Would placement of material in this candidate site affect physical bottom feature that is unique within the local or regional area?

2. Physical Sediment Compatibility: Does the candidate site have similar sediment characteristics to anticipated dredged material?

3. Chemical Sediment Compatibility: Does the candidate site have similar chemical characteristics to anticipated dredged material?

4. Influence of Past Disposal: Would placement of material in this candidate site be affected by previous disposal of dredge material?

5. Living Resources of Limited Distribution: Would placement of material in this candidate site affect any living resources that do not have a coast-wide distribution?

6. Commercial Fisheries: Would placement of material in this candidate site affect any commercial fishing activity (resource impacts are covered in 8-11)?

7. Recreational Fisheries: Would placement of material in this candidate site affect any recreational fishing activity (resource impacts are covered in 8-11)?

8. Breeding/Spawning Areas: Would placement of material in this candidate site affect breeding and spawning areas of any species?

9. Nursery Areas: Would placement of material in this candidate site affect nursery areas of any species?

10. Feeding Areas: Would placement of material in this candidate site affect feeding areas of any species?

11. Migration Routes: Would placement of material in this candidate site affect migration routes of species?

12. Critical Habitat of Threatened or Endangered Species: Would placement of material in this candidate site affect critical habitat of threatened or endangered species?

13. Spatial Distribution of Benthos: Would placement of material in this candidate site change the benthic invertebrate community structure, eg, fine-grain species to coarse-grain species, etc?

14. Marine Mammals: Would placement of material in this candidate site affect marine mammals or their habitat, eg, gray whale feeding areas etc?

15. Mineral Deposits: Would any known mineral deposits be affected by the placement of material?

16. Navigation Hazard: Would the placement of material create a navigation hazard?

17. Other Uses of Ocean: Would placement of material impact other uses of the ocean not addressed elsewhere, such as cables, pipelines, tow boat lanes, and pilot transfer points?

18. Degraded Areas: Would disposal in this candidate site continue to affect or improve the degraded area?

19. Water Column Chemical/Physical Characteristics: Would placement of material in this candidate site affect water column chemical/physical characteristics?

20. Recreational Uses: Would placement of material affect recreational uses?

21. Cultural/Historic Sites: Would placement of material in this candidate site impact or protect a cultural/historic site?

22. Physical Oceanography: Waves/Circulation: Would placement of material affect wave/circulation patterns?

23. Direction of Transport/potential for Settlement: Would placement of material affect direction of sediment transport and/or potential for settlement?

24. Monitoring: Would use of this candidate site affect either on-going monitoring or the ability to monitor using conventional methods? Monitoring typically would include periodic hydrographic surveys, could include sediment sampling or biological data collection.

25. Shape/size of Candidate Site: Is the candidate site suitable for the operation of a dredge?
Maneuverability of the dredge?
Is it orientated so the dredge can place material while heading into the waves?
Is the depth of water sufficient to open the hopper doors/dump scow?
Can the dredge operate safely?
Is the size of the candidate site large enough for long term use?

26. Size of Buffer Zone: Is the candidates site a sufficient distance from important resources or features to protect them from any affect of disposal?

27. Potential for Cumulative Effects: Would placement of material contribute to cumulative affects from other activities?

Figure 16. (continued) Conflict Matrix Legend

2/ Definition of Degrees of Conflict
Conflict: There will definitely be an adverse impact on the resource or the use.
Potential Conflict: There is a possibility of an adverse impact; however. extent and significance are unknown.
No Conflict: There will definitely not be an adverse impact on the resource or the use.
Beneficial Use: There will be a positive impact on the resource or the use.

3/ Eleven Specific Factors for Ocean Disposal Site Selection
1. Geographical position, depth of water, bottom topography, and distance from coast.
2. Location in relation to breeding, spawning, nursery, feeding or passage areas of living resources in adult or juvenile phases.
3. Location in relation to beaches or other amenity areas.
4. Types and quantities of waste proposed to be disposed and proposed methods of release, including methods of packaging the waste, if any.
5. Feasibility of surveillance and monitoring.
6. Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current velocity, if any.
7. Existence and effects of present or previous discharges and dumping in the area (including cumulative effects).
8. Interference with shipping, fishing, recreation, mineral extraction, desalination, shellfish culture, areas of special scientific importance and other legitimate uses of the ocean.
9. Existing water quality and ecology of the site, as determined by available data or by trend assessment or baseline surveys.
10. Potential for the development or recruitment of nuisance species within the disposal site.
11. Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.

4/ General Criteria for the Selection of Ocean Disposal Sites
a. The dumping of material into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shell fisheries, and regions of heavy commercial or recreational navigation.
b. Locations and boundaries of disposal sites will be chosen so that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shell fishery.
c. If at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet criteria for site selection set forth in Sections 228.5 - 228.6, the use of such sites will be terminated as soon as suitable alternative disposal sites can be designated.
d. The sizes of ocean disposal sites will be limited in order to localize, for identification and control, any immediate adverse impacts and to permit the implementation of effective monitoring and surveillance programs to prevent adverse, long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study.
e. EPA will, whenever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used.

Proposed Sites Circulated in the Draft EIS

The next step in the process reduced the 10 candidate sites to sites proposed for final EPA designation. The Corps and EPA considered the information gathered by the work group, the 5-year feasibility study, and historical information to identify and display the three proposed sites circulated in the DEIS. The configuration of the North Site and the South Sites was based on the consideration of the 17 resource overlays (in conjunction with the work group's ranking of the overlays, Table 13), comparison of the 10 candidate sites (giving consideration to the work group's rating of pluses and minuses), additional information for areas the work group identified as "data gaps" (such as the evaluation of potential impacts to soft shell crabs and juvenile flatfish), and the Corps/EPA conflict matrices for the 10 candidate sites.

Table 13. Overlay Prioritization by the Work Group.

Overlay	Relative Importance		
	Low	Medium	High
5) Sediment Characteristics	0	0	10
14) Sediment Contours	0	0	9
11) Benthic Infauna/sq meter	0	0	9
7) Fishing Navigation Routes	0	1	8
12) Commercial Crab Fishing	0	2	7
17) Soft-shell Crab	0	1	7
13) Towboat Lanes	0	0	6
1) Groundfish Trawls	0	1	5
16) Black Cod/Red Rock Fish	4	0	5
4) Juvenile Flatfish	3	1	4
15) Percent Crab Fishing by Income	0	0	4
6) Recreational Fishing	5	0	3
8) Benthic Sampling 1996	4	1	0
9) Benthic Sampling 1993 & 1994	5	1	0
10) Benthic Sampling 1992	5	1	0
3) Razor Clams	7	0	0
2) Shipwrecks	8	0	0

The following assumptions were given great weight by the Corps/EPA in their configuration and selection of the sites proposed for designation that were presented in the DEIS.

- Unique areas like the shale pile and the "mud hole" should be avoided
- Beyond the 200 foot contour the more stable environment supports a more diverse, higher density benthic community which should be avoided
- Navigational safety especially for smaller fishing boats was very important and was the primary factor for the need for new sites
- Nearshore sites have the greatest potential to keep material in the littoral zone

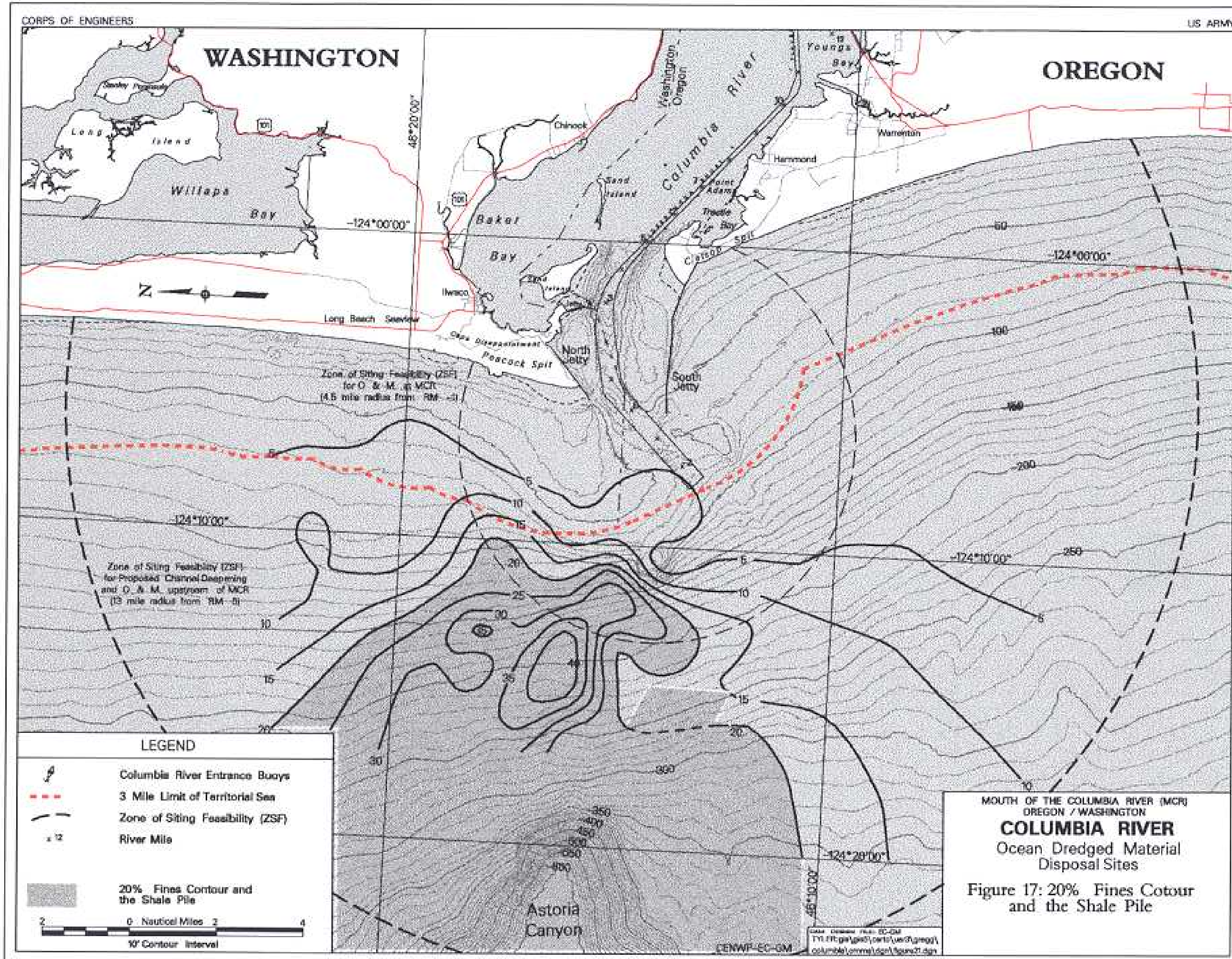
Given these assumptions, the Corps and EPA used the overlays in the following way to identify the three proposed sites presented in the DEIS. On a clean base map the location of the shale pile was plotted and the 20 percent fines contour was plotted (Figure 17). The percent fines overlay is believed to be a conservative mapping of the unique feature referred to as the "mudhole." Although the research (see Exhibit F) conducted by the government did not show any impact to juvenile flatfish due to direct disposal of material, over time, ongoing disposals would have altered this substrate type leading to alteration or elimination of the "mudhole." This feature encompassed the medium and high concentration juvenile flatfish rearing areas (Figure A-12), and also encompassed the black cod/red rock fishing area (Figure G-1). Avoiding this feature would minimize or avoid conflicts by ocean disposal with these resources.

The 200-foot depth contour was considered to be an important boundary due to the higher benthic diversity and density found beyond this depth contour. When added to the base map, almost all of the towboat lanes except an area where the pilots transfer (Figure G-2) was eliminated. The 30-foot contour, the operational constraint the hopper dredges, established the landward limit of consideration (Figure 18).

The fishing navigation routes, especially to the north, were considered very important and sensitive to the placement of dredged material. Due to Peacock Spit, vessels must swing wide into the ocean to transit north rather than hug the shorelines. This substantially increases transit time, an important economic consideration to small commercial fishermen. Fishing navigation routes (Figure G-3) were applied, paying close attention to the northern routes. This left the following overlays to evaluate: groundfish trawls; commercial crab fishing areas; percent crab fishing by income, and soft-shell crab.

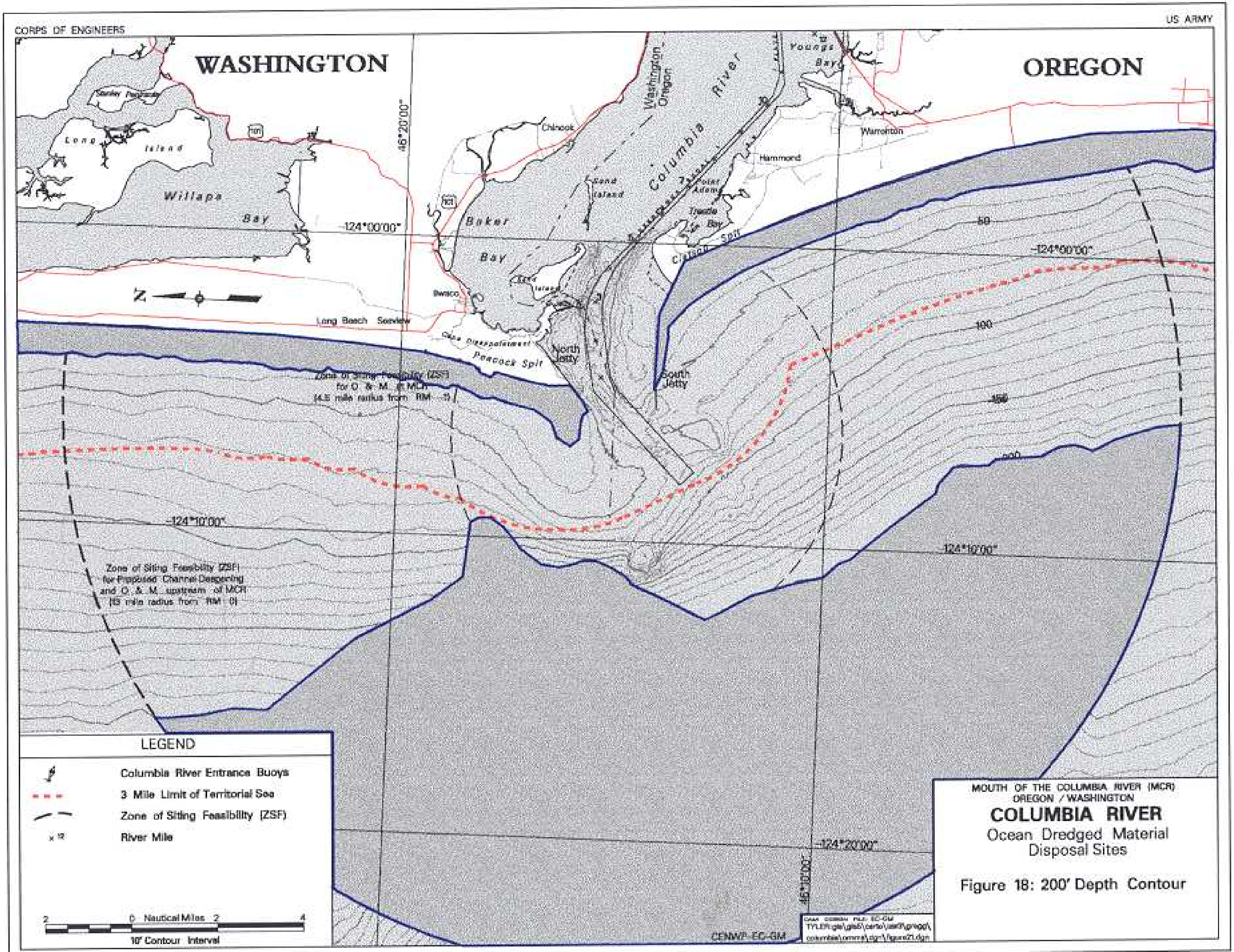
Because most of dredging from the MCR project is July through October, the high commercial fishing use area identified by the crab fishermen (Figure G-5) was added. High use area on the north side is primarily from March through July. High use area on the south side is primarily from December through July, as delineated by the crab fisherman from the Working Group. The government believes that non-mounding disposal in the high use areas at times other than when it is being actively fished by the crab fishermen would minimize interference with and impact to the commercial fishery. Adverse effects on the crab resource itself can be minimized by appropriate disposal practices (placing the material in a non-repetitive pattern). A management plan would further minimize or avoid potential impacts to the soft-shell crab and bottom trawl fishery within the sites.

The composite overlay map (Figure 19) was compared to the 10 candidate sites. The candidate sites that potentially minimize conflicts in combination with other uses and ocean resources are parts of candidate sites 1, 5, 6, 7, and 10. These areas were then configured as three proposed sites, the North Site, the South Site, and Site E, by the Corps and EPA and circulated in the DEIS (Figure 20).



MOUTH OF THE COLUMBIA RIVER (MCR)
OREGON / WASHINGTON
COLUMBIA RIVER
Ocean Dredged Material
Disposal Sites

Figure 17: 20% Fines Cotour and the Shale Pile



MOUTH OF THE COLUMBIA RIVER (MCR)
OREGON / WASHINGTON

COLUMBIA RIVER

Ocean Dredged Material
Disposal Sites

Figure 18: 200' Depth Contour

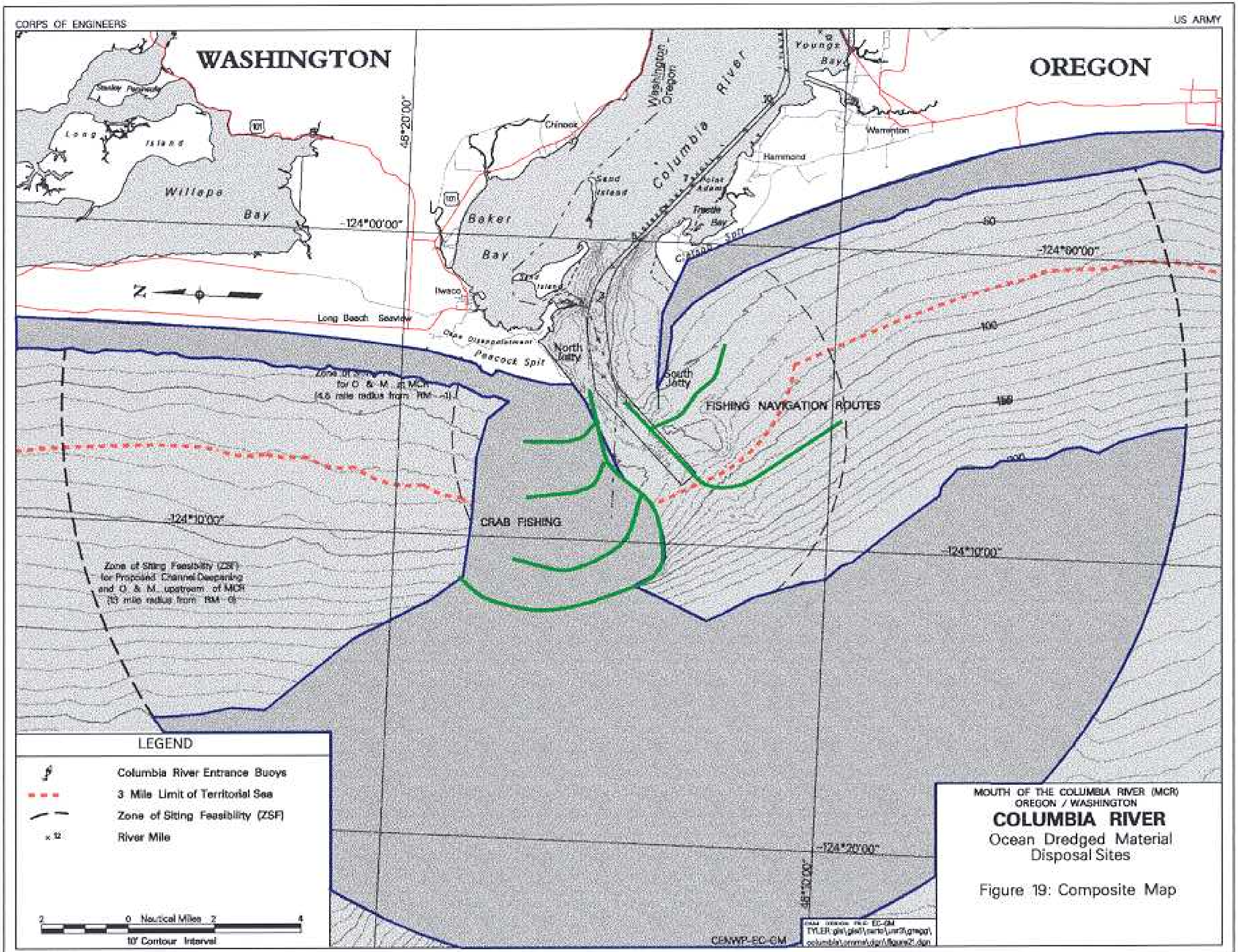


Figure 19: Composite Map

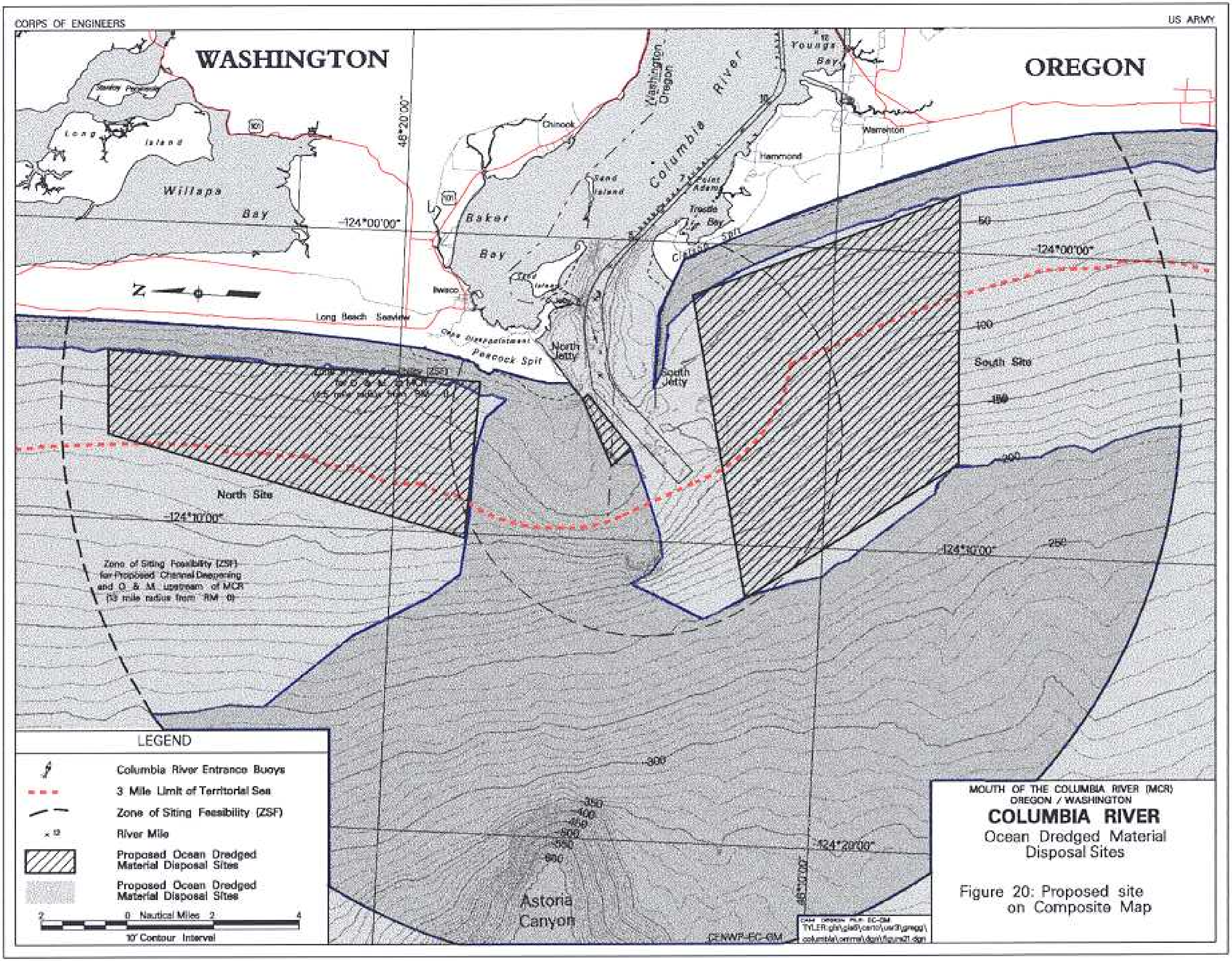


Figure 20: Proposed site on Composite Map

The proposed Site E (candidate Site 2) in the DEIS has the same configuration of the 1997 expanded Site E (Figure 21). Due to limited site capacity at the EPA-designated disposal sites, existing Site E was expanded under the Corps' Section 103 authority. The area in the vicinity of EPA-designated Site E has received material annually since 1973, totaling approximately 50 mcy of dredged material (Exhibit B). The area is erosive as evidenced by the lack of long-term mounding in the area. The material is similar to the material dredged from the channel. Two beneficial uses were identified as shown on the conflict matrix for this site. These are the protection of possible shipwrecks and beach nourishment. Concerns identified in ranking the candidate sites include navigation for small craft, interference with crabbing, impacts to soft-shell crab from disposal mounding, and wave amplification. Requirements of the Site Management and Monitoring Plan for the Mouth of the Columbia River will ensure that navigation hazards to navigation are not created by disposal. Impacts to soft-shell crabs by disposal have been evaluated (Exhibit F). Results indicate that hard and soft crabs are capable of surviving disposal events up to 10 inches of accumulation depending upon whether they move into the water column during disposal or bury in the bottom. If they bury they have much less of a chance of survival than if they move into the water column. Tests to date have indicated that most crabs of all size groups move into the water column during a disposal event. Simulated thin-layer disposal events resulted in very limited mortalities. None of the soft-shell crabs tested were physically damaged by disposal. A detailed discussion of the tests is given in Exhibit F.

The proposed North Site in the DEIS incorporates portions of candidate Sites 6 and 7. Candidate Sites 6 and 7 overlapped to a great extent so were considered together in the conflict matrix analyses and when configuring the proposed site (the portion of candidate Sites 6 and 7 located south of the entrance are discussed under the proposed the South Site description below.) Those portions of candidate Sites 6 and 7 within and immediately offshore of the entrance to the Columbia River were eliminated due to navigational safety considerations. The portion comprising Peacock Spit also was eliminated because of potential navigational hazards to small vessels. Further, disposal on Peacock spit would impact crab fishing activities as this area was identified by the crab fishermen as a location contributing a high percent of their crabbing income. By proposing only the northern portion of these candidate areas, an effort was made to reduce negative impacts while preserving the positive benefits. Four areas of beneficial uses were identified in the conflict matrix, although two of these also could be a potential conflict. Beach nourishment and the protection of cultural resources (shipwrecks) were considered as benefits.

The area is located in the nearshore transport zone and an area of high wave energy. Sediments in this area are similar to the dredged material. The material placed in this location would disperse and contribute to nourishing the beach if placed in less than 60 feet of water. The benthic organisms in this area are adapted to this mobile sand environment and therefore, would be less impacted by direct dredged material placement and subsequent sediment redistribution. Impacts to soft-shell and hard shell crabs are not expected, as discussed above.

The proposed South Site in the DEIS includes portions of candidate Sites 1, 5, 10, and the southern portions of 6 and 7. Those portions of the candidate sites that overlapped with the 1997 expansion of Site B were considered productive for living resources and heavily used for commercial fishing by the work group and were eliminated from designation.

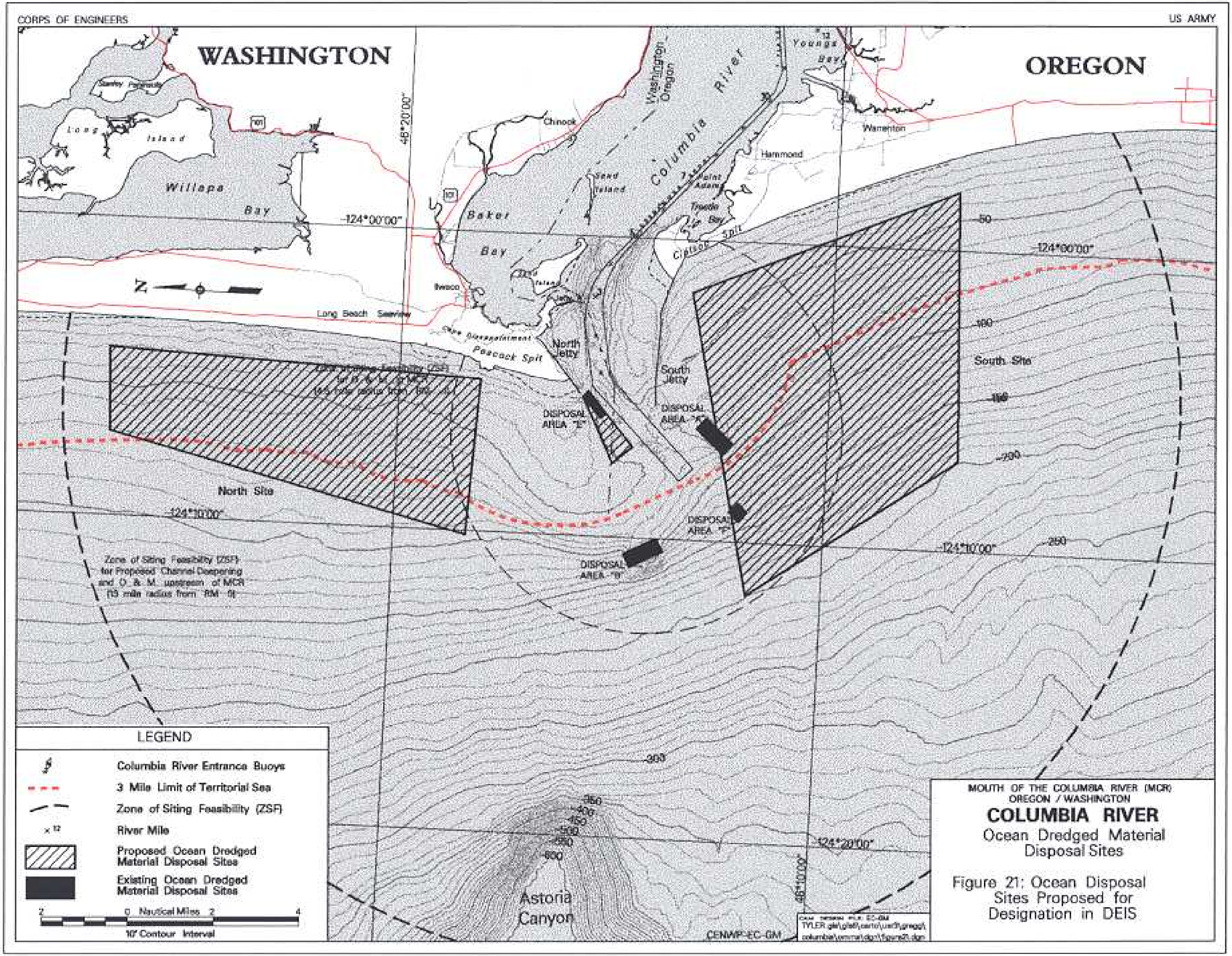


Figure 21: Ocean Disposal Sites Proposed for Designation in DEIS

Those areas of candidate Sites 6 and 7 located north of the entrance were also eliminated (although they are included in the proposed North Site). Areas beyond the 200-foot contour of candidate Sites 1 and 5 were eliminated due to higher benthic productivity and higher species diversity.

The South Site incorporates the 1986 EPA-designated Sites A and F; however, the northern half of expanded Site F (1993) is excluded from the South Site configuration. Excluding this area eliminates some navigational safety conflicts with regard to the transfer areas used by the MCR bar pilots. The conflict matrix prepared by the EPA and the Corps for candidate Sites 1 and 5 indicate a conflict with the shale area and suggested the need of a buffer zone. By eliminating those portions of Sites 1 and 5 beyond the 200-foot contour, a sufficient buffer zone is provided.

The shoreward portion of the proposed South Site includes the southern portion of candidate Sites 6 and 7. Candidate Sites 6 and 7 are located in the nearshore transport zone and in an area of high wave energy. The material placed in this location would disperse and could feed the beach if placed in less than 60 feet of water. Because the bulk of the material dredged at the MCR is derived from Clatsop Spit (Exhibit B), dredged material placed in this area would be similar to existing sediment substrate. The benthic organisms in this area are adapted to moving sand and therefore, would be less impacted by dredged material disposal and subsequent sediment redistribution. Impacts to soft-shell and hard shell crabs would be similar to that discussed for above.

Except for candidate Sites 2 and 10, all the candidate sites had been drawn freehand by various individuals at the workshops. These participants used their individual knowledge and their interpretation of the overlays in depicting areas of limited resources or bathymetric features. The proposed South Site includes a portion of seafloor between candidate Sites, 5, 6 and 7 which was not covered by a candidate site. Because there are no known areas of limited resources or geological features in this area, the Corps and EPA decided to include this area into the proposed site.

Both proposed the North Site and the South Site were extended shoreward to the 30-foot contour to increase the likelihood of material reaching the beach and to allow Federal management of the area through the management and monitoring plan. The shallower areas could only be used under ideal sea conditions that would allow safe navigation and operation of the dredges.

Coordinates (North American Datum, 1983) and dimensions of the three ODMDSs proposed in the DEIS are as follows:

Proposed Site E
Corner Coordinates:

46° 15' 35.36" N, 124° 05' 15.55" W
46° 14' 31.07" N, 124° 07' 03.25" W
46° 14' 58.83" N, 124° 07' 36.89" W
46° 15' 42.38" N, 124° 05' 26.65" W

Dimensions: 1,054 x 3,600 feet wide
x 10,000 feet long
Azimuth (long axis): 229° T

Proposed North Site
Corner Coordinates:

46° 26' 32" N, 124° 04' 21" W
46° 18' 13" N, 124° 04' 54" W
46° 18' 34" N, 124° 10' 03" W
46° 26' 31" N, 124° 07' 07" W

Dimensions: 11,630 x 50,600feet
x 21,840 x 49,800 feet
Depth: 30-90 feetDepth: 45-75 feet

Proposed South Site
Corner Coordinates:

46° 13' 25" N, 124° 01' 58" W
46° 07' 14" N, 124° 58' 01" W
46° 07' 01" N, 124° 07' 06" W
46° 11' 36" N, 124° 11' 43" W

Dimensions: 42,600 x 41,100 feet
x 38,420 x 33,400 feet
Depth: 30-200 feet

Sites Not Proposed in the Draft EIS

In summary, four of the original candidate sites were eliminated from further consideration and not proposed for designation for the reasons given below. These were candidate Sites 3, 4, 8, and 9. Candidate Site 3, the shale site, was removed from consideration because it was identified as a unique geological feature in the area and habitat for halibut and rockfish. The placement of sand on a rocky habitat does not meet the desire to avoid limited resources in the area. Because of the depth this change would be irreversible, as the sandy material would not move once on the bottom. Sand placed here would also be removed from the littoral system. The exact location and extent of the shale area is not precisely known and would require further study.

Candidate Site 4, Benson Beach, is located in an area not under the jurisdiction of the MPRSA and therefore cannot receive designation status under the MPRSA. Material could be placed in this area under the jurisdiction of the Clean Water Act but is not a part of this ocean disposal site designation action. This site is a potential beneficial use site and, if determined viable and if a local sponsor is identified would be evaluated under Section 404 of the Clean Water Act.

Candidate Site 8 was removed from further consideration because of its apparent close proximity to and potential for overlap with candidate Site 3, the shale site and it's presence in deep water where productivity of benthic communities is generally higher. The shale is a unique bottom feature of limited extent as discussed above. Benthic productivity and diversity in this deep water site is greater than in shallower areas, and use of this site would have a greater impact on the resources of the area. In addition, material placed here would be removed permanently from the littoral system. The sites are also outside the ZSF for the MCR project and would not meet the needs for this project.

Candidate Site 9, Astoria Canyon, was eliminated from further consideration as it was identified as a unique bottom feature and fragile biological area. Sand once placed in this area would not be removed or disperse and would be lost from the littoral system. Though remote, concern has been expressed that the placement of dredged material on the continental slope could trigger underwater slides that would in turn produce tsunamis. As with the other deep water sites, the material placed here would not move resulting in a permanent and irreversible change. This change in habitat would effect the composition and spatial distribution of the benthic communities in this area. Another consideration unique to this candidate site is the expense and difficulty to monitor and thereby manage the site.

Further Consideration and Refinements

Due to the large number of comments from the public review of the DEIS received from members of the Working Group, resource agencies, and the public, the Corps and EPA convened additional meetings to discuss further refinements to the proposed ocean disposal sites. An initial series of five meetings was held with sub-groups of the Working Group. The purpose of these smaller meetings was to explain how the COE and EPA used the input from the Working Group in selecting the proposed ocean disposal sites circulated in the DEIS, and to get input for subsequent meetings of the Working Group.

Working Group members expressed concern that the spatial extent of the North Site and South Site was too large and disposal in the sites may unacceptably interfere with the crab fishing industry. The specific criteria for site selection established by the EPA provide that interference of disposal with other legitimate uses of the ocean, including fishing, must be considered [40 CFR 228.6(a)(8)]. Furthermore, the general criteria for site selection provide that dumping will be permitted only at sites selected to minimize this interference, with special emphasis placed on avoiding areas of existing fisheries or shell fisheries [40 CFR 228.5(a)]. Considering these regulatory requirements and the difficulty in scientifically quantifying actual interference with the fishery, the Corps and EPA determined that the concerns expressed by these members, including crab fishermen themselves, warranted revision to the proposed North Site and South Site. Site E in the DEIS has not been altered.

The Corps and EPA revised the proposed North Site and South Site (Revision 1, Figure 22) by reducing the size of the North Site and the South Site. The deep water portion of the South Site would be used in the event that weather conditions or wave climate prevented access by the dredge to the nearshore sites while allowing for predominantly nearshore placement of material. The revised sites were still large enough to limit the impact from an individual dredging season to small areas on a rotational basis. Revision 1 was presented to the Working Group on April 14,1999. Many of the Working Group representatives felt that the spatial extent of the proposed revised North Site and South Site was still too large and impacts to the crab fishing industry would still be unacceptable.

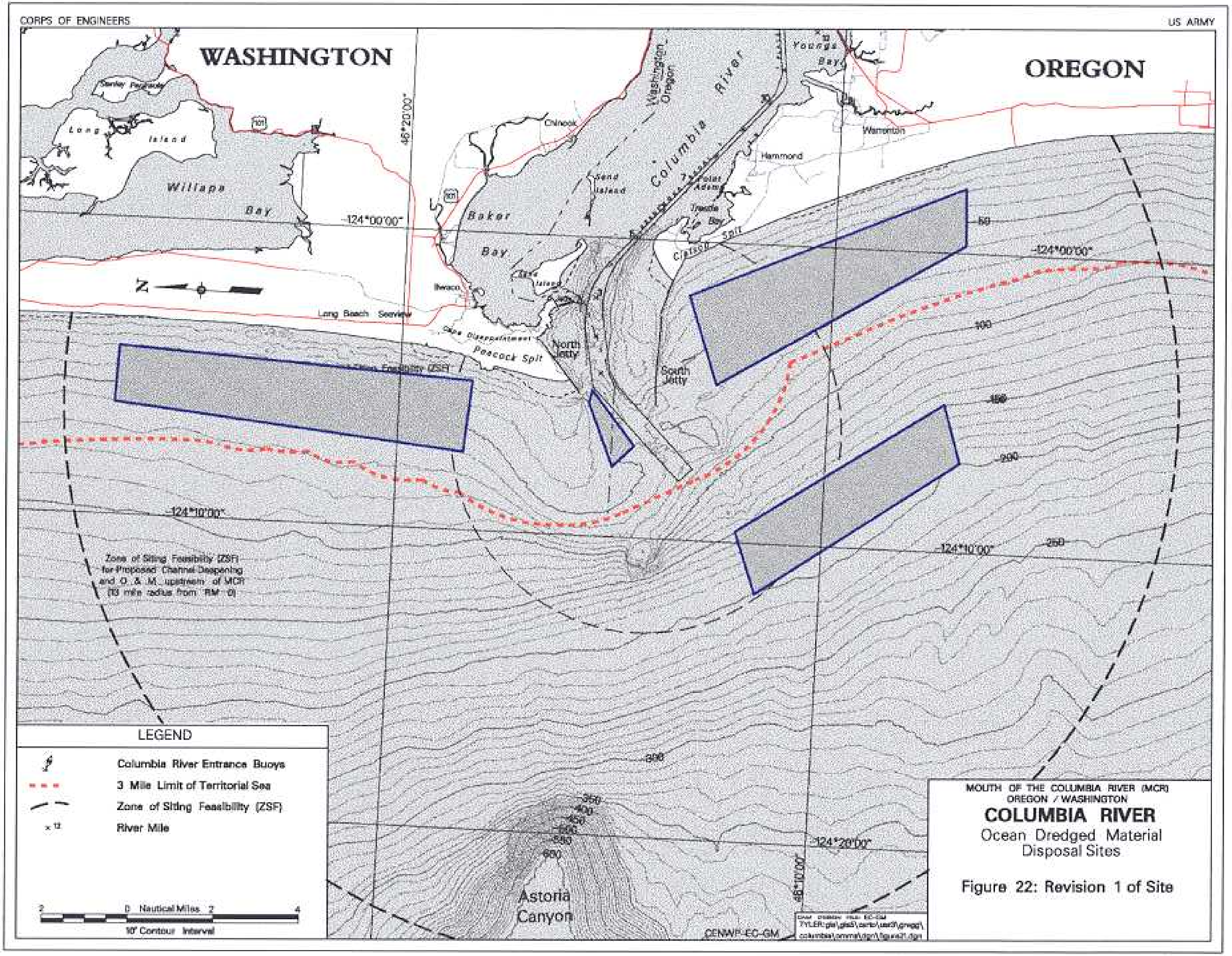


Figure 22: Revision 1 of Site

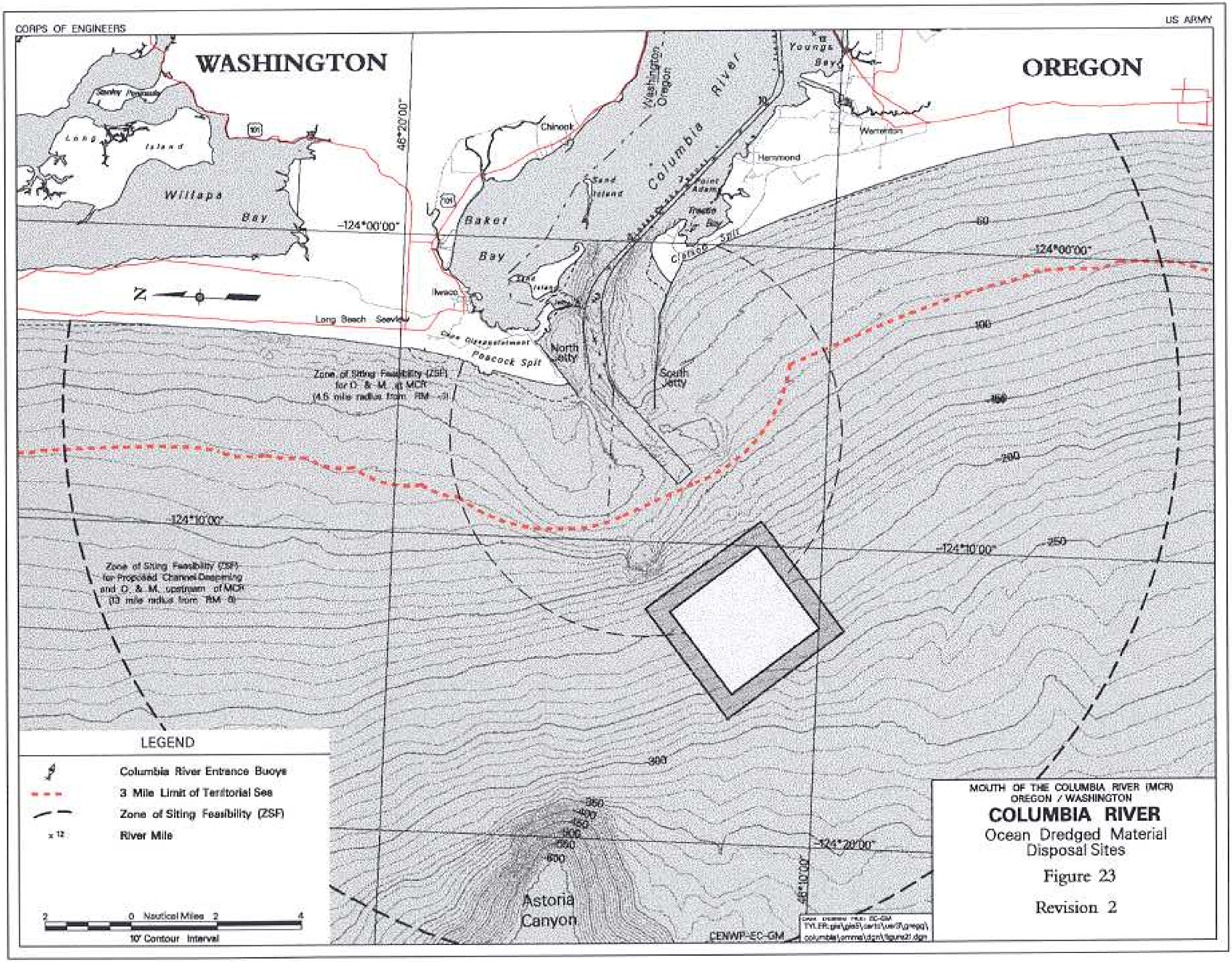
The Corps and EPA proceeded to look for a deep water site near candidate site 8 (Figure 13) that would replace both the proposed North Site and South Site. If the long-term capacity of Site E and the North Jetty Site did not hold, then a deep water site large enough to accommodate the entire dredging quantity for 50 years would be needed. Additionally, the work group recommended that creating a single large mound in deep water was preferable to spreading the material broadly.

The COE and EPA proposed Revision 2 Deep Water Site (Figure 23) at the next Work Group meeting on May 12, 1999. Revision 2 was sized to hold 225 mcy of material (4.5 mcy, average amount dredged from MCR multiplied by 50 years) and not accumulate a mound greater than 40 feet high. The 40-foot accumulation restriction was considered to be the accumulation in that water depth that would not generate adverse wave conditions.

The dimensions of the Revision 2 Deep Water Site consisted of an inner square 13,000 feet on a side where dredged material placement would occur and ultimately form a mound. Surrounding that inner square (the dumping zone) was a 3,000-foot buffer zone where no disposal would be allowed. The buffer zone is to ensure that no material placed in the dumping zone would drift or slough outside of the designated disposal site boundaries. The overall site dimensions would be 19,000 feet on a side.

Discussion with the Working Group resulted in further revision of the Deep Water Site (Revision 3) by adjusting the northern boundary to the south, moving the northeast corner out to 200 feet of water and moving the outer boundary out past 250 feet of water depth (Figure 24). More detailed information on the discussions with the Working Group related to the Revision 3 Deep Water Site is contained in the minutes of the May 12, 1999 Ocean Disposal Working Group Meeting attached in Appendix H, Volume III.

As discussed in this appendix, the quantity of dredged material that will be placed in proposed Site E and the North Jetty Site is uncertain due to the dynamics of the sites. Some quantity of dredged material will likely have to be placed in the proposed Deep Water Site each year; this will result in some material being permanently lost from the littoral zone. The Corps and EPA fully support the concept of nearshore placement of material. The Corps and EPA view dredged material as a valuable resource and feel that keeping the material in the littoral zone is beneficial. Further, disposal of material in the nearshore in the active energy zone would be less biologically impacting than disposal in deep water (depths greater than 200 feet). However as noted above the site selection criteria require that sites be selected that minimize interference with other uses or activities in the marine environment including existing fisheries. Considering the disagreement between some members of the Working Group and the EPA and the COE as to the extent disposal in the nearshore areas (the originally proposed North and South Sites) would interfere with the crab fishery, the EPA and the COE have decided to propose the designation of a Deep Water Site which is viewed by both the Working Group and the COE and EPA as minimizing this interference. Although disposal in the Deep Water Site may result in more biological impacts than disposal in the near shore areas, these impacts are considered acceptable. A conflict matrix for the new proposed Deep Water Site and Site E (Candidate Site 2) is shown in Table 14 and 15.


CORPS OF ENGINEERS
US ARMY
WASHINGTON
OREGON
Long Island
Willapa Bay
Baker Bay
Columbia River
Washington
Oregon
Chinook
Sand Island
Youngs Bay
Warrenton
Hammond
Point Adams
Trestle Bay
Clatsop Spit
Ilwaco
Long Beach
Seaview
Cape Disappointment
Peacock Spit
North Jetty
South Jetty
46°20'00"
46°10'00"
-124°00'00"
-124°10'00"
-124°20'00"
Zone of Siting Feasibility (ZSF)
for O. & M. at MCR
(4.5 mile radius from RM -3)
Zone of Siting Feasibility (ZSF)
for Proposed Channel Deepening
and O. & M. upstream of MCR
(13 mile radius from RM 0)
60
100
150
200
250
300
350
400
450
500
550
600
Astoria
Canyon
LEGEND
Columbia River Entrance Buoys
3 Mile Limit of Territorial Sea
Zone of Siting Feasibility (ZSF)
River Mile
0 Nautical Miles 2
10' Contour Interval
CENWP-EC-GM
MOUTH OF THE COLUMBIA RIVER (MCR)
OREGON / WASHINGTON
COLUMBIA RIVER
Ocean Dredged Material
Disposal Sites
Figure 23
Revision 2

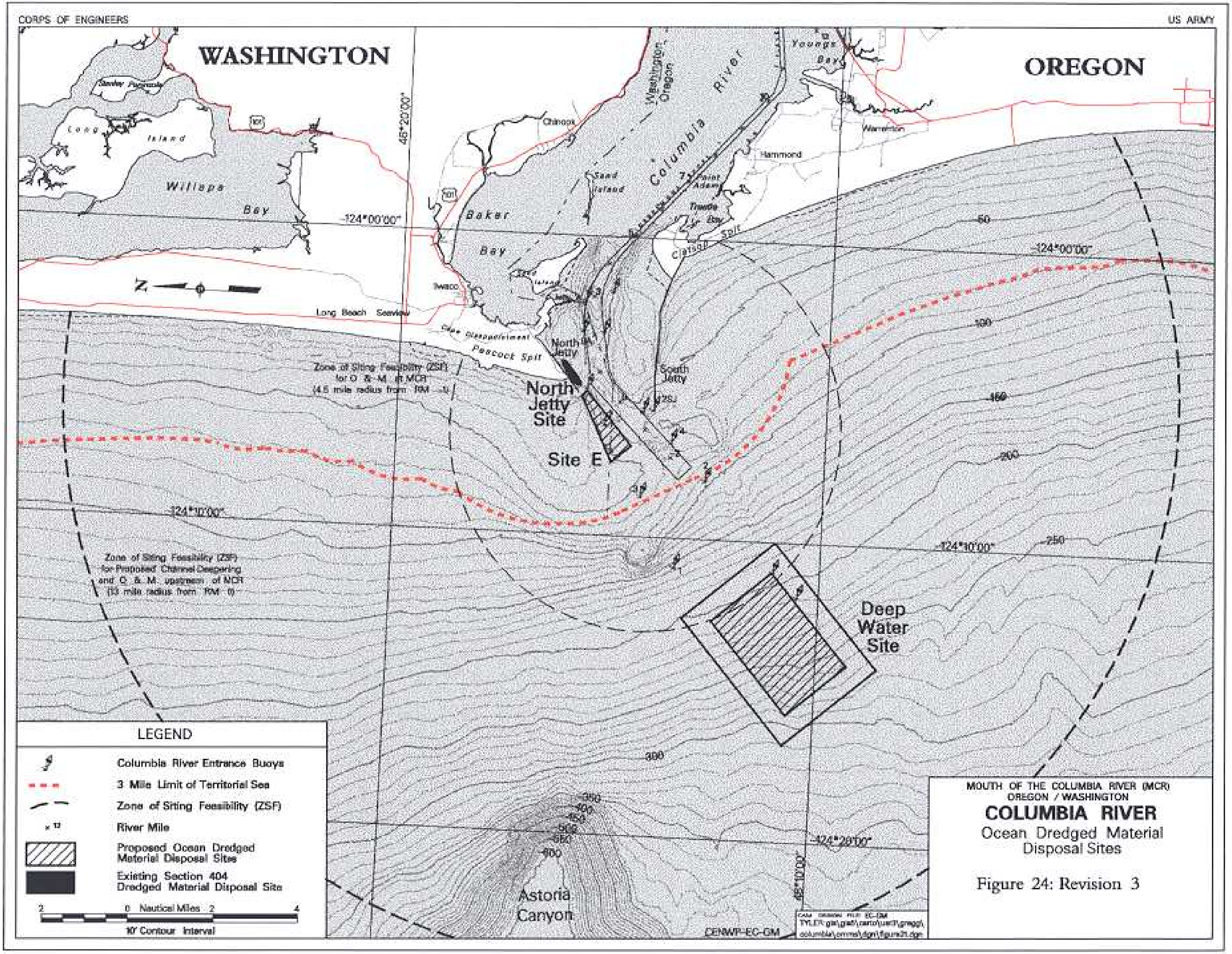


Figure 24: Revision 3

Table 14. Ocean Dredged Material Disposal Site Conflict Matrix for Proposed Deep Water Site

Proposed Deep Water Site

AREA OF CONSIDERATION[1/]	CONFLICT[2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features			✓			1, 6, 8, 11	a
2. Physical Sediment Compatibility		✓			Dredged material coarser	3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✓			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal			✓			5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution			✓			2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries			✓			2, 8	a, b
7. Recreational Fisheries			✓			2, 8	a, b
8.Breeding/Spawning Areas		✓			Crab	2, 8	a, b
9. Nursery Areas		✓			Juvenile flatfish and crabs	2, 8	a, b
10. Feeding Areas		✓			Demersal fish and crab	2, 8	a, b
11. Migration Routes			✓			2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✓			2, 8	a, b
13. Spatial Distribution of Benthos		✓			Will change benthic communities	2, 8, 10	a, b
14. Marine Mammals			✓			2, 8	a, b
15. Mineral Deposits			✓			1, 8	a, b, c
16. Navigation Hazard			✓			1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)			✓			8	a, b, d
18. Degraded Areas			✓			4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✓			4, 6, 9	a, b, d
20. Recreational Uses			✓			2, 8, 11	a, b, c, d
21. Cultural/Historic Sites			✓			11	b
22. Physical Oceanography: Waves/Circulation			✓			1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential For Settlement			✓			1, 3, 6, 7	a, b, d
24. Monitoring			✓			5	c
25. Shape/size of Candidate Site			✓			1, 4, 7	d
26. Size of Buffer Zone			✓			2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✓			Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Table 15. Ocean Dredged Material Disposal Site Conflict Matrix for Proposed Site E

Site E

AREA OF CONSIDERATION[1/]	CONFLICT [2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	REVELANT SPECIFIC FACTORS Eleven Specific Factors[3/] (40CFR 228.6)	REVELANT SPECIFIC FACTORS 5 General Criteria[4/] (40CFR 228.5)
1. Unusual Topography/Unique Bottom Features			✓			1, 6, 8, 11	a
2. Physical Sediment Compatibility			✓			3, 4, 9	b, c, d
3. Chemical Sediment Compatibility			✓			3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal		✓			Possible Mounding	5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution			✓			2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		✓			Could affect crab fishing	2, 8	a, b
7. Recreational Fisheries			✓			2, 8	a, b
8.Breeding/Spawning Areas			✓			2, 8	a, b
9. Nursery Areas			✓			2, 8	a, b
10. Feeding Areas		✓			Could affect feeding of soft shell crab	2, 8	a, b
11. Migration Routes		✓			Could affect crab and fish migration routes	2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			✓			2, 8	a, b
13. Spatial Distribution of Benthos			✓			2, 8, 10	a, b
14. Marine Mammals			✓			2, 8	a, b
15. Mineral Deposits			✓			1, 8	a, b, c
16. Navigation Hazard		✓			Possible mounding; affect to small crafts	1, 8	a, b, d
17. Other uses of Ocean (cables, pipelines etc.)			✓			8	a, b, d
18. Degraded Areas				✓	Beach nourishment	4, 6, 7	a, b, d
19. Water Column Chem./Phys. Characteristics			✓			4, 6, 9	a, b, d
20. Recreational Uses		✓			Mounding/encountering dredge	2, 8, 11	a, b, c, d
21. Cultural/Historic Sites				✓	Cover identified ship wrecks	11	b
22. Physical Oceanography: Waves/Circulation		✓			Could affect wave heights based on volume	1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential For Settlement		✓			Could affect sediment transport	1, 3, 6, 7	a, b, d
24. Monitoring			✓			5	c
25. Shape/size of Candidate Site			✓			1, 4, 7	d
26. Size of Buffer Zone			✓			2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects		✓			Potential affect from crab and other fishing as well as disposal	4, 7	c, d

Eleven Specific Factors for Ocean Disposal Site Selection

The determination to designate ODMDS will be based on the Federal Government's evaluation of compliance with the 11 specific factors and 5 general criteria at 40 CFR 228.6 and 228.5 (Figure 16). A discussion of each factor and criteria for the sites proposed in the DEIS as well as the Deep Water Site follow. The specific evaluations for the North Site, the South Site, and Site E proposed in the DEIS have been carried forward into this final EIS for continuity only. Site E and the Deep Water Site are identified by the government as preferred sites to be formally designated by EPA. The North Site and the South Site proposed in the DEIS will not be considered for designation. Site coordinates (degrees, minutes, seconds) (North American Datum 1983) and dimensions of Site E, the Deep Water Site, and the North Jetty Site are as follows:

Site E

Corner Coordinates:
46° 15' 35.36" N, 124° 05' 15.55" W
46° 14' 31.07" N, 124° 07' 03.25" W
46° 14' 58.83" N, 124° 07' 36.89" W
46° 15' 42.38" N, 124° 05' 26.65" W

Dimensions:
1,054' to 3,600' width
by 10,000' long
Azimuth (long axis): 229° T
Depth: 45'-75'

Deep Water Site Placement Area

Corner Coordinates:
46° 11' 06.00" N, 124° 11' 05.99" W
46° 12' 28.01" N, 124° 12' 48.48" W
46° 10' 37.96" N, 124° 15' 50.91" W
46° 09' 15.99" N, 124° 14' 08.40" W

Dimensions:
11,000' wide
by 17,000' long
Depth 190'-300'

Deep Water Site

Corner Coordinates:
46° 11' 03.03" N, 124° 10' 01.30" W
46° 13' 09.78" N, 124° 12' 39.67" W
46° 10' 40.88" N, 124° 16' 46.48" W
46° 08' 34.22" N, 124° 14' 08.07" W

Dimensions:
17,000' wide
by 23,000' long
Depth 190'-300'
Buffer 3,000 feet

North Jetty Site

Corner Coordinates:
46° 15' 45.67" N, 124° 05' 11.99" W
46° 16' 17.18" N, 124° 04' 17.99" W
46° 16' 10.31" N, 124° 04' 08.72" W
46° 15' 38.18" N, 124° 05' 02.73" W

Dimensions:
1,000' wide
by 5,000' long
Depth 40'-70'

Application of Eleven Specific Criteria (40 CFR 228.6)

Geographical Position, Depth of Water, Bottom Topography and Distance from the Coast: (1). Figure 21 shows the location and bottom topography of the four sites proposed for designation and use in the DEIS (the North Site, the South Site, and Site E), and Figure 25 shows the location and bottom topography of the currently proposed sites for designation (Site E and Deep Water Site). Designated sites would be used for disposal of dredged material from the Columbia River and MCR navigation projects and other permitted projects.

The North Site is located beginning about three miles north of the entrance and extend eight miles farther north along the Washington coast. The width of the site tapers from 3.6 miles at the south end to two miles at the north end. The site has a total area of 17,300 acres and a static disposal capacity of 225 mcy. The bottom topography provides water depths from 20 to 90 feet deep, with most of the site being between 40 and 70 feet deep. The site is located within the active littoral sediment transport zone of Long Beach. Material placed in the North Site may help reduce erosion along Long Beach.

The South Site is located immediately south of the MCR with a total area of 31,300 acres. The bottom topography provides water depths at the site from 30 to 200 feet, with about half the site being offshore in water over 100 feet deep. The offshore portion of the South Site has a static disposal capacity of over 550 mcy. The site includes over six square miles of the Clatsop Spit littoral zone that would have a static capacity of over 115 mcy. Material placed in this littoral zone may help reduce erosion along Clatsop Spit.

The proposed new Site E would replace the existing EPA Section 102 designated Site E to include the Corps' previously selected Section 103 "Expanded Site E". The site is located off the end of the North Jetty and would be about two miles long and expand from 1,054 feet to over 3,600 feet wide, encompassing an area of 670 acres. Located to the north of the channel the bottom topography slopes from the north to the south along the south side of Peacock Spit. Water depths in the site range from 40 to 70 feet. The site has a static capacity (maximum volume within the site boundaries) of 2.1 mcy and a dynamic (dispersive) capacity (volume that could be transported away from the site by waves and currents) of 2.3 mcy/yr. Most of the sand that would be eroded away from Site E is expected to move north on Peacock Spit.

The Deep Water Site is located about 4.5 miles west of the entrance and extends further westerly to about 7 miles. The bottom topography is featureless and gently slopes away from shore. Water depths vary from 200 to 300 feet deep. Overall site dimensions are 17,000 feet by 23,000 feet and consists of an inner rectangle that measures 11,000 feet by 17,000 feet, surrounded on all sides by a 3,000-foot buffer. The site encompasses 8980 acres. Disposal of dredged material would only be allowed within the inner dumping or target zone. The inner placement area of the site has a total area of 4,293 acres and a static disposal capacity of 225 mcy. Material placed at this site is expected to create a mound approximately 40 feet high within the target zone over the estimated 50-year life of the site. No direct disposal of dredged material would be allowed anywhere in the buffer; however, dredged material sloughing off the developing mound may extend into the buffer zone.

Based upon consideration of the location, depth of water, bottom topography, and distance from the coast Site E and the Deep Water Site are suitable for the disposal of dredged material when placed in accordance with the Management and Monitoring Plan (Exhibit H).

Location in Relation to Breeding, Spawning, Nursery, Feeding, or Passage Areas of Living Resources in Adult of Juvenile Phases: (2). Aquatic resources of the oceanic region off the mouth of the Columbia River are described in detail in Exhibit A. Site E, the North Site, and the South Site are located in the nearshore area and many nearshore pelagic organisms occur in the water column over the sites. These include zooplankton (copepods, euphausiids, pteropods, and chaetognaths) and meroplankton (fish, crab and other invertebrate larvae). These organisms generally display seasonal changes in abundance. Since they are present over most of the coast, those from the MCR are not critical to the overall coastal population. Based on evidence from previous zooplankton and larval fish studies, it appears that there will be no impacts to organisms in the water column (Sullivan and Hancock, 1977).

Sites E, the North Site and the South Site are located in areas that generally have lower densities and number of species of benthic infauna. Areas offshore beyond the 200-foot depth contour, including the Deep Water Site, have consistently higher densities and numbers of benthic species (diversity). Therefore, placement of dredged material in the Deep Water Site would have a greater impact to the benthic infaunal community. Benthic infaunal samples were collected at the locations shown in Exhibit A.

The proposed sites are located in the area off the mouth of the Columbia River which supports a variety of pelagic and demersal fish species as well as shellfish including Dungeness crab. Many of these species have a reproductive strategy of releasing a large quantity of eggs so that they can survive a substantial mortality during the larval and juvenile stage. Crabs in particular release large number of eggs into the water column. The larvae that hatch from the eggs are planktonic for several months before settling to the bottom of the estuary and nearshore ocean as young crab. During this time they are subjected to a variety of environmental factors that affect their survival and have a direct affect on population numbers of adults.

Pelagic species include anadromous salmon, steelhead, cutthroat trout, striped bass, lamprey, smelt, herring, sturgeon, and shad that migrate through the estuary to upriver spawning areas. Juveniles of these species are present in the area following their migration out of the river or estuary into the ocean. Some remain in the nearshore area for various periods of time feeding and rearing, while others move directly offshore. Concerns about disposal on both soft and hard shell crab and juvenile flat fish were evaluated in a series of laboratory tests. Results of these tests indicated that both soft and hard shell crabs could survive disposal events up to ten inches if they moved into the water column during disposal, rather than staying buried in the bottom. Most crabs and all the juvenile flatfish tested moved into the water column during disposal. Other pelagic species include the Pacific herring, anchovy, surf smelt, and sea perch. Surf smelt are in nearshore areas and in the estuary in large numbers during the summer. Demersal species present in the nearshore area include juvenile flatfish which rear in the area. Resident species occur in the offshore area throughout the year with many using the estuary as a rearing and nursery area. Species present include various flatfish, rockfish and other demersal fish.

Potentially 30 cetacean species can occur along the coast although their numbers are generally limited. Most cetacean species occur inslope (600- to 6,000-foot depths) or offshore waters (greater than 6,000 feet deep). Harbor porpoises and gray whales were prevalent in shelf waters less than 600 feet deep. The larger cetaceans (whales) typically occur as migrants in the spring and fall, such as the California gray whale. Smaller cetaceans, principally dolphins, porpoises, and some small whales are also present. Five species of pinnipeds are known to occur along the coast: northern sea lion, California sea lion, harbor seal, northern elephant seal and northern fur seal. Harbor seals are resident whereas the four other species of pinnipeds are more transient in nature. Harbor seals and California/northern sea lions are the principal species observed in the estuary. All three species are known to forage within the estuary and adjacent ocean waters.

Four species of marine turtles (loggerhead, green, Pacific ridley, and Pacific leatherback) have been recorded from strandings along the coastline since 1982. Marine turtles are unusual in their occurrence along the Pacific Coast and are typically associated with warmer marine waters.

Pelagic birds are extremely numerous in the offshore area. Studies have found that seabird populations were most densely concentrated over the continental shelf (less than 600 feet in depth). Shearwaters, storm petrels, gulls, common murres and Cassin's auklets numerically dominated the pelagic bird fauna from late spring through late summer. Phalaropes, fulmars and California gulls are important constituents of the fall pelagic bird flocks. The principal species in the winter are phalaropes, California gulls, fulmars, other gulls, murres, auklets, and kittiwakes. Red-throated, Pacific and common loons occur as spring and fall migrants. Western, red-necked, horned, and eared grebes also occur in the area. Brown pelicans occur from late spring to mid-fall along the coast. This species forages in nearshore waters of the Pacific Ocean and estuarine waters of the Columbia River. Concentrations up to 1,000 birds have been reported. Three species of cormorants and three species of terns occur and forage in nearshore Pacific Ocean waters and the estuary.

The federally listed threatened and endangered species which may occur within the area of the proposed sites include: listed salmon and steelhead stocks; blue, finback, sei, right, humpbacked and sperm whales; loggerhead, green, Pacific ridley, and Pacific leatherback sea turtles; northern (Steller) sea lion; marbled murrelet; bald eagle; Aleutian Canada goose; peregrine falcon; and brown pelicans. Occurrence of these species varies by season and location in the offshore area.

Disposal at the sites will result in the mortality of benthic organisms and some of the crabs and fish that are in the disposal location. Disposal at the Deep Water Site is expected to have a greater, but not unacceptable, negative impact to the benthic community because of its higher benthic infaunal density and diversity. With respect to the other living resources that use the area of Site E or the Deep Water Site, the sites have been located in areas that are not limited or unique breeding, spawning, nursery, feeding, or passage areas.

Location in Relation to Beaches and other Amenity Areas (3). The North Site, the South Site and Site E are: to the north of the mouth nearshore, to the south extending from nearshore to the 200-foot depth contour, or within the river mouth, respectively. The shoreward edge of both the previously proposed North Site and South Site are approximately one nautical mile off the beach in 30 feet of water. Dredged material placed in water depths less than 60 feet would likely be transported inshore or along shore by summer wave conditions. Dredged material placed in the deeper portions of the South Site is unlikely to directly impact beaches. Site E lies to the north of the entrance channel in 40 to 70 feet of water. Dredged material placed in Site E would either move north onto Peacock Spit then perhaps onto Benson Beach, or possibly back into the entrance channel. The shoreward edge of the Deep Water Site is approximately 4.5 nautical miles off the beach in 200 feet of water. Material placed at the Deep Water Site will create a mound and is lost to the beach. The North Site, South Site and

Site E have the potential to feed sand to the beach and nourish the beach while the Deep Water Site will remove material from the littoral system.

Types and Quantity of Wastes Proposed to be Disposed of, and Proposed Methods of Release, including Methods of Packing the Waste, if Any: (4). Dredged material subject to the MPRSA is not a waste. Sites that are designated will receive dredged materials transported by either government or private contractor hopper dredges or dump barges. Current hopper dredges or dump barges available for use have hopper capacities ranging from 800 to 6,000 cubic yards. This would be the likely volume range of dredged material deposited in any one dredging placement cycle. The approximately 4.5 mcy estimated to be removed annually from the MCR, and 0.6 mcy of the improved Columbia River channel maintenance can be placed at the sites in one dredging season by any combination of private and government dredges. In addition, 7 mcy from the Columbia River Channel construction would be placed over two seasons, if approved. The dredges or barges would be under power and moving during disposal, allowing the maintenance of steerage.

Materials disposed in the ocean traditionally came from shoals in the MCR entrance channel. They consist primarily of marine sand transported into the entrance. The material is clean, contains no contaminants of concern in excess levels, is far removed from known sources of contaminates, and is acceptable for unconfined open-water disposal. Material proposed to be dredged from the Columbia River navigation channel (RMs 6 to 29) for operation and maintenance purposes and possible channel deepening has been evaluated and found acceptable for unconfined open-water disposal. These sediments consist of sands with low percent of silts and clays or organic material. Some fine-grained material from side channels or backwater areas may be placed offshore in the future which will require testing and evaluation. The sites have been sized to accommodate the quantity of material to be placed.

Feasibility of Surveillance and Monitoring (5). Monitoring shall be in accordance with the Site Management and Monitoring Plan (Exhibit H). At a minimum, annual bathymetric surveys will be conducted in areas that receive dredged material. More frequent surveys will be conducted when necessary to ensure unacceptable mounding is not occurring in Site E or in near vicinity that could pose a threat to navigation safety. Off-site monitoring will be necessary at Site E, at least in the initial years of use. Mounds will be deliberately created at the Deep Water Site. Routine monitoring for management purposes will likely focus on determining how to concentrate dumps into the site and verification that material is not placed in the buffer zone and does not escape outside of the overall site. No off-site monitoring is contemplated for the Deep Water Site.

If actual field monitoring of the disposal activities is required because of a future concern for habitat changes or limited resources, several research groups are available in the area to perform any required work. All of the sites are readily accessible. Most monitoring work for any the nearshore sites can be performed from small, surface research vessels at a reasonable cost. Monitoring at the Deep Water Site may be more problematic and require a medium to large vessel, which will cost more.

Dispersal, Horizontal Transport and Vertical Mixing Characteristics of the Area Including Prevailing Current Direction and Velocity, if Any (6). Exhibit H provides a detailed discussion regarding this criterion. The Columbia River estuary is a sink for marine sediments, which enter through the Mouth of the Columbia River. The estuary also effectively traps most or all of the coarser fluvial sediments. Finer fluvial sediments held in suspension are passed through the estuary into the ocean. There is a need to locate an ODMDSs to prevent the dredged material from returning directly into the entrance channel. This requires knowledge about the direction and rate of longshore transport as well as onshore/offshore transport.

Sediment movement in the littoral zone consists of two mechanisms depending upon sediment grain size. Sediments finer than sand (passes the 230 sieve) remain in suspension in the water and are relatively quickly removed offshore. The almost total lack of silts and clays within the Mouth of the Columbia River and Columbia River navigation channel attests to the efficiency of this mechanism. Sediments, sand size or coarser, may be occasionally suspended by wave action near the bottom, and are moved by bottom currents or directly as bedload. Tidal, wind and wave forces contribute to generating bottom currents that act in relation to the sediment grain size and water depth to produce sediment transport. Net transport for sand sized material along the Oregon and Washington coast is to the north-northwest at a very slow rate (Sollitt, 1983). Sand placed in depths less than 60 feet can be mobilized by these forces and transported within the littoral system.

Sediments placed in the nearshore area (Site E, the North Site, and shoreward portions of the South Site) are expected to mix into the existing littoral system. Sediments placed at the Deep Water Site and the deeper portions of the South Site are lost to that system. The Corps and EPA had contemplated using dispersive placement methods (i.e., thin-layer or non-repetative) even within the deeper portions of the South Site so that the material would not form mounds and the sediments would mix with underlying substrate. Placements at the Deep Water Site will attempt to concentrate the disposals as much as possible, deliberately mounding the material.

Existence and Effects of Current and Previous Discharges and Dumping in the Area (Including Cumulative Effects) (7). Between 1905 and 1940, approximately 8 mcy of sediment was dredged from the MCR entrance bar and placed in open water by hopper dredge. Between 1945 and 1955, a total of approximately 13 mcy was dredged, while between 1956 and 1998, a total of 184 mcy has been dredged and placed in-water. The total volume of material dredged from the MCR channel between 1904 and 1998 is approximately 206 mcy. Limiting placement to EPA-designated sites began in 1977 when "interim sites were described". The most pronounced cumulative effect of past disposal has been the development of mounds at EPA-designated Sites A and B. Mounding has altered the bathymetry to the point that the wave climate in the area has been affected. Monitoring of benthic infauna has generally shown no long-term effects due to dredged material disposal. Oceanographic conditions are the driving factor in benthic infaunal productivity and diversity. The exception to this is lowered productivity on the crest of the mound created in EPA-designated Site B. Crab fishermen have also reported lower crab yields in the area of the mound at Site B, which may be due to reduced productivity or the more difficult conditions for setting and retrieving crab pots. Crab pots have been buried or lost during dredged material disposal operations.

The 1986 EPA designated Site E has received varying quantities of dredged material (Exhibit B). The Section 103 expansion of Site E was first used for disposal in 1998. None of the other sites have been used for disposal of dredged material in the past except for the area of the south site, which contains expanded Site F.

Interference with Shipping, Fishing, Recreation, Mining Extraction, Desalination, Fish and Shellfish Culture, Areas of Special Scientific Importance and Other Legitimate Uses of the Ocean (8).

Commercial and Recreational Fishing. Major commercial and recreational fishing areas occur in the offshore area. The predominant commercial fisheries are for salmon, Dungeness crab, bottomfish and pink shrimp. Salmon trolling and crab fishing are done over much of the nearshore area. The actual location and effort, however, varies from year to year depending upon the abundance of fish or crabs, and resulting seasonal restrictions.

The principal recreational fishing occurring off the MCR is for salmon and bottom fish. Salmon fishing is done by charter boat and private boat and occurs in the same areas as the commercial fishing but generally closer to shore. Bottom fishing is conducted by private and charter boat for halibut, rockfish, and lingcod, which are generally associated with rocky areas. Other recreational activities include claming in the bay and along the beach and fishing off the jetties. Except for crabbing, dredging operations have not been identified as impacting any of these fishing activities.

Crab fishermen have stated that disposal of material at the existing ODMDSs has already affected their fishery by creating mounds which affects small boat navigation, or create a soft bottom condition which lets crab pots sink into the sediments making removal difficult, expensive or impossible. Crab pots have been damaged or lost due to burial when dredged material was placed on them or by the dredges snagging the buoy lines. The Corps has been and will continue to coordinate with the fishermen to minimize this impact. Crab fishermen have also expressed concern that disposal kills crabs by smothering them or by changing the bottom habitat which may reduce the number of crabs available to catch.

Bathymetric monitoring will be done at and in the vicinity of Site E to prevent creating disposal mounds that would cause navigation hazards. The proposed shift to larger sites (North Site and South Site) would have provided greater site management opportunity to reduce the potential for mounding. Disposal at the Deep Water Site will create a permanent mound, however, a mound height restriction and site monitoring will avoid interference with small and large vessel navigation. Furthermore, the Deep Water Site is primarily within the towboat lane and should receive limited fishing use.

Dungeness crabs are distributed widely throughout the area and fishing occurs in most areas north and south of the Columbia River and out into deep ocean water (300+ feet). Throughout the site selection process, the crab fishermen identified specific areas that produced more income for their crab fishing effort. These areas were identified only by a small number of, mostly, Washington fishermen that responded to a survey conducted by Portland District and Columbia River Crab Fisherman's Association. Additional information from some Oregon fishermen was provided by ODFW following the review of the DEIS. Consequently, these areas may not represent the cross-section of all fishermen operating out of the Columbia River. Nevertheless these areas were avoided to the extent practicable in the Corps and EPA configuration of the proposed sites.

In order to evaluate the impacts to individual crabs by dredged material disposal Portland District contracted with Battelle NW Laboratories in Sequim, Washington and Scripps Institution of Oceanography in La Jolla, California. Because assessing these impacts during an actual disposal event could not be done in the ocean it was decided to simulate disposal conditions in the laboratory. The tests at the Battelle Lab were done with recently molted soft-shelled crabs, which have the greatest potential for mechanical damage during a disposal event. The tests at the Scripps Lab were done using hard shell crab, since soft-shell crabs were not available.

The thickness and duration of individual disposal events tested were calculated from a model that simulated disposal events at the following water depths: 50, 100, 150 and 200 feet. This provided a range of likely water depths of proposed disposal. The model predicts that the dredged material will be deposited on the bottom with the maximum thickness at the peak of the mound. It was decided to use this maximum thickness for the test because it would represent worst case conditions. The duration used in the tests was a mid-point of the total duration given by the model for the entire disposal event starting from initial contact of the material with the bottom to the final collapse of the disposal mound. The mid-point was estimated to be the time when the maximum thickness of sediment was reached.

Results of the Battelle tests are given in the Tables 16 and 17 below and described in a separate report. The number of crabs tested was fairly small particularly for the larger adult crabs since the number of crabs tested depended upon the number of softshell crabs available. Test results show a large range of survival that was generally less at the deeper depths of sediment than at the shallower ones. There also appeared to be a reduction in survival with increasing size of crabs and increasing thickness of sediment. Though this may indicate that larger crabs do not survive as well, it is probably more an indication that the 21-inch diameter test tank was too small to allow the larger crabs to escape with lateral movement as they would naturally. This would be consistent with the Scripps tests that showed a much higher survival of larger crabs at the same thickness of sediment by using a larger test tank. The Scripps test tank was 2 feet wide by 12 feet long.

Table 16. Battelle Disposal Tests on Soft Shelled Crabs

Size Group of Crabs (mm)	Thickness of Sediment (inches)	Number Tested	Number Immediately Visible After Test	Total Number After 24 Hrs	Total Number After 48 Hrs	Survival Ratio	Percent survival
<50	2.4	5	3	3	4	4/5	80
	4.2	14	11	11	11	11/14	79
	6.6	10	9	9	9	9/10	90
	10.2	11	10	10	10	10/11	91
50-100	2.4	6	6	6	6	6/6	100
	4.2	10	6	6	6	6/10	60
	6.6	6	3	3	3	3/6	50
	10.2	11	5	5	5	5/11	45
>100	2.4	1	1	1	1	1/1	100
	4.2	4	4	4	4	4/4	100
	6.6	5	1	1	1	1/5	20
	10.2	3	1	1	1	1/3	33

Table 17. Scripps Tests on Disposal Impacts on Hard Shelled Crabs

Size Group of Crabs (mm)	Thickness of Sediment (inches)	Number Tested	Number Immediately Visible After Test	Total Number After 24 Hrs	Total Number After 48 Hrs	Survival Ratio	Percent survival
114-159mm	Wet 10.2	13	8	9	11	11/13	85
121-168mm	Dry 10.2	12	8	11	11	11/12	92
121-165mm	Wet 10.2	12	12	12	12	12/12	100

As indicated above these survival figures are based on worst case conditions since the thickness of sediment in the test was the maximum thickness of the mound. In actuality the thickest part of the mound is only a small percentage of the disposal mound. In the case of disposal in 50 feet of water, the scenario that would produce the thickest sediment in the shortest period of time, only 10% of the mound is thicker than 4.2" and approximately 20% was thicker than 2.2". Using a constant thickness of sediment in the tests produces an overestimate of the actual mortality to the crabs during a real disposal event. Consequently, in order to get the actual mortality of crabs the mortalities was adjusted to account for the different thickness of the mound. Summing the mortalities from each of the different thicknesses gives a more reasonable estimate of overall mortality. The data presented in Table 18 shows this estimated mortality.

Table 18. Weighted Survival of Dungeness Crabs Based on Percent of Disposal Mound by Thickness

Disposal in 50 Feet of Water

Sediment Thicknes s in Inches	Percent of Disposal Mound	Mortality of >50mm crabs	Weighted Mortality >50mm	Mortality of 50-100mm crabs	Weighted Mortality 50-100 mm	Mortality of <100mm crabs	Weighted Mortality <100 mm
6.0-10.2	8	10	0.8	55	4.4	74	5.9
3.6-6.0	10	16	1.6	40	4.0	0	0
<2.2	82	20	16.4	0	0	0	0
Weighted Average Mortality			18.8		8.4		5.9

Disposal in 100 Feet of Water

Sediment Thicknes s in Inches	Percent of Disposal Mound	Mortality of >50mm crabs	Weighted Mortality >50mm	Mortality of 50-100mm crabs	Weighted Mortality 50-100 mm	Mortality of <100mm crabs	Weighted Mortality <100 mm
6.0-10.2	1	10	0.1	55	0.5	74	0.7
3.6-6.0	6	16	1.0	40	2.4	0	0
<2.2	93	20	18.6	0	0	0	0
Weighted Average Mortality			19.7		2.9		0.7

Disposal in 200 Feet of Water

Sediment Thicknes s in Inches	Percent of Disposal Mound	Mortality of >50mm crabs	Weighted Mortality >50mm	Mortality of 50-100mm crabs	Weighted Mortality 50-100 mm	Mortality of <100mm crabs	Weighted Mortality <100 mm
6.0-10.2	0	10		55		74	0
3.6-6.0	0	16		40		0	0
<2.2	100	20	20.0	0	0	0	0
Weighted Average Mortality			20.0		0		0

An observation made during all of the disposal tests was that individual crabs behaved differently during disposal and this difference had a direct effect on their survival. In all the tests conducted crabs were allowed to bury into the sediment before the test dump was done. During the test dump, crabs either moved up into the water column or remained buried. Those that remained buried mostly did not dig out of the sand and subsequently did not survive the test. Those that moved up into the water column survived. The mortality of crabs that did not dig out was not due to mechanical damage during disposal but their apparent inability or unwillingness to dig out of the sand mass after disposal and subsequent suffocation. This behavior was observed for both soft and hard-shelled crabs so it did not appear to be a result of the vulnerable condition of the soft shelled crabs. In addition crabs that were recovered from the sand mass within a short period of time were alive and did not appear to have any injuries. In fact, most were kept in the holding tanks and re-tested at a later date. Indicating there was no delayed mortality. All crabs tested and recovered alive were held for an extended period of time and showed no indication of delayed mortality.

The reason why crabs did not dig out after disposal was not apparent, however, it may be that crabs are being buried and unburied by wave and current action naturally. Oceanographic instruments placed at the mouth of the Columbia River have shown that up to 6" of sediment depth fluctuation can occur naturally within two hours. Further, using a constant thickness of material in a static environment does not represent the mounding that occurs in an actual disposal event. Consequently some crabs may not be responding as they would naturally. Additional disposal tests in a larger tank so that mounding could be created would need to be done to verify this theory.

Results of the limited testing seem inconclusive. In all the tests done, no crabs appeared to be killed or injured by mechanical damage (all crabs removed from the sand mass were alive). The only mortality occurred when they did not dig out of the sand mass. Whether or not this behavior is typical of what occurs in nature is unknown. It seems unlikely, however, that organisms that live in an environment where they are constantly being buried under sand, such at the mouth of the Columbia River, would have evolved a behavior that would result in their mortality. It seems more likely that the mortality associated with this behavior is an artifact of the testing and that the tests do not accurately represent the conditions that they experience in nature.

Crab population levels are affected by a variety of environmental and human factors, including but not limited to: upwelling patterns, onshore currents, wind, and commercial fishing. Any of these conditions can have a devastating affect on population numbers in any year. Changes in oceanographic conditions during the larval stage can dramatically reduce survival and numbers of adults. While some mortality to crabs could occur during an individual disposal event, only a small percentage of the population present and habitat available at the MCR would be affected by an individual disposal or repetitive disposal events. These mortalities and changes in habitat would be significantly less than the changes produced naturally.

Mineral Extraction. There are known metallic mineral deposits within the area, principally black sands. While commercial extraction has been proposed and attempted in the past there are no known current proposals to mine offshore. There have been no exploratory wells drilled offshore near the mouth of the Columbia River. In any case, it is unlikely that production facilities would be permitted near the river's mouth or at any proposed site due to the clear conflict with navigation and endangered species that would be created.

Desalination. There are no desalination plants in the area of the mouth of the Columbia River.

Fish and Shellfish Culture. There is no fish or shellfish culture operations in the area of the mouth of the Columbia River that would be affected by disposal of dredged material at any of the proposed sites.

Shipping and Other Legitimate Uses. Conflicts with commercial navigation traffic have been reported at the four existing 102/103 sites. Disposal operations in Site F, where there is greatest potential for conflict, are closely coordinated with the bar pilots. Placement at Site E has been and would continue to be managed to avoid potential wave impacts, which could affect smaller boats transiting through the area. Conflicts at the North Site and South Site were not expected. The Deep Water Site is located in the towboat lanes and offshore of the Columbia Bar Pilot's exchange point. The potential for conflict with dredges or tug and barges combinations transiting to the site are recognized but can be managed through coordination with the pilots, the Coast Guard, and others.

Special Scientific Importance. There are no known transects or other scientific study locations that would be impacted by disposal at any proposed site.

Coastal Zone Management. The preferred action (designation and use of Site E and the Deep Water Site, in conjunction with the North Jetty 404 site) has been determined by the Corps and EPA to be consistent with the acknowledged local comprehensive plans and the State of Oregon and State of Washington Coastal Zone Management Programs. The State of Oregon, Department of Land Conservation and Development and State of Washington Department of Ecology will review this consistency determination with a request to provide written notification of their findings. A synopsis of their comments will be included in Volume II, Comments and Coordination.

The Existing Water Quality and Ecology of the Site as Determined by Available Data or by Trend Assessment or Baseline Survey (9). Water and sediment quality analyses conducted in the study area and experience with past disposals in this region have not identified any adverse water quality impacts from ocean disposal of dredged material.

The ecology of the offshore area is a Northeast Pacific mobile sand community. This determination is based mainly on fisheries and benthic data. Neither the pelagic or benthic communities should sustain irreparable harm due to their mobility and widespread occurrence off the Oregon and Washington coast.

Potentiality for the Development or Recruitment of Nuisance Species in the Disposal Site (10). Nuisance species are considered as any undesirable organism not previously existing at the disposal site. They are either transported to or recruited to the site because the disposal of dredged materials created an environment where they could establish. Materials dredged and transported to the disposal sites historically have been classified as uncontaminated marine sands similar to the sediment at the ODMDSs. Material dredged from Tongue Point in 1989 placed at Site F included a large volume of fine-grained material. Any material proposed to be placed at any site would be subject to sediment quality evaluation. Therefore, it is highly unlikely that any nuisance species could be established at the disposal site since habitat or contaminant levels are unlikely to change over the long-term.

Existence at or in Close Proximity to the Site of any Significant Natural or Cultural Features of Historical Importance (11). The cultural resource literature search of the Mouth of the Columbia River study area is described in detail in Exhibit D. Due to the proximity of the disposal sites to the channel (excepting the Deep Water Site), the resource that has the greatest potential for impact is shipwrecks. The most likely areas for shipwrecks are in the shallow breaker zone and the Mouth of the Columbia River entrance. Wrecks within these areas would likely be torn apart due to the high energy wave climate. Deeper water would buffer the high-energy wave climate thus shipwrecks in deeper water would be less prone to damage. The shipwrecks in deeper water tend to have more cultural value than shipwrecks nearshore. Undiscovered wrecks could occur in the area.

It has been determined, based on the considerations in Exhibit D, that there will be no cultural resources impacts from designation and use of any proposed site. This determination will be reviewed by the Oregon and Washington State Historic Preservation Offices. The coordination letter will be included in the Main Report Appendix I, *Comments and Coordination.*

Application of Five General Criteria (40 CFR 228.5)

Minimize Interference with Other Activities (a.). The first of the five general criteria requires that a determination be made as to whether the site or its use will minimize interference with other uses of the marine environment. This determination was made by overlaying individual uses and resource overlays presented in the technical exhibits onto a base map, giving bathymetry and location of the proposed disposal sites. The more interactions between various uses and limited resources exist, the more critical the area. The overlay process was used to minimize interference with other uses of the ocean. Site E and the Deep Water Site were particularly selected in order to avoid areas utilized by the Dungeness crab fishery.

Minimizes Changes in Water Quality (b.). The second of the five general criteria requires changes to ambient seawater quality levels occurring outside the disposal site to be within water quality criteria and that no detectable contaminants reach beaches, shoreline, sanctuaries, or geographically limited fisheries or shellfisheries. No significant contaminant or suspended solids releases are expected. Based on previous work at MCR, disposal of either sandy or fine-grained material would not have any long-term impact on the water quality. There would be no water quality perturbations to be concerned with moving toward any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery. Bottom movement of deposited material generally shows a net offshore movement for the finer fractions. Coarser size fractions stay in the same general area as deposited.

Interim Sites Which Do Not Meet Criteria (c.). Sites A, B, E and F were identified as interim sites in 1977. In 1986 EPA issued final site designation to these four interim sites. The 1986 EPA-designated sites, especially Sites A and B, have been shown to be limited in their capacity due to their small size and the large quantity of material dredged. Sites A and B have not received dredged material since 1994 and 1992, respectively, due to mounding and subsequent wave interaction. Prior to expansion in 1993, Site F was not routinely used. Because of the limited site capacity and interference with other activities in the marine environment the Corps and EPA have determined that the 1986-EPA designated Site A, B, E and F do not meet the criteria and factors established in 40 CFR 228.5 and 228.6. The use of these sites will be terminated as soon as suitable alternative sites can be designated.

Size of Sites (d.). The fourth general criterion requires that the size, configuration and location of the site be evaluated as part of the study and that the size be limited. Ocean disposal sites are sized to localize, for identification and control, any immediate adverse impact and permit the implementation of effective monitoring and surveillance programs to prevent long-ranged impacts. In the 1983 EIS and subsequent 1986 ODMDS designation, this was interpreted to mean the absolute minimum size possible. The size of the EPA-designated Sites A, B, E and F was, therefore, based upon the minimum size site that a hopper dredge can operationally use. This narrow interpretation maximized the effects of disposal in these small sites. As a result, mounding of dredged material occurred to the point that the wave climate was altered, imperiling navigational safety, especially for small boats transiting the area. As a consequence the only management options available were to discontinue placement of dredged material in EPA-designated Sites A and B and expand all the existing sites pending completion of this designation process.

The proposed ODMDSs have been sized to provide sufficient capacity to accommodate material dredged from the MCR federal project as well as future material from the Columbia River navigational channel and possible deepening of this channel to 43 feet. The disposal sites provide site capacity for 50-year life in which a projected 225 mcy of material will require ocean disposal. A major consideration in sizing the sites was the prevention of mounding of dredged material as experienced at the original EPA-designated sites. Preventing mounding will assure the wave climate will not be significantly affected and navigational safety not compromised.

Bathymetric surveys of the "placement area" will be conducted as part of the site management and monitoring program at the MCR. The results will be used to document the fate of the dredged material and provide information for future management.

Sites Off the Continental Shelf (e.). Potential disposal areas located off the continental shelf would be at least 20 nautical miles offshore in water depths of 600 feet or greater, with the exception of the Astoria Canyon, which is 11 nautical miles offshore (Figure 1). The haul distance to an off-shelf disposal site is much greater than the 4.5 nautical mile average operational limit of the MCR project, making an off-shelf site infeasible for maintenance of the MCR project. Material dredged from the Columbia and Lower Willamette Rivers project by clamshell could be feasibly transported off the continental shelf by barge. However, the cost for valuation and monitoring along with unanswered environmental concerns about disposal in such areas makes off-shelf disposal undesirable. Further, disposal would remove all sediments from the nearshore littoral transport system, a system that functions with largely non-renewable quantities of sand in Oregon and Washington. Disruption in the mass balance of this system could alter erosion/accretion patterns, adversely impact beaches, spits, wetlands, and other shoreline habitats.

Benthic and pelagic ecosystems near the shelf contain important fishery resources and the effects of disposal operations on them are not well understood. Fine-grain sediment and rocky habitats would be directly impacted in disposal operations. These deep water areas are stable and generally not disturbed by wave action or sediment movement. Consequently, these areas have benthic invertebrate communities that are adapted to very stable conditions and would not likely be able to survive disturbance from disposal operations. Little is known of the ecology of benthic communities on the continental slope, and disposal in this area could cause impacts of unknown severity and duration. Bottom gradients can be 5 to 25 percent on the continental slope, making accumulated unconsolidated sediments susceptible to slumping. Deposited sediments could be transported long distances downslope as turbidity currents and offshore by near-bottom currents.

DETERMINATION OF COMPLIANCE AND SELECTION FOR FORMAL DESIGNATION (40 CFR 227)

Determination of Environmental Acceptability of Ocean Disposal (Subpart B). The Corps and EPA have documented for the record via this combined Feasibility Report and Environmental Impact Statement with appendices (in particular Appendix H with Exhibits) the anticipated environmental effects from designation of ocean dredged material disposal sites offshore of the mouth of the Columbia River and the States of Oregon and Washington and from the potential future regulated use of those sites pursuant to the site management and monitoring plan for disposal of dredged materials. Designation of ocean dredged material disposal sites does not mandate use; however, use of sites once designated is anticipated. Material that could be disposed in the ocean is anticipated to be clean sand from the Mouth of the Columbia River and the lower Columbia River estuary. By regulation, dredged sediments suitable for ocean dumping may not contain any materials listed in section 227.5 or contain any of the materials listed in section 227.6 except as trace contaminants. Determination of trace contaminants is accomplished by Corps and EPA evaluation of the dredged material employing the procedures of applicable national and regional testing manuals. Compliance with the applicable prohibitions, limits, and conditions for site use will assure that formal designation of ocean dredged material disposal sites and their use will not unduly degrade of endanger the marine environment. With respect to this subpart, it is concluded that site designation and use would present:

(a) no unacceptable adverse effects on human health and no significant damage to the resources of the marine environment;
(b) no unacceptable adverse effect on the marine ecosystem;
(c) no unacceptable adverse persistent or permanent effects due to the dumping of dredged materials; and
(d) no unacceptable adverse effect on the ocean for other uses as a result of direct environmental impact.

Determination of Need for Designation of Sites (Subpart C). The need for ocean dumping has been adequately documented by a thorough evaluation of the factors listed in section 227.15. No practicable alternatives presently exist to manage dredged sediments from the two Columbia River federal projects. Designation of ocean dredged material disposal sites to fulfill the present and anticipated future need is required. While the use of designated sites is anticipated, that use is not mandated by the designation. Notwithstanding compliance with the other ocean dumping criteria, ocean dumping of dredged material may not be authorized if there is no need for the dumping, and alternative means of disposal are available, as determined in accordance with subpart C. These factors must be evaluated and documented for the record for each proposed dumping on an individual project basis.

Impact on Esthetics, Recreational and Economic Values (Subpart D). In itself, designation of ocean dredged material disposal sites has no effect on esthetics, recreational or economic values. Designation of ocean dredged material disposal sites does not mandate use; however, use of sites once designated is anticipated and the potential for unacceptable adverse effects results from the individual and cumulative disposals at, and management by the government, of designated sites.

Sites are located to minimize resource impacts and use conflicts to acceptable levels, not necessarily to avoid all conflicts. Potential impacts of use of designated sites offshore of the mouth of the Columbia River were evaluated by the Corps and EPA and are documented in the EIS and appendices. EPA's site designation Rule will define site use conditions, which, in conjunction with the Site Management and Monitoring Plan will limit the extent and severity of any impacts to acceptable levels. In addition, the impact of dumping on esthetic, recreational and economic values must be evaluated on an individual project basis for each proposed dumping. Placement of dredged material into the previously proposed North Site and South Site in the DEIS would have been managed to avoid formation of mounds that would interfere with commercial fishing activities. However, concern was still expressed about the impacts of disposal in these sites on the crab fishing industry. Based on consideration of these concerns as well as other relevant factors, the government configured a Deep Water Site that was considered by the government as well as the interagency and stockholder Working Group to strike a reasonable balance of all relevant factors. Over the fifty or more year life of the Deep Water Site, a 40-foot high dredged material mound will be created. The mound will alter the composition of the benthic population and other living resources. Formation of the mound over time will also make the dump zone of the Deep Water Site less able to be fished by commercial crab fishermen and bottom trawlers using today's standard harvesting methods and equipment. However, the site has been located primarily within the towlanes, avoiding known productive, preferred and heavily fished locations, and where commercial fishing is already discouraged.

The government must also consider the consequences of not authorizing disposal sites and use of those sites, including without limitation, the impact on esthetic, recreation and economic values with respect to the municipalities and industries involved. Without ocean dumping, the federal entrance channel and main navigation channel in the lower Columbia estuary cannot be economically maintained. The benefits analysis performed by the Corps demonstrates that economic values associated with the deep draft shipping into and out of the Columbia River system are substantial on a regional and national scale. While all economic values would not be completely lost, failure to maintain the navigation projects would necessarily result in severe economic disruption to municipalities, industries, and individuals throughout the Pacific Northwest. Failure to maintain the navigation projects would not be expected to directly impact recreational uses or esthetic values defined by this subpart.

With respect to this subpart, it is concluded that designation and use of ocean dredged material disposal sites would not result in unacceptable adverse effects to esthetic, recreational and economic values. Further, it is concluded that in the absence of ocean dumping, unacceptable adverse economic effects to municipalities and industries will occur throughout the interior portion of the Pacific Northwest region and the western potion of the Nation.

Impact on Other Uses of the Ocean (Subpart E). This study, EIS and appendices identified and assessed the nature and extent of existing and potential uses of the disposal sites themselves and of any areas, which might reasonably be expected to be affected by designation of sites and their use. Temporary and long-range effects were evaluated within the state of the art with particular emphasis on any irreversible or irretrievable commitment of resources that would result from use of the designated sites. Based on these evaluations it is concluded that there would be no unacceptable adverse effect on other uses of the ocean as defined by this subpart.

SELECTION OF OCEAN DISPOSAL SITES FOR FORMAL DESIGNATION

Based upon the evaluation of the criteria contained in 40 CFR Parts 220 through 228, the Corps and EPA have determined that the sites proposed in the DEIS (North Site, South Site, and Site E) and the Deep Water Site are suitable for designation and use as disposal sites for ocean dumping of dredged material when disposal and site management is performed in accordance with the management and monitoring plan which as been developed under 40 CFR 228.9 and use restrictions that will be specified as part of designation. The Corps and EPA have further determined that material dredged from the MCR, Columbia River channel and channel deepening (if authorized) projects meet the criteria for dredged material dumping. The North Site and South Site proposed in the DEIS are no longer under consideration for designation and use by the federal government. Site E and the Deep Water Site are proposed for designation by EPA through formal rulemaking, adopting the appropriate sections of this EIS and appendices to support that action. These two new ocean dredged material disposal sites will be used and managed in association with the existing North Jetty Site located adjacent to Site E but in jurisdictional Inland Waters rather than Ocean Waters. The four Columbia River ocean dredged material disposal sites originally designated by EPA in 1986 will be de-designated as part of the rulemaking package for the new sites. The sites selected by the Corps under their Section 103 authority in 1993 and 1997 will expire at the end of their authorized life or will be terminated once EPA's formal rulemaking is completed.