Siuslaw River, Oregon
Ocean Dredged Material Disposal Sites Evaluation Study and Environmental Assessment

U.S. Army Corps of Engineers, Portland District

U.S. Environmental Protection Agency, Region 10

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Abbreviations and Acronyms

CFR	Code of Federal Regulations
cfs	cubic feet per second
cy	cubic yard(s)
CZMA	Coastal Zone Management Act
DMEF	Dredged Material Evaluation Framework
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	essential fish habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
km	kilometers
m^3	cubic meter(s)
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mm	millimeter(s)
MDL	method detection limit
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MPRSA	Marine Protection, Research and Sanctuaries Act
MRL	method reporting limit
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAD	North American Datum
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
OC	Oregon Coast (coho salmon)
ODMDS	ocean dredged material disposal site
ODFW	Oregon Department of Fish and Wildlife
OHV	off-highway vehicle
PAH	polynuclear aromatic hydrocarbon(s)
PCB	polychlorinated biphenyl(s)
ppb	parts per billion
ppm	parts per million
RM	river mile(s)
SEF	Sediment Evaluation Framework
SMMP	Site Management and Monitoring Plan
SONCC	Southern Oregon/Northern California Coast (coho salmon)
TOC	total organic carbon
TBT	tributyltin
ug/g	microgram per gram
ug/kg	micrograms per kilogram
ug/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
ZSF	Zone of Siting Feasibility

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PURPOSE AND NEED

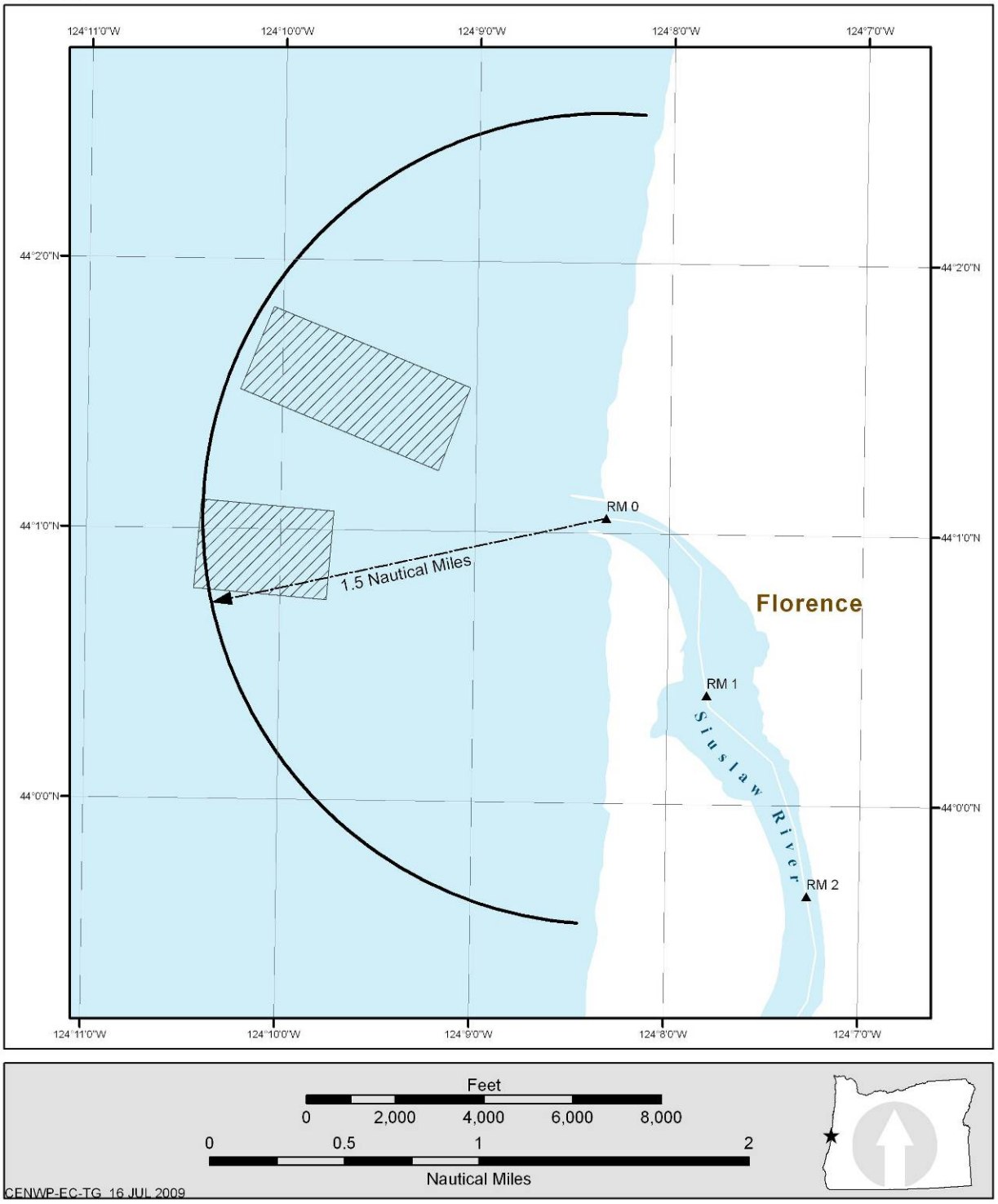
This Ocean Dredged Material Disposal Site (ODMDS) Evaluation and Environmental Assessment (EA) was jointly prepared by the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (EPA). The purpose of this evaluation is to provide documentation in support of final EPA designation of two ODMDS (North and South) located offshore from the Siuslaw River, Oregon (Figure 1). These sites are needed for long-term use by the USACE for the federally authorized Siuslaw River navigation project and for use by others for disposal of dredged material meeting ocean disposal criteria. This evaluation will assess the proposed final designation of the two Siuslaw sites against the statutory requirements set forth in the Marine Protection, Research and Sanctuaries Act, as amended (MPRSA), 33 U.S.C. 1401 to 1445, and the regulations found in Part 228 of Title 40 of the Code of Federal Regulations (CFR). These regulations were promulgated in accordance with criteria set out in Sections 102, 103 and 104 of the MPRSA. This evaluation also outlines EPA's coordination under the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. Sections 4321 to 4370f; Endangered Species Act of 1973 (ESA), 16 U.S.C. Sections 1531 to 1599; Magnuson-Stevens Fishery Conservation and Management Act (MSA), 16 U.S.C. Sections 1801 *et seq*.; Marine Mammal Protection Act of 1972 (MMPA), 16 U.S.C. Sections 1361 *et seq*.; National Historic Preservation Act of 1966 (NHPA), 16 U.S.C. Sections 470 *et seq*.; and the Coastal Zone Management Act of 1972 (CZMA), 16 U.S.C. Sections 1451 to 1466, all as amended.

Need for Disposal Site Designation

The EPA undertook this evaluation to determine whether to designate any dredged material disposal site(s) near the mouth of the Siuslaw River pursuant to its authority under the MPRSA at Section 102(c) in response to several factors. These factors include:

1. The prohibition on further use of the existing Siuslaw Section 103 disposal sites following the close of the 2009 dredging season pursuant to USACE site selection authority under MPRSA Section 103(b), which allows the USACE to select a site under Section 103 for a period of 5 years with a maximum 5-year extension with EPA concurrence;
2. The understanding that in the absence of an EPA-designated disposal site or sites, any necessary open-water disposal would either be precluded or the USACE would have to undertake additional short-term site selections, perhaps a number of them, in the future;
3. The clear Congressional preference expressed in MPRSA Section 103(b) that any open-water disposal of dredged material take place at EPA-designated sites, if feasible; and
4. The statutory preference to concentrate, where feasible, any open-water disposal at sites that have been used historically, see 40 CFR 228.5(e).

Figure 1. Siuslaw River Proposed North ODMDS and South ODMDS



The EPA's evaluation considered whether there was a need for any disposal site designations for long-term dredged material disposal, including an assessment of whether other dredged material management methods and/or disposal options could reasonably be judged to obviate the need for such designations. Having concluded that there was a need for open-water disposal sites, EPA then assessed whether there were sites that would satisfy the applicable environmental criteria to support a site designation under the MPRSA Section 102(c).

Background

The MPRSA was passed by Congress in recognition of the fact that the disposal of material into ocean waters could potentially result in unacceptable adverse environmental effects. Under the MPRSA, the EPA and the USACE were assigned responsibility to regulate the dumping of dredged material into ocean waters and to prevent or strictly limit the dumping into ocean waters of any material that would "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 permit program for ocean disposal of material other than dredged material and designates dredged material disposal sites. The USACE, with EPA's concurrence, issues permits for the disposal of dredged material for the purpose of ocean disposal where the USACE determines that dumping will not unreasonably degrade the environment or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. While the USACE does not administratively issue itself a permit, the requirements that must be met before dredged material derived from USACE projects can be disposed into ocean waters are the same as those where a permit would be issued.

The EPA must consider statutory criteria and evaluate the four general regulatory criteria codified at 40 CFR§ 228.5 and the eleven specific regulatory criteria at 40 CFR § 228.6. Pursuant to Section 102(c) of the MPRSA, the EPA is responsible for designating sites for the disposal of dredged material. The USACE is allowed, with EPA's concurrence, to select a site for ocean disposal of dredged material pursuant to Section 103(b) and (c) of the MPRSA, when a feasible disposal site has not been designated by EPA, or when the continued use of an alternative site is necessary to maintain navigation and facilitate interstate or international commerce, and EPA has determined that the alternative site does not pose an unacceptable risk to human health, aquatic resources, or the environment.

An EPA-designated site requires a site management and monitoring plan (SMMP). Use of a designated site is subject to the restrictions included in the SMMP and EPA's designation regulations. These restrictions are based on an in-depth evaluation of the site 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 USACE or non-USACE permit applicant. Typically, this involves evaluation of the specific disposal activity under the criteria (which can include multiple years of use), circulation of a public notice, specific coordination with stakeholders, and concurrence by the appropriate EPA region.

The EPA proposes to designate two ocean disposal sites, the North ODMDS and South ODMDS, which are located approximately 1 mile offshore of the entrance to the Siuslaw River (see Figure 1). The proposed North site is 4,800 feet by 2,000 feet, and, based on 2009 bathymetric data, ranges from 30 to 115 feet deep. The proposed South site is 3,000 feet by 2,000 feet and ranges in depth from 80 to 120 feet deep.

Offshore Designation and Disposal History

An Interim ocean disposal site, or areas in the same vicinity, have been used by the USACE Portland District since 1929, when hopper dredges began to work the Siuslaw bar and entrance channel. The Interim ODMDS (Interim Site A on Figure 2) was designated an EPA Interim Site in 1977 (40 CFR 228.12) and was used from 1977 to 1996. It was suspected that ocean currents were transporting dredged material placed in the Interim site back into the Siuslaw entrance channel. In 1986-1987, the USACE completed dye and seabed drifter studies (USACE 1988). Results demonstrated dredged material deposited south and/or east of the centroid of the interim site, with prevailing north to northwest winds, could possibly drift back across or into the Siuslaw entrance channel. The Interim site also experienced mounding to 14 feet relative to the 1981 bathymetry due to its small size and the volume dredged. To address these issues, two adjusted and expanded ocean disposal sites, ODMDS B and C, were selected by the USACE under Section 103 of the MPRSA (Figure 2, Sites B and C). Site B includes a portion of Interim Site A. Material removed from the Siuslaw federal navigation project was first deposited at Site C in 1997, while Site B was first used in 1999. Since 1997, material removed from the Siuslaw federal navigation project has only been deposited into ODMDS B and C (see Table 1).

Sites B and C experienced some mounding even though disposal restrictions were used to enhance dispersal. The Interim Site A vicinity of Site B was avoided until previously placed materials could disperse. As a result of the larger sites, reduced overall volumes of dredging and disposal, and avoidance of the Interim Site A corner, all disposal restrictions were lifted in 2008. Pending final designation by EPA, in 2004 the USACE extended the selection of ODMDS B and C for a final 5-year period. Following expiration, the EPA must designate ocean disposal sites under Section 102 of the MPRSA in order for dredged material to be disposed offshore of the Suislaw River.

Table 1 presents the volume of material placed offshore of the Siuslaw River. The bulk of the material dredged has been placed in the larger Site B. Quantities of dredging overall have dropped and future dredged material disposal volumes are not often expected to exceed 100,000 cubic yards (cy) annually (based on a 13-year average of about 60,000 cy and a range of 22,300-117,300 cy). Material is expected to be disposed over a period of 20 days of dredging and disposal (average is about 7 days; range 3-23 days). Generally, dredging and disposal are expected to occur between June 1 and October 31 of each year.

Figure 2. Historical Siuslaw River Ocean Disposal Sites

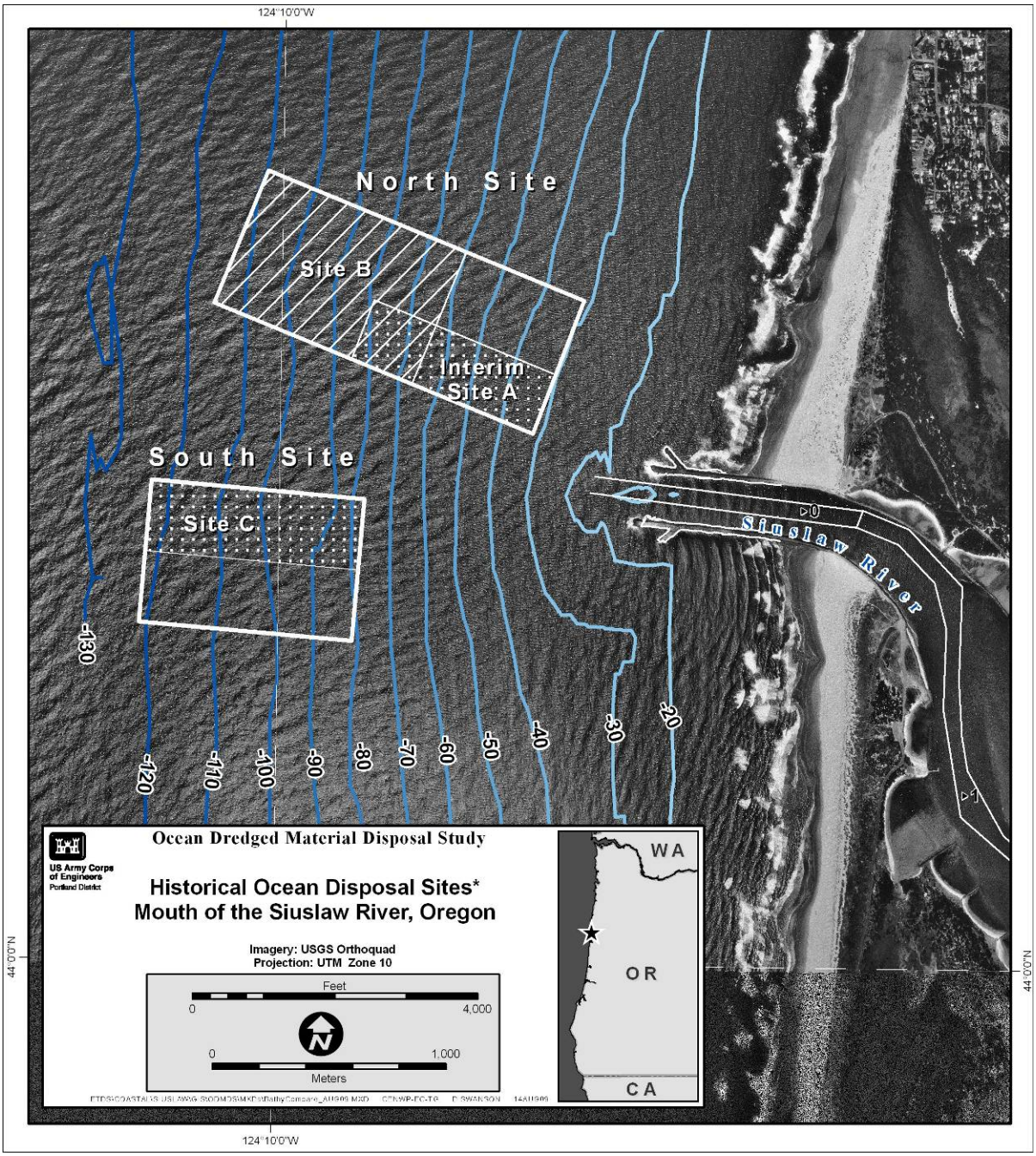


Table 1. Siuslaw River Project Dredging Volumes

Fiscal Year	Dredging Volumes (x 1,000 cy)
1929-1977	2,800.0*
1977	139.3*
1978	191.4*
1979	246.6*
1980	94.2*
1981	388.4*
1982	193.4*
1983	213.3*
1984	221.1*
1985	271.2*
1986	218.8*
1987	215.8*
1988	114.5*
1989	116.8*
1990	99.0*
1991	65.9*
1992	194.2*
1993	239.6*
1994	223.3*
1995	121.6*
1996	84.8*
1997	40.0 (Site C)
1998	69.6 (Site C)
1999	43.5 (Site B)
2000	55.1 (Site C)
2001	101.2 (Site C)
2002	117.3 (Site B)
2003	55.0 (Site B)
2004	14.1 (Site B) & 9.0 (Site C)
2005	33.4 (Site B)
2006	22.3 (Site B)
2007	76.0 (Site B)
2008	69.9 (Site B)
2009	91.7 (Site B)

* Dredged material from 1977 to 1996 was placed in the EPA-designated Interim ODMDS (Site A).

At other ocean disposal sites along the Oregon Coast, the EPA and the USACE have found that the strategy of placing a site to the north and another to the south of the river mouth has worked well (Coos Bay, Umpqua, etc.), primarily because it allows for adaptive management of the sites given a dynamic current environment. Similarly, EPA is proposing two expanded ocean disposal sites located North and South of the mouth of the Siuslaw River. Generally, material placed deeper than 60 feet is less mobile and less available to the active littoral system. To keep more material in the active littoral system, EPA proposes a North site configuration that expands the existing Section 103 Site B to include the original 1977 Interim site (Site A), and a similar

relatively "shallow" area to the north of Site A (see Figure 2). Based on likely northerly movement of coastal littoral material over the course of the yearly dredging and disposal cycle, the EPA proposes to utilize the shallower portions of the North site to the maximum extent possible in order to disperse material into the active littoral zone, limit wave effects due to mounding, and keep material from reentering the navigation channel to the south. The proposed South site's southern boundary was moved further south, doubling the size of the site, to allow for better dispersal should that site be needed. To support annual adaptive management of the sites, EPA anticipates annual bathymetric surveys and other management and monitoring at the proposed North and South sites in accordance with the Site Management and Monitoring Plan (SMMP) (see Appendix F).

AFFECTED ENVIRONMENT

Physical Resources

General

This section provides a summary characterization of the physical resources in the Siuslaw River study area. Additional information is provided in Appendix B: Physical Processes and Geologic Features. The Siuslaw River estuary covers about 1,780 acres and opens into the Pacific Ocean about 160 miles south of the mouth of the Columbia River. It lies within the Heceta Head littoral cell, which extends for about 56 miles from Heceta Head south to Cape Arago. The estuary is fed mainly by Siuslaw River, which is 108 miles from its mouth to headwaters and has a drainage basin of 773 square miles. The watershed encompasses part of the Coast Range, with the Siuslaw River extending inland to Cottage Grove. The coastal zone of the littoral cell consists of a wide plain that is 1- to 2-miles wide, covered by active and stabilized sand dunes backed by the mature upland topography of the Coast Range. The lower portion of the Siuslaw River is bordered by broad alluvial flats. Between the Siuslaw River and Yaquina River estuaries, the continental shelf is at its widest along the Oregon Coast, extending over 44 miles offshore forming the Heceta Bank. Just south of the Siuslaw River, the shelf begins to narrow and is only about 19 miles wide at the mouth of the Umpqua River. At the mouth of the Siuslaw River, the first 2 miles or so of the shelf is covered with sand. From there a thin layer of mud (about 1-inch thick) mantles the surface.

The Heceta Head littoral cell is the largest on the Oregon Coast. Landward of the cell, the coast is primarily beach-fronting sand dunes. Headlands are located at the north and south landward ends of the cell. Three major river systems enter the cell. From north to south, these are the Siuslaw River, the Umpqua River (largest of the three), and the Coos River.

Siuslaw River Sediments

This section provides a summary characterization of the sediments to be dredged from the Siuslaw River. Additional information is provided in Appendix C. In 1991, the USACE collected 10 sediment samples from the Siuslaw River federal navigation channel for physical analysis; one sample from the turning basin at river mile (RM) 5.0 near Florence was subjected to chemical analyses (USACE 1991). Sediments were found to be 99.9% poorly graded sand with low volatile solids content (1.1%). The median grain size of 0.32 millimeters (mm) was

that of medium sand. The results of the chemical analysis from the turning basin had metals concentrations below established levels of concern. No pesticides, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), or phenols were detected.

In 1996, 10 surface grab samples were collected from the entrance to RM 8 (USACE 1996). These samples were subjected to physical tests, with grain-size ranging from 100% to 92.7% (mean 98.6%) poorly graded sand with volatile solids content ranging from 1.4% to 0.3% (mean 0.8%). The mean grain-size was that of medium sand (0.294 mm).

In 2001, eight surface grab samples were collected from the entrance to RM 6 (USACE 2001). All samples were submitted for physical analyses, with grain-size ranging from 100% to 97.9% (mean 99.2%) poorly graded sand with volatile solids content ranging from 0.42% to 3.0% (mean 1.29%). The mean grain-size was that of medium sand (0.29 mm). Two samples were selected for chemical analyses to include metals, total organic carbon (TOC), PCBs, chlorinated hydrocarbons, phenols, phthalates, miscellaneous extractables, and PAHs; one sample was submitted for organotin (TBT - pore water method) analysis. The samples submitted for chemical analysis were taken from the federal channel near the outfall to the sewage treatment plant and near the boat dock. The one sample analyzed for TBT was collected near the boat dock. Sediment represented by these samples would meet the marine screening level guidelines established in the Sediment Evaluation Framework (SEF 2009)[1] for unconfined in-water placement without further characterization.

In August 2006 (Sherman 2007), seven samples were collected from the Siuslaw entrance to RM 5. All samples were submitted for physical analyses, with grain-size ranging from 98.5% to 95.4% poorly graded sand (mean 97.1%), with volatile solids content ranging from 0.69% to 2.24% (mean 1.14%). One sample was selected for chemical analyses to include metals, TOC, PCBs, chlorinated hydrocarbons, phenols, phthalates, miscellaneous extractables, and PAHs. Two samples were submitted for TBT analysis, one from the turning basin adjacent to the marina and the second from the federal channel by the fuel dock. Pore-water TBT was not analyzed due to insufficient pore-water volume in the samples, a result of the high sand content. The chemical analyses showed only low levels of contamination in any of the samples, with all levels well below their respective SEF screening levels. No pesticides, PCBs, PAHs, chlorinated hydrocarbons, or miscellaneous extractables were detected in any of the samples. Several metals, phthalates, phenol, and dibutyltin were detected, but at low levels and well below their respective screening levels. Detection levels were sufficiently low to evaluate material proposed for dredging. The analytical results of this characterization are consistent with historical data.

[1] Pursuant to the Ocean Dumping Regulations at 40 CFR § 227.13(b), dredged material which meets the following criteria is environmentally acceptable for ocean dumping without further testing: (1) dredged material composed primarily of sand, gravel, rock, or any other naturally occurring bottom material with particle sizes larges than silt, and the material is found in areas of high current or wave energy such as streams with large bed loads, or coastal areas with shifting bars and channels; or (2) dredged material for beach nourishment or restoration and is composed primarily of sand, gravel, or shell with particle sizes compatible with material on the receiving beaches; or (3) when the material is substantially the same as the substrate at the proposed disposal site and the site from which the material is taken is far removed from known existing and historical sources of pollution such that there is a reasonable assurance that the material has not been contaminated by such pollution. The use of the SEF screening levels provides an additional safeguard for material that would otherwise meet the regulatory criteria for environmentally acceptable material for ocean dumping without further testing.

Sediment represented by these samples met the marine screening levels guidelines established in the SEF for unconfined in-water placement without further characterization.

Sediments were collected in October 2006 from the Port of Siuslaw marina and from the upper river channel (RM 5 to 16.5). These samples are considered representative of the material from these areas, though dredging above RM 5 is very infrequent. Sediment from the Port's marina ranged in grain-size from 47.3% to 79.4% sand (mean 75.9%), while sediment from the upper river channel ranged from 93.6% to 97.0% sand (mean 95.4%). Sixteen samples were submitted for physical testing and eight samples (two upstream and six marina) were subjected to chemical analysis, including metals, PCB's, pesticides, chlorinated hydrocarbons, miscellaneous extractables, phthalates, phenols, and low and high molecular weight PAH's. The six marina samples were also tested for bulk and porewater TBT. Some samples contained low levels of several COC's, however, none approached their DMEF/SEF screening levels, with all laboratory detection levels and quality controls at acceptable levels.

ODMDS Sediments

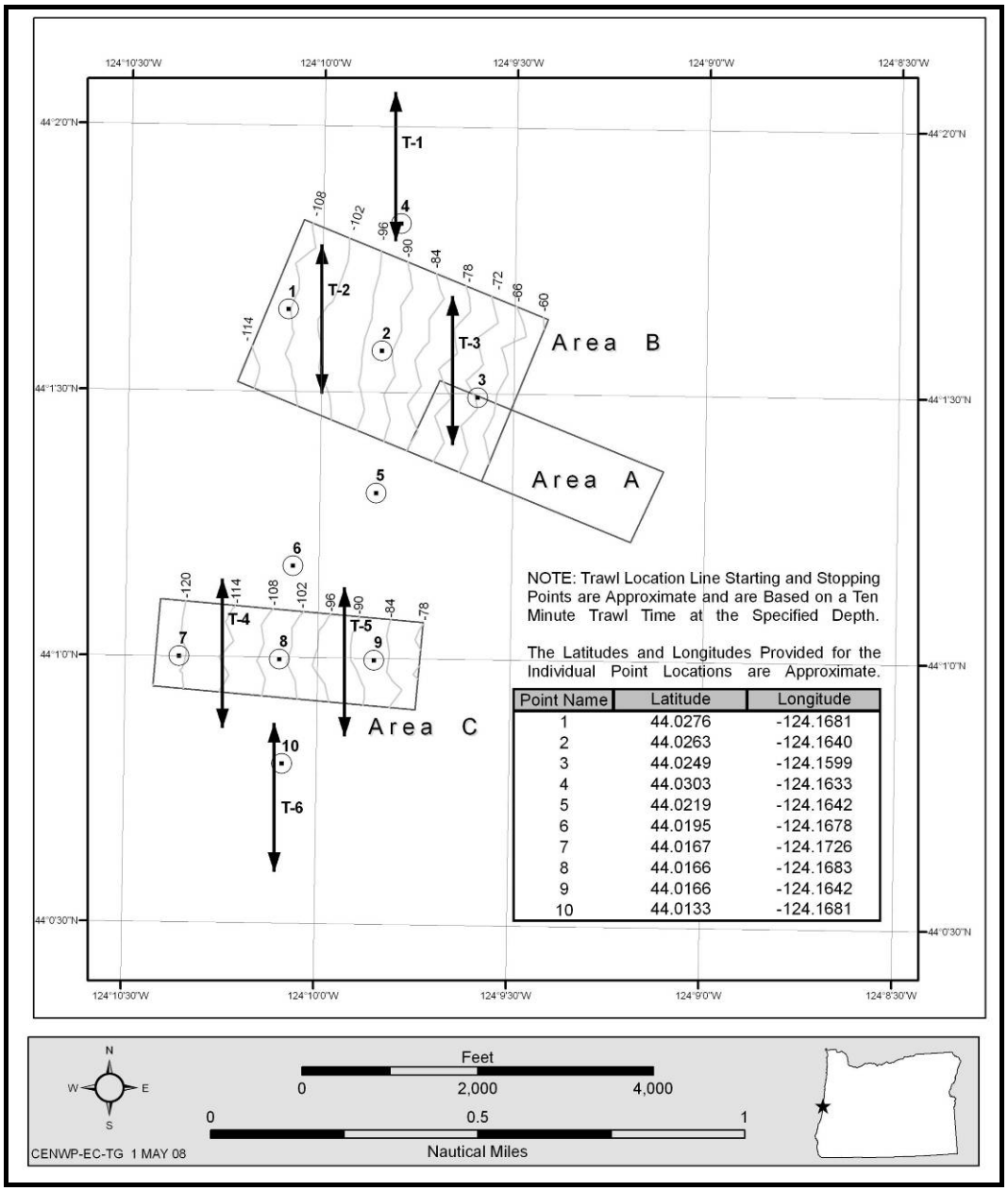
This section provides a summary characterization of the sediments in the ocean environment offshore of the Siuslaw River. Additional information is provided in Appendix C. In August 2008, 10 surface-grab sediment samples were collected at ODMDS B and C (proposed North and South sites) with a 0.96 m^2 modified Gray-O'Hara box core sampler (Figure 3). Three samples (01, 02 and 03) were collected from east to west on the centerline of Site B. Three samples (07, 08 and 09) were collected from east to west on the centerline of Site C. Four reference samples were collected north, south, and between Sites B and C (04, 05, 06, and 10). All samples were subjected to physical/chemical analysis.

Physical Analysis and TOC. The mean value for a grain-size of sand or greater was 97.25% with a mean value of 3.71% fine-grained material (less than 230 sieve); mean value for TOC was 0.107%.

Metals. Sediments were analyzed for 10 metals. Of these, all but antimony (Sb), silver (Ag), and mercury (Hg) were present in all of the samples. No detected metal values approached their respective SEF marine screening levels.

Pesticides/PCBs. Chlordane was reported as technical chlordane in one sample (01), and alpha and gamma Chlordane in three samples (01, 02, 06). Detection levels for technical chlordane were problematic, with non-detects reported at levels above the SEF marine screening levels. These values were not supported by the values found for alpha and gamma chlordane where levels separately and additively were well below the SEF marine SL. In addition, the estimated and non-detect values are all below the SL of 10 ug/kg currently used for decision-making in Puget Sound (where total chlordane is defined as the sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor and oxychlordane). Other than chlordane, all other pesticide values were below method reporting levels and well below SEF marine screening levels. No PCBs were detected.

Figure 3. Siuslaw Ocean Disposal Sites Sampling Locations, 2008



<u>Chlorinated Hydrocarbons, Phthalates, Phenols, and Miscellaneous Extractables</u>. No chlorinated hydrocarbons were detected. Several phthalates, miscellaneous extractables, and phenols were detected at very low levels; all were below their respective SEF marine screening levels.

<u>PAHs</u>. Various "low molecular weight" and "high molecular weight" PAHs were detected, but at very low levels and well below their respective SEF marine screening levels.

Oceanographic Circulation

Coastal circulation offshore of the Siuslaw River is directly influenced by large-scale regional currents and weather patterns in the northwestern Pacific Ocean. During winter, strong low-pressure systems with winds and waves predominantly from the southwest, initiate strong northward currents. During summer, high-pressure systems dominate and consequently, waves and wind are commonly from the north. In both seasons, there are short-term fluctuations related to local wind, tidal and bathymetric effects. Along the Oregon Coast, there is a southerly wind in summer which creates a mass transport of water offshore resulting in upwelling of bottom water nearshore.

In 1985 (see Appendix B), monitoring of currents in the Siuslaw nearshore area showed that summer currents were more frequently to the north and were generally the stronger currents. There were onshore-offshore currents during the summer with speeds equal to or greater than 1 foot/second. Bottom currents in the winter had a strong offshore component. The largest percentage of the winter currents was to the north with the majority of the speeds equal to or greater than 1 foot/second. Appendix B provides details of the sediment transport processes for the Siuslaw River and nearshore area.

Surficial Geology

The geological data collected in 2008 for the ODMDS area showed the mean value for a grain-size of sand was 97.25% with a mean value of 3.71% fine-grained material. Sediments dredged from the Siuslaw River entrance channel are similar to the offshore sediments. Grain-size analyses for these sediments in 2006 resulted in mean values of 0.2% gravel (shell hash, 0.0% - 0.5% range), 97.1% sand (95.4% - 98.5% range), and 2.7% silt/clay (1.5% - 4.1% range).

Water Quality

Water quality throughout the action area is expected to be typical for seawater of the Pacific Northwest. There is no reason to expect significant chemical contamination in either the water or sediments, as few industries are located along the estuary. A large data set regarding the impact of dredged material disposal on the water column was accumulated in the early 1980s, and focus has shifted away from the water column pathway to one having more direct contact with bulk or suspended sediment. Currently, water column tests are rarely performed unless there is a “reason to believe” a water column release may occur.

In the summer of 2002, oxygen levels in the water near the Oregon coast plunged so low that fishes, crabs, and other marine organisms had to flee or die in the suffocating waters (PISCO 2009). These low oxygen conditions, commonly called hypoxia, had never been documented in Oregon prior to 2002, but have recurred every summer since. The most severe event occurred in the summer of 2006 when oxygen levels dropped to historic lows and hypoxic water could be found in large areas along the Washington and Oregon coasts. In 2006, the dead zone lasted 4 months and large areas of the coastal ocean were affected by oxygen levels that dropped as low as zero. It is normal to find naturally low-oxygen conditions in deep, offshore waters, e.g., at the edge of the continental shelf and slope. However, the occurrence of low-oxygen water close to shore (the inner shelf, less than 165’ of water) is highly unusual and had not been reported prior to 2002, despite over 50 years of scientific observations along the Oregon coast. No evidence of

impacts due to hypoxia have been documented in over 34 years of studies at the various ODMDSs off the Oregon coast.

Biological Resources

This section summarizes biological conditions in the ocean environment offshore of the Siuslaw River. Additional information is provided in Appendix A.

Plankton and Fish Larvae

No specific data is available for zooplankton in the Siuslaw River nearshore area. However, Keister and Peterson (2003) provided a discussion of the zooplankton community found off the central Oregon Coast (along the Newport hydrographic line). They indicated that the zooplankton community is influenced strongly by seasonal variations in wind and current patterns. During late spring and summer, northwesterly winds set up flow towards the equator and coastal upwelling. Northwesterly winds dominate from April/May-September; periodic relaxations or southwesterly storms rapidly affect the hydrograph of nearshore areas. During this time period conditions about 30 kilometers (km) offshore are less variable. Boreal neritic copepods such as *Pseudocalanus mimus*, *Calanus marshallae*, *Centropages abdominalis*, *Acartia longiremis*, and *Acartia hudsonica* dominate the coastal plankton during summer (Peterson and Miller 1977). In early fall, winds reverse and upwelling ceases; during autumn and winter, winds are predominantly southwesterly, the Davidson Current flows toward the pole, and offshore surface waters are transported onshore. In winter, the coastal zooplankton is populated by warm-water species such as *Mesocalanus tenuicornis*, *Paracalanus parvus*, *Ctenocalanus vanus*, *Clausocalanus spp.*, *Acartia tonsa*, and *Corycaeus anglicus* (Peterson and Miller 1977).

Auth and Brodeur (2006) examined ichthyoplankton off the central Oregon Coast (along the Newport hydrographic line). The dominant taxa collected were northern anchovy (*Engraulis mordax*), slender sole (*Lyopsetta exilis*), rockfishes (*Sebastes* spp.), northern lampfish (*Stenobrachius leucopsarus*), and blue lanternfish (*Tarletonbeania crenularis*). Total larval concentration increased from 49.3 per 1,000 cubic meters (m^3) in 2000 to 72.0 per 1,000 m^3 in 2002, with seasonal concentrations highest in August 2000 (90.3 per 1000 m^3) and April 2002 (151.2 per 1,000 m^3). Relatively few larvae were found at depths greater than 100 meters, while highest larval concentrations generally were observed from depths of 0 to 50 meters. Larval diversity and concentration were higher offshore (46-84 km off the coast) than in nearshore areas (9-28 km off the coast). Highest concentrations were normally found at an intermediate station, approximately 65 km off the coast. Species designated as either coastal or offshore species by previous studies were predominantly found in their respective shelf regions. Most larval concentrations were positively correlated with temperature and negatively correlated with salinity.

Auth and others (2007) examined the ichthyoplankton assemblages from a single station 69 km off Heceta Head on the central Oregon Coast. The authors noted that the species composition, assemblages, and dominant taxa were similar to those found in other studies conducted in this area during summer (Richardson 1973; Richardson and Pearcy 1977; Brodeur et al., 1985; Auth and Brodeur 2006). This similarity provided evidence to support the hypothesis of Auth and Brodeur (2006) that past sampling along the Newport hydrographic line during summer is representative of ichthyoplankton assemblages elsewhere along the Oregon Coast.

Benthic Invertebrates

Field sampling in October 1984 and January 1985 gathered information on benthic invertebrates at 14 stations off the mouth of the Siuslaw River (USACE 1992). Another benthic study was conducted at 11 offshore stations in September 1988 (USACE 1992). During these studies, the Siuslaw offshore area exhibited diverse benthic invertebrate communities. A total of 135 taxa were collected in October 1984, 106 taxa in January 1985, and 163 taxa in 1988. Densities were very similar in 1984 and 1985, with approximately 2,200 individuals/m^2 collected. An average of 4,445 individuals/m^2 was collected in the 1988 survey. Polychaetes (annelid worms) were the numerically dominate species collected during the 1984-1985 sampling periods. *Scoloplos armiger*, *Chaetozone setosa*, and *Megelona sacculata* were the dominant polychaete species, reaching densities of approximately 2,500/m^2, 1,500/m^2, and 1,400/m^2, respectively. Other dominant species collected included the amphipods *Eohaustorius sencillus*, *Mandibulophoxus gelesi*, and *E. sawyeri*. The area also had a large number of sand dollars, *Dendraster excentricus*. In 1988, the dominant polychaete species was *Owenia fusiformis*, although the density of this polychaete was low to moderate when compared to other coastal areas. Another dominant polychaete collected was *Spiophanes bombyx*.

Field surveys were conducted in August and September 2008 by Marine Taxonomic Services (USACE 2009) to supplement earlier benthic invertebrate data and provide current information on fish and epibenthic species present in the area of the proposed Siuslaw ocean disposal sites. The benthic invertebrate fauna in the vicinity of the proposed sites was found to be typical of the nearshore, high-energy environment found along the Oregon Coast. The density distribution data indicated large juvenile recruitment of most species from spring spawning. This recruitment includes both opportunistic short-lived species (*Spiophanes bombyx*) and longer-lived species (razor clams, *Siliqua* sp. juv. and *Dendraster excentricus*). The large recruitment of these longer-lived species and the recruitment of some shorter-lived species, mostly polychaeta and crustacea, indicate good ocean conditions in the spring and summer months in this area. The crustaceans showed some population spikes throughout the data; however, the same species were not always the driving factors. Gammarid amphipods were often present but also present were *Diastylopsis dawsoni* (Cumacea) and barnacles (Cirripedia), which showed up on hard features such as snail shells and the occasional rock. The echinoderms were driven by *Dendraster* sp. juv/*Dendraster excentricus* and the other miscellaneous groups were largely populated by Nemertinea and juvenile holothuroids.

The benthos in the Siuslaw nearshore area is typical of the communities found near other ocean disposal sites along the Oregon Coast, such as Coos Bay sites E and F, Umpqua River, Rogue River, and Chetco River (Hancock et. al., 1981; USACE 1985, 1988a, 1988b, 1990). This benthic community, largely dominated by very mobile organisms, provides an important link in the marine food web. These organisms serve as a direct food source for other benthic organisms and demersal fishes. They also play an active role in the breakdown of organic debris and the tube-building species that help stabilize the marine sediments. Many of the benthic species in the area are able to survive in this dynamic environment being either very mobile or being able to react both to natural or man-made perturbations. The benthic community would be expected to re-colonize within a period of a few weeks to months after disposal (USACE 1993).

Fish and Epibenthic Species

Commercially and recreationally important epibenthic species in the Siuslaw nearshore area are shellfish and Dungeness crab (*Cancer magister*). Clam beds are located on the north side of the Siuslaw estuary at RM 1. Gaper clams (*Tresus capex*) are the dominant bivalves harvested in this area. Dungeness crab adults occur on sandflat habitat along the entire Oregon Coast. They spawn in offshore areas and occur in the estuary when conditions are favorable in late summer and fall.

The nearshore area has been known to be a squid spawning area with the location and size varying annually (USACE 1992). Although there have been incidental catches of squid within 1.5 nautical miles of the mouth of the Siuslaw, there has been no directed squid harvest within this area. There have been reports of egg capsules and adults caught in trawls, as well as the presence of egg capsules on crab gear. Outside of the 1.5 nautical mile radius from the mouth, there have been directed squid harvests south of Heceta Head to Cape Perpetua. Squid spawn between water depths of 5 to 40 meters, with maximum spawning occurring at 15 meters. After hatching, they school in the middle of the water column, moving toward the surface as they mature. Mature squid feed mostly at water depths of 20-50 meters (USACE 1992).

The nearshore area off the Siuslaw River supports anadromous salmonids including coho salmon, winter steelhead, and spring and fall Chinook salmon, as well as a variety of other pelagic and demersal fish species. Other pelagic species include the Pacific herring (*Clupea harengus pallasi*), northern anchovy (*Engraulis mordax*), and surf smelt (*Hypomesus pretiosus*).

Demersal species present in the nearshore area are mostly residents and include a number of sculpins, sea perch, and rockfish species associated rocky habitats, as well as flatfish species occurring predominantly over open sandflats. Flatfish include English sole (*Parophrys vetulus*), sanddab (*Citharichthys* sp.), and starry flounder (*Platichthys stellatus*). English sole and starry flounder, along with the sand sole (*Psettichthys melanostictus*), spawn in the inshore area in the summer and juveniles of these, as well as other marine species, may rear in the Siuslaw estuary.

Commercial and Recreational Fisheries

Based on data from NMFS (2006) for commercial fishing, a total of 38 commercial vessels delivered landings to Florence in 2000. Landings were in the following West Coast fisheries (data shown represents landings in metric tons/value of landings/number of vessels landing): crab (112.8/$562,057/10), groundfish (124.3/$442,781/15), highly migratory species (6.9/$11,712/5), salmon (29.7/$113,885/22), shrimp (35.7/$28,529/5), and other species (1.5/$6808/5). There were no fish processors operating in Florence in 2000. A total of 41 commercial vessels were owned by Florence residents in 2000, 19 of which participated in the federally managed groundfish fishery. Recreational fishing takes place in the same general areas as the commercial fishery but usually closer to shore. For the port complex around Florence, the 2000 recreational salmonid catch in the ocean boat fishery was 250 Chinook salmon and 472 coho salmon. The recreational non-salmonid catch was a total of 213 fish. The top species landed, in order, included greenstripe, canary, and yelloweye rockfish, and Pacific halibut.

Wildlife

Steller sea lions, harbor seals, and California sea lions are present most of the year in the Siuslaw nearshore area. Steller sea lions forage at river mouths and nearshore areas along the Oregon Coast. Harbor seals breed in the estuary and on nearshore rocks. The Siuslaw nearshore area and shoreline provides important habitat for shorebirds, waterfowl, herons, bald eagles, hawks, and many other species of birds. Pelagic birds (e.g., murres, auklets, cormorants) are likely to use the area near the proposed Siuslaw ocean disposal sites and adjacent waters for foraging.

Threatened and Endangered Species

Oregon Coast (OC) coho salmon is a federally threatened species that may be present in the vicinity of the proposed Siuslaw ocean disposal sites. The Siuslaw River and estuary are designated as critical habitat for this species, but the ocean area off the Siuslaw River is not designated critical habitat. Coho salmon are present in the vicinity of the proposed ocean disposal sites as both adults and juveniles. Adults hold in the offshore area prior to entering the estuary to migrate up river to spawn. Juveniles rear in the nearshore ocean area after migrating downstream and transitioning to saltwater. Upstream migration of adult coho salmon generally takes place from August through November. Juvenile outmigration extends from April through June, but peaks in May.

The Southern Oregon/Northern California Coast (SONCC) coho salmon is also federally threatened and includes all naturally spawned populations of coho in coastal streams between Cape Blanco, Oregon, and Punta Gorda, California. The proposed Siuslaw ocean disposal sites are not located within designated critical habitat for SONCC coho. This coho species typically migrates north along the coast. While migrating individuals may utilize the coastal habitat off of the Siuslaw River for migratory purposes, they are likely to be further offshore than the proposed ocean disposal sites.

The Southern Distinct Population Segment (DPS) of green sturgeon (*Acipenser medirostris*) is a federally threatened species. Critical habitat has been designated for the species (74 FR 52300, 9 October 2009). Green sturgeon that spawn to the north, primarily in the Klamath and Rogue rivers, constitute the Northern DPS, which is not federally listed. These two DPSs for sturgeon were established because they were genetically distinct. Southern DPS green sturgeon may be observed in the vicinity of the proposed ocean disposal sites offshore of the Siuslaw River as they migrate to northern estuaries during summer and early fall.

The Southern DPS of Pacific Eulachon was proposed threatened in March 2009. Eulachon (commonly called smelt, candlefish, or hooligan) are a small, anadromous fish from the eastern Pacific Ocean. Eulachon typically spend 3-5 years in saltwater before returning to freshwater to spawn from late winter through mid spring. Eulachon occur in nearshore ocean waters and to 1,000 feet in depth, except for the brief spawning runs into their natal (birth) streams. In the continental United States, most eulachon originate in the Columbia River Basin. Other areas where eulachon have been documented include the Sacramento River, Russian River, Humboldt Bay and several nearby smaller coastal rivers, and the Klamath River in California; the Rogue and Umpqua rivers in Oregon; and infrequently in coastal rivers and tributaries to Puget Sound, Washington. The NMFS Status Review for Eulachon concluded that eulachon were thought to

occur in "rare" relative abundance in the Siuslaw River (NMFS 2008). Although eulachon migrate along the coast, little is known about eulachon use of the nearshore and marine habitat.

Federally listed avian species that may be present in the Siuslaw offshore area include the marbled murrelet, brown pelican, and short-tailed albatross. Threatened marbled murrelets are observed in small flocks or as individuals in the ocean throughout the year. Endangered brown pelicans are abundant from June to September along the coast and in the lower reach of the Siuslaw River estuary. The endangered short-tailed albatross may forage in open ocean areas off the coast, however the normal range for this species is Alaska and sightings are rare along the Oregon coast.

Two shoreline areas in Lane County support breeding and wintering western snowy plovers (*Charadrius alexandrinus nivosus*), a federally threatened species (USFWS 2007). These shoreline areas are Heceta Head to the Siuslaw River, and the Siuslaw River to the Siltcoos River. These shoreline areas fall outside the limits of the Siuslaw River project and would not be affected by ocean disposal activities.

The blue, fin, sei, sperm, humpback, and southern resident killer whales are all federally endangered and have been observed as migrants off the coast in waters typically farther from shore than within the proposed Siuslaw ocean disposal sites. Threatened Steller sea lions are year-long residents and forage at the river mouth and nearshore areas along the coast. The proposed ocean disposal sites are not located in or near designated critical habitat for the Steller sea lion.

Socio-Economic Resources

The City of Florence is bordered by both the Pacific Ocean and Siuslaw River. The 2000 Census reported that Florence had a total population of 7,263 people, a 40.7% increase from the 1990 Census. Based on the 2000 Census, highest employment in Florence was in educational, health and social services (22.9%), followed by accommodation and food services (16.6%), retail trade (16.1%), government (12.1%), and agriculture, forestry, fishing, and hunting (3.8%).

Cultural Resources

Appendix D provides detailed information concerning cultural resources offshore of the mouth of the Siuslaw River. Prehistoric cultural resources are unlikely to be found within the Siuslaw River offshore area. Shipwrecks are the most probable cultural resources to be expected within the offshore area. A review of the historical records indicates several recorded shipwrecks in the Siuslaw offshore area (see Appendix D). Side-scan sonar surveys were conducted in the area, and no shipwrecks or other historic remnants were detected. Based on the studies and research in Appendix D, there are no known shipwrecks offshore of the mouth of the Siuslaw River.

Recreational Uses

Recreational resources in the area of the proposed Siuslaw River ocean disposal sites are described in Appendix E. Although the Siuslaw River area receives recreational use year-round, the most popular months are from May through October. Fishing in the area is particularly

popular because of the excellent fishing opportunities in the Siuslaw River and nearby freshwater lakes. Other recreational activities include camping, picnicking, beachcombing, and sightseeing.

The Siuslaw River marks the northern boundary of the Oregon Dunes National Recreation Area. This portion of the recreation area contains no developed facilities other than a paved road that parallels the shoreline and provides access to the beach and South Jetty area. During the summer, beachcombing and sightseeing are the most popular activities. The Siuslaw jetty fishery is popular and accounts for a relatively high number of angler use days. The jetties are among the best in the state for catching surf perch. The most popular season is May through September. Scuba diving is another activity which occurs on the outside of both jetties. The main attraction for divers is the opportunity for spear fishing.

A locally important salmon fishery exists offshore of the Siuslaw River. Even though the offshore salmon fishing can be productive, a rough bar has periodically limited this opportunity for most small pleasure craft. Salmon fishing is most popular from May through September when ocean conditions are more predictable and salmon are feeding in the nearshore area prior to the fall spawning runs.

A smooth bottom offshore of the Siuslaw River has limited the establishment of any substantial bottom fish populations. One exception is a small area located just off the mouth which has proven productive for flounder fishing. The lack of good bottom fishing opportunities and the relatively short salmon fishing season have limited the number of charter boats in the area.

Commercial Uses

The Siuslaw River offshore area supports a moderate commercial fishery primarily for salmon, groundfish, and Dungeness crabs. Clams are commercially harvested in the estuary. The fishing and tourist industries are a primary source of income to the local economy. No significant mineral or petroleum deposits are known to exist in the vicinity of the proposed Siuslaw ocean disposal sites.

ANALYSIS OF ALTERNATIVES

A Section 102 site designation allows for long-term sustainable use with no specified time limit on the life of the site. Specific regulatory criteria and factors per the MPRSA are analyzed later in this document.

The EPA and the USACE considered several alternatives for disposal of dredged material generated from the Siuslaw River navigation project and other projects with authorized users. Those alternatives included no action, upland disposal, and estuarine disposal. Alternatives considered for ocean disposal included disposal off the continental shelf, continued use of the existing ocean disposal sites, and/or designation of new sites. Although other users may require dredged material disposal options, the USACE navigation project is the largest and most regular source of dredged material in the vicinity. Since other potential, but smaller, users of the site would likely face many of the same constraints as the USACE in the disposal of dredged material, the discussion of alternatives focuses primarily on USACE navigational dredging.

No Action Alternative

Under the no action alternative, EPA would refrain from formal designation of any ODMDS for the placement of dredged material by the USACE or other authorized persons or entities. If EPA did not designate site(s), the USACE has the authority to select alternate sites under MPRSA Section 103. The substantive requirements for information and evaluation of a Section 103 site are similar to those of an EPA formal designation under Section 102, and site designation under Section 103 requires EPA concurrence. In addition, the use of a Section 103 site is limited to 5 years with one possible 5-year extension. The present sites being used at Siuslaw River are Section 103 sites. At the end of the 2009 dredging season, both present sites will have reached the 10-year use restriction and will no longer be available for use. The no-action alternative would not meet the project purpose, which is to provide dredged material disposal capacity for long-term use by the USACE for the federally authorized Siuslaw River navigation project and disposal capacity for other potential users. Therefore, the no action alternative was judged by both the USACE and EPA to be unacceptable and was dropped from further consideration.

Upland Disposal Alternative

Hopper dredges are self-propelled, seagoing vessels and are the only equipment that can be used to dredge the navigation channel because they can move quickly to minimize interference with navigation traffic and can adjust to rapidly changing weather and sea conditions. Because hopper dredges stockpile dredged material on-board and are designed to bottom dump that material, they are most efficiently utilized in conjunction with an in-water disposal area. Rehandling of material, moving it from the hopper dredge to another location for disposal, introduces an additional cost and logistical component to the process. To dispose of material from a hopper dredge to a land-based disposal site would necessitate dredging an in-water sump in the estuary, bottom dumping the dredged material from the hopper dredge into the in-water sump, and then pumping the material ashore with a pipeline suction dredge. Aside from increased costs, this approach would have additional adverse environmental impacts associated with the dredging of an in-water estuarine site to be used as the sump. Estuarine sites are both highly valued and limited (see below for additional discussion). In addition, a significant adverse impact of upland disposal is that naturally occurring sediments would be removed from the littoral system. For the purposes of this analysis, regular upland disposal of Siuslaw River entrance material is not considered feasible due to the economic and environmental effects resulting from nearshore rehandling of dredged material.

Estuarine Disposal Alternative

Estuarine habitat is limited and environmentally sensitive. Placement of dredged material in estuarine areas is generally only environmentally acceptable for specific beneficial uses, such as in areas where substrate is eroding and the dredged material would be suitable (e.g., fine-grained and clean) to supplement existing substrate. In general, disposal of dredged material in estuaries would result in greater adverse environmental impacts than disposal in the ocean due to both the limited abundance and high productivity of estuaries relative to nearshore oceanic habitats. Disposal of material into the estuary would also increase the risk of the material eroding and reshoaling in the channel, potentially increasing dredging frequency and/or volumes.

There are operational constraints to estuarine disposal as well. Due to the narrow and shallow confines of the Siuslaw River estuary, no suitable estuarine disposal areas were identified that could be accessed by a hopper dredge and could accept the volume of material annually dredged from the Siuslaw River entrance channel.

Ocean Disposal Alternatives

Ocean disposal alternatives include disposal of the material off the continental shelf, continued use, by designation, of the existing Section 103 ocean disposal sites, or designation of a new ocean disposal site(s). In addition to general criteria and specific factors required for analysis by MPRSA, at Siuslaw, EPA has site management criteria that will be applied when managing disposal at a designated site, and that help to inform the alternatives analysis. These include maximizing site capacity and lifetime by maximizing the volume of material that moves from the site into the natural nearshore littoral system; avoiding the potential for mounding and associated safety concerns (e.g. encouraging rapid dispersal); supporting safe and efficient site use/management and site monitoring logistics; and avoiding adverse effects to unique resources.

Disposal Off the Continental Shelf

The MPRSA directs EPA to utilize, whenever feasible, locations beyond the edge of the continental shelf (Section 102(a)(I), 33 U.S.C. § 1412(a)(I)). This same directive is found in the regulations in the general criteria at 40 CFR § 228.5(e). 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-grained 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 likely be less able to survive disturbance from the immediate impact of disposal and the long-term alteration of substrate type. Bottom gradients can be 5% to 25% on the continental slope, making accumulated unconsolidated sediments susceptible to slumping. Deposited sediments could be transported long distances both downslope, through turbidity currents, and offshore, by near-bottom currents, potentially affecting organisms outside of any designated site.

Disposal off the continental shelf would remove natural sediments from the nearshore Hecata Head littoral transport system, a system that functions with largely non-renewable quantities of sand in Oregon. While the loss of the present volumes of Siuslaw River dredged material is unlikely to result in disruption of the mass balance of the littoral system, the State of Oregon is already experiencing erosion/accretion patterns that are adversely impacting beaches, spits, wetlands, and other shoreline habitats. Consequently, keeping this material in the littoral system is perceived as a benefit and helps to sustain a dynamic equilibrium along the Oregon coast.

An additional limiting factor in considering a location beyond the edge of the continental shelf is logistical feasibility. At and in the vicinity of the Siuslaw River, potential disposal areas located off the continental shelf would be at least 15 nautical miles offshore in water depths of 600 feet or greater. This distance is well beyond the reasonable haul distance of hopper dredges working the Siuslaw River project, which is discussed in greater detail in the discussion of the Zone of Siting Feasibility (ZSF). In addition, the feasibility of monitoring a site located off the

continental shelf is questionable, based on safety, cost, and time constraints correlated with increased distance from shore.

Given potential uncertain environmental concerns, coupled with the cost/logistical issues of both disposal and monitoring, disposal off the continental shelf is not a feasible alternative. Substantial additional investigation would be required to determine the scope of the possible environmental impacts of this alternative. Such an investigation is not warranted unless there are no suitable sites closer to shore.

Continued Use of Existing Sites

The two existing 103-selected Siuslaw ocean disposal sites (B and C) have been used for disposal of dredged material since 1997 (see Table 1 and Figure 2). Based on placement of dredged material between 1997 and 2009 at the sites prior to designation, approximately 800,000 cy total have been placed, for a 13-year average annual loading volume of about 60,000 cy/year. Annual bathymetric surveys have shown the potential for mounding at the two previously utilized Section 103 Sites B and C. Disposal restrictions, until lifted in 2008, were placed on the southeast corner of Site B which overlapped the much smaller original 1977 Interim Site A. Since there has been a history of mounding at all of the previously utilized Siuslaw ocean disposal sites, continued use of existing sites is not considered a viable alternative.

Designation of New ODMDS

New ODMDS could be evaluated for designation in location(s) that incorporate the existing historical disposal sites, or a new disposal site could be designated in an entirely new location. EPA and the USACE prefer to continue use of the two existing historical sites because there is a clear regulatory preference for the designation of previously used sites (40 CFR 228.5(e)), and with expansion and adaptive management, they are anticipated to meet the goals for designation. In addition, EPA can utilize past monitoring and surveillance information from these sites for designation, and maintain continuity of monitoring, while extending the monitoring program to expansion areas.

The EPA is proposing to increase capacity and minimize mounding by designating both a larger North and larger South ODMDS for the Siuslaw River. Generally, material placed deeper than 60 feet disperses slowly, and is therefore removed from the active littoral system. To keep more material in the nearshore active littoral system, EPA proposes a North Site configuration that expands the existing 103 Site B to include the original 1977 Interim Site (Site A), and a similar "shallow" (30' to 60' deep) area to the north of Site A, away from the river mouth. EPA proposes to utilize the shallower portions of the North site to the maximum extent possible in order to keep material in the active littoral zone, and to promote dispersal of material from the site. The EPA acknowledges that previous studies showed the potential for material disposed within the southeastern portions of Site A to re-enter the channel. However, by allowing for adaptive management at an expanded North site, EPA and the USACE do not expect measurable volumes of dredged material to migrate back into the channel from the proposed North Site. In addition, the proposed South site's southern boundary was moved to the south, away from the river mouth, doubling the size of the site. Continued management and monitoring of the new Section 102 North and South sites will take place in accordance with a Site Monitoring and Management Plan (see Appendix F).

ANALYSIS OF OCEAN DUMPING SITE DESIGNATION PROCESS AND ENVIRONMENTAL EFFECTS

Overview

Formal designation of ocean dumping sites is the responsibility of EPA as stated in the MPRSA. The process for site designation is found in the ocean dumping regulations at 40 CFR Part 228. The process followed by EPA, Region 10, and the USACE for the proposed Siuslaw River ocean disposal sites generally follows the site designation procedures developed by a joint task force of EPA and USACE personnel titled, *General Approach to Designation Studies for Ocean Dredged Material Disposal Sites* (EPA/USACE 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 40 CFR §§ 228.5 to 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 MPRSA (33 U.S.C. 1401 to 1445) tasks EPA and the USACE with the joint obligation to ensure that ocean disposal will not "unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." The EPA's site criteria and joint EPA/USACE guidance are intended to result in the designation of an environmentally acceptable site, oriented toward avoidance of unreasonable degradation or endangerment of human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities, which is operationally efficient.

Defining a Zone of Siting Feasibility

At the outset, and pursuant to jointly developed guidance titled *General Approach to Designation Studies for Ocean Dredged Materials Disposal Sites* (EPA/USACE 1984), a geographic area of consideration referred to as a Zone of Siting Feasibility (ZSF) is a first step towards designating a site. According to the guidance, a reasonable distance of haul from the dredging site to the disposal site is the determining factor in establishing the ZSF, and will be affected by available dredging equipment, energy use constraints, costs, and safety considerations. The initial ZSF, once established, is evaluated according to the statutory and regulatory criteria under the MPRSA. Each of the criteria is overlain on the preliminary ZSF in sequence to eliminate unsuitable areas and determine the location and overall suitability of remaining sites, if any, within the ZSF that could be designated for the disposal of dredged material. If, based on that evaluation, a suitable site is not located within the initial ZSF, then the area of consideration must be expanded in order to ensure that a disposal site can be designated that will not unreasonably degrade or endanger human health, welfare, amenities, the marine environment, or ecological systems.

Although an ODMDS may be proposed for use and potentially utilized by any person or entity,

the primary anticipated user for the currently proposed Siuslaw ODMDS is the Corps, who is expected to use the site annually for disposal of dredged material from the Siuslaw River navigation project. No other potential users of the proposed Siuslaw ODMDS have been identified at this time. Therefore, the discussion of the ZSF below is based solely on the Corps' anticipated disposal activities.

On the West Coast, weather and ocean conditions are major considerations and act as significant limiting factors when assessing the reasonable distance of haul. Rough seas and adverse weather conditions are the norm from October through May on the West Coast. These conditions act to limit ocean disposal of dredged material to a narrow window where it is generally safe to work from roughly the end of May to no later than mid-October, with a high probability of down time due to adverse weather at either end of that period.

The availability of dredging equipment is also a constraint that must be considered in the determination of a ZSF for a proposed ocean disposal site, but particularly so for sites on the West Coast of the United States. For most of the designated sites in Oregon, the USACE is the primary user and must confront equipment availability issues. The USACE evaluates the availability of Government or contract equipment annually and allocates the use of government dredges for the nation. Hopper dredges are mobile, can work in sea swell conditions up to 10 feet, and are self-propelled. Therefore, they are generally the only feasible equipment for dredging most ocean entrance channel/bar situations.

Hopper dredge availability on the West Coast has been limited. Many hopper dredges working in the U.S. are often committed to other work on the Atlantic and Gulf of Mexico coasts and are not available to be used elsewhere, except perhaps on an emergency basis. As a result, there are typically three hopper dredges working on the West Coast that can be used safely at the Siuslaw River. These dredges must also maintain other projects in Oregon, Washington, California, and occasionally Hawaii and Alaska.

Siuslaw River Zone of Siting Feasibility

The 8-year average (2002-2009) for dredging at the Corps' Siuslaw River navigation project is 57,495 cy. The amount of time necessary to maintain a coastal project (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 essentially 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, but may vary slightly depending on the disposal methodology outlined in the Site Management and Monitoring Plan (SMMP). The SMMP will direct disposal activities in such a manner to minimize mounding or other environmental effects at the ODMDS. 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 and very probably would have repercussions on the Corps' ability to maintain other West Coast projects.

Under current and foreseeable conditions at the project, the estimated volume of material to be removed annually is expected to remain near the current average of 57,495 cy. Based on workload, available funding, and other constraints, the Government-owned hopper dredge *Yaquina* is typically expected to be available 6.92 days (according to latest 8-year average) at the Siuslaw River navigation project, or a contract dredge is expected to be available for a similar length of time. This translates into an 8,309 cy per day average production requirement. The rated capacity for the *Yaquina* is 1,042 cy and the average load for the Siuslaw project is 1,002 cy/load. Pump time typically is around 65 minutes for the Siuslaw project. Depending on the SMMP, environmental conditions, and characteristics of the dredged material, dump time could vary from 2 to 6 minutes. The dredge typically works 24 hours per day except for Tuesdays when the crew change occurs. The ZSF can be calculated as follows:

Assume 8.29 loads per day (8,309 cy/day ÷ 1,002 cy/load = 8.29 loads/day)

Pump time (1.085 hr) + Dump time (0.095 hr) = 1.18 hr/load x 8.29 loads or 9.79 hr/day

24 hr/day - 9.79 hr/day = 14.21 hr/day for transit to and from the disposal site

14.21 hr/day ÷ 8.29 loads/day = 1.71 hour transit time for one round trip

1.71 ÷ 2 = 0.855 hr transit one way

0.855 x 6 kts (vessel speed) = 5.14 nautical miles

Thus, the outer limit of the ZSF for the Siuslaw ODMDS, as limited by the capacity of the available dredging plant, average annual dredging quantity, and limited dredging time period, is 5.14 nautical miles from the Siuslaw River navigation project. This is the area within which potential sites will initially be evaluated according to the MPRSA statutory and regulatory criteria.

Regulatory Criteria for Ocean Disposal Site Selection

The EPA evaluated the four general (40 CFR 228.5) and 11 specific (40 CFR 228.6) regulatory criteria for site designation in reviewing the currently proposed Siuslaw River North and South ODMDS. A conflict matrix format is utilized in Table 2 to simplify and consolidate scoring for the general and specific site criteria review process. Each area of consideration on the conflict matrix addresses at least one general or specific criterion. A legend defining the matrix categories follows the table.

Application of Four General Criteria (40 CFR 228.5)

Minimize Interference with Other Activities (a.). The first of the four general criteria requires that a determination be made as to whether the proposed site or its use will minimize interference with other uses of the marine environment. This determination was made by overlaying individual uses with the resources presented in the *Siuslaw Ocean Dredged Material Disposal Site Evaluation* (USACE 1992) and the more recent appendices prepared for this evaluation. The report presented the overlays on a base map giving bathymetry and location of the previous ocean disposal sites in the ZSF. 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. The selection of features to use for this determination was dependent on whether the resource was considered limited.

Table 2. Proposed Siuslaw North and South ODMDS Conflict Matrix

AREA OF CONSIDERATION [1/]	CONFLICT [2/]	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	RELEVANT SPECIFIC FACTORS 11 Specific Factors [3/] (40 CFR 228.6)	RELEVANT GENERAL CRITERIA 4 General Criteria [4/] (40 CFR 228.5)
1. Unusual Topography/Unique Bottom Features			X			1, 6, 8, 11	a
2. Physical Sediment Compatibility			X			3, 4, 9	b, d
3. Chemical Sediment Compatibility			X		Periodic monitoring conducted	3, 4, 7, 9	a, b, d
4. Influence of Past Disposal		X			Mounding due to past disposal	5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution			X			2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		X			Salmon, pelagic fish, crabs	2, 8	a, b
7. Recreational Fisheries		X			Salmon, pelagic fish	2, 8	a, b
8. Breeding/Spawning Areas			X			2, 8	a, b
9. Nursery Areas		X			Juvenile flatfish and crabs.	2, 8	a, b
10. Feeding Areas		X			Juvenile/adult salmonids, marine mammals, pelagic birds	2, 8	a, b
11. Migration Routes		X			Marine mammals, salmonids, pelagic and shore birds	2, 8	a, b
12. Critical Habitat of Threatened or Endangered Species			X		No critical habitat present	2, 8	a, b
13. Spatial Distribution of Benthos			X			2, 8, 10	a, b
14. Marine Mammals		X			Potential impact to resident and migratory species	2, 8	a, b
15. Mineral Deposits			X			1, 8	a, b,
16. Navigation Hazard		X			Navigation of small boats around the dredge	1, 8	a, b, d
17. Other Uses of Ocean (cables, pipelines, etc)			X			8	a, b, d
18. Degraded Areas			X			4, 6, 7	a, b, d
19. Water Column Chemical/Physical Characteristics			X			4, 6, 9	a, b, d
20. Recreational Uses		X			Inconvenience to recreational boats	2, 8, 11	a, b, d
21. Cultural/Historic Sites			X		No shipwrecks identified	11	b
22. Physical Oceanography - Waves/Circulation			X			1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement			X			1, 3, 6, 7	a, b, d
24. Monitoring			X			5	a, d
25. Shape/Size of Site			X			1, 4, 7	d
26. Size of Buffer Zone			X			2, 3, 4, 7, 11	b, d
27. Potential for Cumulative Effects			X			4, 7	d

Conflict Matrix Tables 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 (e.g., fine-gain species to coarse-grain species, etc)?
14. Marine Mammals: Would placement of material in this candidate site affect marine mammals or their habitat (e.g., 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 and could include sediment sampling or biological data collection.
25. Shape/Size of Candidate Site: Is the candidate site suitable for the operation and maneuverability of a dredge?
Is it oriented 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?

Conflict Matrix Tables Legend (continued)

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 1 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/ Four General Criteria for the Selection of Ocean Disposal Sites

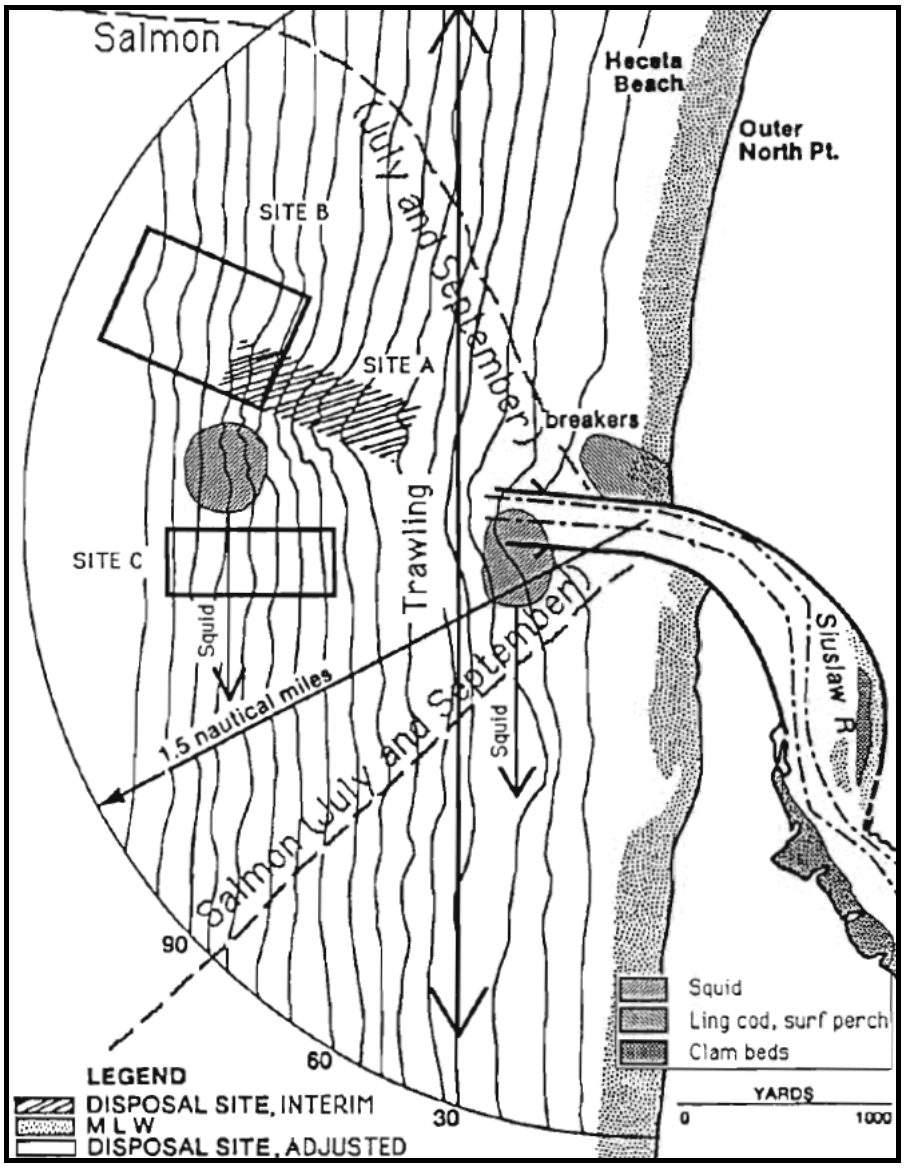
a. The dumping of material into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shell fisheries, and regions of heavy commercial or 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. Effective January 1, 2009, this paragraph, 40 CFR 228.5(c) was removed and reserved, see 73 Fed. Reg. 74983 (December 10, 2008), and is therefore no longer a criterion in the regulations.
d. The sizes of ocean disposal sites will be limited in order to localize, for identification and control, any single immediate adverse impact 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.

The following were selected for evaluation of resources of limited distribution:

1. Navigation Hazards Area/Other Recreation Areas
2. Shellfish Areas
3. Critical Aquatic Resources
4. Commercial and Sport Fishing Areas
5. Geological Features
6. Cultural, Historically Significant Areas

Figure 4 is a composite of the above areas and shows high usage areas within the vicinity of the Siuslaw ocean disposal sites. The denser the pattern overlap, the more interactions between various limited resources exist, thus the more critical the overlap area.

Figure 4. Overlay Evaluation of Individual Resources



As Figure 4 shows, the adjusted sites are within minimal conflict areas in the ZSF. Disposal operations occur generally between June 1 and October 31 of each year. While this represents a temporal overlap, communications with USACE personnel indicate no observable conflicts between the dredging activities and the fishery. Appendix A contains a discussion of all potential conflicts within the ZSF with living resources, and concludes that there are no major conflicts or predictable future conflicts.

Minimizes Changes in Water Quality (b). The second of the four general criteria requires changes to ambient seawater quality levels occurring outside the disposal sites 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 with disposal of Siuslaw sandy material (about 97% of dredged material) or disposal of finer-grained material (about 3% of dredged material) (see Appendix C). The proposed sites should not have any long-term impact on the water quality, with the primary impact of disposal activities on water quality expected to be the temporary turbidity caused by the physical movement of sediment through the water column. There should be no water quality perturbations moving toward a limited resource. Bottom movement of deposited material is discussed in Appendix B.

Interim Sites Which Do Not Meet Criteria (c). Effective as of January 1, 2009, this paragraph, 40 CFR 228.5(c) was removed and reserved. *See* 73 Fed. Reg. 74983 (December 10, 2008), and is therefore no longer a criterion in the regulations.

Size of Sites (d). The third general criterion requires that the size, configuration, and location of the site(s) be evaluated as part of the study, and that the size be limited.

Since 1977 specific dredged material disposal sites have been used off the mouth of the Siuslaw River. More than thirty-years of monitoring at Siuslaw and other Oregon ODMDS have shown that original 1977 Interim Site configurations were too limited in size. Potential mounding limited long-term site capacity, and since there has been a history of mounding at the smaller previously utilized sites, it is clear that new designated sites should be larger to increase capacity and enhance dispersal.

The USACE 1992 Siuslaw Ocean Dredged Material Disposal Site Evaluation report identified two ODMDSs north and south of the entrance. These sites have been used under the Corps Section 103 site selection authority since 1997. This tripled the area available for dredged material placement compared to the relatively small 1977 Interim Site. Based upon annual bathymetric monitoring of the Section 103 sites from 1981 to 2009 (See Appendix B figures B-4 through B-8), EPA proposes to ensure long-term disposal capacity by enlarging the designated sites -- doubling the South Site and expanding the North Site into shallower water. Two sites are again being proposed, to ensure site managers can be responsive to the specifics of each dredging season based on dredge schedules and recorded seasonal sediment transport patterns north and south along the Oregon coast.

The proposed sites are located within the generally homogeneous sandy habitat off the mouth of the Siuslaw River, within a reasonable haul distance from dredging areas and generally removed

from other use conflicts. They encompass previously used and monitored sites, so past monitoring data may be used to manage the sites. The proposed sites now incorporate shallow and deep water areas. Use of the shallower portion of the North Site will facilitate increased sediment transport thereby increasing long-term site capacity. Preferential utilization of the shallow portions of the North Site also meets the management goal of keeping material in the littoral system. However, as seen in the 1977 Interim Site, mounding could occur if too much material is placed too quickly in shallow water. The designation of multiple sites with deeper areas within the sites, allows site managers to be responsive to annual and long-term sediment transport patterns.

The proposed sites are oriented for safe and optimal on-site dredge operations. Oriented with their long axis toward the west and northwest, the sites allow hopper dredges leaving the Siuslaw to head perpendicular to the dominant wave direction while disposing of dredged material.

Finally, in addition to formal site selection criteria and factors, the size, configuration and locations of the proposed sites meet other selection and management considerations important to EPA, including maximized capacity of the sites (since a Section 102 site designation is not limited to a predetermined number of years), minimized potential for mounding and associated safety concerns, maximized volume of material remaining in the littoral system, and avoidance of effects to unique resources.

Sites Off the Continental Shelf or Other Historically Used Sites (e). Any potential disposal sites off the continental shelf in the area of the Siuslaw River would be at least 40 nautical miles offshore. By contrast, the Siuslaw ZSF extends a maximum of only 5.14 nautical miles from shore. The Siuslaw navigation project could not be economically maintained using current dredging technology and availability if a site off the continental shelf was used. In addition, use of a site off the continental shelf would result in as loss of sediments from the nearshore littoral transport system, which could cause detrimental bottom or shoreline changes in the ZSF. Further, very little is known of the ecology of benthic communities on the continental slope, and disposal in this area could cause impacts of unknown severity. Finally, relative monitoring and surveillance logistics would be more costly and difficult at a site located off the continental shelf. For these reasons, designation of an ODMDS off the continental shelf is not recommended. The proposed sites encompass sites that have been historically used, meeting the second directive of this criterion.

Application of Eleven Specific Factors (40 CFR 228.6)

Geographical Position, Depth of Water, Bottom Topography, and Distance from the Coast (1). The proposed North and South ODMDS are approximately 1 mile offshore from the entrance to the Siuslaw River (see Figure 1). Appendix B contains a discussion of the bottom topography of the proposed sites. The two designated sites would be used for disposal of dredged material from the Siuslaw River navigation project and other permitted projects.

The proposed North ODMDS is 4,800 feet by 2,000 feet with an average depth of 90 feet (depth ranges from approximately 30-115 feet), and has the following coordinates (NAD 83):

44° 01' 31.03"N, 124° 10' 12.92"W
44° 01' 49.39"N, 124° 10' 02.85"W
44° 01' 31.97"N, 124° 09' 01.86"W
44° 01' 13.45"N, 124° 09' 11.41"W

The proposed South ODMDS is 3,000 feet by 2,000 feet with an average depth of 100 feet (depth ranges from approximately 80-125 feet), and has the following coordinates (NAD 83):

44° 00' 46.72"N, 124° 10' 26.55"W
44° 01' 06.41"N, 124° 10' 24.45"W
44° 01' 04.12"N, 124° 09' 43.52"W
44° 00' 44.45"N, 124° 09' 45.63"W

Based upon consideration of the location, depth of water, bottom topography, and distance from the coast, the proposed Siuslaw ocean disposal sites are expected to be suitable for the disposal of dredged material when the material is placed in accordance with the SMMP.

Location in Relation to Breeding, Spawning, Nursery, Feeding, or Passage Areas of Living Resources in Adult or Juvenile Phases (2). Aquatic resources of the oceanic region off the mouth of the Siuslaw River are described in detail in Appendix A. In addition, EPA evaluated possible impacts to species and critical habitat listed under the Endangered Species Act in a Biological Assessment (EPA 2009). The proposed ocean disposal sites are located in the nearshore area and many nearshore pelagic organisms are found 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 in the oceanic region off of most of the Pacific Coast, those populations directly off the Siuslaw River are small compared to the overall coastal populations. 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).

Benthic samples are discussed in detail in Appendix A. Based on the analysis of benthic samples collected from the area of the proposed Siuslaw ocean disposal sites, the sites contain benthic fauna common to nearshore, sandy, wave-influenced regions that exist along much of the Pacific Coast in Oregon and Washington.

Sediment in and near the proposed Siuslaw ocean disposal sites consists of well-sorted, fine sands typical of Pacific Northwest coastal areas (Appendix C). The infaunal community of the Siuslaw study area is dominated by gammarid amphipods and polychaete worms. The benthos in the area is typical of the communities found near other ocean disposal sites along the Oregon Coast, such as Coos Bay areas E and F, the Siuslaw River, and the Chetco River (Hancock et al., 1981; USACE 1985, 1988a, 1988b, 1990). This benthic community, largely dominated by very mobile organisms, provides an important link in the marine food web. These organisms serve as a direct food source for other benthic organisms and demersal fish. They also play an active role in the breakdown of organic debris and the tube-building species help stabilize the marine sediments. Many of the benthic species in the area are able to survive in this dynamic

environment since they are either very mobile or are able to react both to natural or human perturbations. They can readily recolonize disturbed areas.

The Siuslaw nearshore area supports a variety of pelagic and demersal fish species and shellfish. Many of these species have a reproductive strategy that includes releasing a large quantity of eggs so that some individuals will survive the substantial mortality common to the species during the larval and juvenile stages. Crabs in particular release large number of eggs into the water column. The larvae that hatch are planktonic for several months before settling to the bottom of the estuary and in the nearshore area 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 adult population numbers.

Numerical modeling of the disposal process by Pearson and others (2006) at the mouth of the Columbia River showed that predicted impact pressure, shear stress, and mound depth were greatly reduced by discharge in deep water (e.g., ocean disposal in 230 and 280 feet of water). The study found that vulnerability of crabs to compression (vertical) forces was low and that crabs may be vulnerable to injury from surge currents. However, the surge currents from modeling the deep-water scenarios were not strong enough to mobilize sediment greater than 1 millimeter or juvenile Dungeness crabs. Results also suggested that Dungeness crabs were vulnerable to injury from burial through effects on crab respiration and survival (Pearson et al., 2006). Previous studies showed that under burial with 10 centimeters (about 4 inches) of material, crabs were unable to recover the respiratory pathway and switched to moving up through the sediment, a process that occurred over 24 hours.

Vavrinec and others (2007) performed laboratory experiments to isolate the effects on Dungeness crabs from burial by dredged material, and crab response and injury caused by tumbling in horizontal surge currents. The horizontal surge current experiments showed no damage, 100 percent survival, and the behavioral capability of crabs to recover their proper orientation after tumbling. The crabs either maintained their proper orientation on the bottom and in the water column, or righted themselves within 2 seconds after being moved by a 3.2 meter/second (about 10.5 feet/second) surge current.

The crab burial experiments (Vavrinec et al., 2007) showed that survival from burial increased as burial depth decreased, and survival increased as crab size increased. Also, male crabs had a higher survival rate than female crabs. When restrained and not allowed an escape response, all the adult crabs suffocated and died within 24 hours when buried in 8 centimeters of dredged material. The observations clearly show that maintaining the respiratory pathway is the key to surviving burial. For unrestrained crabs tested in large tanks with sufficient space for escape response, survival increased substantially. Escape response and other adaptive behavior clearly enabled the subadult and adult crabs to achieve almost 100 percent survival under the same burial depth that allowed no survival at all for restrained crabs. For unrestrained age 2+ crabs, predicted survival begins to decrease at burial depths greater than 10 centimeters, and is less than 10 percent at burial depths greater than 16 centimeters. Behavioral observations and survival results showed that subadult and adult crabs have the capability to respond to surge currents and burial in ways that substantially reduce exposure to stress and allow high survival.

The nearshore area off the Siuslaw River supports anadromous salmonids including coho salmon, summer and winter steelhead, and spring and fall Chinook salmon, as well as a variety of other pelagic and demersal fish species. Seals and sea lions inhabit the lower Siuslaw River and coastal area. The Siuslaw nearshore area and shoreline provides important habitat for shorebirds, waterfowl, herons, and many other species of birds. Pelagic birds (e.g., murres, auklets, cormorants) likely use the area for foraging. Federally listed species that may be present in the Siuslaw offshore area were previously discussed in the *Affected Environment, Biological Resources* section of this report.

In general, the locations of the proposed ocean disposal sites do not provide unique breeding, spawning, nursery, feeding, or passage habitat. It is unlikely that any of the larger organisms (fish, marine mammals, etc.) would experience physiological effects as a consequence of disposal because the resulting turbidity plume and physical disturbance to the water column would likely cause them to avoid the area. Based on modeling completed by the USACE, water column turbidity would be expected to dissipate within a few minutes to half hour. Any avoidance behavior would be limited to the duration of this physical disturbance. Indirect impacts could occur if disposal operations changed the value of the habitat by burying the existing benthic community where dredged material is deposited. The benthic community would be expected to re-colonize within a period of a few weeks to months after disposal, limiting any effects to forage fish (USACE 1993). Lastly, evaluation of past disposal activities has not indicated that any long-term adverse impacts to living resources have occurred.

Location in Relation to Beaches and other Amenity Areas (3). The proposed ocean disposal sites are at least 2,000 feet from the end of the jetties and 3,000 feet from the nearest beach. There are no rocks or pinnacles in the vicinity of either site. The Siuslaw River marks the northern boundary of the Oregon Dunes National Recreation Area. This portion of the recreation area contains no developed facilities other than a paved road that parallels the shoreline and provides access to the beach and South Jetty area. Two public recreation areas are located to the north of the Siuslaw River. Heceta Beach Park is operated by Lane County with beach access, picnic tables, and restrooms. Harbor Vista Park is also operated by the county and offers 15 acres of tent and recreation vehicle camping on a year-round basis. It is one of the few campgrounds on the Oregon Coast with an ocean view and has restrooms, showers, a playground and hiking trails. Beachcombing, sightseeing and clamming are popular activities along the entire coastline. The area within the Oregon Dunes National Recreation Area receives a greater amount of use because of availability of public access. The proposed designation of the Siuslaw North and South ocean disposal sites is not expected to have any impact on the recreational uses of the adjacent uplands areas within these recreation areas.

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. The 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 capacities ranging from 800 to 6,000 cy. This would be the likely volume range of dredged material deposited in any one dredging placement cycle. The estimated volume to be removed annually from the Siuslaw River federal navigation project will range, but can be placed at the sites in one dredging season by any combination of

private and government dredges. For example, volumes from 1997 to 2009 ranged from 22,300 cy to 117,300 cy, giving a 13-year average annual volume of about 60,000 cy. The dredges or barges would be under power and moving during disposal.

The bulk of the dredged material to be disposed in the ocean comes from shoals in and near the Siuslaw River entrance channel. These shoals consist primarily of marine sand transported into the entrance as part of the Heceta Head littoral cell. The material meets marine sediment screening level guidelines for chemicals of concern per the Sediment Evaluation Framework (SEF 2009), is far removed from known sources of contaminants, and has been characterized under the SEF as suitable for unconfined open-water disposal.

The federally maintained entrance channel into the Siuslaw River is authorized at 18 feet deep and 300 feet wide, and runs from deep water to river mile (RM) 0.2. From there upstream to the dock at Florence (RM 5.0), the channel is maintained to 16 feet deep and 200 feet wide. A turning basin, currently maintained by the Corps at 16 feet deep, 400 feet wide and 600 feet long, is located opposite the dock at Florence. The channel from RM 5.0 upstream to RM 16.5 is an authorized (though not currently maintained) federal channel, 12 feet deep and 150 feet wide. At RM 15.8 the channel widens into a turning basin 12 feet deep, 300 feet wide and 500 feet long, also part of the federally authorized, but not currently maintained channel.

The channel above RM 5.0 has required very infrequent maintenance. A pipeline dredge last cleared the shoals at RM 5.5 and 6.0 in 1982. No dredging has been performed above that point since 1976. Siuslaw River sediments (to RM 16.1) were last sampled in 2006. These physical and chemical analyses indicate that the material is primarily sand, meets marine sediment screening level guidelines for chemicals of concern per the Sediment Evaluation Framework (SEF 2009), is far removed from known sources of contaminants, and would be characterized under the SEF as suitable for unconfined open-water disposal

Feasibility of Surveillance and Monitoring (5). Monitoring and surveillance are both feasible within the ZSF and are included as requirements in the SMMP for these proposed sites (see Appendix F). 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 that could pose a threat to navigation safety. 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. The proposed Siuslaw ocean disposal sites are readily accessible. Most surveillance and monitoring work can be performed from small, surface research vessels at a reasonable cost, or from the disposal vessel.

Dispersal, Horizontal Transport and Vertical Mixing Characteristics of the Area Including Prevailing Current Direction and Velocity, if Any (6). The sediments dredged from the Siuslaw River entrance are predominantly marine sands and fluvial gravels. Although the Siuslaw River delivers a large sediment load, the bottom contours suggest a rapid distribution away from the river mouth. The beaches seem to be in equilibrium, suggesting that littoral transport is in balance. From bottom current records, there appears to be a net annual transport of sediment to the north. There is some southward sediment transport during summer. During

summer, the current velocities are variable (see Appendix B). This is due to the constantly varying river outflow combined with tidal flows to produce a highly variable influence on the nearshore circulation.

Sediment movement in the littoral zone consists of two mechanisms depending upon the size of the sediment. Anything finer than sand-size is carried in suspension in the water and is removed offshore relatively quickly. The almost total lack of silts and clays within the Siuslaw ZSF 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, which act in relation to the sediment grain size and water depth to produce sediment transport.

Existence and Effects of Current and Previous Discharges and Dumping in the Area including Cumulative Effects (7). No cumulative effects have been documented in the area aside from mounding, i.e. lack of material dispersal, within the sites as currently configured. The Siuslaw North and South ODMDS are being proposed because of mounding problems associated with disposal at the previous 1977 Interim and Section 103-selected ocean disposal sites. The proposed North and South sites are located and sized to allow management of the sites – a flexible disposal strategy implemented within larger sites to minimize mounding. Per the SMMP, annual bathymetric monitoring will be used to track changes in site bathymetry and will be used to evaluate potential mounding. The preference for disposal of material in the shallow portions of the proposed North Site will provide the positive cumulative effect of returning natural material to the Heceta Head littoral cell.

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).

Shipping. No conflicts with commercial navigation traffic have been recorded in the long history of hopper dredging activity. The likely reason for this is the light commercial traffic in the Siuslaw River channel.

Commercial and Recreational Fishing. Commercial and recreational fisheries occur in and around the proposed Siuslaw ocean disposal sites (see Appendix A). The Siuslaw ZSF area supports a moderate commercial fishery primarily for salmon, groundfish, and Dungeness crabs. The commercial fishing season generally begins in June and runs through October, subject to established catch quotas. During this period, the potential exists for conflicts between a dredge and fishing boats. Based on data from the National Marine Fisheries Service (NMFS 2006) for commercial fishing, a total of 38 vessels, all commercially registered, delivered landings to Florence in 2000, in the following West Coast fisheries: crab, groundfish, highly migratory species, salmon, shrimp, and other species. Dungeness crab had the highest landing value at $562,057, while groundfish landings were the largest by weight at 124.3 metric tons. A total of 41 commercial vessels were owned by Florence residents in 2000, 19 of which participated in the federally-managed groundfish fishery.

A locally important recreational salmon fishery exists offshore of the Siuslaw River. Based on data from NMFS (2006), there is at least one sport fishing charter business in Florence. There were seven sport fishing licensing agents in Florence in 2000, when 4,907 sport fishing licenses were sold at a value of $80,163. Even though the offshore salmon fishing can be productive, a rough bar periodically limits this opportunity for most small pleasure craft. Salmon fishing is most popular from May through September when ocean conditions are more predictable and salmon are feeding in the nearshore area prior to the fall spawning runs. The year 2000 recreational salmonid catch in the ocean boat fishery was 250 Chinook salmon and 472 coho salmon.

The Siuslaw jetty fishery is also popular and accounts for a relatively high number of angler use days. The jetties are among the best in the state for catching surf perch. A smooth bottom offshore of the Siuslaw River has limited the establishment of substantial bottom fish populations, however the year 2000 non-salmonid catch was a total of 213 fish including greenstripe, canary, and yelloweye rockfish, and Pacific halibut.

Mineral Extraction. There are no known metallic mineral deposits within the Siuslaw ZSF. No exploratory oil/gas wells have been drilled offshore near the mouth of the Siuslaw River and no development is expected in the future.

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

Wave Energy. With the increased interest in alternative energy sources, various wave energy projects have been proposed off the Oregon Coast. The Oregon State Governor, in a November 2007 news release to the Oregon Fishing Industry, stated that he was asking the Federal Energy Regulation Commission to limit the permitting of wave energy to five to seven locations. Wave energy projects at those locations will involve numerous generating buoys moored offshore with transmission lines running to shore distribution facilities. Currently, no wave energy projects are proposed off the Siuslaw River.

Fish and Shellfish Culture. There are no fish or shellfish culture operations in the area of the proposed Siuslaw ocean disposal sites.

Marine Reserves. The State of Oregon has initiated efforts to establish a network of state marine reserves as part of an overall strategy to manage its marine waters and submerged lands. The overall purpose would be to protect, sustain, or restore the nearshore marine ecosystem, its habitats, and species. A state marine reserve, as defined by Oregon, is an area within Oregon's state territorial sea or adjacent intertidal area that is protected from all extractive activities including the removal or disturbance of living and non-living marine resources. Marine reserves are intended to provide lasting protection. Dredging and disposal are identified as disturbances and would be banned from areas designated as marine reserves. In 2009, Oregon authorized two marine reserves, one at Otter Rock off Depoe Bay and one at Redfish Rocks off Port Orford. State agencies are to evaluate potential reserves at Cape Falcon south of Cannon Beach, Cascade Head near Lincoln City, and Cape Perpetua near Yachats. State agencies also have been directed to support a reserve proposal for the Cape Arago-Seven Devils area, south of

Coos Bay. None of the sites currently identified are in or near the proposed Siuslaw OSMDS, and all coastal ocean disposal site designations will have to avoid marine reserve areas.

Special Scientific Importance. There are no known transects or other scientific study locations that would be impacted by disposal at the proposed Siuslaw ocean disposal sites.

General Discussion of Other Legitimate Uses. There has not been a demonstrated conflict with any of the above listed uses at the historically used ocean disposal sites and no use conflicts are expected at the two proposed sites. There is a low potential for future conflicts given that the area of the proposed sites has no unique value, is relatively small, and presents few potential conflicts with other uses in the vicinity. Since dredged material disposal sites in the vicinity have been in use for over 30 years, EPA's designation of the two proposed Siuslaw ocean disposal sites would not be expected to result in any change to the existing uses of the area, by any individuals or groups, or any associated economic benefit of those uses.

It should also be noted that EPA is proposing to designate these ODMDS primarily in support of the Corps' operation and maintenance dredging in the Siuslaw River navigation channel. The need for that maintenance dredging was recently underscored by U.S. Coast Guard in a letter dated March 15, 2010, which characterized the Siuslaw as the most restricted entrance bar on the coast of Oregon. The dredging of the entrance bar at Siuslaw is required annually in order to facilitate many of the other uses of the area.

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 (see Appendix C). The ecology of the offshore area, based mainly on fisheries and benthic data, is that of a mobile sand community. Neither the pelagic or benthic communities should sustain any long-term impacts due to their mobility and widespread occurrence off the Oregon Coast (see Appendix A).

Potentiality for the Development or Recruitment of Nuisance Species in the Disposal Site (10). Nuisance species are any undesirable organism(s) not previously found at a disposal site. They are transported to, or recruited to, a site because the disposal of dredged materials creates an environment where they can establish. Materials to be dredged and transported to the proposed Siuslaw ocean disposal sites historically have been classified as uncontaminated marine sands similar to the sediment present at the sites. Potential material dredged from the upstream boat basin access channels may include fine-grained material, however only limited quantities of fine-grained material from the boat basin access channels have been placed in the ocean. Any material proposed for ocean disposal would be subject to sediment quality evaluation. Therefore, it is highly unlikely that 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 resources of the Siuslaw River study area is described in detail in Appendix D. The cultural resource that has the greatest potential for impact by use of the proposed ocean disposal sites is shipwrecks. Potential shipwreck areas are

evaluated in Appendix D. Historical records show that there are not any shipwrecks within the area of the proposed Siuslaw ocean disposal sites.

SUMMARY OF COORDINATION UNDER OTHER APPLICABLE FEDERAL STATUTES

Federal Action

The proposed federal action consists of designation of two ocean disposal sites at the mouth of the Siuslaw River. Site designation does not create or confer rights on any person to use a designated site upon the effective date of site designation. Persons or entities who seek to use a site must first obtain a federal permit, or in the case of the USACE, meet the substantive permit requirements, in order to actually use a designated ocean dredged material disposal site. This process would include meeting the requirements of applicable statutes and regulations. The EPA recognizes, however, that site designation is intended to have a practical result. When sites are designated, it is expected that such sites will be used by persons or entities meeting the statutory and regulatory criteria for ocean disposal of dredged material. Therefore, actual disposal is an indirect effect of site designation and is included in the evaluation of effects under the below listed statutes.

Public Comments

EPA received three comments on the proposed rule. All three comments supported the Site designations. One commenter asked whether the Sites could be extended to run parallel to the coastline in order to create a “speedbump” resulting in decreased wave energy and erosion on the beach. The final Sites include shallow areas (less than 50 ft), where more material is expected to remain the littoral system, thereby potentially decreasing potential beach erosion. The creation of a nearshore “speedbump” or berm would dissipate wave energy reaching the beach, but would increase the wave height at the berm, potentially creating an unacceptable safety risk. The same commenter asked whether the sandy dredged material could be used to restore an eroded beach rather than be disposed in the Sites. The sandy dredged material in the vicinity of these Sites is already found in abundance onshore in the nearby Oregon Dunes Recreation Area and onshore dune fields. No eroded beaches in the immediate vicinity of the Sites for which this material is needed have been identified at this time. Other general questions included in this comment letter regarding timing of dredging and disposal, sediment quality, alternatives, etc. are addressed elsewhere in this document.

Endangered Species Act

In the Biological Assessment prepared for the proposed action (EPA 2009) and subsequent supporting documents, EPA concluded that the indirect effects of designation of the Siuslaw ocean disposal sites:

1. May affect, but is not likely to adversely affect OC coho salmon, SONCC coho salmon, and Lower Columbia River coho salmon; no effect to critical habitat for OC and SONCC coho salmon.
2. May affect, but is not likely to adversely affect any Chinook ESU; no effect to critical habitat.
3. May affect, but is not likely to adversely affect Southern DPS green sturgeon or designated critical habitat.
4. Is not likely to jeopardize the continued existence of Southern DPS Pacific eulachon.
5. May affect, but is not likely to adversely affect Steller sea lion, blue whale, fin whale, humpback whale, southern resident killer whale; no effect to critical habitat.
6. May affect, but is not likely to adversely affect marbled murrelet, short-tailed albatross, and brown pelican; no effect to critical habitat.
7. No effect on western snowy plover, northern spotted owl, Oregon silverspot butterfly, Fender's blue butterfly, Kincaid's lupine, Willamette daisy, and Bradshaw's desert parsley; no effect to critical habitat.

The EPA initiated consultation under Section 7 of the Endangered Species Act of 1973, as amended, 16 U.S.C. Sections 1531 to 1544, based on this documentation with both the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) by letter dated July 22, 2009. USFWS concurred with EPA's "may affect, not likely to adversely affect determination for marbled murrelet, short-tailed albatross, and brown pelican via letter dated August 24, 2009.

NMFS issued a Biological Opinion (BO) on April 21, 2010. NMFS concluded that EPA's action is not likely to jeopardize the continued existence of Oregon Coast (OC) coho salmon or southern green sturgeon (Acipenser medirostris), or to destroy or adversely modify critical habitat designated for green sturgeon. NMFS also concluded that EPA's action would not likely adversely affect southern green sturgeon, euchalon, eastern Stellar sea lions, blue whales, fin whales, humpback whales, Southern Resident Killer whales, marine turtle species, or critical habitat designated for southern green sturgeon or proposed for green leatherback turtles. NMFS concluded that dredging activities were not interrelated to EPA's action. However, NMFS did make a finding that disposal of dredged material at the Sites by the Corps, the anticipated primary user of the Sites, was interrelated to EPA's action.

NMFS then focused its effects analysis on the effects of disposal at the Sites. Looking solely to the effects of disposal of dredged material at the Sites by the Corps from the Corps' Siuslaw River Navigation project, NMFS estimated 19 juvenile OC coho salmon per year were likely to be injured or killed by Corps activities. NMFS acknowledged that EPA's action does not authorize or compel site use and will not itself result in disposal of dredged material. NMFS found that all incidental take will occur at the project-specific level. Based on this finding, NMFS did not find a basis to provide a take authorization in the current BO. NMFS stated that all take authorization will occur in subsequent site-specific consultations.

Finally NMFS included two discretionary conservation recommendations in the BO. The first recommendation suggested collaborating with NMFS and the Corps on a methodology to evaluate the effects of dredging and disposal on ESA-listed species. The second recommendation suggested undertaking a study to determine seasonal distribution, abundance,

and habitat use of salmon, sturgeon, and marine turtles in the nearshore within and near the contour of designated ocean dredged material disposal sites. Such recommendations are purely advisory in nature. EPA appreciates that collaboration on a methodology could be helpful and supports NMFS and Corps efforts in such an endeavor. EPA also appreciates that the study recommended by NMFS could contribute to the scientific knowledge base but believes that NMFS, the expert Federal agency on seasonal distribution, abundance and habitat use would be better suited than EPA to carry out such a study.

Magnuson-Stevens Fishery Conservation and Management Act

In the Essential Fish Habitat (EFH) assessment prepared for the proposed action (EPA 2009), it was concluded that the designation of the proposed Siuslaw ocean disposal sites may adversely affect EFH for some flatfish species (arrowtooth and starry flounder; English, sand, butter, petrale, rock, and curlfin sole; and Pacific sanddab), big skate, spiny dogfish, soupfin shark, four coastal pelagic fish species (northern anchovy, pacific sardine, pacific mackerel, and jack mackerel), and Chinook/coho salmon. However, any effects are expected to be minor and temporary and are not expected to reduce the quality and/or quantity in any significant way for any EFH for these species. Additionally, the following measures were considered by EPA as a way to mitigate any adverse impacts to designated EFH. The EPA expects to incorporate these measures into the SMMP for the proposed Siuslaw ocean disposal sites.

1. Dredged material to be disposed at the Siuslaw North and South ocean disposal sites must determined to be suitable for unconfined, aquatic disposal. In the event that any dredged material is not suitable for unconfined, aquatic disposal, the dredged material found unsuitable will not be disposed at the Siuslaw ocean disposal sites, but will be placed at acceptable upland disposal sites.
2. Bathymetry at the Siuslaw North and South ocean disposal sites will be monitored on a regular basis to ensure that mounding is not occurring.

The EPA initiated consultation under the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. Section 1855(b), based on this documentation with NMFS by letter dated July 22, 2009.

NMFS response, dated April 16, 2010, concluded that the proposed action and the effect of disposal at the Sites would have adverse effects on designated EFH in the form of increased turbidity and decreases in prey resources. NMFS provided two “conservation recommendations” seeking to implement the effects methodology and habitat usage studies included in the ESA section of the BO. EPA is responding to these recommendations separately, by letter as required under the Magnuson-Stevens Fishery Conservation and Management Act.

Marine Mammal Protection Act

The EPA determined that the proposed action to designate the proposed Siuslaw ocean disposal sites would not result in take or incidental take of any protected marine mammal under the Marine Mammal Protection Act of 1972, as amended, 16 U.S.C. Sections 1361 to 1389. The Biological Assessment, which evaluated the possible effects on ESA listed marine mammals, including Steller sea lions and whales, was provided the NMFS Office of Protected Resources

for review on July 22, 2009. In their April 16, 2010 BO, NMFS found that all effects of the action are expected to be discountable or insignificant for ESA-listed marine mammals.

Coastal Zone Management Act

EPA submitted a consistency determination pursuant to the Coastal Zone Management Act, 16 U.S.C. Sections 1451 to 1465, to Oregon's Department of Land Conservation and Development (DLCD) by letter dated January 19, 2010. Via letter dated April 14, 2010, DLCD concurred with the EPA that the proposed project is consistent to the maximum extent practicable with the enforceable policies of the Oregon Coastal Management Program.

National Historic Preservation Act

National Historic Preservation Act, as amended, 16 U.S.C. Sections 470 to 470a-2, which requires Federal agencies to take into account the effect of their actions on districts, sites, buildings, structures, or objects, included in, or eligible for inclusion in the National Register. The EPA determined that no historic properties would be affected by the proposed undertaking, the designation of the proposed Siuslaw ocean disposal sites. The EPA provided that determination and supporting evaluation to the State Historic Preservation Officer in the Oregon Parks and Recreation Department by letter dated November 24, 2009. The Tribal Governments, listed in the next section, were copied on the historic property letter as consulting parties. By letter dated December 10, 2009, the State Archaeologist concurred that the project would have no affect on any known cultural resources.

Tribal Consultation

Government-to-government consultation letters, dated November 24, 2009, were sent to the Coquille Indian Tribe, the Cow Creek Band of Umpqua Tribe of Indians, the Confederated Tribes of the Grand Ronde Community, the Confederated Tribes of the Siletz Indians, and the Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians. Tribal comments were also solicited during the NHPA process. Follow-up phone calls were made to staff at each of the listed Tribes during January 2010. No Tribal comments were received.

SELECTION OF OCEAN DISPOSAL SITES FOR FORMAL DESIGNATION

Based on the evaluation of criteria contained in 40 CFR Part 228, the Corps and EPA have determined that the Siuslaw River North and South ocean disposal sites are suitable for designation. The designation of the ODMD Sites by EPA will be finalized through formal rulemaking adopting this Environmental Assessment/MPRSA Criteria Evaluation and the appendices to support this action.

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Appendix A

Living Resources
Siuslaw River, Oregon

April 2010

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Living Resources
Siuslaw River, Oregon

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Appendix A
Living Resources
Siuslaw River, Oregon

Introduction

Information on living resources in the Siuslaw River/Oregon Coast offshore areas was obtained from a variety of published and unpublished reports, theses, and personal communications. In addition, field sampling was conducted in 2008 to obtain benthic invertebrate, fish, and epibenthic data in the area of the proposed ocean dredged material disposal sites (ODMDS).

Plankton and Fish Larvae

Plankton sampling has not been performed in the Siuslaw River offshore area. However, Keister and Peterson (2003) provided a discussion of the zooplankton community found off the central Oregon Coast (along the Newport hydrographic line). For the Siuslaw offshore area, it is likely that zooplankton population dynamics would be similar to those found in the Newport area because of similar oceanographic conditions.

Keister and Peterson (2003) indicate that the zooplankton community is influenced strongly by seasonal variations in wind and current patterns. During late spring and summer, northwesterly winds set up equatorward flow and coastal upwelling. Northwesterly winds dominate from April/May-September; periodic relaxations or southwesterly storms rapidly affect the hydrography of nearshore areas, but offshore of about 30 kilometers, conditions are less variable. Boreal neritic copepods such as *Pseudocalanus mimus*, *Calanus marshallae*, *Centropages abdominalis*, *Acartia longiremis*, and *Acartia hudsonica* dominate the coastal plankton during summer (Peterson and Miller 1977). In early fall, winds reverse and upwelling ceases; during autumn and winter, winds are predominantly southwesterly, the Davidson Current flows poleward, and offshore surface waters are transported onshore. In winter, the coastal zooplankton is populated by warm-water species such as *Mesocalanus tenuicornis*, *Paracalanus parvus*, *Ctenocalanus vanus*, *Clausocalanus spp.*, *Acartia tonsa*, and *Corycaeus anglicus* (Peterson and Miller 1977).

Auth and Brodeur (2006) examined the species composition, distribution, and concentration of ichthyoplankton off the central Oregon Coast (along the Newport hydrographic line) to investigate annual, seasonal, vertical, and cross-shelf variability. Larval concentrations were also analyzed in relation to water temperature and salinity. The 281 samples collected from 5 cruises along a historically sampled transect between April and September in 2000 and 2002 yielded 4,944 fish larvae comprising 72 taxa in 28 families. The dominant taxa collected were northern anchovy (*Engraulis mordax*), slender sole (*Lyopsetta exilis*), rockfishes (*Sebastes* spp.), northern lampfish (*Stenobrachius leucopsarus*), and blue lanternfish (*Tarletonbeania crenularis*). Total larval concentration increased from 49.3 per 1000 m^3 in 2000 to 72.0 per 1000 m^3 in 2002, with seasonal concentrations highest in August 2000 (90.3 per 1000 m^3) and April 2002 (151.2 per 1000 m^3). Relatively few larvae were found at depths greater than 100 meters, while highest larval concentrations generally occurred from depths of 0 to 50 meters. However, slender sole concentrations were highest from depths of 50 to 100 meters. Larval diversity and concentration were higher offshore (46-84 kilometers) than in coastal areas (9-28 kilometers). Highest concentrations were normally found at an intermediate station 65 kilometers off the coast. Species designated as either coastal or offshore species by previous studies were predominantly found in

their respective shelf regions. With the exception of slender sole, larval concentrations were positively correlated with temperature and negatively correlated with salinity.

Auth and others (2007) examined diel vertical distribution, concentration, and community structure of ichthyoplankton from a single station 69 kilometers off Heceta Head on the central Oregon Coast. The depth-stratified samples yielded 1,571 fish larvae from 20 taxa, representing 11 families, and 128 fish eggs from 11 taxa within 9 families. Dominant larval taxa were rockfishes, northern lampfish, and blue lanternfish. The dominant egg taxa were Pacific sardine (*Sardinops sagax*), medusafish (*Icichthys lockingtoni*), Pacific viperfish (*Chauliodus macouni*), and Pacific jack mackerel (*Trachurus symmetricus*). Larval concentrations generally increased from the surface to 50 meters, and then decreased with depth. Larval concentrations were higher at night than during the day, and there was evidence of larval diel vertical migration. Depth stratum was found to be the most important factor explaining variability in larval and egg concentrations. The authors noted that the species composition, assemblages, and dominant taxa were similar to those found in other studies conducted during the summer off the central Oregon Coast (Richardson 1973; Richardson and Pearcy 1977; Brodeur et al., 1985; Auth and Brodeur 2006). This similarity provides evidence to support the hypothesis of Auth and Brodeur (2006) that past ichthyoplankton sampling along the Newport hydrographic line during the summer is representative of ichthyoplankton assemblages elsewhere along the Oregon Coast.

Benthic Invertebrates

Benthic invertebrates play an important role in secondary productivity in nearshore marine systems. They are not only a direct source of food for many demersal fishes, but also play an active part in the shredding and breakdown of organic material and in sediment reworking.

Field sampling in October 1984 and January 1985 gathered information on benthic invertebrates at 14 stations off the mouth of the Siuslaw River (Figure A-1, USACE 1992). Another benthic study was conducted at 11 offshore stations in September 1988 (Figure A-2, USACE 1992). During these studies, the Siuslaw offshore area exhibited diverse benthic invertebrate communities. A total of 135 taxa were collected in October 1984, 106 taxa in January 1985, and 163 taxa in 1988. Densities were very similar in 1984 and 1985, with approximately 2,200 individuals/m^2 collected. An average of 4,445 individuals/m^2 was collected in the 1988 survey. Polychaetes (annelid worms) were the numerically dominate species collected during the 1984-1985 sampling periods. *Scoloplos armiger*, *Chaetozone setosa*, and *Megelona sacculata* were the dominant polychaete species, reaching densities of approximately 2,500/m^2, 1,500/m^2, and 1,400/m^2, respectively. Other dominant species collected included the amphipods *Eohaustorius sencillus*, *Mandibulophoxus gelesi*, and *E. sawyeri*. The area also had a large number of sand dollars, *Dendraster excentricus*. In 1988, the dominant polychaete species was *Owenia fusiformis*, although the density of this polychaete was low to moderate when compared to other coastal areas. Another dominant polychaete collected was *Spiophanes bombyx*.

Field surveys were conducted in 2008 by Marine Taxonomic Services (USACE 2009) to supplement earlier benthic invertebrate data and provide current information on fish and epibenthic species present in the area of ODMDS B and C (proposed North and South ODMDS). The benthic infaunal study used a modified Gray-O'Hara box core to take five biological cores and one geological core at each of the ten sampling stations (Figure A-3). The demersal fish and epibenthic study used a 12-foot semi-balloon otter trawl with a 0.25-inch mesh liner to take 20-minute (bottom time) trawls at each of the six trawl sites (see Figure A-3). Both studies were undertaken in August and September 2008.

Figure A-1. 1984-1985 Siuslaw Benthic Invertebrate Sampling Locations

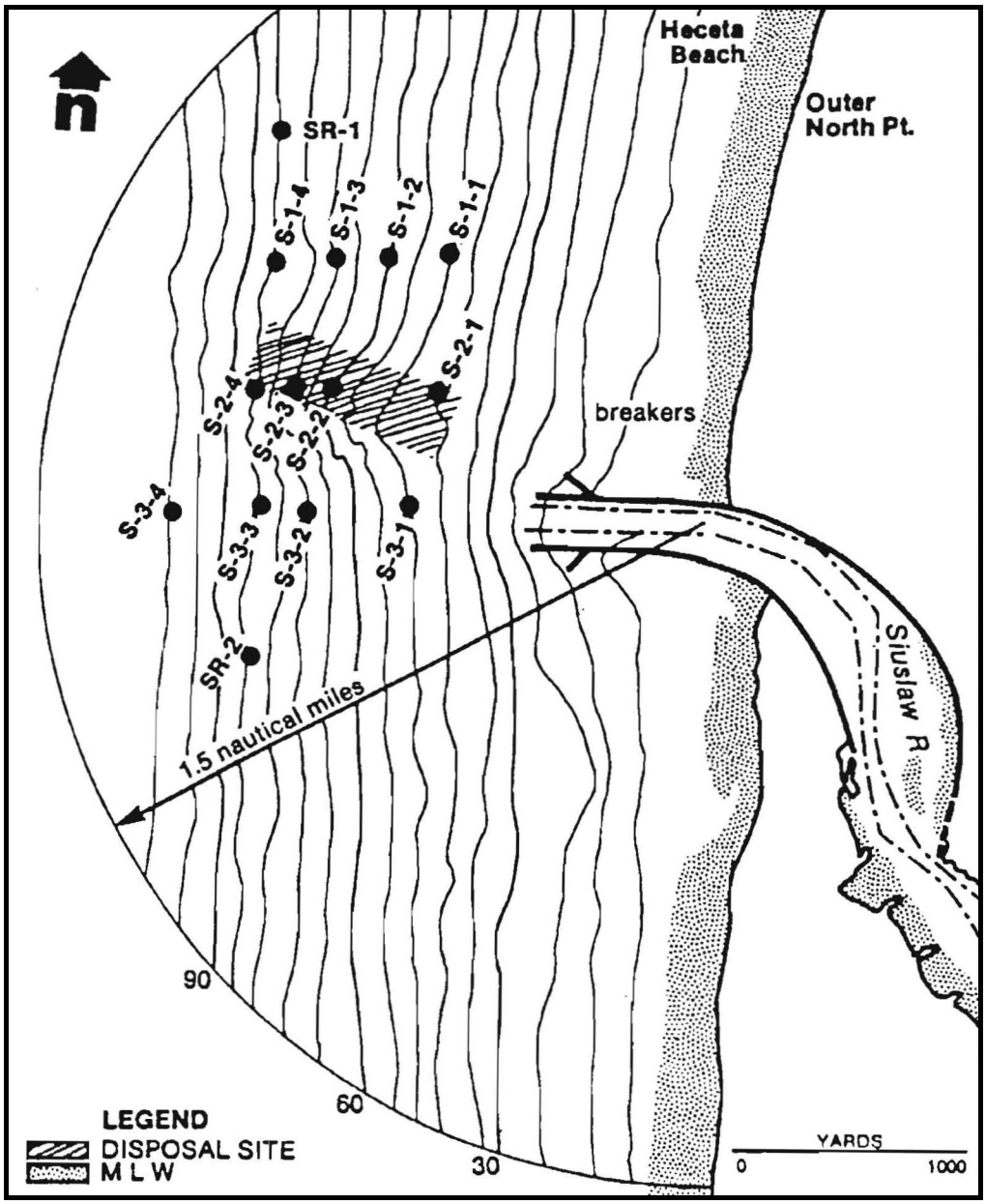


Figure A-2. 1988 Siuslaw Benthic Invertebrate Sampling Locations

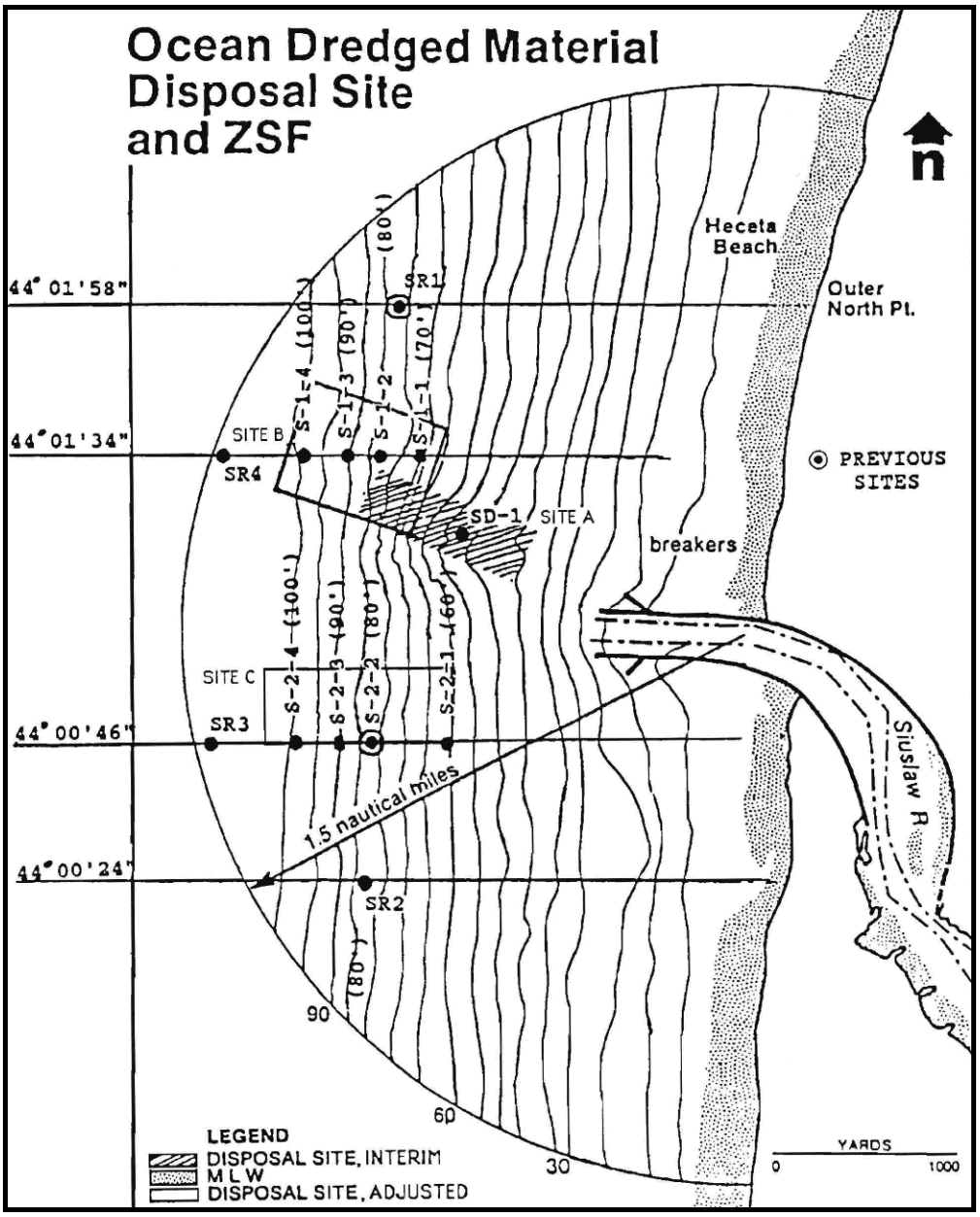
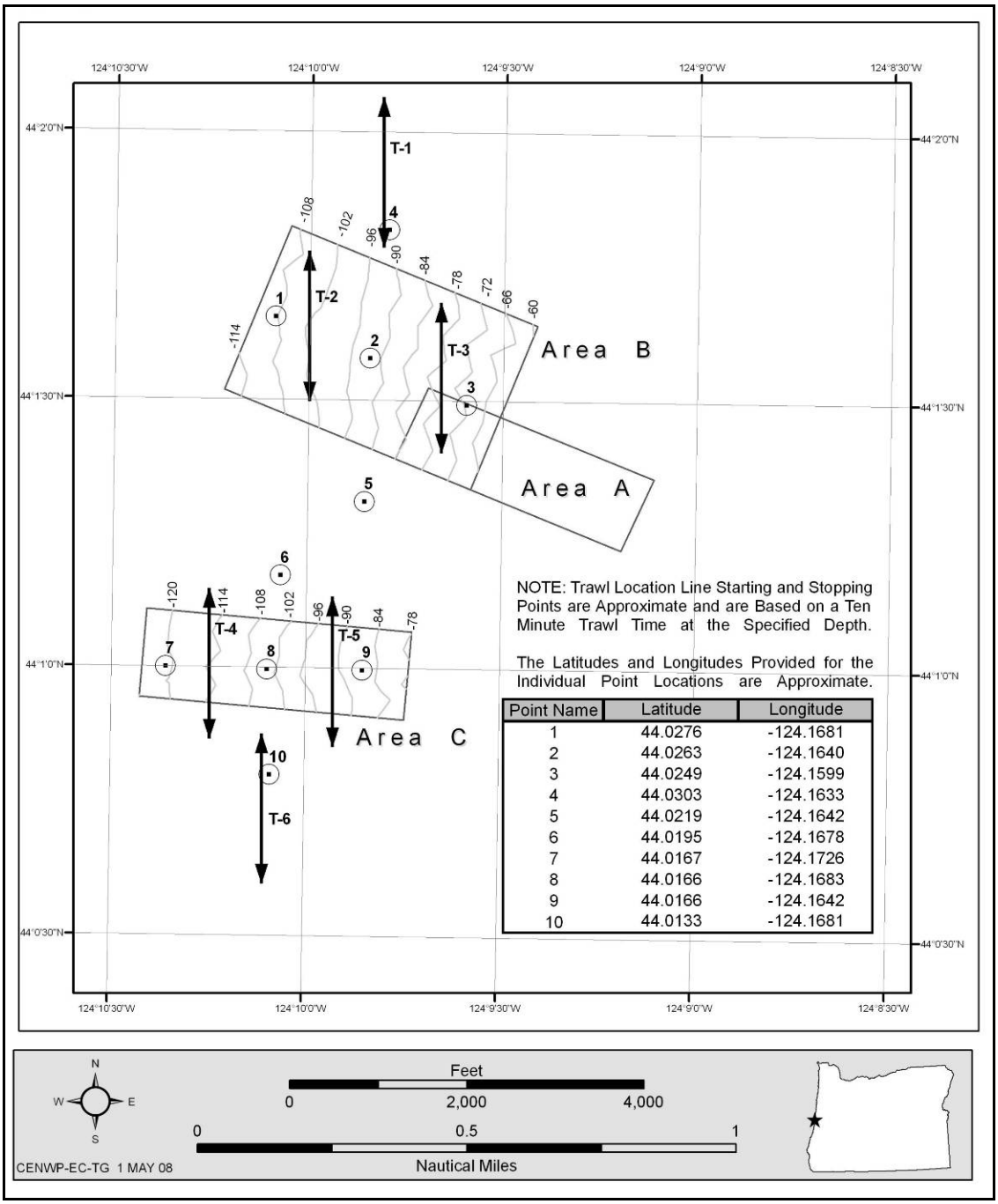


Figure A-3. 2008 Sampling Stations and Trawl Sites, Siuslaw ODMDS



The infaunal data were computer analyzed and the following components of community structure were calculated: (1) H', the Shannon-Weaver diversity index (Shannon-Weaver 1963); (2) SDV, the Simpson Diversity Value (Simpson 1949); (3) SR, species richness, defined by Margalef (1958) as the number of species in a sample; and (4) J', evenness, defined as the distribution of individuals among species (Lloyd and Ghelardi 1964).

The geological data showed that the sediments were medium- to fine-grained marine sands; percent sand ranged from 88% to 99% and total organic carbon ranged from 0.40% to 0.05% of the total volume. Shell debris was present at all sampling stations.

Benthic Invertebrates

The benthic invertebrate fauna collected in 2008 were typical of the nearshore, high-energy environment found along the Oregon Coast. Tables A-1 and A-2 provide the dominant species at collected at each station in August and September 2008, respectively.

Table A-1. Dominant Benthic Invertebrate Fauna by Station, August 2008

Station and Species, August 2008	Number of Animals	Animals per square meter
Station 1		
Nemertinea	213	443.04
Diastylopsis dawsoni	578	1202.24
Siliqua sp juv.	243	505.44
Spiophanes bombyx	216	449.28
Scoloplos armiger	70	145.60
Station 2		
Nemertinea	408	848.64
Diastylopsis dawsoni	162	336.96
Siliqua sp juv.	780	1622.40
Scoloplos armiger	38	79.04
Guernea reduncans	70	145.60
Station 3		
Nemertinea	80	168.48
Siliqua sp juv.	97	201.76
Scoloplos armiger	78	162.24
Magelona sacculata	64	133.12
Mandibulophoxus gilesi	62	128.96
Station 4		
Scoloplos armiger	77	160.16
Spiophanes bombyx	114	237.12
Siliqua sp juv.	1008	2096.64
Diastylopsis dawsoni	172	357.76
Nemertinea	514	1069.12
Station 5		
Magelona sacculata	78	162.24
Scoloplos armiger	78	162.24
Siliqua sp juv.	1856	3860.48
Nemertinea	379	788.32
Dendraster excentricus juv.	59	122.72
Station 6		
Nemertinea	157	326.56
Diastylopsis dawsoni	1364	2837.12
Siliqua sp juv	365	759.20
Spiophanes bombyx	110	228.80
Scoloplos armiger	75	156.00

Station and Species, August 2008	Number of Animals	Animals per square meter
Station 7		
Nemertinea	376	782.08
Diastylopsis dawsoni	106	220.48
Siliqua sp juv	617	1283.36
Spiophanes bombyx	153	318.24
Scoloplos armiger	39	81.12
Station 8		
Nemertinea	347	721.76
Diastylopsis dawsoni	678	1410.24
Siliqua sp juv	433	900.64
Spiophanes bombyx	50	104.00
Dendraster excentricus juv	56	116.48
Station 9		
Nemertinea	255	530.40
Diastylopsis dawsoni	234	486.72
Siliqua sp juv	743	1545.44
Macoma sp juv	40	83.20
Spiophanes bombyx	39	81.12
Station 10		
Nemertinea	284	590.72
Diastylopsis dawsoni	156	324.48
Siliqua sp juv	226	470.08
Spiophanes bombyx	115	239.20
Scoloplos armiger	80	166.40

Table A-2. Dominant Benthic Invertebrate Fauna by Station, September 2008

Station and Species, September 2008	Number of Animals	Animals per square meter
Station 1		
Nemertinea	214	445.12
Guernea reduncans	132	274.56
Heteropodarke heteromorpha	65	135.20
Spiophanes bombyx	89	185.12
Diastylopsis dawsoni	78	162.24
Station 2		
Nemertinea	761	1582.88
Guernea reduncans	304	632.32
Neomysis kadiakensis	129	268.32
Mytilis sp juv.	79	164.32
Dendraster excentricus	43	89.44
Station 3		
Alienacanthomysis macropsis	148	307.84
Nemertinea	82	170.56
Scoloplos armiger	137	284.96
Mandibulophoxus gilesi	70	145.60
Chaetozone nr. setosa	34	70.72

Station and Species, September 2008	Number of Animals	Animals per square meter
Station 4		
Nemertinea	541	1125.28
Siliqua sp juv.	340	707.20
Macoma sp juv.	290	603.20
Diastylopsis dawsoni	78	162.24
Tellina sp juv.	88	183.04
Station 5		
Nemertinea	445	925.60
Cirripedia	191	397.28
Siliqua sp juv.	269	559.52
*Macoma s*p juv.	92	191.36
Tellina sp juv.	72	149.76
Station 6		
Diastylopsis dawsoni	183	380.64
Tellina sp juv.	232	482.56
Siliqua sp juv.	336	698.88
Macoma sp juv.	462	960.96
Glycinde armigera	215	447.20
Station 7		
Nemertinea	264	549.12
Siliqua sp juv.	113	235.04
Macoma sp juv.	136	282.88
Spiophanes bombyx	83	172.64
Scoloplos armiger	62	128.96
Station 8		
Nemertinea	314	653.12
Mytilis sp juv.	273	567.84
Guernea reduncans	106	220.48
Siliqua sp juv..	66	137.28
Scoloplos armiger	49	101.92
Station 9		
Nemertinea	355	738.40
Scoloplos armiger	66	137.28
Mandibulophoxus gilesi	63	131.04
Siliqua sp juv.	36	74.88
Spiophanes bombyx	30	62.40
Station 10		
Nemertinea	256	532.48
Siliqua sp juv.	355	738.40
Macoma sp juv.	205	426.40
Mytilis sp juv.	145	301.60
Tellina sp juv.	142	295.36

Figure A-4 shows the densities of the animals per square meter at each station, and Figures A-5 to A-7 show the diversity and species richness of benthic invertebrates at each station.

Figure A-4. 2008 Densities of Benthic Invertebrates, Siuslaw ODMDS

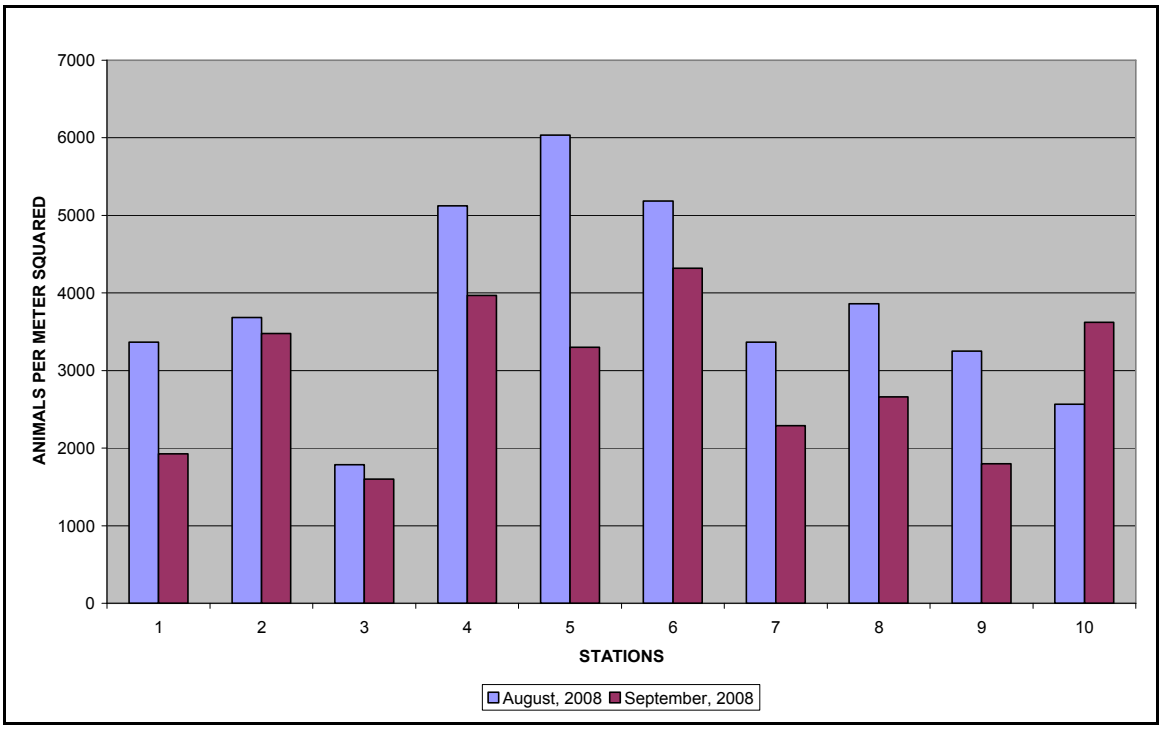


Figure A-5. 2008 Diversity of Benthic Invertebrates (H'), Siuslaw ODMDS

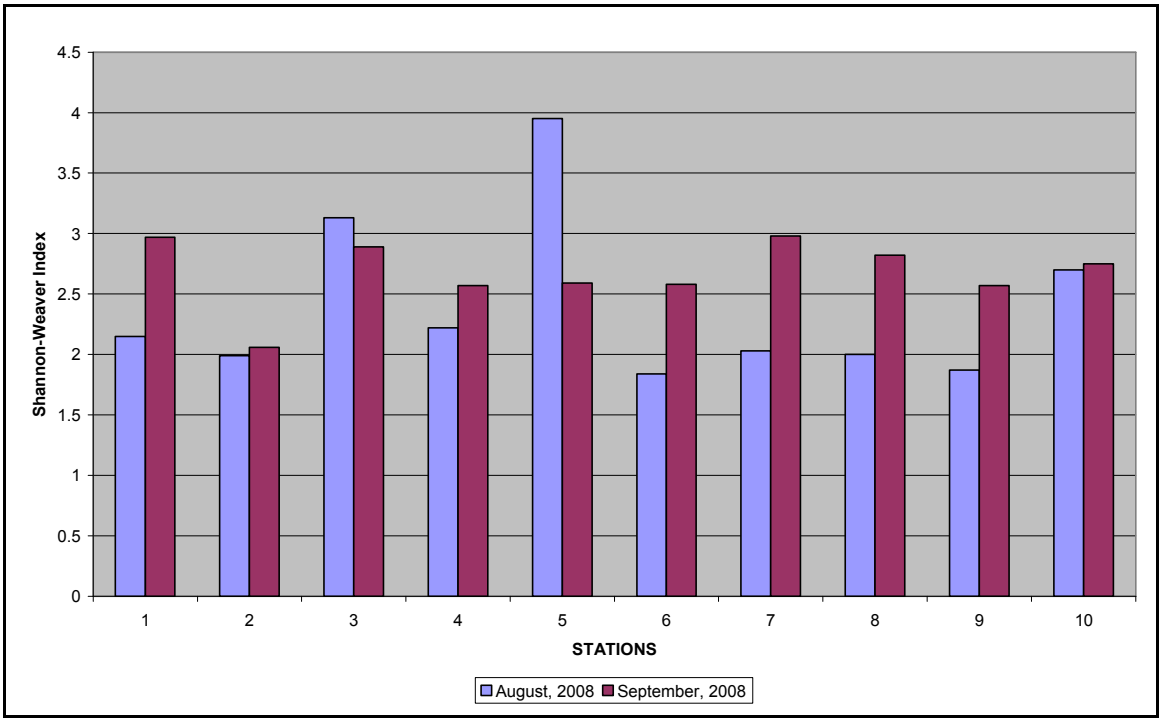


Figure A-6. 2008 Diversity of Benthic Invertebrates (SDV), Siuslaw ODMDS

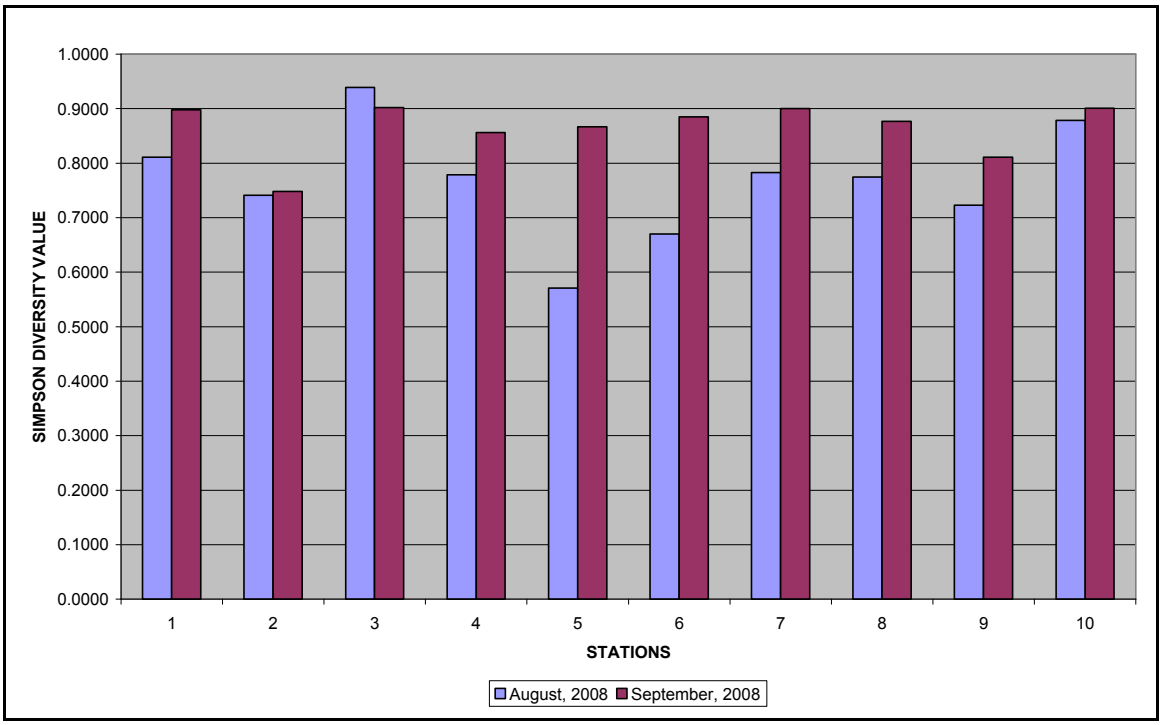
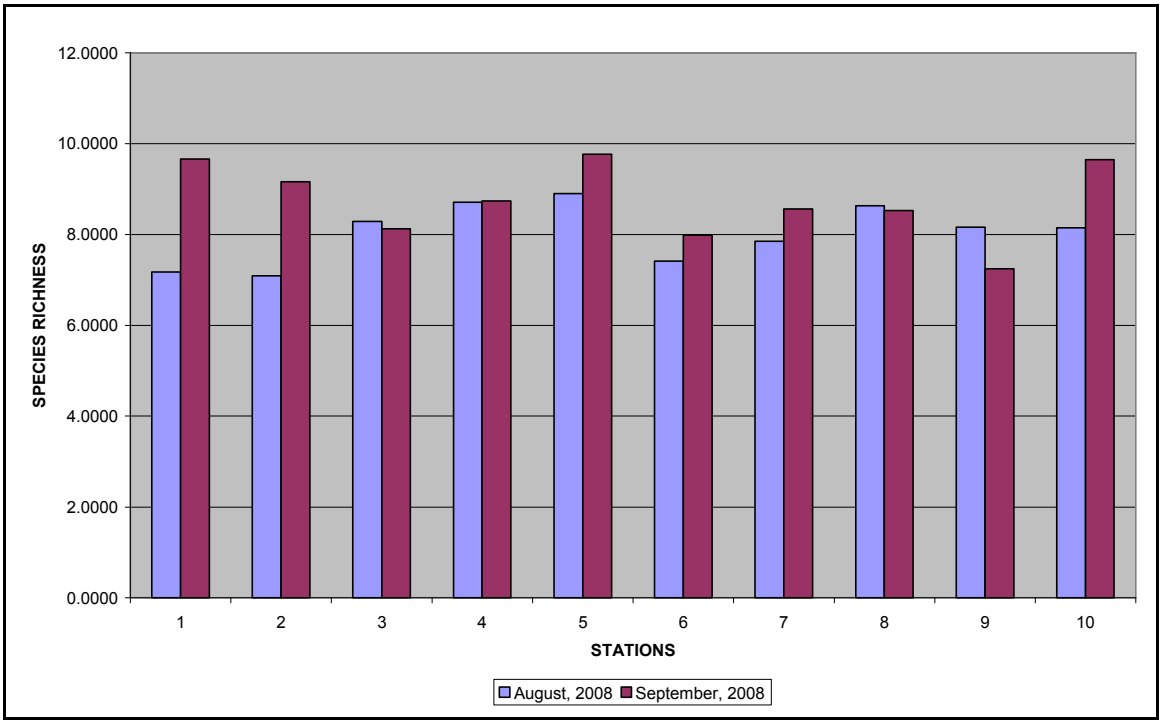


Figure A-7. 2008 Species Richness of Benthic Invertebrates, Siuslaw ODMDS



The density distribution data indicates large juvenile recruitment of most species from spring spawning. This recruitment includes both opportunistic short-lived species (*Spiophanes bombyx*) and longer-lived species (razor clams, *Siliqua* sp. juv. and *Dendraster excentricus*). The large recruitment of these longer-lived species and the recruitment of some shorter-lived species, mostly polychaeta and crustacea, indicate good ocean conditions in the spring and summer months in this area.

The crustaceans showed some population spikes throughout the data; however, the same species were not always the driving factors. Gammarid amphipods were often present but also present were *Diastylopsis dawsoni* (Cumacea) and barnacles (Cirripedia), which showed up on hard features such as snail shells and the occasional rock. The echinoderms were driven by *Dendraster* sp. juv/*Dendraster excentricus* and the other miscellaneous groups were largely populated by Nemertinea and juvenile holothuroids.

The benthos in the area is typical of the communities found near other ocean disposal sites along the Oregon Coast, such as Coos Bay sites E and F, Umpqua River, Rogue River, and Chetco River (Hancock et. al., 1981; USACE 1985, 1988a, 1988b, 1990). This benthic community, largely dominated by very mobile organisms, provides an important link in the marine food web. These organisms serve as a direct food source for other benthic organisms and demersal fishes. They also play an active role in the breakdown of organic debris and the tube building species help to stabilize the bottom sediments.

Many of the benthic species in this study are able to survive in this dynamic environment being either very mobile or being able to react both to natural or man-made perturbations. They readily recolonize in disturbed areas such as dredging scars or disposal site events.

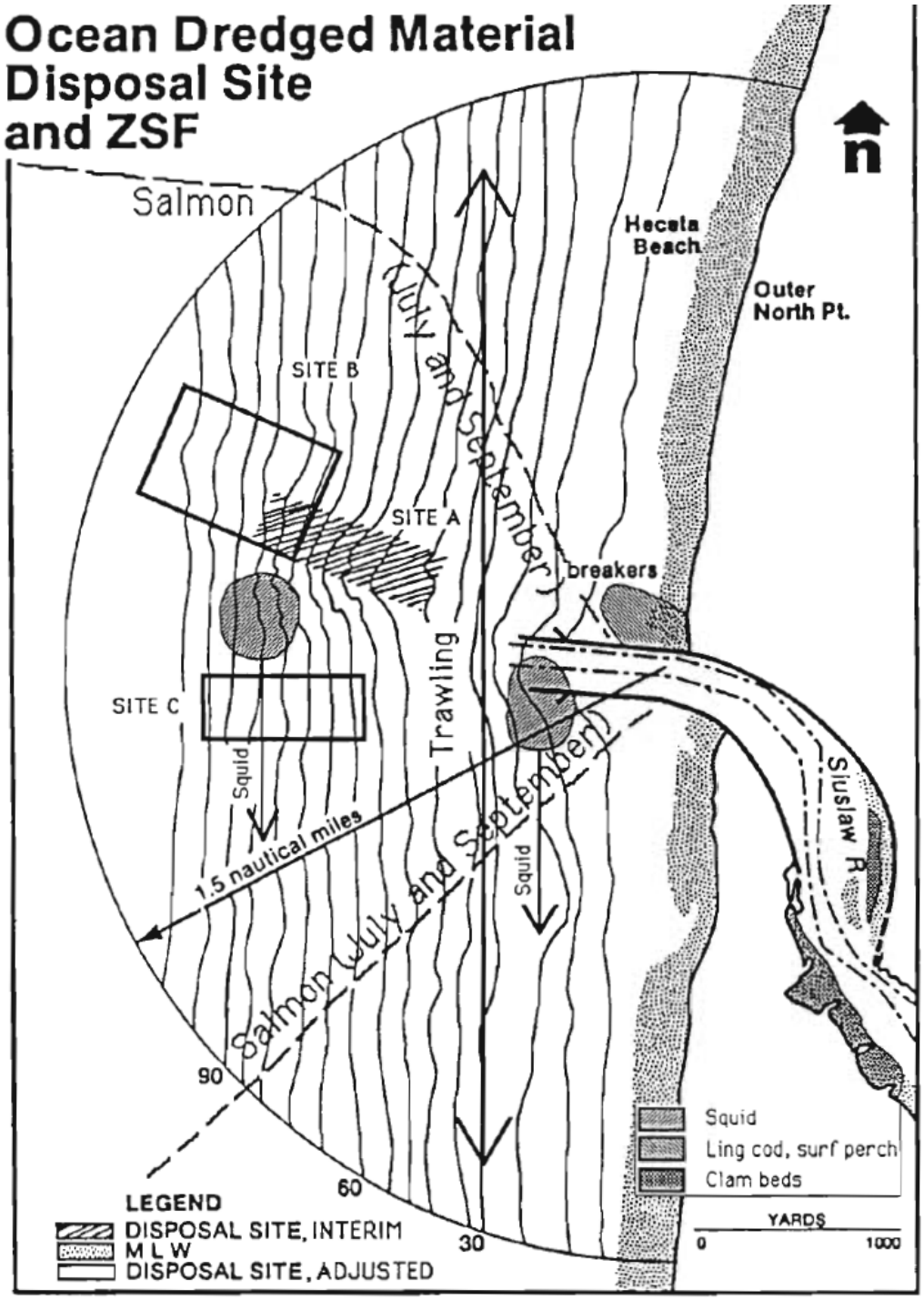
Fish and Epibenthic Species

The commercially and recreationally important epibenthic species in inshore coastal areas of Oregon include shellfish and Dungeness crab (*Cancer magister*). Figure A-8 shows the major commercial and recreational fishing areas. Clam beds are located on the north side of the Siuslaw estuary at river mile 1. Gaper clams (*Tresus capex*) are the dominant bivalves harvested in this area. Dungeness crab adults occur on sandflat habitat along the entire Oregon Coast. They spawn in offshore areas and occur in the estuary when conditions are favorable in late summer and fall.

The nearshore area has been known to be a squid spawning area with the location and size varying annually (USACE 1992). Although there have been incidental catches of squid within 1.5 nautical miles of the mouth of the Siuslaw, there has been no directed squid harvest within this area. There have been reports of egg capsules and adults caught in trawls, as well as the presence of egg capsules on crab gear. Outside of the 1.5 nautical mile radius from the mouth, there have been directed squid harvests south of Heceta Head to Cape Perpetua. Squid spawn between at water depths of 5 to 40 meters, with maximum spawning occurring at 15 meters. After hatching, they school in the middle of the water column, moving toward the surface as they mature. Mature squid feed mostly at water depths of 20 to 50 meters (USACE 1992).

The nearshore area off the Siuslaw River supports anadromous salmonids including coho salmon (*Oncorhynchus kisutch*), winter steelhead (*Oncorhynchus mykiss*), and spring and fall Chinook salmon (*Oncorhynchus tshawytscha*), as well as a variety of other pelagic and demersal fish species. Other pelagic species include the Pacific herring (*Clupea harengus pallasi*), northern anchovy (*Engraulis mordax*), and surf smelt (*Hypomesus pretiosus*).

Figure A-8. Major Commercial and Recreational Fishing Areas



Demersal species present in the inshore area are mostly residents and include a number of sculpins, sea perch, and rockfish species associated rocky habitats, as well as flatfish species occurring predominantly over open sandflats. Flatfish include English sole (*Parophrys vetulus*), sanddab (*Citharichthys* sp.), and starry flounder (*Platichthys stellatus*). English sole and starry flounder, along with the sand sole (*Psettichthys melanostictus*), spawn in the inshore area in the summer and juveniles of these, as well as other marine species, may rear in the Siuslaw estuary.

Field surveys were conducted in August and September 2008 by Marine Taxonomic Services (USACE 2009) to provide current information about the fish and epibenthic species present in the area of ODMDS B and C (proposed North and South ODMDS). Tables A-3 and A-4 show the trawl results with numbers of individuals, average size, and size range for the fish and crabs captured in each trawl.

Table A-3. August 2008 Trawl Data, Siuslaw ODMDS

	August 2008 Trawl#	**1**	**2**	**3**	**4**	**5**	**6**
Cancer magister	Dungeness Crab - Female						
	number of individuals	14	3	3	6	60	7
	size range (mm)	40-140	120-150	110-140	125-140	30-162	55-175
	average size (mm)	114.1	140	126.6	131.6	50	133.6
Cancer magister	Dungeness Crab - Male						
	number of individuals	5		2	2	188	5
	size range (mm)	120-155		75-165	135-145	32-150	130-140
	average size (mm)	138		120	140	47.7	136
Bothidae juv.	Juvenile Flat Fishes						
	number of individuals		1		2	1	
	size range (mm)		41		20-42	38	
	average size (mm)		41		31	38	
Citharichthys sp.	Sanddab						
	number of individuals		4		1	2	1
	size range (mm)		70-170		110	110	55
	average size (mm)		113		110	110	55
Engraulis mordax	Northern Anchovy						
	number of individuals				1		
	size range (mm)				90		
	average size (mm)				90		
Enophrys bison	Buffalo Sculpin						
	number of individuals				1	4	1
	size range (mm)				118	90-135	100
	average size (mm)				118	115	100
Gadidae	Pacific Tom Cod						
	number of individuals	47	94	13	116	129	39
	size range (mm)	50-175	52-185	60-190	56-188	48-185	55-170
	average size (mm)	78.6	79	102.7	87.1	85.9	96.7
Isopsetta isolepis	Butter Sole						
	number of individuals	150	144	80	131	2	54
	size range (mm)	40-200	45-172	40-210	50-220	140-143	45-235
	average size (mm)	117	118	120	125.2	141.5	149
Leptocottus armatus	Staghorn Sculpin						
	number of individuals	30	17		14	9	12
	size range (mm)	128-190	139-189		145-205	115-192	110-170
	average size (mm)	162.6	162.4		163.7	143	140.6
Liparis pulchellus, Liporidae	Showy Snailfish						
	number of individuals	27	24	15	4	1	3
	size range (mm)	16-120	18-150	20-112	14-34	53	120-150
	average size (mm)	34.5	37.2	40.6	22	53	133.3
Liparididae juv.	Snail Fish						
	number of individuals					2	1
	size range (mm)					16-18	20
	average size (mm)					17	20
Ophiodon	Ling Cod						

	August 2008 Trawl#	1	2	3	4	5	6
elongatus	number of individuals		2		1	1	2
	size range (mm)		112-150		120	135	100-100
	average size (mm)		136		120	135	100
Osmeridae	Smelt						
	number of individuals	31	7	27	26	2	
	size range (mm)	32-112	35-102	28-110	30-90	95-97	
	average size (mm)	65.3	71.7	59.4	50.5	96	
Parophrys vetulus	English Sole						
	number of individuals	45	38	11	147	15	43
	size range (mm)	82-330	35-265	67-285	45-275	87-120	38-240
	average size (mm)	152	157.5	146.1	140.5	105.4	129
Pholis ornata	Saddle Back gunnel						
	number of individuals			20			4
	size range (mm)			130-190			85-145
	average size (mm)			166			120
Pleurenectidae juv.	Flat Fishes						
	number of individuals	71	26	30	16	5	1
	size range (mm)	28-53	30-45	27-88	30-45	35-46	50
	average size (mm)	37.7	37.1	39	36.4	39.8	50
Psettichthys melanostictus	Sand Sole						
	number of individuals	1	3	1	3	4	10
	size range (mm)	48	143-195	175	165-250	152-192	115-200
	average size (mm)	48	171	175	195	171.5	147.8
Raja binoculata	Big Skate						
	number of individuals						1
	size range (mm)						365
	average size (mm)						365
Scorpaenidae	Juvenile Rock Fish						
	number of individuals		2	2	1		
	size range (mm)		45-52	50-53	60		
	average size (mm)		48.5	51.5	60		
Stellerina xyosterna	Prickle Breasted Poacher						
	number of individuals	140	149	87	139	30	8
	size range (mm)	15-63	116-131	17-65	18-72	18-60	25-56
	average size (mm)	38.1	40.6	37.6	40.3	36.2	40.75
Pallasina barbata	Tube Nose Poacher						
	number of individuals		6	4		3	
	size range (mm)		73-149	47-77		68-170	
	average size (mm)		96.2	62.75		105.3	
Pisaster brevispinus	Pink Short Spined Starfish						
	number of individuals				1		
	(not measured)						
Crangon spp, *Cancer* larval forms, isopods, amphipods, mysids, drift algae (present but not counted)		X	X	X	X	X	X

Table A-4. September 2008 Trawl Data, Siuslaw ODMDS

	September 2008 Trawl#	1	2	3	4	5	6
Cancer magister	Dungeness Crab - Female						
	number of individuals	2	1			1	
	size range (mm)	50-55	45			135	
	average size (mm)	52.5	45			135	
Cancer magister	Dungeness Crab - Male						
	number of individuals	6	8		2	18	4
	size range (mm)	108-165	45-170		110-140	110-180	8-138
	average size (mm)	138.6	110		125	136.9	70.5
Citharichthys sp.	Sanddab						
	number of individuals	1	13	2	8	4	16
	size range (mm)	105	90-125	120-150	90-150	50-188	90-174
	average size (mm)	105	109.2	135	109.4	114.5	114.6
Gadidae	Pacific Tom Cod						
	number of individuals	49	5	1	1	13	
	size range (mm)	50-130	80-130	102	120	88-178	
	average size (mm)	99.8	95	102	120	130.2	
Hexagrammos decagrammus	Kelp Greenling						
	number of individuals					1	
	size range (mm)					108	
	average size (mm)					108	
Isopsetta isolepis	Butter Sole						
	number of individuals	37	7	9	15	48	22
	size range (mm)	38-210	55-190	125-200	55-170	110-220	84-170
	average size (mm)	120.6	129.3	158.3	117.9	141.8	133.1
Leptocottus armatus	Staghorn Sculpin						
	number of individuals	16	2	1	9	23	1
	size range (mm)	105-200	140-160	130	120-160	95-140	115
	average size (mm)	135.75	150	130	138.8	115.1	115
Liparis pulchellus	Showy Snailfish						
	number of individuals		1	6	1	4	2
	size range (mm)		59	55-145	135	65-180	80-130
	average size (mm)		59	77.5	135	100	105
Osmeridae	Smelt						
	number of individuals	57					
	size range (mm)	30-110					
	average size (mm)	49.5					
Parophrys vetulus	English Sole						
	number of individuals	23	11	9	13	10	33
	size range (mm)	45-170	49-180	45-140	42-125	40-125	44-150
	average size (mm)	88.6	96.8	65.1	69.3	56.9	73.5
Pleurenectidae juv.							
	number of individuals		2	4	9		1
	size range (mm)		50-50	45-50	40-50		45
	average size (mm)		50	47.5	47.4		45
Psettichthys melanostictus	Sand Sole						
	number of individuals	1	3	2	3	5	3
	size range (mm)	215	110-180	180-250	145-150	140-190	130-180
	average size (mm)	215	150	215	148.3	167	154

	September 2008 Trawl#	1	2	3	4	5	6
Raja binoculata	Big Skate						
	number of individuals	1		1			
	size range (mm)	235		280			
	average size (mm)	235		280			
Stellerina xyosterna	Prickle Breasted Poacher						
	number of individuals	38	5	38	8	30	
	size range (mm)	40-100	50-70	20-85	55-140	45-120	
	average size (mm)	55.1	60.6	49.2	74.1	63.3	
Pallasina barbata	Tube Nose Poacher						
	number of individuals	4	3		1	7	4
	size range (mm)	55-100	95-100		100	75-100	90-110
	average size (mm)	78.75	96.6		100	89	98.3
Pisaster brevispinus	Pink Short Spined Starfish						
	number of individuals		1	1	4		
	(not measured)						
Crangon spp, *Cancer* larval forms, isopods, amphipods, mysids, drift algae (present but not counted)		X	X	X	X	X	X

The trawl data shows that non-commercial species are present in the ODMDS area. These included quantities of krill (Mysidacea) and various species of sand shrimp, mostly of the genus Crangon along with several species of fish. These data also showed several commercially and recreationally important species in the study area. Most of the specimens are juvenile or sub-legal individuals. Commercially and recreationally important species included the following:

- *Cancer magister* (Dungeness crab)
- *Citharichthys* sp. (sand dab)
- *Isopsetta isolepis* (butter sole)
- *Psettichthys melanostictus* (sand sole)
- *Ophiodon elongates* (ling cod)
- *Parophrys vetulus* (English sole)

The trawl samples denote this nearshore area as a nursery ground with an abundant food source. Most of the species encountered in the trawl samples were benthic feeders that tend to utilize the shallower areas both because of the abundant food and because of fewer predators. The majority of the fish and crabs captured in the trawls were juveniles and young of the year. However, larger crabs and fish have the ability to avoid the trawl net.

Threatened and Endangered Fish Species

On February 4, 2008, the NMFS listed the Oregon Coast (OC) coho salmon Evolutionarily Significant Unit (ESU) as a threatened species under the Endangered Species Act (73 *Federal Register* 7816). The listing includes all naturally spawned populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco, including the Cow Creek [Oregon Department of Fish and Wildlife (ODFW) stock #37] coho hatchery program. Critical habitat also was designated. The Siuslaw River and estuary were designated as critical habitat but the ocean area off the Siuslaw River was not. Coho are present in the Siuslaw offshore area as both adults and juveniles. Adults hold in the offshore area prior to entering the estuary to migrate up river

to spawn. Juveniles rear in the nearshore ocean area after migrating downstream and transitioning to saltwater. Upstream migration of adult coho salmon ranges from August through November. Juvenile outmigration extends from April through June and peaks in May.

The Southern Oregon/Northern California Coast (SONCC) coho ESU was listed as threatened on May 6, 1997 and includes all naturally spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon, and Punta Gorda, California (62 *Federal Register* 24588). The proposed Siuslaw ocean disposal sites are not located within designated critical habitat for SONCC coho. This coho species typically migrates north along the coast. While migrating individuals may utilize the coastal habitat off the Siuslaw River for migratory purposes, they are likely to be further offshore than the proposed ocean disposal sites. In 2005, the status of SONCC coho was reaffirmed as federally threatened and three artificial propagation programs were added to the ESU: (1) Cole Rivers Hatchery (ODFW stock #52), Rogue River, Oregon; (2) Trinity River Hatchery, Trinity River, California; and (3) Iron Gate Hatchery, Klamath River, California (70 *Federal Register* 37160). The NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the ESU (70 *Federal Register* 37160).

In 2005, the Lower Columbia River Coho Salmon ESU was listed as threatened and includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers, and includes the Willamette River to Willamette Falls, Oregon, as well as twenty-five artificial propagation programs (70 *Federal Register* 37160). While migrating individuals may utilize the coastal habitat off the Siuslaw River for migratory purposes, they are likely to be further offshore than the proposed ocean disposal sites.

Several ESUs of Chinook salmon listed in 2005 (70 *Federal Register* 37160) could potentially be in the ocean area off the Siuslaw River. These include the Lower Columbia River Chinook (threatened), Upper Willamette River spring-run Chinook (threatened), Upper Columbia River spring-run Chinook (endangered), Snake River spring/summer run Chinook (threatened), and Snake River fall-run Chinook (threatened). All of these ESUs have designated critical habitat, but only the Upper Willamette River Chinook has designated critical habitat within the Siuslaw area (from the line of extreme high tide to a depth of 100 feet and inclusive of Lane County). None of these ESUs spawn in the Siuslaw River, but they are ocean-type Chinook and adults may be transiting in the ocean area off the Siuslaw River during disposal activities.

The southern Distinct Population Segment (DPS) of green sturgeon (*Acipenser medirostris*) was listed as threatened on April 7, 2006 (71 *Federal Register* 17757). Critical habitat has been designated for the species (74 FR 52300, 9 October 2009). Green sturgeon that spawn to the north, primarily in the Klamath and Rogue rivers, constitute the Northern DPS, which is not federally listed. These two DPSs for sturgeon were established because they were genetically distinct. Southern DPS green sturgeon may be observed in the vicinity of the proposed ocean disposal sites offshore of the Siuslaw River as they migrate to northern estuaries during summer and early fall. From 2000 to 2004, ODFW conducted a study of coastal streams to examine characteristics of green sturgeon populations. In 2003, the Siuslaw River was sampled during 3 weeks in May and June with gill nets, seines, and underwater cameras; no green sturgeon were captured (Farr and Rien 2003). According to NMFS (73 *Federal Register* 52084), southern DPS green sturgeon presence is likely but not confirmed in the Siuslaw River estuary.

The Southern DPS of Pacific Eulachon was proposed threatened in March 2009 (74 *Federal Register* 10857). Eulachon (commonly called smelt, candlefish, or hooligan) are a small, anadromous fish

from the eastern Pacific Ocean. Eulachon typically spend 3-5 years in saltwater before returning to freshwater to spawn from late winter through mid spring. Eulachon occur in nearshore ocean waters and to 1,000 feet in depth, except for the brief spawning runs into their natal (birth) streams. In the continental United States, most eulachon originate in the Columbia River Basin. Other areas where eulachon have been documented include the Sacramento River, Russian River, Humboldt Bay and several nearby smaller coastal rivers, and the Klamath River in California; the Rogue and Umpqua rivers in Oregon; and infrequently in coastal rivers and tributaries to Puget Sound, Washington. The NMFS Status Review for Eulachon concluded that eulachon were thought to occur in "rare" relative abundance in the Siuslaw River (NMFS 2008).

According to the NMFS analysis supporting the proposed listing of Pacific eulachon, the most significant threat to eulachon and their habitats are changes in ocean conditions due to climate change (74 *Federal Register* 10870). Dredging is identified as a low to moderate threat to eulachon primarily due to spawning related impacts. Impacts associated with disposal of dredged material were not identified as a threat to eulachon. Due to the relative rare abundance of eulachon in the Siuslaw River, the potential for eulachon to be in the Siuslaw offshore area during disposal activities is low.

Commercial and Recreational Fisheries

The major commercial fishing areas in the vicinity of Siuslaw ocean disposal sites are shown in Figure A-8. Based on data from NMFS (2006) for commercial fishing, a total of 38 vessels, all commercially registered, delivered landings to Florence in 2000. Landings were in the following West Coast fisheries (data shown represents landings in metric tons/value of landings/number of vessels landing): crab (112.8/$562,057/10), groundfish (124.3/$442,781/15), highly migratory species (6.9/$11,712/5), salmon (29.7/$113,885/22), shrimp (35.7/$28,529/5), and other species (1.5/$6808/5). There were no fish processors operating in Florence in 2000. A total of 41 commercial vessels were owned by Florence residents in 2000, 19 of which participated in the federally managed groundfish fishery.

The major recreational fishing areas in the vicinity of Siuslaw ocean disposal sites are shown in Figure A-8. Based on data from NMFS (2006), there is at least one sport fishing charter business in Florence. There were seven sport fishing licensing agents in Florence in 2000. In the same year, agents sold 4,907 sport fishing licenses at an estimated value of $80,163. For the port complex around Florence, the 2000 recreational salmonid catch in the ocean boat fishery was 250 Chinook salmon and 472 coho salmon. The recreational non-salmonid catch was a total of 213 fish. The top species landed, in order, included greenstripe, canary, and yelloweye rockfish, and Pacific halibut.

Wildlife

Three species of seals and sea lions inhabit the lower Siuslaw River and coastal area. Steller sea lions (*Eumetopias jubatus*), a federally threatened species, and harbor seals (*Pusa vitulina*) are year-long residents, while California sea lions (*Zalophus californianus*) are present most of the year. Steller sea lions forage at river mouths and nearshore areas along the Oregon Coast. The closest Steller sea lion haul out site is located about 8.5 miles north of the Siuslaw River entrance (Sea Lion Caves). Harbor seals breed in the estuary and on nearshore rocks. The Siuslaw River nearshore area and shoreline provides habitat for shorebirds, waterfowl, herons, bald eagles (*Haliaeetus leucocephalus*), hawks, and many other species of birds. Pelagic birds (e.g., murres, auklets, cormorants) likely use the Siuslaw River and adjacent waters for foraging.

Federally listed avian species that may be present in the Siuslaw offshore area include the marbled murrelet (*Brachyramphus marmoratus*), brown pelican, (*Pelecanus occidentalis*), and short-tailed albatross (*Phoebastria albatrus*). Threatened marbled murrelets are observed in small flocks or as individuals in the ocean throughout the year. Endangered brown pelicans are abundant from June to September along the coast and in the lower reach of the Siuslaw River estuary. The endangered short-tailed albatross may forage in open ocean areas off the coast.

The Pacific Coast population of the western snowy plover (*Charadrius alexandrinus nivosus*) is a federally threatened species that breeds in coastal areas in California, Oregon and Washington. In 2005, the USFWS designated critical habitat for the snowy plover (see 70 *Federal Register* 56970) and a recovery plan was completed in 2007 (USFWS 2007). Two shoreline areas in Oregon's Lane County support breeding and wintering snowy plovers (USFWS 2007): Heceta Head to Siuslaw River (OR-8) and Siuslaw River to Siltcoos River (OR-9). These shoreline areas fall outside the limits of the Siuslaw project and will not be affected by ocean disposal activities. In the areas used for snowy plover nesting, seasonal restrictions on beach use have been implemented in an effort to reduce disturbance to breeding plovers (USFWS 2007).

There are many whale and sea turtle species in Oregon's offshore coastal area that are federally listed under the Endangered Species Act. The blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), humpback whale (*Megaptera novaeangliae*), and southern resident killer whale (*Orcinus orca*) are all federally endangered species and occur as migrants off the Oregon Coast in waters typically farther from shore than within the proposed Siuslaw North and South ODMDS.

Blue whales occur off the Oregon Coast in May and June, as well as August through October. Blue whales typically occur offshore as individuals or in small groups and winter well south of Oregon. Fin whales also winter far south of Oregon and range off the coast during summer. Sei whales also winter south of Oregon and probably occur in southward migration off the Oregon Coast in late summer and early fall. Sperm whales occur as migrants and some may summer off the Oregon Coast; they forage in waters much deeper than those in the nearshore area. Humpback whales primarily occur off the Oregon Coast from April to October with peak numbers from June through August. Humpback whales are particularly concentrated in Oregon along the southern edge of Heceta Bank and are found primarily on the continental shelf and slope. The range of the southern resident killer whale during the spring, summer, and fall includes the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait. Their occurrence in the coastal waters off Oregon has been documented. Little is known about their winter movements and range.

The loggerhead sea turtle (*Caretta caretta*, threatened), green sea turtle (*Chelonia mydas*, threatened), leatherback sea turtle (*Dermochelys coriacea*, endangered), and olive ridley sea turtle (*Lepidochelys olivacea*, threatened) are all federally listed species and have been recorded from strandings along the Oregon and Washington coasts. The occurrence of sea turtles off the Oregon Coast is associated with the appearance of albacore. Albacore occurrence is strongly associated with the warm waters of the Japanese current. Because these warm waters generally occur 30 to 60+ miles offshore from the Oregon Coast, these sea turtle species do not typically occur in the nearshore area.

Marine Reserves

The State of Oregon has initiated efforts to establish a network of marine reserves as part of an overall strategy to manage its marine waters and submerged lands. The overall purpose would be to protect, sustain, or restore the nearshore marine ecosystem, its habitats, and species. A marine reserve is an area within Oregon's state territorial sea or adjacent intertidal area that is protected from all extractive activities including the removal or disturbance of living and non-living marine resources. Marine reserves are intended to provide lasting protection. In a November 2007 news release to the Oregon Fishing Industry, Governor Ted Kulongoski stated that he was asking the Federal Energy Regulation Commission to limit the number of reserve sites to less than 10 sites. The governor further stated that these reserve sites be large enough to provide for scientifically testing the ecological benefits they produce, but small enough to avoid economic or social impacts such as loss of significant fishing opportunities. Dredging and disposal are identified as disturbances and would be banned from areas designated as marine reserves. At this time, no marine reserves have been designated as the state is still developing the marine reserve selection process. Ocean disposal sites will need to avoid any marine reserve areas.

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Appendix B

Physical Processes and Geologic Features
Siuslaw River, Oregon

April 2010

Appendix B
Physical Processes and Geologic Features
Siuslaw River, Oregon

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SECTION 1. GEOLOGICAL RESOURCES

Regional Setting

The estuary of the Siuslaw River opens into the Pacific Ocean about 160 miles south of the mouth of the Columbia River. It lies within the Heceta Head littoral cell, which extends for about 56 miles from Heceta Head south to Cape Arago. Figure B-1 shows the location of the littoral cell. The estuary is fed by two rivers, the Siuslaw and the North Fork of the Siuslaw. The watershed encompasses part of the Coast Range and drains an area of approximately 790 square miles. The coastal zone of the littoral cell consists of a wide plain, 1 to 2 miles wide, covered by active and stabilized sand dunes backed by the mature upland topography of the Coast Range. The lower portion of the Siuslaw River is bordered by broad alluvial flats. Between the Siuslaw and Yaquina estuaries, the continental shelf is at its widest along the Oregon Coast, extending over 44 miles offshore forming the Heceta Bank. Just south of the Siuslaw River, the shelf begins to narrow and is only about 19 miles wide at the mouth of the Umpqua River. At the mouth of the Siuslaw River, the first 2 miles or so of the shelf is covered with sand. From there a thin layer of mud (about 1-inch thick) mantles the surface (Kulm 1977).

The Heceta Head littoral cell is the largest on the Oregon Coast. Except for the headlands at both ends of the cell, the entire coastline is made of beach fronting sand dunes. Three major river systems enter the cell. From north to south, these rivers are the Siuslaw, the Umpqua, which is the largest of the three, and the Coos.

Regional Geology

The Heceta Head littoral cell and the larger part of the Siuslaw River are in the southern portion of the Coast Range. Rocks of the Coast Range are marine and deltaic sediments, and volcanic rocks, mostly from the earlier half of the Cenozoic. During the Eocene, the area was part of a large embayment of the ocean with a volcanic island arc to the west. The sea gradually withdrew to the west and north, so by the end of the Oligocene the southern portion was emergent. In the Miocene, uplift began that transformed the area into the mountains present today. Figure B-2 shows the coastal geology near the Siuslaw.

During the Pliocene and Pleistocene, periodic ice ages and warmer interglacial periods caused major fluctuations in the sea level. Terraces were cut that, in conjunction with tectonic uplift, are now raised above sea level. Low stand of sea level allowed streams to cut below today's sea level. With the sea level rise that came with the end of the last glaciation these valleys were drowned, forming large estuaries, including the Siuslaw. Along the coast of the Heceta Head littoral cell, the Flournoy Formation was eroded into a low coastal plain. The combination of favorable terrain and ample sediment supply allowed extensive dune fields, the Coos Bay dune sheet, to form. The sheet had its origin at the end of the last ice age. Its advance and growth is associated with the subsequent period of submergence (Cooper 1958, Lund 1973).

The Siuslaw River originates in the Coast Range near Cottage Grove. For the most part, it flows through Eocene formations of the Coast Range. The most important of these are the Fisher and Colestin formations near Cottage Grove, the Roseburg Formation, the Flournoy Formation, the Tyee Formation, and the Elkton Formation.

Figure B-1. Littoral Cells in Oregon

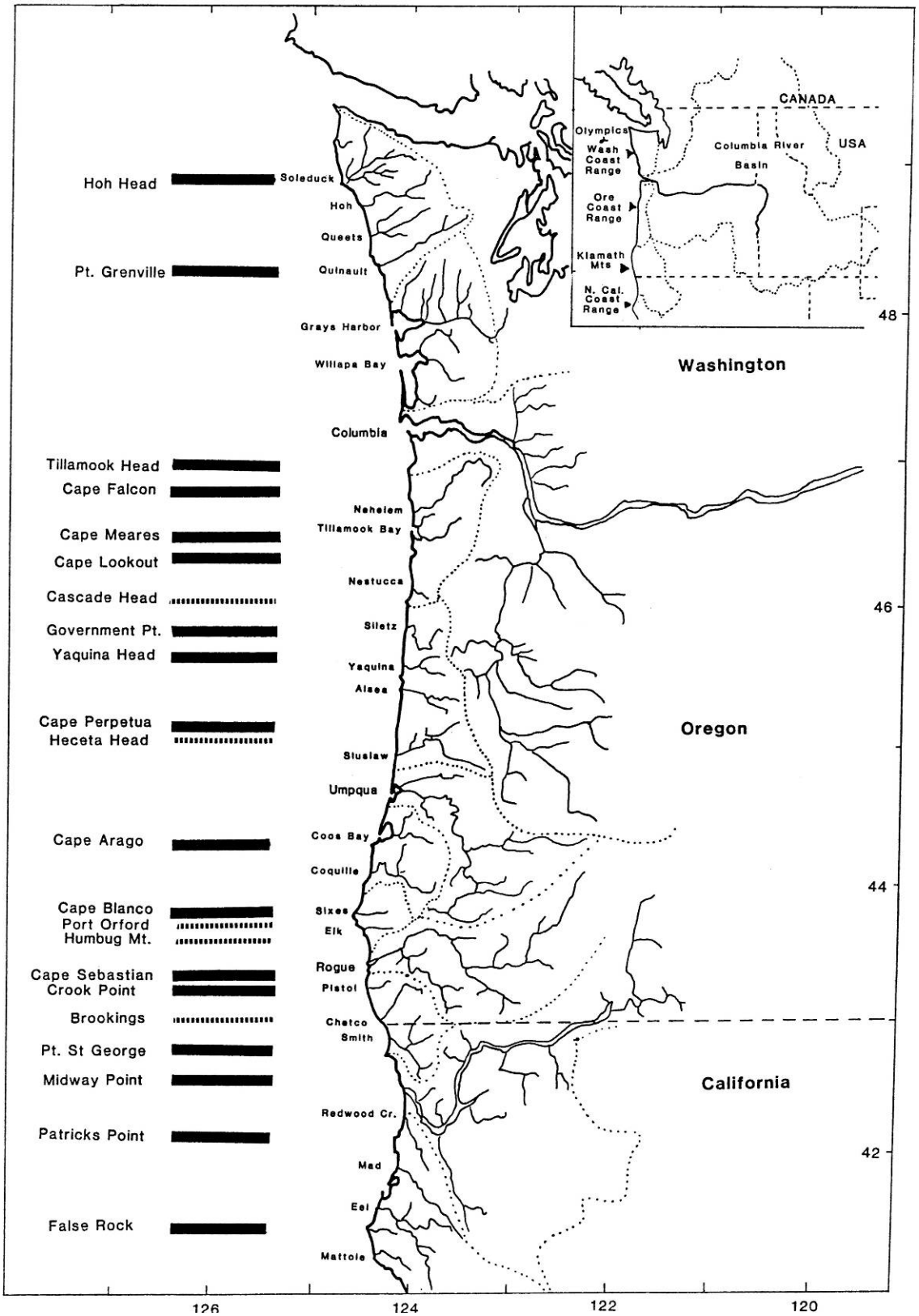
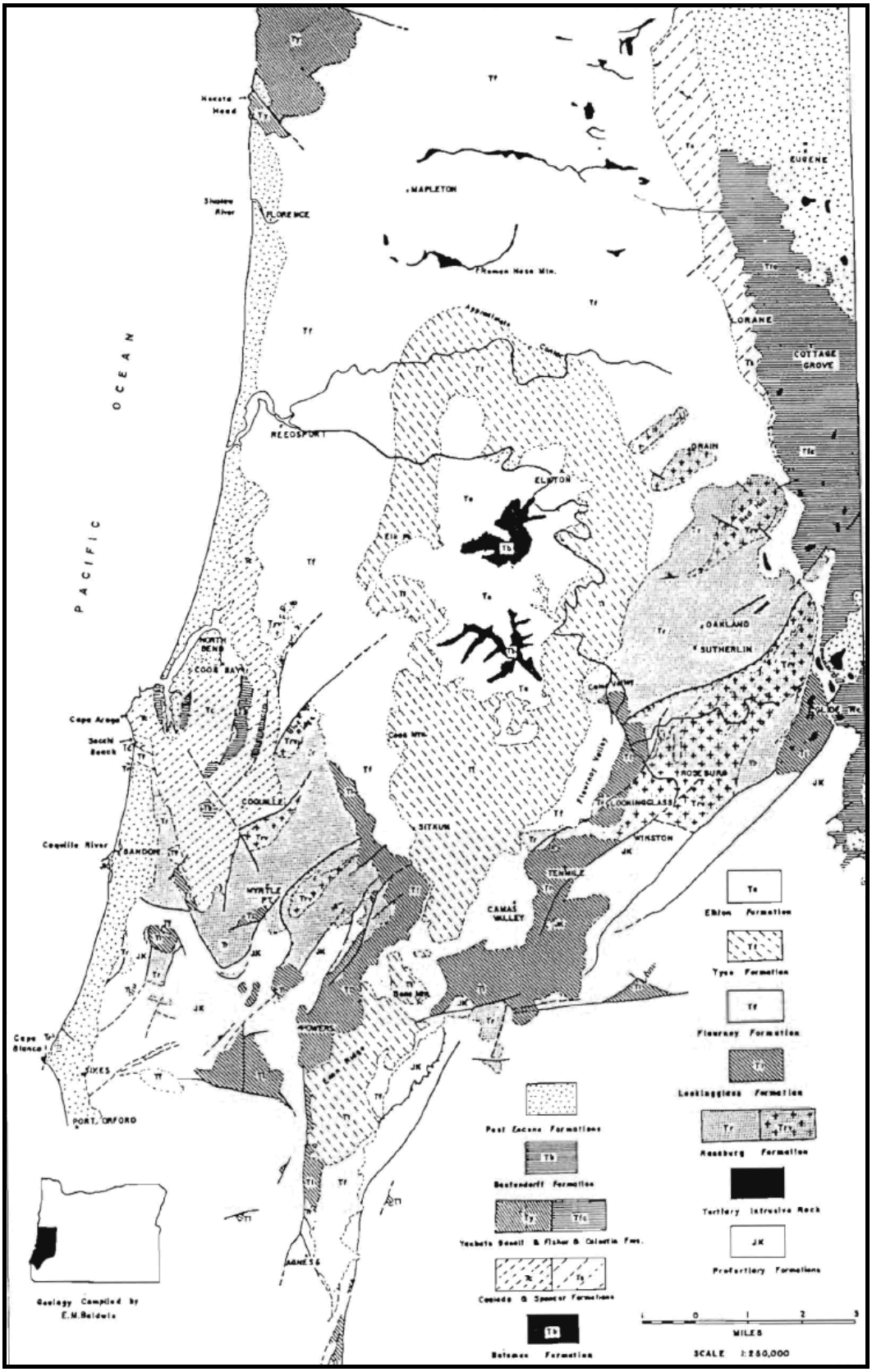


Figure B-2. Siuslaw River Watershed Geology



The Roseburg Formation was deposited in the early Eocene, and folded and thrust by subduction at the end of the Eocene. It consists of volcanics and interbedded sediments. The Flournoy Formation is probably middle Eocene in age and is primarily composed of rhythmically bedded sandstone with thin interbeds of siltstone. The Tyee Formation of late middle Eocene age overlies the Flournoy. It is made of rhythmic graded bedding, with micaceous sand grading upward into siltstone. The Elkton Formation is also from the late middle Eocene, though younger than the Tyee. It consists of siltstone with minor amounts of sandstone (Baldwin 1981).

Bedrock is not exposed within the Siuslaw River study area. However, the geologic maps indicate the study area is underlain by the Tyee Formation of middle Eocene age, which consists of rhythmically bedded sandstone and siltstone. The sub-bottom seismic records indicate these layers dip to the west beneath the study area. No faults have been mapped or projected into the study area from onshore mapping. Clarke and others (1981) recognized three acoustic units separated by unconformities in seismic reflection profiles across the continental shelf of central Oregon. They are, in order of increasing age, Pleistocene deposits (Unit 1), late Miocene to late Pliocene (Unit 2), and Eocene to middle Miocene (Unit 3). It is not possible to project the findings of Clarke and others (1981) into the Siuslaw study area because of the extensive distance between the two study areas. No faults or folds are identified within about 6 miles of the mouth of the Siuslaw River (USACE 1986).

Economic Geology

There are no accumulations of minerals or gravel along the coast near the mouth of the Siuslaw River. While there have been exploratory oil and gas wells bored on the continental shelf, as well as inland, no significant quantities of oil and gas have been found (Gray and Kulm 1985).

Sediments

The Heceta Head littoral cell is fed by the Umpqua, Smith, Coos and Siuslaw rivers, with a combined drainage basin of 6,769 square miles. The Umpqua River is the major source for sediment in the littoral cell. Mean monthly discharge from the Siuslaw River is highest in January and lowest in September. Mean annual discharge is about 3,150 cubic feet per second (cfs), which gives a 6-hour mean discharge of 6.8×10^7 cubic feet. The estuary of the Siuslaw River covers 1,780 acres. The diurnal tidal prism is 3.66×10^8 cubic feet, which divided by the 6-hour discharge gives a hydrographic ratio of 5. This means the Siuslaw estuary is fluvially dominated and that a large portion of the fluvial sediments will be transported out the river's mouth and into the ocean. The Umpqua River estuary has a hydrographic ratio of 9, so it is also fluvially dominated and contributes sediment to the littoral cell. Coos Bay has a hydrographic ratio of 20, making it tidally dominated and a net sediment trap.

Coastal erosion does not seem to be a significant source of sediment for the Heceta Head littoral cell. The coastline of the cell is generally stable. Only at Cape Arago and Heceta Head are there slowly retreating cliffs (USACE 1971, Stembridge 1976). The extensive sand dune fields along the coast constitute a large sediment sink. Sand is transported off the beach by wind and deposited on the dunes; ironically, however, the stabilization of sand dunes by vegetation may leave them vulnerable to undercutting by waves (USDA 1975). Still, the coast of the Heceta Head littoral cell must be considered a net sediment sink. Rates and quantities of the material involved in either erosion or migration onto the land are not available.

Within the littoral cell, there are three projects with offshore dredged material disposal sites. These are Coos Bay, which involves the largest quantities, the Umpqua, and the Siuslaw. The type of material contributed by dredging depends on both the location and hydrologic conditions. Dredging during or just

after high flows is more likely to pick up fluvial sediments than dredging done during periods of low flow, when marine sediments have intruded into the mouth. Similarly, the further upstream dredging is done the more likely it is that fluvial sediments will be encountered. Judging by the size of the material dredged from the Siuslaw River, it seems that it is primarily fluvial in origin. Because the Siuslaw is fluvially dominated, most of its sediment load should eventually be carried out into the ocean. This means that the net contribution of dredging to the sediment budget is much smaller than the amount naturally carried offshore.

In determining the importance of the various potential sources, the mineral assemblages of the sediments and the sources can be useful. The Heceta Head littoral cell is differentiated from the neighboring cells by its orthopyroxene to clinopyroxene ratio of about 1:1. Of the rivers entering the cell, only the Umpqua has a similar ratio, indicating that it is the major source of sediment for the cell. A slight increase in the ratio around the mouth of the Siuslaw River shows that it contributes minor amounts of material. Coos Bay, in contrast, seems to be a sediment sink, trapping marine sands, as well as fluvial sediments (Chesser and Peterson 1987).

Conditions in the Siuslaw River Offshore Area

Interim Site A. A September 1981 bathymetric survey of dredged material placement at the 1977 Interim Site A indicated mounding, exceeding the depth of -42 feet MLLW, along the southern boundary near the Siuslaw River entrance (Figure B-4). By August 1992, the mound had decreased by 12 feet; however, the outer third of the disposal site showed 10 feet of accumulation. By April 1994, accumulation reached 12 feet and by September 1996 reached 14 feet. Water depths over this portion of the mound were between -60 and -84 feet MLLW. No material has been placed in the area of Interim Site A since 1996. The May 1998 survey indicated material in Interim Site A was being eroded and moved out of the site. The June 1999 survey shows further erosion of material from Interim Site A. The 11-foot mound height in the outer third of the site in 1998 was reduced to 9-foot by June 1999 and remained at 8-foot as of June 2002. The 2005 through 2009 bathymetry over Interim Site A are fairly smooth and regularly spaced, which indicates that the previous mound has been eroded and material redistributed into the littoral zone.

Alternate Sites B and C. Because of the mounding in the 1977 Interim Site A, in September 1995 the Portland District, under its Section 103 authority, selected the two alternate sites (Sites B and C – Fig. B-3), which had been recommended for final site designation in its 1992 site evaluation study (USACE 1992). This eliminated further dredged material placement and mounding of Interim Site A. No material was placed in the Section 103 Site B prior to 1999 as the Section 103 Site C received all material dredged in 1997 and 1998. Material was exclusively placed in Site B in 1999 and then from 2002 through 2009, except in 2004. The area overlapping Interim Site A was avoided through 2008 to allow this mounded area to erode. While it is important to avoid overloading this southeast corner, placement was not restricted after 2008.

Figure B-3. Historical and Proposed Siuslaw River Ocean Disposal Sites

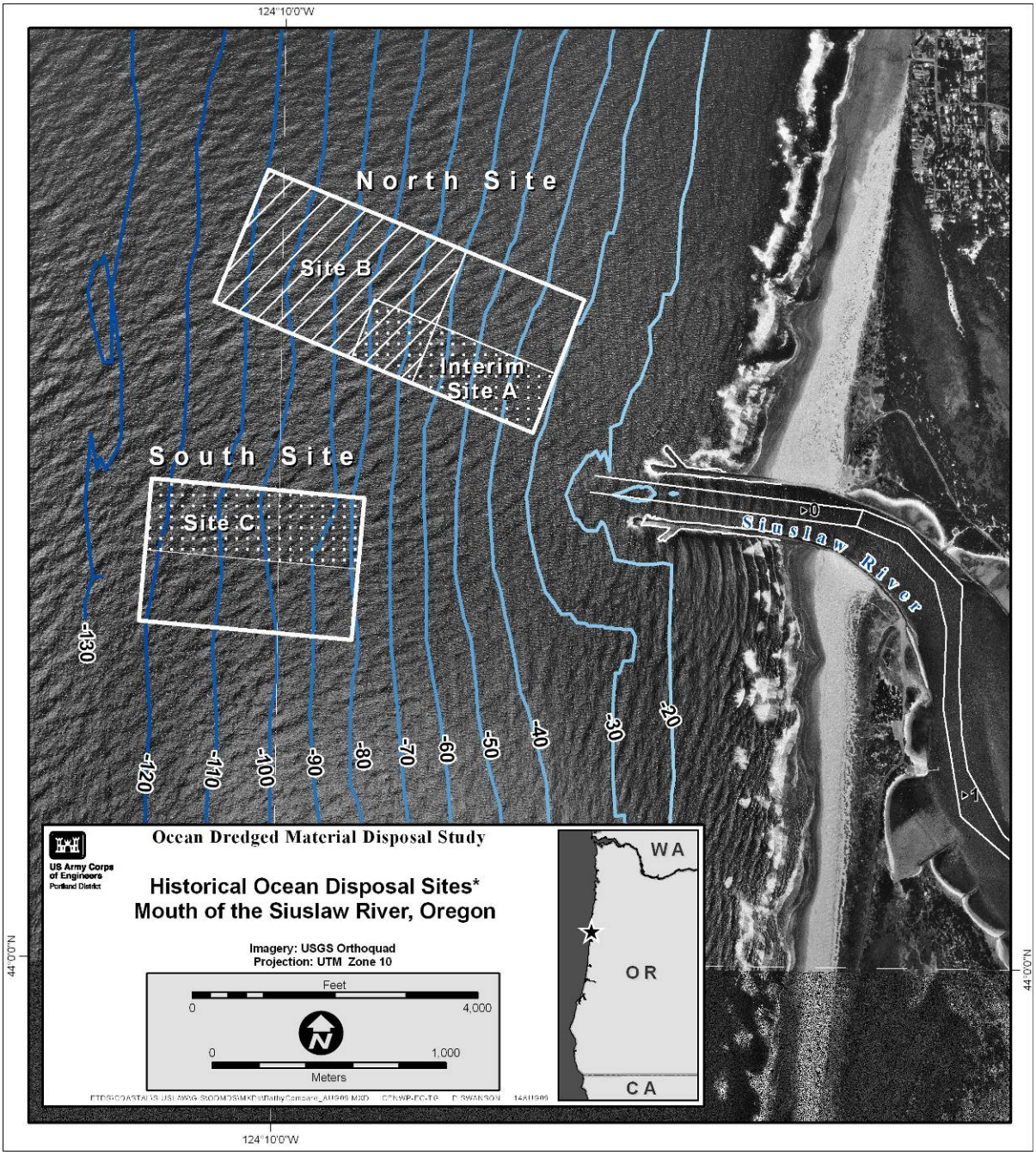


Figure B-4. Siuslaw ODMDS 1981 Offshore Bathymetry

The September 1997 survey of Site C shows dredged material mounded to a maximum of 4 feet. The May 1998 survey also shows the maximum mound height to be 4 feet but the footprint of the mound increased. The material placed at the site was concentrated in the shallower half of the site closer to the project. The June 1999 survey of Site C shows 4 feet of accumulation and the 2001 and 2002 surveys show a maximum of 7 feet and 9 feet of accumulation, respectively, over the shoreward third of the site. Minimum water depth at the site was 80 feet MLLW. Because of the mounding in Site C, disposal operations after 2001 were primarily shifted to Site B. In 2004, only 9,000 cy of material was placed in Site C.

Systemic Changes. Bathymetric features off the Siuslaw River entrance have evolved over time due to dredged material disposal, as well as larger sediment transport and depositional processes. The ocean bed in the vicinity of the historic and proposed Siuslaw ocean disposal sites (Figure B-3) is characterized by a bulging outward of the bathymetric contours west of the mouth of the Siuslaw River, forming a fan-like feature on the ocean floor. This bulge is evident both north and south of the entrance and to water depths of 100 feet. Seven bathymetric surveys were made between 1978 and 1988 and presented in USACE 1992. It was noted that changes in the bathymetry mostly occurred after 1981 with a net aggradation nearshore after 1984; the accumulation was as much as 18 feet. The change started in an approximate water depth of 60 feet. A large portion of the increase was on the previously used 1977 Interim Site A (see Figure B-3) or immediately south of the site. It was concluded that the disposal of dredge material had contributed to the aggradation of the bulge but probably was not the sole source of material. The large bulge itself is the ebb delta of the Siuslaw River. The cause of the aggradation just west of the river mouth is difficult to explain but was speculated to be from a combination of factors, such as the amount of material disposed, discharge of the Siuslaw River, and wave action between 1984 and 1988 after jetty modifications made in 1985.

Beginning in 1992, detailed annual bathymetric surveys of the Siuslaw ocean disposal sites were instituted as an annual routine monitoring requirement. During analysis of the August 1992 to September 1981 ODMDS bathymetric difference plots, it was noted that there appeared to be continued significant shoaling of material in-shore and to the south of the 1977 Interim Site A. Maximum accumulation was 24 feet. Review of the previous August 1990 to September 1981 bathymetric plot indicated only 16 feet of accumulation in the same area. This area is directly off the mouth of the Siuslaw River and indicates significant changes to the ebb delta when compared to 1981 bathymetry. It was obvious from the annual routine monitoring efforts that this buildup is not solely related to Portland District's dredge material disposal operations. Subsequent bathymetric monitoring indicated that the seaward movement of depth contours appears to have moderated after 1996.

Analysis of Difference Plots for 1981, 1996 and 2009 Surveys. Figures B-4, B-5, and B-6 show bathymetric surveys for 1981, 1996, and 2009, respectively. Using 1981 as the baseline, difference plots showing elevation changes can be utilized to illustrate and update bathymetric changes reported in the March 1992 evaluation report (USACE 1992). Figure B-7 shows elevation changes between 1981 and 1996 and Figure B-8 shows elevation changes between 1981 and 2009. The aggradation just west of the river mouth discussed in the March 1992 evaluation report (USACE 1992) up to 1988 persists and is still evident in 2009.

The 1981 survey indicates a seaward bulge in the Siuslaw ebb tidal delta to the north of the entrance. The sharp bend in the 50-foot contour seen at the southeast corner of the North Site can be attributed directly to dredged material placement in the 1977 Interim Site A. The 1996 survey shows a significant seaward shift in depth contours compared to the 1981 survey. The 1981-1996 difference plot (Fig. B-7) shows an increase of 22 feet in seafloor elevation seaward directly off the entrance. Water depth decreased from about 50 feet to about 30 feet. Differences in elevation decrease seaward but extend to a depth of about

100 feet. Differences in elevation extend north of the entrance about 6,000 feet and about 4,500 feet to the south.

By 2009, the maximum elevation difference between 1981 and 2009 had decreased to 18 feet. The 2009 contours are smoother and more symmetrical in relation to the entrance than in 1981 and 1996. When compared to 1981, the depth contours at 30 feet through 60 feet exhibit the most change. Depth contours of 100 feet or greater show no broad change between 1981 and 2009 the exception being in areas where active dredged material placement has occurred since initiation of disposal in 1996 at Site C and 1999 at Site B. Accumulations of 6 to 8 feet in limited areas of Site B and Site C is seen. In addition, the mounding along the southern boundary of 1977 Interim Site A has eroded and is no longer evident as a seaward bulging of the 50-foot depth contour as was evident in the 1981 bathymetric survey.

Sidescan Sonar Results. A 1984 sidescan sonar survey of the Siuslaw River nearshore area found primarily silt/sand (Figure B-9). Sand waves were observed extending at least 2,000 feet north of the mouth of the Siuslaw to about 1 mile south and to a depth of about 42 feet. A thin lens of what was interpreted as coarse sand/or gravel was found just off the mouth in water depths of 42 to 48 feet.

Figure B-10 shows the results of three sub-bottom seismic profiles that cross the study area from east-southeast to west-northwest, essentially parallel with the slope. The seismic profile locations #1-3 are shown on Fig. B-9. The layer of unconsolidated sediment was quite thick, varying between 45 to over 180 feet thick. The bedrock surface was irregular and sediment filled in the depressions. Just north of the previously used 1977 Interim Site, the sidescan sonar detected a number of objects on the ocean floor. Because these objects only showed up as small black spots on the sonar records, it was not possible to determine their identity. They could possibly be boulders, debris, fishnets, and/or crab pots. The Siuslaw River study area was primarily covered by silt/sand. The one exception was a lens of coarse sand/gravel west of the mouth in water depths of 36 to 50 feet. The 1977 Interim Site was located on the fan-like feature or "mound" (northwest portion). Hence, the "mound" was composed, at least in part, of dredged sediments. Slope of the mound varied from a minimum in the south to a maximum in the north. The maximum slope was 126 feet\mile and the minimum slope was 34 feet\mile. The bulging in the contours appeared to dissipate in water depth greater than 100 feet.

Based upon the results of annual bathymetric monitoring at Site B and Site C, it was concluded that the sites, as configured in the March 1992 evaluation report (USACE 1992), did not have sufficient long-term capacity. Therefore, it was proposed that these two sites be further increased in size by extending the eastern boundary of Site B shoreward to include the original 1977 Interim Site A. In addition, a similar sized area to the north of the 1977 Interim Site A was included (see Figure B-3). This will allow material to be placed in shallower depths thereby being more likely dispersed by waves and currents. Experience here and at other locations (Coos Bay and the Mouth of the Columbia River) shows that material placed in less than 50 feet of water is most likely to be redistributed over the winter months. Material placed in 60 feet of water or greater is redistributed less readily and tends to mound over time if not managed. In addition, it is proposed to increase Site C to the south. While Site C does not have a shallow portion (<50 feet), this expansion would double the size of the site.

Figure B-5. Siuslaw ODMDS 1996 Offshore Bathymetry

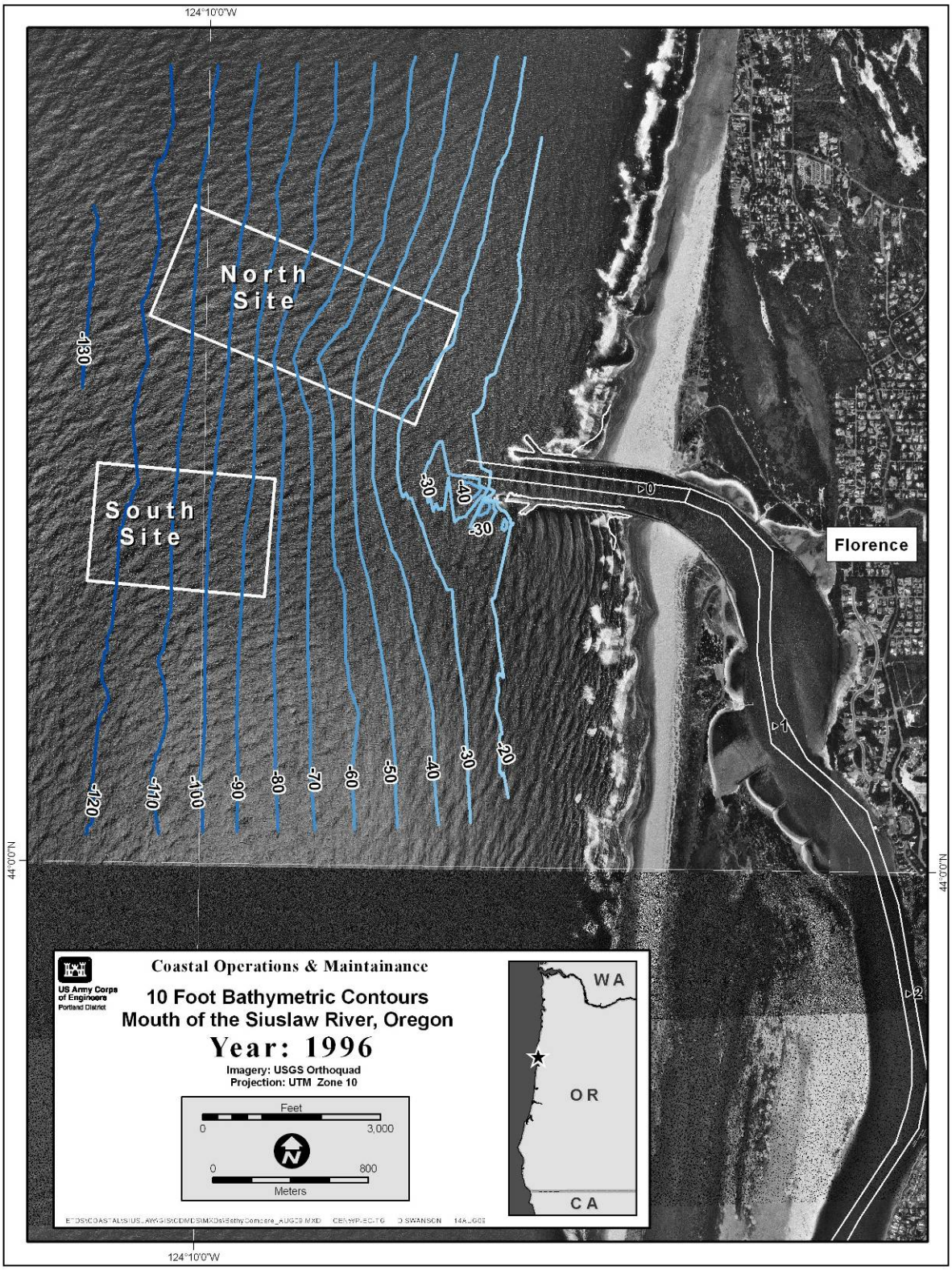


Figure B-6. Siuslaw ODMDS 2009 Offshore Bathymetry

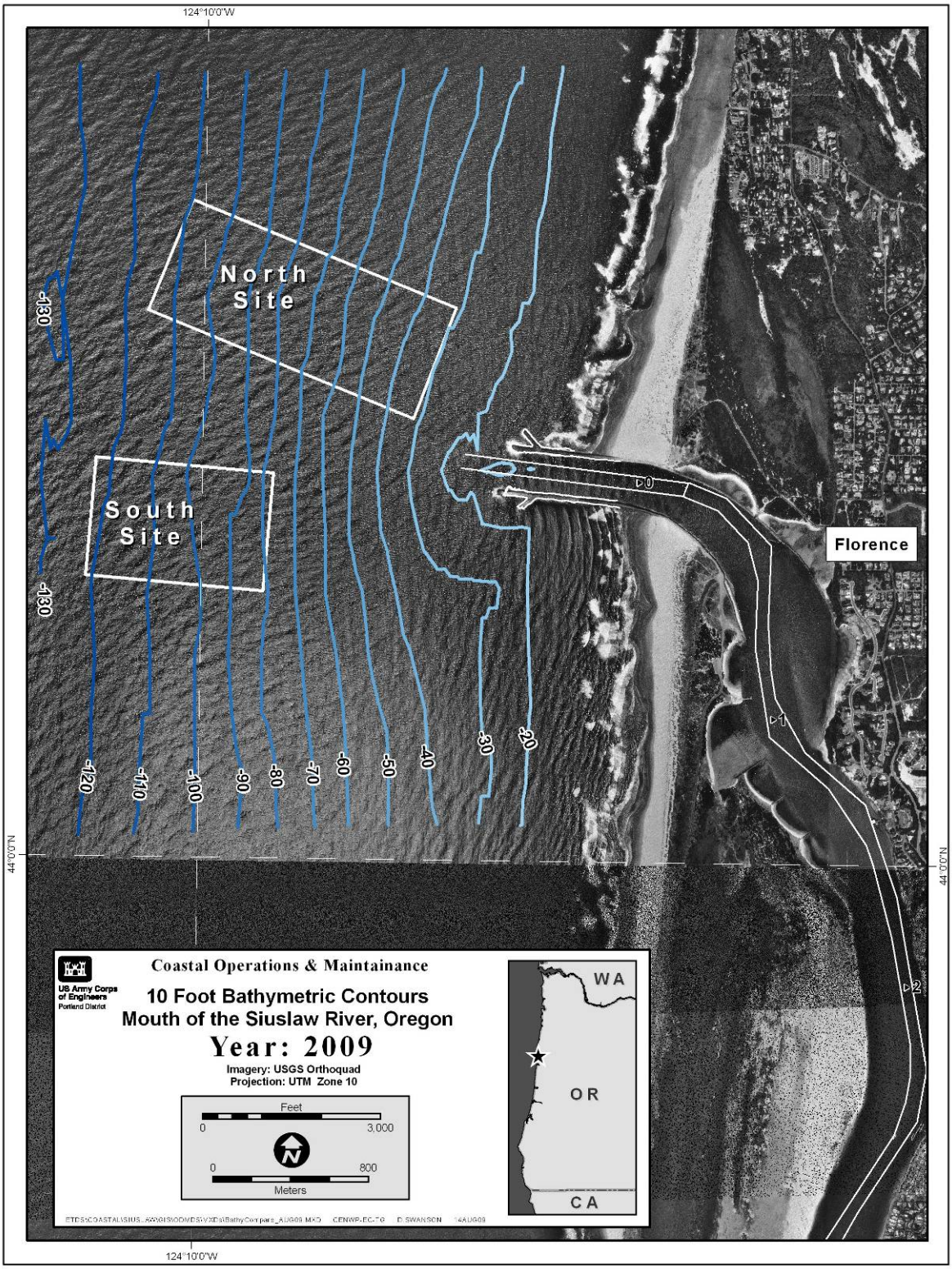


Figure B-7. Siuslaw ODMDS Offshore Bathymetry Difference Plot 1981-1996

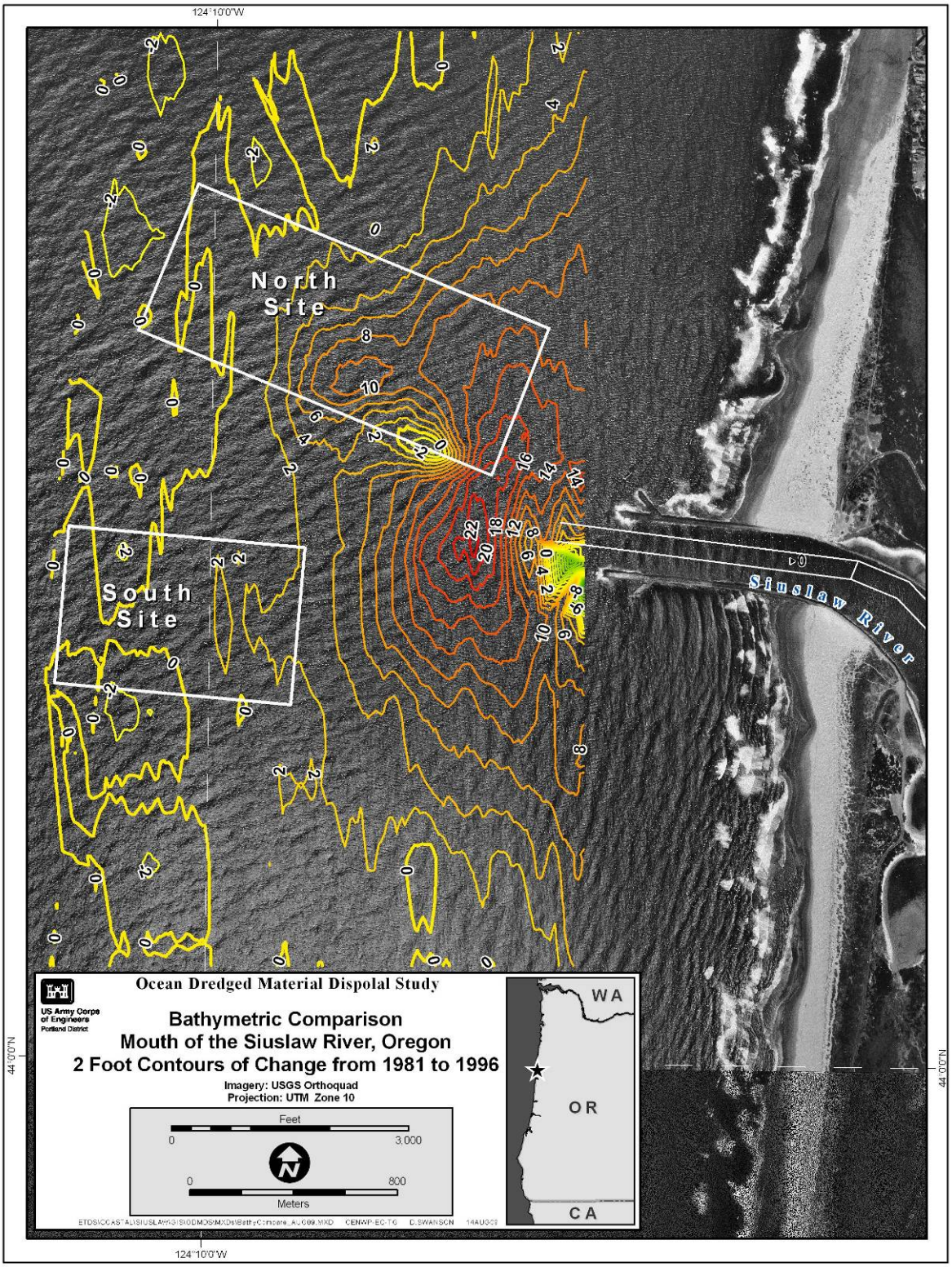


Figure B-8. Siuslaw ODMDS Offshore Bathymetry Difference Plot 1981-2009

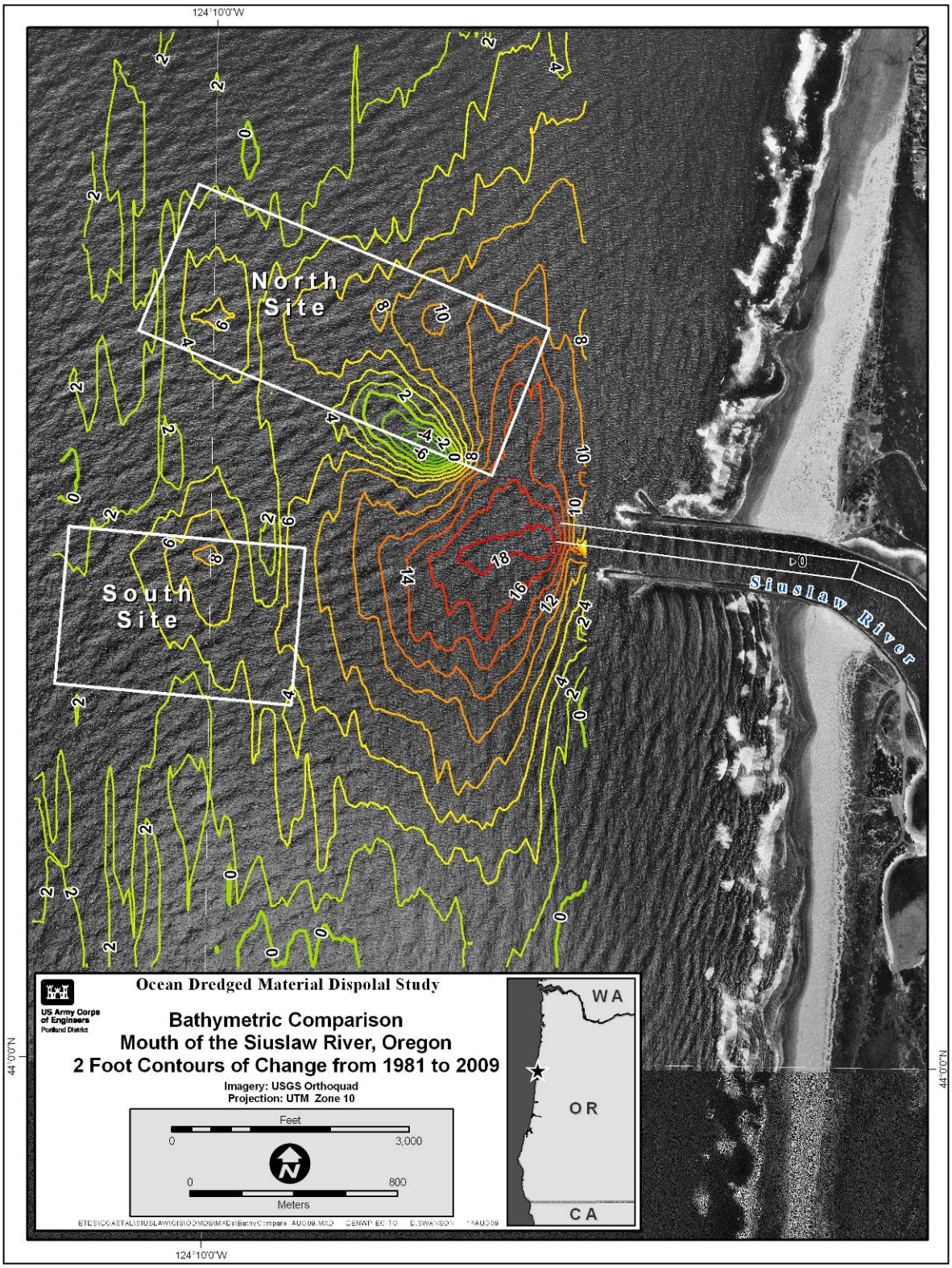


Figure B-9. Sidescan Sonar Map Offshore of the Siuslaw River

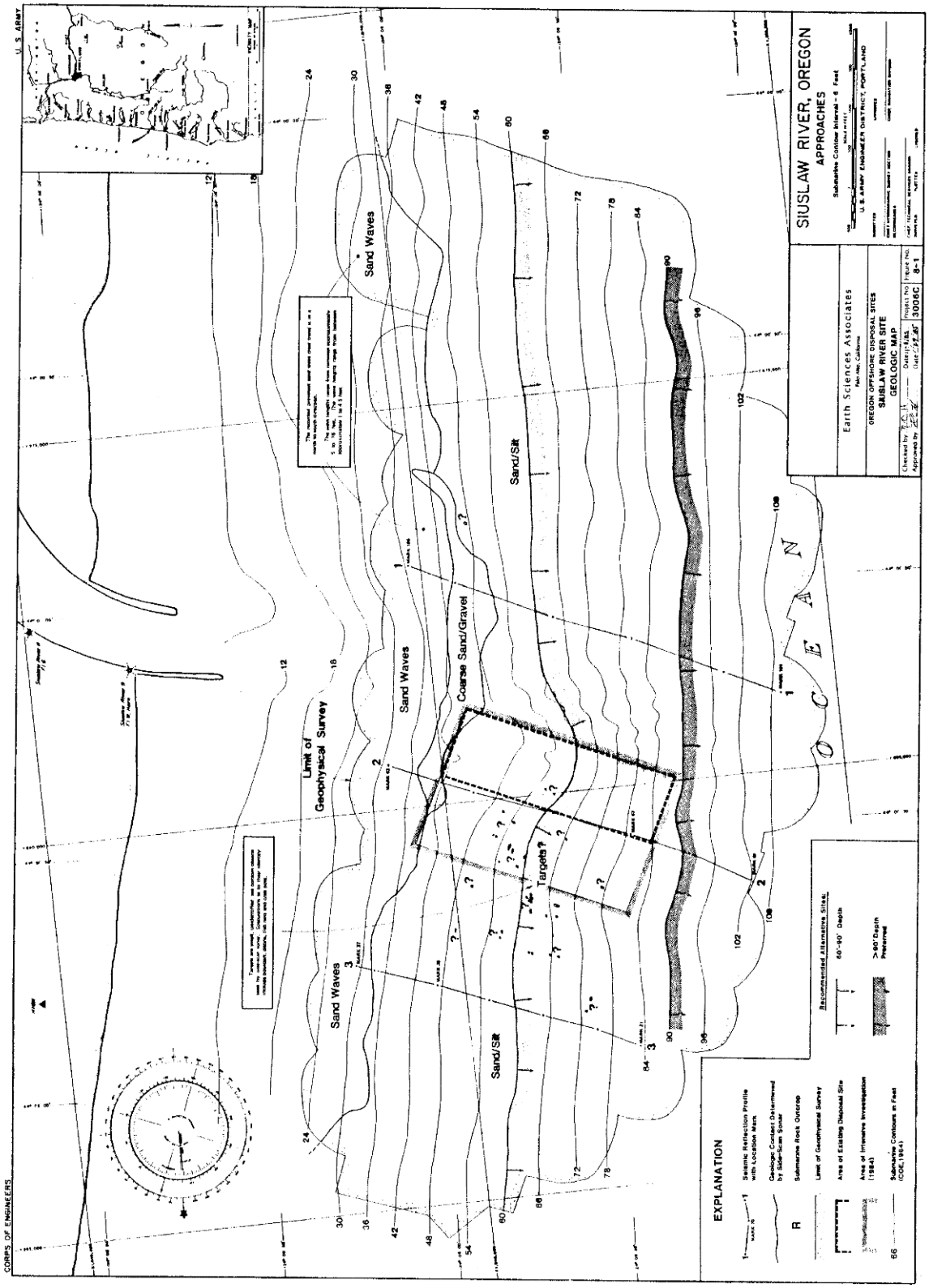


Figure B-10. Seismic Profiles Offshore of the Siuslaw River

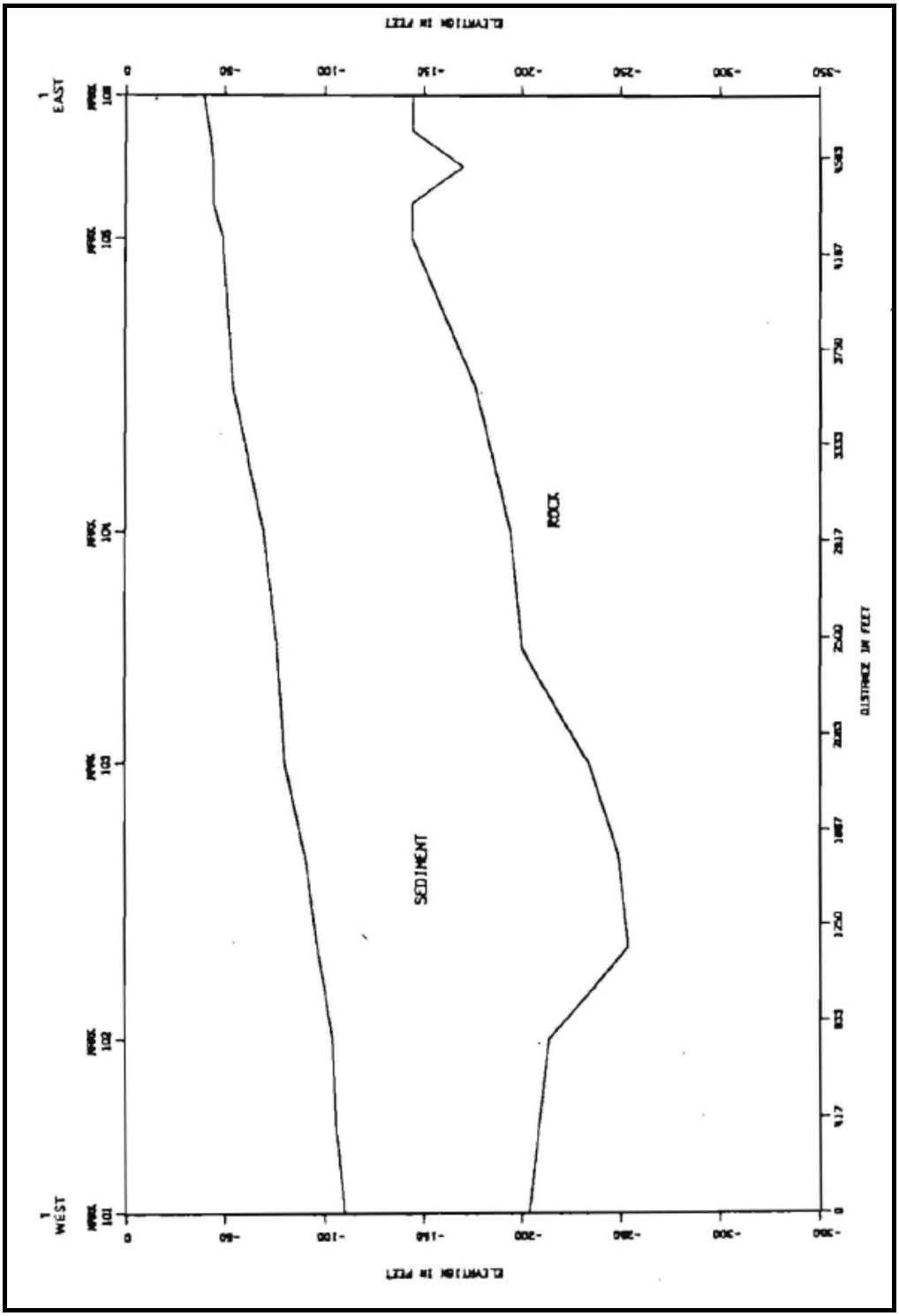


Figure B-10 (continued). Seismic Profiles Offshore of the Siuslaw River

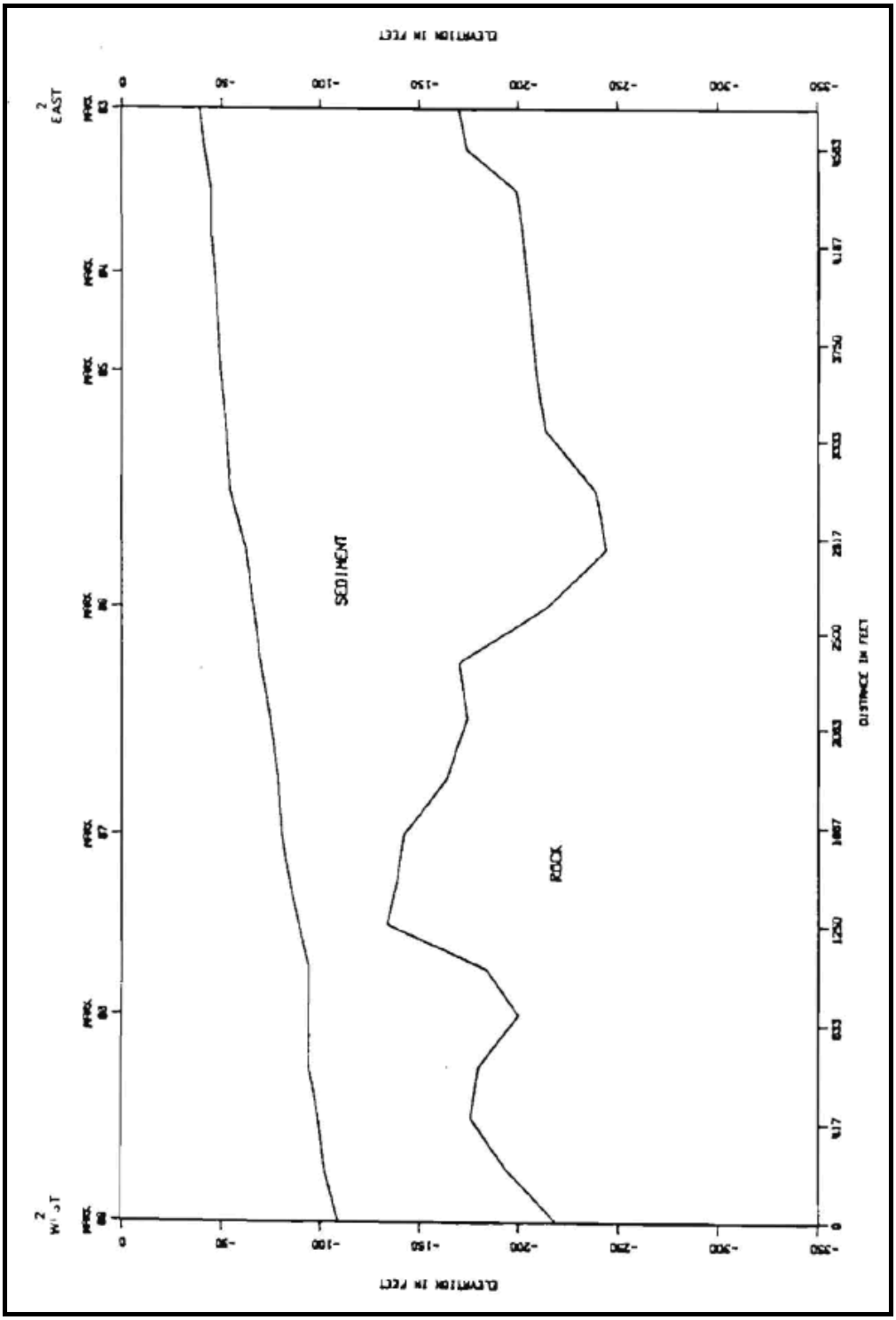
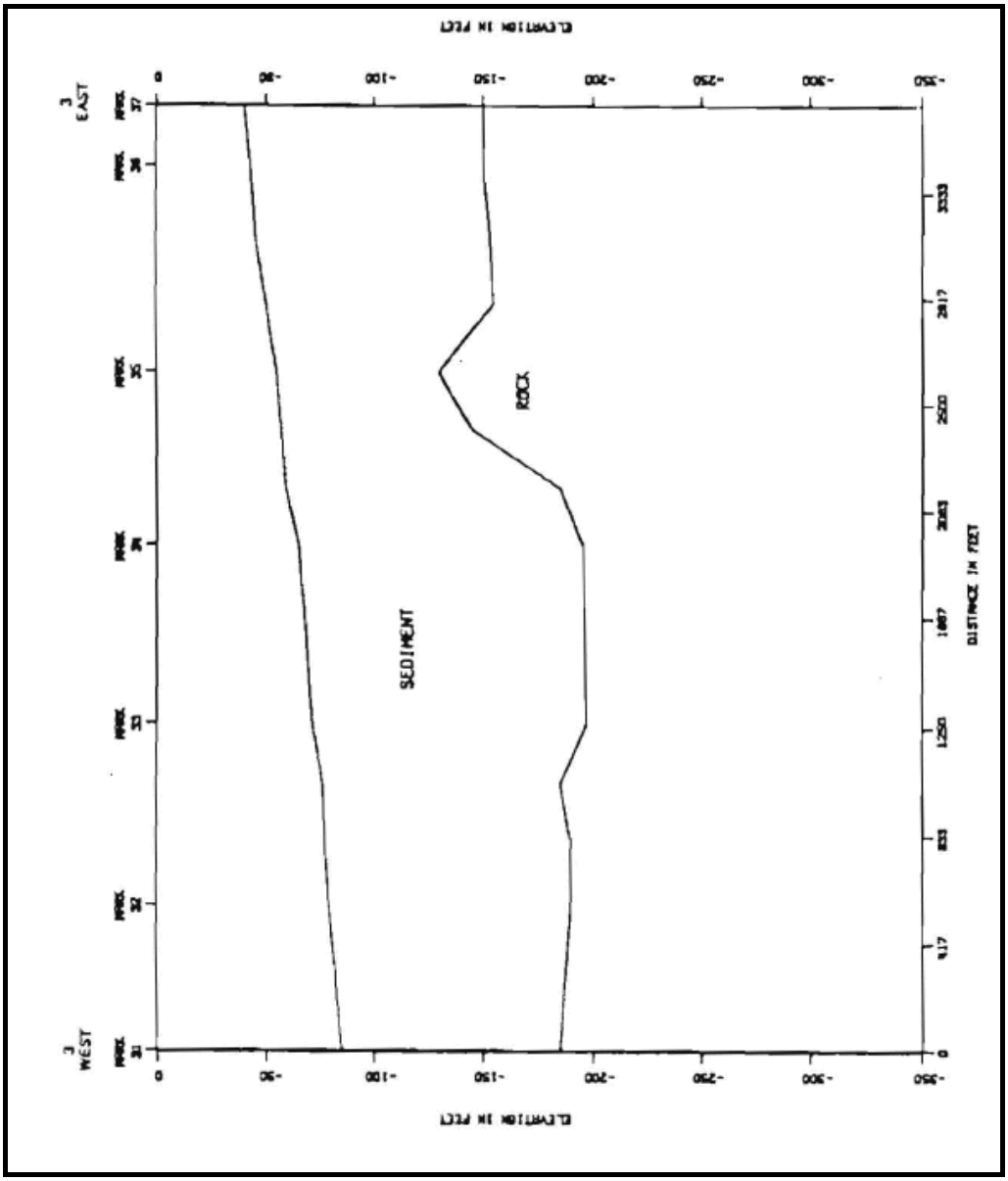


Figure B-10 (continued). Seismic Profiles Offshore of the Siuslaw River



SECTION 2. OCEANOGRAPHIC PROCESSES

Coastal Circulation

Coastal circulation offshore of the Siuslaw River is directly influenced by large-scale regional currents and weather patterns in the northwestern Pacific Ocean. During winter, strong low-pressure systems with winds and waves predominantly from the southwest, initiate strong northward currents. During the summer, high-pressure systems dominate; and consequently, waves and wind are commonly from the north. In both seasons there are short-term fluctuations related to local wind, tidal and bathymetric effects. Along the Oregon Coast, there is a southerly wind in summer which creates a mass transport of water offshore resulting in upwelling of bottom water nearshore. Figure B-11 shows the predominant Oregon coastal circulation in summer and winter.

Ocean Waves and Tide

Ocean waves arriving at the Siuslaw are generated by distant storms and/or local winds. Distant storms produce waves that arrive at the coast as swell, which are fairly uniform in height, period and direction. The longer period swells generated by more distant storms approach generally from the west-northwest or west-southwest. Longest period swell generally occurs during autumn, while shortest swell periods occur during the summer. Local winds produce seas which contain a mixture of wave heights, periods and directions. Generally, local seas have higher waves and shorter periods than incoming swell. Local seas generally approach the coastline from the south-southwest during autumn and winter and from the north-northwest in spring and summer.

Wave hindcast predictions from meteorological records, 1956 through 1975, near the mouth of the Siuslaw River are presented as a wave rose diagram in Figure B-12. Approximately 71% of the waves were within 22.5 degrees of due west with over 60% of the waves having heights of 9 feet or more. Only 7% of waves are from the southwest, but for the most part, all were over 9 feet high. Waves from the northwest occur 22% of the time with only 12% over 9 feet high. The larger waves are usually from the west-southwest and occur during winter months. For safety and operational reasons hopper dredges prefer to head perpendicular to wave crests during disposal operations. Therefore ODMDS at Siuslaw are oriented with their long axis toward the west and northwest, the dominant wave direction during the dredging season.

Superimposed upon the slowly varying regional or seasonal circulation are periodic currents due to the tides, which are very important nearshore. Tidal currents are rotary currents that change direction following the period of the tide. These tidal currents generally flood and ebb twice daily. Direction and speed of nearshore tidal currents is highly variable. Tidal current speeds have been measured at lightships along the Pacific Coast and reported by the National Oceanic and Atmospheric Administration (NOAA 1986). Hancock and others (1981), Nelson and others (1983), and Sollitt and others (1984) summarized current meter data offshore of Coos Bay between May 1979 and March 1983. These reports substantiate the influence of tides on nearshore bottom currents. Bottom current records were found to be dominated by tidal influence with the maximum velocities associated with tides, including spring tide effects. These tidal influences were additive to currents produced by surface waves and winds. One station closest to the estuary was noticeably affected by the ebb current.

Figure B-11. Oregon Coastal Circulation

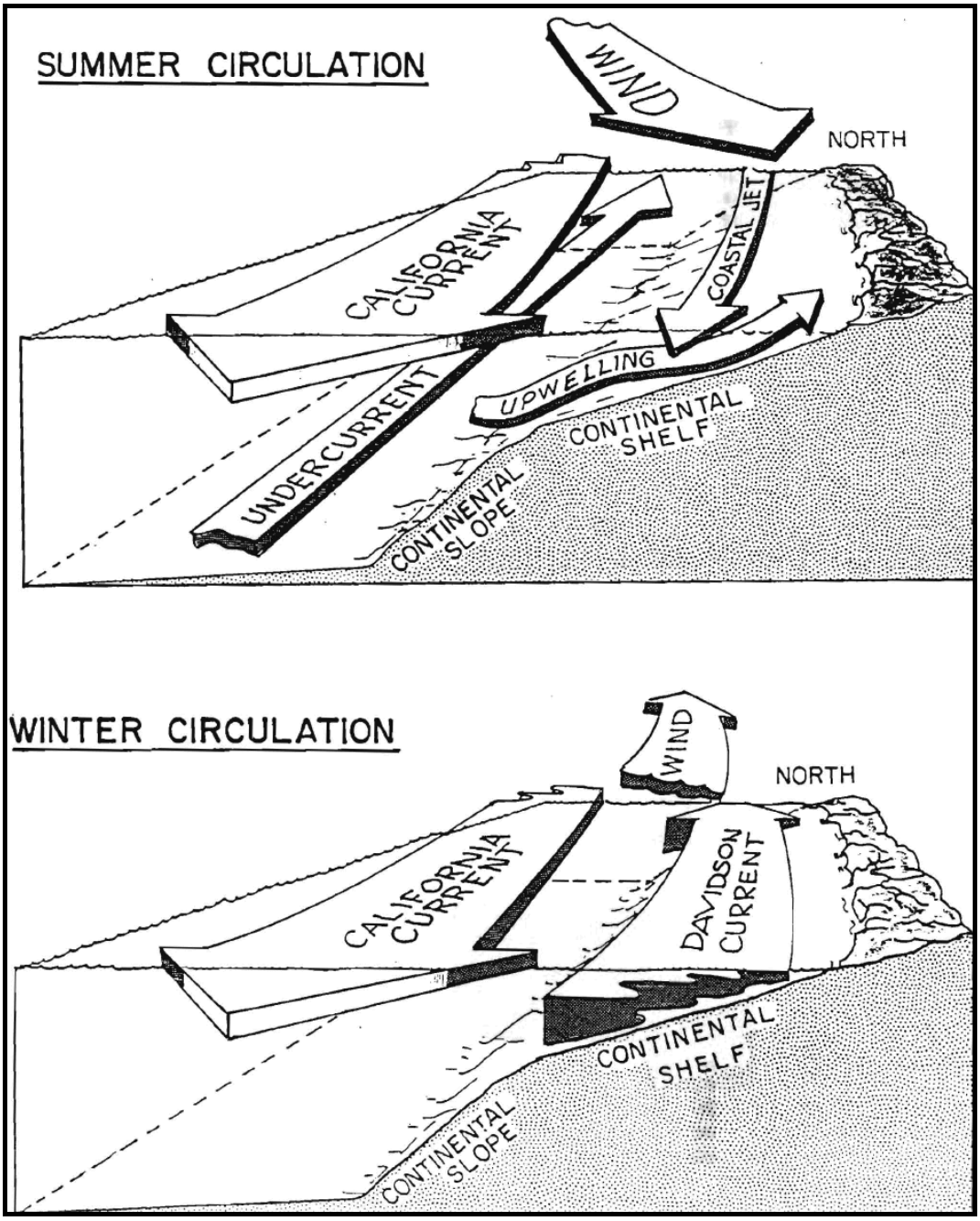
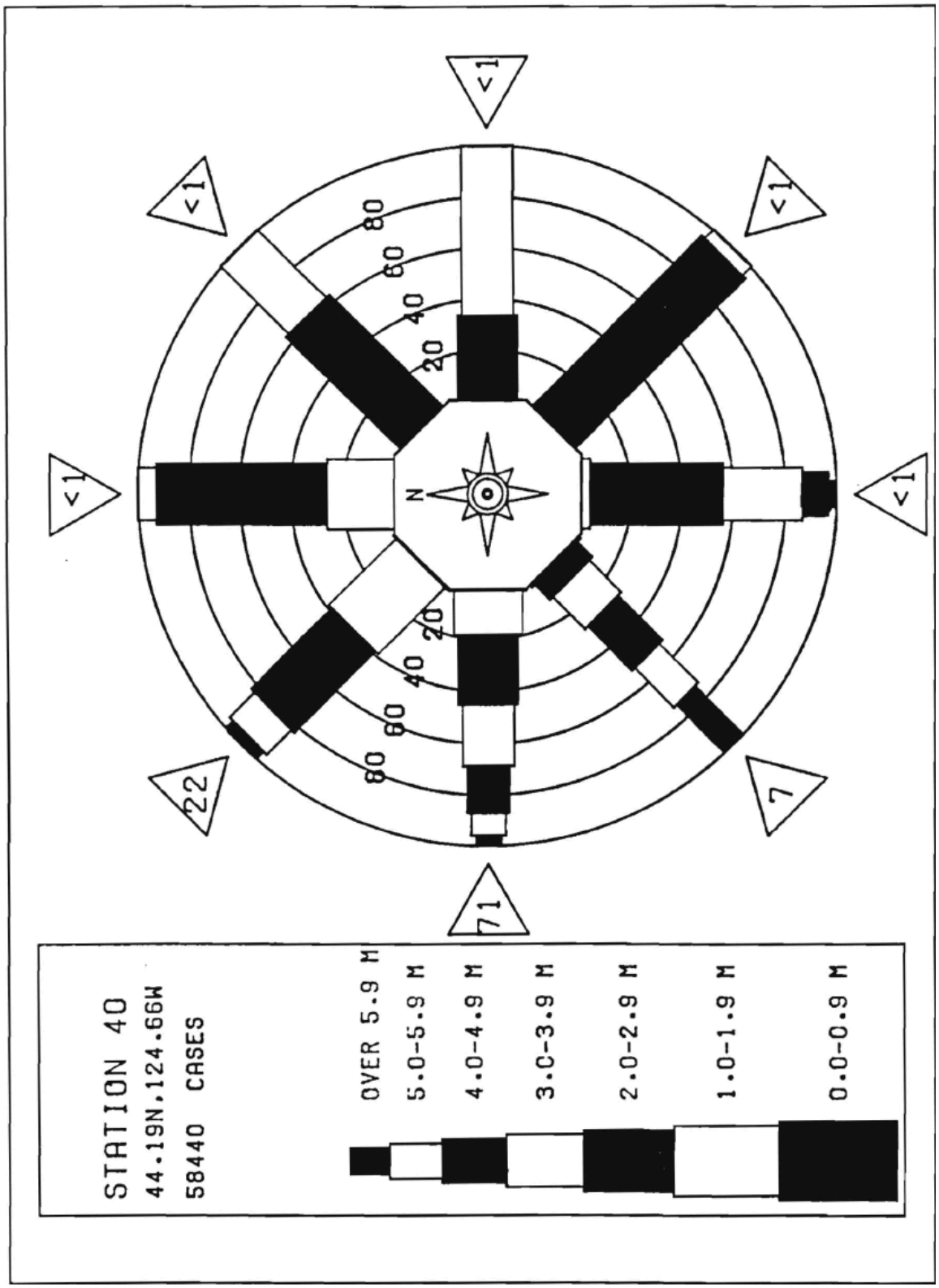


Figure B-12. Wave Direction and Height near Mouth of Siuslaw River



Wave Energy

The Oregon Coast has been identified as an ideal location for wave energy conversion based primarily on its tremendous wave resource and coastline transmission capacity. As a result, wave energy developers have been attracted to Oregon and are exploring possible projects. The Oregon Wave Energy Trust, with members from fishing and environmental groups, industry and government, is a nonprofit public-private partnership funded by the Oregon Innovation Council to serve as a connector for all stakeholders involved in wave energy project development.

The Federal Energy Regulatory Commission issues preliminary permits to study the development of a non-federal wave energy project, and the license required to construct and operate a project. Preliminary permits have been issued for wave energy projects in waters off Tillamook Bay, Coos Bay, and Reedsport.

Local Processes

The proposed Siuslaw River ocean disposal sites are approximately 1 mile from the estuary entrance. The minimum and maximum flows presented in Table B-1 show that river flows are highly variable. The constantly varying river outflow combines with tidal flows to produce a variable influence on the nearshore circulation. In the estuarine part of the river, the ebbing tide adds to the normal river discharge to produce a net ebb dominance. The Siuslaw River shows little or no long-term accumulation of fine sediments in the estuary, and net bypassing of sand-size sediments into the ocean.

Table B-1. Important Characteristics of the Siuslaw River Study Area

Characteristic	Siuslaw River
Drainage Basin Area (sq. mi.)	773
Estuary Surface Area (sq. ft.)	7.75×10^7
Mean Tide Range (ft.)	5.2
Diurnal Tide Range (ft.)	6.9
Mean Tidal Prism (cu. ft.)	2.76×10^8
Diurnal Tidal Prism (cu. ft.)	3.66×10^8
Minimum Annual Flow (cfs)	590 (October)
Maximum Annual Flow (cfs)	4,377 (January)
Mean Annual Flow (cfs)	3,150
Minimum Discharge (cfs)	45 (1977)
Extreme Discharge (cfs)	32,300 (1970)
Mean Hydrographic Ratio (HR)	5
Maximum Hydrographic Ratio (HR)	46

Note: The data are from Oregon State University (OSU 1971), Johnson (1972), and Percy and others (1974). The hydrographic ratio (HR) is the tidal prism volume divided by the mean river discharge for a 6-hour period. Peterson and others (1984) use the HR to compare the tidal prism with the river discharge for the same 6-hour period. The tidal prism is estimated as the volume of water brought into the estuary by each flood tide. The 6-hour river discharge is estimated from the annual average discharge. The higher the HR, the more tidally dominated the estuary. For comparison, Table B-1 lists two values for HR; the maximum HR only occurs during extreme low summer river flows. The variation in HR shows that the Siuslaw probably discharges sediment on an annual basis, but may trap marine sands during the summer months.

Currents

Current meters were deployed near the ocean disposal site in 1985. The meters were attached to moorings at depths from 48 to 54 feet. Bottom current records were obtained from March 16 to April 6, 1985 and from July 31 to August 14, 1985. These periods were picked to represent typical winter and summer conditions; however, the transition to summer conditions can begin as early as April. Figures B-13 and B-14 show the daily average bottom current speed and direction for summer and winter records. In the current rose, each bar represents the direction the current is moving toward. The length of the bar represents the percent of occurrence of the current in that direction (i.e., the longer the bar, the more prevalent the current in that direction). The width of the bar represents the range of velocity (i.e., the thicker the bar, the faster the current). The current meters were deployed in 1986 but the batteries failed on those at the Siuslaw and consequently, very few readings were obtained.

Summer currents in 1985 were more frequently to the north, and were generally the stronger currents. There were onshore-offshore currents during the summer with speeds equal to or greater than 1 foot/second. Bottom currents in the winter of 1985 had a strong offshore component. The largest percentage of the winter currents was to the north with the majority of the speeds equal to or greater than 1 foot/second.

Figure B-13. Current Velocity Vectors at Siuslaw, March 16 to April 6, 1985

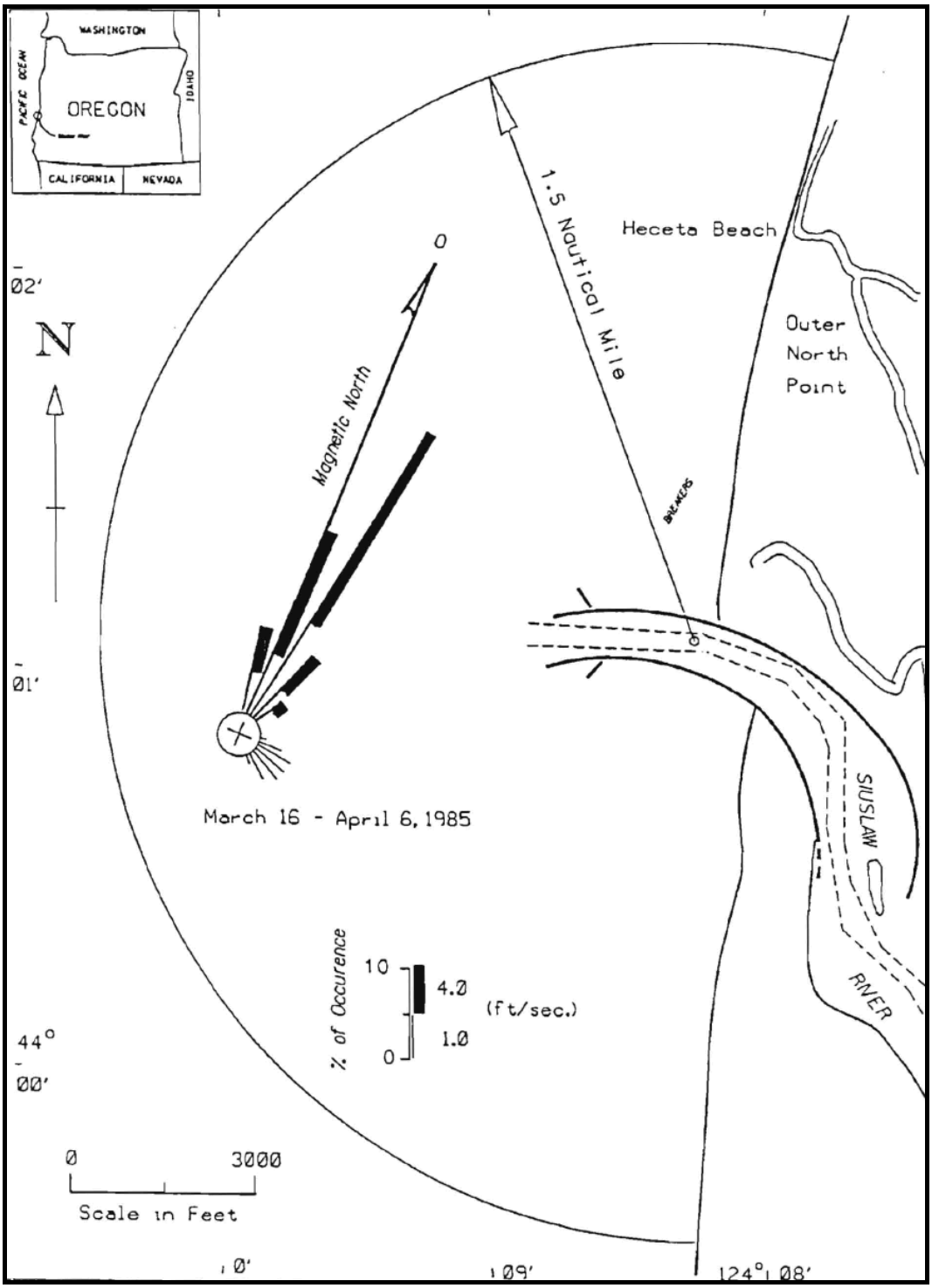
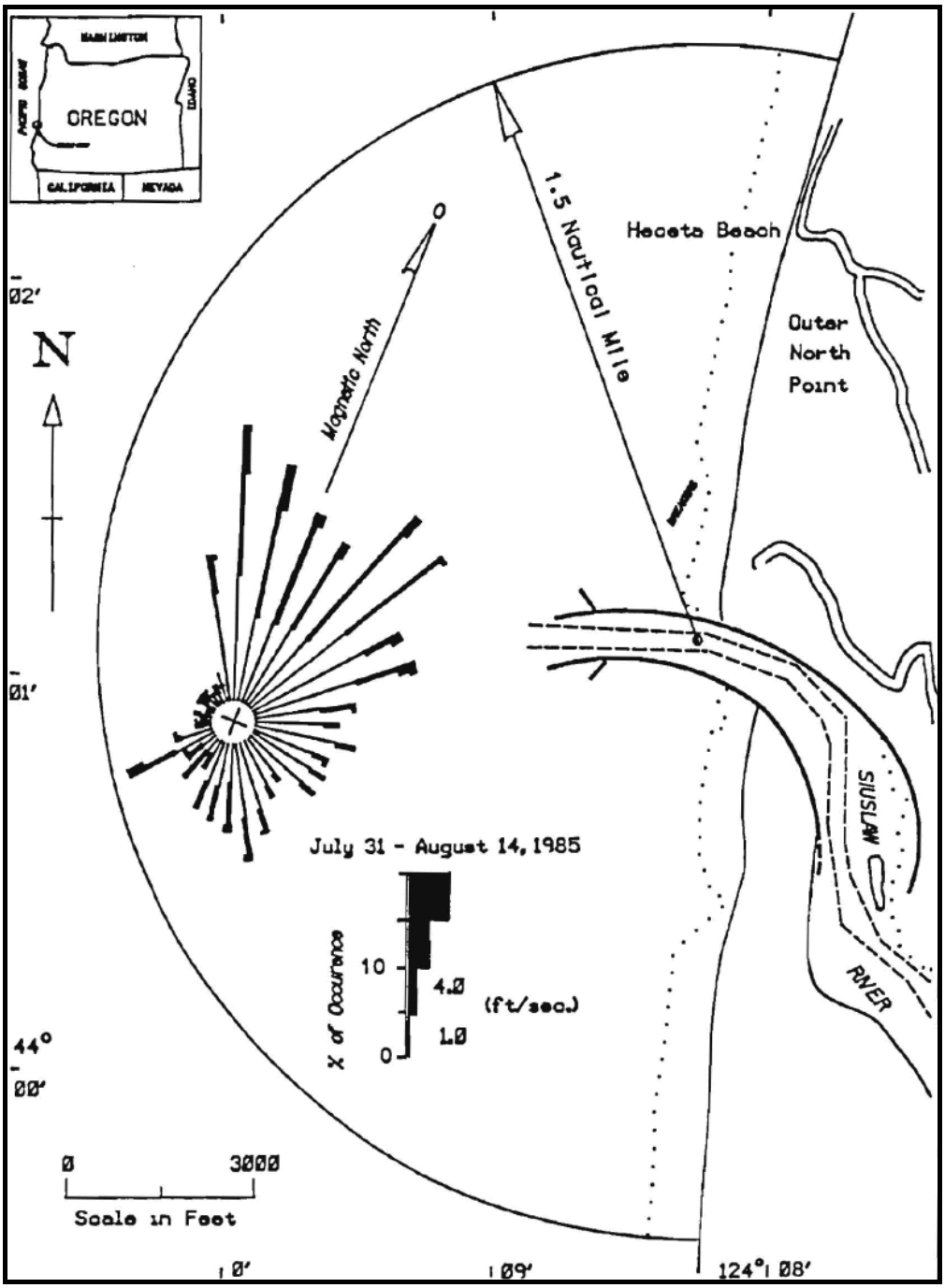


Figure B-14. Current Velocity Vectors at Siuslaw, July 31 to August 14, 1985



SECTION 3. SEDIMENT TRANSPORT

The Littoral System

At the Siuslaw, there is a need to locate offshore ocean disposal sites to prevent the dredged material from returning to 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 the size of the sediment. Anything finer than sand size is carried in suspension in the water and is relatively quickly removed far offshore. The almost total lack of silts and clays within the Siuslaw offshore area 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, which act in relation to the sediment grain size and water depth to transport sediment.

Hallermeier (1981) defined two zones of sand transport based on wave conditions. The inner littoral zone is the area of significant year-round alongshore and onshore-offshore transport by breaking waves (Figure B-15). The outer shoal zone is affected by wave conditions regularly enough to cause significant onshore-offshore transport. Using Hallermeier (1981) and long-term wave data from Newport (Creech 1981), the depth limit for strong longshore transport varied from 28 feet in summer to 51 feet in winter. Significant onshore-offshore transport occurred to depths of 83 feet in summer and to 268 feet in winter. Hancock and others (1984) calculated the probability for wave-induced current velocities at various depths off Coos Bay. From other studies, a critical velocity of 20 centimeters/second has been shown necessary to erode sediment in the 0.2-millimeter sand size, the sand particle size common off the Oregon Coast. Using the Coos Bay data, the probability of wave-induced sand movement was very small beyond water depth of about 150 feet. Various sediment studies suggested an offshore limit of sand movement at water depths of 60 feet, while others push this limit out to over 100 feet.

Heceta Head Littoral Cell

Figure B-1 shows the Heceta Head littoral cell which extends approximately 56 miles north from Cape Arago to Heceta Head. The Umpqua is the dominant river entering this littoral cell, with an estimated 400,000 cubic yards of sand contributed annually (Karlin 1980). Mineral assemblages of the Umpqua River correlate with the littoral sand mineralogy, as well as mineralogy of terrace deposits within the littoral cell (C.D. Peterson, personal communication). This indicates that the primary source of sand within the cell has historically been from the Umpqua River with minor sand contributions from the Siuslaw River.

Figure B-16 shows areas of more active dunes in the vicinity of the Siuslaw River. Old well-vegetated dunes line the north bank of the Siuslaw River from Florence to the ocean. Erosion of these dunes is a major contributor to the shoaling at the mouth of the river (Komar 1975).

Figure B-15. Littoral Sediment Transport

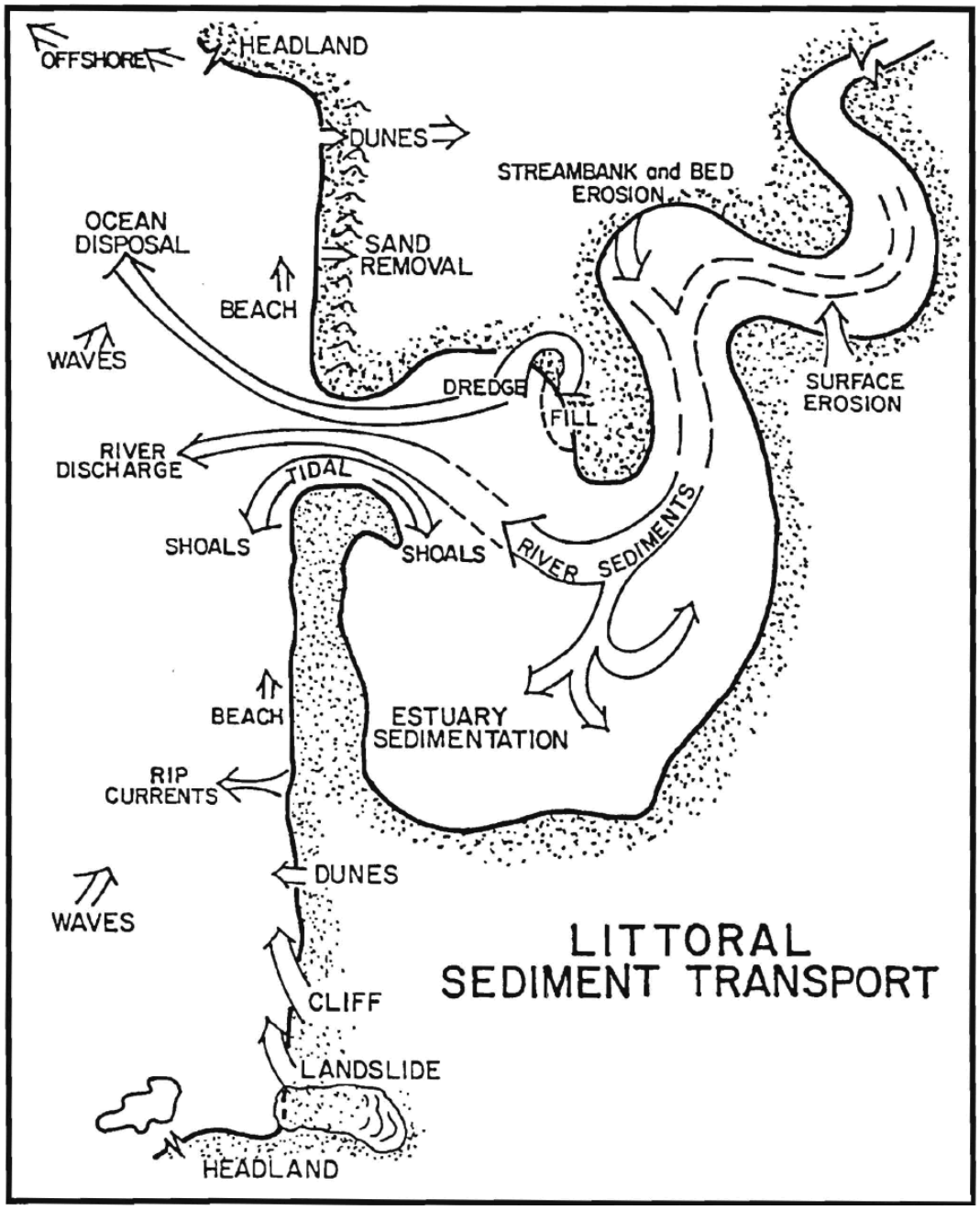
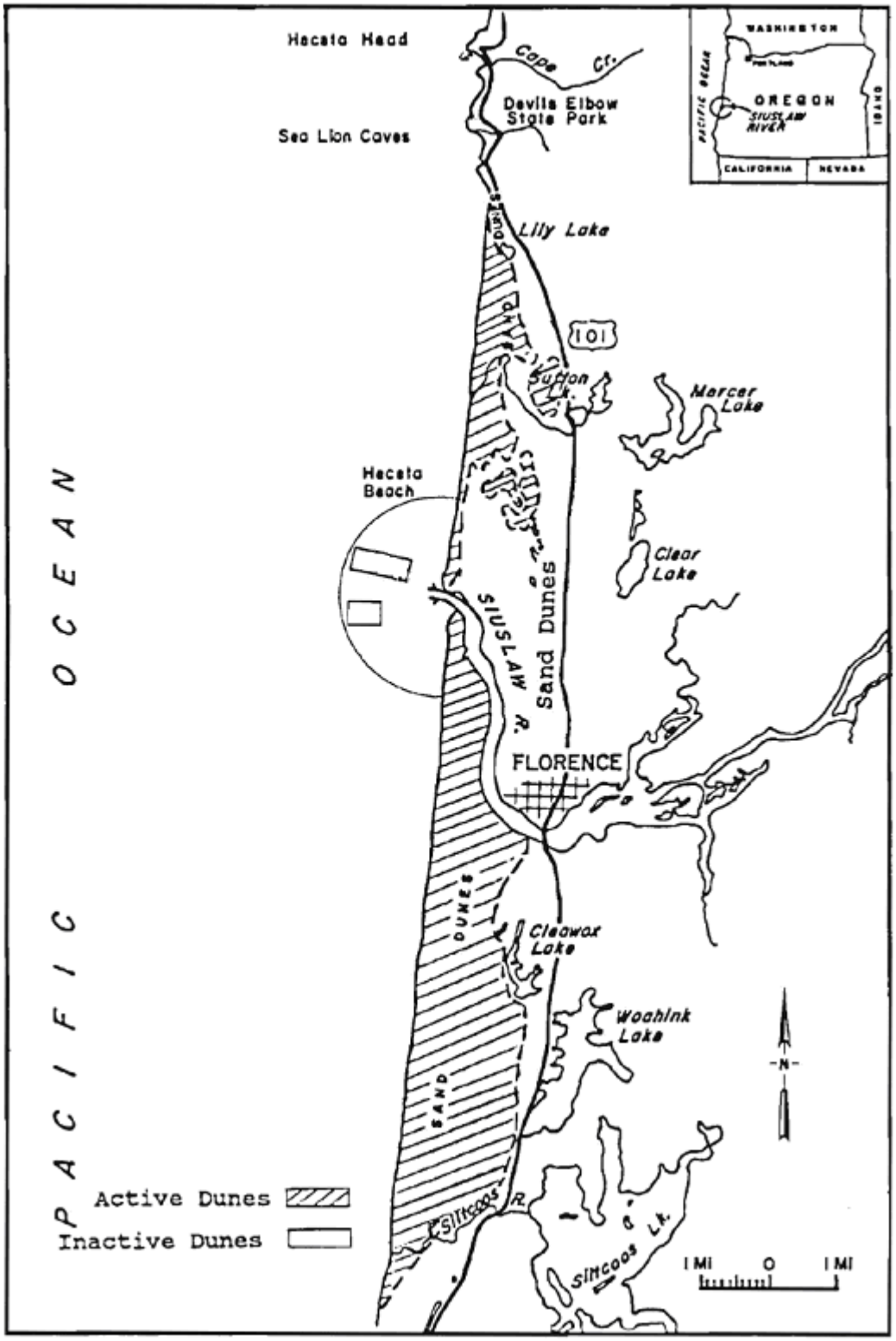


Figure B-16. Sand Dunes near Siuslaw River



Siuslaw Sediment Transport

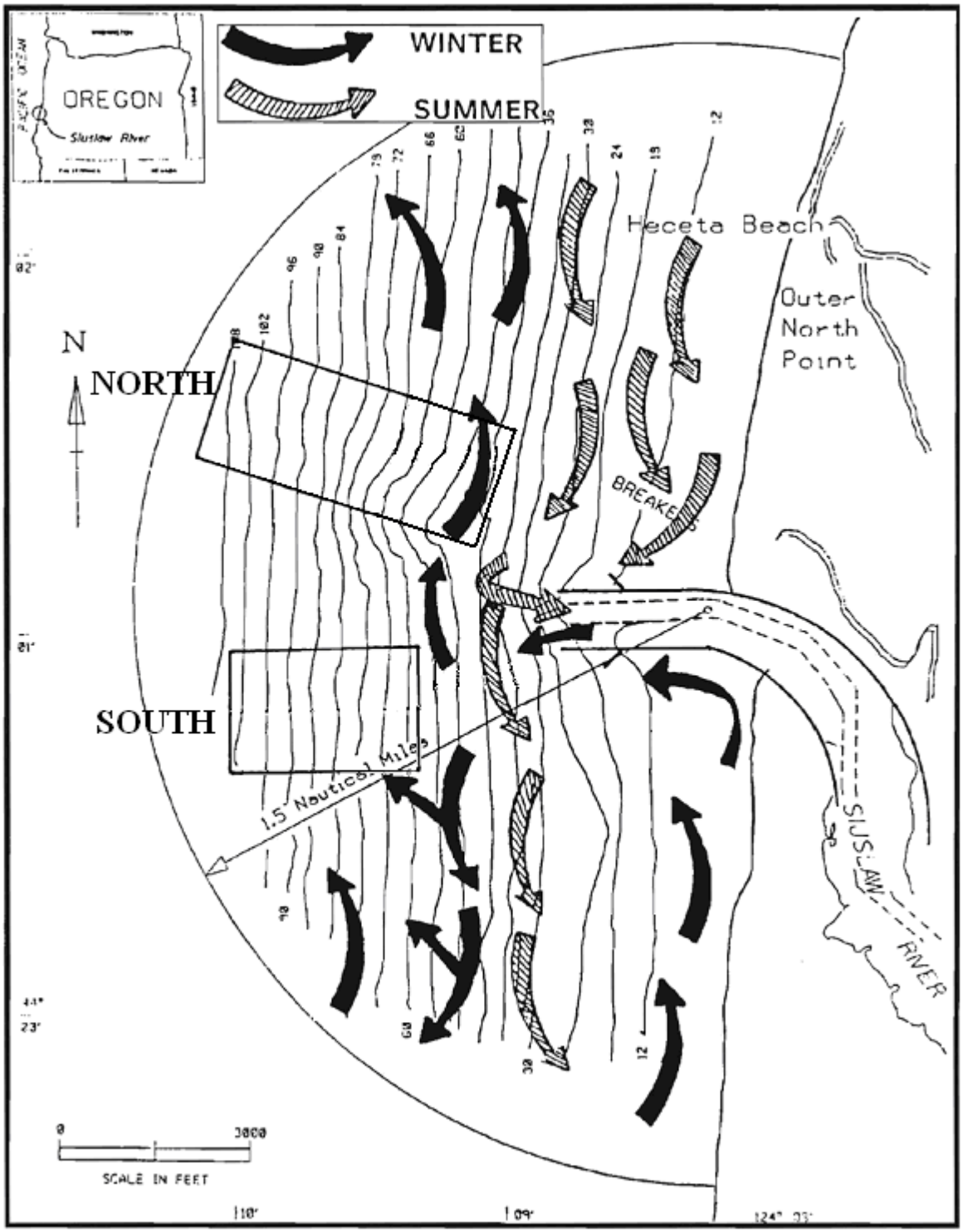
The northern limit of the Heceta Head littoral cell is approximately 10 miles north of the entrance to the Siuslaw River. Ocean circulation off the Oregon Coast is propelled by wind, wave and tidal action. River discharges have only a local influence on ocean circulation. Nearshore currents are more varied, mainly due to changes in prevailing winds and waves. Surface currents are wind driven while bottom currents result from wave and tidal motion. Surf zone or littoral circulation is wave-driven. At any one time, the current near the beach may be moving directly opposite the offshore current and/or surface currents opposite bottom currents.

The Oregon Coast has two oceanographic seasons resulting from changes in regional weather patterns (Figure B-17). The prevailing winds are predominantly from the southwest with intermittent northwest to west winds from November to April. With southwest winds, the littoral transport is northward. In April, the prevailing winds shift and begin blowing from north to northwest. Occasionally, short-term changes in weather patterns during the summer create southwest wind and subsequent northward transport. The dominant wind pattern from April to November is north to northwest. Littoral drift is southward and the net transport is also southward.

Results from dye and seabed drifter studies (USACE 1988) indicated the seasonal littoral transport adjacent to the mouth of the Siuslaw is comparable to the Oregon coastal pattern. Summer current transport is southward while winter transport is northward. Strong intense winter storms cause significantly more northward littoral transport. Because of the seasonal directional variations in sediment transport, the 1988 USACE report recommended establishing two ocean disposal sites for the Siuslaw: a northern site for late summer months prior to winter, and a southern site for disposal prior to or during months when the prevailing transport direction is to the south. By using two sites, north and south of the entrance, the likelihood of dredged material moving back into the entrance channel would be diminished. Multiple sites allow adaptive management of dredged material based upon observed sediment transport patterns. This would include allowing one site or portions of a site to not be used allowing further sediment transport.

Since 1977 specific dredged material disposal sites have been used off the mouth of the Siuslaw River. More than thirty-years of monitoring at Siuslaw and other Oregon ODMDSs have shown that original 1977 Interim Site configurations were too limited in size. Potential mounding limited long-term site capacity. The USACE 1992 Siuslaw Ocean Dredged Material Disposal Site Evaluation report identified two ODMDSs north and south of the entrance as recommended by USACE 1988. These sites have been used under the Corps Section 103 site selection authority since 1997. This tripled the area available for dredged material placement compared to the 1977 Interim Site. Based upon annual bathymetric monitoring of the Section 103 sites from 1996 to 2009 (See Figure B-4 through B-8), the present recommended configuration of doubling the South Site and expanding the North Site into shallower water are needed to assure long-term site capacity off the Siuslaw River. The shallower portion of the North Site will facilitate increased sediment transport thereby increasing long-term site capacity. However, as seen in the 1977 Interim Site, mounding could occur if too much material is placed too quickly in shallow water. Therefore, deeper areas for disposal of dredged material are also required.

Figure B-17. Sediment Transport in Siuslaw Vicinity



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Appendix C

Sediment and Water Quality
Siuslaw River, Oregon

April 2010

Appendix C
Sediment and Water Quality
Siuslaw River, Oregon

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Appendix C
Sediment and Water Quality
Siuslaw River, Oregon

GENERAL

The Marine Protection, Research and Sanctuaries Act (MPRSA) requires that five general criteria and eleven specific factors be addressed during the designation process (40 CFR 228.5 and 228.6). General criterion (b) and specific factors 4, 9, and 10 of 40 CFR 228.5 and 228.6 require sediment and water quality analyses indicative of both the dredging areas and disposal sites be reported. Dredged materials placed in ocean dredged material disposal sites (ODMDS) along the Oregon Coast usually consist of medium to fine sands taken from entrance bar shoals and deposited on slightly finer continental shelf sands. The bulk of the sediments dredged at the U.S. Army Corps of Engineers (USACE) Siuslaw River federal navigation project and placed in the ODMDS are similar in grain size to those at the disposal sites. Because of their coarse nature, the presence of strong hydraulic regimes, similarity to ODMDS sediments, and isolation from known or historical contaminant sources, dredged sands from entrance bar shoals are often deemed acceptable for ocean dumping without further testing (40 CFR 227.13(b)). The use of SEF screening levels provides an additional safeguard for this material. Data for channel sands and fines in the Siuslaw estuary and the proposed North and South ODMDS are presented in this appendix.

The general criteria and specific factors of the MPRSA have been interpreted as 27 different "areas of consideration" that cover the proposed Siuslaw North and South ODMDS and the dredged material they receive. These areas of consideration are listed in a conflict matrix (see Evaluation study/EA report) that is used to evaluate each disposal site on its compliance with the requirements for disposal site designation. The results of the conflict matrix are compared and used to select the best ocean disposal site(s). The areas of consideration involving sediment quality include:

1. Physical and chemical sediment compatibility.
2. Water column chemistry and physical characteristics.
3. Influence of past disposal.
4. Size and shape of the disposal site.
5. Size of the buffer zone.
6. Degraded areas.
7. Potential for cumulative effects.

This information including baseline data needed for the seven sediment quality areas of consideration is provided in this appendix.

SIUSLAW RIVER FEDERAL NAVIGATION PROJECT

Summary information on project water and sediment quality is provided for data collected in 1987, 1991, 1996, 2001, and 2006 from the Siuslaw federal navigation project. Project sediments are routinely collected and subjected to physical and chemical analysis typically on a 5-year schedule or as specific sediment quality issues are raised. This is more frequent than required by regional testing guidance in the May 2009 Sediment Evaluation Framework (SEF). Information and specific data regarding these sediment quality evaluations are maintained and available at the

USACE Portland District. Detailed information including specific sample locations and physical/chemical data is provided for the latest project sediment quality assessment in 2006.

Water Quality Summary

Water quality data, including elutriate testing, was collected to establish baseline conditions at various coastal locations in the early 1980s by the U.S. Geological Survey (USGS) under contract to the USACE. In May and December 1980, the USGS conducted native water and elutriate studies at 15 locations in Oregon and Washington. Along the Oregon Coast, locations included the Columbia River estuary, Tillamook Bay at Garibaldi, Yaquina River, Umpqua River, and Coos Bay (Fuhrer 1983). In 1982, the USGS conducted additional native water and elutriation studies in the Columbia River estuary but also additional studies along the Oregon Coast at Chetco River and Rogue River estuaries in southwest Oregon (Fuhrer 1984). A five-phase predisposal baseline study was conducted offshore at Coos Bay (Nelson 1983). Elutriate tests of the fine-grained sediments from Coos Bay Isthmus Slough showed very little potential for release of toxic contaminants, such as heavy metals or chlorinated organic compounds, into the solution phase. Because of these extensive studies, a large data set regarding the impact of ocean dredged material disposal on water quality at numerous Oregon Coast locations was established. Dredged material testing has subsequently shifted to solid and suspended phase sediment and biological analyses. Currently, water column tests are rarely performed unless there is a "reason to believe" a water column release may occur.

Sediment Quality Summary

In 1987, USACE Portland District personnel sampled 17 stations in the Siuslaw River estuary that were analyzed for physical analyses only. In 1991, the Portland District collected 10 sediment samples from the Siuslaw federal navigation project for physical analysis; one sample from the turning basin at river mile (RM) 5.0 near Florence was subjected to chemical analyses (USACE 1991). Siuslaw River sediments were found to be 99.9% poorly graded sand with low volatile solids content (1.1%). The median grain size of 0.32 millimeters (mm) was that of medium sand. The results of the chemical analysis from the turning basin had metals concentrations below established levels of concern. No pesticides, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), or phenols were detected.

Ten surface grab samples were collected in 1996 using a ponar sampler from the entrance to RM 8 (USACE 1996). These samples were subjected to physical tests, with grain-size ranging from 100% to 92.7% (mean 98.6%) poorly graded sand with volatile solids content ranging from 1.4% to 0.3% (mean 0.8%). The mean grain-size was that of medium sand (0.294 mm).

In 2001, eight surface grab samples were collected from the entrance to RM 6 (USACE 2001). All samples were submitted for physical analyses, with grain-size ranging from 100% to 97.9% (mean 99.2%) poorly graded sand with volatile solids content ranging from 0.42% to 3.0% (mean 1.29%). The mean grain-size was that of medium sand (0.29 mm). Two samples were selected for chemical analysis including metals, total organic carbon (TOC), PCBs, chlorinated hydrocarbons, phenols, phthalates, miscellaneous extractables, and PAHs; one sample was submitted for organotin (TBT - pore water method) analysis. The samples submitted for chemical analysis were taken from the federal channel near the outfall to the sewage treatment plant and near the boat dock. The one sample analyzed for TBT was collected near the boat dock. Sediment represented by these samples would meet the marine screening level guidelines established in the SEF for unconfined in-water placement without further characterization.

DETAILED 2006 SEDIMENT QUALITY RESULTS AND DISCUSSION

In August 2006 (Sherman 2007), seven samples were collected in the Siuslaw River from the entrance to RM 5 (Figures C-1 to C-5). This area represents the reach most frequently dredged in the system. All samples were submitted for physical analyses, with grain-size ranging from 98.5% to 95.4% poorly graded sand (mean 97.1%), with volatile solids content ranging from 0.69% to 2.24% (mean 1.14%). One sample was selected for chemical analysis to include metals, TOC, PCBs, chlorinated hydrocarbons, phenols, phthalates, miscellaneous extractables, and PAHs; two samples were submitted for bulk TBT analysis. The first sample analyzed for TBT was collected in the turning basin, adjacent to the marina (sample 06). Sample 07 was collected in the federal channel by the fuel dock and was submitted for all the chemical parameters listed above. Pore-water TBT was not analyzed due to insufficient pore-water volume in the samples, a result of the high sand content.

The chemical analyses showed only low levels of contamination in any of the samples, with all levels well below their respective SEF marine screening levels. No pesticides, PCBs, PAHs, chlorinated hydrocarbons, or miscellaneous extractables were detected in any of the samples. Several metals, phthalates, phenol, and dibutyltin were detected, but at low levels and well below their respective screening levels. Detection levels were sufficiently low to evaluate material proposed for dredging. The analytical results of this characterization are consistent with historical data. Sediment represented by the samples collected during this sampling event met the guidelines established in the SEF for unconfined in-water placement without further characterization.

Physical Analysis/Volatile Solids (ASTM methods) and TOC (EPA method 9060)

Seven samples were submitted for testing and results are presented in Table C-1. Grain-size analyses resulted in mean values of 0.2% gravel (shell hash, 0.0% - 0.5% range), 97.1% sand (95.4% - 98.5% range), and 2.7% silt/clay (1.5% - 4.1% range) with 1.14% volatile solids (0.69% - 2.24% range). The TOC mean value is 0.13% (0.04 - 0.26 range).

Table C-1. Siuslaw River Project Physical Analysis, Volatile Solids and TOC, 2006

Sample I.D.	Grain Size Percent (%)				
	Gravel (shell hash)	Sand	Silt/Clay	Volatile Solids	TOC
082906SLFC-BC-01	0.5	97.9	1.6	0.69	0.04
082906SLFC-BC-02	0	98.5	1.5	0.74	0.07
082906SLFC-BC-03	0	97.9	2.1	0.97	0.26
082906SLFC-BC-04	0.1	97.1	2.8	0.52	0.11
082906SLFC-BC-05	0.2	97.1	2.7	1.34	0.09
082906SLFC-BC-06	0.1	96.1	3.8	1.49	0.09
082906SLFC-BC-07	0.5	95.4	4.1	2.24	0.24
Average	0.2	97.1	2.7	1.14	0.13
Minimum	0	95.4	1.5	0.69	0.04
Maximum	0.5	98.5	4.1	2.24	0.26
SLFC = Siuslaw federal channel BC = Box-core sampler (surface grab sampler)					

Figure C-1. Siuslaw River Project Vicinity Map

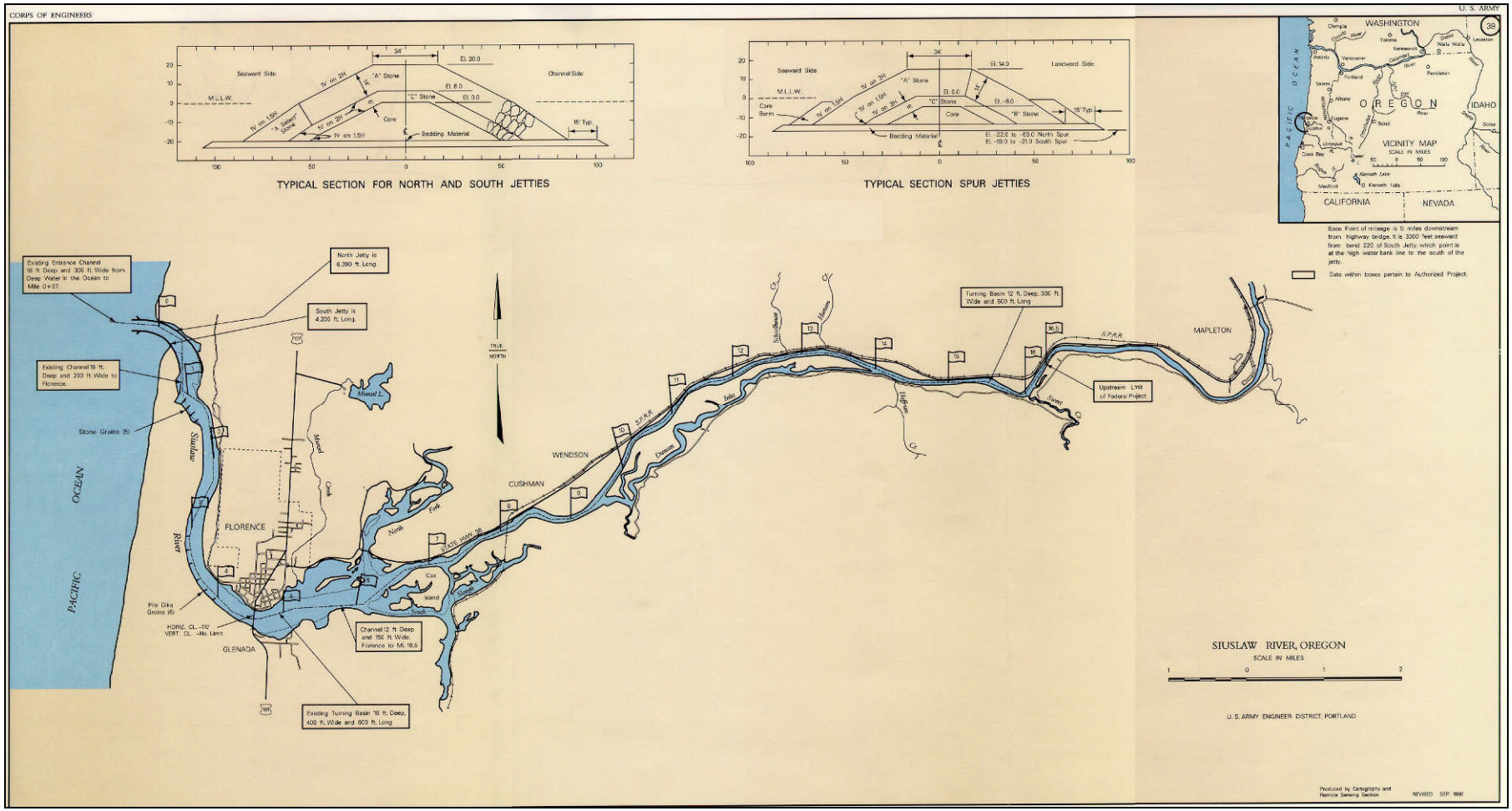


Figure C-2. Sediment Sampling Locations, Siuslaw River Channel Entrance, 2006

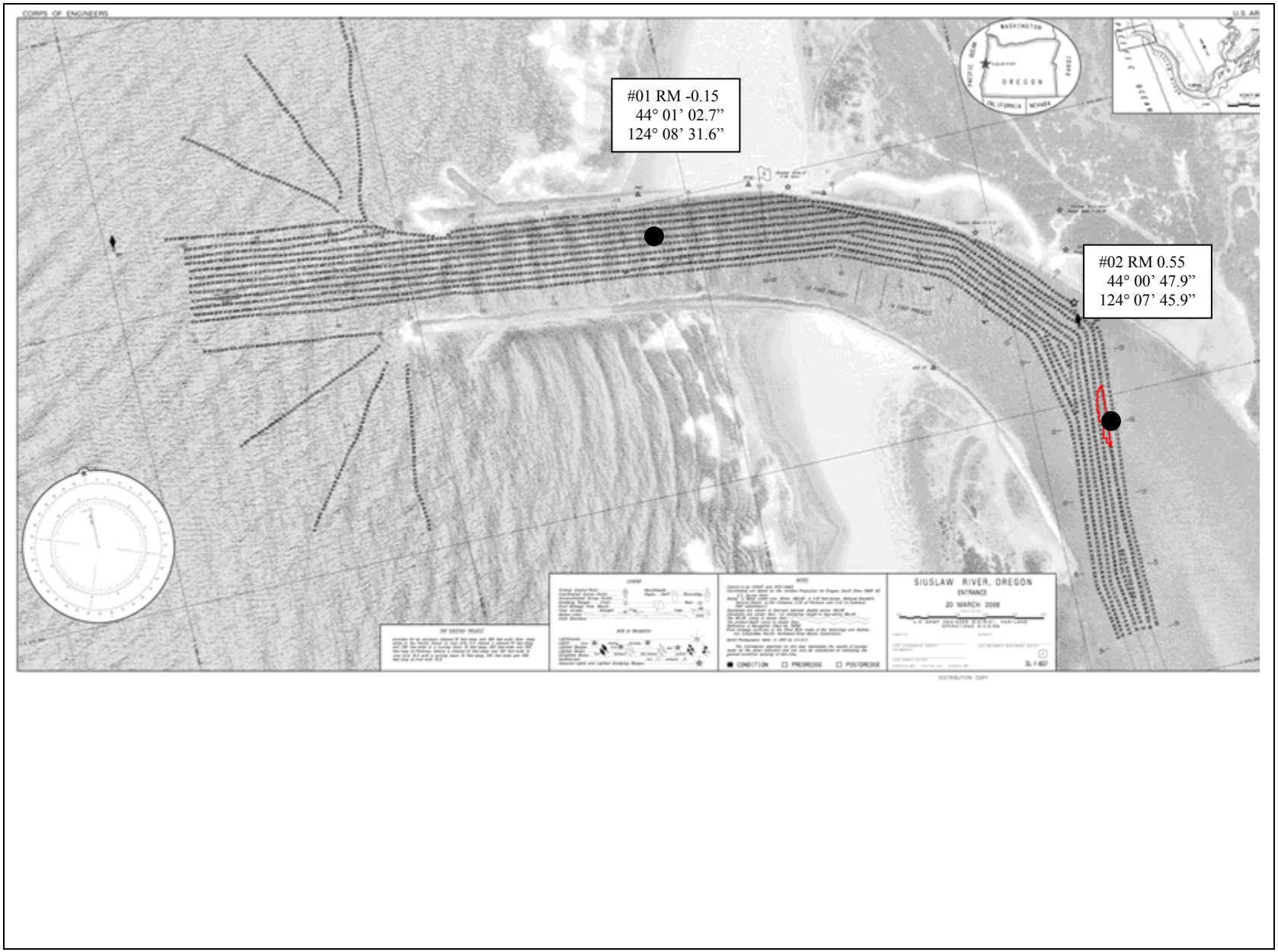


Figure C-3. Sediment Sampling Locations, Siuslaw River Channel, Cannery Hill Reach, 2006

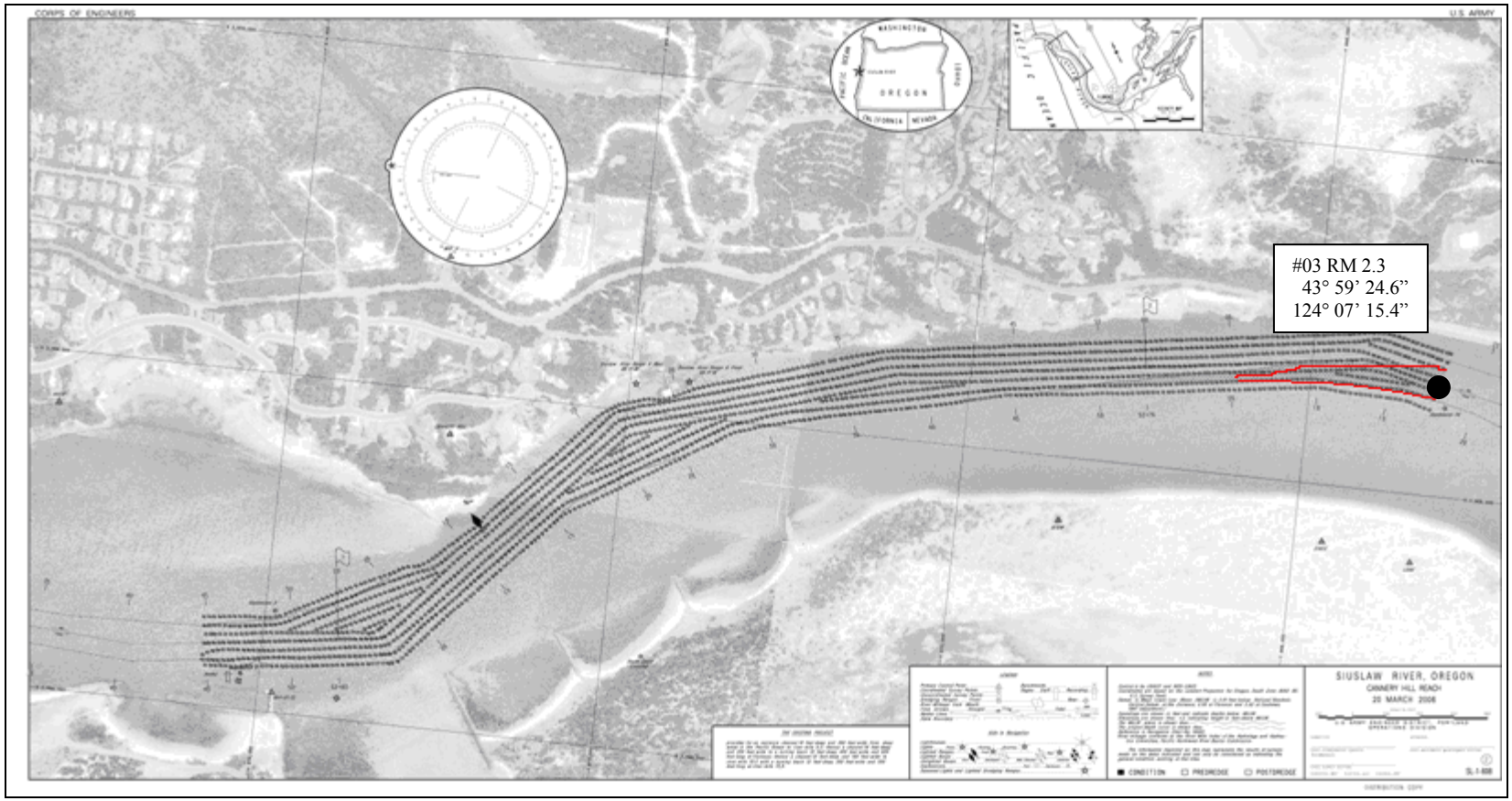


Figure C-4. Sediment Sampling Locations, Siuslaw River Channel, Spruce Point Bend Reach, 2006

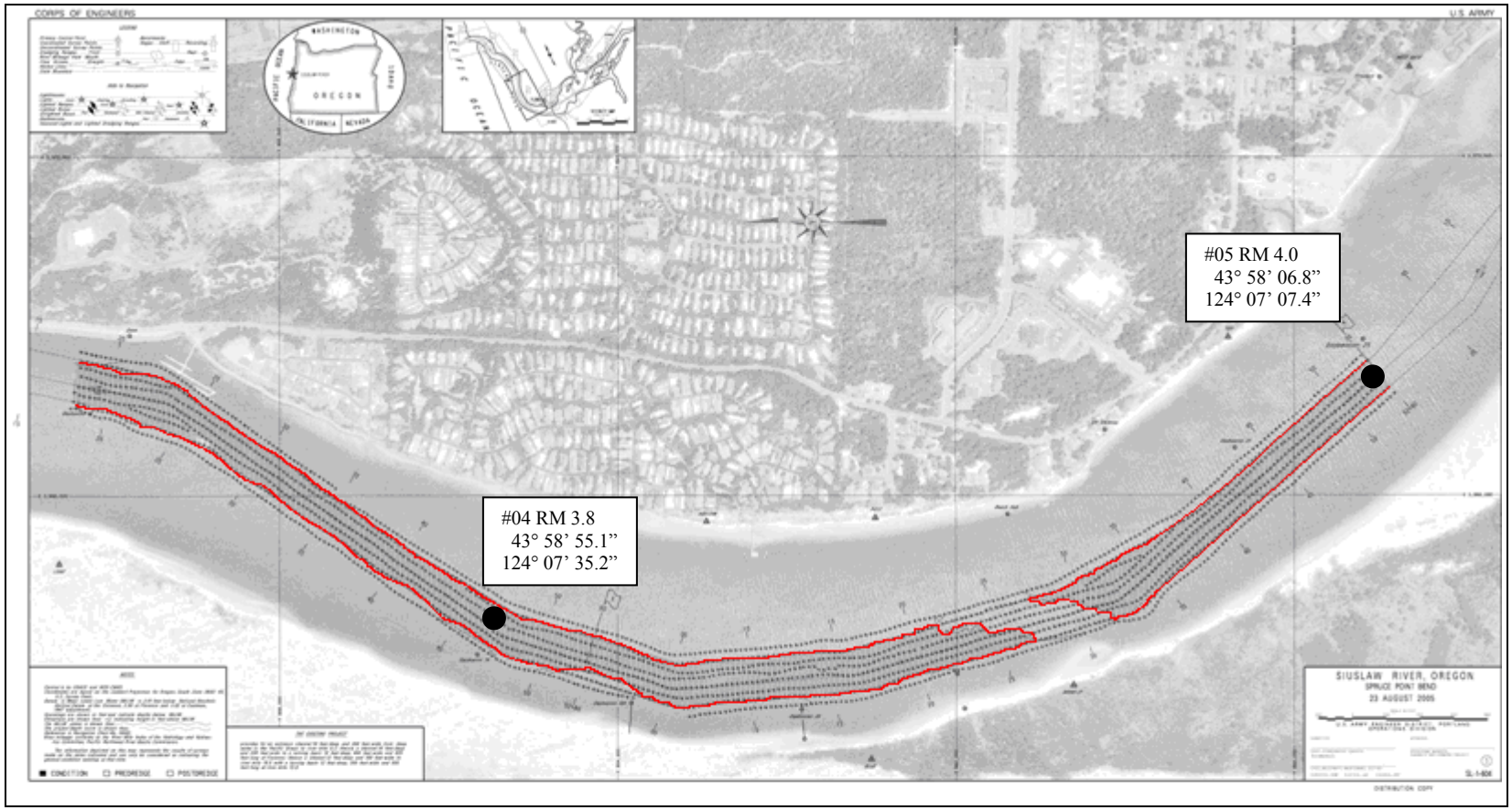
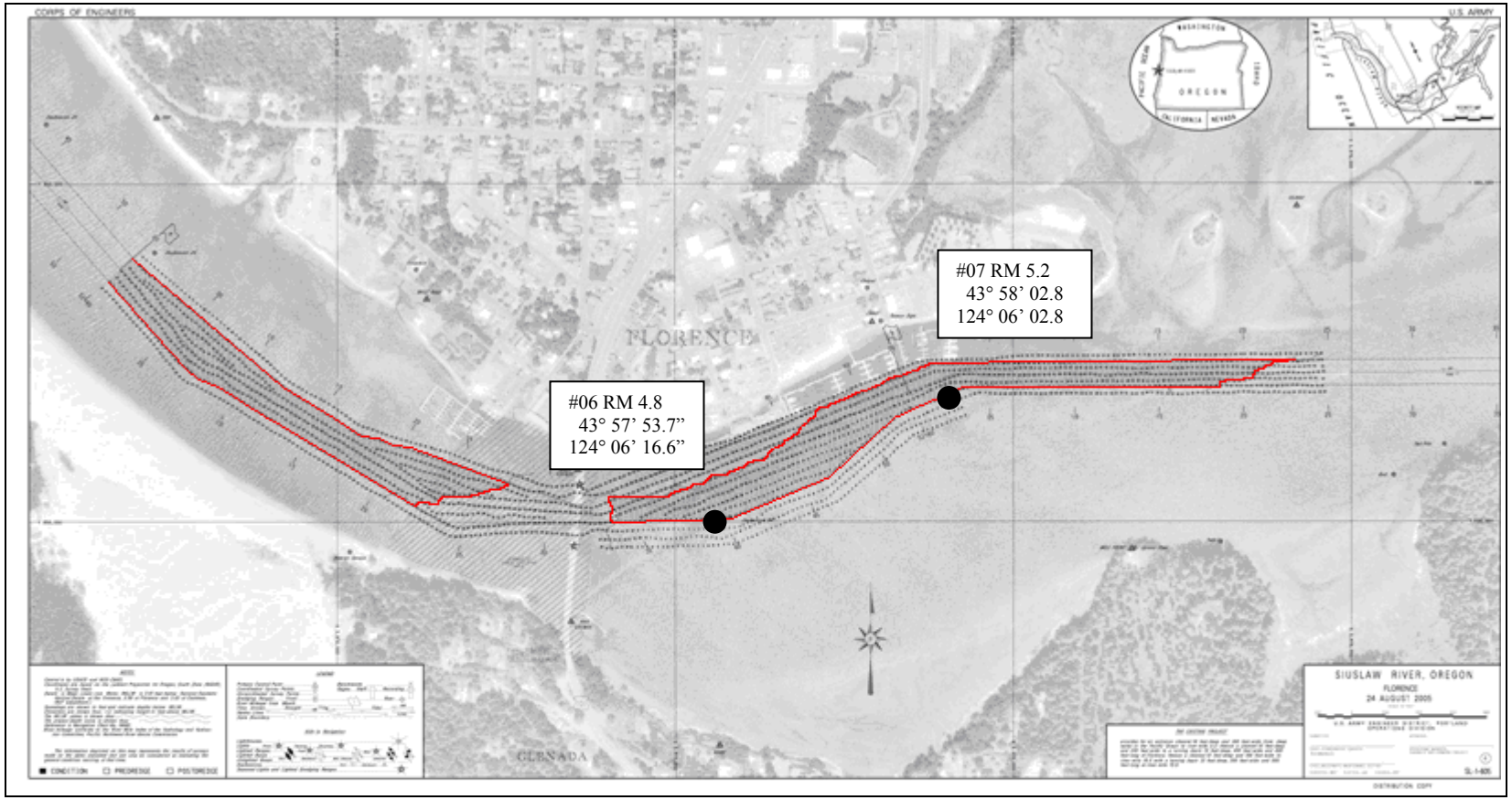


Figure C-5. 2006 Sediment Sampling Locations, Siuslaw River Channel, Florence Reach, 2006



Metals (EPA method 6010/7471)

One sample was submitted for testing and results are presented in Table C-2. Low levels of arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), mercury (Hg) and zinc (Zn) were detected in all samples with no levels approaching their respective SEF marine screening levels; no antimony (Sb) was detected in the sample.

Table C-2. Siuslaw River Project Metals, 2006

Sample I.D.	Metals mg/kg (ppm)									
	As	Cd	Cr	Sb	Cu	Pb	Ni	Ag	Zn	Hg
082906SLFC-BC-07	2.87	0.04	12.6	<0.05	3.02	3.6	7.95	0.016	28.5	0.005
SEF Marine Screening Level	57	5.1	260	150	390	450	--	6.1	410	0.41

Symbol (--) = Screening level not established.
mg/kg = milligrams per kilogram ppm = parts per million

Pesticides (EPA method 8081)

One sample was submitted for testing and results are presented in Table C-3. No pesticides were detected at the method detection limits (MDL) in the sample. The detection level for chlordane was problematic, with a non-detect reported at a level slightly above the SEF marine screening level. The non-detect value is below the SL of 10 ug/kg currently used for decision-making in Puget Sound (where total chlordane is defined as the sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor and oxychlordane). Other than chlordane, all other pesticide values were below method reporting levels and well below SEF marine screening levels.

Table C-3. Siuslaw River Project Pesticides, 2006

Sample I.D.	Pesticides - ug/kg (ppb)								
	Aldrin	Chlordane	Dieldrin	Hepta-chlor	Gamma-BHC (Lindane)	4,4'-DDD	4,4'-DDE	4,4'-DDT	Sum ∑ DDT
082906SLFC-BC-07	<0.26	<4.4	<0.40	<0.36	<0.21	<1.4	<1.0	<0.27	ND
SEF Marine Screening Level	9.5	2.8	1.9	1.5	--	16	9.0	12	--

Symbol (<) = Non-detect (ND) at the value listed (MDL). Symbol (--) = Screening level not established.
ug/kg = micrograms per kilogram ppb = parts per billion

PCBs (EPA method 8082)

One sample was submitted for testing and results are presented in Table C-4. No PCB aroclors were detected at the MDL in the sample.

Table C-4. Siuslaw River Project PCBs, 2006

Sample I.D.	PCB Aroclors - ug/kg (ppb)							
	1016	1221	1232	1242	1248	1254	1260	Sum ∑
082906SLFC-BC-07	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	ND
SEF Marine Screening Level							Total	130
Symbol (<) = Non-detect (ND) at the value listed (MDL). ug/kg = micrograms per kilogram ppb = parts per billion								

Chlorinated Hydrocarbons (EPA method 8270)

One sample was submitted for testing and results are presented in Table C-5. No chlorinated hydrocarbons were detected at the MDL in the sample.

Table C-5. Siuslaw River Project Chlorinated Hydrocarbons, 2006

Sample I.D.	Chlorinated Hydrocarbons - ug/kg (ppb)				
	1,3-Dichloro-benzene	1,4-Dichloro-benzene	1,2-Dichloro-benzene	1,2,4-Trichloro-benzene	Hexachloro-benzene
082906SLFC-BC-07	<2.2	<2.6	<1.8	<2.1	<1.9
SEF Marine Screening Level	170*	110	35	31	22
Symbol (<) = Non-detect (ND) at the value listed (MDL). * DMEF value ug/kg = micrograms per kilogram ppb = parts per billion					

Phthalates (EPA method 8270)

One sample was submitted for testing and results are presented in Table C-6. Di-n-butyl phthalate was detected at a level between the method reporting level (MRL) and the MDL in the sample; this value is considered an estimate by the laboratory. The value was well below the SEF marine screening level.

Table C-6. Siuslaw River Project Phthalates, 2006

Sample I.D.	Phthalates - ug/kg (ppb)					
	Bis(2-ethylhexyl) phthalate	Butyl benzyl phthalate	Diethyl phthalate	Dimethyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate
082906SLFC-BC-07	30J	<2.1	<4.8	<2.4	5.7J	<1.7
SEF Marine Screening Level	1,300	63	200	71	1,400	6,200
J = Estimated value (reported values are above the MDL, but below the MRL). Symbol (<) = Non-detect (ND) at the value listed (MDL). ug/kg = micrograms per kilogram ppb = parts per billion						

Miscellaneous Extractables (EPA method 8270)

One sample was submitted for testing and results are presented in Table C-7. No miscellaneous extractables were detected at the MDL in the sample.

Table C-7. Siuslaw River Project Miscellaneous Extractables, 2006

Sample I.D.	Miscellaneous Extractables - ug/kg (ppb)					
	Benzyl alcohol	Benzoic Acid	Dibenzo-furan	Hexachloro-ethane	Hexachloro-butadiene	N-Nitroso diphenylamine
082906SLFC-BC-07	<5.0	<130	<1.8	<3.0	<1.9	<3.0
SEF Marine Screening Level	57	650	540	1400*	11	28

J = Estimated value (reported values are above the MDL, but below the MRL).
Symbol (<) = Non-detect (ND) at the value listed (MDL). * DMEF value
ug/kg = micrograms per kilogram ppb = parts per billion

Phenols (EPA method 8270)

One sample was submitted for testing and results are presented in Table C-8. Phenol was detected at a level between the MRL and the MDL; this value is considered an estimate by the laboratory. The value was well below the SEF marine screening levels.

Table C-8. Siuslaw River Project Phenols, 2006

Sample I.D.	Phenols - ug/kg (ppb)				
	2,4-Dimethyl phenol	2-Methyl phenol	4-Methyl phenol	Pentachloro phenol	Phenol
082906SLFC-BC-07	<7.5	<4.6	<4.0	<12	14J
SEF Marine Screening Level	29	63	670	400	420

J = Estimated value (reported values are above the MDL, but below the MRL).
Symbol (<) = Non-detect (ND) at the value listed (MDL).
ug/kg = micrograms per kilogram ppb = parts per billion

PAHs, Low Molecular Weight (EPA method 8270C)

One sample was submitted for testing and the results are presented in Table C-9. No low molecular weight PAHs were detected at the MDL in the sample.

Table C-9. Siuslaw River Project PAHs, Low Molecular Weight, 2006

Sample I.D.	Low Molecular Weight PAHs - ug/kg (ppb)							
	Ace-naphthene	Ace-naphthylene	Anthra-cene	Fluorene	2-Methyl naphthalene	Naphtha-lene	Phen-anthrene	Total Low PAHs
082906SLFC-BC-07	<1.4	<1.9	<1.9	<2.3	<1.7	<1.8	<1.8	ND
SEF Marine Screening Level	500	560	960	540	670	2100	1500	5200

J = Estimated value (reported values are above the MDL, but below the PQL).
Symbol (<) = Non-detect (ND) at the value listed (MDL).
ug/kg = micrograms per kilogram ppb = parts per billion

PAHs, High Molecular Weight (EPA method 8270C)

One sample was submitted for testing and results are presented in Table C-10. No high molecular weight PAHs were detected at the MDL in the sample.

Table C-10. Siuslaw River Project PAHs, High Molecular Weight, 2006

Sample I.D.	High Molecular Weight PAHs - ug/kg (ppb)									
	Benz(a)-anthracene	Benzo-fluro-anthenes	Benzo-(g,h,i)-perylene	Chrysene	Pyrene	Benzo(a)-pyrene	Indeno-(1,2,3-cd)-pyrene	Dibenz-(a,h) anthracene	Fluor-anthene	Total High PAHs
082906SLFC-BC-07	<1.9	<3.4	<3.1	<1.9	<1.8	<2.2	<2.6	<3.0	<3.0	ND
SEF Marine Screening Level	1300	3200	670	1400	2600	1600	600	230	1700	12000

J = Estimated value (reported values are above the MDL, but below the PQL).
Symbol (<) = Non-detect (ND) at the value listed (MDL).
ug/kg = micrograms per kilogram ppb = parts per billion

Tributyltin (Krone method for total/bulk organotin)

In the SEF 2009, TBT is a chemical of special occurrence. Two samples were submitted for testing and results are presented in Table C-11. Pore-water TBT was not analyzed due to insufficient pore-water volume in the samples, a result of the high sand content. Total/bulk TBT was run on the sample from the turning basin (sample 06) and the sample collected by the refueling dock (sample 07). Organotin was detected as dibutyltin (0.11 ug/kg) in sample 07 at a level between the MRL and the MDL; this value is considered an estimate by the laboratory and was also present in the method blank analysis (0.091 ug/kg). The SEF lacks a bulk marine screening value for comparison. Bulk TBT was extremely low and well below any historic bulk screening values.

Table C-11. Siuslaw River Project Organotin, 2006

Sample I.D.	Organotin - ug/kg (ppb)			
	Monobutyltin	Dibutyltin	Tributyltin	Tetrabutyltin
082906SLFC-BC-06	<0.26	<0.037	<0.074	<0.092
082906SLFC-BC-07	<0.21	0.11JB	<0.076	<0.095
SEF Screening Level*			73*	

*The SEF lacks a total TBT screening level for marine sediments - 73 ug/kg was the accepted historic bulk screening level for TBT. The SEF 2006 established 75 ug/kg for freshwater sediments.

Symbol (<) = Non-detect (ND) at the value listed (MDL).
J = Estimated value (reported values are above the MDL, but below the PQL).
B = Detected in the method blank at 0.091 ug/kg.
ug/kg = micrograms per kilogram ppb = parts per billion

Summary of the 2006 Sediment Evaluations for the Siuslaw River

Sediments collected for analysis in August 2006 from the Siuslaw River entrance to RM 6 are considered representative of the material most frequently dredged including any advanced maintenance or overdepth material. Grain-size ranged from 98.5% to 95.4% (mean 97.1%) and is classified as poorly graded sand with a volatile solids content ranging from 0.69% to 2.24% (mean

1.14 %). One sample in 2006 was selected for chemical analysis which included TOC, metals, pesticides, PCBs, chlorinated hydrocarbons, phthalates, miscellaneous extractables, phenols and PAHs; two samples were submitted for TBT (total) analysis. The data from samples collected during the August 2006 sampling event are consistent with historical sampling results and are representative of sediments found in the Siuslaw River and estuary. As shown, the sediments meet the guidelines established in the SEF 2009 for unconfined in-water placement without further characterization. All COC's, with the exception of chlordane, were found to be below marine SL's. The detection level for chlordane was problematic, with a non-detect reported at a level slightly above the SEF marine screening level (see previous discussion). The chemical of special occurrence, porewater TBT, could not be collected in the sandy sampling areas, however, bulk TBT was measured and found to be extremely low, and well below any historic bulk screening numbers.

In addition to the August 2006 sampling event described in detail above, sediments were collected in October 2006 from the Port of Siuslaw marina and from the upper river channel (RM 5 to 16.5). These samples are considered representative of the material from these areas, though dredging above RM 5 is very infrequent. Sediment from the Port's marina ranged in grain-size from 47.3% to 79.4% sand (mean 75.9%), while sediment from the upper river channel ranged from 93.6% to 97.0% sand (mean 95.4%). Sixteen samples were submitted for physical testing and eight samples (two upstream and six marina) were subjected to chemical analysis, including metals, PCB's, pesticides, chlorinated hydrocarbons, miscellaneous extractables, phthalates, phenols, and low and high molecular weight PAH's. The six marina samples were tested for bulk and porewater TBT. Some samples contained low levels of several COC's, however, none approached their DMEF/SEF screening levels, with all laboratory detection levels and quality controls at acceptable levels.

SIUSLAW RIVER ODMDS

Historic Disposal Volumes

Table C-12 shows the available records for volumes of material placed offshore of the Siuslaw River at historic disposal sites and the year placement occurred. An Interim ODMDS or areas in the same vicinity have been used by Portland District since 1929, when hopper dredges began to work the bar and entrance channels. The site was designated an EPA Interim site in 40 CFR 228.12. Since 1996, material removed from the Siuslaw federal channel by hopper dredge has been deposited at the Siuslaw River Section 103 Sites B and C. The frequency of maintenance dredging depends upon the volume of sediments transported into the estuary, storm frequency, and severity of storm conditions. Material is removed generally from the shoal areas by hopper dredge from June through October.

Table C-12. Siuslaw River Project Dredging Volumes and Disposal Site

Fiscal Year	Dredging Volumes (x 1,000 cy)
1929-1977	2,800.0
1977	139.3*
1978	191.4*
1979	246.6*
1980	94.2*
1981	388.4*
1982	193.4*
1983	213.3*
1984	221.1*
1985	271.2*
1986	218.8 *
1987	215.8 *
1988	114.5 *
1989	116.8 *
1990	99.0 *
1991	65.9 *
1992	194.2 *
1993	239.6 *
1994	223.3 *
1995	121.6 *
1996	84.8 *
1997	40.0 (Site C)
1998	69.6 (Site C)
1999	43.5 (Site B)
2000	55.1 (Site C)
2001	101.2 (Site C)
2002	117.3 (Site B)
2003	55.0 (Site B)
2004	14.1 (Site B) & 9.0 (Site C)
2005	33.4 (Site B)
2006	22.3 (Site B)
2007	76.0 (Site B)
2008	69.9 (Site B)
2009	91.7 (Site B)

* Dredged material from 1977 to 1996 was placed in the EPA-designated Interim ODMDS (Site A).

Baseline Analysis Results

Three sediment sampling surveys were conducted at the Siuslaw Interim ODMDS Site A in September 1984, January 1985, and September 1988. Fourteen stations were sampled in September 1984 and January 1985, and eleven stations were sampled in September 1988. Figures C-6 and C-7 show sample station locations in relation to the disposal site. In general, all of the sample stations adjacent to the disposal site (S-1-1 through S-1-4 and S-3-1 through S-3-4) had smaller mean grain size than the sample stations within the disposal site (see Table C-13). For the

most part, the change is inconsequential. The eight external stations had a mean grain size of less than 0.12 mm, with respect to mean grain size of the four sample stations within the interim disposal site. The difference between the external and internal stations is equivalent to the difference of fine and medium sand. The fine sand is located adjacent to the interim disposal site and the medium sand is located within the interim disposal site. Within the interim disposal site, the change in the mean grain size was less (0.07 mm). Immediately adjacent to the disposal site, the change was usually less than 0.04 mm. It appears from samples SR-2, SR-3 and SR-4 that the mean grain size of the sediment increases at greater distances from the disposal site. These samples may also represent an increase in sediment size with depth.

Table C-13. Siuslaw River Interim Ocean Disposal Site Sediment Samples, 1984-1985

Station	Mean (mm)			Median (mm)			% Fines		
	Sep 1988	Jan 1985	Sep 1984	Sep 1988	Jan 1985	Sep 1984	Sep 1988	Jan 1985	Sep 1984
SR-1	0.24	0.18	0.19	0.21	0.17	0.18	0	1	1
SR-2	0.28	0.25	0.19	0.31	0.25	0.18	0	0	1
SR-3	0.29	--	--	0.29	--	--	0	--	--
SR-4	0.29	--	--	0.28	--	--	0	--	--
SD-1	0.19	--	--	0.18	--	--	0	--	--
S-1-1	0.23	0.17	0.18	0.2	0.17	0.17	0	1	1
S-1-2	0.26	0.18	0.17	0.18	0.16	0.17	3	1	1
S-1-3	0.22	0.16	0.17	0.2	0.16	0.17	0	2	1
S-1-4	0.23	0.19	0.17	0.2	0.18	0.18	0	1	1
S-2-1	0.17	0.26	0.22	0.17	0.25	0.26	0	0	0
S-2-2	0.23	0.21	0.22	0.2	0.21	0.27	0	0	0
S-2-3	0.27	0.2	0.22	0.25	0.2	0.25	0	0	0
S-2-4	0.26	0.22	0.22	0.22	0.21	0.25	0	0	0
S-3-1	--	0.17	0.19	--	0.17	0.17	--	0	1
S-3-2	--	0.16	0.18	--	0.16	0.16	--	1	0
S-3-3	--	0.21	0.18	--	0.17	0.16	--	1	1
S-3-4	--	0.17	0.24	--	0.19	0.24	--	1	1

Note: Shaded stations are within Interim Site A.

Figure C-6. Siuslaw River Interim Ocean Disposal Site Sampling Locations, 1984-1985

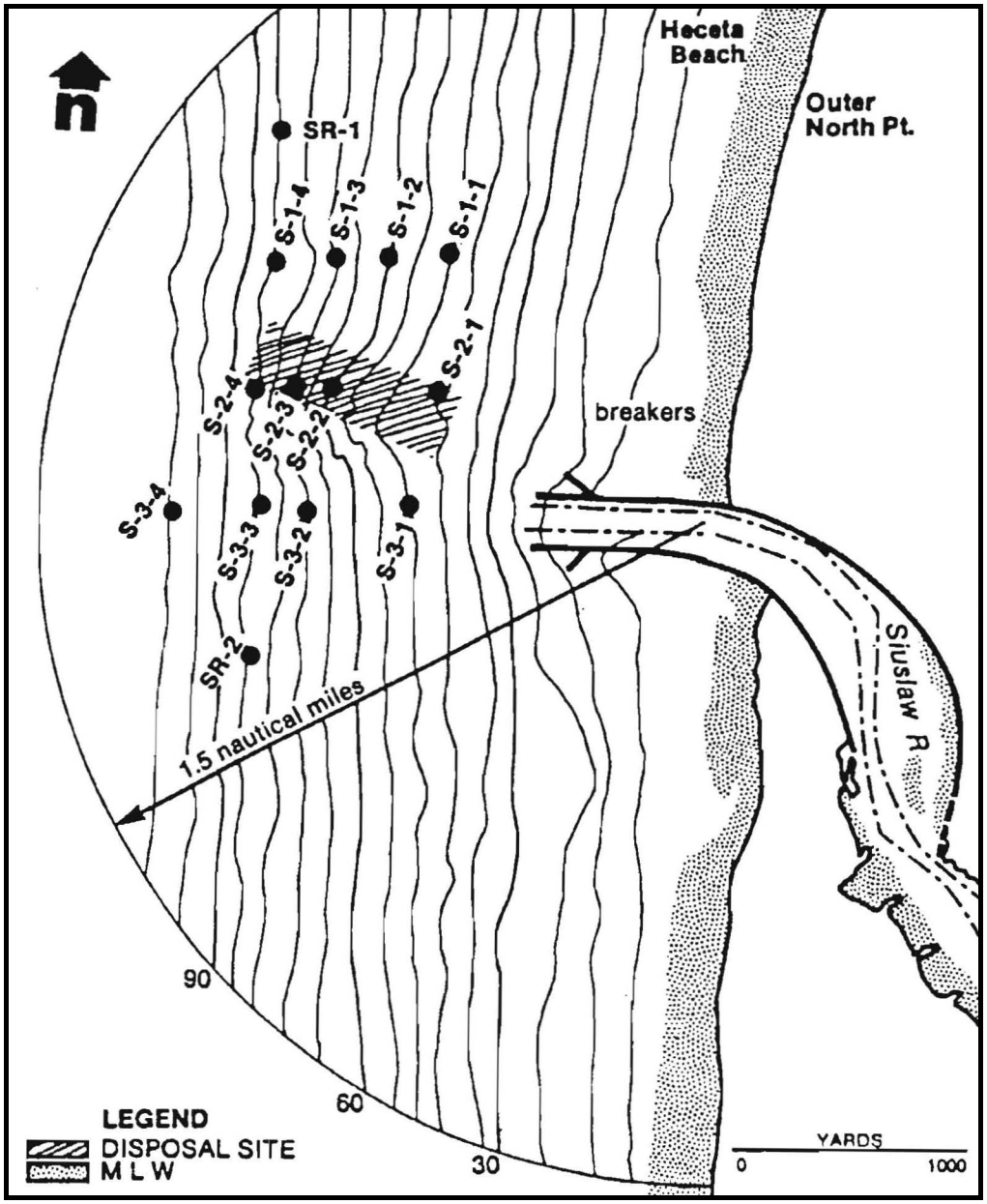
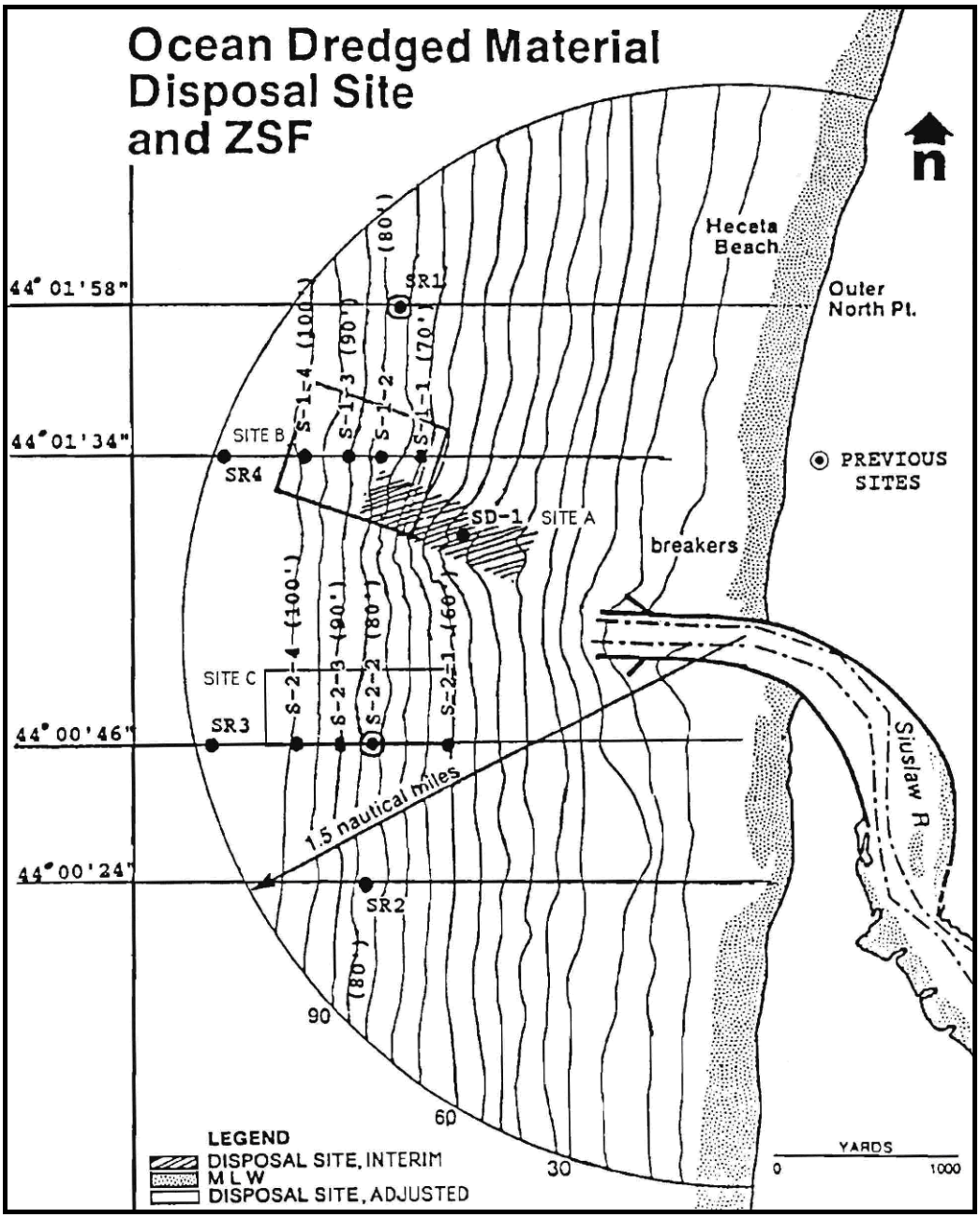


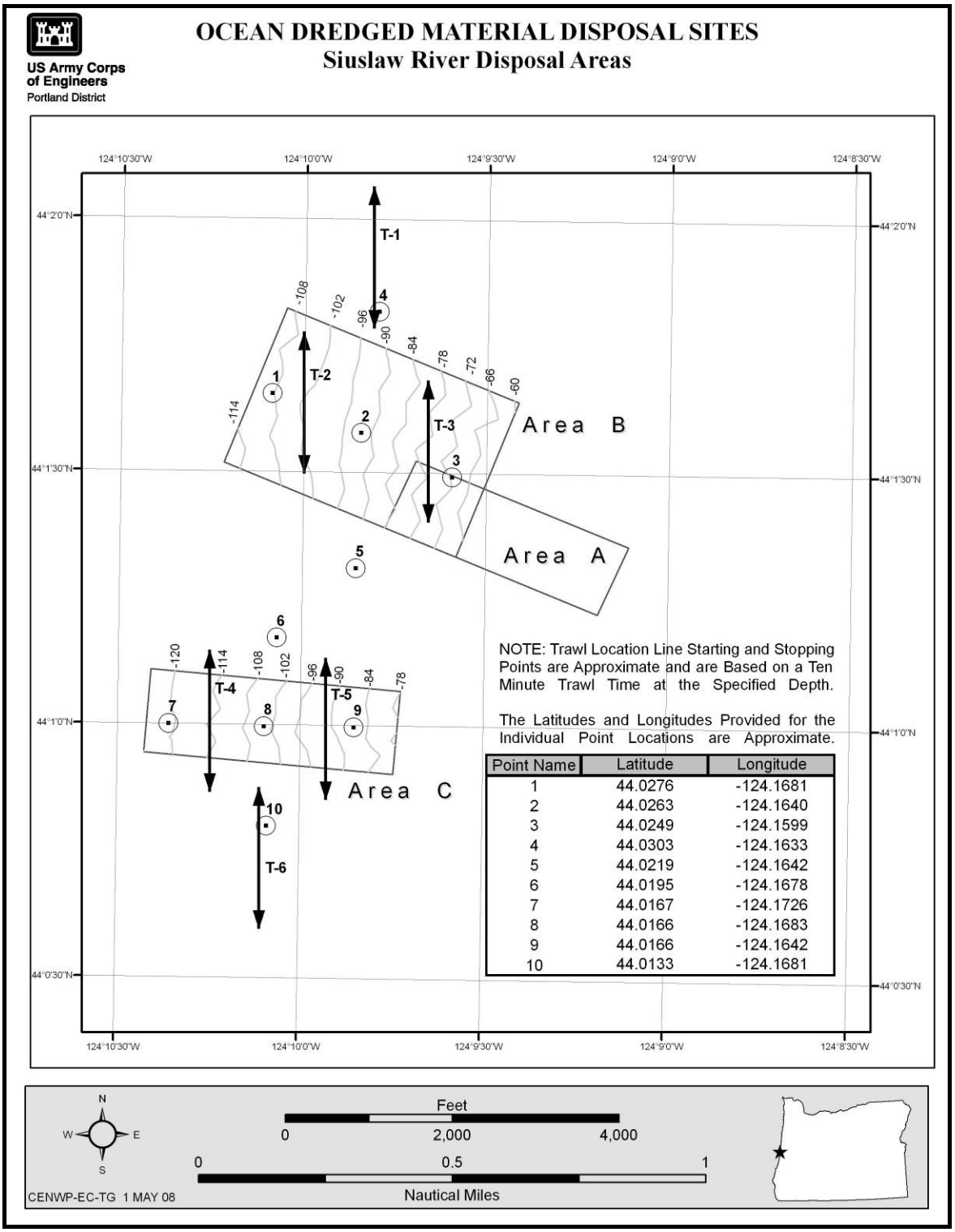
Figure C-7. Siuslaw River Interim Ocean Disposal Site Sampling Locations, 1988



DETAILED 2008 ODMDS SEDIMENT QUALITY RESULTS

In August 2008, ten surface-grab sediment samples were collected at ODMDS B and C (proposed North and South ODMDS) with a 0.96 m^2 modified Gray-O'Hara box core sampler (Figure C-8). Three samples (01, 02 and 03) were collected from east to west on the centerline of Site B. Three samples (07, 08 and 09) were collected from east to west on the centerline of Site C. Four reference samples were collected north, south, and between Sites B and C (04, 05, 06, and 10). All samples were subjected to physical and chemical analysis.

Figure C-8. Siuslaw River ODMDS B and C Sampling Locations, 2008



Note: Dredged material from 1977 to 1996 was placed in the EPA-designated Interim ODMDS (Area A).

Physical Analysis (ASTM methods) and TOC (EPA method 9060)

Ten samples were submitted for testing and results are presented in Table C-14. The mean value for a grain-size of sand or greater (note that sample 01 was 88.0% sand-sized material) was 97.25% with a mean value of 3.71% fine-grained material (less than 230 sieve); mean value for TOC was 0.107%.

Table C-14. Siuslaw River ODMDS Physical Analysis and TOC, 2008

Sample I.D.	Grain Size Percent (%)			
	Gravel Size	Sand	Silt/Clay	TOC
J-08-S-ODMDS-01	0.0	88.0	22.0	0.40
J-08-S-ODMDS-02	0.0	98.6	1.4	0.05
J-08-S-ODMDS-03	0.0	97.8	2.2	0.08
J-08-S-ODMDS-04	0.0	97.3	2.7	0.08
J-08-S-ODMDS-05	0.4	97.2	2.4	0.14
J-08-S-ODMDS-06	0.0	99.2	0.8	0.07
J-08-S-ODMDS-07	0.0	98.7	1.3	0.06
J-08-S-ODMDS-08	0.0	98.3	1.7	0.07
J-08-S-ODMDS-09	0.0	98.4	1.6	0.07
J-08-S-ODMDS-10	0.0	99.0	1.0	0.05
Mean	0.0	97.25	3.71	0.107

Note: Shaded stations are within Sites B and C.

Metals (EPA method 6010/7471)

Ten samples were submitted for testing, with data presented in Table C-15. Sediments were analyzed for ten metals. No detected metal values approached their respective SEF marine screening levels.

Table C-15. Siuslaw River ODMDS Metals, 2008

Sample I.D.	Metals - mg/kg (ppm)									
	Sb	As	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Hg
J-08-S-ODMDS-01	<0.02	2.36	0.03	9.87	1.74	1.57	6.89	0.02	11.1	0.005
J-08-S-ODMDS-02	<0.02	2.04	0.02	5.50	0.90	1.27	3.90	0.01	7.00	<0.002
J-08-S-ODMDS-03	<0.02	2.29	0.01	7.78	1.23	1.34	5.44	0.01	9.10	0.003
J-08-S-ODMDS-04	<0.02	2.21	0.01	8.49	1.32	1.39	5.54	<0.01	9.40	0.003
J-08-S-ODMDS-05	<0.02	2.58	0.01	9.65	1.57	2.04	7.28	0.02	12.20	0.005
J-08-S-ODMDS-06	<0.02	2.45	0.01	8.00	1.18	1.36	6.01	<0.01	9.20	0.004
J-08-S-ODMDS-07	<0.02	2.25	0.01	6.65	1.15	1.24	5.04	0.01	8.20	0.002
J-08-S-ODMDS-08	<0.02	2.28	0.01	7.23	1.09	1.35	4.80	<0.01	8.20	0.004
J-08-S-ODMDS-09	<0.02	2.29	0.02	9.83	1.27	1.48	6.22	0.01	9.40	0.003
J-08-S-ODMDS-10	<0.02	2.03	0.01	5.37	0.90	1.02	3.99	<0.01	7.10	<0.002
SEF Marine Screening Levels	150	57	5.1	260	390	450	---	6.1	410	0.41

Symbol (<) = Non-detect (ND) at the value listed (MDL).
--- = No established screening level. mg/kg = milligrams per kilogram ppm = parts per million

Pesticides/PCBs (EPA method 8081/8082)

Ten samples were submitted for testing and results are presented in Tables C-16 and C-17. Chlordane was reported as technical chlordane in one sample (01), and alpha and gamma chlordane in three samples (01, 02, 06). Detection levels for technical chlordane were problematic, with non-detects reported at levels above the SEF marine screening level. These values were not supported by the values found for alpha and gamma chlordane where levels separately and additively were well below the SEF marine SL. In addition, the estimated and non-detect values are all below the SL of 10 ug/kg currently used for decision-making in Puget Sound (where total chlordane is defined as the sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor and oxychlordane). Other than chlordane, all other pesticide values were below method reporting levels and well below SEF marine screening levels. No PCBs were detected.

Table C-16. Siuslaw River ODMDS Pesticides, 2008

Sample I.D.	Pesticides ug/kg (ppb)									
	Aldrin	Chlordane			Diel-drin	Hepta-chlor	Gamma-BHC Lindane	4,4'-DDD	4,4'-DDE	4,4'-DDT
		Technical	Alpha	Gamma						
J-08-S-ODMDS-01	<1.1	9.8JT	0.79J	0.8J	<0.3	<0.081	<0.16	<1.1	<0.11	<0.065
J-08-S-ODMDS-02	<0.15	---	0.45J	0.65J	<0.29	<0.08	<0.99	<0.99	<0.1	<0.064
J-08-S-ODMDS-03	<0.15	<8.1	<0.23	<0.064	<0.064	<0.08	<0.98	<0.12	<0.1	<0.064
J-08-S-ODMDS-04	<0.15	<8.1	<0.23	<0.064	<0.29	<0.08	<0.15	<0.12	<0.1	<0.064
J-08-S-ODMDS-05	<0.15	<8.1	<0.23	<0.064	<0.29	<0.08	<0.15	<0.12	<0.1	<0.064
J-08-S-ODMDS-06	<0.15	<8.1	0.37J	0.55J	<0.29	<0.08	<0.15	<1.0	<0.1	<0.064
J-08-S-ODMDS-07	<0.15	<8.1	<0.23	<0.064	<0.29	<0.08	<0.15	<0.12	<0.1	<0.064
J-08-S-ODMDS-08	<0.15	<8.1	<0.23	<0.064	<0.29	<0.08	<0.15	<0.12	<0.1	<0.064
J-08-S-ODMDS-09	<0.15	<8.1	<0.23	<0.064	<0.29	<0.08	<0.15	<0.12	<0.1	<0.064
J-08-S-ODMDS-10	<0.15	<8.1	<0.23	<0.064	<0.29	<0.08	<0.15	<0.12	<0.1	<1.0
SEF Marine Screening Levels	9.5	2.8	2.8		1.9	1.5	--	16	9	12

Symbol (<) = Non-detect (ND) at the value listed (MDL).
JT =The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
ug/kg = micrograms per kilogram ppb = parts per billion

Table C-17. Siuslaw River ODMDS PCBs, 2008

Sample I.D.	PCB Aroclors ug/kg – (ppb)						
	1016	1221	1232	1242	1248	1254	1260
J-08-S-ODMDS-01	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
J-08-S-ODMDS-02	<2.0	<12.0	<1.9	<2.7	<1.7	<1.7	<1.7
J-08-S-ODMDS-03	<1.7	<1.7	<1.7	<1.7	<1.7	<9.8	<1.7
J-08-S-ODMDS-04	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7
J-08-S-ODMDS-05	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7
J-08-S-ODMDS-06	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7
J-08-S-ODMDS-07	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7
J-08-S-ODMDS-08	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7
J-08-S-ODMDS-09	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7
J-08-S-ODMDS-10	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7

SEF Marine Screening level = 130 ppb sum of PCB Aroclors.
Symbol (<) = Non-detect (ND) at the value listed (MDL).
ug/kg = micrograms per kilogram ppb = parts per billion

Chlorinated Hydrocarbons, Phthalates, Phenols, and Miscellaneous Extractables (EPA method 8270)

Ten samples were submitted for testing and results are presented in Tables C-18 to C-21. No chlorinated hydrocarbons were detected. Several phthalates, miscellaneous extractables, and phenols were detected at very low levels; all were below their respective SEF marine screening levels.

Table C-18. Siuslaw River ODMDS Chlorinated Hydrocarbons, 2008

Sample I.D.	Chlorinated Hydrocarbons - ug/kg (ppb)			
	1,4-Dichloro-benzene	1,2-Dichloro-benzene	1,2,4-Trichloro-benzene	Hexachloro-benzene
J-08-S-ODMDS-01	<15.0	<15.0	<13.0	<0.08
J-08-S-ODMDS-02	<2.9	<2.9	<2.6	0.35J
J-08-S-ODMDS-03	<2.9	<2.9	<2.6	<0.079
J-08-S-ODMDS-04	<2.9	<2.9	<2.6	<0.079
J-08-S-ODMDS-05	<15.0	<15.0	<13.0	<0.079
J-08-S-ODMDS-06	<2.9	<2.9	<2.6	<0.079
J-08-S-ODMDS-07	<2.9	<2.9	<2.6	<0.079
J-08-S-ODMDS-08	<2.9	<2.9	<2.6	<0.15
J-08-S-ODMDS-09	<2.9	<2.9	<2.6	<0.13
J-08-S-ODMDS-10	<2.9	<2.9	<2.6	0.37J
SEF Marine Screening Levels	110	35	31	22

Symbol (<) = Non-detect (ND) at the value listed (MDL)
ug/kg = micrograms per kilogram ppb = parts per billion

Table C-19. Siuslaw River ODMDS Phthalates, 2008

Sample I.D.	Phthalates ug/kg – (ppb)					
	Dimethyl-phthalate	Diethyl-phthalate	Di-n-butyl-phthalate	Butyl benzyl phthalate	Bis(2-ethylhexyl)-phthalate	Di-n-octyl-phthalate
J-08-S-ODMDS-01	<5.0	<6.5	<40.0	<16.0	<35.0	<8.5
J-08-S-ODMDS-02	<1.0	1.5 J	9.1 J	3.9 J	<7.0	<1.7
J-08-S-ODMDS-03	<1.0	1.8 J	17.0	3.5 J	7.4 J	<1.7
J-08-S-ODMDS-04	<1.0	1.8 J	11.0 J	3.9 J	9.9 J	<1.7
J-08-S-ODMDS-05	<5.0	<6.5	<40.0	<16.0	<35.0	<8.5
J-08-S-ODMDS-06	<1.0	1.9 J	12.0 J	4.1 J	9.3 J	<1.7
J-08-S-ODMDS-07	<1.0	1.9 J	11.0 J	<3.2	<7.0	<1.7
J-08-S-ODMDS-08	<1.0	1.5 J	10.0 J	<3.2	7.1 J	<1.7
J-08-S-ODMDS-09	<1.0	1.8 J	12.0 J	5.5 J	13.0 J	<1.7
J-08-S-ODMDS-10	<1.0	5.7 J	10.0 J	<3.2	7.3 J	<1.7
SEF Marine Screening Levels	71	200	1400	63	1300	6200

Symbol (<) = Non-detect (ND) at the value listed (MRL).
JT =The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
ug/kg = micrograms per kilogram ppb = parts per billion

Table C-20. Siuslaw River ODMDS Phenols, 2008

Sample I.D.	Phenols - ug/kg (ppb)				
	Phenol	2-Methyl-phenol	4-Methyl-phenol	2,4-Dimethyl-phenol	Pentachloro phenol
J-08-S-ODMDS-01	<10.0	<7.5	16.0 J	<28.0	<100.0
J-08-S-ODMDS-02	<2.0	<1.5	<1.5	<5.5	<20.0
J-08-S-ODMDS-03	2.1 J	<1.5	<1.5	<5.5	<20.0
J-08-S-ODMDS-04	<2.0	<1.5	<1.5	<5.5	<20.0
J-08-S-ODMDS-05	<10.0	<7.5	15.0 J	<28.0	<100.0
J-08-S-ODMDS-06	<2.0	<1.5	<1.5	<5.5	<20.0
J-08-S-ODMDS-07	<2.0	<1.5	<1.5	<5.5	<20.0
J-08-S-ODMDS-08	<2.0	<1.5	<1.5	<5.5	<20.0
J-08-S-ODMDS-09	<2.0	<1.5	<1.5	<5.5	<20.0
J-08-S-ODMDS-10	<2.0	<1.5	<1.5	<5.5	<20.0
SEF Marine Screening Levels	420	63	670	29	400

Symbol (<) = Non-detect (ND) at the value listed (MDL).
JT =The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
ug/kg = micrograms per kilogram ppb = parts per billion

Table C-21. Siuslaw River ODMDS Miscellaneous Extractables, 2008

Sample I.D.	Miscellaneous Extractables - ug/kg (ppb)				
	Benzyl alcohol	Benzoic Acid	Dibenzo-furan	Hexachloro-butadiene	N-Nitroso diphenylamine
J-08-S-ODMDS-01	<11.0	<480.0	<6.0		<8.0
J-08-S-ODMDS-02	<2.1	<96.0	<1.2	<2.5	<1.6
J-08-S-ODMDS-03	<2.1	<96.0	<1.2		<1.6
J-08-S-ODMDS-04	<2.1	<96.0	<1.2		<1.6
J-08-S-ODMDS-05	<11.0	<480.0	<6.0		<8.0
J-08-S-ODMDS-06	<2.1	<96.0	<1.2		<1.6
J-08-S-ODMDS-07	<2.1	<96.0	<1.2		<1.6
J-08-S-ODMDS-08	<2.1	<96.0	<1.2		<1.6
J-08-S-ODMDS-09	<2.1	<96.0	<1.2		<1.6
J-08-S-ODMDS-10	<2.1	<96.0	<1.2		<8.0
SEF Marine Screening Levels	57	650	540	11	28

Symbol (<) = Non-detect (ND) at the value listed (MDL).
JT =The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
ug/kg = micrograms per kilogram ppb = parts per billion

PAHs (EPA method 8270C)

Ten samples were submitted for testing and results are presented in Tables C-22 and C-23. Various "low molecular weight" and "high molecular weight" PAHs were detected, but at very low levels and well below their respective SEF marine screening levels.

Table C-22. Siuslaw River ODMDS Low Molecular Weight PAHs, 2008

Sample I.D.	PAHs - Low Molecular Weight - ug/kg							
	Acena-phthene	Acena-phthylene	Anthra-cene	Fluo-rene	2-Methyl-naph-thalene	Naph-thalene	Phen-anthrene	Total Low PAHs
J-08-S-ODMDS-01	<7.0	<6.0	<8.0	<5.5	<11.0	<12.0	23.0 J	23.0
J-08-S-ODMDS-02	<1.4	<1.2	<1.6	<1.1	<2.2	2.3 J	<1.4	--
J-08-S-ODMDS-03	<1.4	<1.2	<1.6	<1.1	<2.2	<12.0	1.9 J	1.9
J-08-S-ODMDS-04	<1.4	<1.2	<1.6	<1.1	<2.2	<2.3	1.7 J	1.9
J-08-S-ODMDS-05	<7.0	<6.0	<8.0	<5.5	<11.0	<2.3	<7.0	--
J-08-S-ODMDS-06	<1.4	<1.2	<1.6	<1.1	<2.2	23.0 J	<1.4	23.0
J-08-S-ODMDS-07	<1.4	<1.2	<1.6	<1.1	<2.2	1.9 J	<1.4	1.9
J-08-S-ODMDS-08	<1.4	<1.2	<1.6	<1.1	<2.2	<7.0	1.5 J	1.5
J-08-S-ODMDS-09	<1.4	<1.2	<1.6	<1.1	<2.2	<1.4	<1.4	--
J-08-S-ODMDS-10	<1.4	<1.2	<1.6	<1.1	<2.2	<1.4	<1.4	--
SEF Marine Screening Levels	500	560	960	540	670	2100	1500	5200

Symbol (<) = Non-detect (ND) at the value listed (MDL).
ug/kg = micrograms per kilogram

Table C-23. Siuslaw River ODMDS High Molecular Weight PAHs, 2008

Sample I.D.	PAHs - High Molecular Weight (ug/kg)									
	Benz(a) anthra-cene	Benzo-fluro-anthenes	Benzo-(g,h,i)-perylene	Chrys-ene	Py-rene	Benzo (a) pyrene	Indeno (1,2,3 cd) pyrene	Dibenzo (a,h) anthra-cene	Fluoran-thene	Total High PAHs
J-08-S-ODMDS-01	14.0 J	13.0 J	<7.5	13.0 J	26.0J	14.0 J	7.7 J	<7.5	28.0 J	115.7
J-08-S-ODMDS-02	<1.7	<1.4	<1.5	<1.5	1.6 J	<1.7	<1.5	<1.5	1.7 J	3.3
J-08-S-ODMDS-03	<1.7	<1.4	<1.5	<1.5	1.6 J	<1.7	<1.5	<1.5	2.0 J	3.6
J-08-S-ODMDS-04	<1.7	<1.4	<1.5	<1.5	1.6 J	<1.7	<1.5	<1.5	2.0 J	3.6
J-08-S-ODMDS-05	<8.5	<7.0	<7.5	<7.5	<7.5	<8.5	<7.5	<7.5	<8.0	--
J-08-S-ODMDS-06	<1.7	<1.4	<1.5	<1.5	<1.5	<1.7	<1.5	<1.5	1.6 J	1.6
C J-08-S-ODMDS-07	<1.7	<1.4	<1.5	<1.5	<1.5	<1.7	<1.5	<1.5	<1.6	--
J-08-S-ODMDS-08	<1.7	<1.4	<1.5	<1.5	<1.5	<1.7	<1.5	<1.5	1.8 J	1.8
J-08-S-ODMDS-09	<1.7	<1.4	<1.5	<1.5	<1.5	<1.7	<1.5	<1.5	1.8 J	1.8
J-08-S-ODMDS-10	<1.7	<1.4	<1.5	<1.5	<1.5	<1.7	<1.5	<1.5	<1.6	--
SEF Marine Screening Levels	1300	3200	670	1400	2600	1600	600	230	1700	12000
Symbol (<) = Non-detect (ND) at the value listed (MDL). ug/kg = micrograms per kilogram										

DISCUSSION AND CONCLUSIONS

The areas of consideration involving sediment quality include:

1. Physical and chemical sediment compatibility.
2. Water column chemistry and physical characteristics.
3. Influence of past disposal.
4. Size and shape of the disposal site.
5. Size of the buffer zone.
6. Degraded areas.
7. Potential for cumulative effects.

The Siuslaw River federal navigation project and ODMDS B and C (which are encompassed by the proposed North and South ODMDS) were sampled in 2006 and 2008, respectively. Physical and chemical analyses were conducted by Columbia Analytical Services in Kelso, Washington. Sampling and analyses were conducted in accordance with the SEF and included testing for metals (10 inorganic), TOC, pesticides, PCBs, phenols, phthalates, miscellaneous extractables, PAHs and TBT.

Sediments collected for analysis in August 2006 from the Siuslaw River entrance to RM 6 are considered representative of the material most frequently dredged including any advanced maintenance or overdepth material. Grain-size ranged from 98.5% to 95.4% (mean 97.1%) and is

classified as poorly graded sand with a volatile solids content ranging from 0.69% to 2.24% (mean 1.14 %). One sample in 2006 was selected for chemical analysis which included TOC, metals, pesticides, PCBs, chlorinated hydrocarbons, phthalates, miscellaneous extractables, phenols and PAHs; two samples were submitted for TBT (total) analysis. The data from samples collected during the August 2006 sampling event are consistent with historical sampling results and are representative of sediments found in the Siuslaw River and estuary. As shown, the sediments meet the guidelines established in the SEF 2009 for unconfined in-water placement without further characterization. All COC's, with the exception of chlordane, were found to be below marine SL's. The detection level for chlordane was problematic, with a non-detect reported at a level slightly above the SEF marine screening level. The chemical of special occurrence, porewater TBT, could not be collected in the sandy sampling areas, however, bulk TBT was measured and found to be extremely low, and well below any historic bulk screening numbers.

Sediments were collected in October 2006 from the Port of Siuslaw marina and from the upper river channel (RM 5 to 16.5). These samples are considered representative of the material from these areas, though dredging above RM 5 is very infrequent. Sediment from the Port's marina ranged in grain-size from 47.3% to 79.4% sand (mean 75.9%), while sediment from the upper river channel ranged from 93.6% to 97.0% sand (mean 95.4%). Sixteen samples were submitted for physical testing and eight samples (two upstream and six marina) were subjected to chemical analysis, including metals, PCB's, pesticides, chlorinated hydrocarbons, miscellaneous extractables, phthalates, phenols, and low and high molecular weight PAH's. The six marina samples were tested for bulk and porewater TBT. Some samples contained low levels of several COC's, however, none approached their DMEF/SEF screening levels, with all laboratory detection levels (including chlordane) and quality controls at acceptable levels.

In 2008, physical and bulk chemical analyses were conducted on sediments from ten locations in and near the ocean disposal sites. These analyses indicate that the sediment is typical of clean marine sands. The sediment quality analyses showed concentrations of chemicals of concern to be below MDLs and below marine screening level guidelines established in the SEF. (NOTE: See discussion on chlordane detection limits). There is no indication that the placement of dredged material from the federal navigation project has caused any chemical contamination at the ocean disposal sites. There does not appear to be any long-term impact based upon the physical and chemical characteristics of the dredged material placed.

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Appendix D

Cultural Resources
Siuslaw River, Oregon

April 2010

Appendix D
Cultural Resources
Siuslaw River, Oregon

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Appendix D
Cultural Resources
Siuslaw River, Oregon

Introduction

This appendix evaluates the cultural resource potential of the Siuslaw River ocean dredged material disposal sites (ODMDS) study area. The study area was set as an arc transcribed 1.5 nautical miles out from the mouth of the Siuslaw River and ends both north and south at the beach (Figure D-1). The proposed action consists of final designation of the proposed North ODMDS and South ODMDS located approximately 1 mile offshore of the entrance to the Siuslaw River. For both sites, the disposal site, placement area, and drop zone are identical. The proposed North ODMDS is 4,800 feet by 2,000 feet with an average depth of 90 feet (depth ranges from approximately 30-115 feet), and has the following coordinates [North American Datum (NAD 83)]:

44° 01' 31.03"N, 124° 10' 12.92"W
44° 01' 49.39"N, 124° 10' 02.85"W
44° 01' 31.97"N, 124° 09' 01.86"W
44° 01' 13.45"N, 124° 09' 11.41"W

The proposed South ODMDS is 3,000 feet by 2,000 feet with an average depth of 100 feet (depth ranges from approximately 80-125 feet), and has the following coordinates (NAD 83):

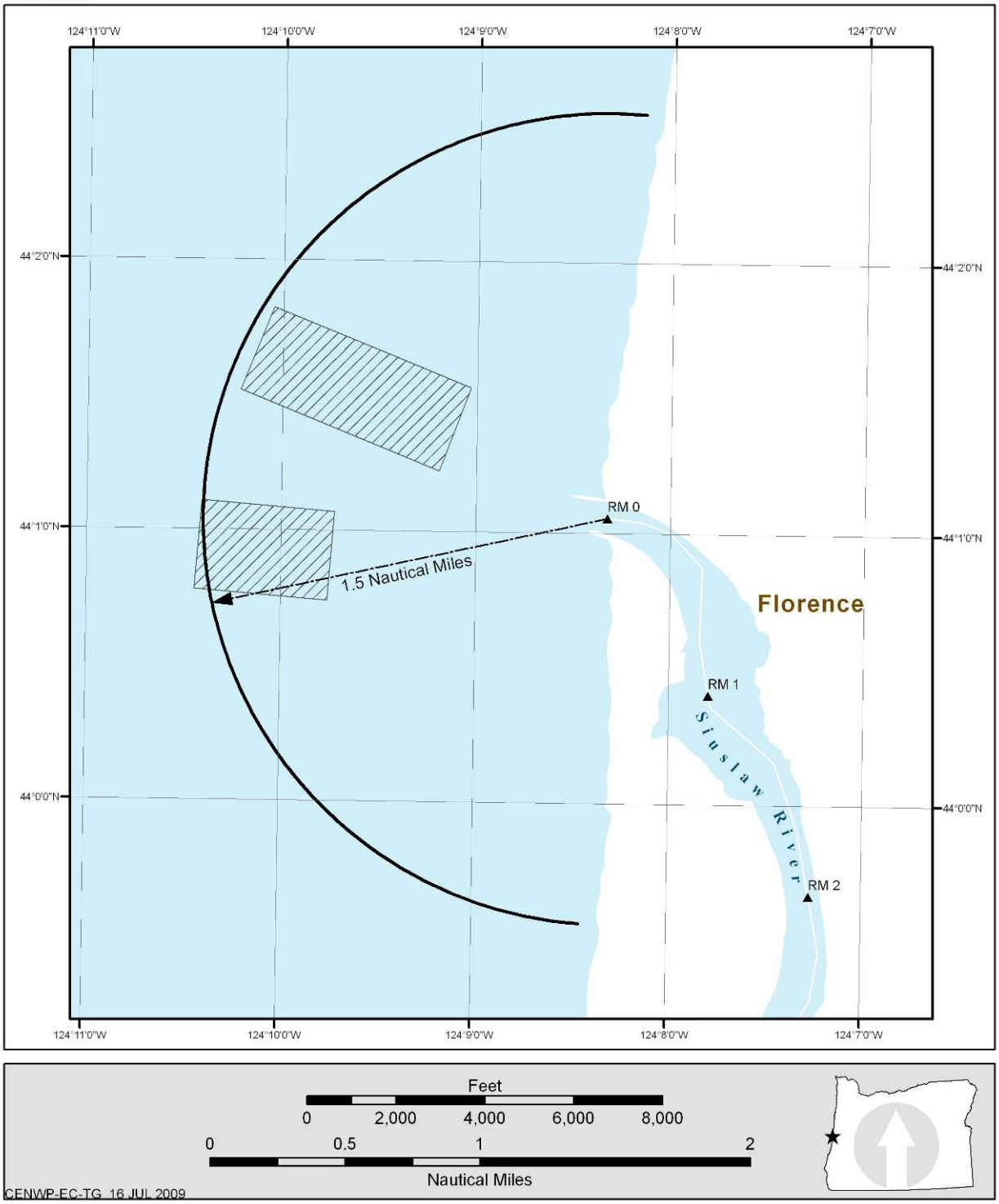
44° 00' 46.72"N, 124° 10' 26.55"W
44° 01' 06.41"N, 124° 10' 24.45"W
44° 01' 04.12"N, 124° 09' 43.52"W
44° 00' 44.45"N, 124° 09' 45.63"W

Prehistoric Potential

Two archeological surveys have been conducted within the lower estuary of the Siuslaw River. These surveys were project specific; one survey was conducted for upland disposal sites along the Siuslaw River and the other survey was conducted for highway improvements along the northern bank of the Siuslaw River. Neither survey resulted in the location of prehistoric or historic cultural resources (Oregon State Historic Preservation Office site files in USACE 1992).

An unconfirmed but substantial prehistoric occupation is most likely present near the estuary of the Siuslaw River. This potential is based on an archeological investigation conducted immediately to the south of the Siuslaw River. South of the estuary along the shoreline of Tahkenitch Lake is an archeological site with a prehistoric occupation extending back as far as 8,000 years before present with cultural markers indicating an intensified occupation between 5,200 and 3,000 years ago. This site is located approximately 2 miles inland from the active beachline. The site contains substantial faunal information that indicates the use of mollusks and fish from the marine environment, upland game such as deer and elk, and the use of whales as food sources. Absence of artifacts that indicate a technology may have been used to hunt whales, as well as a historic tradition involving scavenging of whales, suggests that the prehistoric inhabitants took advantage of stranded whales rather than procuring them through hunting.

Figure D-1. Siuslaw River North and South ODMDS Study Area



The site also provides information on the geomorphology and paleoenvironment of the coastal setting of 5,200 to 3,000 years ago. Analysis of geomorphic data, although not conclusive, suggests: (1) the site was on or very near an active shoreline with the characteristics of an estuary rather than the shoreline of a fresh water lake; (2) paleo-pollen studies indicate vegetation changes overtime attributed to the destruction of nearshore forest environment as dunes spread inland; (3) marine faunal remains (shellfish) are of the type that are characteristic of a interior bay; and (4) the presence of articulated whale skeletal remains (the whales could not have be carried from the beach to an inland site 2 miles away). Hypotheses explaining this environmental change range from tectonic uplift to increases in sea level with the ending of the effects of Pleistocene glaciations (Minor and Toepel 1986).

Cultural Resources from the Historic Period

With the arrival of explorers, fur traders and settlers, the historic record (notes, diaries and journals) provides a glimpse of the range of historic Siuslaw Indian occupation. Historic records indicate that the Siuslaw Indians occupied an area focusing on the Siuslaw estuary extending south to Five Mile Lake, north to the Yachats River, and inland along the Siuslaw River into the Coast Range, although one informant extended their range, ". . .as far east as Eugene City" (Beckham et al., 1982). At least one major village site is reported on the south shoreline of the lower portion of the estuary.

The Siuslaw subsistence pursuits included exploitation of the anadromous fish runs, marine resources of the nearshore ocean environment and the estuary, deer and elk of the uplands, and the floral resources of the wetlands and upland meadows (Beckham et al., 1982).

Historical Settlement

Historical settlement of the Siuslaw River drainage began in the upper reaches of the Siuslaw River. The lower reaches were, for a time set aside by treaty as part of the Siletz Indian Reservation. Following the termination of the reservation period the lower portion of the drainage was opened for settlement in 1876 (Douthit 1986). Hudson Bay Company employees under Alexander McLeod entered and trapped along the Oregon Coast in 1824. References made to the Siuslaw River indicate the difficulty of canoe travel on the Siuslaw, even for the trappers. The Indians on the Siuslaw advised McLeod that the preferred access to the Willamette Valley was up the Umpqua River (Dicken and Dicken 1979).

The historic development on the Siuslaw River occured quickly with a definite economic purpose and more recently than the settlements of the other Oregon coastal communities. Consequently, an early settlement history with coastal schooners supplying a slowly growing pioneering group does not characterize the study area. Settlement was motivated by the economic pursuits of salmon packing and lumbering.

The processing and canning of salmon was a founding economic enterprise in the lower Siuslaw. Walling notes that Florence, ". . .was founded in 1876 by Duncan and Co., who established a cannery and [by] A.J. Moody, a store." In 1882, there were three houses in Florence. A succession of developments followed with a cannery located in Acme (Cushman) established by O.W. Hurd in 1882, a cannery on Bay street in Florence in 1884 (Douthit 1986), William Kyle's cannery (1884) and lumber mill in the 1890s (Beckham et al., 1982), and the Rose Hill Cannery. A shipyard was located near the Rose Hill Cannery (USACE 1889) where small schooners where built (Dicken and Dicken 1979).

Catching and processing salmon provided seasonal income for many of the residents. Local residents spent, ". . .many hours weaving nets, building traps, or working the seines in the estuaries." Chinese

laborers brought in by the cannery owners and operators provided the seasonal labor for processing and canning the salmon (Beckham et al., 1982).

Examination of shipwreck data tends to indicate that the Siuslaw estuary was not a destination point for the maritime trade until after 1880. The only shipwreck occurring before this period was the *Fawn* in 1856, bringing supplies to the military at Fort Umpqua (Beckham 1969). Moreover, much of the inbound trade brought supplies for the canneries rather than goods for a pioneering or developing community (USACE 1889). Shipwrecks of vessels supplying the Siuslaw settlements started to occur after 1880. The first shipwreck in 1880, the *Olivia Schultze*, was carrying salmon and barrel staves (for barrels of salted preserved salmon; West no date).

Navigational Improvements

At the urging of local residents, the Siuslaw area was evaluated by the staff of the USACE Portland District to determine whether the construction of navigation improvements was warranted. Following the first survey in 1886, Captain Powell recommended against improvements because of the small population and isolation of the area. In 1889, a more positive review of the areas economy and trade resulted in a study process, design and eventually the construction of the North Jetty which was finished in 1901 (Willingham 1983). Records associated with these reviews describe the Siuslaw community developing around the canneries, lumbering and small-scale farming. In 1889, canned salmon, livestock, wool, furs and hide, and lumber involved a trade valued in the neighborhood of $200,000. In-bound trade primarily supplied the canneries (USACE 1889).

Siuslaw River Shipwrecks

The majority of background research has been directed at documenting the presence of historic cultural resources, specifically shipwrecks within the Siuslaw ODMDS study area. This documentary effort forms the essential background for evaluating potential effects on cultural resources by defining the most likely cultural resource(s) within the area. Based on USACE investigations of Ports along the Oregon Coast including studies at the mouth of the Columbia River, Yaquina Bay, Coquille River, Chetco River, and Tillamook Bay, historic shipwrecks are the most likely cultural resources present in the Siuslaw offshore area.

A shipwreck database was developed from the information compiled during background research. The Siuslaw shipwreck database covers an area extending 7 miles south, 10 miles north, and within 0.1 mile or less of the entrance. In addition, two shipwreck sites in the Siuslaw estuary are included in the database. Forty-one documented shipwrecks have occurred within this area. These shipwrecks are listed in Table D-1. These shipwrecks have the following distribution:

- 21 shipwrecks (51%) have been deposited on the beaches.
- 10 shipwrecks (24%) in the surf zones.
- 4 shipwrecks (10%) on the bar at the mouth of the Siuslaw.
- 2 shipwrecks (5%) offshore.
- 2 shipwrecks (5%) in the Siuslaw estuary.
- 2 shipwrecks (5%) on the jetty.

Table D-1. Shipwrecks of the Siuslaw River

Name and Date Of Shipwreck	Site of Shipwreck	General Type of Vessel	Salvaged	Citation
Albion 1/??/1895	Estuary	Schooner	No	The West 2/1/1895.
Alice Kimbal 10/12/1904	So. Beach	Two-mast schooner	No	Gibbs 1957, West, no date.
Anvil 4/11/1913	No. Beach	Gas schooner	No	The West 4/18/1913, West, no date.
Augusta 11/27/1888	Beach	Steam schooner	Refloated	West, no date.
Berwick 2/5/1900	Beach	Schooner	Refloated	The West 2/9/1900.
Berwick 3/13/1908	Bar	Schooner	No	The West 3/20/1908.
Charles Nelson 11/08/1903	Offshore	Steam schooner	Yes	West, no date.
Del Norte 6/11/1904	Beach	Schooner	Refloated	The West 6/17/1904, The West 7/1/1904.
Emma Utter 12/18/1886	Beach	Schooner	Yes	West, no date.
Fawn 11/21/1856	Beach	Brig	No	Gibbs 1971.
Frederick 4/3/1914	Jetty	Barge	No	The West 4/10/1914.
Free Trade 12/31/1891	Beach	Sailing schooner	Yes	The West 1/6/1892.
George H. Chance 2/14/1892	Beach	Steamer	Refloated	The West 2/26/1892.
Grace Dollar 9/5/1915	Beach	Steel steam schooner	Refloated	The West 9/10/1915.
Harrison 9/2/1892	Beach	Steamer	No	The West 9/9/1892.
Hugh Hogan 4/28/1914	Surf zone	Three-mast schooner	Yes	The West 5/1/1914, 5/8/1914.
Humboldt Woodsman 8/18/1960	Jetty	Barge	No	West, no date.
Klihyam 9/27/1958	Surf zone	Tug	No	Oregonian 9/28/1950.
L. Roscoe 1/12/1907	Beach	Steam tug	Yes	West, no date.
Maggie 2/5/1900	Surf zone	Steam tug	Refloated	The West 2/9/1900.
Mayflower 8/15/1908	Surf zone	Schooner	Yes	West, no date.
Mischief 6/??/1887	Beach	Scow schooner	Refloated	West, no date.
Nettie Sundberg 1/16/1902	Beach	Two-mast schooner	No	The West 1/17/1902.
Nettie Sundberg 12/28/1902	Bar	Schooner	No	Gibbs 1957, Marshall 1982.
Nora 2/??/1908	Beach	Gas launch	No	West, no date.
Ocean Spray 11/17/	Estuary	Schooner	No	The West 11/20/1903.
Olivia Schultze 5/1/1880	Beach	Schooner	Yes	Gibbs 1957, West, no date.

Table D-2 (continued). Shipwrecks of the Siuslaw River

Name and Date Of Shipwreck	Site of Shipwreck	General Type of Vessel	Salvaged	Citation
P.S. No. 91 1/??/1952	Offshore	Unknown	Yes	Gibbs 1957.
Ranger 12/??/1911	Beach	Gas boat	Yes	West, no date.
Record 5/??/1891	Surf zone	Steamer	refloated	West, no date.
Restless 10/13/1919	Bar	Streamer	Yes	West, no date.
Robarts 12/28/1901	Beach	Steam tug	Refloated	The West 1/3/1902.
Robarts 1/12/1907	Beach	Steam tug	Yes	The West 1/18/1907.
Robert & Minnie ??/??/????	Surf zone	Schooner	No	The West 1/18/1907.
S. Danielson 11/6/1892	Surf zone	Two-mast Schooner	Refloated	The West 11/15/1892, Coos Bay Times 2/12/1907.
S. Danielson 10/6/1894	Surf zone	Two-mast schooner	Refloated	West, no date.
S. Danielson 2/24/1900	Bar	Two-mast schooner	Refloated	The West 3/2/1900.
W.H. Harrison 9/2/1893	Surf zone	Steamer	Refloated	West, no date.
W.H. Harrison 10/??/1900	Beach	Steamer	Yes	West, no date.
Wing and Wing ??/??/????	Surf zone	Two-mast schooner	Yes	West, no date.

The 2007 edition of the Northern Shipwrecks Database (Northern Maritime Research 2007) was reviewed for any entries within the Siuslaw River study area. This database includes information compiled from the annual reports of Merchant Vessels of the United States, containing shipwreck reports dating from 1868 to 1968 (these reports were the basis of Bruce D. Berman's 1972 book *Encyclopedia of American Shipwrecks*), the National Oceanic and Atmospheric Administration's Automated Wrecks and Obstructions Information System (AWOIS), the United States Non-Submarine Contact List (NSC), war losses from World Wars I and II and the Civil War, and directories such as Lloyd's Register of Shipping. No new information was found to augment the list of known shipwrecks in the area.

Siuslaw ODMDS Study Area Evaluation

A percentage of the shipwrecks included in the Siuslaw shipwreck database have occurred within the ODMDS study area. The study area is defined as that area within a 1.5-mile radius of the mouth of the Siuslaw River. Of the 41 shipwrecks in the Siuslaw shipwreck database, 38 have occurred within the ODMDS study area. These shipwrecks have the following distribution:

- 20 shipwrecks (56%) have been deposited on the beaches.
- 10 shipwrecks (28%) in the surf zone.
- 4 shipwrecks (11%) on the bar.
- 0 shipwrecks offshore.
- 2 shipwrecks (6%) in the estuary.
- 2 shipwrecks (6%) on the jetty.

Further analysis indicates that a substantial portion of these shipwrecks were salvaged or refloated after their event. Twenty-four shipwrecks have been abandoned within the Siuslaw study area. These shipwrecks have the following distribution:

- 14 shipwrecks (58%) have been deposited on the beaches.
- 4 shipwrecks (17%) in the surf zone.
- 2 shipwrecks (8%) on the bar.
- 2 shipwrecks (8%) in the estuary.
- 2 shipwrecks (8%) on the jetty.

The disposal of dredged material in the Siuslaw ODMDS study area will not affect any of these shipwreck sites. Two disposal sites are proposed for the material dredged from the Siuslaw River (see Figure D-1). Based on the studies and research in this appendix, there are no known shipwrecks offshore of the Siuslaw River mouth.

Undocumented shipwrecks are also possible within the nearshore environment at the Siuslaw. Earth Sciences Associates and GeoRecon International evaluated the study area using side-scan sonar (USACE 1986). Although the side-scan sonar was effective enough to locate small objects thought to be crab traps and remnants of commercial fishing nets, no side-scan signatures were noted which might indicate the presence of an undocumented shipwreck. Based on these results, it seems unlikely that an undocumented shipwreck exists in the Siuslaw ODMDS study area.

National Historic Preservation Act Compliance

The above information was shared with the State Archaeologist of Oregon through telephone conversations. Because there appears to be no significant accumulation of materials over the seabed resulting from previous use of the area for disposal of dredged materials, it was concluded that there would be no historic properties affected within the Siuslaw River ODMDS study area by the continued ocean disposal activities. A letter with a determination of “no historic properties affected” was sent to the Oregon State Historic Preservation Office for concurrence.

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Appendix E

Recreational Resources
Siuslaw River, Oregon

April 2010

Appendix E
Recreational Resources
Siuslaw River, Oregon

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Appendix E
Recreational Resources
Siuslaw River, Oregon

Introduction

This appendix identifies the major recreational use areas in the vicinity of the proposed Siuslaw River North and South ocean dredged material disposal sites (ODMDS). Figure E-1 shows major adjacent recreational use areas. The information was compiled to determine the potential impacts of disposal operations on recreation.

Recreational Use Areas

Although the Siuslaw River area receives recreational use year-round, the most popular months are from May through October. Fishing in the area is particularly popular because of the excellent fishing opportunities in the Siuslaw River and nearby freshwater lakes. Other recreational activities include camping, picnicking, beachcombing, and sightseeing.

The Siuslaw River marks the northern boundary of the Oregon Dunes National Recreation Area. This portion of the recreation area contains no developed facilities other than a paved road that parallels the shoreline and provides access to the beach and South Jetty area. During the summer, beachcombing and sightseeing are the most popular activities. The recreation area is a popular for off-highway vehicles; however, this portion of the recreation area is closed to vehicles during the summer months.

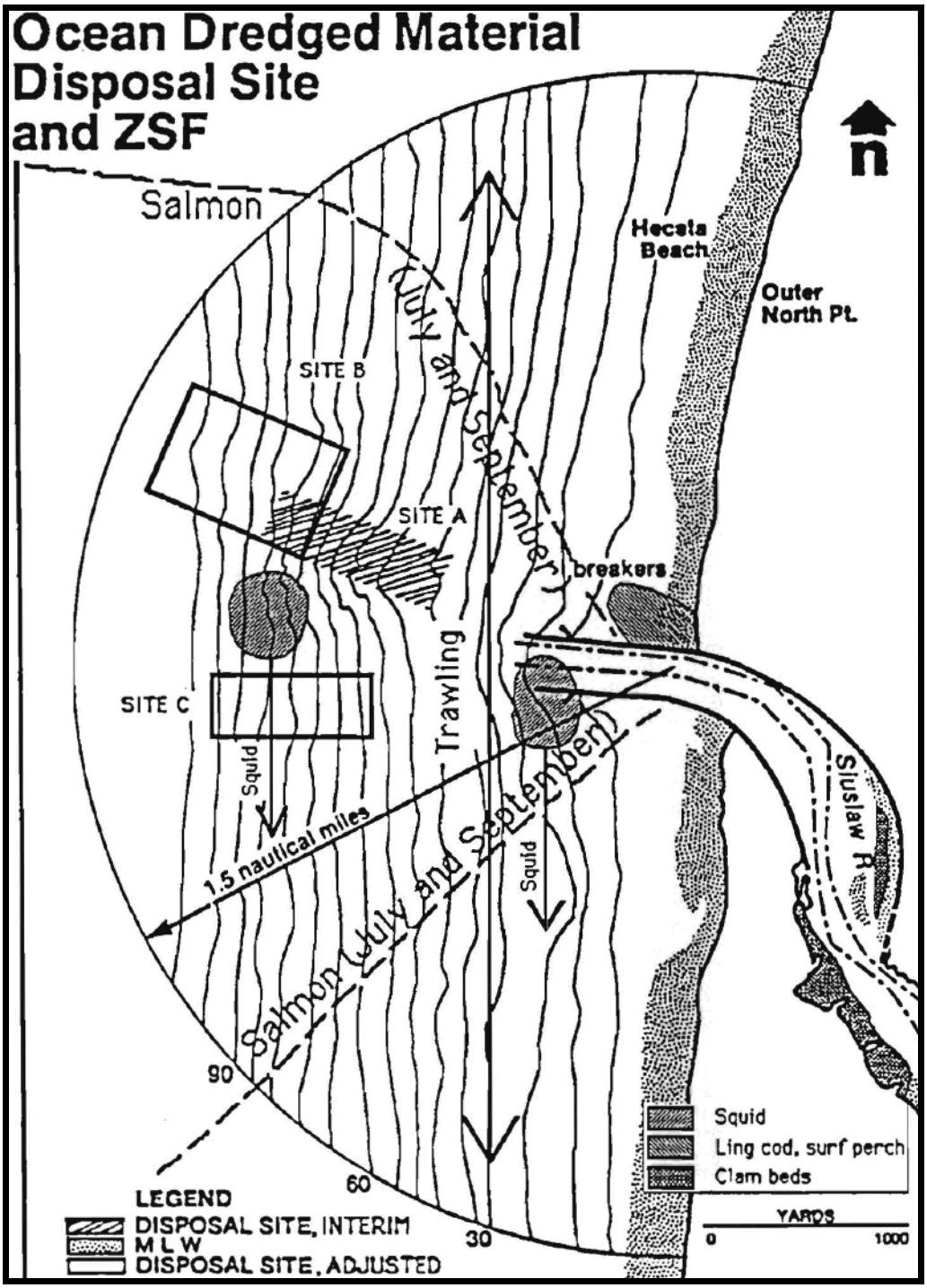
Two public recreation areas are located to the north of the Siuslaw River. Heceta Beach Park is operated by Lane County with beach access, picnic tables, and restrooms. Harbor Vista Park is also operated by the county and offers 15 acres of tent and recreational vehicle camping on a year-round basis. It is one of the few campgrounds on the Oregon Coast with an ocean view and has restrooms, showers, a playground, and hiking trails.

The Siuslaw River jetty fishery is popular and accounts for a relatively high number of angler use days. The jetties are among the best in the state for catching surf perch. The most popular season is May through September. Scuba diving is another activity which occurs on the outside of both jetties. The main attraction for divers is the opportunity for spear fishing. This is a specialized form of recreation and accounts for only a small percentage of the total visitor use at the jetties.

A locally important salmon fishery exists offshore of the Siuslaw River. Even though the offshore salmon fishing can be productive, a rough bar has periodically limited this opportunity for most small pleasure craft. Salmon fishing is most popular from May through September when ocean conditions are more predictable and salmon are feeding in the nearshore area prior to the fall spawning runs.

A smooth bottom offshore of the river has limited the establishment of any substantial bottom fish populations. One exception is a small area located just off the mouth which has proven productive for flounder fishing. The lack of good bottom fishing opportunities and the relatively short salmon fishing season have limited the number of charter boats in the area.

Figure E-1. Recreational Resources in the Vicinity of the Proposed Siuslaw River Ocean Disposal Sites



The lower part of the Siuslaw River from the Highway 101 bridge to the mouth receives the highest recreational use in the area. The number of sea run cutthroat in this stretch of the river represents one of the largest runs on the Oregon Coast, and each fall angling activity is very popular. There are also excellent salmon fishing opportunities in this area.

Beachcombing, sightseeing and clamming are popular activities along the entire coastline. The area within the Oregon Dunes National Recreation Area receives a greater amount of use because of availability of public access.

Impacts of Disposal Operations

The proposed North and South ocean disposal sites are located within a salmon fishing area (see Figure E-1). Few conflicts are expected to occur between anglers and dredge operations due to the availability of alternate salmon fishing sites. Conflicts between disposal operations and recreationists may occur as the dredge is en route to the ocean disposal sites. These conflicts may include time delays for recreational boaters caused by the passing of the dredge or an increase in navigational hazards during congested periods. Conflicts such as these can be considered an inconvenience rather than a threat to recreational activity. The only serious problem would be a collision between recreational boaters and dredge traffic. Accidents of this nature are rare because the dredge moves at a slow speed and the potential for collisions is low.

The proposed ocean disposal sites are at least 2000 ft. from the end of the jetties, and 3000 ft. from the nearest beach. There are not rocks or pinnacles in the vicinity of either site. When dredged material is deposited at the ocean disposal sites, the turbidity in the surrounding water increases. This results in reduced visual quality of the area and may disrupt the feeding patterns of sport fish. Both of these situations are temporary and limited in area, with normal conditions returning as soon as the sediment settles.

Conclusion

The use of the proposed North and South ocean disposal sites at the Siuslaw River should have little impact on recreation in the area. During disposal operations, the turbidity in the surrounding water increases. Any impact this may have on sport angling or visual quality of the area is temporary and limited in area. Some inconveniences may be experienced by recreational boaters and anglers. Overall, the disposal operations appear to pose no serious threats to recreation.

If future studies indicate the disposal operations are either detrimental to ocean fauna or disrupt sediment deposition along the coastline, further information should be collected to determine more specifically what extent the impacts have on recreation. However, until any of these impacts are observed, future disposal of dredged material at the proposed sites is not expected to have any substantial effects on recreation.

Appendix F

Site Management and Monitoring Plan
Siuslaw River, Oregon

April 2010

Final

Siuslaw River North and South ODMDS

Site Management/Monitoring Plan

Section 102 of the Marine Protection, Research and Sanctuaries Act, as amended,
Ocean Dredged Material Disposal Sites (ODMDS)

April 2010

ABSTRACT

This Site Management/Monitoring Plan (SMMP) has been prepared jointly by the U.S. Environmental Protection Agency, Region 10 (EPA), and the U.S. Army Corps of Engineers, Portland District (USACE), and describes management and monitoring requirements for the EPA-designated ocean dredged material disposal sites (ODMDS) located offshore from the Siuslaw River in Oregon. This SMMP supersedes all previous SMMPs for the Siuslaw River. Periodic review and updating of this SMMP will occur no less frequently than 10 years from the date this SMMP is effective. All permits or other authorizations to use the Siuslaw River ODMDS shall be conditioned as necessary to assure consistency with this SMMP.

Siuslaw River ODMDS
Site Management/Monitoring Plan

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Introduction

This Site Management/Monitoring Plan (SMMP) was jointly prepared by the U.S. Environmental Protection Agency, Region 10 (EPA), and the U.S. Army Corps of Engineers, Portland District (USACE). This SMMP describes management and monitoring requirements for the EPA-designated Siuslaw North and South Ocean Dredged Material Disposal Sites (ODMDS) located offshore of the Siuslaw River in Oregon, hereafter referred to as the Siuslaw River ODMDS or Siuslaw Sites (Figure F-1). This SMMP becomes effective upon the effective date of the site designation and supersedes and replaces any previous SMMP for this location.

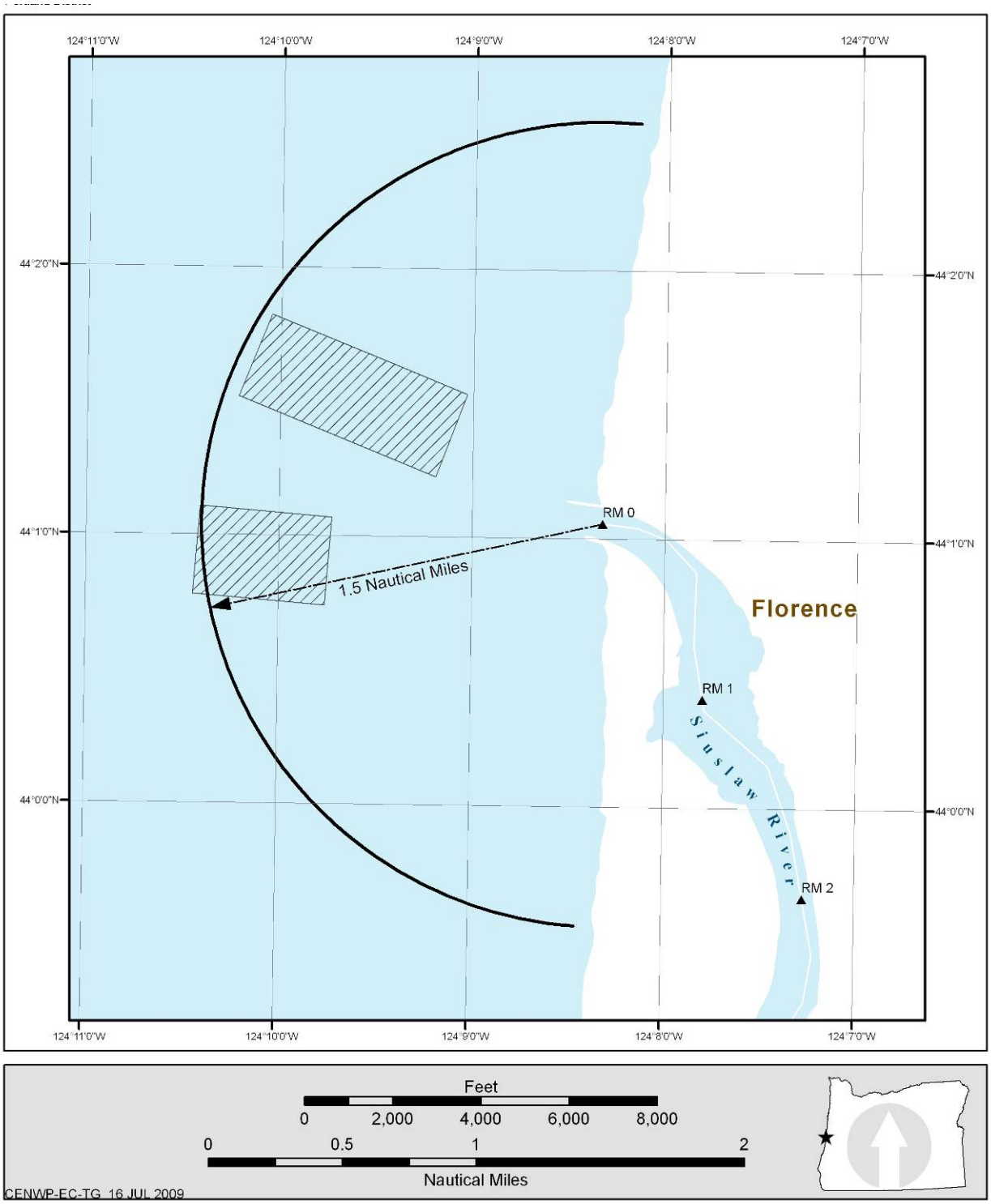
It is the responsibility of the EPA and the USACE to manage and monitor each ODMDS designated by EPA pursuant to Section 102 of the Marine Protection, Research and Sanctuaries Act, as amended (MPRSA). EPA has final authority over site management. The SMMP provisions establish requirements for all dredged material disposal activities at each site. All permits issued pursuant to Section 103 of the MPRSA for the ocean disposal of dredged materials at the Siuslaw Sites shall be conditioned as necessary to ensure consistency with this SMMP. The USACE shall ensure that its use of the Sites is consistent with this SMMP.

Guidance for the preparation of a SMMP for ODMDS is provided in the joint EPA/USACE Guidance Document for *Development of Site Management Plans for Ocean Dredged Material Disposal Sites* (USACE/EPA 1996). This guidance document lays out a recommended framework for site management plan development and content.

Each SMMP is required, pursuant to the MPRSA, to include: a baseline assessment of conditions at the site; a program for monitoring the site; special management conditions or practices to be implemented at each site that are necessary for protection of the environment; consideration of the quantity of material to be disposed at the site, and the presence, nature, and bioavailability of the contaminants in the material; consideration of the anticipated use of the site over the long term, including the anticipated closure date for the site, if applicable, and any need for management of the site after closure; and a schedule for review and revision of the plan which must be no less frequently than 10 years after adoption of the plan and at least every 10 years thereafter.

Specific management of each designated ODMDS involves regulating the times of use, the quantity and the physical/chemical characteristics of dredged material that is dumped at the site; and establishing disposal controls, conditions, and requirements to avoid and minimize potential impacts to the marine environment. Appropriate management of each ODMDS is aimed at assuring that disposal activities comply with permit requirements, site management objectives and conditions, and do not unreasonably degrade or endanger human health, welfare, the marine environment or economic potentialities. Monitoring the site and adjacent environs is a critical component of management to verify compliance with requirements, objectives, and conditions of site management, to ensure that unanticipated or significantly adverse effects are not occurring from use of the disposal site, and ensure that permit terms are met.

Figure F-1: Siuslaw River North and South ODMDS and Vicinity



Site Management Roles and Responsibilities

The designation of ODMDS and the issuance of permits for such sites are components of the federal, non-delegable, ocean dumping program. Site designation and management are federal responsibilities. Owing to the interactive nature of regulating ocean disposal of dredged material, the functional management of ODMDS along the coast of Oregon is shared between EPA Region 10 and the USACE Portland District. The EPA and USACE will routinely consult on all decisions regarding site use and management. The primary mechanism for pre-disposal consultation will be the ODMDS annual summary assessment report and monitoring update prepared by the Portland District.

The EPA may condition, terminate or restrict site use with cause. The EPA, Region 10 is responsible for managing and monitoring ocean dredged material disposal sites in ocean waters off the States of Alaska, Washington, and Oregon, including the Siuslaw River Sites addressed in this SMMP.

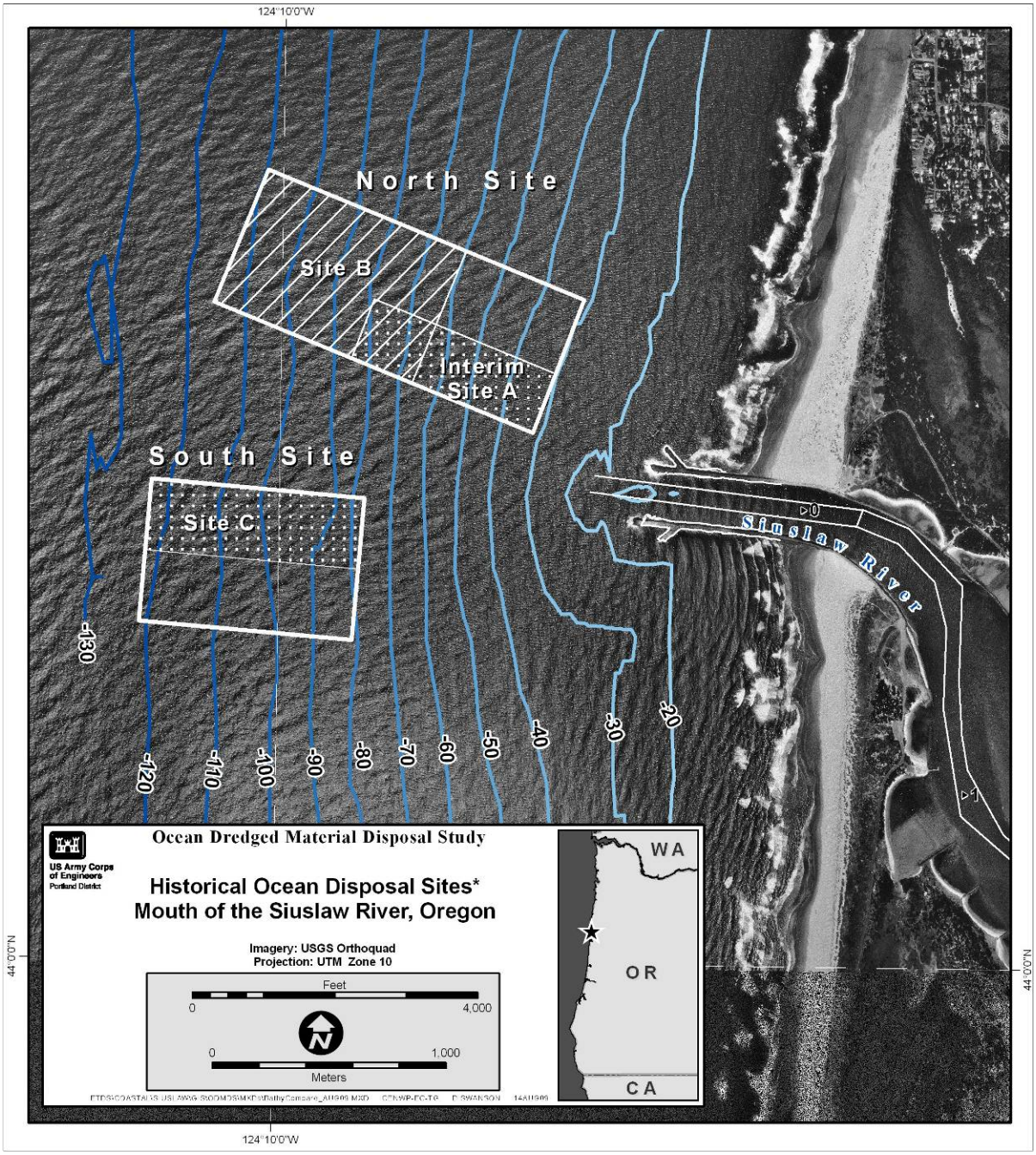
The USACE is expected to be the primary user of the Siuslaw River Sites for dredged material from federal navigation projects. The USACE also issues permits for transportation of dredged material for the purpose of ocean disposal, after consultation with and concurrence from the EPA, in compliance with these criteria. The USACE meets substantive permit requirements, including EPA concurrence, for its own use of the Siuslaw Sites.

Baseline Definition

Section 102(c)(3)(A) of the MPRSA requires that the SMMP include a baseline assessment of conditions at the site. The baseline record for the Siuslaw River Sites includes over 30 years of studies and surveys which are pertinent to dredged material management. Assessments of physical, chemical and biological characteristics of the section of the Pacific Ocean encompassing the sites are described in Richardson 1973; Peterson and Miller 1977; Richardson and Pearcy 1977; Brodeur et al., 1985; USACE 1991, 1992, 1996, 2001, 2009; Keister and Peterson 2003; Auth and Brodeur 2006; Auth et al., 2007; and Sherman 2007, as well as other technical studies and annual monitoring surveys. There are no rare or unique features or habitats at or near the Siuslaw Sites. The Siuslaw Sites are situated near land in an open, dynamic ocean environment. The topography of the seabed in the vicinity of the Sites is fairly uniform. The ocean bed is characterized by an outward bulging of the bathymetric contours northwest of the mouth of the Siuslaw River, forming a fan-like feature on the ocean floor. This bulge is evident to water depths of 100 feet.

Areas in the same vicinity as the Siuslaw Sites have been used by the USACE since 1929, when hopper dredges began to work the Siuslaw bar and entrance channel. Site A (Figure F-2) was designated an EPA Interim Site in 1977 (40 CFR 228.12). It was suspected that ocean currents were transporting dredged material placed in the Interim Site A back into the Siuslaw entrance channel. In 1986-1987, the USACE completed dye and seabed drifter studies. Results demonstrated dredged material deposited south and/or east of the centroid of Interim Site A, with prevailing north to northwest winds, could possibly drift back across or into the Siuslaw entrance channel. Interim Site A also experienced mounding to 14 feet relative to the 1981 bathymetric baseline due to the volume of dredged material disposed and the small size of the site. Two adjusted ocean disposal sites, Sites B and C, were selected by the USACE under Section 103 of the MPRSA (see Figure F-2). Since 1997, material removed from the Siuslaw federal navigation project has been deposited into Sites B and C.

Figure F-2: Historical Siuslaw River Ocean Disposal Sites



Sites B and C also experienced mounding. Disposal restrictions, until lifted in 2008, were placed on the southeast corner of Site B, an area which overlapped Interim Site A. The bulk of the dredged material has been placed in the larger Site B. The primary goals in locating and managing the Section 102 Sites are to: (1) maximize their capacity since a Section 102 site designation is potentially indefinite based on management, monitoring and response to impacts of disposal; (2) minimize the potential for mounding and associated safety concerns; (3) maximize the volume of material that remains in the nearshore littoral system; and (4) avoid adverse effects to unique biological resources. It was clear that the Section 102 Sites should be expanded to increase capacity and to allow for careful management to minimize mounding, if historically used sites in the nearshore zone were to be designated.

At other ocean disposal sites along the Oregon Coast, the EPA and the USACE have endorsed the strategy of placing a site to the north and another to the south of the river mouth (Yaquina Bay, Umpqua River, etc.), primarily because such placement allows for adaptive management of the sites in a dynamic current environment. Therefore, the Siuslaw Sites include both a North and South ODMDS.

Generally, material placed deeper than 60 feet remains where it is placed, or disperses very slowly and is therefore, removed from the active littoral system. To keep more material in the active littoral system, the North Site configuration expands the footprint of the former Section 103 Site B to include the original 1977 Interim Site A, and a similar area to the north of Interim Site A (see Figure F-2). Although previous studies showed the potential for material disposed in portions of Interim Site A to re-enter the channel, the larger Siuslaw North and South Sites allow for greater adaptive management based on observed seasonal sediment transport patterns. Strategic management and monitoring of the Siuslaw Sites is expected to prevent measurable volumes of dredged material from migrating back into the channel. To further address potential mounding and movement of material into the federal channel, the southern boundary of the South Siuslaw ODMDS was moved further south than the former Section 103 Site C, doubling the footprint of the site. The shallower portions of the North Siuslaw ODMDS will be utilized to the maximum extent possible in order to keep material in the active littoral zone.

Site Definitions and Description

Disposal Site Definitions

For the purposes of management and monitoring of the designated Siuslaw Sites, the following definitions are applicable.

Disposal Sites: The sea bottom within the coordinates specified in the applicable *Federal Register* Final Rule designating the individual sites and the overlying water column.

Placement Area (also can be called disposal area): The area of the sea bottom that will be immediately occupied by disposed dredged material released at the water surface (1) on an annual use basis, and/or (2) over the anticipated life of the disposal site. The disposal sites will be managed as dispersive sites. Generally, the placement area for dispersive sites is designated and managed on a seasonal or annual cycle. Material discharged and accumulating in the placement area during the active disposal season is expected to be transported out of the site and redistributed by natural forces (e.g., tides, currents, waves) leaving the placement area with near its original capacity.

Disposal Site Description

The Sites are located near the mouth of the Siuslaw River and are primarily intended to receive suitable dredged material from the USACE Siuslaw River federal navigation project, other local USACE projects, and appropriately permitted dredged material from non-USACE projects. The location of the Sites (coordinates) and size are shown in Table F-1.

Table F-1. Coordinates, Dimensions and Anticipated Use of the Siuslaw North and South ODMDS

Siuslaw North ODMDS (North American Datum 1983)

44° 01' 31.03"N, 124° 10' 12.92"W
44° 01' 49.39"N, 124° 10' 02.85"W
44° 01' 31.97"N, 124° 09' 01.86"W
44° 01' 13.45"N, 124° 09' 11.41"W

Dimensions: 4,800 feet long x 2,000 feet wide
Depth Range: 30-115 feet
Average Depth: approximately 90 feet

Siuslaw South ODMDS (North American Datum 1983)

44° 00' 46.72"N, 124° 10' 26.55"W
44° 01' 06.41"N, 124° 10' 24.45"W
44° 01' 04.12"N, 124° 09' 43.52"W
44° 00' 44.45"N, 124° 09' 45.63"W

Dimensions: 3,000 feet long x 2,000 feet wide
Depth Range: 80-125 feet
Average Depth: approximately 100 feet

Components of the Sites: The disposal sites, placement areas, and drop zones are identical.

Disposal Capacity: Disposal volumes for these Sites are not often expected to exceed 118,000 cubic yards (cy)/annually (based on a 13 year average of about 60,000 cy and range of 22,300 to 117,300 cy); material is expected to be disposed approximately 20 days annually (based on an average of 7 days and a range of 3-23 days). Generally, dredging and disposal are expected to take place between June 1 and October 31 of each year.

Anticipated Site Use

Section 102(c)(3)(E) of the MPRSA requires that the SMMP include consideration of the anticipated use of the site. Primary and regular use of the Siuslaw Sites is expected by the USACE, Portland District, for the disposal of dredged material removed from the federal navigation project on an annual maintenance schedule. It is also expected that the sites will be used for disposal of material dredged by other public or private entities pursuant to a permit as required by Section 103 of the MPRSA. These individual Section 103 permits (which could be multiple-year authorizations up to 7 years) will be issued by the USACE Regulatory Branch after EPA concurrence. Individual permits generally require public notice and require other federal consultations (e.g., Endangered Species Act, Essential Fish Habitat) and authorizations (e.g., water quality certification) prior to issuance.

Siuslaw River Navigation Project Description

The Siuslaw River federal navigation project, authorized by the Rivers and Harbor Act of: 1890, 1910, 1925, and 1958, as a Section 107 Project in 1960, and under Public Law 96-367 in 1980, includes:

Jetties

- North Jetty is 8,390 feet long.
- North Spur Jetty is 400 feet long.
- South Jetty is 4,200 feet long.
- South Spur Jetty is 400 feet long.

Channel

- Entrance channel from deep water to river mile (RM) 0 is 300 feet wide and 16 feet deep, thence a channel 5 miles long, 200 feet wide and 16 feet deep.
- Turning basin at Florence is 600 feet long, 400 feet wide and 16 feet deep.
- Channel from Florence to RM 16.5 is 11.5 miles long, 150 feet wide and 12 feet deep.
- Turning basin at RM 15.5 is 500 feet long, 300 feet wide and 12 feet deep.

The Siuslaw River federal navigation project was authorized for the following purposes:

- Decrease waiting times for vessels crossing the bar;
- Provide a protected entrance for small draft tugs, barges, and commercial and recreational fishing vessels;
- Provide mooring facilities for small boats which take advantage of project facilities;
- Permit barge and small boat traffic upstream to RM 17;
- Provide a harbor of refuge; and
- Provide a dependable year-round entrance channel.

Site Management Objectives

The primary goal of this SMMP is to provide for safe and efficient disposal of suitable dredged material at the Siuslaw North and South ODMDS, while minimizing adverse effects to the environment including, but not limited to, coastal and marine resources, to the greatest extent practicable. General site management objectives for accomplishing this goal are to:

1. Avoid creation of persistent mounds;
2. Minimize impacts on coastal sediment circulation by keeping sediment in the littoral zone to the extent practicable;
3. Minimize long-term adverse effects to coastal and marine resources;
4. Minimize interference with other uses of the ocean;
5. Maintain safe navigation;
6. Promote safe and efficient dredge operations; and
7. Document disposal and monitoring activities at the North and South ODMDS.

All these general site management objectives are applicable to the Sites and additional specific management restrictions may be imposed, as necessary. Specific individual Site objectives and restrictions will be periodically reassessed and/or revised in the future.

To minimize the creation and persistence of mounds, the Sites will be managed to maximize the dispersal capability of the shallower portions of the disposal sites. Generally, there will be a preference for the use of the North Site in areas shallower than -60 feet MLLW if capacity exists at these depths.

- Site management may include establishing cells along the nearshore portion of each Site to ensure uniform placement, minimize the accumulation of material, maximize dispersal out of the Site, and avoid excessive or persistent mounding. Dump plans will be developed and may be adjusted during each disposal season to utilize different portions or cells within the shallower areas of the Sites to achieve uniform placement and minimize mounding.
- Disposal may be alternated as necessary between the two Sites to allow for maximum dispersal and minimal impact. The North Site is anticipated to receive more frequent initial use, but this may change as conditions warrant.

Site Monitoring and Special Studies

Site monitoring is a key component of site management. The main purpose of a disposal site monitoring program is to determine compliance with site use requirements or conditions, and to determine whether site management practices, including disposal operations, need to be changed to avoid unacceptable adverse effects and/or endangerment to human health and welfare or the marine environment. Monitoring of these activities is referred to as "routine monitoring" throughout the SMMP. Routine monitoring events may be triggered annually or some other time interval (e.g., 7-10 years), when a set volume of material has been disposed at the Sites, or when a combination of volume and chronology provide a logical trigger. Special studies will be undertaken as necessary to address specific questions or issues that are not covered by routine monitoring events. Such situations could include follow-up after an incident (e.g., spill of a material or fish kill), in advance of use of a new type of equipment, following placement of a different type of material (e.g., rocks) at the Sites, or following receipt of significant new information (physical, chemical, biological, or social/economic) that could influence the ongoing adaptive management of the Sites. The results of these special studies are intended to refine future management objectives and practices, modify routine monitoring requirements or reset baseline conditions.

Potential decision outcomes resulting from routine monitoring of disposal or special studies at the Siuslaw Sites include the following:

No Change:

a. No Change *Required* (e.g., routine monitoring reveals no cause for concern; disposal and monitoring continue as planned).
b. No Change *Possible* (e.g., one-time event or accident took place at a Site; while there may be no change in disposal operations, other actions may be appropriate).

Additional Information Required:

a. Adjust routine monitoring (e.g., employ more frequent bathymetric surveys, conduct physical, chemical or biological monitoring).
b. Require a special study.

Operational Change Required:

a. Scheduling (e.g., adjust time periods or rates of disposal).

b. Adjust placement of material within a Site (e.g., place material in a different manner).
c. Restrict type or quantity of material placed at a Site.

Change Sites:

Relocate disposal activities from one Site to another (i.e., days to weeks); follow-up with monitoring to determine if additional attention is warranted.

Discontinue Disposal Site Use:

a. Cease Disposal – short-term (e.g., 1 season). A known temporary condition took place which merits discontinued use for a short period of time; follow-up with monitoring to determine if additional attention is warranted.
b. Cease Disposal – long-term. Typically, this would occur when routine monitoring or a special study confirms an unacceptable condition persists. This would require Site modification or identification and designation of a new site(s).

Routine Monitoring

Routine monitoring will generally consist of annual bathymetric monitoring at the Sites, typically done in the spring. Initial baseline is currently defined as the September 1981 bathymetric survey – the first year that Siuslaw bathymetric data were entered into a computer system that allowed for computerized record-keeping and long-term trend analyses. In subsequent years, Siuslaw ODMDS bathymetric monitoring results will be compared to the initial baseline survey at a Site, the designation baseline of spring 2010, and the previous year's survey. In addition, other historical surveys from the area will be retained and used as needed to determine trends and gather information relevant to site management. More intensive monitoring is employed when annual bathymetry or direct field observation reveals persistent mounding or a rapid increase in mounding from the previous year. The level of monitoring sufficient to address the specific management questions at hand will be undertaken.

The following specific monitoring objectives are identified for the Siuslaw River North and South Sites:

- Ensure that dredged material is being placed as required by this SMMP and the provisions as codified in the Federal Register for the Sites;
- Ensure that the dredged material is behaving as predicted during placement (e.g., monitoring vs. modeling);
- Ensure that placement of dredged material does not create persistent and adverse wave-generating mounds (principally shallow water concern);
- Assess the significance of potential impacts of disposal operations on the public safety and resources or resource use; and
- Verify that material is moving out of the North and South Sites over time, as predicted, providing long-term capacity without adverse effects.

Specific Routine Monitoring

For management purposes, routine monitoring will concentrate on determining how dredged material is behaving within and in the vicinity of the Siuslaw North and South Sites. Bathymetric surveys shall be conducted annually. The number and length of transects required for annual assessment will be sufficient to encompass the area impacted by dredged material disposal. The survey area will

extend at least one survey transect beyond the area impacted. Bathymetric surveys will be used to monitor the disposal mound and assist in verification of material placement, to monitor bathymetric changes and trends, and to determine whether Site capacity has been exceeded (i.e., that the placement area does not exceed the Site boundaries). Initial Site capacity is assessed using Site bathymetric surveys from the previous year to establish how much of the previous year's disposed material has dispersed from each Site. Any year's annual bathymetric profile is evaluated for cumulative changes based upon comparison to initial and designation baselines, and the previous year's survey. This information will be provided to EPA as part of the annual summary assessment report. In addition, while not available for the summary assessment report, any more recent and then-current bathymetry must also be used for the annual spring planning/site adaptive management process between the Corps and EPA.

If mound heights appear to be increasing over time, more intensive monitoring and/or management action will be taken. Such action may consist of restricting placement to only certain portions of a Site or some other similar disposal or management action. If placement restrictions or similar management actions do not sufficiently control mound height, the Site(s) or portions thereof, may be temporarily, or in the instance of extreme mounding, permanently closed to use.

Monitoring surrounding areas for biological resources, as well as confirmatory physical, chemical and biological characterizations of associated Site and adjacent sediments, are expected to be performed on an approximate 9-year schedule unless otherwise warranted. For example, the first major monitoring at the Sites would occur around 2017. This fieldwork could include a level of effort similar to that expended in the 2008 baseline studies at the Sites and surrounding area, however, the nature and extent of these studies will depend on Site use and issues that arise during adaptive management in the intervening years. In 2016, during the annual spring planning meeting, EPA and the Corps will discuss the 2015 Annual Summary Assessment Report and ongoing site management issues. In addition, EPA and the Corps should identify the nature and extent of physical, chemical and biological characterizations needed to support ongoing Site management. It is anticipated that any reassessments will be documented as stand-alone reports to directly support monitoring efforts at the Siuslaw North and South Sites.

Adaptive Management and Monitoring

The North and South Sites will be adaptively managed to avoid unacceptable adverse effects or endangerment to human health or welfare, or to the coastal and marine environment. Site management and monitoring will be adjusted at any time as conditions warrant. If EPA has reason to believe the marine environment at the Sites may be at an increased risk of degradation, additional testing may be required and Site use may be restricted or terminated while Site assessment is underway. From time to time, the Corps and EPA may discuss Site monitoring with federal and state agencies.

Special Studies

Special studies are non-routine studies of specified duration that are intended to address specific questions or issues that are not covered by routine monitoring events or that arise from routine monitoring. The obvious need for a special study would be following an accident or spill. Under such circumstances, EPA and USACE would mutually scope and conduct appropriate studies to determine the effect of the incident on the Sites and whether specific contingency or possible enforcement action would be necessary. The results of any special studies would be used to refine future management objectives and practices, modify routine monitoring requirements, or reset baseline conditions. Depending on study objectives, technical assistance or advice would be sought

from other agencies and entities. It is anticipated that special studies would be coordinated with the Northwestern Regional Dredging Team (RDT).

Restrictions and Requirements

- Only clean dredged material can be placed into the ocean under existing statutes and regulations. Sediment suitability must be documented prior to disposal following procedures in the national testing manual, *Evaluation of Dredged Material Proposed for Ocean Disposal* (Corps/EPA 1991) and the regional *Sediment Evaluation Framework for the Pacific Northwest* (SEF 2009) or their subsequent replacements. For further explanation, see the *Quantity of Material and Presence of Contamination* section below.

- Though expected to be unusual for the Siuslaw Sites, EPA and the Corps may jointly determine whether a site utilization plan is necessary for a given year. The decision may be based on volume, equipment, or origin of dredged material considerations. This decision must be agreed to by the agencies prior to dredging and disposal at the Sites in a given dredging year.

- USACE, Portland District shall submit an Annual Summary Assessment, as outlined below, to EPA each spring. The Annual Summary Assessment shall include sediment volumes from USACE disposal actions as well as permitted disposal actions.

- As detailed below, all users are required to keep daily records of disposal activities

- All users must notify EPA prior to disposal according to the timelines detailed below.

- EPA may condition, terminate or restrict site use with cause.

Annual Summary Assessment Requirement

The operational mechanism for use and monitoring of the Siuslaw Sites on an annual basis, as well as management decision-making, will be annual summary assessment report updates. The annual summary report for a given dredging year is based on the results of the previous year's monitoring, the pre-dredging/disposal hydrographic surveys (typically conducted the previous spring), and dredge operating parameters. The summary will focus on any operational adjustments that should be implemented. It is expected that the primary user of the Sites will be the USACE for material dredged from the Siuslaw River federal navigation project. The annual summary will identify Site capacities, actual volumes discharged, sediment quality analysis of material proposed for discharge, dredging and disposal techniques, timing and locations, routine monitoring (e.g. annual bathymetry and comparisons to initial (1981) and designation (2010) baselines) and/or special studies, and other considerations drawing on the then-current Site use conditions and SMMP. The USACE, as prime user of the Sites and as permitting authority, will take the lead to draft the summary and provide it to EPA each spring. If applicable, the USACE annual summary will include sediment volumes from permitted disposal actions. Once reviewed by EPA, with an opportunity for EPA's recommendations/suggested changes to be incorporated, and with an opportunity for the Corps and EPA to discuss any more-recent site-specific information, the summary will constitute the template for that year's disposal. EPA recognizes that the summary cannot anticipate every operational situation. Day-to-day flexibility in dredging and disposal decisions will be necessary, however, the user will make every effort to consult and coordinate with EPA and will seek EPA's concurrence before changes are initiated. Such changes could include decisions to increase the spacing between

dumping positions, to shift disposal operations to other portions of the Sites, or to redistribute placement of material between the Sites.

Record-Keeping and Reporting Requirements

EPA must review and concur on Corps-issued dredged material ocean disposal permits, and on Corps "self-permits" for Corps-sponsored dredged material ocean disposal. EPA's concurrence on Corps-issued "self-permits" and Corps-issued dredged material ocean disposal permits, may result in additional conditions that affect record-keeping and reporting requirements (as deemed necessary to support Site management). All site users are required to keep daily records of disposal activities indicating where material was dredged and where and how material was disposed of at the Site(s). The start and endpoint coordinates must be recorded for each load placed. The annual summary report must include all annual and cumulative quantities disposed at each Site. When needed for adaptive management, the Corps and/or EPA may also request placement plots showing which portions of each Site were used for disposal that dredging year.

The annual summary assessment report and data reports from any routine monitoring or special studies must be compiled and submitted to EPA (ATTN: Region 10, Pacific Northwest Ocean Dumping Coordinator). These results will be evaluated by the EPA and USACE, and these agencies will attempt to make consensus decisions concerning the need for management changes regarding the Sites. While a consensus process is the goal, EPA has final authority over Site management decisions. Finally, all users shall notify EPA when in-water work is to begin. In spring of any given year, Portland District will submit an annual dredging schedule to EPA. All users shall notify EPA (via telephone or email) of the disposal schedule as they become available. Portland District shall notify EPA not less than 15 days prior to the beginning of a dredging cycle or project disposal. Holders of Section 103 permits shall notify EPA not less than 20 days prior to use of the Sites in a given dredging year.

Inspection and Surveillance Provisions

EPA will typically utilize the inspection and surveillance capabilities of the USACE and the U.S. Coast Guard (USCG). For example, contract dredges are periodically inspected by USACE personnel to ensure dredging and disposal takes place in the correct locations, and USACE dredges are responsible for ensuring their own proper positioning. EPA may also choose to implement its own inspection and surveillance requirements using EPA personnel or contractors. It is expected that EPA and the USACE will coordinate with each other on any special inspections and surveillance.

Special Management Conditions or Practices

The following special management conditions will be implemented at the Siuslaw North and South Sites.

Placement Strategy

The placement strategy has a large influence on the consequences of disposal in any site. Placement strategies vary, ranging from individual dumps to the long-term distribution of material. Both EPA and USACE policy establishes a preference for beneficial use of dredged material when practical. A uniform placement strategy will be applied to both Siuslaw Sites; however, the specific manner in which this strategy will be applied at each Site may differ due to the greater dispersive or less-

dispersive characteristics of different depth zones. Application of "uniform placement" is most critical to each annual disposal series. At the Siuslaw Sites uniform placement means the spreading of disposal activity within the Sites, rather than spot dumping. Uniform placement at the Sites is expected to result in a relatively uniform accumulation on the bottom. Application of "uniform placement" is an expected outcome over the long-term and multiple-year disposals, rather than a placement regime to be achieved during each dredging season, particularly in the offshore zones where dispersal is very slow.

The shallow, nearshore portions of the North Site are expected to have greater potential to provide a positive benefit as dispersion of sediments is inshore toward the beaches as well as along existing bathymetric contours. Dredged material is to be preferentially placed in the North Site, in the nearshore area, if capacity is available in that location. Exceptions to this requirement may include: (1) material or equipment incompatibility; (2) weather or navigation safety conflicts (e.g., use of multiple dredges); (3) expected volumes exceed annual capacity in any year; (4) conflict with non-federal conditions; and/or (5) specific restriction or direction by EPA.

Equipment Considerations

The type of dredge used influences the dimensions of the individual and cumulative dump mound. No specific disposal technique is required at the Siuslaw North and South Sites. For the hopper dredges that commonly work the Siuslaw River federal navigation project, such as the USACE's multiple bottom-door hopper dredge *Yaquina*, each load would produce a thinner deposit than the typical split-hull contract hopper dredges at any given water depth. Material discharged from a split-hull barge is typically more consolidated than material discharged from a hopper dredge. Hopper dredges are the dredge type normally deployed at Siuslaw River for sandy material.

Quantity, Seasonal Weather and Environmental Restrictions

Quantities placed at the North and South Sites will vary year-to-year depending on project shoaling. Disposal volumes and placement will be closely monitored and documented to verify uniform placement and to assess dispersive capability. Adverse sea and weather conditions limit dredging and disposal to a period typically from June 1 through October 31. Even during the dredging season, storm events can restrict disposal events. In the event that new information or monitoring results reveal the need for any additional restrictions, disposal activities will be scheduled so as to avoid unacceptable adverse effects.

Equipment Requirements and Discharge Point

Hopper dredges or clamshell and barge operations could include USACE and private contract dredges and barges. All such operations are required to meet all U.S. Coast Guard requirements for safety. They are also required to use modern global positioning equipment capable of fixing their location within plus or minus 3 feet to ensure that material is placed within the designated disposal sites. As stated in the reporting requirements section, daily records are required of dredgers indicating where material was dredged and where and how material was placed when disposed. The start and endpoint coordinates for each load disposed at the North or South Sites must be recorded and shall be reported when requested by either EPA or the Corps.

Debris Removal Provisions

Debris is material that could cause interference with particular uses of the ocean. Floatable debris might include logs, wood chunks, or plastics that can be navigation hazards or that could foul

beaches. Non-floatable debris comprises material that could reasonably be expected to cause conflicts with bottom-net or trawl fishing such as logs, pilings, rip-rap and concrete. As a general rule, non-floatable, non-sediment materials that would pass through a 24-inch x 24-inch mesh is not considered debris if it is natural in origin and only occasionally found within, and therefore dredged as part of, the sediment matrix. This would only be a potential issue for clamshell dredging as hopper and pipeline dredges are incapable of picking up large debris.

Typically, the planning or permitting process assesses the potential risks of any debris that could be encountered during dredging. Should debris be identified as a potential issue, the USACE or EPA may make dredging or disposal area inspections to ensure that a contractor is in compliance with the approved operating plans, and that debris is removed prior to discharge at the Sites. The preference is that floatable debris be removed at the dredging area, however, circumstances may occur where it must be picked out of the water at the disposal area. Clamshell-dredged sediments, which contain debris that is not easily removed, may require screening through a 24-inch x 24-inch mesh or grid structure. The mesh must be periodically cleaned and the debris disposed of according to the approved dredging and disposal plan

Disposal of debris at the Sites is prohibited. Dredging contractors and USACE dredge captains are required to maintain a record of the handling of debris encountered during dredging and disposal. Compliance inspectors may review these records. If debris is encountered, copies of dredging logs recording management of debris shall be provided to EPA.

Quantity of Material and Presence of Contamination

Section 102(c)(3)(D) of the MPRSA requires that management plans include consideration of the quantity of the material to be disposed of at the site, and the presence, nature, and bioavailability of the contaminants in the material.

The dredged material placed is not expected to remain within the boundaries of the Siuslaw Sites after disposal. The rate and direction of movement across the boundaries of the Sites are determined by physical transport mechanisms. Depending on these transport mechanisms and the nature of the material, transport may be rapid and continuous, or may occur only during episodic events, such as storms or seasonal changes in transport mechanisms.

Only clean dredged material can be placed into the ocean under current statutes and regulations. Material suitability must be documented prior to disposal at the Sites. This is typically completed as part of regulatory permitting (non-USACE) or the USACE substantive review process. EPA will review all sediments to be placed at the Siuslaw North and South Sites according to applicable current requirements of the MPRSA, national guidance, and local/regional manuals, and will determine whether material is suitable for that purpose.

Characterization records of dredged material approved to be disposed at the Siuslaw Sites shall typically be retained by the USACE—either as the entity responsible for the dredging and disposal [Planning and/or Operations and Maintenance (O&M) program] or the permitting agency (regulatory permits). Sediment evaluation reports for USACE O&M projects will be posted on the web at https://www.nwp.usace.army.mil/ec/dme.asp . Ultimately, all sediment data will be routinely entered into the publicly available RDT sediment database. Secondary copies of characterizations will be retained by EPA.

Site Management Plan Review and Revision

Section 102(c)(3)(F) of the MPRSA requires that SMMPs include a schedule for plan review and revision. SMMP revisions will be made as determined necessary by EPA. If the results of monitoring or special studies indicate that the continued use of the Sites would lead to unacceptable effects, then this SMMP will be modified as necessary to mitigate the adverse effects. At least every 10 years after the effective date of this SMMP and throughout the life of the Sites, the EPA will conduct a substantive review of the SMMP and make modifications as necessary. These reviews will involve coordination with other agencies, technical experts, and stakeholders.

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