US Army Corps
of Engineers
Portland District

Siuslaw Ocean Dredged Material Disposal Site Evaluation

Final Report

March 1992

SIUSLAW OCEAN DREDGED MATERIAL DISPOSAL SITE EVALUATION

Portland District

U.S. ARMY CORPS OF ENGINEERS

FINAL REPORT

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Syllabus

This report was prepared by the Portland District, Corps of Engineers, to describe conditions at the existing interim and proposed adjusted Ocean Dredged Material Disposal Sites (ODMDSs) for the Siuslaw River, Oregon. The report also documents compliance of the ODMDS with requirements of the following laws:

Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972,
National Environmental Policy Act 1969,
Endangered Species Act of 1973,
National Historic Preservation Act of 1966, and the
Coastal Zone Management Act of 1972, all as amended.

The Siuslaw ODMDS received its interim designation from the Environmental Protection Agency (EPA) in 1977. The MPRSA requires that, for a site to receive a final ODMDS designation, the site must satisfy the specific and general disposal site criteria set forth in 40 CFR 228.6 and 228.5, respectively. This document evaluates both the interim site and the proposed adjusted disposal sites. At the Siuslaw River, final designation is requested for two adjusted disposal sites. The northern site is located approximately 2,000 feet northwest of the interim site in water depths of 90 to 105 feet and is 3,000 feet by 2,000 feet. The second site is located south of the interim site and the entrance channel in water depths of 90 to 105 feet and is 3,000 feet by 1,000 feet. The adjusted ODMDSs (with final designation) will be used to dispose of sediments dredged by the Corps to maintain the federally authorized navigation project at Siuslaw River. They may also be used for disposal of material dredged during other actions authorized under the MPRSA.

The main report contains an analysis of all 40 CFR criteria and factors required for final designation of an ocean disposal site under MPRSA. Also, sections of the main report addressing the alternatives, affected environment and environmental effects provide EA - level NEPA documentation. Technical data and coordination letters gathered to address these criteria are contained in the six appendices.

This document is submitted to EPA for agency review and processing and satisfies Corps documentation responsibility in seeking a final ODMDS designation at the Siuslaw River, Oregon.

SIUSLAW OCEAN DREDGED MATERIAL DISPOSAL SITE EVALUATION

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SIUSLAW OCEAN DREDGED MATERIAL DISPOSAL SITE EVALUATION

PURPOSE AND NEED

Purpose

1. The purpose of this evaluation study is to provide documentation to support a request to Region 10, Environmental Protection Agency, to formally designate two Ocean Dredged Material Disposal Sites (ODMDSs) offshore of Siuslaw River in the State of Oregon. Two ODMDSs are requested, one primarily for disposal during summer weather conditions and the other for disposal during spring and fall weather conditions. This study will determine if the proposed ODMDSs (2 sites) at Siuslaw River, Oregon fully meet all criteria and factors set forth in Parts 228.5 and 228.6 of Title 40 CFR. These regulations were promulgated in accordance with criteria set out in Sections 102 and 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972. The report makes full use of existing information to discuss various criteria, supplemented by field data, to describe environmental conditions within and adjacent to the proposed sites. Further, this document is intended to provide sufficient information to determine compliance with the Coastal Zone Management Act, Endangered Species Act, National Environmental Policy Act and National Historic Preservation Act of 1966. Use of the site would be for disposal of material dredged for operation and maintenance of the Federally authorized navigation project at Siuslaw River, Oregon and for disposal of dredged material from other dredging projects authorized in accordance with Section 103 of the MPRSA.

2. The evaluation of the Siuslaw River ocean dredged material disposal sites uses ODMDS designation study procedures developed by a joint task force of EPA and U.S. Army Corps of Engineers (CoE) personnel in a draft workbook entitled, "Technical Guidance for the Designation of Ocean Dredged Material Disposal Sites," dated October 1983. In May 1984, further guidance on the general approach to designation studies for ODMDS was jointly developed by EPA and CoE and published as the "General Approach to Designation Studies for Ocean Dredged Material Disposal Sites." The report "Yaquina Bay Interim Ocean Dredged Material Disposal Site Evaluation Study," dated April 1985, prepared by Portland District, CoE, was the first to closely followed this guidance. The report contained a main body which addresses the 5 general and 11 specific criteria, a general bibliography, and technical appendices which describe environmental processes and features of the study area. Several reports prepared for Oregon ODMDSs since the Yaquina Bay evaluation have followed this format, including this report.

3. The existing ODMDS at Siuslaw received an interim designation from EPA in 1977 as defined in 40 CFR 228.12(a). Disposal sites, given final designation, will be used to dispose of sediments dredged by the CoE to maintain the Federally authorized navigation project at Siuslaw River, Oregon and for disposal of materials dredged during other actions authorized in accordance with Section 103 of the MPRSA.

Need

4. The interim ODMDS has been and the final designated sites will be a necessary part of maintenance on the authorized project. No other environmentally or economically feasible estuary or upland disposal sites are now approved for use or are likely to be in the future. The Siuslaw River project was authorized for the following purposes:

a. To decrease waiting times for vessels crossing the bar;

b. To provide a protected entrance for shallow draft tugs, barges and commercial & recreational fishing vessels;

c. To provide mooring facilities for small boats which take advantage of project facilities;

d. To permit barge and small boat traffic upstream to river mile 17;

e. To provide a harbor of refuge; and,

f. Provide a dependable year-round entrance channel.

5. Consequently, maintenance of the navigation channel to authorized depths is critical to keeping the river and harbor open and sustaining these vital components of the local and state economy.

6. Ocean disposal of dredged materials is required for maintenance work near the river entrance. A hopper dredge is used for the dredging work because the rough seas encountered at the entrance are not suitable for operation of a pipeline dredge. No upland disposal sites have been identified. Upland disposal of dredged material from a hopper dredge is not feasible for economic and environmental reasons (see paragraph 35). There are no suitable sites in the estuary, and if there were, their use would cause greater adverse environmental impacts than ocean disposal. Estuarine habitats are generally more productive and far less extensive than are offshore oceanic habitats. Disposal of material upstream of the dredging site tends to increase the dredging requirements as the disposal material moves back downstream.

BACKGROUND

General

7. The Siuslaw River enters the Pacific Ocean near the town of Florence, Oregon, approximately 160 miles south of the Columbia River (see Figure 1). The river constitutes a navigable approach to Florence, Cushman and Mapleton. 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. Monthly discharge for the Siuslaw is highest in January and lowest in September. Mean annual discharge is about 2,130 cfs. Records from 1967 to 1980 show extreme flows of 49,400 cfs and 45 cfs. The coastal zone of

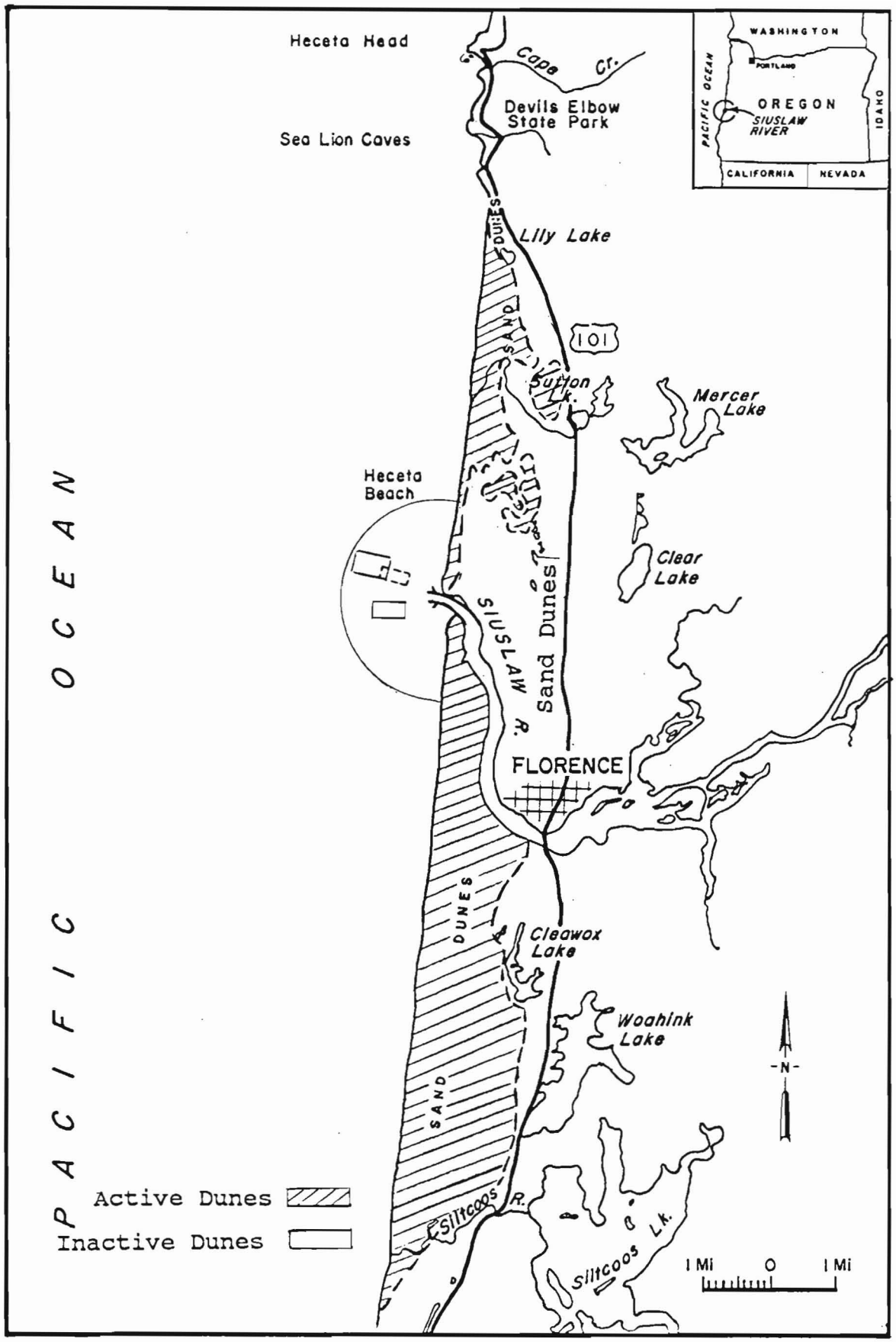

Figure 1
General Location of the Siuslaw River

the littoral cell consists of a one to two mile wide plain covered by active and stabilized sand dunes backed by the mature upland topography of the Coast Range. The Siuslaw River estuary covers 1,780 acres.

8. The Portland District, Corps of Engineers has been responsible for maintenance of navigable waterways of the North Pacific Coast since 1871. To improve navigation at Siuslaw River, two high tide jetties were completed in 1917, the north jetty having first been constructed in 1893. Dredging began after 1929. Both jetties were modified by the addition of spurs and extended seaward in 1985. Portions of the authorized project considered in this report are:

a. An entrance channel 18 feet deep and 300 feet wide from deepwater in the Pacific Ocean to RM .5;

b. A channel 16 feet deep and 200 feet wide to a turning basin 16 feet deep, 400 feet wide and 600 feet long at Florence;

c. A channel 12 feet deep and 150 feet wide to RM 16.5 with at turning basin 12 feet deep, 300 feet wide and 500 feet long at RM 15.8.

9. 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 small hopper dredge during the months of June through September. To date, over 5.3 million cubic yards have been removed from the bar, entrance and lower river, most of which has been dumped at sea. Since 1977, 2.5 million cubic yards have been placed at the designated interim offshore site. The average annual volume of dredged material between 1958-1990 has been 156,611 cubic yards (cy) from the entrance bar and channel . The minimum was 50,831 cy (1958) and the maximum was 388,360 cy (1981). The maximum value is deceptive because dredging in 1980 was limited due to the use of the dredges to clear sediment in the Columbia River caused by the eruption of Mount St. Helens. A large portion of the dredging in 1981 was due to the curtailment of dredging in 1980. The need for the ocean disposal site will continue for the foreseeable future, as it is an integral part of maintaining the channels to authorized depths. Use of this interim disposal site has been essential to the Corps' ability to carry out its statutory responsibilities for maintaining navigable waterways. To continue these responsibilities, it is essential that environmentally acceptable ocean disposal sites be identified, evaluated and permanently designated for continued use.

Historical ODMDS Use

10. The interim site (ocean disposal) 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 interim site in 40 CFR 228.12. The site designations in 1977 were an attempt by EPA to document and establish coordinates for historically used Corps of Engineers disposal sites. Interim designations are to lead to final designations or termination of their use, pending completion of required studies for final designation.

This study will report on these requirements and request final site designation from EPA for the adjusted site to the north and a new site to the south of the entrance channel.

11. The site designated interim in 40 CFR 228.12 was entitled,"Siuslaw River Entrance" and has the following coordinates (NAD 27):

44 01'32" N., 124 09'37" W.,
44 01'22" N., 124 09'02" W.,
44 01'14" N., 124 09'07" W.,
and 44 01'24" N., 124 09'42" W.

The approximate location of this site is 1.2 miles from the Siuslaw River entrance, with dimensions: 3,000 feet x 900 feet with an average water depth of 70 feet. The interim site and adjusted sites are the subject of this evaluation study to determine feasibility for final EPA ocean disposal site designation.

12. Review of data and information within the ZSF shows two offshore disposal sites are required for the Siuslaw. Local fisherman indicate dredged material deposited at the interim site in the last few years may be drifting back into the entrance channel during late summer. The extension of the jetties in 1985 to within 1000 feet of the interim site increased the possibility of ocean currents transporting dredged material back into the entrance channel. Consequently, the Corps completed dye and seabed drifter studies (USACE, 1988) during late July and August in 1986 and 1987. 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 entrance channel. Therefore two adjusted sites are recommended for final designation, a northern site for winter-like conditions (south to southwest winds) disposal and a southern site for summer-like conditions (north, northwest winds) disposal. Having two sites available will allow greater flexibility for dredges to adjust for prevailing sea conditions during disposal. A suitable northern site is located approximately 2,000 feet northwest of the interim site in water depths of 90 to 105 feet and has the following coordinates (NAD 27):

44 01'49.94" N., 124 09'58.44" W.,
44 01'39.03" N., 124 09'20.26" W.,
44 01'20.67" N., 124 09'30.33" W.,
and 44 01'31.57" N., 124 10'08.51" W.

The proposed adjusted northern site is 3,000 feet by 2,000 feet. This site is more than double the size of the interim site. ODMDS monitoring revealed mounding at the Siuslaw interim site and other coastal ODMDS's such as Mouth of the Columbia, Coos Bay, Umpqua and Yaquina. The turning radius of the dredge Yaquina (smallest dredge owned and operated on the Oregon coast by the Corps) is approximately 1000 to 1500 feet. Hence larger ODMDS's are requested to insure adequate material dispersal and confinement of disposal material within the designated site. The northern site is viewed as the primary site since the net longshore transport in the area is to the north and the

predominant annual wind pattern is from the south, southwest. The second site is located south of the interim site and entrance channel. It also is in water depths of 90 to 105 feet and has the following coordinates (NAD 27):

44 01'06.95" N., 124 10'20.04" W.,
44 01'04.67" N., 124 09'39.11" W.
44 00'54.83" N., 124 09'40.16" W.,
and 44 00'57.11" N., 124 10'21.09" W.,

This site is 3,000 feet by 1,000 feet. The two sites (the northern adjusted site and the southern site) are recommended for final designation in this report.

13. The frequency of maintenance dredging depends upon several factors: the volume of sediment transported into the estuary, storm frequency and severity of storm conditions. An average annual volume of dredged material for 5 years (1986 through 1990) was 153,033 cubic yards from the entrance bar and channel. The need for the ocean disposal sites will continue.

14. Channel improvements began on the Siuslaw in 1893 and consisted of constructing 4,000 feet of north jetty. Since 1929 over 5.2 million cubic yards have been disposed at sea with over 2.5 million cubic yards disposed in the designated interim offshore site since 1977. Between 1958 and 1990 annual disposal has averaged 156,611 cy, with a maximum of 388,360 cy and a minimum of 50,831 cy. Federal channel maintenance dredging that contributes to offshore disposal is done to maintain the entrance channel 18 ft deep and 300 ft wide and an inside channel 16 feet deep to Florence, Oregon. Maintenance dredging of the entrance channel is via hopper dredge as shoaling occurs primarily between the jetties at the mouth.

Dredged Material

15. The average annual quantity of dredged material disposed offshore from 1958 to 1990 is 156,611 cy, consisting entirely of sand. The maximum and minimum quantities during this period were 388,630 cy and 50,831 cy, respectively. The annual volumes are given in Appendix B, Table B-1. Projections indicate yearly dredging quantities will be consistent with the 1958-1990 average for sandy material. Future dredged material disposal may include fine grained sediment from non-federal dredging.

Interim Disposal Site

16. The ocean bed in the vicinity of the Siuslaw ZSF is characterized by a bulging outward 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 and the interim site is located near the crown of the bulge.

Compatibility of Sediment

17. The surface sediments of the Siuslaw ZSF can be differentiated from the disposed dredge material. The native surface sediments are moderately to well sorted fine sand (0.19 to 0.125 mm). Within the interim disposal site the sediment is poorly graded sand, with an average mean grain size of 0.2 mm, and

a range of variation from 0.074 mm and 0.9 mm. The transition between the native and dredged sediments appears to be abrupt. For the native surface sediments, there may be a slight tendency for an increase of fines with depth. Even though the native surface sediments can be distinguished from the disposed dredge material within the ZSF, the size difference is considered minor. Both are classified as sand and the grain sizes vary only in fractions of a millimeter. Hence Siuslaw dredged material is very similar to insitu sediments at the ODMDS and sediment compatibility should not be a problem.

18. Future use of the disposal site may include the disposal of fine-grained sediment from the Siuslaw estuary, or further upstream in the vicinity of the towns of Florence and Mapleton. In the event of fine-grained dredged material disposal, the insitu disposal site material may experience increases in the silt, clay and organic content. The disposal area is within a high energy wave environment and dispersion of fine grained material should be rapid. Determination of the suitability of material for ocean disposal shall be in accordance with the testing manual titled "Ecological Evaluation of Proposed Discharge of Dredged Material Into Ocean Waters" (the "Green Book"). Except for the possibility of fine-grain sediments, Siuslaw dredged material is very similar to insitu sediments at the ODMDS. Due to the limited quantity of fine-grained sediment, similarity of the disposal site sediment with the entrance bar sediment, and the high energy wave environment sediment compatibility should not be a concern.

Effects of Previous Disposal

19. The most recent bathymetric surveys showed some mounding at the interim disposal area. The dredged material normally disperses from the site in the littoral drift system with movement expected to be to the north and offshore during the winter and lesser movement to the south in the summer. The mounding can be attributed to above average disposal during several dredging seasons and mild wave climate during the winter of 1987-88. Disposal activities have not had any noticeable longterm impact on either the bottom sediment or bathymetry prior to the recent surveys.

Economic Geology

20. There are no accumulations of heavy minerals or gravel along the coast in the vicinity of the mouth of the Siuslaw River. While there have been exploratory oil and gas wells bored both to the north and south on the continental shelf, as well as inland of the entrance of the Siuslaw, significant quantities of oil and gas have not been found. Currently there are no mining activities in the area, nor is there a history of mining. Therefore, no conflict is anticipated.

EVALUATION PROCEDURES

General

21. The procedures used to evaluate the Siuslaw ODMDSs consisted of evaluating each of the five general and eleven specific criteria as required in 40 CFR 228.5 and 228.6. The results of the evaluations were then applied to potential disposal locations within a Zone of Siting Feasibility (ZSF). The limit of the ZSF is defined as the maximum distance away from a dredging site

that a disposal site can be located and still have a economically and logistically viable project. The ZSF is limited by economic haul distance, dredge plant availability and seasonal restrictions imposed by weather or environmental considerations for a specific project.

22. Natural and cultural resources of the area within the ZSF were identified from information obtained through review of literature, interviews with resource agencies and local users and site specific studies. Critical information was evaluated, mapped and overlaid to identify areas of resource conflict. The selection of resources to use for this determination was dependent on whether the resource was considered limited. A coast-wide resource, i.e., a flatfish spawning area, was not considered a limited resource and was not included in the overlay evaluation technique. Figure 2 shows the results of overlaying each of the individual resources to identify areas of highest cumulative resource value.

Format

23. This report will constitute a site evaluation study, utilizing the procedures developed in the above referenced report and as required in 40 CFR, Parts 228.4(e), 228.5, 228.6, 228.9, and 228.12. The main body of the report addresses specifically all criteria and factors required in Parts 228.5 and 228.6. Technical information used to discuss these criteria and factors are contained in technical appendixes.

24. Procedures used to evaluate criteria and factors, as discussed in the preceding section, are those developed in a workbook entitled, "General Approach to Designation Studies for Dredged Material Disposal Sites", EPA and USACE, May 1984 (see Figure 3).

Site Selection Criteria

25. The MPRSA requires that site evaluation be performed prior to final designation for continued use of the interim and/or adjusted sites as ocean disposal sites. A site evaluation study is defined in 40 CFR 228.2(c) as:

"The collection, analysis, and interpretation of all pertinent information available concerning an existing disposal site, including but not limited to, data and information from trend assessment surveys, monitoring surveys, special purpose surveys of other Federal agencies, public data archives, and social and economic studies and records of affected areas."

26. These studies are used to comply with and discuss criteria and factors listed in Parts 228.6 and 228.5. Criteria and factors are listed in Tables 1 and 2.

Sites Evaluated

27. The designation workbook and 40 CFR 228 separate evaluations given to new sites versus interim ODMDS. All alternative area locations for the new ODMDS should be considered. If a discussion of factors demonstrate that the existing site will have undesirable impacts on important resources, an adjusted site or sites will be considered.

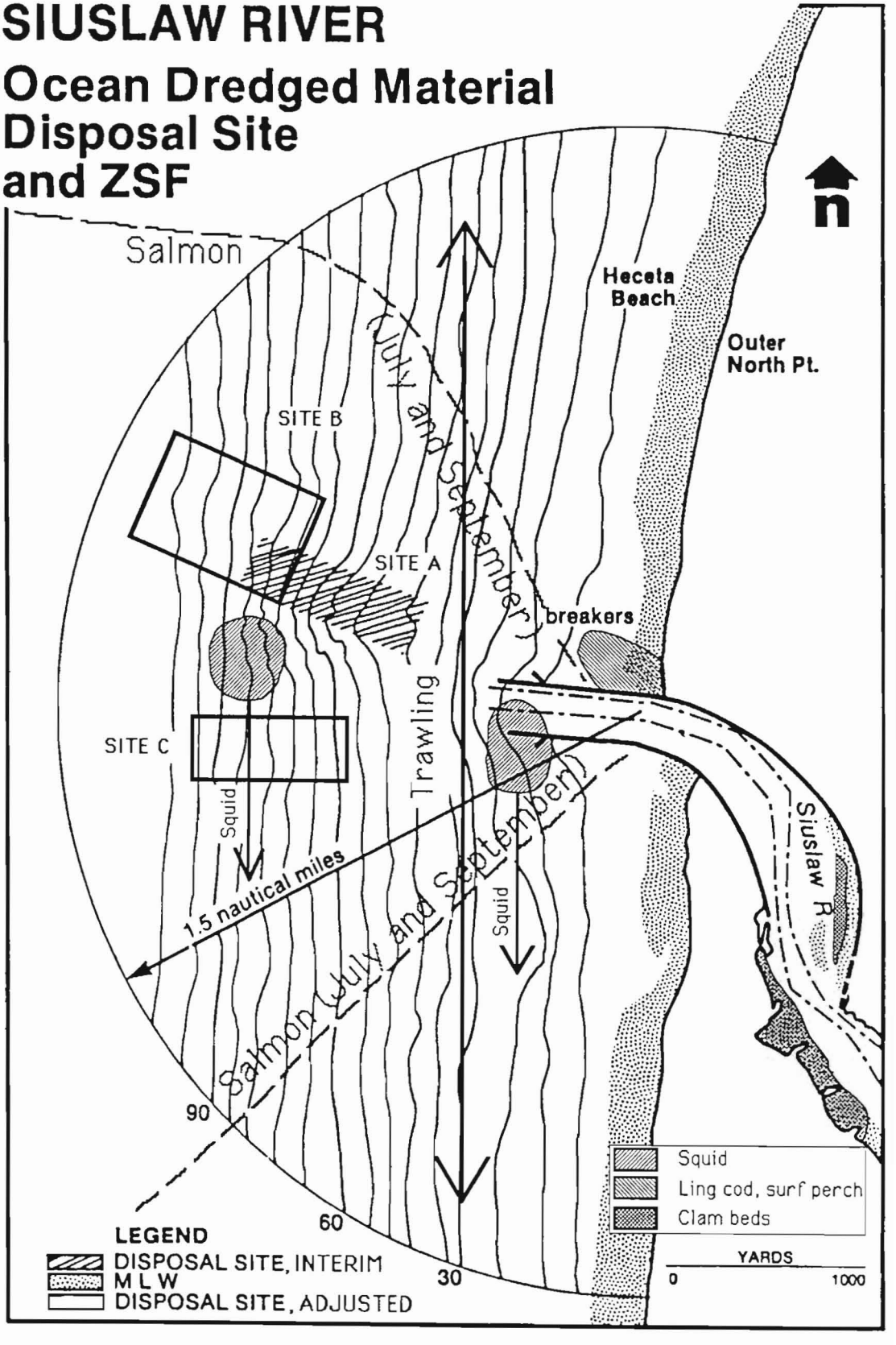

Figure 2
Overlay Evaluation of Individual Resources

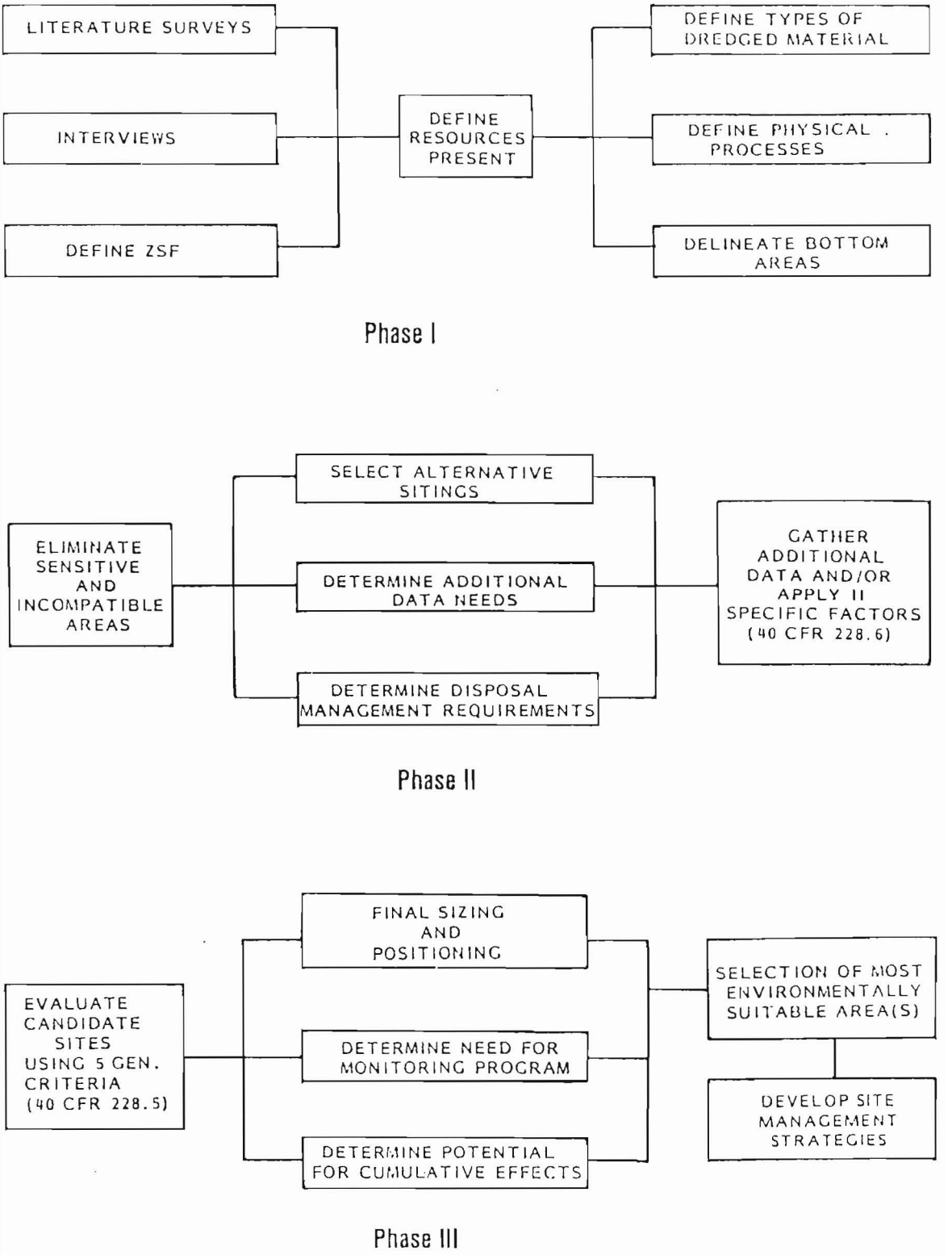

Figure 3

Overall Process for ODMDS Evaluation

Table 1

Eleven Specific Factors for Ocean Disposal Site Selection

1. Geographical position, depth of water, bottom topography, and distance from coast.

2. Location in relation to breeding, spawning, nursery, feeding or passage areas of living resources in adult or juvenile phases.

3. Location in relation to beaches or other amenity areas.

4. Types and quantities of waste proposed to be disposed and proposed methods of release, including methods of packaging the waste, if any.

5. Feasibility of surveillance and monitoring.

6. Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current velocity, if any.

7. Existence and effects of present or previous discharges and dumping in the area (including cumulative effects).

8. Interference with shipping, fishing, recreation, mineral extraction, desalination, shellfish culture, areas of special scientific importance and other legitimate uses of the ocean.

9. Existing water quality and ecology of the site, as determined by available data or by trend assessment or baseline surveys.

10. Potential for the development or recruitment of nuisance species within the disposal site.

11. Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.

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28. This approach was employed for the Siuslaw River interim and adjusted ODMDS evaluation. The first item under this approach is to conduct a literature search of existing information. The general bibliography of this search is provided at the end of the report. This bibliography was used as the initial step of all the technical appendixes. The ZSF was investigated and suitable adjusted sites were located northwest and south of the interim site.

Table 2

General Criteria for the Selection of Ocean Disposal Sites

a. The dumping of material into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shell fisheries, and regions of heavy commercial or recreational navigation.

b. Locations and boundaries of disposal sites will be chosen so that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shell fishery.

c. If at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved for ocean dumping do not meet criteria for site selection set forth in Sections 228.5 - 228.6, the use of such sites will be terminated as soon as suitable alternative disposal sites can be designated.

d. The sizes of ocean disposal sites will be limited in order to localize, for identification and control, any immediate adverse impacts and to permit the implementation of effective monitoring and surveillance programs to prevent adverse, long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study.

e. EPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used.

Zone of Siting Feasibility (ZSF)

29. The interim disposal site must be located within an economically and operationally feasible radius from the point of dredging. The designation workbook suggests establishing a ZSF. The ZSF at Siuslaw River was set as an arc transcribed 1.5 nautical miles out from river mile (RM) 0 and ends both north and south at the beach (see Figure 4).

30. The determination of a 1.5-mile limit is based on the amount of dredging necessary to maintain the channel to the authorized depth, the availability of dredging equipment that can be dedicated to that work, the dredging volume, the time capability of equipment to dredge and haul the material to the disposal site and the amount of time available annually to accomplish the

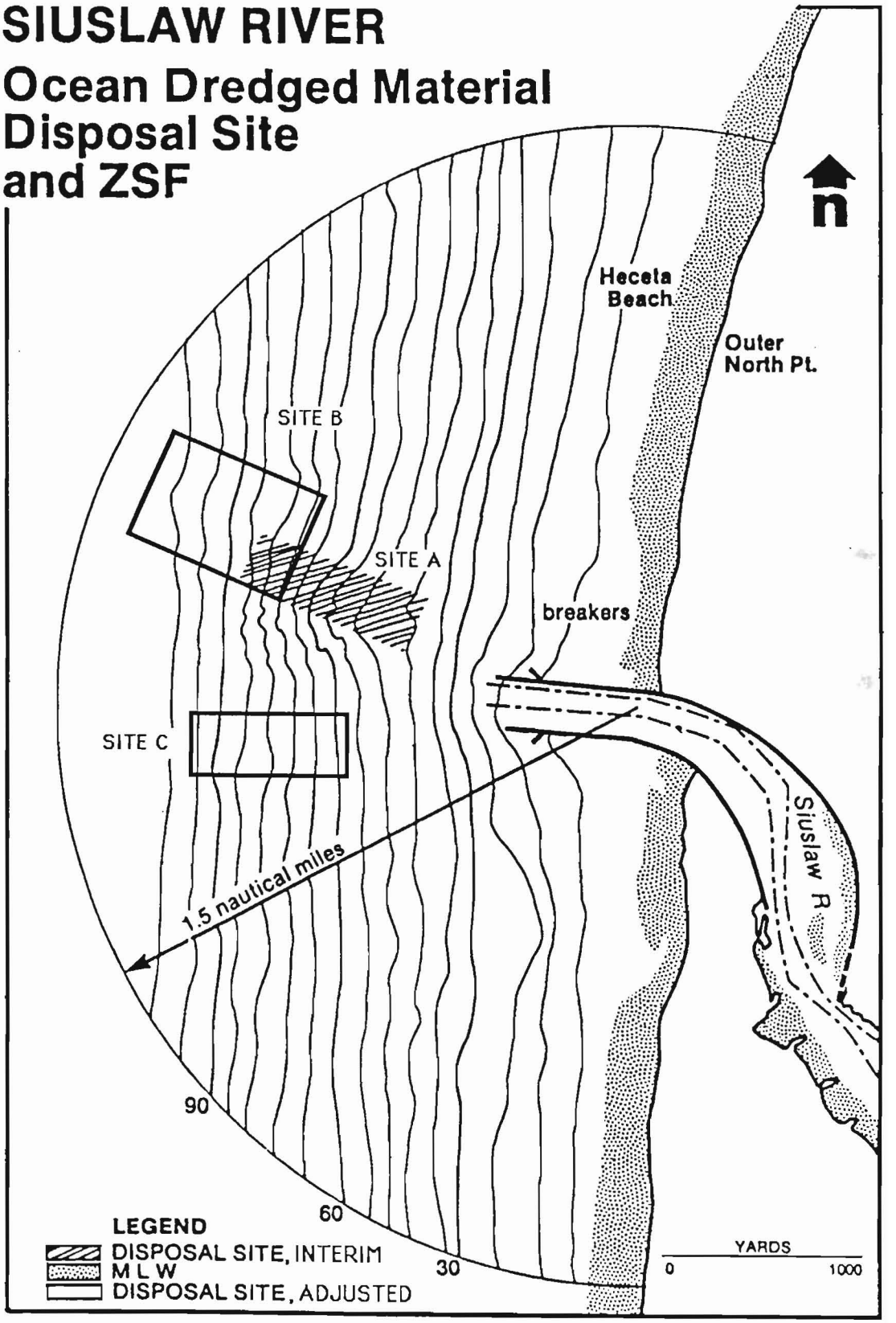

Figure 4
Siuslaw River ODMDSs and ZSF

necessary maintenance dredging for the Siuslaw River as well as other ports along the Pacific Coast.

31. Dredging of the coastal ports is limited to a season from April through October. That limit is imposed by storms and rough sea conditions that predominate in winter throughout the Northeastern Pacific Ocean, rendering dredging infeasible and unsafe during the winter. The size of the ZSF is controlled by the capability of available dredging equipment as allocated among the nine Oregon, one Washington, and four California coastal projects and the haul distance. Twenty-one days each year are presently allocated for dredging at Siuslaw. Longer hauling distances increase vessel operating costs and the time required for completion of the work. Based on these factors, the extreme practical limit of the Siuslaw ZSF is 1.5 nautical miles (nm).

32. Present dredging along the Pacific coast is accomplished by a combination of government owned and privately owned hopper dredges. Though contract dredges have dredged the Siuslaw River in the past, most of the maintenance dredging is accomplished by government owned dredges.

33. Government operated dredges are currently authorized 230 days for dredging annually. Production capability of the dredge Yaquina at the Siuslaw is approximately 11,000-15,000 cubic yards per day with a haul distance of no more than 1.5 nautical miles from the entrance. With this production rate the Yaquina can complete the required dredging at the Siuslaw in the time allocated thus maintaining a reasonable schedule to dredge the remaining 13 ports. A disposal area located at a greater distance would reduce the capability of the dredge. Analyzing the total dredging workload for the Portland District, the number of contractor dredges capable of dredging this port and the relatively small amount of material to be removed annually, it is unlikely a contractor-owned dredge would be available reliably during the months permitted by favorable weather and sea conditions. Therefore, the outer limit of the ZSF is controlled by the capability of the available dredging plant, the limited dredging time period imposed by weather and sea conditions on the Oregon coast, and the large dredging workload of the Portland District.

ALTERNATIVES

34. Ocean disposal of dredged materials is required for maintenance work near the river entrance. A hopper dredge must be used for this work because the rough seas encountered at the entrance are not suitable for safe operation of a pipeline dredge. No inwater disposal sites exist in the Siuslaw estuary as it is too narrow and shallow.

Upland Disposal

35. Upland disposal is not feasible for economic and environmental reasons. Currently no upland disposal sites have been identified. Potential problems with upland disposal include both environmental and economic impacts. The project is bordered on the south by the Oregon Dunes National Recreation Area (NRA) and county parks and to the north by steep hills. Sand pumped onto the dunes to the south would likely be blown back into the channel. The master

plan for the NRA establishes guidelines for the preservation of most of the area in its natural state, so an upland disposal site adjacent to the project would be questionable. Also, because of the need to use a hopper dredge, it would be necessary to rehandle materials to use an upland disposal site. Such an operation would require dredging an in-water sump, bottom-dumping into the sump, then pumping the material ashore with a pipeline suction dredge. This would be very costly and also would increase adverse environmental impacts of the project by adding the impact of an in-water estuarine disposal site. Another adverse impact of upland disposal is that naturally occurring sediments would be removed from the littoral transport system which could cause erosion of nearby shorelines over the long term.

Sites off Continental Shelf

36. Potential disposal areas located off the continental shelf in the Siuslaw River area would be at least 40 nm offshore, in water depths of 600 feet or greater. The haul distance to a site beyond the shelf is much greater than the 1.5 nm limit of the Siuslaw ZSF, making the site economically infeasible. Further, significant environmental concerns about disposal in such areas make off-shelf disposal undesirable. Such disposal would remove large quantities of natural sediments from the nearshore littoral transport system, a system that functions with largely nonrenewable quantities of sand in Oregon. Disruption in the mass balance of this system would alter erosion/accretion patterns, adversely impacting beaches, spits, wetlands, and other shoreline habitats.

37. Benthic and pelagic ecosystems near the continental slope contain important fishery resources and processes effecting them are not well understood. Fine grain sediment and rocky habitats would be directly impacted in disposal operations. Deposited sediments could be transported long distances downslope. Bottom gradients can be 5% to 25% on the continental slope, making accumulated unconsolidated sediments susceptible to slumping. Also, offshore transport by near bottom currents could occur. Very little is known of the ecology on the continental slope and disposal in this area could cause impacts of known severity.

38. Designation of a site beyond the shelf would require extensive seasonal site characterization studies and monitoring to understand the system and evaluate disposal impacts. Distance offshore and depth of required sampling would add further to the time and expense of such a program.

Ocean Disposal in the ZSF

39. Three alternatives for ocean disposal within the ZSF are considered for the Siuslaw project:

(1) Termination of ocean disposal at Siuslaw.
(2) Designation of the existing interim ODMDS.
(3) Designation of an adjusted ODMDS.

Ocean disposal at the Siuslaw River interim ODMDS has not resulted in any longterm adverse impacts and termination of ocean disposal is not the preferred alternative. The final designation of the interim site is also not

the preferred alternative. The results of dye and seabed drifter studies (USACE 1988) have demonstrated the need for establishing two disposal sites at Siuslaw (Appendix B, paragraph 3.8). Designation of an adjusted site north of the entrance channel and a new site to the south of the channel is proposed. The designation of two sites would allow disposal to occur at either location, dependant upon prevailing, local conditions. Depression of the benthic community has occurred at the interim site, but densities would be expected to return to normal within a few recruitment seasons following cessation of disposal activities. The proposed sites were located in areas where impacts would be minimal.

APPLICATION OF ELEVEN SPECIFIC CRITERIA (40 CFR 228.6)

Overview

40. The determination of whether or not to continue disposal at the interim site or to begin disposal at the two adjusted sites will be based on a discussion of each of the 11 specific factors and 5 general criteria given in 40 CFR 228.6 and 228.5 and Tables 1 and 2 of this report. The discussions of each factor and criteria which follow are general in nature, as they are discussed in detail in the technical appendixes. Each factor is examined and related to how it affects the continued use of the interim or adjusted disposal sites. Following the separate discussions, a comparison of all factors will be made. Resources of limited distribution within the ZSF, or which could be affected outside the ZSF, will be discussed, mapped, and compared to determine potential conflicts with the interim and adjusted disposal sites.

Geographic Location (1)

41. Figure 4 shows the location the interim and two adjusted ODMDSs, along with bottom contours. The interim and two adjusted sites lie in 42 to 130 feet of water and are approximately 1.0 nautical mile offshore of the Siuslaw River entrance. Coordinates were presented in the Purpose and Need Section of this report. Bottom topography within both sites is varied and is presented in detail in Appendix B.

Distance from Important Living Resources (2)

42. Aquatic resources of the sites are described in detail in appendix A. The sites are located in the nearshore area and many nearshore pelagic organisms occur in the water column over the sites. These include zooplankton (copepods, euphausiids, pteropods, and chaetognaths) and meroplankton (fish, crab and other invertebrate larvae). These organisms generally display seasonal changes in abundance. Since they are present over most of the coast, those from Siuslaw are not critical to the overall coastal population. Based on evidence from previous zooplankton and larval fish studies, it appears ocean disposal will have no impacts to organisms in the water column (Sullivan and Hancock, 1978).

43. Benthic samples were collected at the locations shown in Figure A-1. The particular species identified from the disposal site are adapted to high energy environments and are able to withstand large sediment fluxes.

44. The nearshore area off the mouth of the Siuslaw supports a variety of pelagic and demersal fish species. Pelagic species include anadromous salmon, steelhead, cutthroat trout and shad that migrate through the estuary to upriver spawning areas (ODFW, 1979). Other pelagic species include the Pacific herring, anchovy, lingcod and sea perch.

45. Demersal species present in the nearshore area were sampled in October, 1984 and in January, 1985. The species sampled were mostly resident and included flatfish, sculpins, sea perch and rocky reef fish. Flatfish were primarily located over open sandflats while the sculpins and rockfish were associated with rock pinnacles, reefs and jetties.

46. English, Dover, and petrale sole move from deep offshore waters in winter, to shallow nearshore waters in summer. Shallow inshore waters are important nursery areas for juvenile English sole (Krygier and Pearcy 1986). The nearshore area is an important spawning and rearing area for demersal fish species and crab. Most of the individuals collected were juveniles. Flatfish in particular use the sandflat habitat for spawning and rearing. The high numbers of juvenile crabs collected in the nearshore area off of the mouth of the Siuslaw River indicates this area is an important rearing habitat for juvenile crab.

47. Nearshore areas have been known to be a squid spawning area with the location and size varying annually. Since squid are highly motile, disposal activities probably will not adversely affect them.

48. Portland District has requested an endangered species listing for the site from U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). The brown pelican, marbled murrelets, Leatherback Sea Turtle, and Grey, Humpback, Blue, Fin, Sei, Right, Sperm Whales, Northern Sea Lions, Sacramento River Winter Chinook Salmon and Snake River Sockeye, spring/summer chinook and fall chinook salmon are the only anticipated species which will be listed. No impacts to listed species are anticipated from the project. Letters of response are included in Appendix F.

Distance from Beaches and other Amenities (3)

49. The adjusted disposal sites are at least 2,400 ft from the end of the jetties and 5,000 ft from the nearest beach. There are no rocks or pinnacles in the vicinity of the interim or adjusted sites.

Types and Quantity of Disposal Material (4)

50. The final disposal sites will receive dredged materials transported by either government or private contractor hopper dredges. The current dredges available for use at Siuslaw have hopper capacities from 800 to 4,000 cubic yards. This would be the range in volumes of dredged material disposed of in any one dredging/disposal cycle. An average of 156,611 cubic yards estimated to be removed annually from Siuslaw can be placed at the sites in one dredging

season by any combination of private and government plants (see discussion under ZSF). The dredges would be under power and moving while disposing, allowing the ship to maintain steerage.

51. Material dredged for offshore disposal comes primarily from bars forming at the mouth of the Siuslaw. They consist primarily of marine sand transported into the river's mouth. The sand is medium to fine grained, and is slightly coarser than the native offshore sediments. The sand is clean, containing no contaminants of concern in excess levels, and is excluded from further biological and chemical testing as discussed in 40 CFR 227.13b. Fine grain materials to be placed in the final sites would receive chemical and biological testing, if appropriate, as outlined in 40 CFR 227.13c to supplement existing information. Appendix C presents the results of sediment analysis. Tables C-6 through C-7 deal with contaminants. Appendix C provides grain size information for the dredged area and the disposal sites (see Figures C-5 to C-15).

Feasibility of Surveillance and Monitoring (5)

52. Surveillance of disposal operations can be made from shore or small boat. Possible monitoring may include hydrosurveys, sediment chemistry or benthic community responses. If actual field monitoring of the disposal activities or sites is required because of a future concern for habitat changes or impacts to limited resources, several research groups are available in the area to perform any required work. This work could be performed from small surface research vessels at a reasonable cost.

Dispersal, Horizontal Transport, and Vertical Mixing Characteristics of the Area (6)

53. 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 the bottom current records, there appears to be a net annual transport of sediment to the north. There is some southward sediment transport during the summer. During the summer the current velocities are variable (See Appendix B, Figures B-16 and B-17, and B-27, respectively). This is due to the constantly varying river outflow combined with tidal flows to produce a highly variable influence on the nearshore circulation.

54. 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 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.

Effects of Previous Disposals (7)

55. Average annual volume of dredged material disposed offshore from 1958 to 1990 was 156,611 cubic yards. The maximum and minimum quantities of sandy material were 388,360 and 58,831 cubic yards respectively. Appendix B, table B-1 gives the volumes of material disposed of in the last 30 years. The adjusted sites have not received any dredged material except for the southeast corner of the northern site. This corner was part of the interim site.

56. Detailed offshore bathymetry at the mouth of the Siuslaw River shows a bulge in bottom contours on and adjacent to the interim ODMDS. The bulge is probably related to the combination of river discharge and ebb tide currents, which create an "ebb delta" of nearshore material. Ebb deltas are common in many areas of the world. The crest of the ebb delta runs along the southern edge of the interim disposal site. Historically there has not been mounding within the site, nor is there aggradation specific to the site. Figure 5 shows survey data for the past 10 years. Recent surveys indicate some mounding within the interim site. The recent mounding may be attributed to above average disposal from 1983 to 1988 and mild wave climate during the winter of 1987-88.

57. No pre or post-disposal water or sediment quality monitoring has been performed. Based on information presented in Appendix C, there has not been any chemical impacts on the marine environment surrounding the interim disposal site. Dredged material previously, and currently disposed at the site are physically similar to the samples collected in close proximity to the disposal site (Appendix B), and no chemical contaminants are present in significant concentrations.

Interference with Other Uses of the Ocean (8)

a. Commercial and Recreational fishing.

58. Major commercial and recreational fisheries occur in and around the disposal site. Coho and chinook salmon are taken in a nearshore commercial troll fishery. Commercial fish landings for salmon are 240,133 pounds (ODFW, Annual Reports, 1978-1985). Salmon support a good recreational fishery centered off the Siuslaw bar. Both commercial and recreational fishing seasons generally begin in June and run through October, subject to catch quotas set by ODFW.

59. The recreational Dungeness crab fishery takes place mainly within the Siuslaw Estuary. Some commercial crab sites are within close proximity to the disposal sites. Figure A-6 shows the general location of the commercial fishing areas. The commercial crab harvest is 103,407 pounds. Ghost shrimp support a small commercial fishery. Commercial harvests of shrimp are 2,361 pounds annually.

b. Offshore Mining Operations

60. There are no known metallic mineral deposits within the area. Likewise, there have been no exploratory wells drilled offshore near the mouth

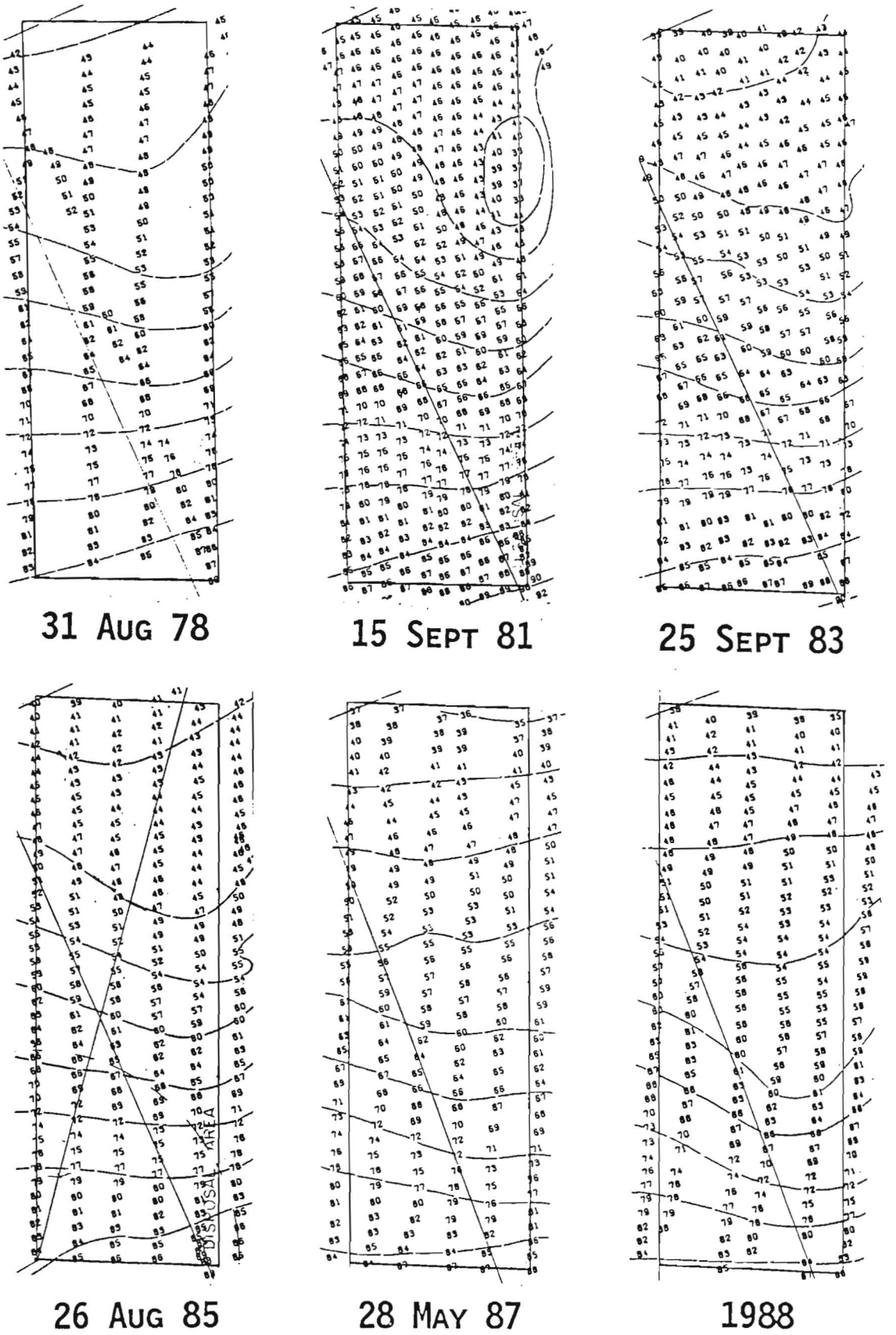

Figure 5: Siuslaw River Interim ODMDS Bathymetry

of the Siuslaw. Exploratory wells near Reedsport (on land) did not result in production. In any case it is unlikely that production facilities would be placed near the river's mouth or the disposal site due to the hazard to navigation that would be created.

c. Navigation.

61. No significant conflicts with commercial navigation traffic have been reported. Conflicts at the adjusted sites are not expected due to the light traffic in the Siuslaw River area and the sites location away from the channel. This situation is not expected to change substantially.

d. Scientific.

62. There are no known transects or other scientific study locations that could be impacted by the disposal sites.

e. Coastal Zone Management.

63. Local comprehensive land use plans for the Siuslaw area have been reviewed and approved by the State of Oregon. These plans discuss ocean disposal and recognize the need to provide for suitable offshore sites for disposal of dredged materials. In addition, this site evaluation document indicates that no significant effects on ocean, estuarine, or shoreland resources are anticipated, as Goal 19 of the Oregon Statewide Planning Goals and Guidelines requires.

64. The proposed action has been determined by the Corps to be consistent with the acknowledged local comprehensive plans and the State of Oregon Coastal Zone Management Program. The State of Oregon, Department of Land Conservation and Development will review this consistency determination with a request to provide written notification of their findings. Their letter will included in Appendix F, "Comments and Coordination", of the final document.

Existing Water Quality and Ecology (9)

65. Water and sediment quality analyses conducted at several Oregon ODMDS are discussed in Appendix C. These studies have not shown adverse water quality impacts from ocean disposal of entrance shoal sands. Likewise, such impacts are not expected from dredged material disposal at the Siuslaw ODMDS.

66. The ecology of the area is discussed in general terms based on information presented in Appendix A. The offshore area is a northeast Pacific mobile sand community. This determination is based mainly on fisheries data. The benthic community is also described in detail in Appendix A. Neither the pelagic or benthic communities should sustain irreparable harm due to their mobility and widespread occurrence off the Oregon coast. Studies indicate a depressed density of benthic infauna within the interim disposal site, but no impact to densities outside of the site relative to the reference stations. Reasons for depression in the density may be due to the coincidence of the dredging activity and the benthic recruitment season. If disposal at the interim site is discontinued, the benthic densities are expected to return to normal levels.

Potential for Recruitment of Nuisance Species (10)

67. Nuisance species are considered as any undesirable organism not previously existing at the disposal site which are either transported to or recruited and established there because of the disposal of dredged materials. All materials dredged and transported to the interim disposal site historically have been classified as noncontaminated marine sands (Appendix C). They have further been discussed as being similar to sediments at the interim disposal site. While there are no immediate plans for the disposal of fine grain material, the possibility exists in the future. It is anticipated that the quantity of fine grain material would be small and infrequent, (less than 40 thousand cubic yards every four years). Any fine grain material placed in the site would be subject to state water quality criteria and other sediment quality guidelines, and would not have significant contaminate levels. The high energy wave and current environment would tend to further disperse and dilute any fine sediments and associated contaminants. Therefore, it is highly unlikely that any nuisance species could be established at the disposal site since neither habitat nor contaminant levels are likely to change.

Existence of Significant Natural or Cultural Features (11)

68. The cultural resource literature search of the Siuslaw River study area is described in detail in Appendix E. Due to the proximity of the disposal site, the resource that has the greatest potential for impact by use of the ODMDS is shipwrecks. As indicated on Figure E-1, the most likely areas for shipwrecks in the project area are in the shallow breaker zone and the Siuslaw River mouth. Any wreck within these areas would experience damage from the high energy wave climate. Deeper water would buffer the high energy wave climate, thus shipwrecks in deeper water would have less damage. The shipwrecks in deeper water tend to have more cultural value, but tend to be fewer than shipwrecks nearshore. Included in Appendix E is a table of all recorded shipwrecks in the project area. Historical records indicates there are not any shipwrecks within the interim or adjusted ODMDS.

69. Wrecks could occur in the project area that have not yet been discovered. However, based on previous investigations in other Oregon coastal settings (Yaquina Bay, Coquille, Columbia River Mouth), beaches, surf zones, and shallow waters are the most likely areas for shipwreck occurrence. The Siuslaw ODMDSs are removed from these areas.

70. It has been determined, based on the considerations in Appendix E, that there will be no cultural resource impacts from designation of the Siuslaw ODMDSs. Appendix E will be reviewed by the Oregon State Historic Preservation Officer to determine whether they concur with this finding. Their coordination letter(s) will be included in Appendix F of the final report.

APPLICATION of The FIVE GENERAL CRITERIA (40 CFR 228.5)

General

71. An evaluation of an ODMDS is based on the 11 specific factors in 40 CFR 228.6 of the ocean dumping regulations and criteria. These 11 factors have been discussed in the preceding section. The next step is to utilize the 11

specific factors to discuss requirements of the five General Criteria (40 CFR 228.5).

Minimal Interference with Other Activities (a.)

72. The first of the five criteria require that a determination be made as to whether the site will minimize interference of the proposed disposal operations with other uses of the marine environment. This determination is made by overlaying several individual maps presented in the technical appendixes onto a base map, giving bathymetry and location of the interim disposal site and ZSF. The selection of figures to use for this determination was dependent on whether the resource was considered limited. A coast-wide resource, i.e. flat fish spawning area, was not considered a limited resource and was not included in the overlay evaluation technique. The following figures, depicting spatial distribution of specific resources, were included in the evaluation of resources of limited distribution.

- Navigation Hazards Area/Other Recreation Areas
- Shellfish Areas
- Critical Aquatic Resource
- Commercial and Sport Fishing Areas
- Geological Features
- Cultural, Historically Significant Areas

73. Figure 2 is a composite of all of the above figures and illustrates high usage areas within the ZSF. The denser the pattern overlap, the more interactions between various limited resources exist, thus the more critical the overlap area. As the figure shows, the adjusted sites are within minimal conflict areas in the ZSF. Disposal operations occur from May through October of each year. While this represents a temporal overlap, communications with ODFW personnel (Appendix A) 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.)

74. The second of the five general criteria require changes to ambient seawater quality levels occurring outside the disposal site be within water quality standards and that no detectable contaminants reach beaches, shoreline, sanctuaries, or geographically limited fisheries or shell fisheries. Figure 2 was utilized to determine the potential for effects on items mentioned above. No significant contaminant or suspended solids releases are expected with disposal of Siuslaw sand. Based on previous work at Coos Bay site H (Appendix C), disposal of fines at the final site should not have any long term impact on the water quality. There should be no water quality perturbations to be concerned with moving toward a limited resource. Bottom movement of deposited material is discussed in Appendix B and in general shows a net offshore movement for the finer fractions. Coarser fractions stay in the same general area.

Interim Sites Which Do Not Meet Criteria (c.)

75. The evaluation indicates that the interim disposal site does not meet the criteria and factors established in 40 CFR 228.5 and 228.6. Due to the extension of the Siuslaw jetties in 1985 the interim site is now within 1000 feet of the north jetty. Concern has been raised by local interests and evidence from drifter studies indicate that material deposited at the interim site could migrating back into the channel between the jetties. Potential conflicts could occur during dredging activities and navigation and safety problems could develop if mounding occurs within the interim site.

Size of Sites (d.)

76. The fourth general criterion requires that the size, configuration and location of the site will be evaluated as part of the study. The recommended Siuslaw River adjusted ODMDSs are rectangular (the north site or Site B is 3000 ft by 2000 ft and the south site or Site C is 3000 ft by 1000). Mounding has been a problem at other ODMDSs (Mouth of the Columbia River, Coos Bay, Umpqua River, Yaquina Bay). Increasing the size and number of disposal sites allows greater dredged material management flexibility. These disposal sites are considered dispersive and are of adequate size to accommodate the annual volumes of material normally ocean-disposed at Siuslaw.

Sites Off the Continental Shelf (e.)

77. Any possible disposal sites off the continental shelf in the area of the Siuslaw are at least 40 nautical miles offshore. By contrast, the Siuslaw ZSF extends a maximum of only 1.5 nautical miles from shore. The project could not be maintained economically with the current dredging technology and availability of plant if a slope site was required. Also, use of a site off the continental shelf would result in 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. For these reasons, designation of an ODMDS off the continental shelf is not desirable, economically nor environmentally.

CONFLICT MATRIX ANALYSIS

Summary of Environmental Effects/Affects

78. Once the specific and general site selection criteria were addressed for the proposed disposal site, a conflict matrix analysis was completed. Portland District developed the matrix format to simplify the general and specific site criteria review process and has used the matrix for several ODMDS studies. Each area of consideration on the conflict matrix addresses at least one general and specific criteria. Table 3 contains comments pertinent to the criteria for the proposed site. In addition to the conflict matrix, operational constraints and cost were considered for the site.

AFFECTED ENVIRONMENT

79. A brief summary of the physical, biological and socio-economic environments at the proposed disposal sites are presented in the following two sections: Affected Environment and Environmental Effects. The summaries are the basis for evaluating the suitability of the sites for ocean disposal. The

TABLE 3

Conflict Matrix

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

AREA OF CONSIDERATION	CONFLICT	POTENTIAL CONFLICT	NO CONFLICT	BENEFICIAL USE	COMMENTS	RELEVANT SPECIFIC FACTORS (From Table 1 & 40CFR 228.6)	RELEVANT GENERAL CRITERIA (From Table 2 & 40CFR 228.5
1. Unusual Topography			X			1, 6, 8, 11	a
2. Physical Sediment Compatibility		X			Possible disposal of fines.	3, 4, 9	b, c, d
3. Chemical Sediment Compatibility		X			No known contamination, but will continue periodic monitoring.	3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal			X			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			Navigation problem with fishing boats.	2, 8	a, b
7. Recreational Fisheries		X			Navigation problem with fishing boats.	2, 8	a, b
8. Breeding/Spawning Areas			X			2, 8	a, b
9. Nursery Areas		X			Juvenile flatfish and crab.	2, 8	a, b
10. Feeding Areas		X			Pelagic birds, gray whales and other marine mammals, & juvenile/adult salmonids.	2, 8	a, b
11. Migration Routes		X			Marine mammals, salmonids, pelagic birds and shore birds.	2, 8	a, b
12. Critical Habitats of Threatened or Endangered Species			X		No critical habitat present, numerous threatened & endangered species.	2, 8	a, b
13. Spatial Distribution of Benthos			X			2, 8, 10	a, b
14. Marine Mammals		X			Potential impact to resident & migratory species.	2, 8	a, b
15. Mineral Deposits			X			1, 8	a, b, e
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 Col. Chem./Phys. Characteristics			X			4, 6, 9	a, b, d
20. Recreational Uses		X			Inconvenience to recreational boats.	2, 8, 11	a, b, c, d
21. Cultural/Historic Sites		X			Minor - 15 identified ship wrecks.	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	c
25. Shape/Size of Site (orientation)			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	c, d

information is formatted for use in NEPA documentation. More detailed information on the affected environment is presented in the appendices.

Physical Environment

80. The topography of the seabed in the vicinity of the proposed disposal site is fairly uniform. Depths at the site range from 60 to 110 feet. Previous disposal operations have not created a noticeable mound before 1987. Bathymetric surveys made prior to 1988 have indicated no change in bathymetry. The 1988 survey was done immediately after disposal activity and shows some mounding within the interim site.

81. Bottom sediments range from fine sand to medium sand. Finer than sand-sized sediments are carried in suspension and are quickly removed from the site by longshore and offshore currents. Coarser sediments remain at the site for longer periods but are eventually redistributed by currents. The zone of active sediment movement in the area extends to a depth of about -150 feet.

82. The materials dredged from the mouth of the Siuslaw River are medium to coarse sands with occasional gravels similar in range to the existing nearshore sediments. Dredging volumes from 1958 to 1990 ranged from 58,831 to 388,360 cubic yards, averaging 156,611 cubic yards per year.

83. Water and sediment quality in the vicinity of the channel entrance and disposal site is typical for seawater of the Pacific Northwest with no known source of pollutants.

Biological Environment

84. The disposal sites are located in the nearshore environment and the overlying waters contain many nearshore pelagic organisms. These include zooplankton (copepods and euphausiids) and meroplankton (fish, crabs, and other invertebrate larvae). These organisms generally display seasonal changes in abundance with maximum abundance occurring from February to July.

85. Benthic sampling in the vicinity of the disposal site indicates the sand environments are characterized by polychaete annelids and numerous species of cumaceans, gammarid, molluscs, and snails. The species inhabiting the sandy environments are generally more mobile types which tolerate or require high sediment flux. Juvenile and adult dungeness crab are also abundant in this environment.

86. Commercially and recreationally important macroinvertebrates such as shellfish and Dungeness crabs occur in the vicinity of the Siuslaw ZSF. Most of these species are found in shallower habitats than the disposal site. Pelagic and demersal fish species in the vicinity of the disposal sites include coho and chinook salmon, steelhead, surf perch, starry flounder, English, Dover and petrale sole.

87. Numerous species of birds and mammals occur in the pelagic, nearshore, and shoreline habitats in and around the proposed disposal sites. Principal shorebird species found offshore include the western snowy plover, black oystercatcher, killdeer, and spotted sandpiper. Recent shorebird surveys along the Oregon Coast have shown that the northern portion of the Oregon

Dunes National Recreation Area (ODNRA) supports some of the highest densities of wintering sanderlings in the world. Mammals within the ZSF include seals, sea lions, Gray, Humpback, Blue, Fin, Sei, Right, and Sperm whales and the Leatherback turtle. The migration of the whales does not coincide with the dredging at the Siuslaw.

Socio-economic Environment

88. The Siuslaw River enters the Pacific Ocean near the City of Florence, Oregon and navigation on the river is critical to the local economy. The City of Florence has a population of 3240 (1974), while Lane County's population is 54,741 (1970).

89. The Florence area is popular with recreationists because of the spectacular coastal scenery and excellent fishing opportunities both offshore and in the Siuslaw River. The area is increasing in popularity as a small boat harbor and has excellent facilities for the thousands of anglers who fish here annually. The offshore area also supports a moderate commercial fishery, primarily for salmon, and sole. Dungeness crab is also commercially harvested in the estuary and offshore. The forest products industry is the primary source of income to the local economy. Other important sources include commercial fishing, agriculture and tourism.

90. No significant mineral or petroleum deposits are known to exist in the vicinity of the proposed disposal site.

91. Shipwrecks could occur in the project area that have not yet been discovered. However, based on previous investigations in other Oregon coastal settings (Yaquina Bay, Coquille, Columbia River Mouth), beaches, surf zones, and shallow waters are the most likely areas for shipwreck occurrence. The Siuslaw ODMDSs are removed from these areas; therefore, there should be no cultural resource impacts from designation of the Siuslaw ODMDSs.

ENVIRONMENTAL EFFECTS

General

92. The proposed action is the designation of two sites for ocean disposal of dredged material. Designation of the sites would not have any direct environmental effects, but it would subject the sites to use as an ocean disposal area. Therefore, this document addresses the likely effects of disposal at the sites based upon the current Operation and Maintenance dredging program for the Siuslaw River navigation project. A separate evaluation of the suitability of dredged material and disposal impacts will be conducted for each proposed disposal action as required under Section 103 of the MPRSA.

Effects on Physical Environment

93. Disposal of the expected dredged material at the proposed disposal sites would not have a significant effect on the physical environment. Material dredged for offshore disposal comes from bars forming in the estuary and at the mouth of the Siuslaw. Material dredged from the bar is medium to fine grained sand, and is slightly coarser than the native offshore sediments. The material from within the Siuslaw estuary ranges in size from silt to medium

sand. All of the anticipated future dredged material will be sand, and would be comparable to the variation in sediment size found in or near the disposal sites. In the event of fine grain material disposal, some increase in insitu fine fraction may occur. The dredged material would disperse from the site in the littoral drift system with movement expected to be to the north and offshore during the winter and lesser movement to the south in summer, with some northward transport. No mounding is expected to occur at the two adjusted ODMDS with the average disposal quantities expected.

94. The sand is clean, containing no contaminants of concern in excess levels, and is excluded from further biological and chemical testing as discussed in 40 CFR 227.13b. Fine grain materials placed in the final sites would receive chemical and biological testing, if appropriate, as outlined in 40 CFR 227.13c to supplement existing information, and would be restricted to relatively clean material. Therefore, disposal would not introduce significant contaminants to the sediments at the disposal sites or degrade the longterm water quality in or adjacent to the sites.

95. No mineral resources are expected to be affected by disposal.

Effects on Biological Environment

96. Impacts to the biological environment would be primarily to the benthic community. Some mortality would occur as a result of smothering. Most of the benthic species present are motile and adapted to a high energy environment with shifting sands. Therefore, many would likely survive the effects of disposal. In addition, some recolonization would occur from surrounding areas since the sediments would be compatible. The rate of recolonization would be affected by disposal frequency.

97. Larger, more motile organisms such as fish, birds, and marine mammal species would likely avoid the disposal activity or move out once it has begun. They would be exposed to short term turbidity at most. Therefore, impacts are expected to be limited to disturbance rather than injury or mortality.

98. The brown pelican, the Gray, Humpback, Blue, Fin, Sei, Right, and Sperm Whales; Leatherback turtle; Northern Sea Lions; Sacramento River Winter Chinook Salmon; Snake River Sockeye Salmon are endangered species identified by the USFWS and NMFS as possible part or full time residents or possibly passing through the project area. Biological assessments addressing impacts to these species have been prepared and no significant impact to the listed species is anticipated from the designation or use of the ocean disposal site.

Effects on Socio-economic Environment

99. The designation of two ODMDSs for dredged material off the mouth of the Siuslaw River would allow the continued maintenance of the Federal navigation channel. This would result in waterborne commerce remaining an important component of the local economy. If a site is not designated, maintenance dredging would cease for lack of adequate disposal sites. The channel would shoal in and become unsafe and/or unnavigable. Shipping and fishing traffic would have to be directed through other ports and the local economy would suffer.

100. No known mineral or economic resources would be impacted by disposal at the proposed site.

101. Few impacts to recreation are expected to occur. Recreational fishery resources would be temporarily displaced during disposal operations. Time delays for recreational boaters caused by the passing of the dredge or an increase in navigation hazards during congested periods could occur. Conflicts such as these can be considered an inconvenience rather than a threat to recreational activity.

102. There would be a short-term reduction in aesthetics at the disposal site as a result of turbidity following disposal. The material would settle rapidly and not affect any areas outside of the disposal area. No impacts are anticipated to the beach or adjacent recreation areas.

103. It is unlikely that any cultural resources are present in the adjusted disposal sites. Therefore, designation and use of the adjusted sites are not expected to have any impact on cultural resources.

104. In reviewing proposed ocean disposal sites for consistency with the Coastal Zone Management (CZM) plan, they were evaluated against Oregon's Statewide Goal 19 (Ocean Resources). Local jurisdiction does not extend beyond the baseline for territorial seas; therefore, local plans do not address offshore sites. Goal 19 requires that agencies determine the impact of proposed projects or actions. Paragraph 2.g of Goal 19 specifically addresses dredged material disposal. It states that agencies shall "provide for suitable sites and practices for the open sea discharge of dredged material which do not substantially interfere with or detract from the use of the continental shelf for fishing, navigation, or recreation, or from the long-term protection of renewable resources". Decisions to take an action, such as designating an ocean disposal site, are to be preceded by an inventory based on sound information, an understanding of the resources and potential impacts. In addition, there should be a contingency plan and emergency procedures to be followed in the event that the operation results in conditions which threaten to damage the environment.

105. Ocean disposal sites for dredged material are designated following guidelines prepared by the EPA (Ocean Dumping Regulations). Site selection is to be based on studies and an evaluation of the potential impacts (40 CFR Part 228.4(e)). This meets the requirements of State Goal 19 for decisions to be based on an inventory and a sound understanding of impacts. The five general and eleven specific criteria for the designation of a site presented in 40 CFR 228.5 and 228.6 outline the type of studies to be conducted and the resources to be considered. According to 40 CFR Part 228.5(a), ocean disposal will only be allowed at sites "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". Monitoring is to be conducted at the ocean disposal sites. If adverse effects are observed, then use of the site may be modified or terminated. The requirements of the ocean dumping regulations are broad enough to meet the need of Goal 19. Therefore, the designation of the adjusted site for ocean disposal of dredged material

following the ocean dumping regulations would be consistent with Goal 19 and the State of Oregon's Coastal Zone Management Plan.

COORDINATION

106. Procedures used in this evaluation and the proposed continued use of an ODMDS has been discussed with the following State and Federal agencies:

- Oregon Department of Fish and Wildlife
- Oregon Department of Environmental Quality
- Oregon Dept. of Land Conservation and Development
- Oregon Division of State Lands
- U.S. Coast Guard
- U.S. Fish and Wildlife Service
- National Marine Fisheries Service
- U.S. Environmental Protection Agency

107. The agencies were briefed on evaluation techniques and existing information was requested from them. A formal public involvement program designed to receive comments from all state and local agencies, private groups, and individuals will be carried out by EPA during the final site designation process. Coordination letters received in response to requests to evaluate consistency determinations made in this document will be included in Appendix F of this report and EPA's final EIS.

108. This proposed Federal action requires concurrence or consistency for three Federal laws from the responsible agencies as indicated below.

* Endangered Species Act of 1973, as amended	U.S. Fish & Wildlife Service National Marine Fisheries Service
* National Historic Preservation Act of 1966, as amended	State Historic Preservation Officer
* Coastal Zone Management Act of 1972, as amended	Oregon Department of Land Conservation and Development

Consistency or concurrence letters from the above listed agencies will be included in Appendix F or obtained as part of the final site designation process. State water quality certification, required by Section 401 of the Clean Water Act, will be obtained for individual dredging actions.

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APPENDIX A

Living Resources

APPENDIX A

LIVING RESOURCES

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LIVING RESOURCES

Introduction

1.01 Information on aquatic resources was obtained from a field sampling program conducted in 1984, 1985, 1986, and 1988. There was also a thorough utilization of a variety of published and unpublished reports, theses, and personal communications with the Oregon Department of Fish and Wildlife (ODFW) Marine Resources Division biologists. Critical resources were determined by whether the resource was unique to the area or limited along the Oregon coast.

Plankton

1.02 Distribution and abundance of inshore plankton species vary depending upon near shore oceanographic conditions. In the summer when the wind is from the northwest, surface water is moving south and away from the shore. Colder, more saline, nutrient rich water then moves up from depth onto the shore. This upwelling phenomenon can extend up to 10 km offshore and last from days to weeks depending upon the strength and duration of the wind. Plankton taxa during this time are predominantly those from subarctic water masses.

1.03 In the winter the wind is primarily out of the west and southwest and surface waters are transported inshore. The zooplankton community during this time period is primarily those from the transitional or Central Pacific water masses.

1.04 Plankton sampling has not been carried out off Siuslaw. Peterson and Miller (1976) and Peterson et al. (1979) have conducted sampling of the zooplankton community off Yaquina Bay and found copepods to be the dominant taxa. Zooplankton species varied with season, of the 58 species collected, 38 were collected in the summer and 51 in the winter. Eight occurred commonly in both summer and winter while seven occurred only or predominantly in the summer and six in the winter. A list of dominant summer and winter species is given below. In general winter species are less abundant.

Table A-1
Dominant Copepoda Species by Season in Decreasing Order of Abundance

Winter Species	Summer Species
Pseudocalanus sp.	*Pseudocalanus* sp.
Oithona similis	*Acartia clausii*
Paracalanus parvus	*Acartia longiremis*
Acartia longiremis	*Calanus marshallae*
Centrophages abdominalis	*Oithona similis*

1.06 Other taxa collected were of lesser abundance as compared to the copepods except for some organisms during parts of the year. Taxa collected are listed in tables A-2 and A-3.

Table A-2: Total Relative Density and Frequency of Plankton during Upwelling Season off Yaquina Bay

TAXA	TOTAL RELATIVE DENSITY			FREQUENCY		
	1969	1970	1971	69	70	71
Calarus nauplii	119.5	695.5	172.7	21	40	28
Other Copepod nauplii	43.1	68.1	52.3	10	20	20
Amphipods	8.5	18.5	15.7	5	15	14
Euphausiid nauplii	46.3	85.9	84.0	5	26	18
Euphausiid Calyptopis	13.3	14.5	17.2	4	17	11
Euphausiid furcilia	30.2	13.6	17.7	14	20	10
Thysanoessa spinifera	35.4	4.0	87.3	2	7	11
Evadne nordmanni	73.7	58.9	9.8	17	26	2
Podon leukarti	2.8	115.3	5.2	2	12	1
Pteropods	10.2	24.6	60.6	11	22	35
Chaetognaths	89.4	50.3	30.8	25	33	34
Oikopleura	69.2	85.7	66.5	11	15	21
Ctenophores	6.0	2.5	34.9	7	5	19
Schphomedusae	22.9	70.9	22.8	13	28	22
decapid shripm mysis	142.7	52.6	45.3	16	24	22
barnacle nauplii	59.3	168.3	231.4	8	32	28
barnacle cypris	4.4	64.0	8.3	2	19	10
polychaete post-trochophores	16.2	20.1	21.4	5	23	15
bivalve veligers	170.5	258.9	68.3	20	40	27
gastropod veligers	28.9	79.2	42.2	16	33	23
hydromedusae	6.1	3.2	10.3	2	2	11
unidenitifed annelid without parapodia	8.2	23.1	35.8	3	3	16
pluteus	0.0	16.0	117.6	0	5	11
large round eggs (fish)	36.8	25.0	17.8	11	13	12
Calanus eggs	870.1a	168.7	226.1	10	28	25
euphausiid eggs, early	55.0	686.1	449.6	11	29	24
euphausiid eggs, late	70.0	57.5	39.6	2	16	14
other fish eggs	19.1	35.1	34.3	12	18	18

a = biased by signle observaton of 760 indidvuals/µs.

The following taxa were found in less than five samples: radiolarians, foraminifera, siphonophores, planula larva, trochophores, *Tomopteris*, heteropids, *Clione*, phoronid larva, ascideian larva, salps, auricularia larva, imm starfish, decapod protozoeas, unusual barnacle nauplii, *Stylockeiron abbreviatum*, anchovy eggs, and four miscellaneous unidentified meroplanktonic taxa.

Total relative density and frequency of occurrence of other holophlanktonic taxa and meroplnakton taken 18 km of the coast during 1969, 1970 and 1971 upwelling taken. I seasons. Table entries are sums of average abundancd at each of four stations (Peterson & Miller, 1976).

Table A-3: Total Relative Density and Frequency of Plankton during Winter off Yaquina Bay

TAXA	TOTAL RELATIVE DENSITY			FREQUENCY		
	1969-70	1970-71	1971-72	69-70	70-71	71-72
Calarus nauplii	1188.7	165.9	35.1	10	15	15
Other Copepod nauplii	29.1	122.5a	20.2	11	13	12
Amphipods	5.9	4.8	5.0	12	4	10
Euphausiid nauplii	2.8	108.4a	3.4	4	5	4
Euphausiid Calyptopis	6.4	56.1a	14.2	13	4	8
Euphausiid furcilia	3.1	0.4	7.6	7	2	5
Evadne nordmanni	5.8	24.1	4.8	2	2	4
Pteropods (*Limacina*)	66.0	88.0	14.2	17	15	13
Chaetognaths	62.9	47.4	22.4	20	33	13
Oikopleura spp.	551.9	101.2	75.6	22	16	15
Ctenophores	7.0	6.2	10.3	8	8	9
Schphomedusae	10.0	94.3	16.6	5	6	10
Salps	0.9b	***	***	9	0	0
Isopods	0.5	0.7	***	2	3	0
Mysids	0.2	3.3	2.1	2	1	2
decapid shripm mysis	3.1	21.4	5.6	7	10	11
barnacle nauplii	309.1	192.7	77.9	11	6	12
barnacle cypris	8.7	188.1a	16.4	4	4	12
polychaete post-trochophores	41.5	13.5	70.8	12	8	11
bivalve veligers	87.8	98.2	118.4	20	18	15
gastropod veligers, assorted	31.3	27.6	37.2	19	18	15
gastropod A	***	1.0	***	0	6	0
hydromedusae	9.2	1.8	3.3	4	2	3
annelid without parapodia	40.0	74.9	21.9	5	4	11
echinoderm pluteus	41.7	0.8	22.1	5	2	4
large round eggs (fish)	9.0	5.5	4.9	6	11	8
Calanus eggs	36.5	36.7	4.7	10	11	4
euphausiid eggs	***	274.7a	2.8	0	6	3

a = high value the resul of one station or sampling date.
b = a value of 34.3/m^3 on 29 October 1969 was ommitted from the summation.

The following taxa were found in less than five samples: The euphausiids *Thysanoessa spinifera* and *Euphausia pacifica*, amphipod larvae and eggs, astracods, cumaceans, siphonophores, *Sagitta scrippsii*, *S. bierii*, *S. minima*, *Lepas* naupii, other unidentified barnacle nauplii, echinoderm bipinnaria, imm. starfish, imm. urchins, planula larvae, trochophors, foraminifera, radiolarians, *Tomopteris*, cyphonautes larvae, other fish eggs, and six miscellaneous unidentified meroplankton taxa.

Total relative density and frequency of occurrence of other holophlanktonic and meroplnakton taxa taken within 18 km of the coast during three winters. Table entries are sums of relative densities at each of four stations (Peterson & Miller, 1976).

1.07 Another plankton species of importance is the megalops stage of the Dungeness crab (*Cancer magister*). Lough (1976) has reported that megalops occur inshore off Oregon from January to May and are apparently retained there by the strong longshore and onshore components of the surface currents in the winter. After May, the megalops metamorphoses into juvenile crabs and settle out of the plankton moving into rearing areas in the estuary. Shenker(1988) also found megalops to be abundant off Yaquina Bay in the spring. He found their distribution to be patchy and associated with convergence zones of surface currents. Megalops were most abundant at the surface during dusk and dawn and least abundant during the day. Megalops have been collected as deep as 50-70 m during the day (Shenker 1988).

1.08 Fish larvae are a transient member of the inshore coastal plankton community. Their abundance and distribution has been described by Richardson (1973), Richardson and Pearcy (1977) and Richardson et al. (1980).

1.09 Three species assemblages have been described off the Oregon coast: coastal, transitional, and offshore. In general, the species in the coastal and offshore assemblages never overlapped while the transitional species overlapped both groups. The break between the coastal and transitional groups occurred at the continental slope.

1.10 The coastal group is dominated by smelts (*Osmeridae*) making up over 50 percent of the larvae collected. Other dominant species included the English sole (*Parophrys vetulus*), speckled sanddab (*Citharichthys stigmaeus*), starry flounder (*Platichthys stellatus*), and tomcod (*Microgadus proximus*). Maximum abundance occurred from February to July when greater than 90 percent of the larvae were collected. Two peaks of abundance were present during this period, one prior to upwelling in February and March (24 percent of larvae)an one in May to July (68 percent of larvae) following upwelling. Dominant species during each peak are shown below (table A-4).

Table A-4
Dominant Fish Larval Species During the Two Peaks of Abundance

Species	Feb.-March	May-July
Smelt (*Osmeridae*)	1.51*	4.12
English sole (*Parophrys vetulus*)	4.09	
Sandlance (*Ammodytes hexapterus*)	1.76	
Speckled sanddab (*Citharichthys stigmaeus*)	1.73	2.21
Tomcod(*Microgadus proximus*)		2.03
Slender sole (*Lyopsetta exilis*)		1.07

* Biological index - Ranking method that averages abundance and frequency of occurrence in samples. 5 to 1 in decreasing order.

1.11 Shenker (1988) did additional sampling of fish larvae off Yaquina Bay and found a similar pattern of zonal distribution. The data, however, indicated a more rapid switch in species, following onset of upwelling, than

previous studies. Four of the dominant species collected also had distributions that crossed the zonal boundaries. Larval cabezon (*Scorpaenichthy marmoratus*) dispersed offshore out of the coastal zone as they grew and larval brown Irish lords (*Hemilepidotus spinosus*) originally found offshore moved inshore to the coastal zone as they grew. Juvenile greenling were found in all zones prior to upwelling and juvenile ronquils (*Ronquilus jordani*) were found at all stations both before and after upwelling.

Benthic Invertebrates.

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

1.13 Knowledge of the benthic communities off the nearshore Oregon coast is limited. Investigations have been primarily on offshore disposal sites and are specific to that site. Studies have been done on the offshore sites near the mouth of the Columbia River (Richardson et al. 1973), Coos Bay (Hancock et.al. 1981, Nelson et.al. 1.1983, and Sollitt et.al. 1984), Yaquina Bay (USACE 1985), Chetco River (USACE 1988a), and the Rogue River (USACE 1988b). Additional studies have also been done on the Umpqua River, Depoe Bay, Siuslaw River, and Tillamook Bay sites (Emmett et al. 1987). Two unpublished studies one of the meiobenthos at Moolach Beach north of Yaquina Bay entrance (Hogue 1982) and one of an International Paper Company outfall near Gardiner, Oregon have also provided some general information.

1.14 Site specific benthic invertebrate data for the Siuslaw interim disposal site were collected at 14 stations off the mouth of Siuslaw River (Figure A-1) in October 1984 and January 1985 (Emmett et al 1987). In this study, stations were located on the centerline of the disposal site and on transect to the north and south of the site on the 40, 50, 60, 70, 80, and 100-foot contours. Another benthic study was conducted in September 1988 in order to evaluate the possibility of relocating the disposal site further offshore. Mounding from past disposal has made the interim disposal site unusable. In this study, there were eleven stations sampled, four each at the two proposed disposal sites one north and one south of the interim disposal site at 60, 70, 80, and 90-foot depths. Two stations outside the proposed sites as well as one in the interim site were also sampled (Figure A-2).

1.15 Six replicate bottom samples were taken at each station using a modified Gray-O'Hara box corer which sampled a .096m^2 area of the bottom. One sample was sent to the Portland District for determination of grain size and organic content. The remaining five box-core samples were sieved through a 0.5 mm mesh screen; organisms retained on the screen were preserved in 10 percent buffered formalin, picked from the sediment and counted and identified to the lowest taxon practicable.

1.16 Sediments off Siuslaw River were predominately fine sand with a grain size of approximately 3 phi. Sediments were also low in silt-clay (0.23 and

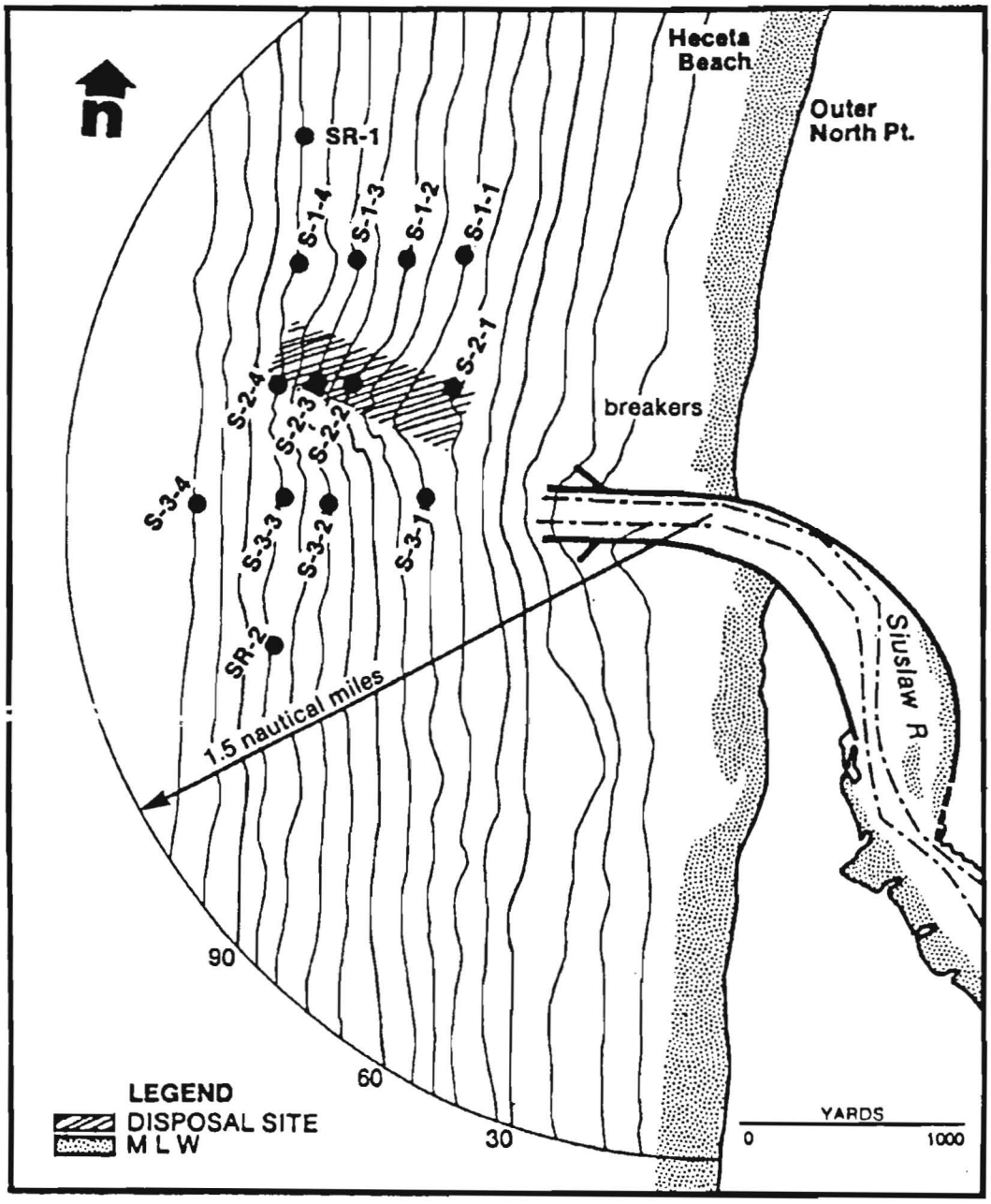

Figure A-1
1984-1985 Benthic Invertebrate Survey Stations

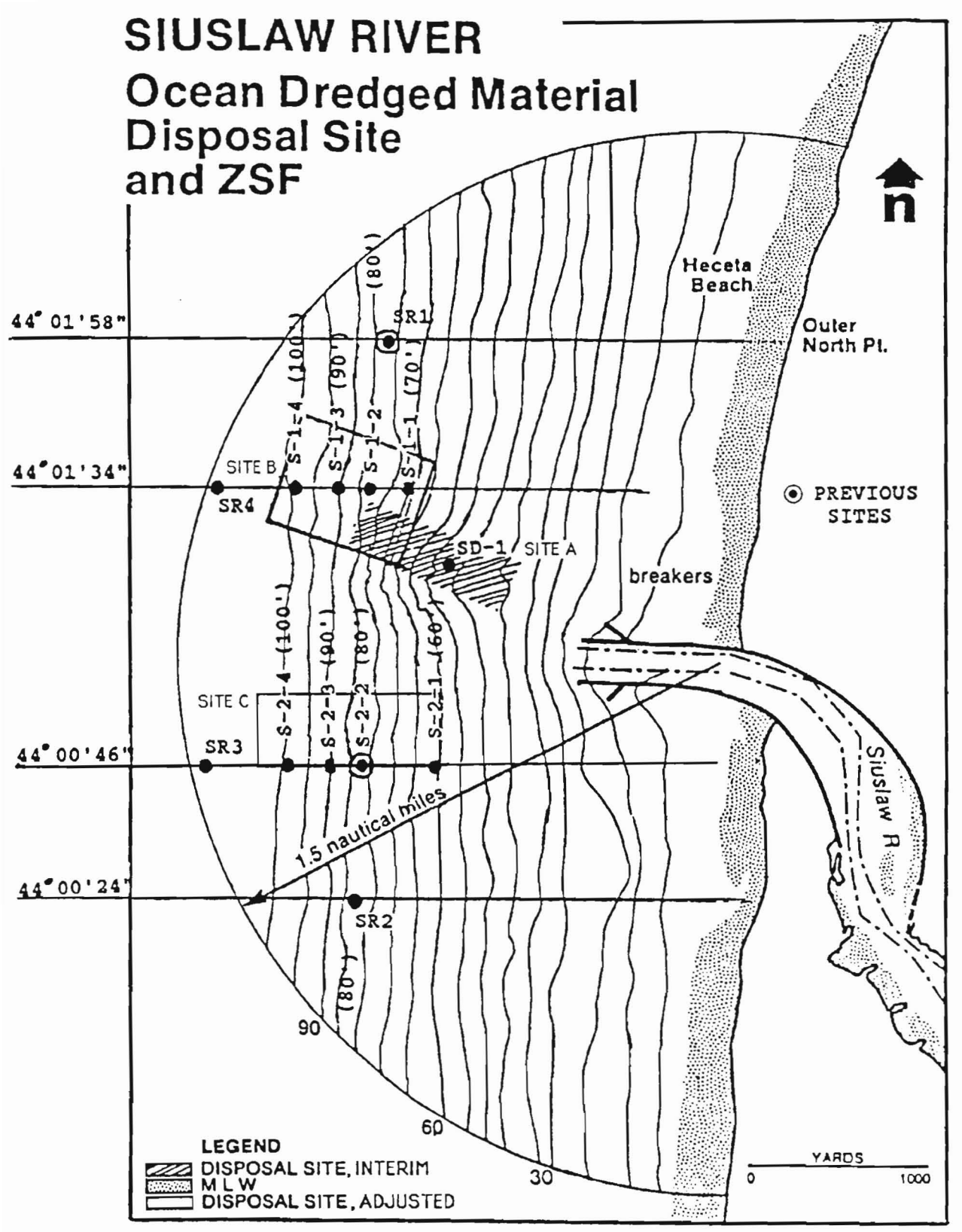

Figure A-2
1988 Benthic Invertebrate Survey Stations

0.69%) and organic (0.74 and 0.87%). The volatile solids were relatively low in September 1988.

1.17 The interim disposal site and proposed disposal sites all exhibited diverse benthic invertebrate communities. A total of 135 taxa were collected in October 1984, 106 in January 1985, and 163 taxa were collected at the proposed disposal sites 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 were collected in the 1988 survey.

1.18 Lowest densities occurred in the immediate vicinity of the interim disposal site, particularly in the more shallow survey sites. Highest densities occurred further offshore and to the north or south of the disposal site (Figures A-3 and A-4). In October 1984, the site was actively being used for the disposal of dredged material and the low densities may have been the result of disposal operations. Densities in January 1985, however,were similar to those obtained in October, indicating that either densities are low in this area or recolonization of the disposal site had not occurred. Due to the active dredging operations, the species composition in October may also have been influenced by the introduction of organisms. In the January 1985 survey the species composition may have been influenced by both seasonal variation and recolonization of the area.

1.19 Diversity values were highest during the January 1985 survey. The reason for this is unclear, except that the area was disturbed during disposal operations in October, and was not yet recolonized by January. The proposed disposal sites exhibited much lower diversity values than those obtained at the interim disposal site, although the densities were higher. This was due to the abundance of the polychaetes, *Owenia fusiformis* and *Spiophanes bombyx*.

1.20 Polychaetes were the numerically dominate species collected during the 1984-85 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 including the amphipods: *Eohaustorius sencillus*, *Mandibulophoxus gelesi*, and *E. sawyeri*. This area also had a large number of sand dollars, *Dendraster excentricus*.

1.21 At the proposed disposal site, the dominant species was *Owenia fusiformis* (USACE, 1988), although the density of this polychaete was low to moderate when compared to other coastal areas (Emmett et al., 1987). Another dominant polychaete collected during this period was *Spiophanes bombyx*.

1.22 In the 1984-85 survey, there was no correlation between density and depth, but it was instead a function of the proximity to the interim disposal site. There were no significant differences between densities in the October and January surveys probably due to the dumping operations occurring in the area during the October survey. The September 1988 survey showed higher densities in the deeper locations and lower densities in the more shallow locations. The high densities in September 1988 were mainly due to presence of *Owenia* and *Spiophanes bombyx* in the deeper waters. Since the stations

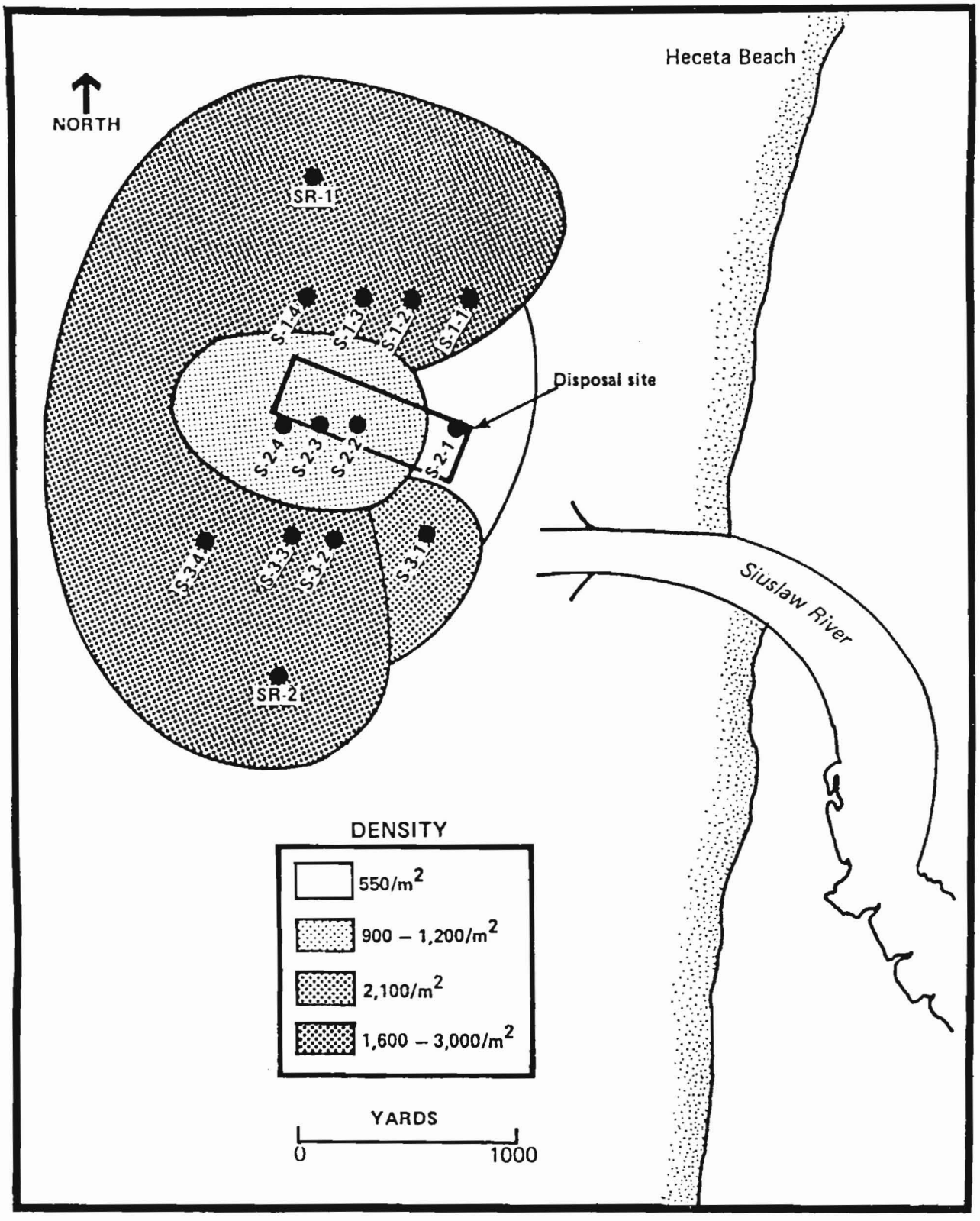

Figure A-3
Locations of the Benthic Invertebrate Cluster Groups
Identified From Survey 1 (Oct 84) (Emmett, 1987)

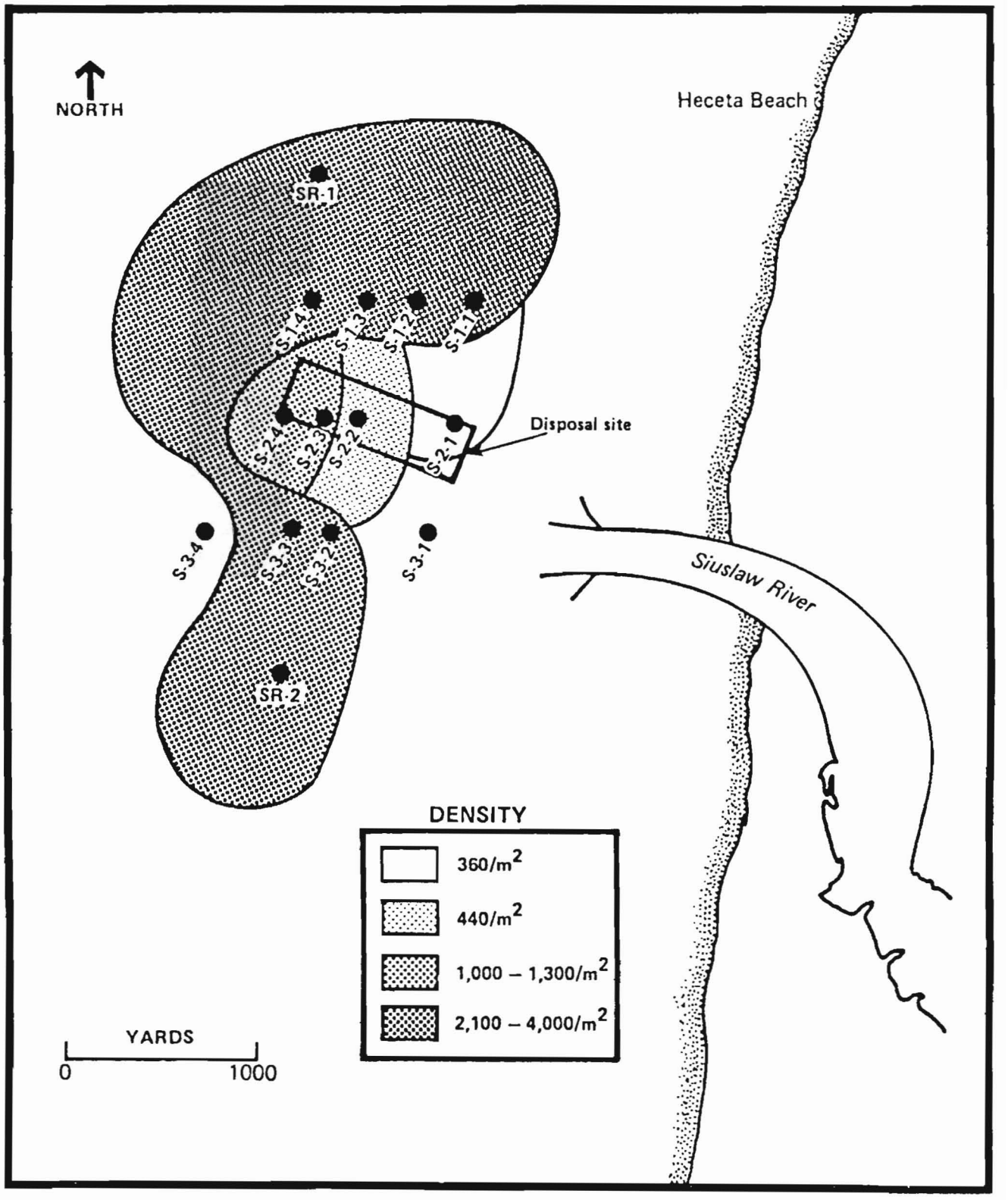

Figure A-4
Location of the Benthic Invertebrate Cluster Groups
Identified from Survey 2 (Jan 1985) (Emmett, 1987)

sampled in 1988, in most cases, did not correspond with the 1984-85 stations no comparision can be made between the two survies. However, there does appear to be greater benthic invertebrate density further offshore in 1988 due to the presence of high numbers of *Owenia* and *Spiophanes*.

Macroinvertebrates

1.23 The dominant commercially and recreationally important macroinvertebrate species in the Siuslaw River area are shellfish and Dungeness crabs (*Cancer magister*). Shellfish distribution is shown in Figure A-5. Clam beds are located on the north side of the estuary at river mile one. Gaper clams (*Tresus capex*) are the predominant bivalves harvested in this area (USACE, 1978).

1.24 Dungeness crab adults occur on sandflat habitat along the entire Oregon coast. They spawn in offshore areas and the juveniles rear in the estuary and nearshore areas. Trawling samples of the area around the disposal site were taken in October 1984 and January 1985 (Emmett et al., 1987). The high numbers of juvenile crabs collected indicates that the nearshore area off mouth of the Siuslaw River is an important rearing area for juvenile crabs. The density of crabs collected during the two survey periods was not significantly different.

1.25 The nearshore area has been known to be a squid spawning area with the location and size varying annually. There have been incidental catches of squid at the mouth of the Siuslaw to the south of the dumpsite, but there has been no directed squid harvest within the ZSF (Figure A-5). There have been reports of egg capsules and adults caught in trawls as well as the presence of egg capsules on crab gear. Outside the ZSF, there have been directed squid harvest south of Heceta Head to Cape Perpetua. Squid spawn between the depths of five to 40 meters, with maximum spawning occurring at 15 meters. (Jones, pers. comm) After hatching they school in the middle of the water column, moving toward the surface as they mature. Mature squid are found to feed mostly at a depth of 20 to 50 meters. (Jefferts, 1983)

Fisheries

1.26 The nearshore area off Siuslaw River supports a variety of pelagic and demersal fish species. Pelagic species include anadromous salmon, steelhead, shad, and searun cutthroat trout which migrate through the estuaries to upriver spawning areas. Other pelagic species include the lingcod, Pacific herring, anchovy, smelt, sea perch.

1.27 Though migratory species are present year-around, individual species are only present during certain times of the year. Table A-5 lists the species and periods of occurrence off Siuslaw River.

1.28 Demersal species present in the inshore area were sampled by trawl during the October 1984 and January 1985 surveys (Emmett et al.1987 and 1988). Demersal species were mostly residents, and included a number of flatfish, sculpins, sea perch and rocky reef fish. The flatfish species occur

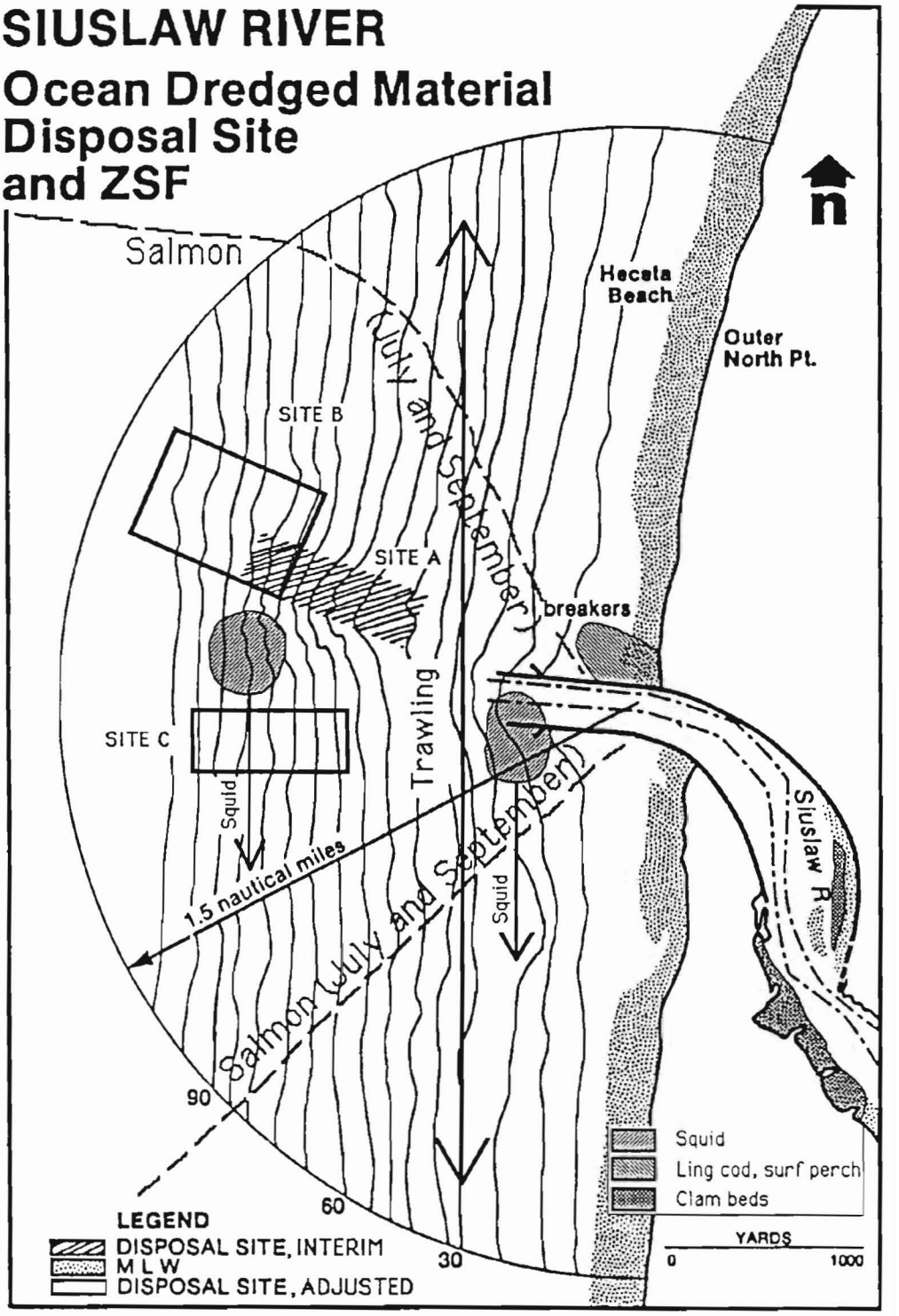

Figure A-5
Commercial and Recreational Fishing Areas

TABLE A-5

ANADRAMOUS SPECIES

	SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SENSITIVE STAGE
SALMON	FALL CHINOOK				JUVENILES					ADULTS				MIGRATION PERIOD
					JUVENILES									ESTUARY REARING
	COHO			JUVENILES							ADULTS			
TROUT	STEELHEAD	ADULTS										ADULTS		MIGRATION PERIOD
				JUVENILES										
	CUTTHROAT								ADULTS					MIGRATION PERIOD
					JUVENILES									

predominately over open sandflats, while the sculpins and rockfish were associated with rock pinnacles, reefs and jetties.

1.29 Dominant species in October 1984 were speckled sanddab (*Citharichthys stigmaeus*), Pacific tomcod (*C. sordidus*), Northern anchovy (*Alosa sapidissima*), sand sole (*Psettichthys melanostictus*), English sole (*Parophyrus vetulus*), and Dungeness crab. In the January sampling period, the dominant species were unidentified juvenile smelt, Pacific tomcod, night smelt (*Spirinchus starksi*), sand sole, butter sole (*Isopsetta isoletis*), and Dungeness crab. Table A-6 lists the species and number of individuals collected.

1.30 Diversity of species collected was somewhat higher in the October survey than in the January survey. Diversity values increased with depth in the January survey but showed no trends in the October survey.

1.31 Density was higher in January than in October except for the deeper station (80 feet) which was fairly constant. Density decreased with depth in the January survey but showed no such trend during the October survey. Both of these findings are the inverse of what was found at other disposal sites studied along the Oregon Coast. The October trawl may have been affected by the active disposal of dredged material during the sampling period, which would have increased turbidity and possibly affected the catch size and composition. The reason for the January decrease in density with increased depth is unknown.

1.32 The inshore area is an important spawning and rearing area for many demersal fish species and consequently most individuals collected were juveniles. Flatfish in particular use the sandflat habitat for spawning and rearing. Many of the juveniles of the coastal species also rear in the estuaries. The only adults collected were poachers, smelts and speckled sanddab.

Commercial and Recreational Fisheries

1.33 Major commercial and recreational fishing areas are shown in Figure A-5. The predominant commercial fishery is for salmon, Dungeness crab, bottomfish, and American shad. Salmon trolling and crab fishing are done over much of the area in the ZSF. The actual location, however, varies from year to year depending upon the abundance of fish or crabs.

1.34 The other major commercial fishing activity in the area is for clams in the intertidal mudflats in the bay and beaches along the coast. Commercial fish landings for Siuslaw River are given below in Table A-6.

Table A-6. Commercial Fish Landings for Siuslaw River

Species	Pounds Landed
Ocean	
Salmon	240,133
Crab	103,407
Bottomfish	546,674
American shad	12,451
Total	902,665
In River	
Ghost shrimp	2,361
Clams, softshell	1,206
Misc.	358
Total	3,925

1.35 The principal recreational fishing that occurs off the mouth of the Siuslaw River is for salmon and bottom fish. Salmon fishing is done by charter boat and private boat and occurs in the same areas as the commercial fishing but generally closer to shore. Bottom fishing is done north of Siuslaw by charter boat for black rockfish and lingcod. Other recreational activities include clamming in the bay and along the beach and fishing off the jetties.

Wildlife

1.36 Numerous species of birds and marine mammals occur in the pelagic, near shore, and shoreline habitats in and surrounding the proposed disposal site. Information on most species of shorebirds is lacking, therefore their abundance and distribution can only be addressed in general terms; they occur along much of the coast primarily as migrants and/or winter residents. A few species of shorebirds including western snowy plover, black oystercatcher, killdeer, and spotted sandpiper nest along the coast. Several species of special concern, bald eagle, peregrine falcon, and brown pelican occur along the coast and may use the ZSF or the surrounding areas. Brown pelicans and peregrine falcons are often associated with spits and offshore rocks. Pelagic birds (e.g. murres, shearwaters) use the ZSF and adjacent waters for foraging.

1.37 Data on marine animals is from the "Natural History of Oregon Coast Mammals", Maser et al. (1981), Pearson and Verts (1970), and the Pacific Coast Ecological Inventory (USFWS 1981), except as indicated. Except for seals and sea lions, information on marine mammals is extremely limited. Whales are known to occur throughout coastal waters primarily during migrations; population estimates and information on areas of special use generally are not available. Dredging occurs in the summer when most migrating whales have

past, however, summer resident gray whales may be present. The disposal area is not a known foraging area for gray whales and disposal should not interfere with whale migration. Gray whales, harbor seals, harbor porpoises and sea lions have been observed at the mouth of the Siuslaw River, within the jetties. It is unlikely, however, that they will be impacted by disposal operations.

1.38 Within the ZSF (Figure A-6), Heceta Beach has been identified as an important nesting and congregation area for snowy plovers (Listed by State of Oregon as threatened). The area also supports one of the densest wintering populations of sanderlings along the eastern Pacific. Breeding populations of western and glaucous-winged gulls also nest within the ZSF. Brown pelicans are typically found along the coast from June to November. The majority of these are immature birds. Foraging occurs in the bay, river mouth, and surf zone. Loafing occurs on spits, sandbars, offshore rocks, headlands, beaches, and jetties. Osprey are commonly seen foraging at the mouth of the Siuslaw River and adjacent nearshore areas.

1.39 Several species and areas important to wildlife outside the ZSF potentially could be affected by disposal of dredged material (Figure A-6). The Oregon Dunes National Recreational Area, located to the south of the ZSF, accommodates a large number of shorebirds, particularly sanderlings. Thousands of these birds can be seen along the beaches of the DNRA during the winter months. There are also a number of snowy plover populations located along the coast near the ZSF, from Sutton Creek to Heceta Head and in the vicinity of the Siltcoos River. Heceta Head to Alsea has also been identified as one of the main foraging areas for marbled murrelets. The area contains the greatest density of murrelets in Oregon (Varoujean, 1987). They typically feed within 500 m of shore, their main food source being sandlance as well as other fish and marine invertebrates (Marshall, 1988). Pigeon guillemots, Brandt's cormorants, and gulls congregate and nest at Heceta Head. Leach's storm-petrels, Cassin's auklets, cormorants, and gulls nest at Conical Rock. Parrot Rock is a nesting and congregational site for Cassin's auklets, Leach's storm-petrels, glaucous-winged and western gulls, pigeon guillemots, and tufted puffins. Raptors, including osprey and bald eagles, have been observed foraging in the surf to the north and south of the ZSF. Peregrine falcons have also been sighted at Sutton Creek (Woolington, 1985). To the north of the ZSF, California and Stellar sea lion colonies are found at the Oregon Sea Lion Caves, and several haul-out areas are located along the coast, including one at Parrot Rock.

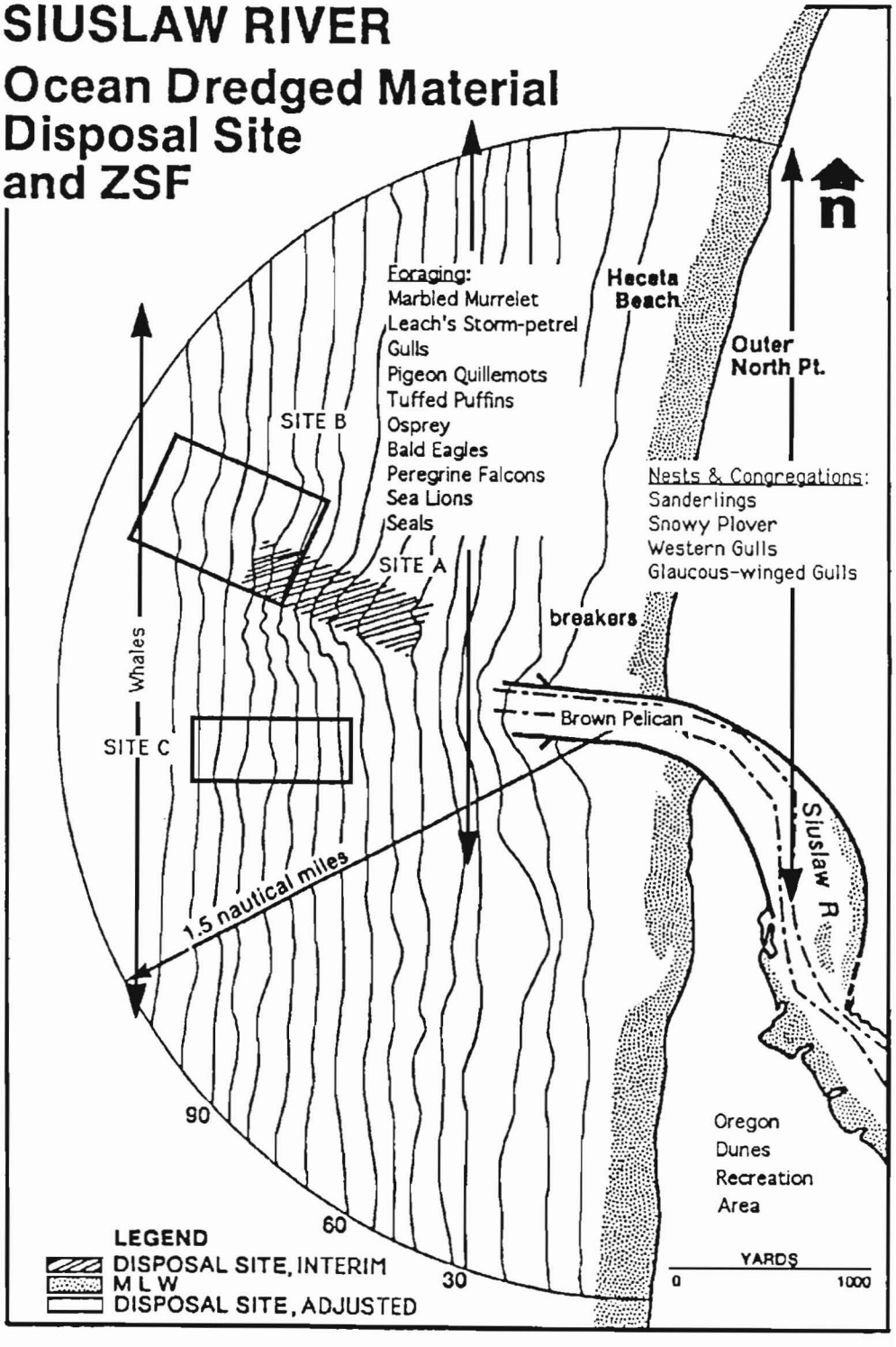

Figure A-6
Areas and Wildlife Potentially Effected by
Disposal of Dredged Material

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APPENDIX B

GEOLOGICAL RESOURCES, OCEANOGRAPHIC PROCESSES AND SEDIMENT TRANSPORT

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GEOLOGICAL RESOURCES

Regional Setting

1.1 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 90 km from Heceta Head south to Cape Arago. Figure B-1 shows the location of the Siuslaw 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, one to two 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 70 km offshore forming the Heceta Bank. Just south of the Siuslaw the shelf begins to narrow and is only 30 km wide at the mouth of the Umpqua. At the mouth of the Siuslaw the first 3 km of the shelf is covered with sand. From there a thin layer of mud (1 to 3 cm thick) mantles the surface (Kulm 1977).

1.2 The Heceta Head Littoral Cell is the largest on the Oregon coast. Except for the headlands at both ends of the cell, the entire coast line is made of beach fronting sand dunes. Three major river systems enter the cell. From north to south these are the Siuslaw, Umpqua (which is the largest of the three) and Coos River.

Regional Geology

1.3 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.

1.4 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's. 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. (Lund 1973, Cooper 1958).

1.5 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

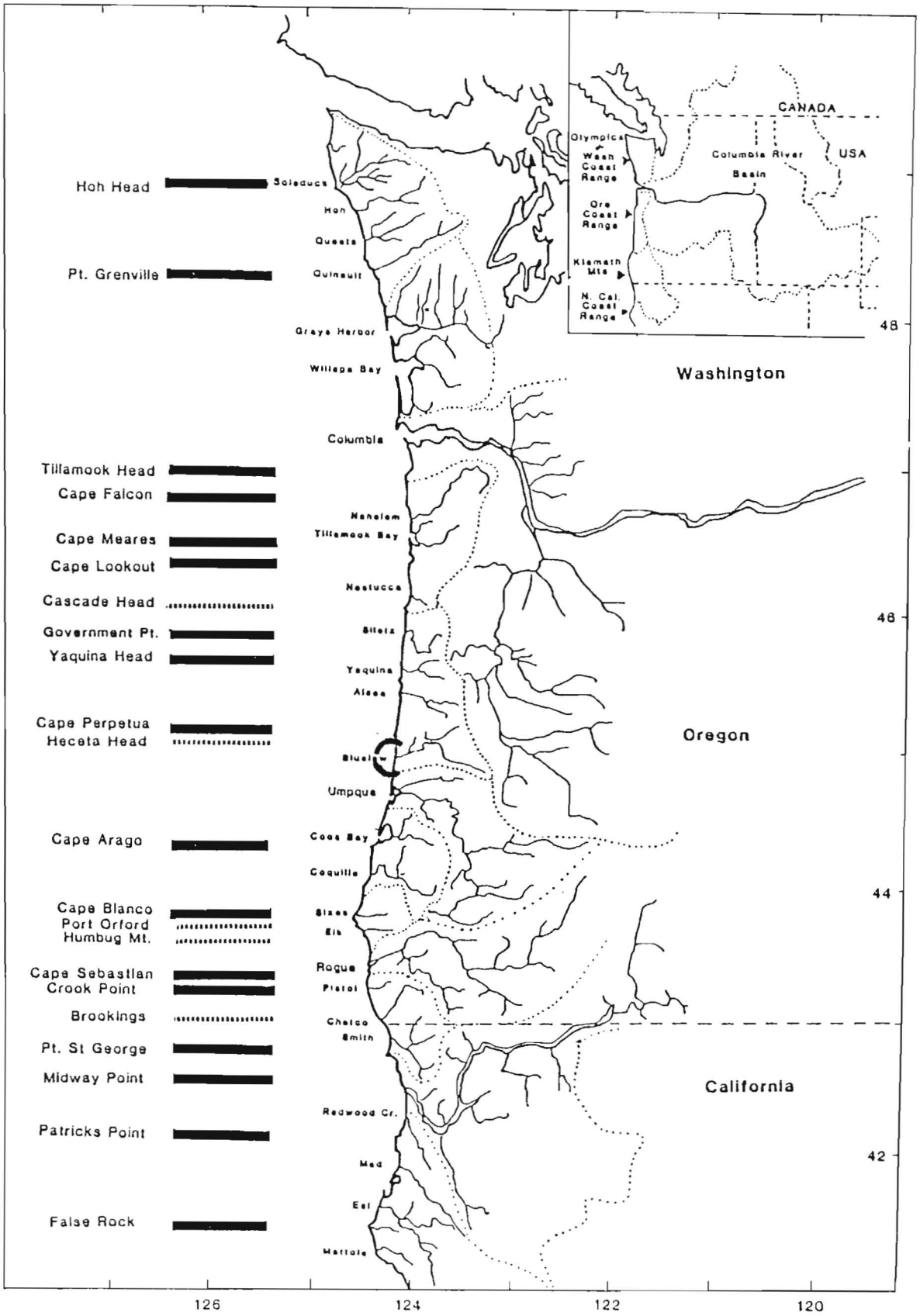


Figure B-1
Siuslaw Littoral Cell Location

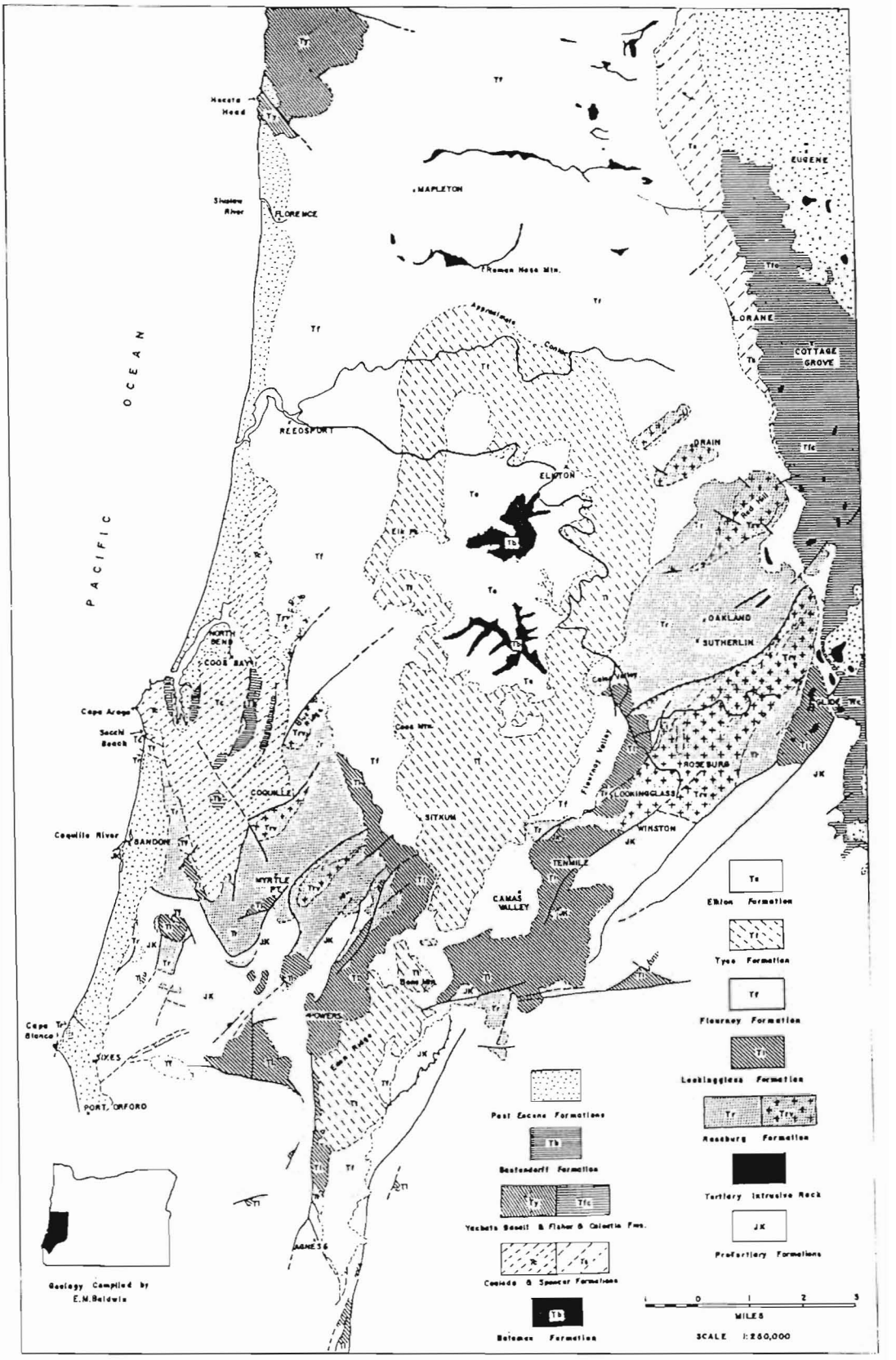


Figure B-2
Coastal Geology near Siuslaw

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. 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, unconformably 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, Baldwin and Beaulieu 1973).

Economic Geology

1.6 There are no accumulations of heavy minerals or gravel along the coast in the vicinity of 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

1.7 The Umpqua River is the major source for sediment in the littoral cell. The littoral cell is fed by the Umpqua, Smith, Coos and Siuslaw Rivers, with a combined drainage basin of 6769 square miles. Mean monthly discharge from the Siuslaw is highest in January and lowest in September. Mean annual discharge is about 3150 cfs, which gives a six hour mean discharge of $6.8X10^7$ cf. The estuary of the Siuslaw River covers 1780 acres. The diurnal tidal prism is $3.66X10^8$ cf, which divided by the six-hour discharge gives a hydrographic ratio of 5. This means the estuary is fluvially dominated; and consequently, a large portion of the fluvial sediments will be transported out the mouth into the ocean. The Umpqua River estuary has a hydrographic ratio of 9, so it too is fluvially dominated and contributes sediment to the cell. Coos Bay has a hydrographic ratio of 20, making it tidally dominated and a net sediment trap. (Peterson pers com)

1.8 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, SSWCC 1978). 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.

1.9 Within the Heceta Head Littoral Cell there are three offshore dredge disposal projects. These are Coos Bay (which involves the largest quantities), Umpqua and 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. By the same token the further upstream dredging is done the more likely it is that fluvial sediments will be encountered. Judging by the particle 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 the Siuslaw's sediment load eventually is 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.

1.10 Offshore disposal of dredge material at Siuslaw began in 1924. Since then, more than 2.5 million cy have been dumped at sea. Between 1958 and 1988 annual disposal has averaged 156,611 cy, with a maximum of 338,360 cy and a minimum of 50,831 cy. The dredging that contributes to offshore disposal is done to maintain the entrance channel 18 feet deep and 300 feet wide (See Table B-1). Shoaling occurs between the jetties at the mouth.

1.11 In determining the importance of the various sediment sources the mineral assemblages of the sediments and their origins 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. (Peterson pers. com., Chesser and Peterson 1987)

1.12 The surface sediments of the Siuslaw ZSF are clearly differentiated between the native sediments and the disposed dredge material. The native sediments are moderately to well sorted fine sand (0.19 to 0.125 mm). Within the interim disposal site the sediment is poorly graded sand, with an average mean grain size of 0.2 mm, and a range of variation from 0.074 mm and 0.9 mm. The transition between the native and dredge sediments appears to be abrupt. For native sediments, there may be a slight tendency for an increase of fines with depth.

1.13 Three sediment sampling surveys were conducted 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. See Figure B-3A & B-3B for sample station locations in relation to the Siuslaw ZSF (zone of siting feasibility). 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 B-2 and Table B-3). For the most part the change is inconsequential. Generally 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. Basically 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). Immediately adjacent

TABLE B-1

Siuslaw River Dredging History

Year	Quantities Dredged (cy)	Year	Quantities Dredged (cy)
1958	50,831	1975	237,705
59	112,811	76	163,600
1960	80,445	77	139,310
61	63,530	78	191,400
62	92,126	79	246,563
63	84,553	1980	94,200
64	134,600	81 *	388,360
66	76,500	82	193,390
67	101,750	83	213,325
68	127,500	84	221,063
69	200,050	85	271,249
1970	199,200	86	218,996
71	106,300	87	215,778
72	118,550	88	114,465
73	153,675	89	116,804
74	186,050	1990	99,120

* Catch-up work after Mt. St. Helens

1958 - 1990 Average	156,611
1968 - 1990 Average	183,333
1978 - 1988 Average	198,824
1958 - 1990 Minimum	50,831
1958 - 1990 Maximum	388,360

to the disposal site the change was usually less than 0.04 mm. It appears from samples SR-2, SR-3 and SR-4 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 B-2

Siuslaw Offshore Sediment Samples

Station	Mz*			D50		
	Sept 1988	Jan 1985	Sept 1984	Sept 1988	Jan 1985	Sept 1984
SR-1	0.24	0.18	0.19	0.21	0.17	0.18
SR-2	0.28	0.25	0.19	0.31	0.25	0.18
SR-3	0.29	----	----	0.29	----	----
SR-4	0.29	----	----	0.28	----	----
SD-1	0.19	----	----	0.18	----	----
S-1-1	0.23	0.17	0.18	0.20	0.17	0.17
S-1-2	0.26	0.18	0.17	0.18	0.16	0.17
S-1-3	0.22	0.16	0.17	0.20	0.16	0.17
S-1-4	0.23	0.19	0.17	0.20	0.18	0.18
S-2-1	0.17	0.26	0.22	0.17	0.25	0.26
S-2-2	0.23	0.21	0.22	0.20	0.21	0.27
S-2-3	0.27	0.20	0.22	0.25	0.20	0.25
S-2-4	0.26	0.22	0.22	0.22	0.21	0.25
S-3-1	----	0.17	0.19	----	0.17	0.17
S-3-2	----	0.16	0.18	----	0.16	0.16
S-3-3	----	0.21	0.18	----	0.17	0.16
S-3-4	----	0.17	0.24	----	0.19	0.24

* Mean grain size (Mz) calculated using Folk and Ward's (1954) parameters. Grain size given in millimeters.

TABLE B-3
Siuslaw Offshore Sediment Samples

Station	D90			% Fines		
	Sept 1988	Jan 1985	Sept 1984	Sept 1988	Jan 1985	Sept 1984
SR-1	0.30	0.25	0.26	0	1	1
SR-2	0.40	0.40	0.29	0	0	1
SR-3	0.43	----	----	0	----	----
SR-4	0.45	----	----	0	----	----
SD-1	0.28	----	----	0	----	----
S-1-1	0.40	0.22	0.23	0	1	1
S-1-2	0.36	0.27	0.23	3	1	1
S-1-3	0.37	0.26	0.23	0	2	1
S-1-4	0.40	0.29	0.27	0	1	1
S-2-1	0.25	0.38	0.34	3	0	0
S-2-2	0.40	0.35	0.36	0	0	0
S-2-3	0.42	0.32	0.36	0	0	0
S-2-4	0.42	0.36	0.36	0	0	0
S-3-1	----	0.26	0.29	----	0	1
S-3-2	----	0.36	0.23	----	1	0
S-3-3	----	0.26	0.24	----	1	1
S-3-4	----	0.35	0.35	----	1	1

Grain size given in millimeters.

Conditions in the ZSF

1.14 Bedrock is not exposed within the Siuslaw River study area. However, the geologic maps of the area (Beaulieu and Hughes, 1975) 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 10 km of the mouth of the Siuslaw River (From USACE 1986).

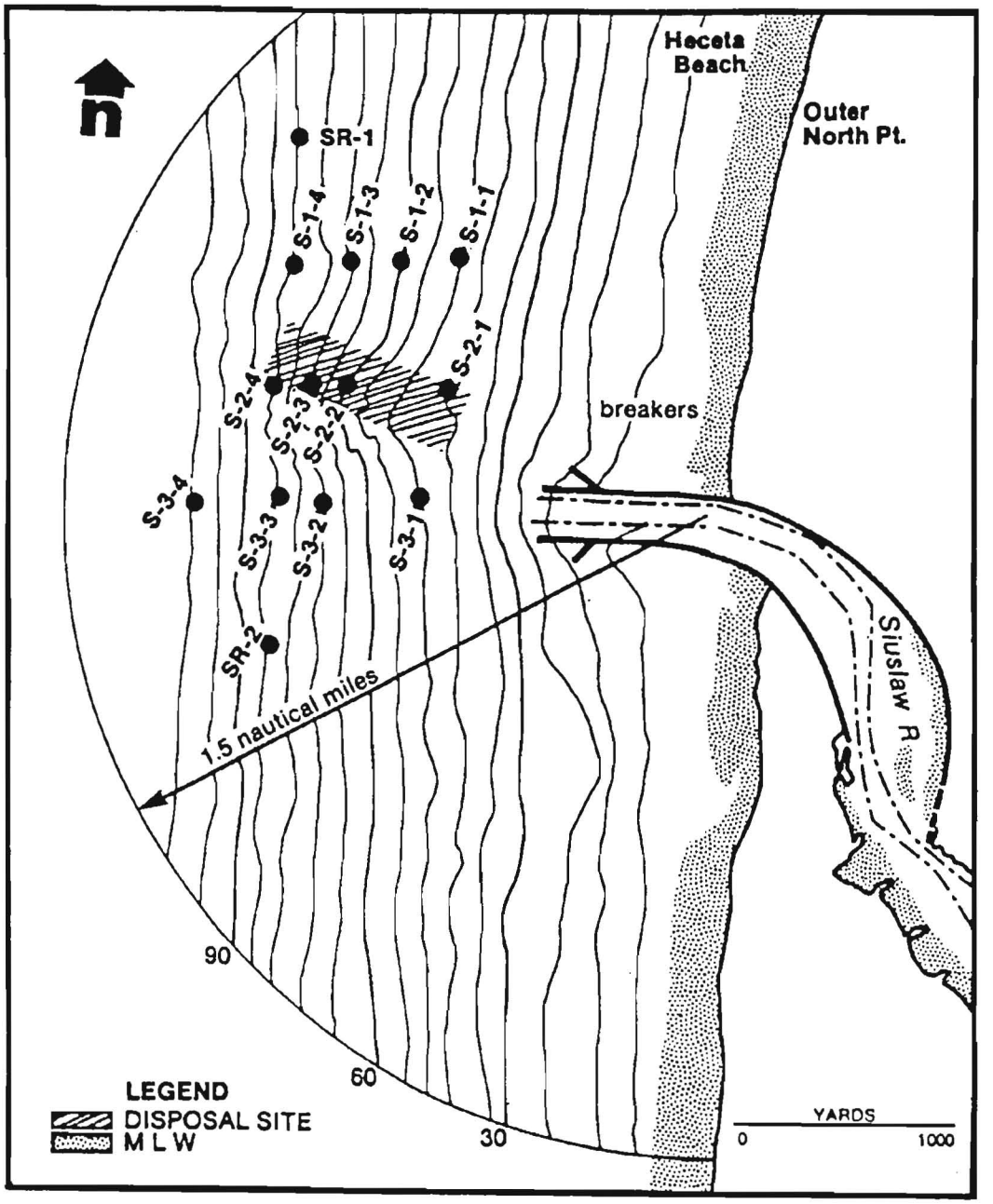


Figure B-3A
Siuslaw ZSF and 1984-1985 Sampling Locations

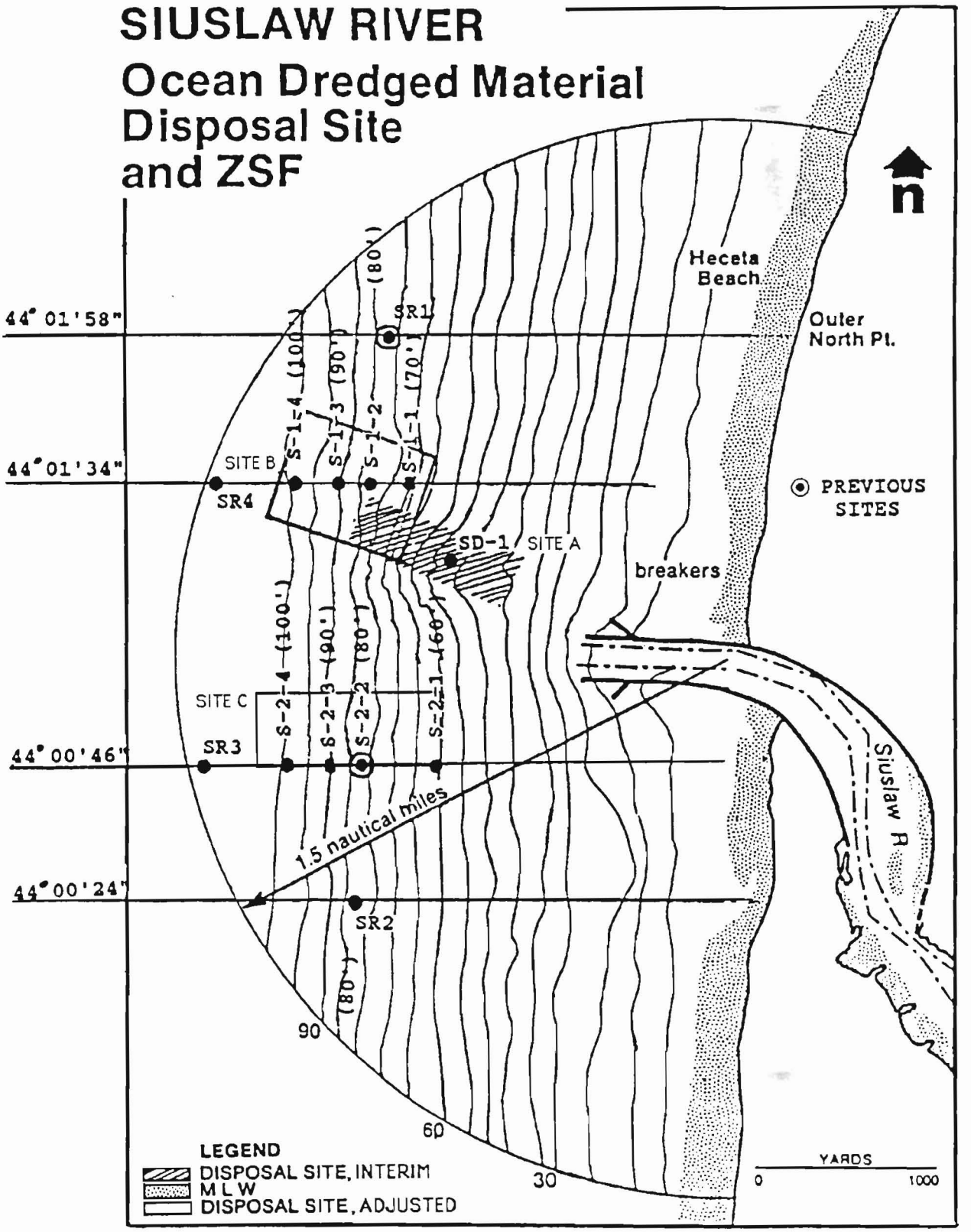


Figure B-3B
Siuslaw ZSF and 1988 Sampling Locations

1.15 The ocean bed in the vicinity of the Siuslaw ZSF is characterized by a bulging outward 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 and the interim site is located near the crown of the bulge.

1.16 Seven bathymetric surveys were made between 1978 and 1988. Based on these surveys 4 profiles (Figure B-4 thru B-8) were constructed for each of the dates and compared to observe changes through time. Three of the profiles were oriented downslope (east-west), one over the bulge to the north, a second due west of the river mouth and a third south of the river mouth. The fourth profile was parallel to the shoreline and crossed the other three profiles near their midpoints. Most of the changes in the profiles occurred after 1981. There was little net change along the north and south profiles (#1 and #3) between 1978 and 1988. The central profile (#2) showed net aggradation near shore after 1984. Near shore the accumulation was as much as 18 feet. The change started in an approximate water depth of 60 feet and continued to the end of the profile. Significant aggradation was also observed in profile #4 constructed parallel to the shoreline. This profile across the bulge had an increase in aggradation of nearly 7 feet. A large portion of the increase was on the interim disposal site or immediately south of the site. The disposal of dredge material at the offshore site has contributed to the aggradation of the bulge but probably is not the sole source of material. The large bulge itself is probably the ebb delta of the Siuslaw River. The aggradation just west of the river mouth is difficult to explain. Cause of aggradation at this location is a combination of factors such as the amount of material disposed, discharge of the Siuslaw River and wave action between 1984 and 1988.

1.17 Figure B-9 shows the results of the 1984 sidescan sonar survey of the ZSF. The area surveyed by sidescan sonar is primarily silt/sand. Sand waves were observed extending at least two thousand feet north of the Siuslaw's mouth to about a mile south and to a depth of about 42 feet. A thin lens of what is interpreted as "coarse sand/or gravel" is found just off the mouth in water depths of 42 to 48 feet. No samples have been taken from the lens to confirm this interpretation.

1.18 Figure B-10 through B-12 shows three seismic profiles which cross the study area from ESE to WNW, essentially parallel with the slope. The layer of unconsolidated sediment is quite thick, varying between 45 to over 180 feet thick. The bedrock surface is irregular and sediment has filled in the depressions. Just north of the interim disposal 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 possible be boulders, debris, fish nets and/or crab pots. The Siuslaw River study area is primarily covered by silt/sand. The one exception is a lens of coarse sand/gravel west of the mouth in water depths of 36 to 50 feet. The disposal site is located on the fan like feature or "mound" (northwest portion). Hence the "mound" is composed, at least in part, of dredged sediments. Slope of the mound varies from a minimum in the south to a maximum in the north. The maximum slope is 126 ft\mile and the minimum slope is 34 ft\mile. The bulging in the contours appears to dissipate in water depth greater than 100 feet.

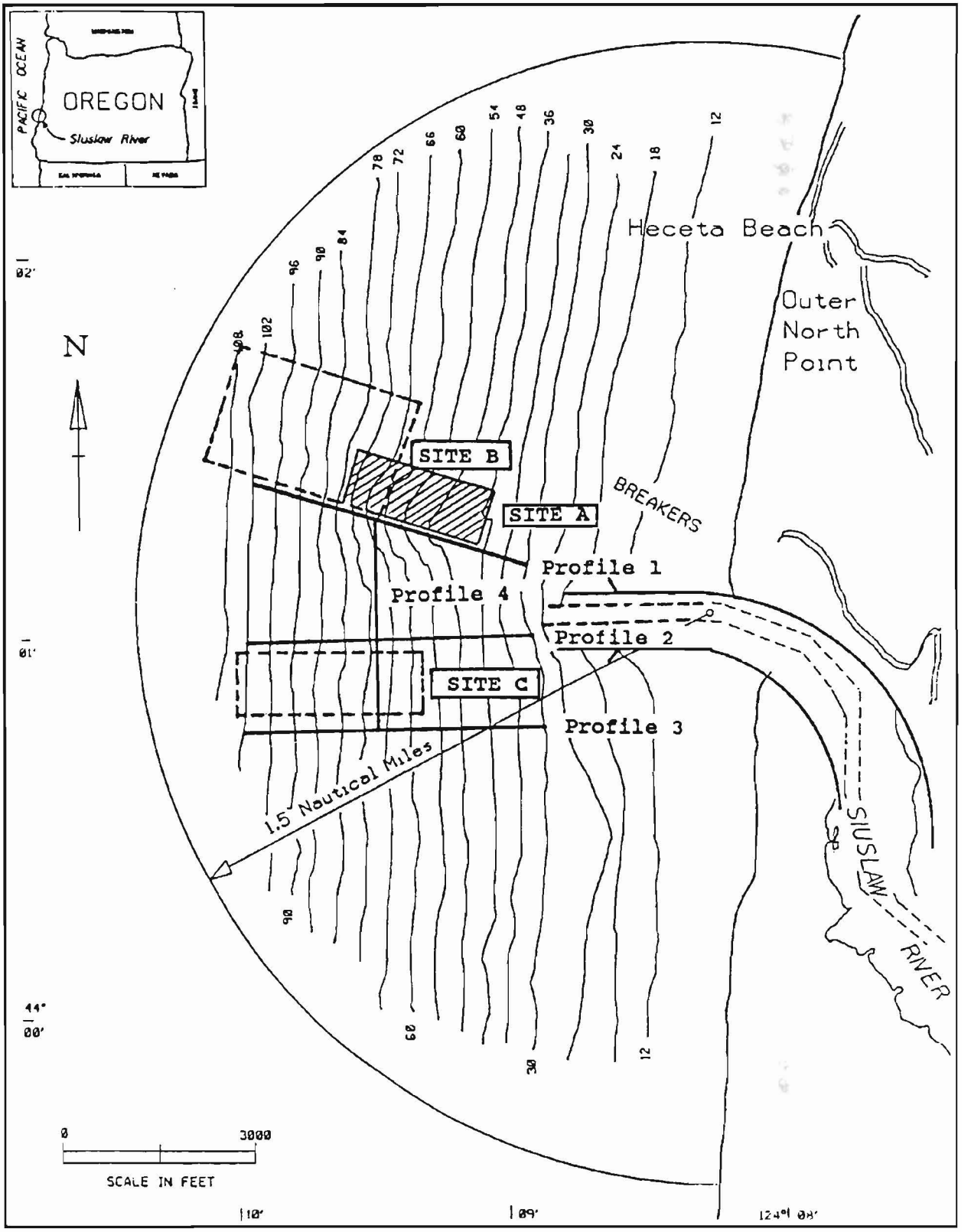
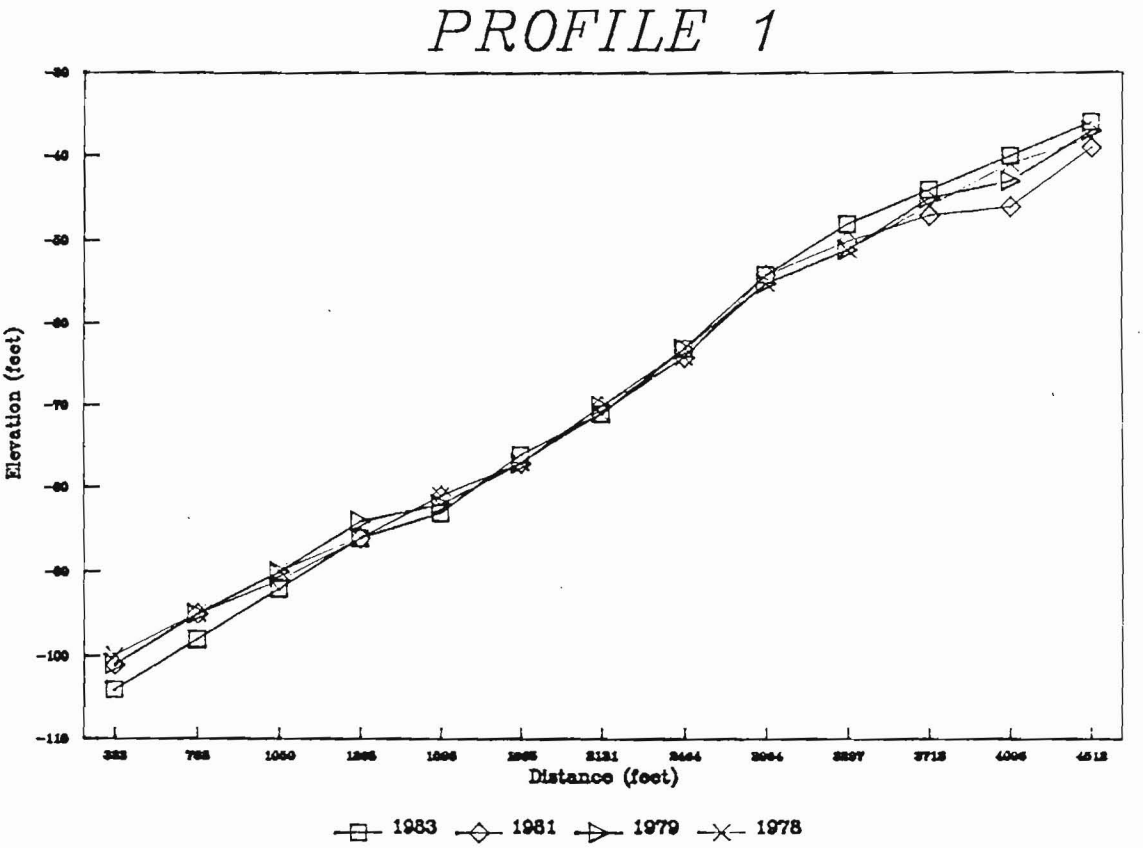


Figure B-4
Siuslaw ZSF and Bottom Profiles



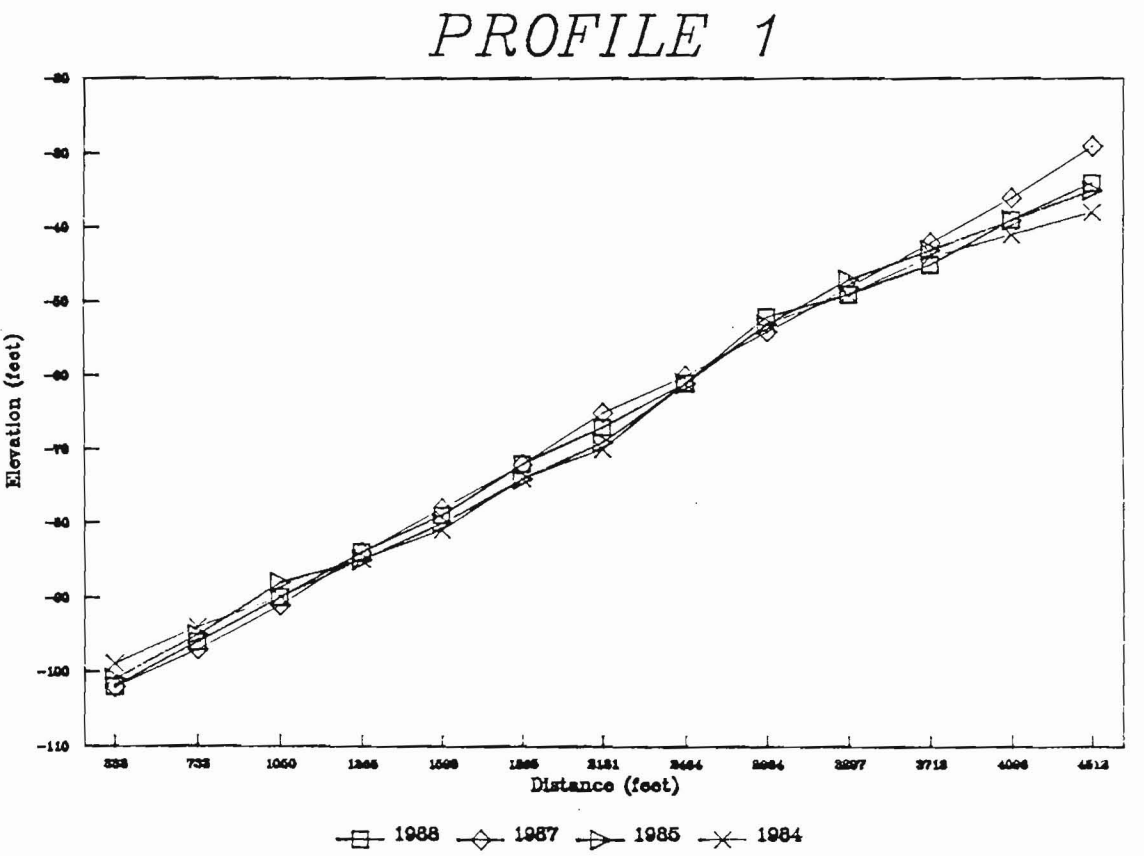
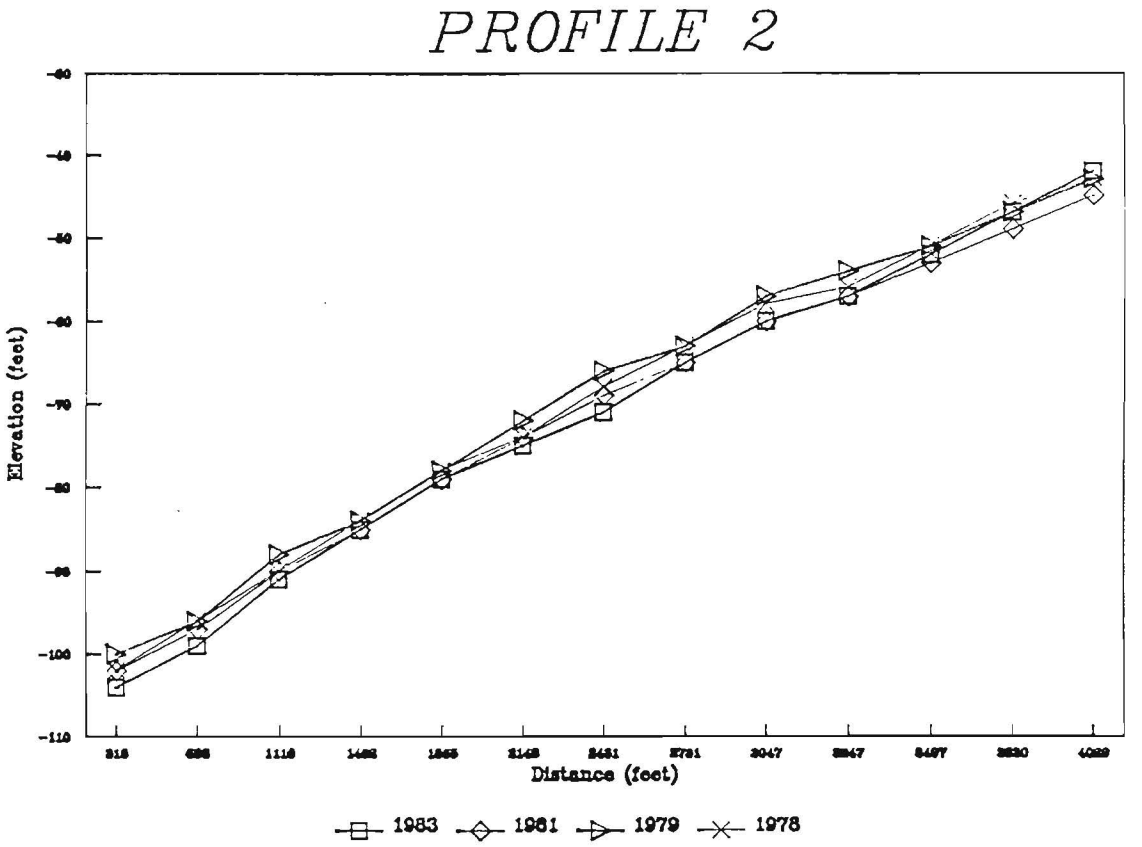


Figure B-5: Siuslaw ZSF and Profile 1



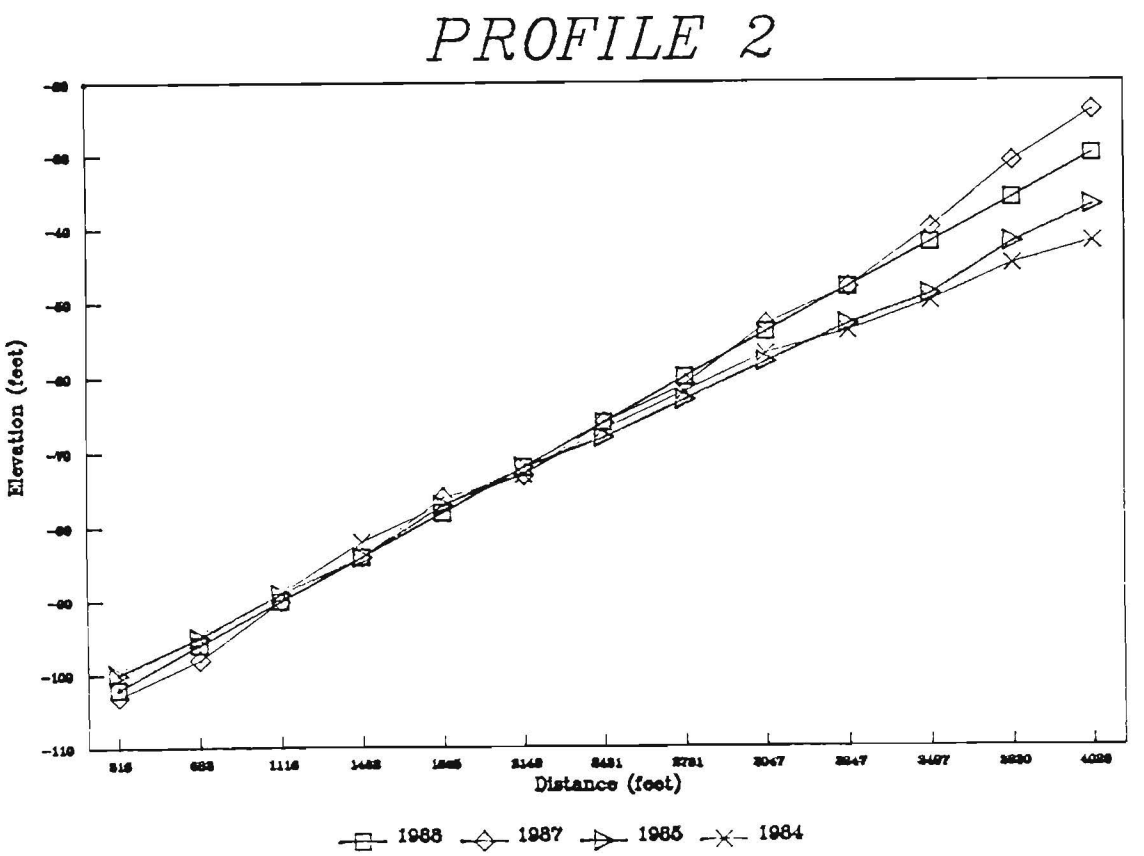
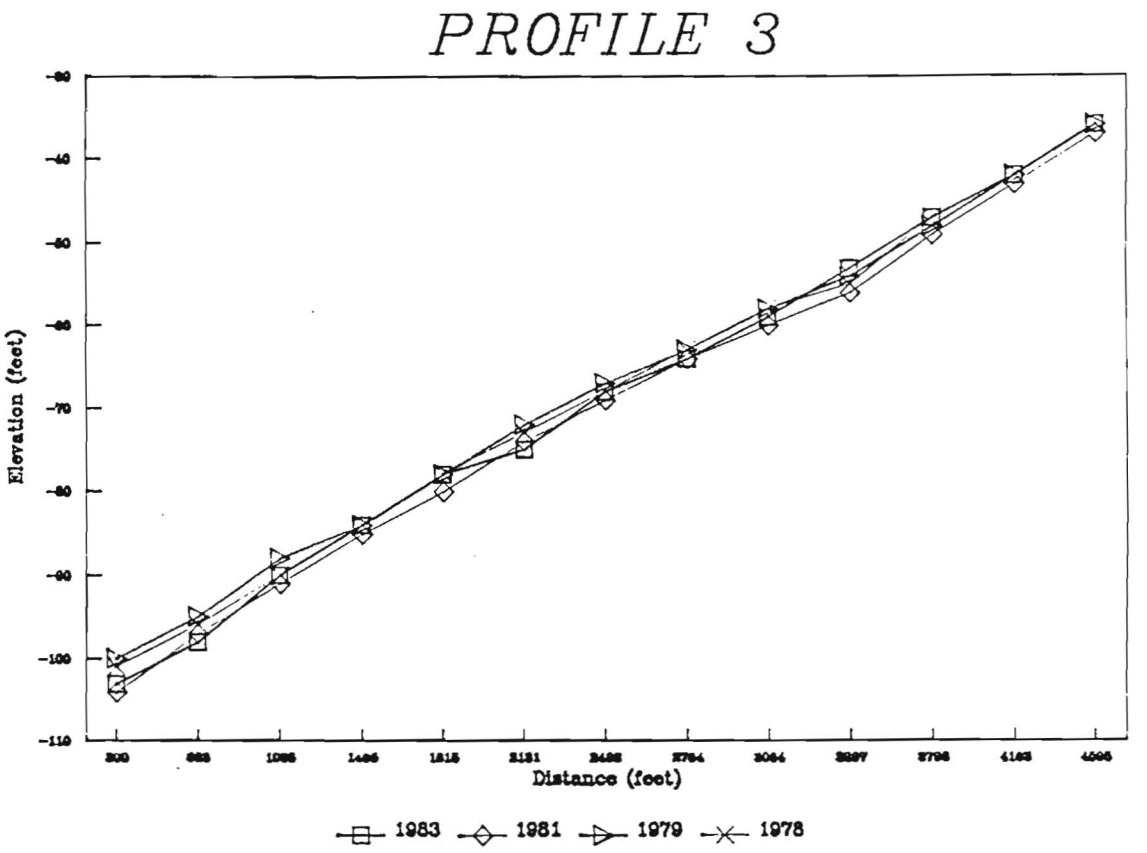


Figure B-6: Siuslaw ZSF and Profile 2



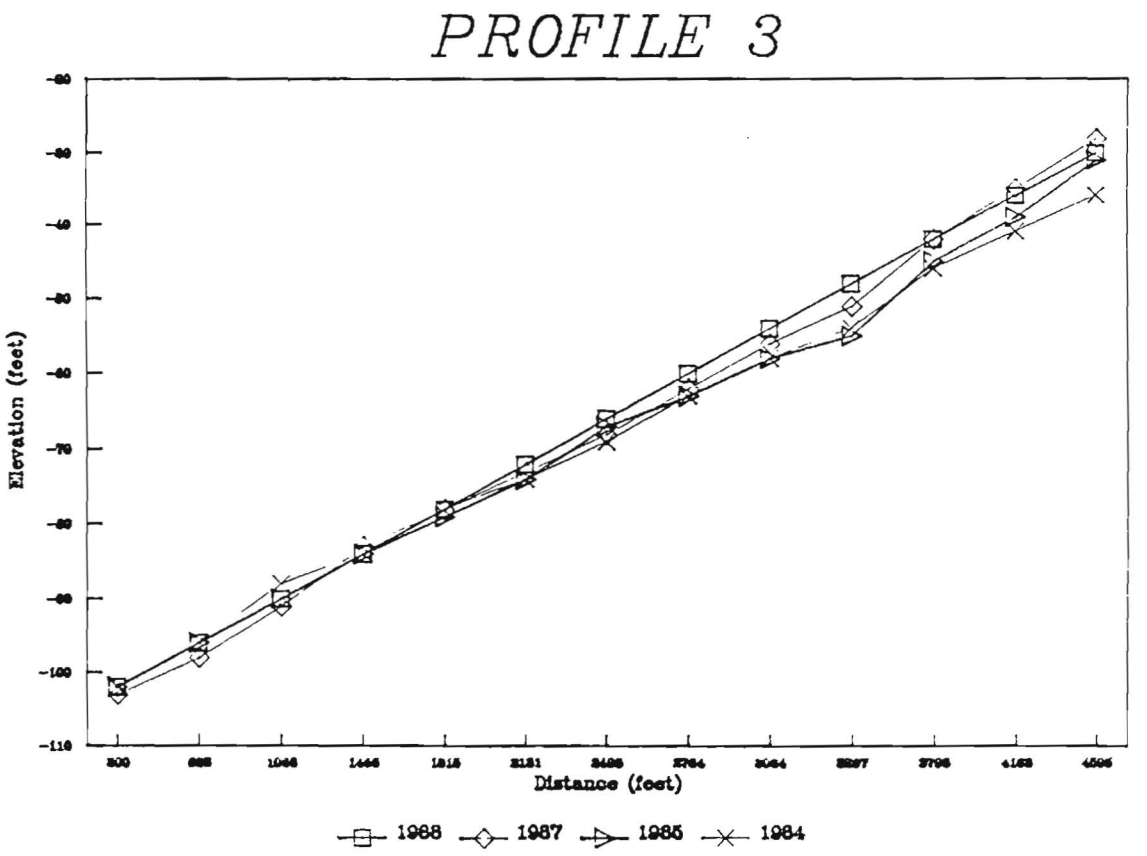
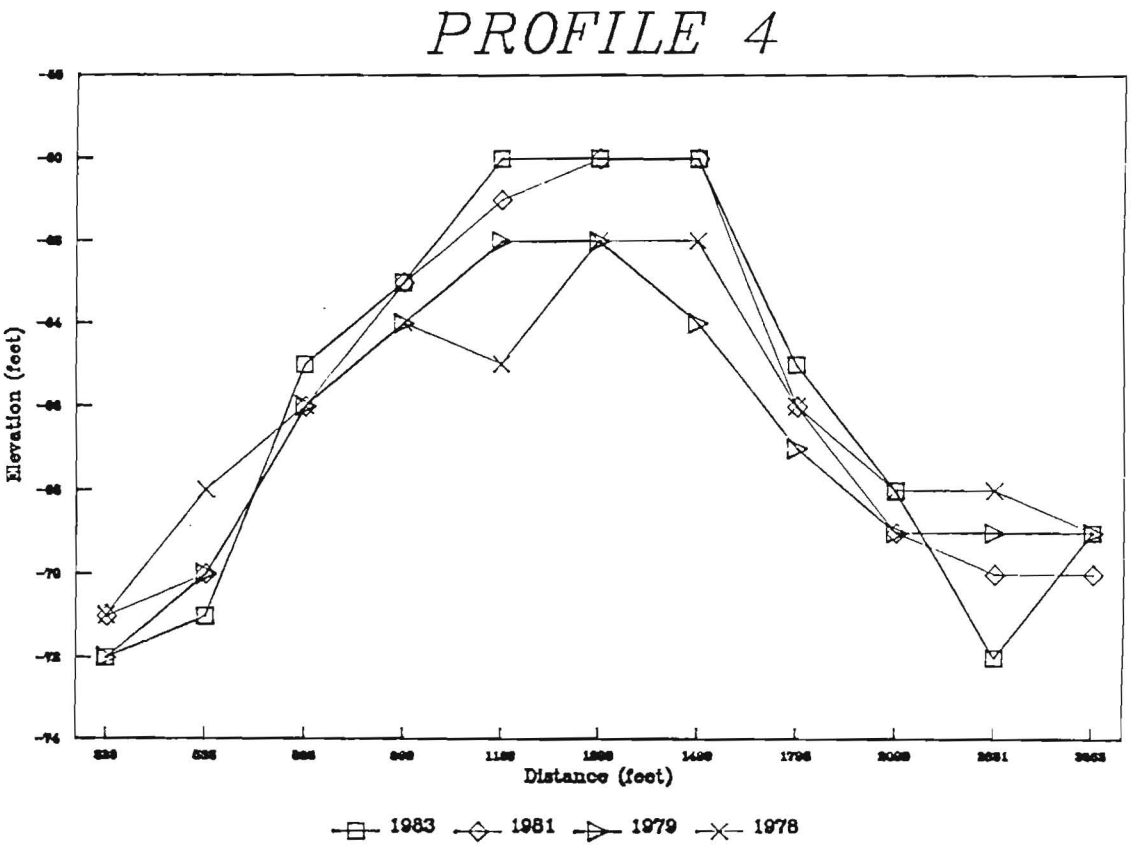


Figure B-7: Siuslaw ZSF and Profile 3



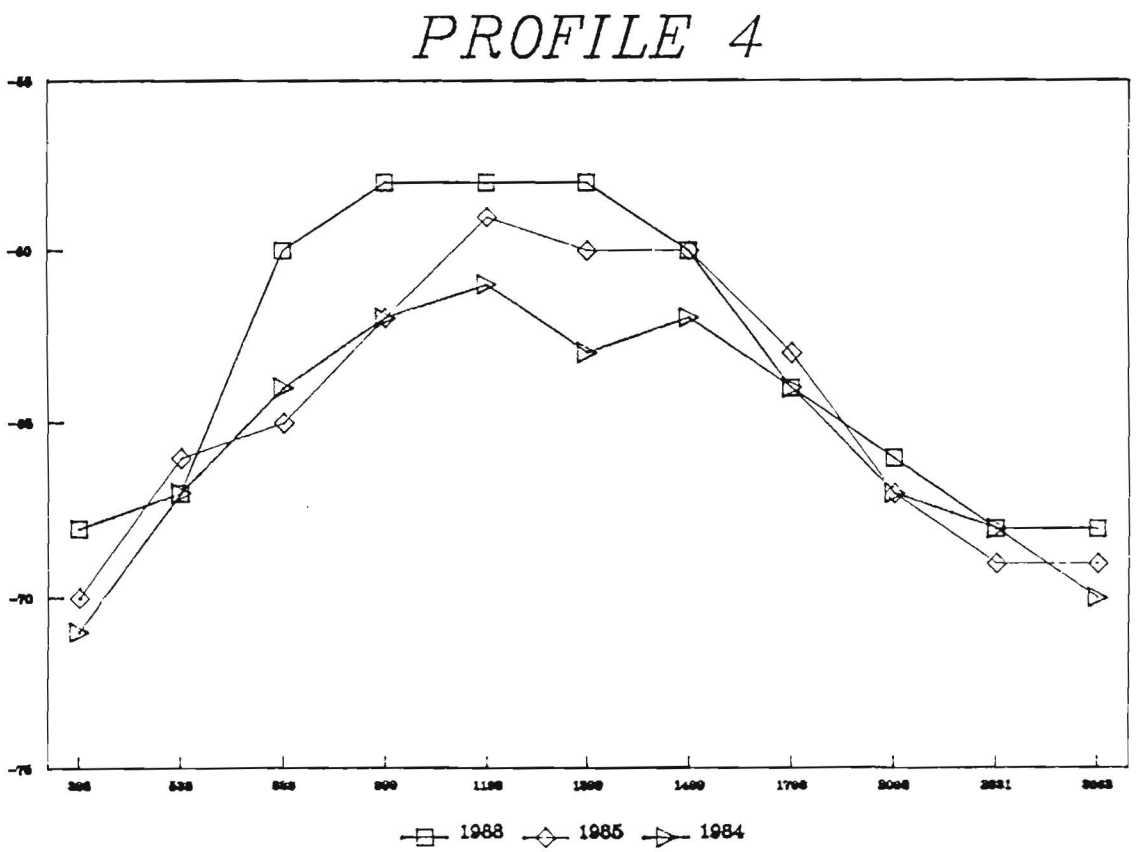


Figure B-8: Siuslaw ZSF and Profile 4

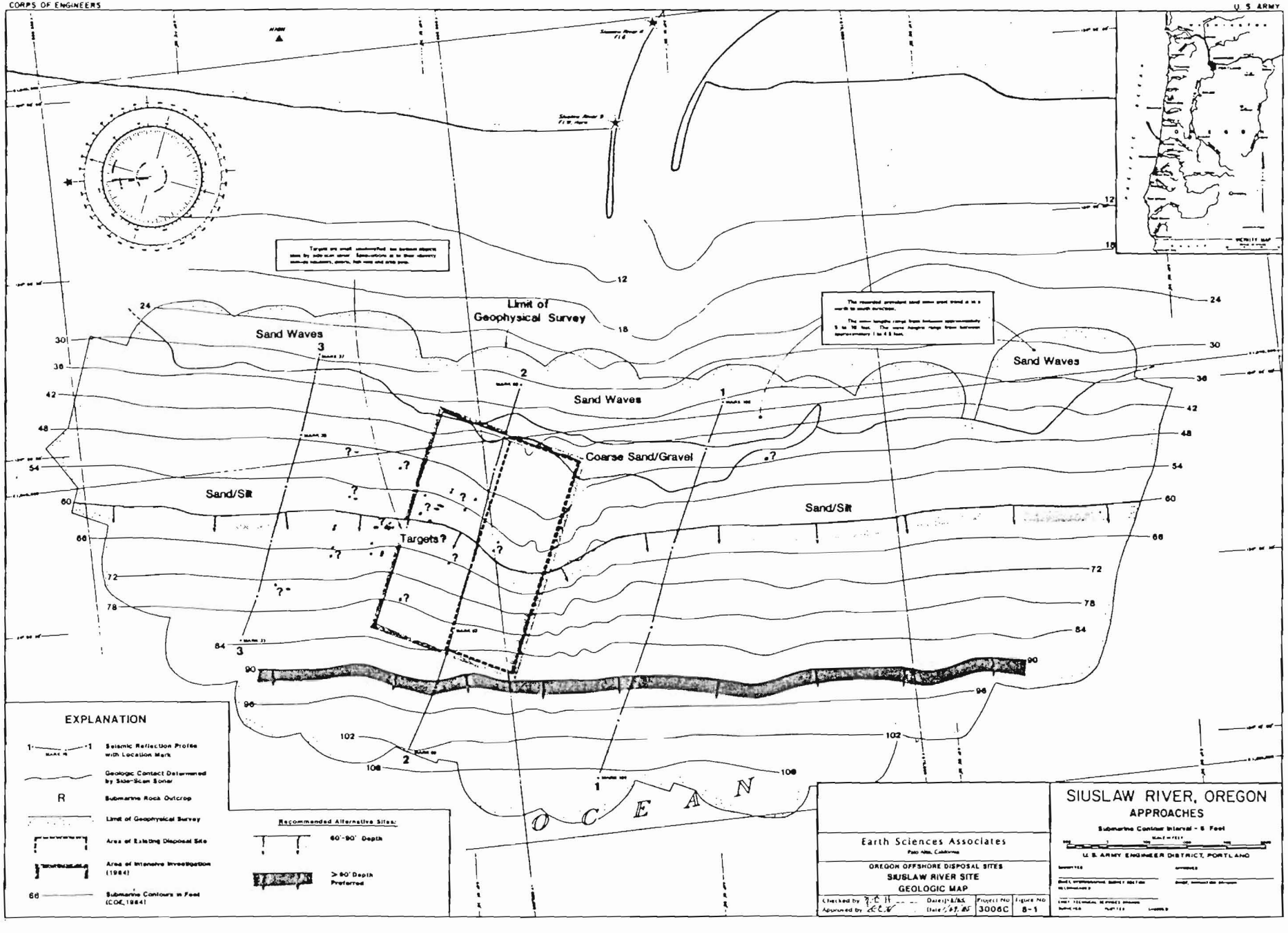


Figure B-9: Sidescan Map

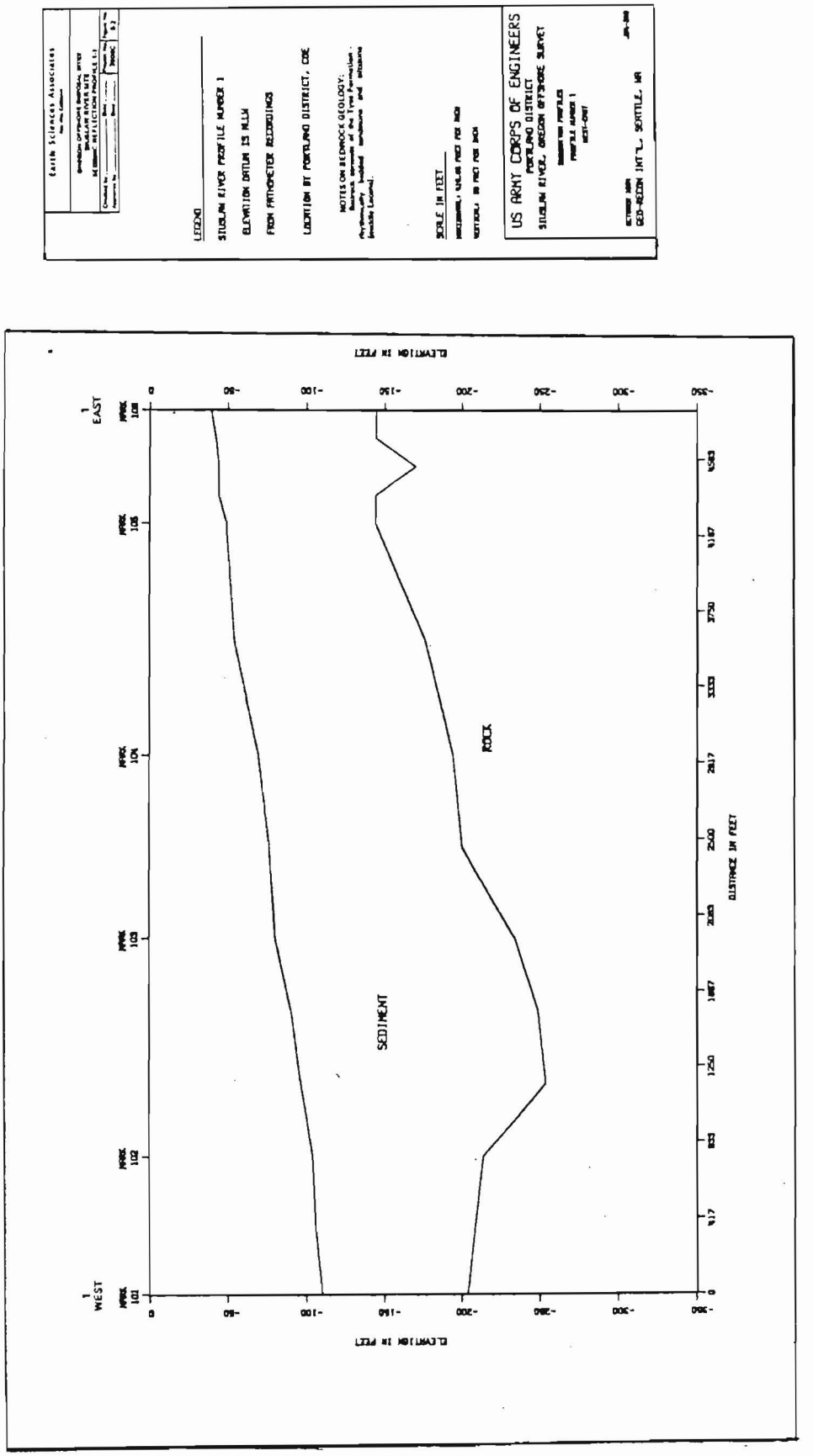


Figure B-10
Seismic Profile No. 1

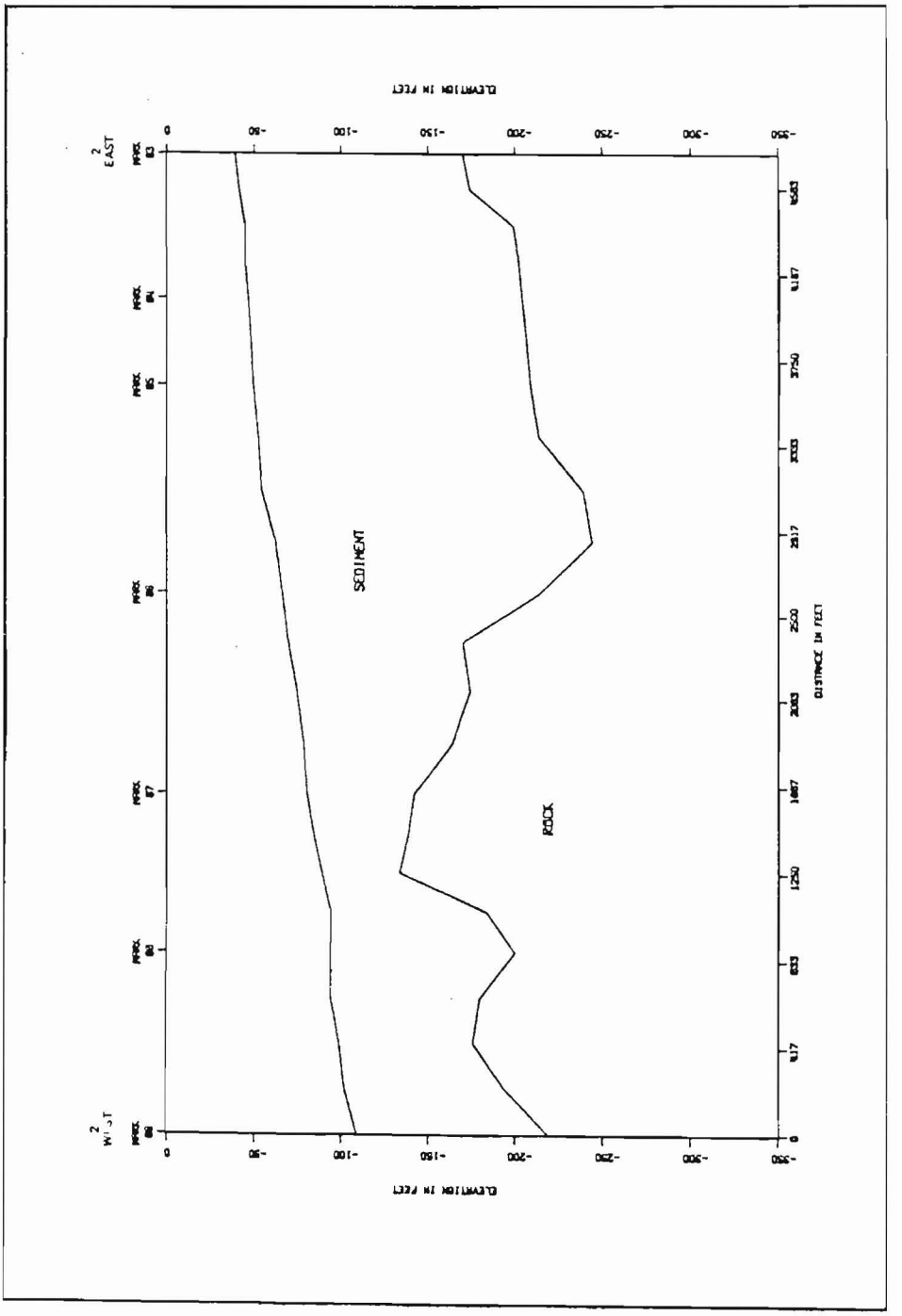


Figure B-11
Seismic Profile No. 2

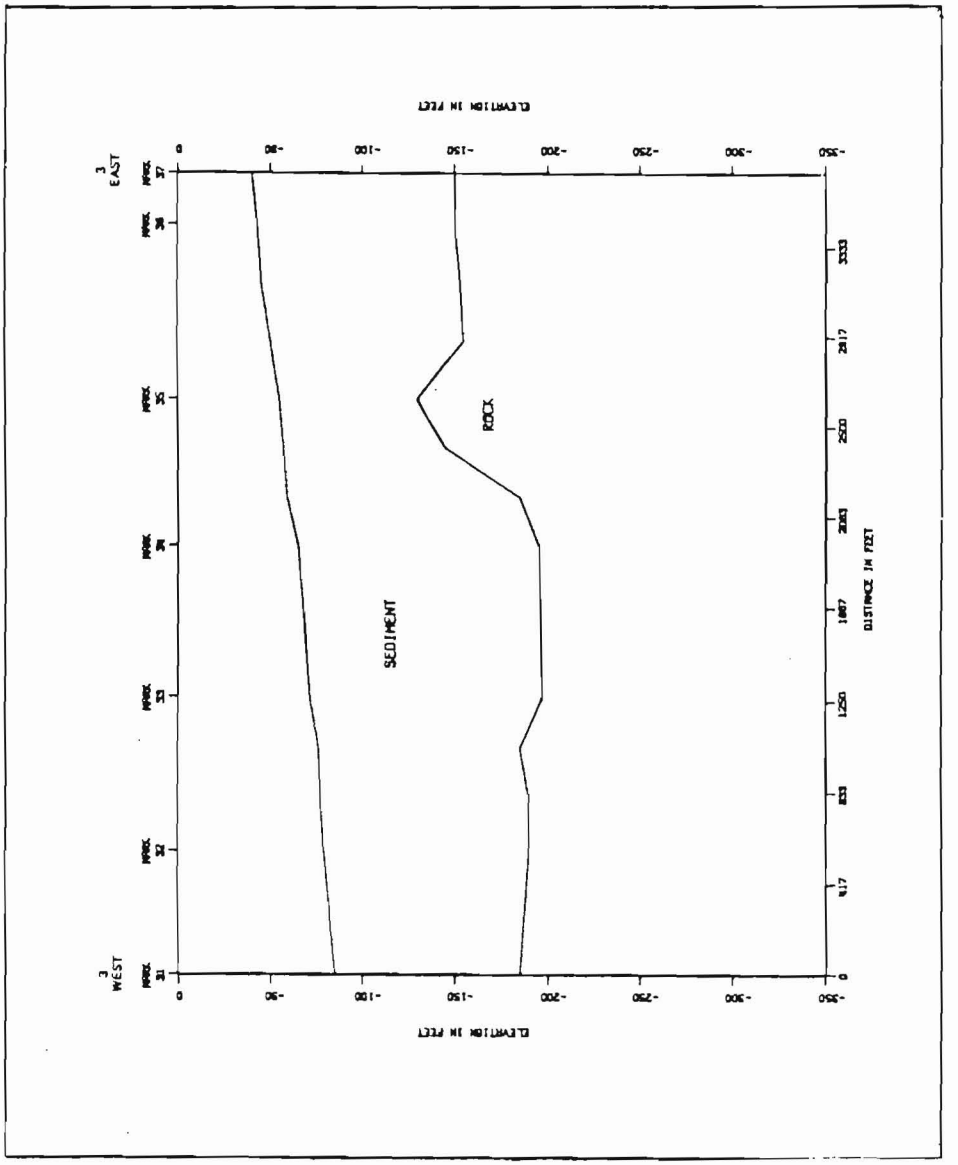


Figure B-12
Seismic Profile No. 3

OCEANOGRAPHIC PROCESSES

Coastal Circulation

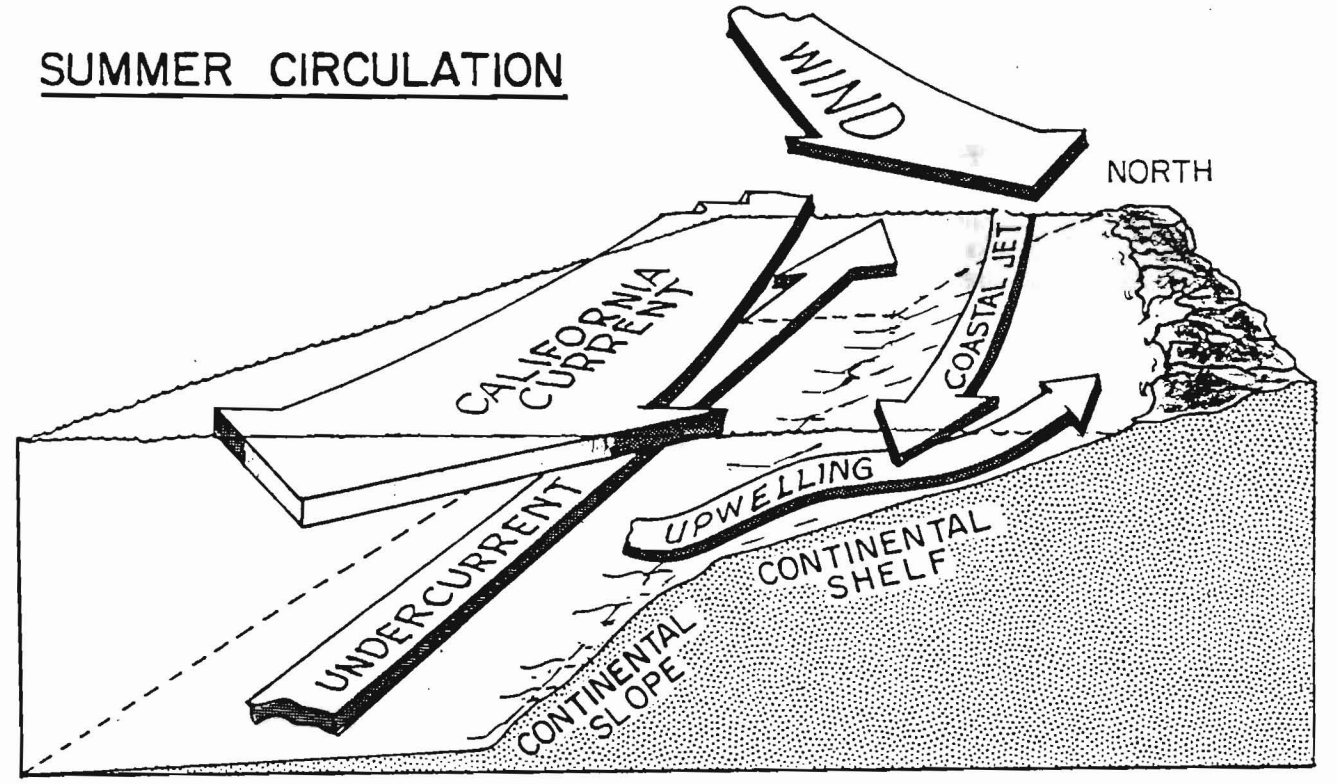
2.1 Coastal circulation near the Siuslaw ZSF is directly influenced by large-scale regional currents and weather patterns in the northwestern Pacific Ocean. During winter strong low pressure systems with winds and waves predominantly from the southwest initiate strong northward currents. During the summer, 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-13 shows the predominant Oregon coastal circulation.

Ocean Waves and Tide

2.2 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 NW-W or W-SW sectors. 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 SW-S sectors during autumn and winter but from the N-NW sectors in spring and summer.

2.3 Wave hindcast predictions from meteorological records, 1956 through 1975, near the mouth of the Siuslaw (Figure B-14) are presented as a wave rose diagram in Figure B-15. Seventy-one percent of the waves are within 22 1/2 degrees of due west with over 60 percent of the waves having heights of 3 meters or more. Only 7 percent of waves are from the southwest, but for the most part, all were over 3 meters high. Waves from the northwest occur 22 percent of the time with only 12 percent over 3 meters high. The larger waves are usually from the west-southwest and occur during winter months.

2.4 Superimposed upon the slowing-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 NOAA (1986). Hancock, et al (1984), Nelson, et al (1984) and Sollitt, et al (1984) summarize 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.



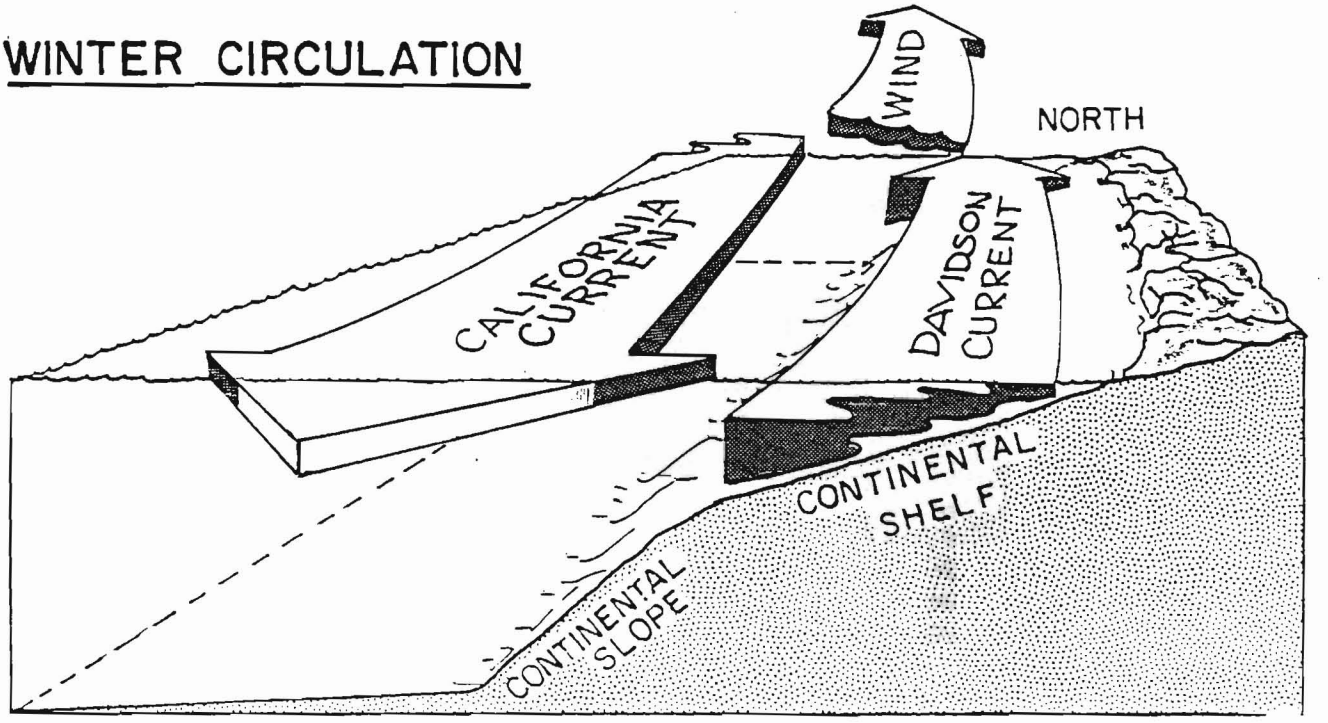


Figure B-13
Oregon Coastal Circulation

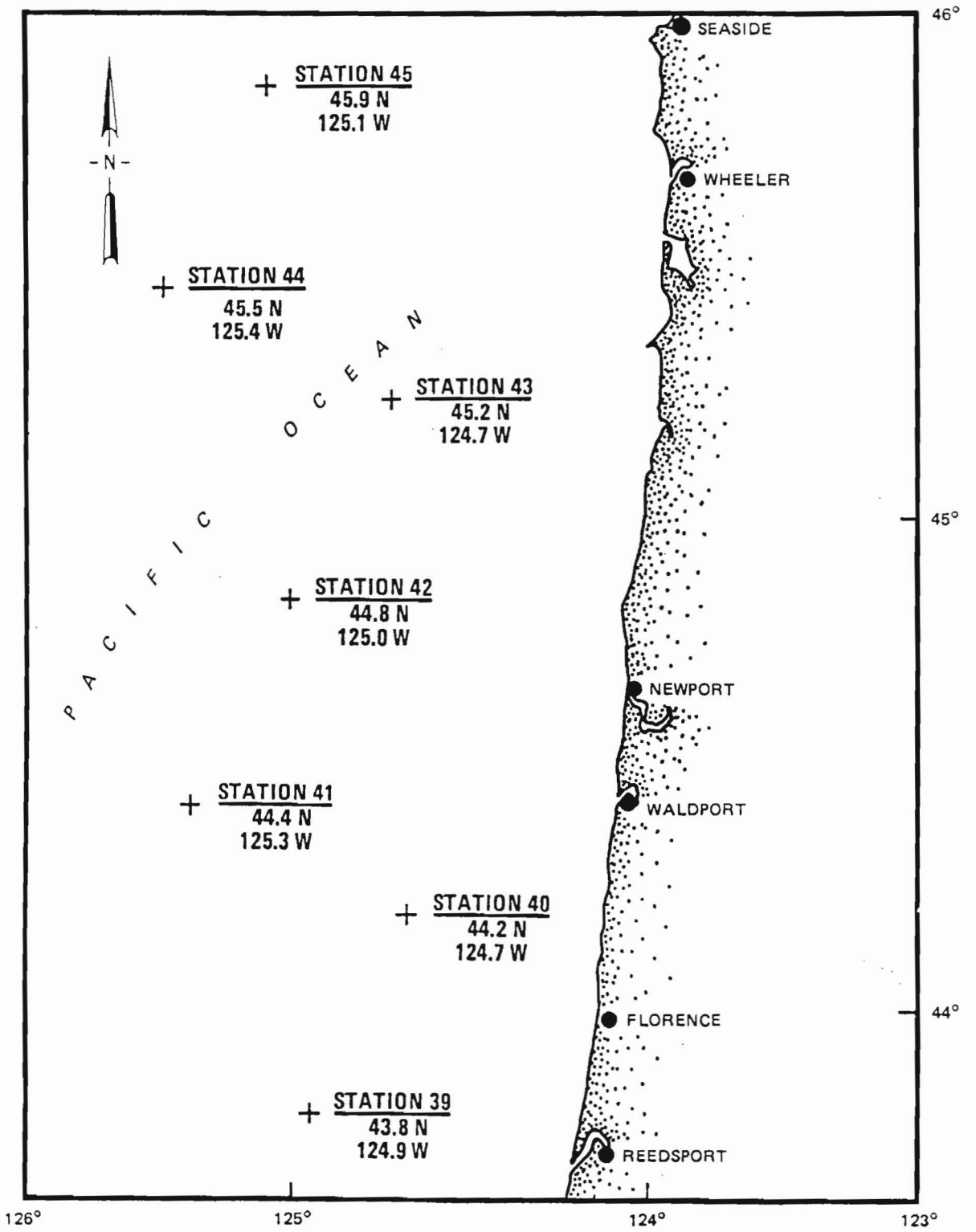


Figure B-14
Location of Monitoring Stations for Hindcast Studies

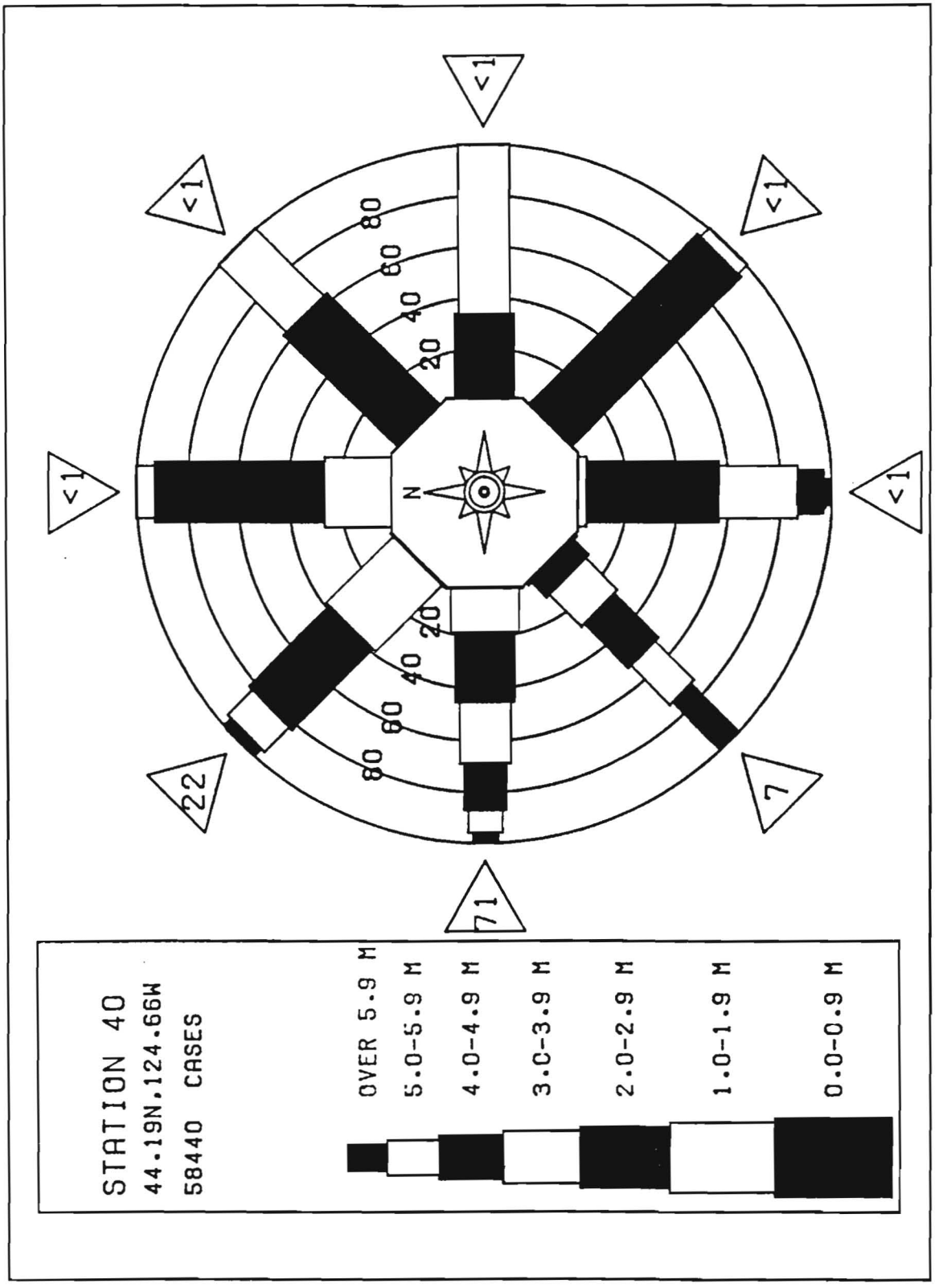


Figure B-15
Wave Direction and Height for Station 40

Local Processes

2.5 The two Siuslaw adjusted disposal sites are within 1 mile of the estuary entrance. The minimum and maximum flows presented in Table B-4 indicate the river flows are highly variable. This constantly varying river outflows 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 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-4 lists important characteristics of the study area.

TABLE B-4
Physical Characteristics of the Siuslaw River

Drainage Basin Area (sq. mi.)	773
Estuary Surface Area (ft^2)	7.75×10^7
Mean Tide Range (ft.)	5.2
Diurnal Tide Range (ft.	6.9
Mean Tidal Prism (ft^3)	2.76×10^8
Diurnal Tidal Prism (ft^3)	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

2.6 The numbers in Table B-4 are from Percy,et al (1974), OSU (1971) and Johnson (1972). The Hydrographic Ratio (HR) is the tidal prism volume divided by the mean river discharge for a six hour period. Peterson, et al (1984) use the Hydrographic Ratio to compare the tidal prism with the river discharge for the same six hour period. The tidal prism is estimated as the volume of water brought into the estuary by each flood tide. The six hour river discharge is estimated from the annual average discharge. The higher the HR the more tidally dominated the estuary. For comparison Table B-4 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.

2.7 Local interest groups have expressed a concern, especially since the extension of the jetties in 1985 to within 1200 feet of the interim ODMDS, that dredged material from the ODMDS moves back into the channel. Recommendations of the feasibility study for the jetty extensions were additions on the north and south jetties of 2000 feet and 2500 feet, respectfully. But during the final design stage the extension of the north jetty was reduced to 1900 feet and the south jetty to 2300 feet.

Site Monitoring at Siuslaw

2.8 Current meters were deployed near the Siuslaw interim 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 in 1985 and from July 31 to August 14 in 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-16 and B-17 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, ie., the longer the bar, the more prevalent the current in that direction. The width of the bar represents the range of velocity, ie., 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.

2.9 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 ft/sec. 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 ft/sec.

SEDIMENT TRANSPORT

The Littoral System

3.1 At the Siuslaw dredging project there is a need to locate two offshore 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 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.

3.2 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 (See Figure B-18). 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 limit for strong longshore transport varies from -28 feet in summer to -51 feet in winter. Significant onshore-offshore transport occurs to depths of -83 feet in summer and to -268 feet in winter. Hancock, et al (1984) calculated the probability for wave-induced current velocities at various depths off Coos Bay. From other studies a critical velocity of 20 cm/sec has been shown necessary to erode

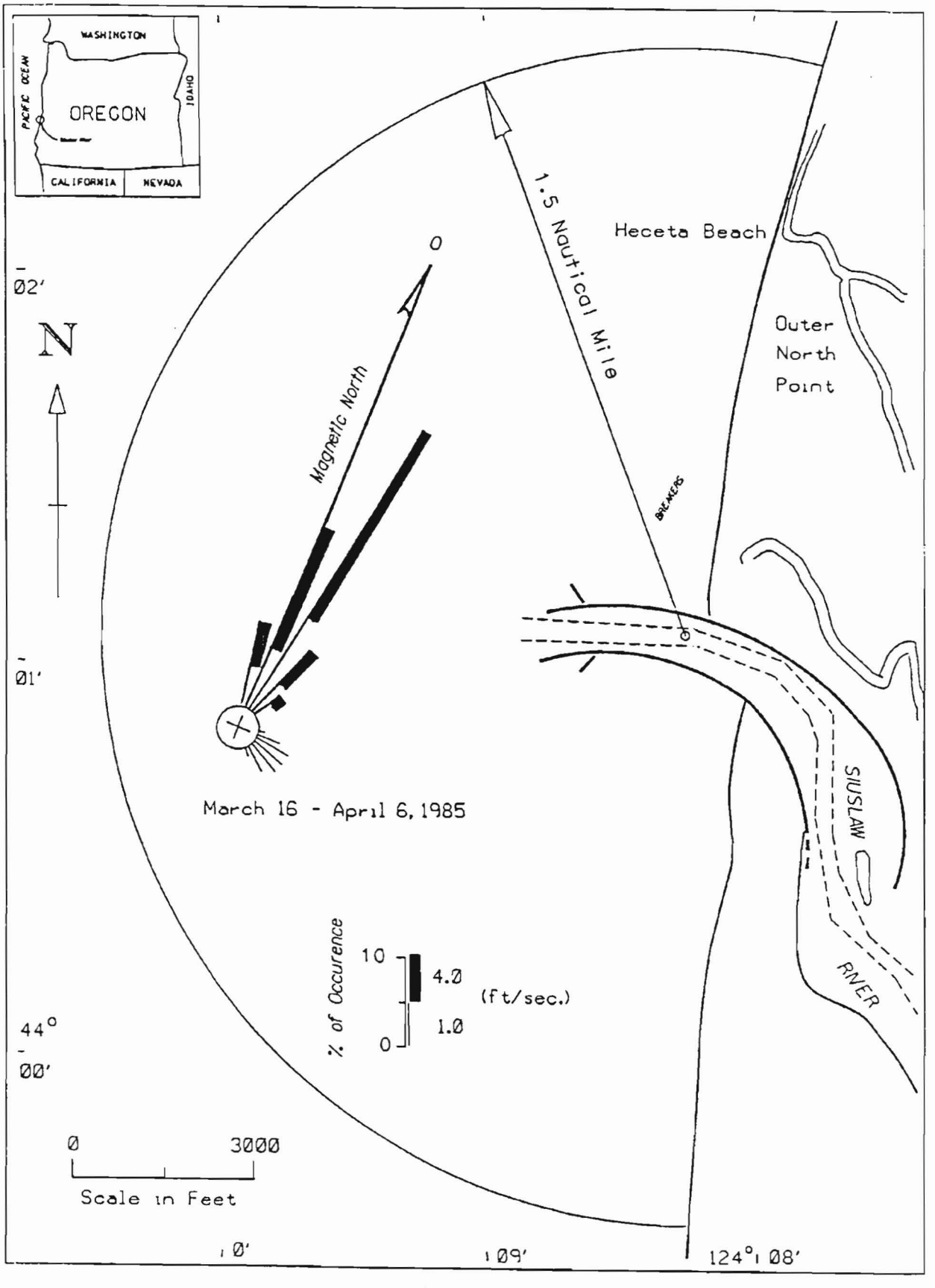


Figure B-16
Current Velocity Vectors at Siuslaw, March 16 thru April 6, 1985

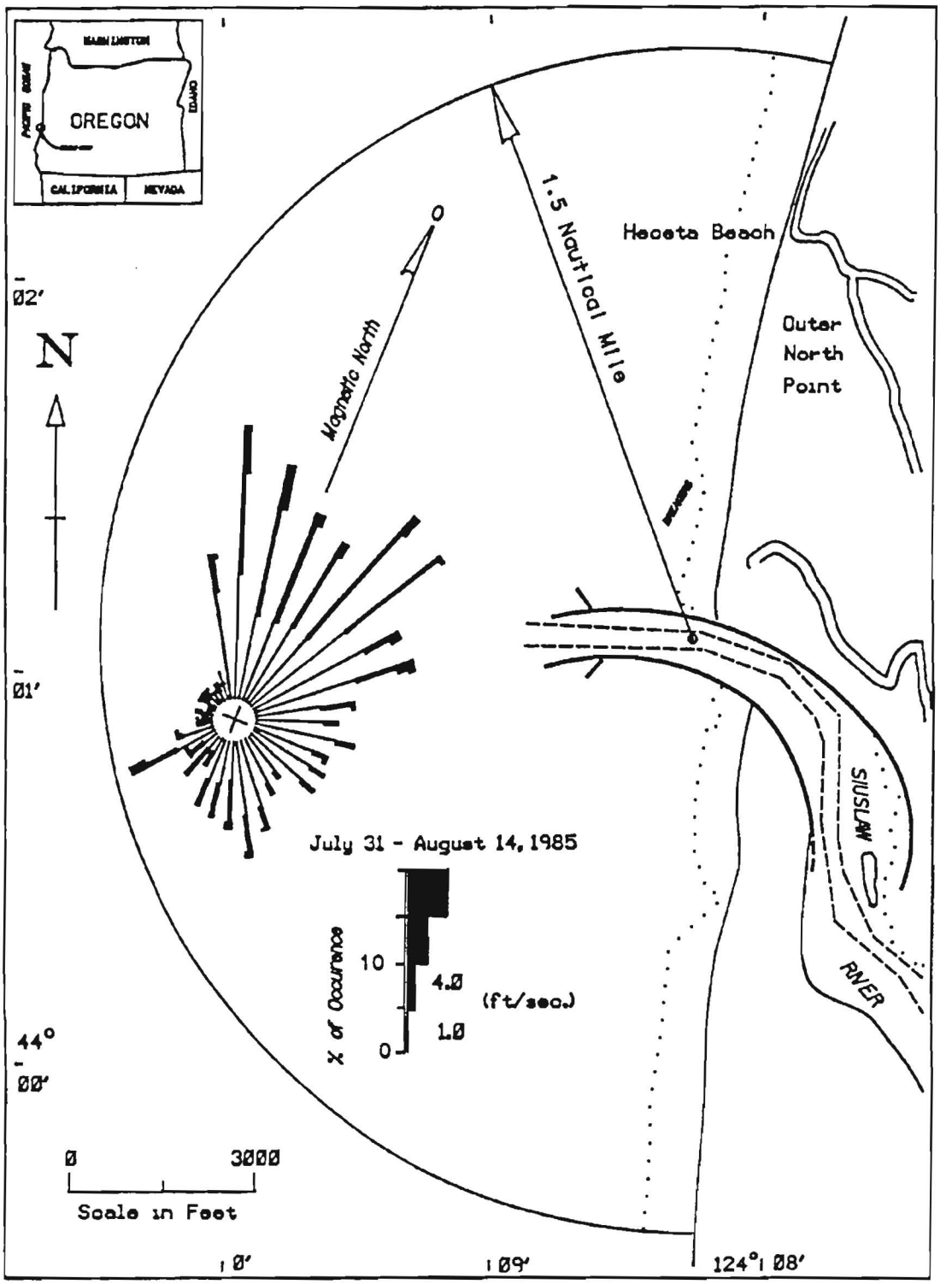


Figure B-17
Current Velocity Vectors at Siuslaw, July 31 thru August 14, 1985

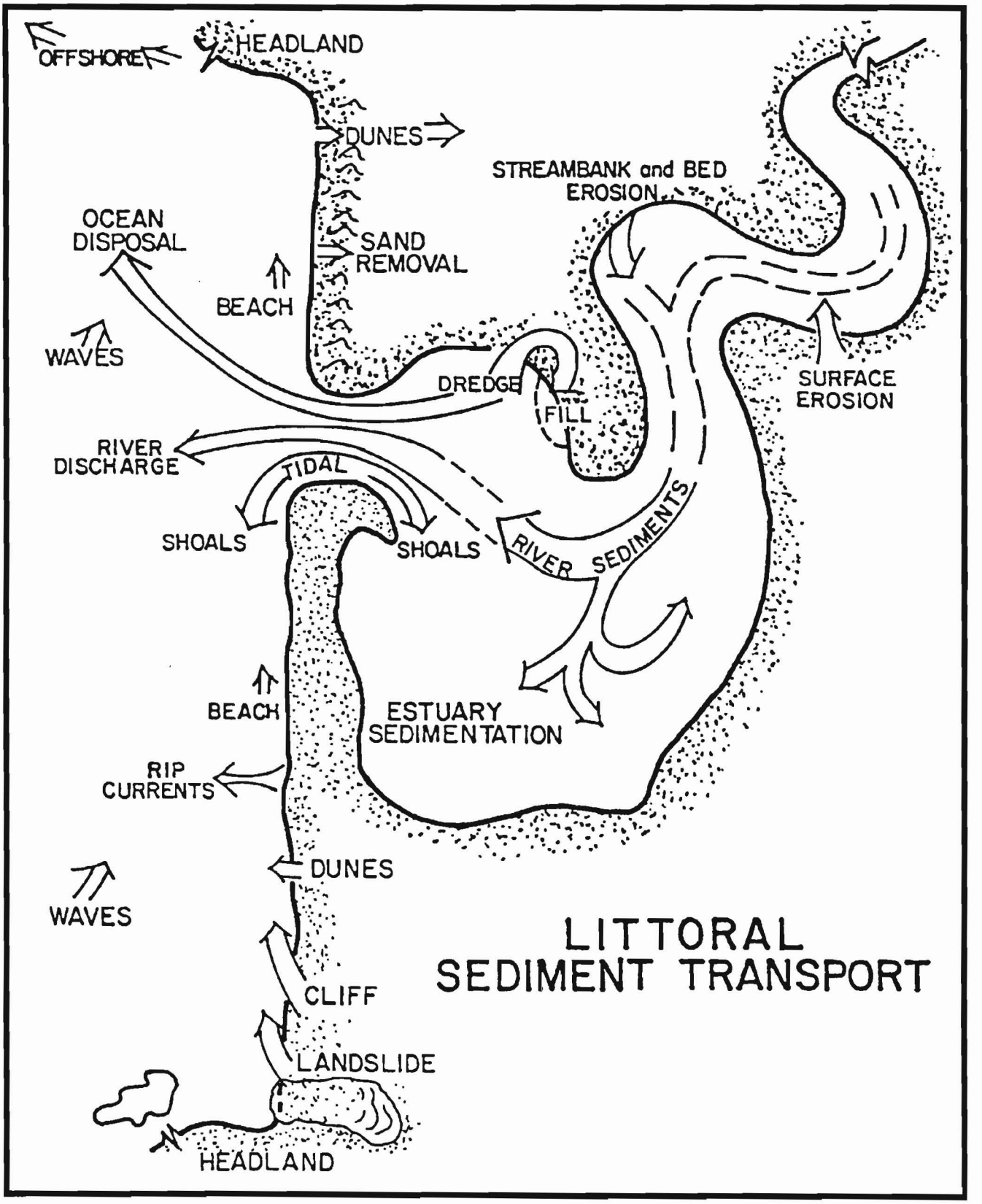


Figure B-18
Littoral Sediment Transport

sediment in the 0.2 mm sand size, the sand particle size common off the Oregon Coast. Using the Coos Bay data the probability of wave-induced sand movement is very small beyond water depth of about 150 feet. Various sedimentologic studies have 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

3.3 Figure B-2 shows the Heceta Head Littoral Cell which extends approximately 90 km 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 mineralogies as well as mineralogies of terrace deposits within the littoral cell (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.

3.4 Figure B-19 shows areas of more active dunes in the vicinity of the Siuslaw. 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).

Siuslaw Sediment Transport

3.5 The Siuslaw River entrance lies near the north end of the Heceta Head Littoral Cell. Heceta Head, northern limit of the cell, is approximately 10 miles north of the entrance.

3.6 Ocean circulation off the Oregon coast is propelled by wind, wave and tidal action. River discharges have only a local influence on ocean circulation. Near shore 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.

3.7 The Oregon coast has two oceanographic "seasons" resulting from changes in regional weather patterns (Figure B-20). The prevailing winds are predominantly from the southwest with intermittent northwest to west winds from November to April. With southwest wind 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.

3.8 Results from dye and seabed drifter studies (USACE, 1988) indicate 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. The 1988 report recommends

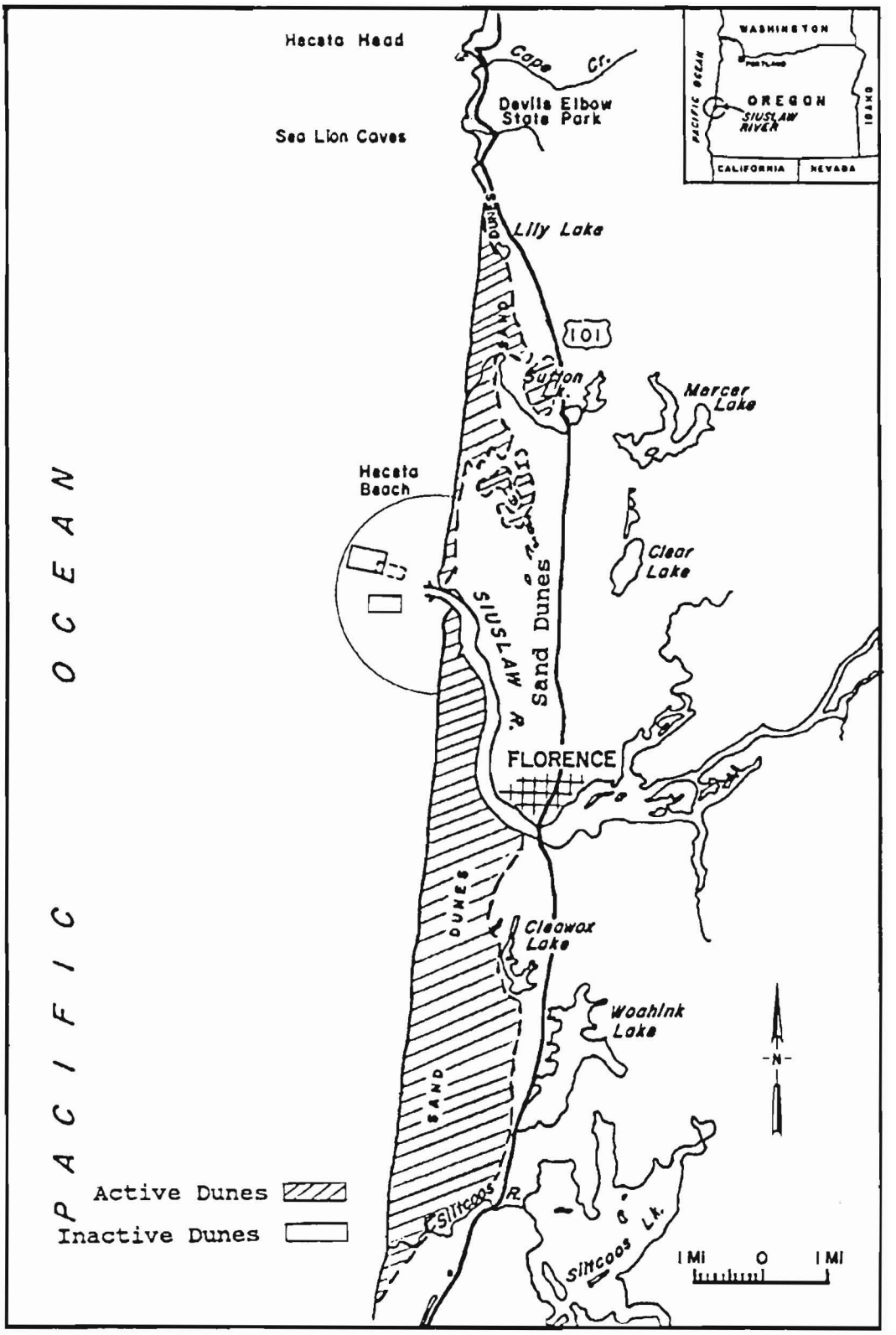


Figure B-19
Sand Dunes near Siuslaw

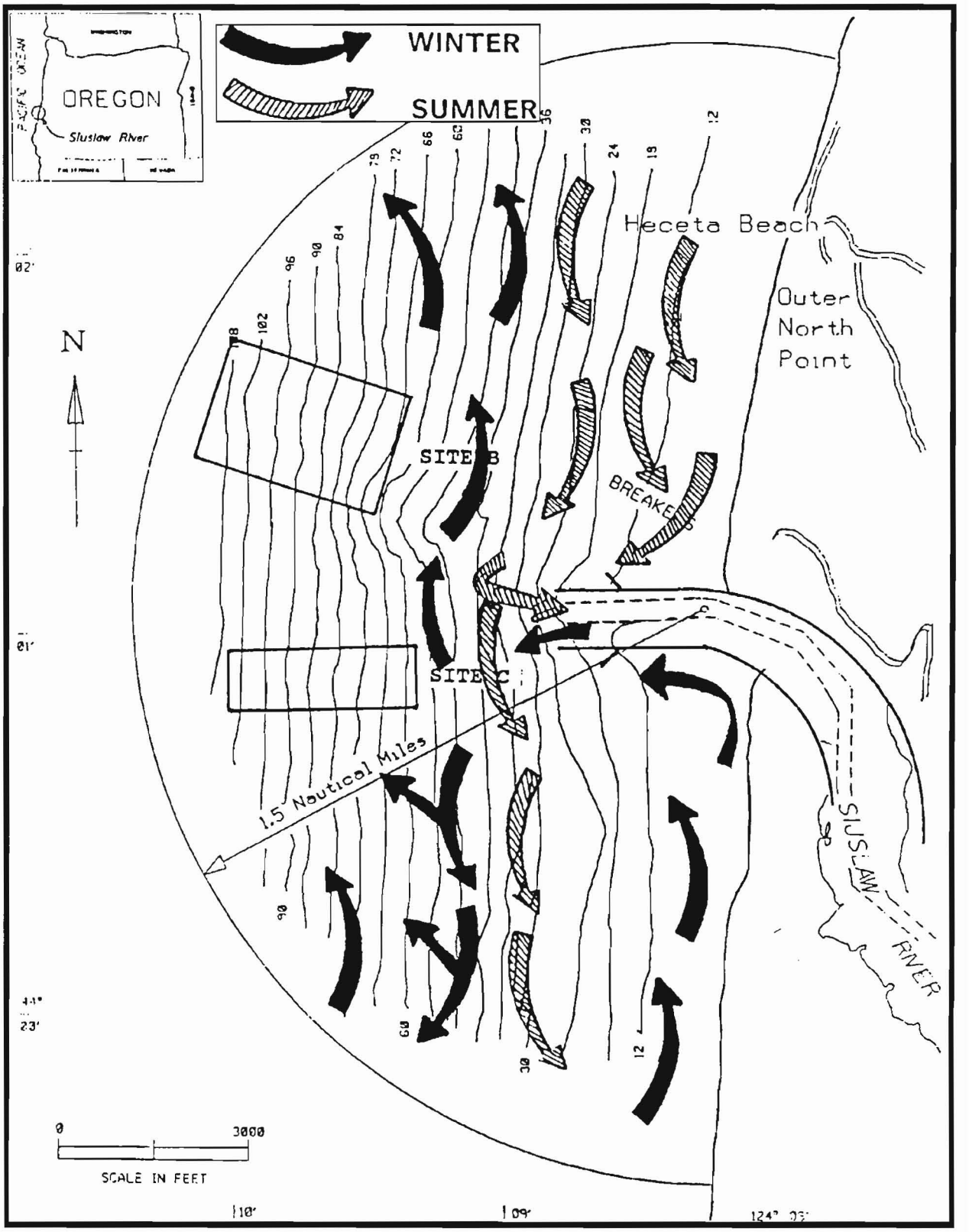


Figure B-20
Sediment Transport at Siuslaw

establishing two offshore disposal sites for the Siuslaw. A northern site located northwest of the interim site for use prior to or during months where the prevailing winds will be from the southwest. This site is more than twice as large as the interim site, allowing more dispersal of dredge material during placement. It is expected that most of the dredged material will be placed at this site. The site has been located further offshore to prevent local currents from moving dredged material into the entrance channel. A second site is located south of the entrance channel for disposal prior to or during months where the prevailing winds will be north to northwest. This site is approximately the same size as the interim site.

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APPENDIX C

Sediment and Water Quality

APPENDIX C
Sediment and Water Quality

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APPENDIX C

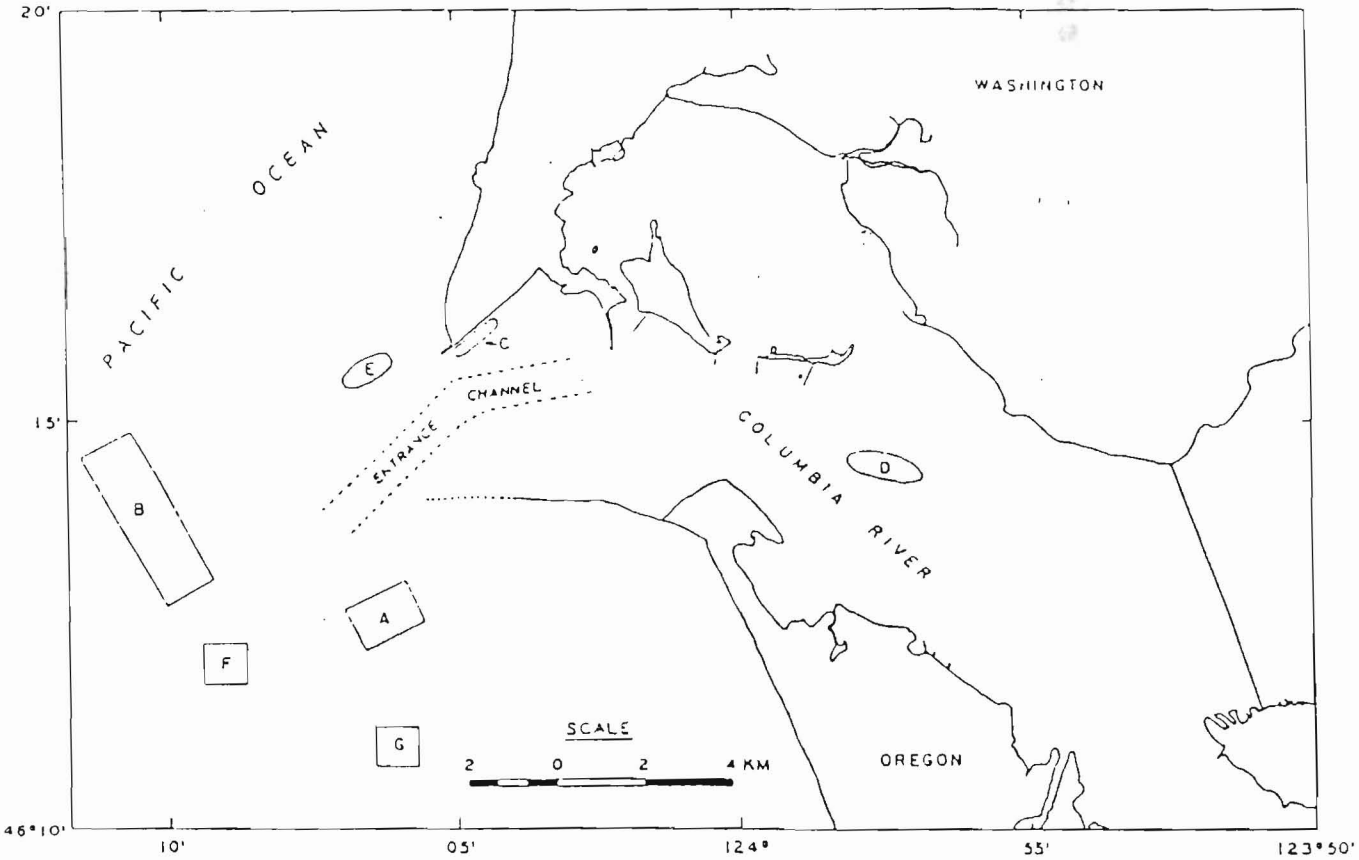
Sediment and Water Quality

General

1.1 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. Dredged materials placed in interim-designated 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. Disposed sediments at Siuslaw are similar in grain size to those at the disposal sites. Because of their coarse nature, similarity to ODMDS sediments, isolation from known existing or historical contaminant sources and the presence of strong hydraulic regimes, the dredged sands from entrance bar shoals meet criteria for exemption from further testing according to provisions of 40 CFR 227.13(b). Some data are available from Siuslaw ODMDS and ZSF and are presented in this appendix. The Siuslaw ODMDS and ZSF data was compared with water and sediment quality impacts associated with disposal of sands and silts at ODMDS for the two largest Oregon coastal navigation projects, the Mouth of the Columbia River (MCR) and Coos Bay, and no impacts are anticipated with ocean disposal at the Siuslaw ODMDSs. If fine sediments are ocean disposed at Siuslaw, available data will need to be reviewed and possibly supplemented with additional chemical or biological testing to evaluate such an action.

1.2 The MCR project was one of the Aquatic Disposal Field Investigations conducted as part of the Dredged Material Research Program (DMRP) in the mid-1970's (Boone et al. 1978, Holton et al. 1978). The DMRP was a nationwide program conducted by the Corps of Engineers to evaluate environmental impacts of dredging and dredged material disposal. The MCR studies included work at an experimental ODMDS, site G, located south of the MCR channel at an average depth of 85 feet. Figure C-1 shows the Columbia River Entrance and the disposal sites. Following baseline physical, chemical, and biological characterizations of the site, a test dumping operation disposed of 600,000 cubic yards of medium to fine sands (median grain diameter = 0.18 mm) during July - August 1975. Sediments at the disposal site were a fine to very fine sand (median grain diameter = 0.11-0.15 mm).

1.3 Monitoring results for the MCR Site G indicated a mound of slightly coarser sediment within the site that gradually mixed with ambient sediments and dissipated over several months. Water quality monitoring during disposal showed no elevated levels of toxic heavy metals, including Cu, Zn, Cd, and Pb, with some nontoxic elevated levels of Fe and Mn. Nutrient fluctuations were associated primarily with tidal variations, as were chlorophyll and particulate organic carbon. Dissolved oxygen remained high throughout disposal operations. Sediment quality remained high, with slight but nontoxic increases in Pb (from 2 to 4 mg/kg) and Hg (from 0.008 to 0.05 mg/kg) recorded before and after disposal at area G. Oil & grease values in the sediments decreased slightly after disposal, while there were no elevated levels in ammonia. The authors concluded that there were no adverse impacts in terms of water/sediment quality or toxicity from disposal of MCR sands at Site G. They



Columbia River entrance channel and ODMDS, including experimental disposal site G (From Boone et al. 1978).

Figure C-1
Columbia River Entrance Channel and ODMDS

attributed fluctuations in tested variables primarily to sediment and suspended particulate input from the Columbia River, biological activity and processes, and laboratory difficulties associated with repeated measurements close to analytical detection limits.

1.4 An evaluation of areas offshore of Coos Bay was conducted under Corps contract by Oregon State University researchers pursuant to designation of a new ODMDS for fine grain sediments from upper Coos Bay and Isthmus Slough (Hancock et al. 1984, Nelson et al. 1984, Sollitt et al. 1984, U.S.A.C.E. Portland District 1984). The program, conducted in five phases during 1980-1984, included baseline physical, biological, and chemical surveys of offshore areas followed by selection of candidate sites and a test dump/monitoring study at proposed Site H. Figure C-2 shows the location of the Coos Bay sample stations. This site was subsequently designated by EPA as the final site for fine Coos Bay sediments (51 FR 29927 - 29931, dated 21 August 1986).

1.5 The dump/monitoring program at Site H consisted of disposal of 60,000 cubic yards of fine sediments from Isthmus Slough, accompanied by water quality and benthic monitoring during disposal operations and followed by post-disposal monitoring of the site and adjacent areas over the next 18 months. Elevated levels in ammonia, Cu and Mn were observed during disposal that in some cases were at the threshold of acute toxicity. However, these increased levels were of short duration. No substantial elevated levels of other contaminants or changes in dissolved oxygen, oxy-redox potential, turbidity, or pH were observed. Sediments at the site showed elevated levels of volatile solids, fines, and heavy metals that gradually decreased over the next 18 months. Figure C-3 shows the results of the chemical test results. Total volatile solids were found to be the most sensitive and reproducible indicator of levels of contaminants and its use was suggested as a monitoring tool to utilize during further disposal operations at Site H.

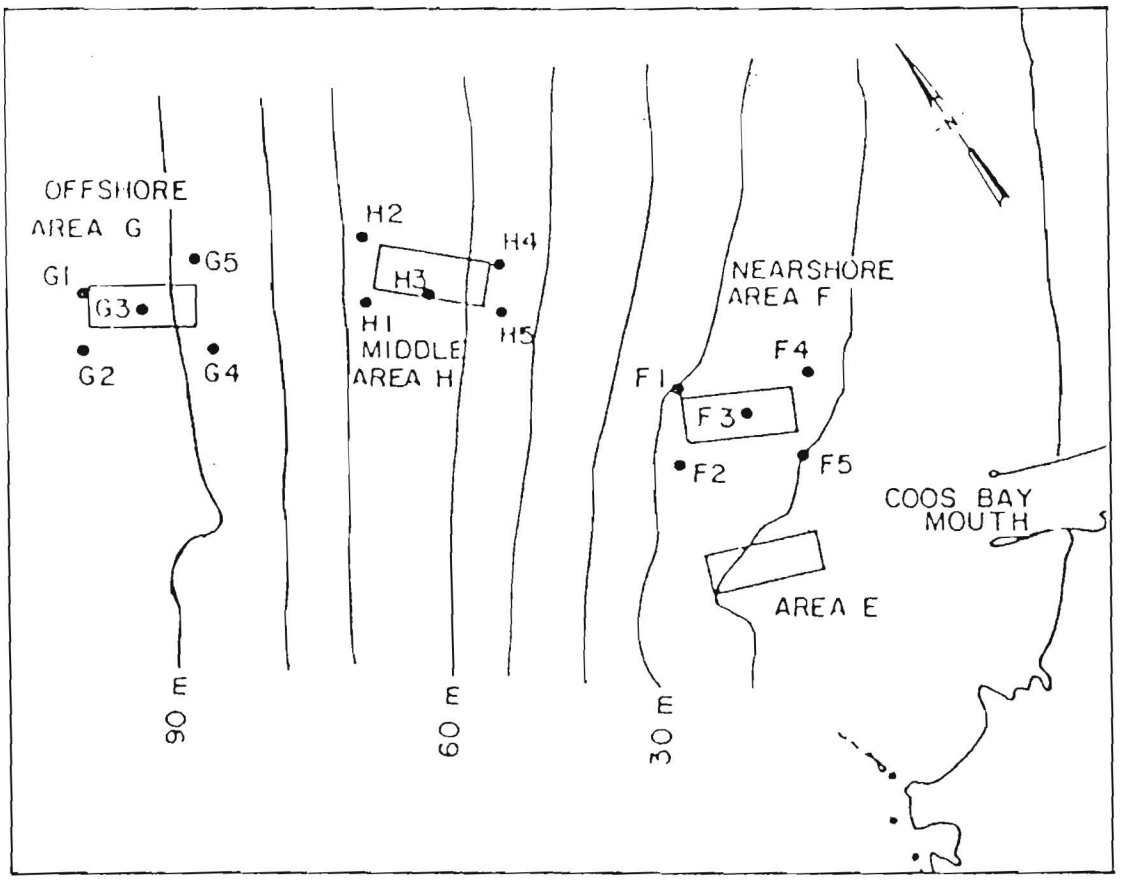
Sediment and Water Quality of Siuslaw Sands

2.1 The Siuslaw ZSF was sampled in September 1988, January 1985 and September 1984. Locations of these sampling stations are given in Figure C-4A and C-4B (See Tables C-1 and C-2 for a summary of the physical characteristics of the sediments).

2.2 Physical sediment and total volatile solids analyses were performed on the samples. A summary of the results are located in Appendix B.

2.3 Dredged materials deposited at the ODMDSs primarily come from the entrance bar. Disposal site sediments are well-sorted medium sands with median grain size approximately 0.2 mm (Figures C-8 and C-9). Sediment gradation tests on locations outside the interim disposal site indicate the mean grain size of the sediment was 0.12 mm. The sediment of the ZSF, excluding the interim ODMDS, is a well sorted fine sand. Thus, Siuslaw dredged sediments are very similar to sediments at the ODMDS.

2.4 The percentage of volatile solids in the Siuslaw interim sediments is less than 1.0. Other locations sampled in the ZSF had a volatile solids



Coos Bay sample station locations for chemical, biological, and physical studies at interim-designated and candidate ODMDS (From U.S.A.C.E. Portland District 1984).

Figure C-2
Coos Bay Sample Station Locations

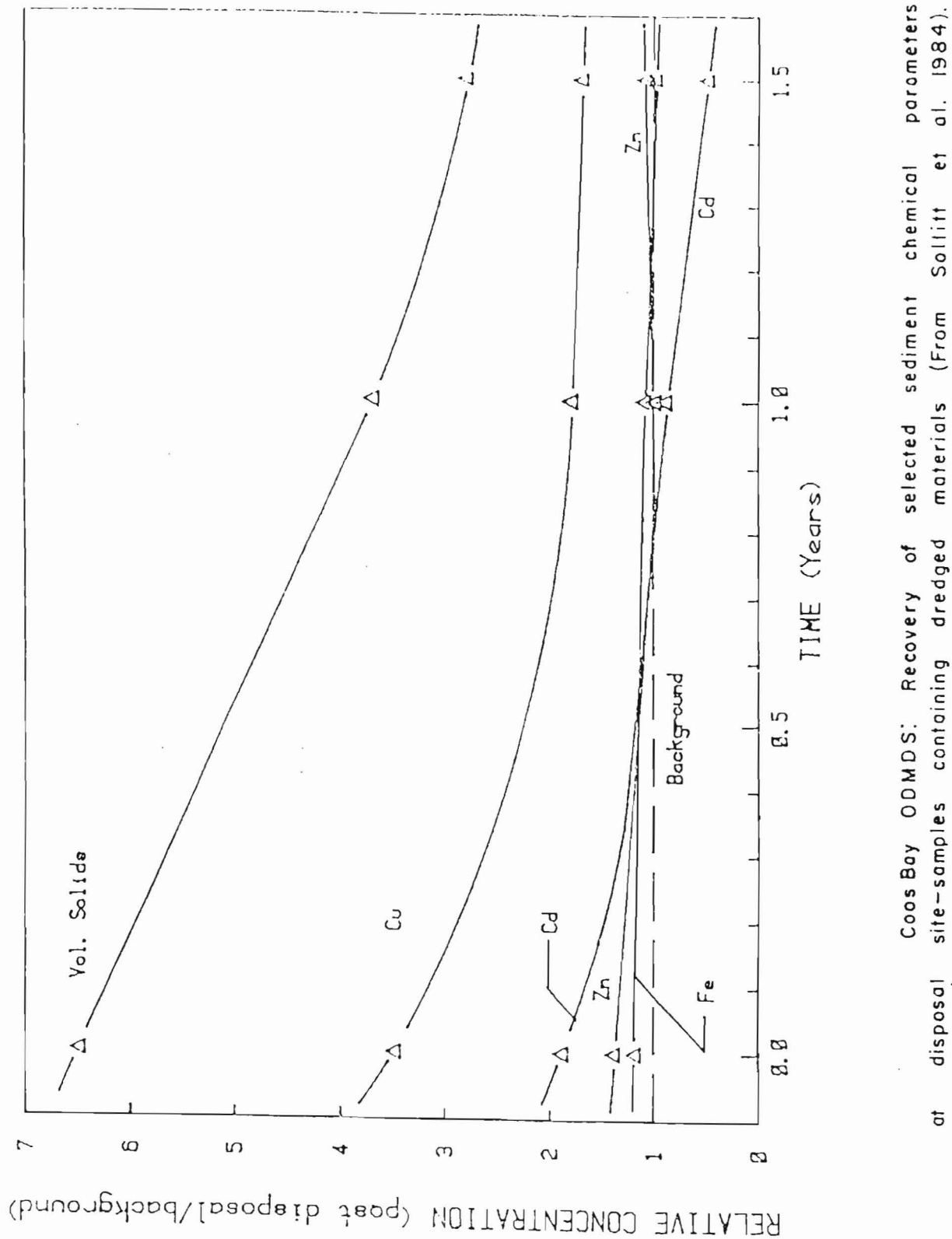


Figure C-3

Coos Bay ODMDS: Recovery of Selected Sediment Chemical Parameters at Disposal Site-Samples Containing Dredged Material

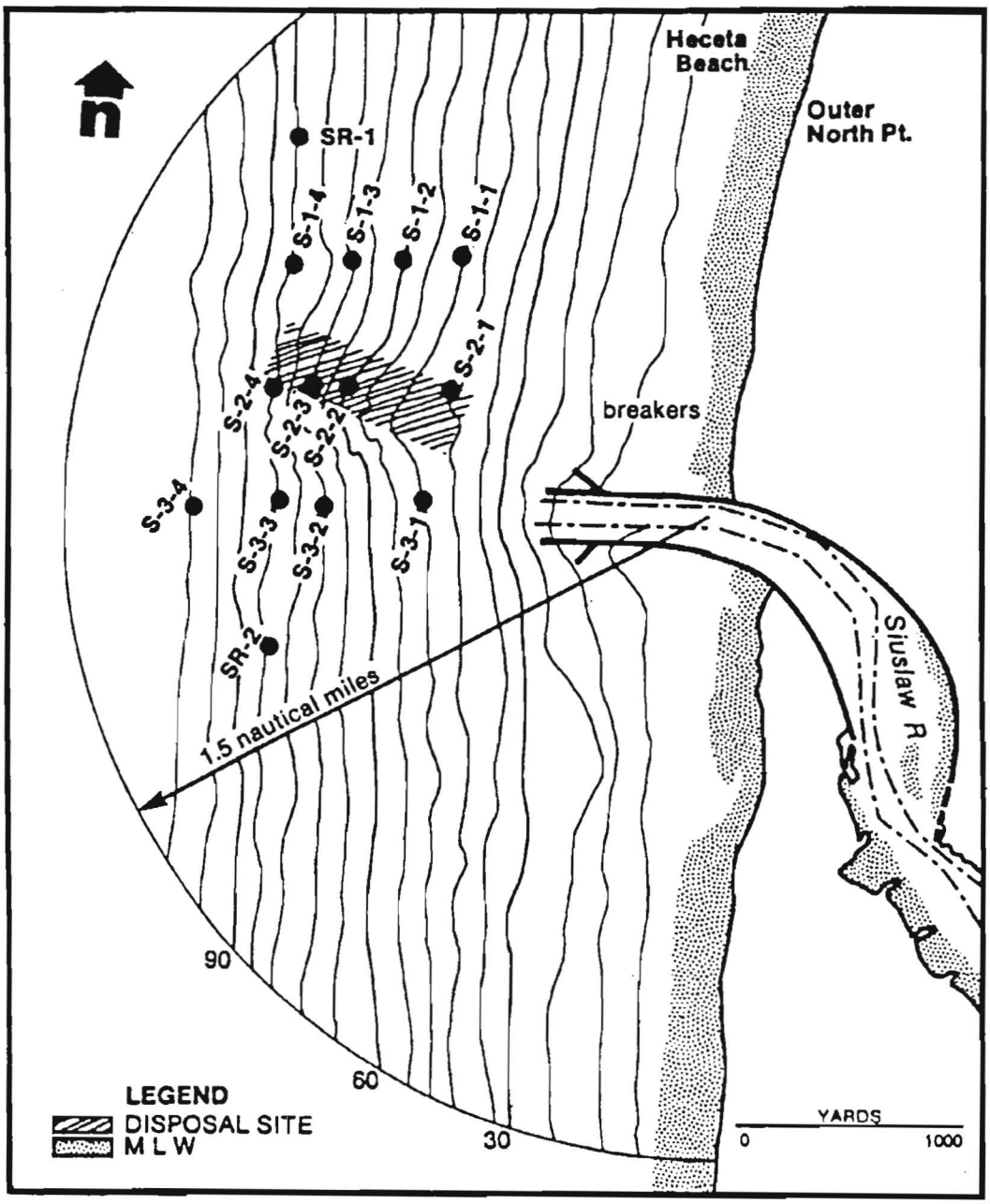


Figure C-4A
Siuslaw ZSF and 1984-1985 Sampling Locations

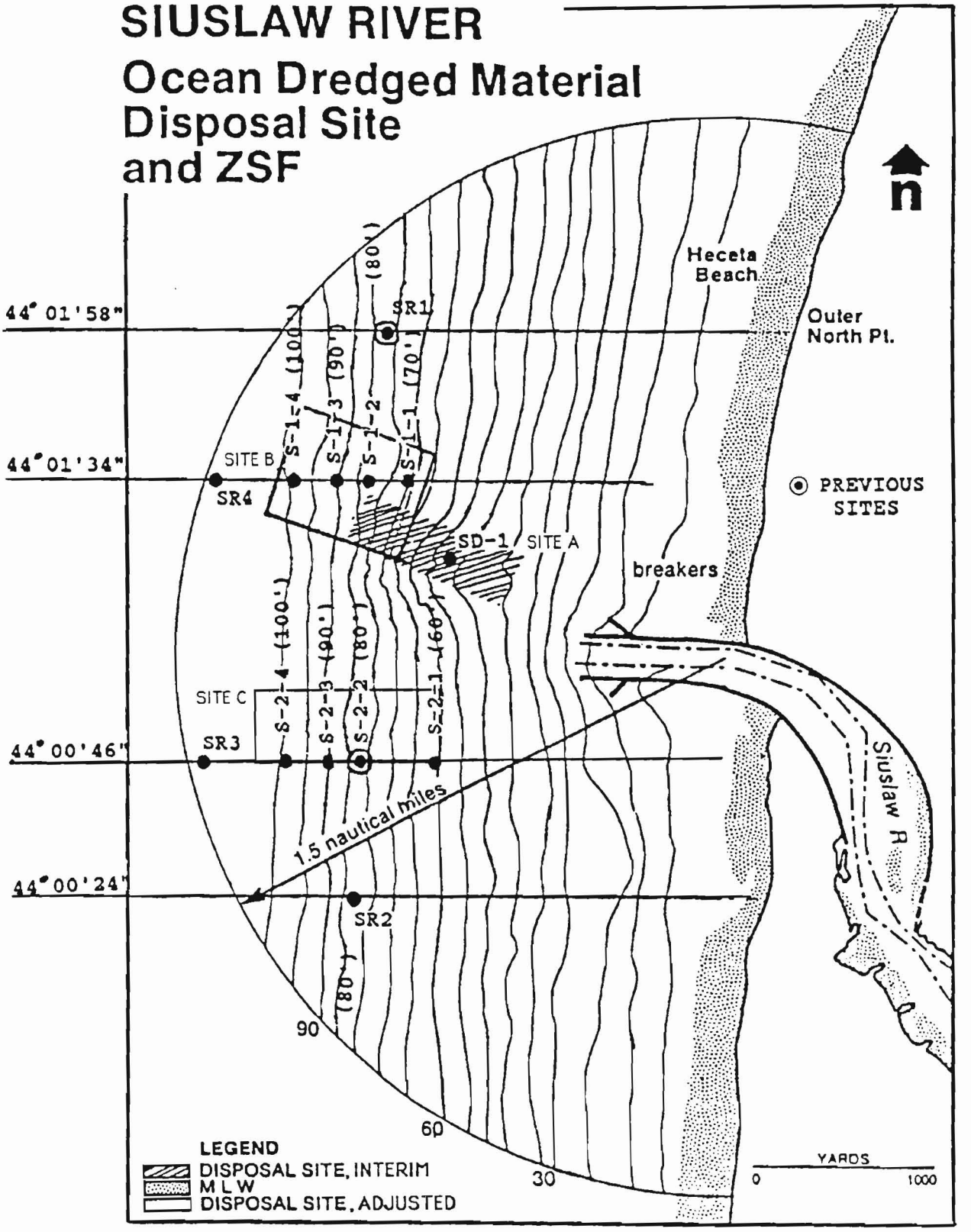


Figure C-4B
Siuslaw ZSF and 1984-1985 Sampling Locations

percentage less than 1.4. Both areas are below the concern levels of 5 %. The variation in concentration levels of volatile solids at various locations in the ZSF is not considered significant (See Figures C-5 and C-6).

TABLE C-1
Siuslaw Offshore Sediment Samples

Station	Mz*			D50		
	Sept 1988	Jan 1985	Sept 1984	Sept 1988	Jan 1985	Sept 1984
SR-1	0.24	0.18	0.19	0.21	0.17	0.18
SR-2	0.28	0.25	0.19	0.31	0.25	0.18
SR-3	0.29	----	----	0.29	----	----
SR-4	0.29	----	----	0.28	----	----
SD-1	0.19	----	----	0.18	----	----
S-1-1	0.23	0.17	0.18	0.20	0.17	0.17
S-1-2	0.26	0.18	0.17	0.18	0.16	0.17
S-1-3	0.22	0.16	0.17	0.20	0.16	0.17
S-1-4	0.23	0.19	0.17	0.20	0.18	0.18
S-2-1	0.17	0.26	0.22	0.17	0.25	0.26
S-2-2	0.23	0.21	0.22	0.20	0.21	0.27
S-2-3	0.27	0.20	0.22	0.25	0.20	0.25
S-2-4	0.26	0.22	0.22	0.22	0.21	0.25
S-3-1	----	0.17	0.19	----	0.17	0.17
S-3-2	----	0.16	0.18	----	0.16	0.16
S-3-3	----	0.21	0.18	----	0.17	0.16
S-3-4	----	0.17	0.24	----	0.19	0.24

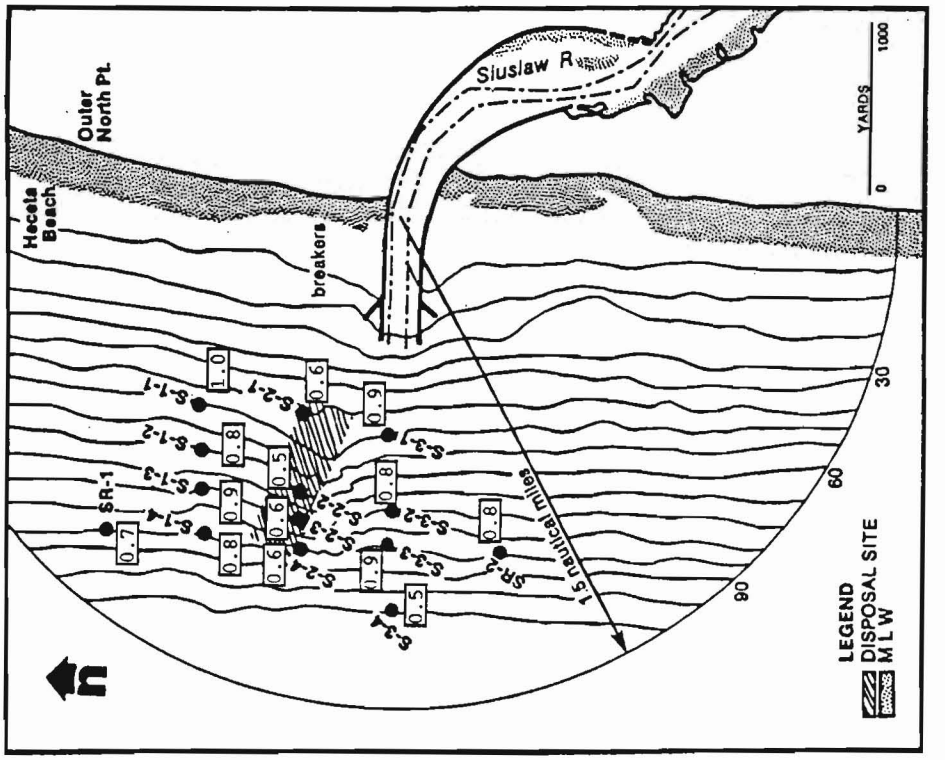
* Mean grain size (Mz) calculated using Folk and Ward's (1954) parameters. Grain size given in millimeters.

TABLE C-2

Siuslaw Offshore Sediment Samples

Station	D90			% Fines		
	Sept 1988	Jan 1985	Sept 1984	Sept 1988	Jan 1985	Sept 1984
SR-1	0.30	0.25	0.26	0	1	1
SR-2	0.40	0.40	0.29	0	0	1
SR-3	0.43	----	----	0	----	----
SR-4	0.45	----	----	0	----	----
SD-1	0.28	----	----	0	----	----
S-1-1	0.40	0.22	0.23	0	1	1
S-1-2	0.36	0.27	0.23	3	1	1
S-1-3	0.37	0.26	0.23	0	2	1
S-1-4	0.40	0.29	0.27	0	1	1
S-2-1	0.25	0.38	0.34	3	0	0
S-2-2	0.40	0.35	0.36	0	0	0
S-2-3	0.42	0.32	0.36	0	0	0
S-2-4	0.42	0.36	0.36	0	0	0
S-3-1	----	0.26	0.29	----	0	1
S-3-2	----	0.36	0.23	----	1	0
S-3-3	----	0.26	0.24	----	1	1
S-3-4	----	0.35	0.35	----	1	1

Grain size given in millimeters.



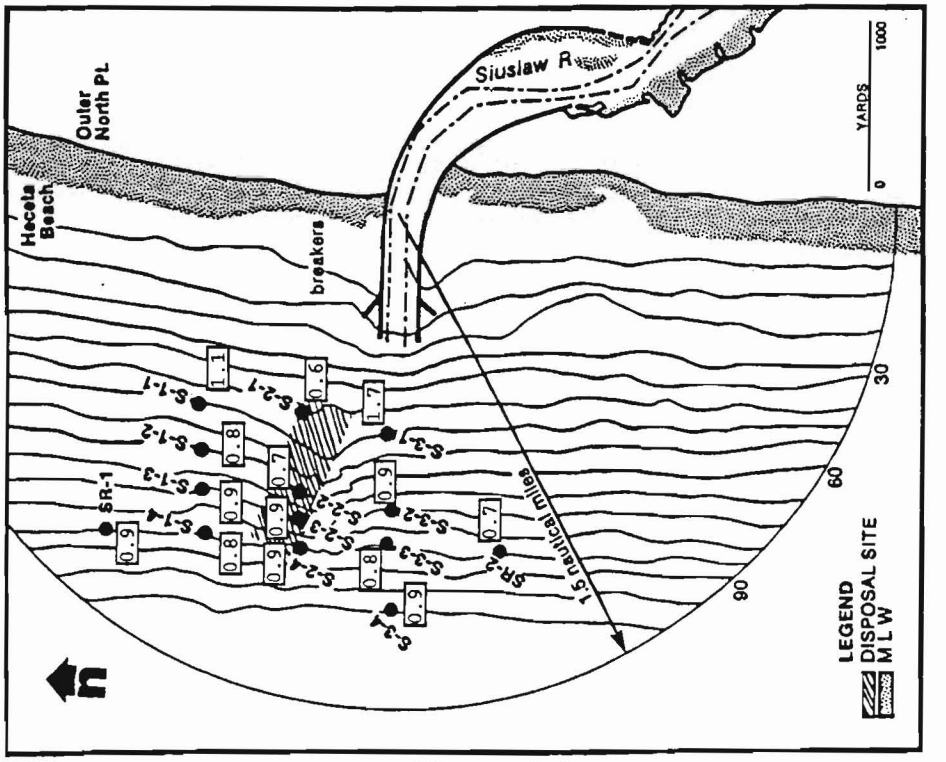


Figure C-5
Volatile Solids (Sept 1984 & Jan 1985)

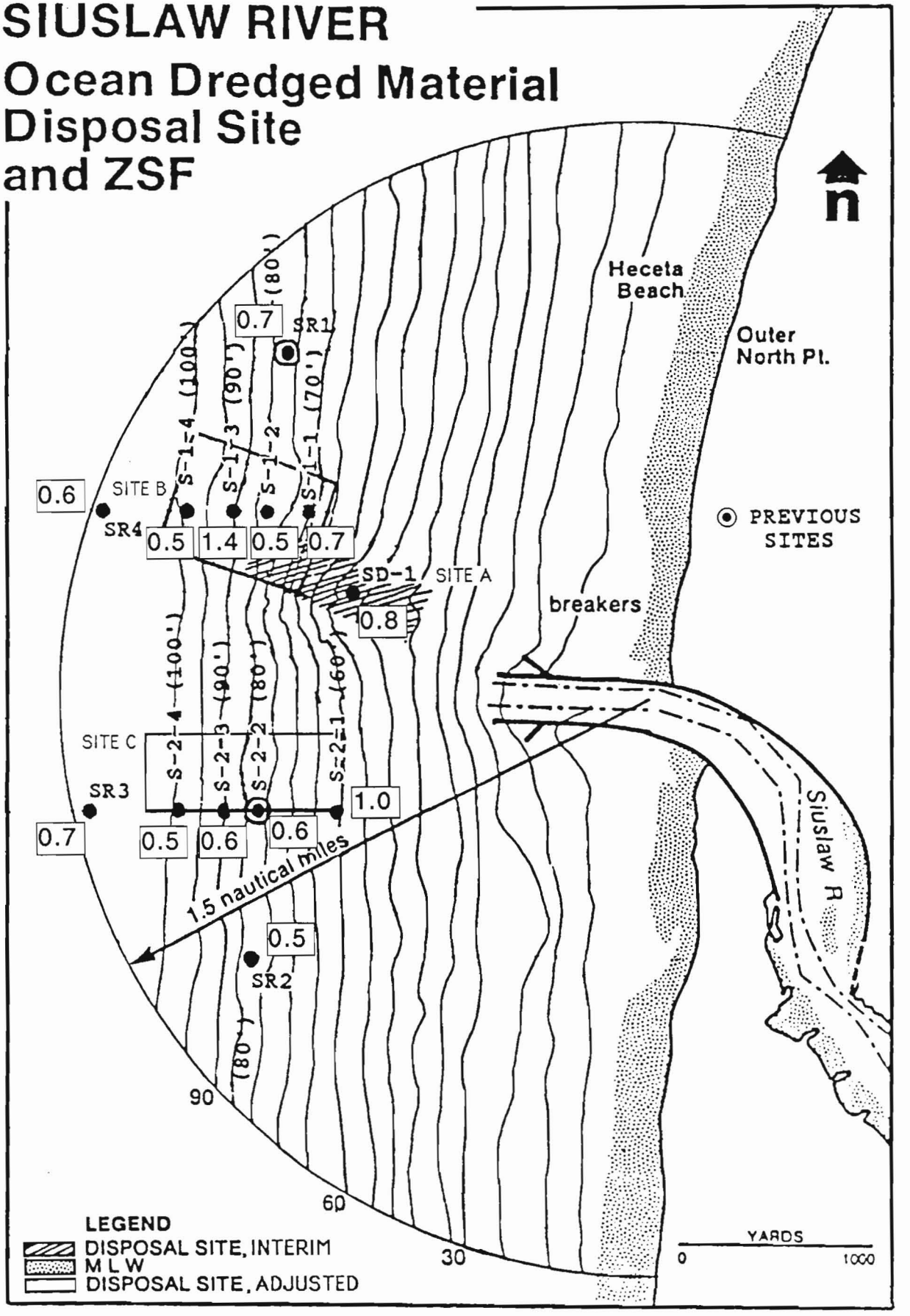
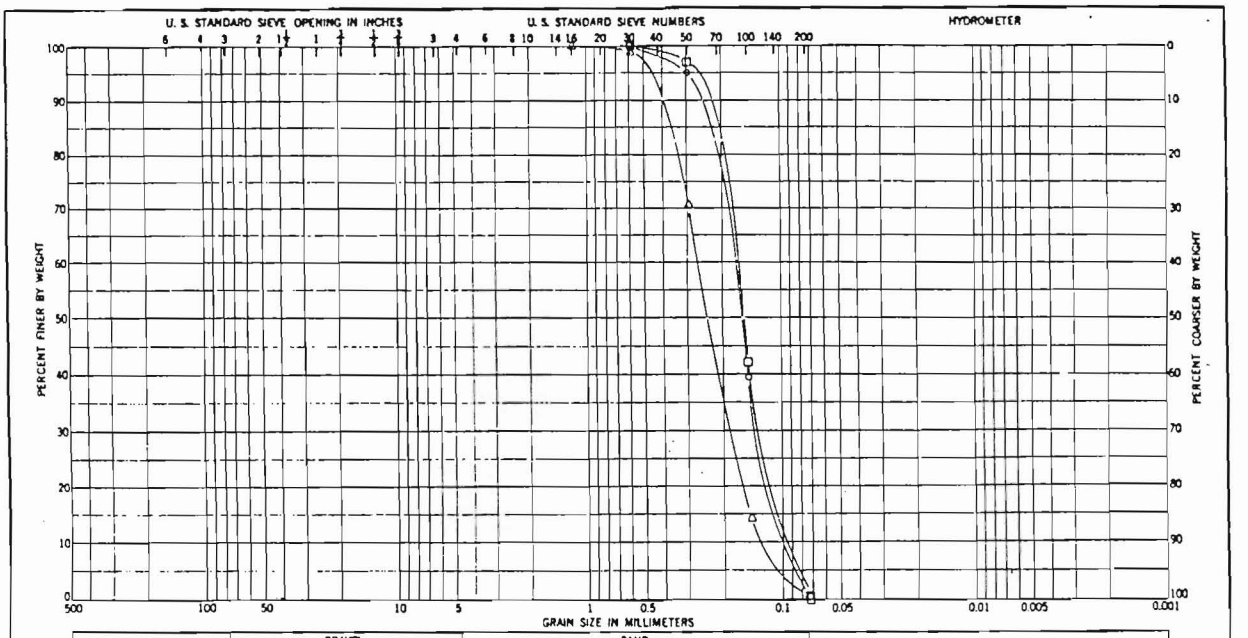


Figure C-6
Volatile Solids (Sept 1988)



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids,%			
SR-1	○	Fine SAND (SP)		0.9		
SR-2	△	Poorly Graded SAND (SP)		0.7		
S-1-1	□	Fine SAND (SP)		1.1		

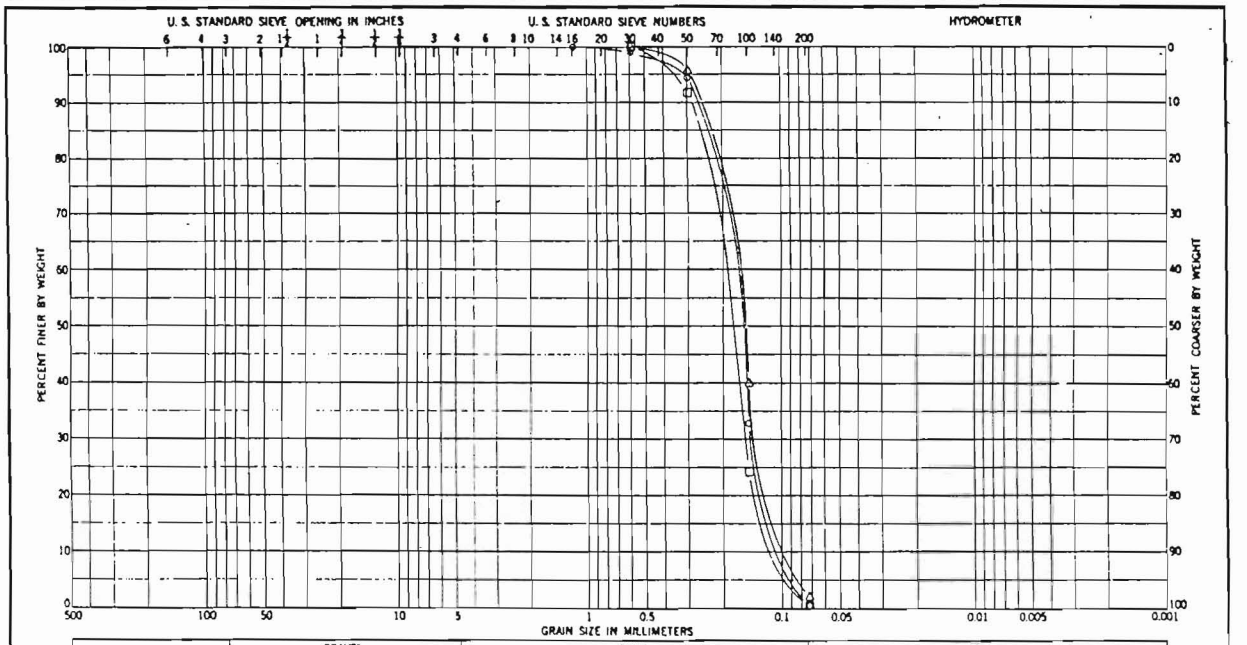
Project GENERIC OCEAN DISPOSAL SITES

Area Siuslaw River

~~Boring No.~~ Sampled 28 Jan 85

Date MAY 8 1985 (85-SH-730)

GRADATION CURVES NPD



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids,%			
S-1-2	○	Fine SAND (SP)		0.8		
S-1-3	△	Fine SAND (SP)		0.9		
S-1-4	□	Fine SAND (SP)		0.8		

Project GENERIC OCEAN DISPOSAL SITES

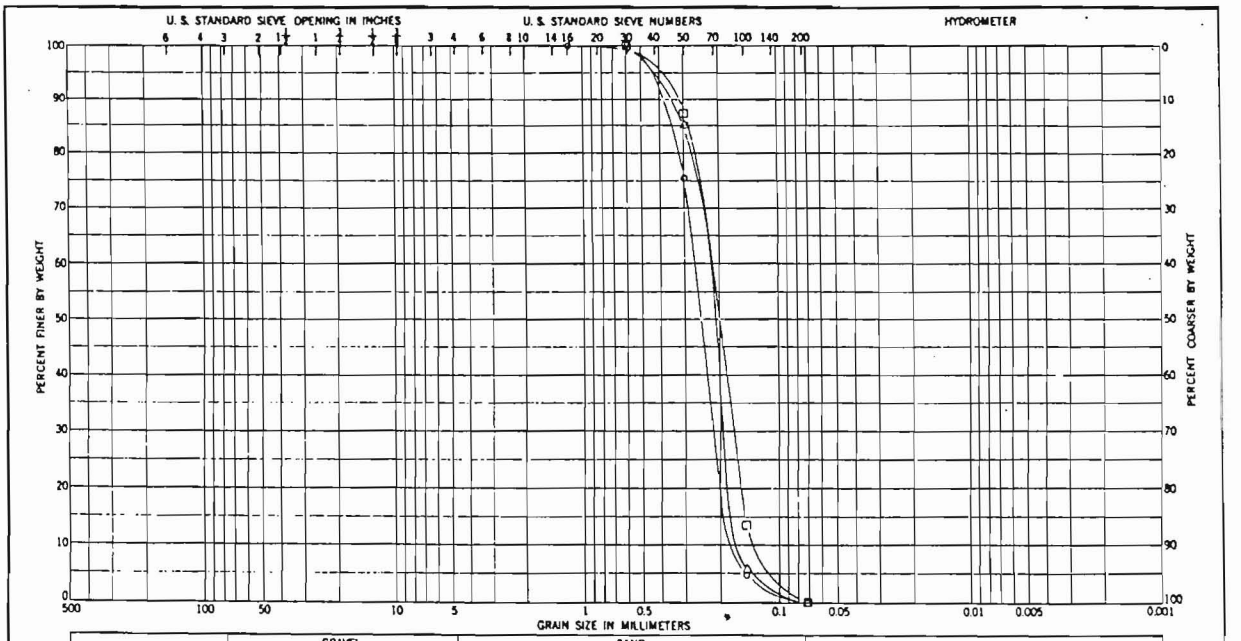
Area Siuslaw River

~~Boring No.~~ Sampled on 28 Jan 85

Date MAY 8 1985 (85-SH-730)

GRADATION CURVES NPD

Figure C-7
Gradation Curves



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids,%			
S-2-1	○	Poorly Graded SAND (SP)		0.6		
S-2-2	△	Poorly Graded SAND (SP)		0.7		
S-2-3	□	Fine SAND (SP)		0.9		

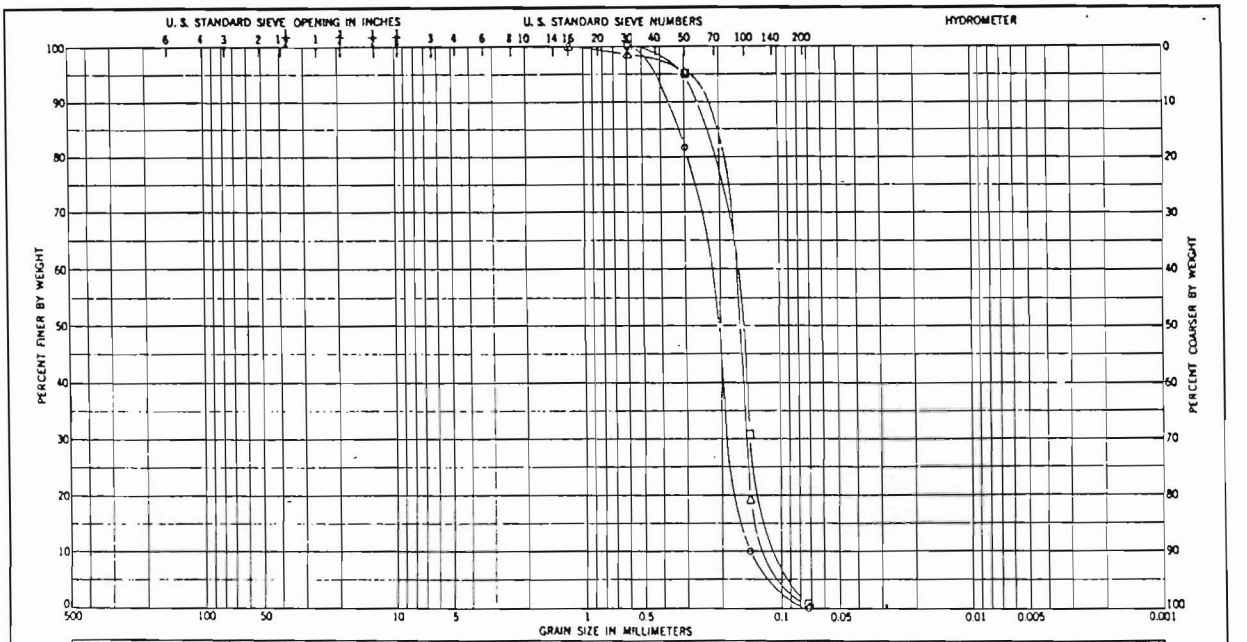
Project GENERIC OCEAN DISPOSAL SITES

Area Siuslaw River

~~Boring No.~~ Sampled on 28 Jan 85

Date MAY 8 1985 (85-SH-730)

GRADATION CURVES NPD



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids,%			
S-2-4	○	Poorly Graded SAND (SP)		0.5		
S-3-1	△	Fine SAND (SP)		1.7		
S-3-2	□	Fine SAND (SP)		0.9		

Project GENERIC OCEAN DISPOSAL SITES

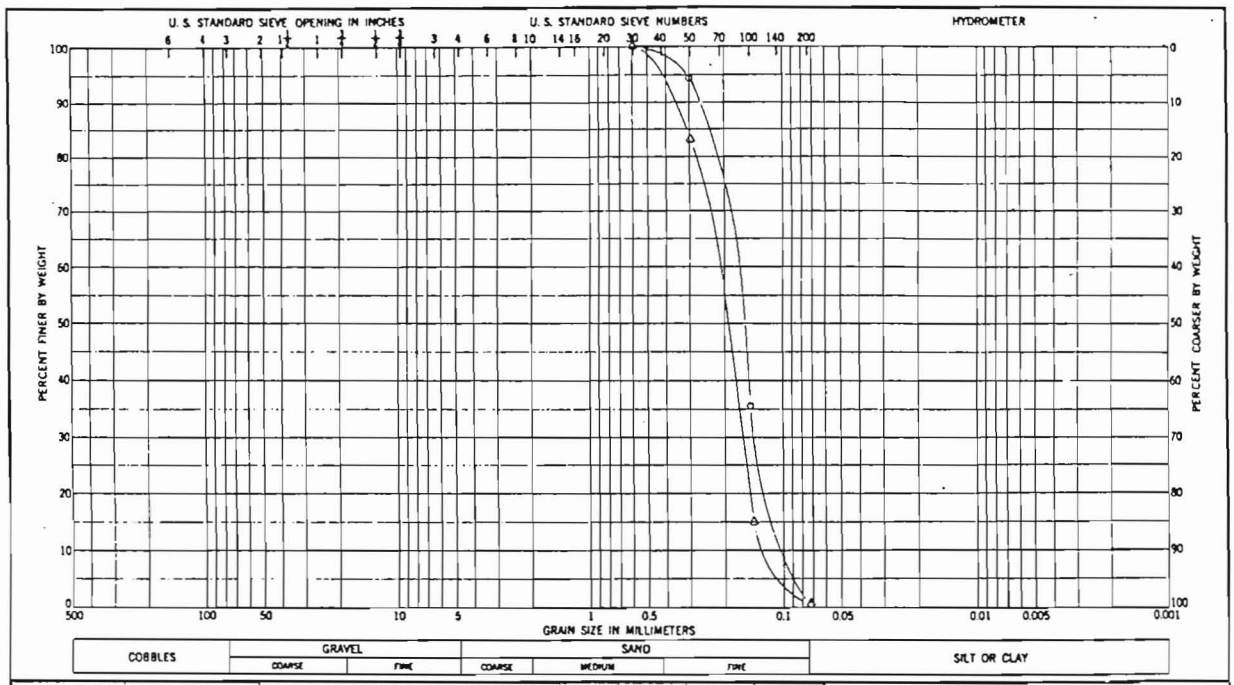
Area Siuslaw River

~~Boring No.~~ Sampled 28 Jan 85

Date MAY 8 1985 (85-SH-730)

GRADATION CURVES NPD

Figure C-8
Gradation Curves



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids, %			
S-3-3	○	Fine SAND (SP)		0.8		
S-3-4	△	Poorly Graded SAND (SP)		0.9		

Project GENERIC OCEAN DISPOSAL SITES

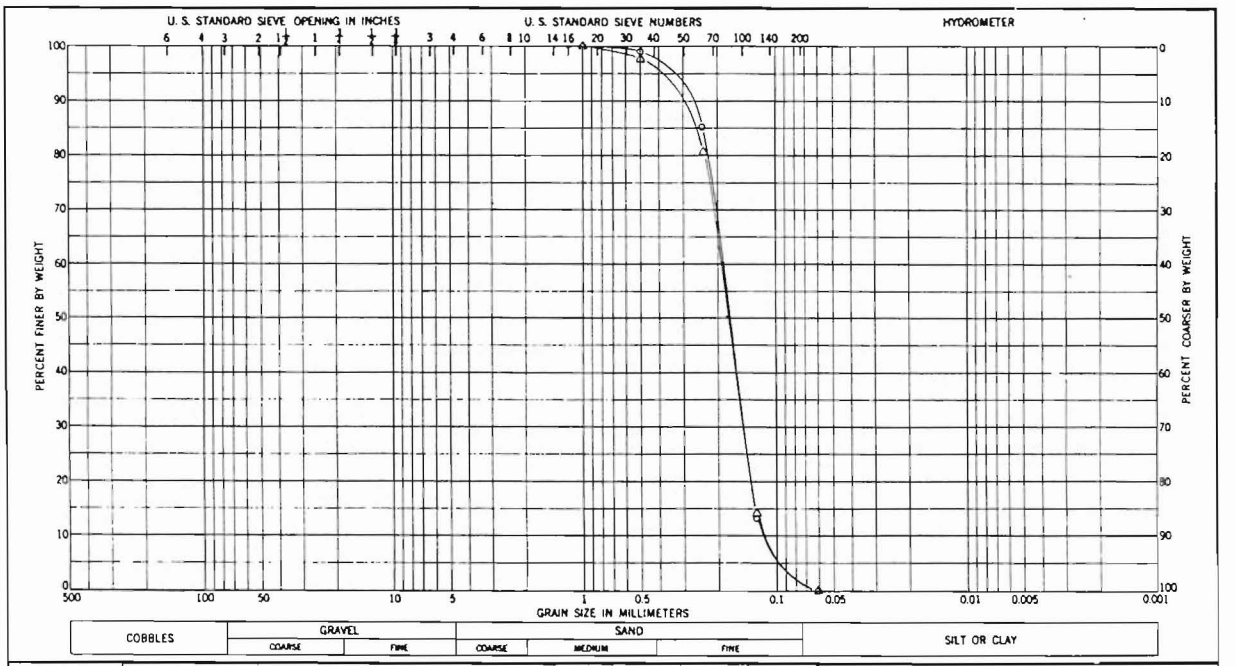
Area Siuslaw River

Boring No. Sampled 28 Jan 85

GRADATION CURVES NPD

Date MAY 9 1985 (85-SH-730)

Figure C-9
Gradation Curves



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
				Volatile Solids, %		
SR-1 ○	80 ft	Fine SAND (SP)		0.7		
SR-2 △	80 ft	Fine SAND (SP)		0.8		

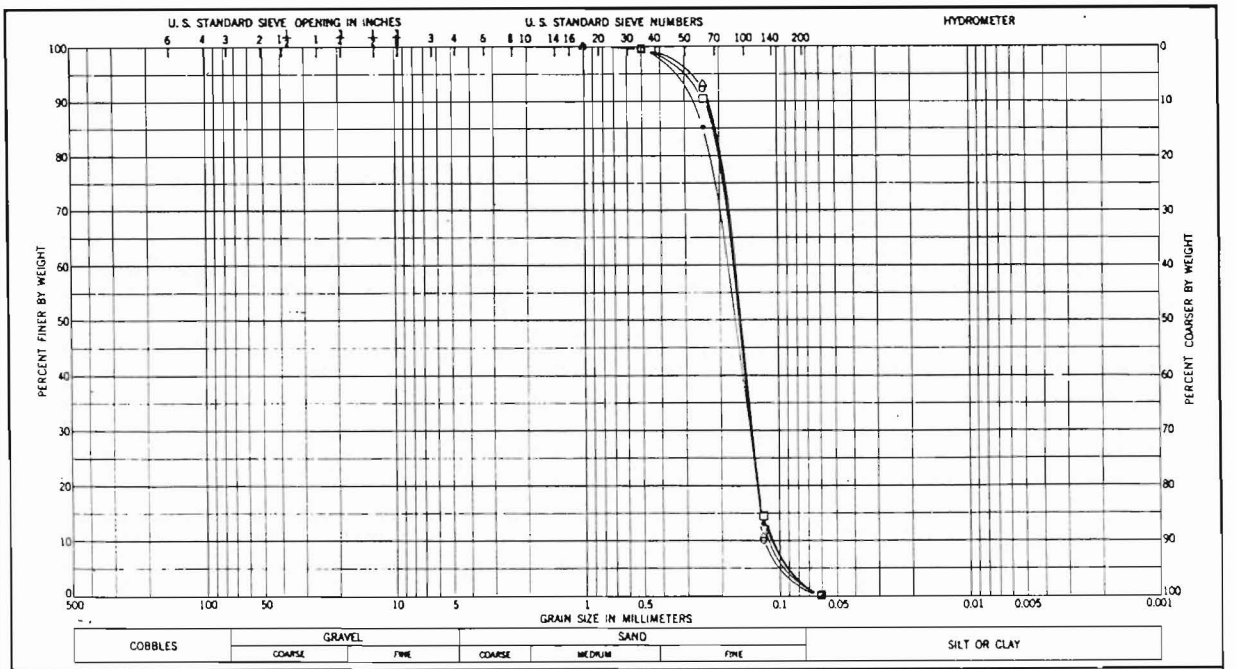
Project GENERIC OCEAN DISPOSAL SITES

Area Siuslaw

Boring No. Sampled on 2 Oct 84

Date NOV 29 1984 (85-SH-730)

GRADATION CURVES NPD



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
				Volatile Solids, %		
S-1-1 ○	50 ft	Fine SAND (SP)		1.0		
S-1-2 △	60 ft	Fine SAND (SP)		0.8		
S-1-3 □	70 ft	Fine SAND (SP)		0.9		
S-1-4 •	80 ft	Fine SAND (SP)		0.8		

Project GENERIC OCEAN DISPOSAL SITES

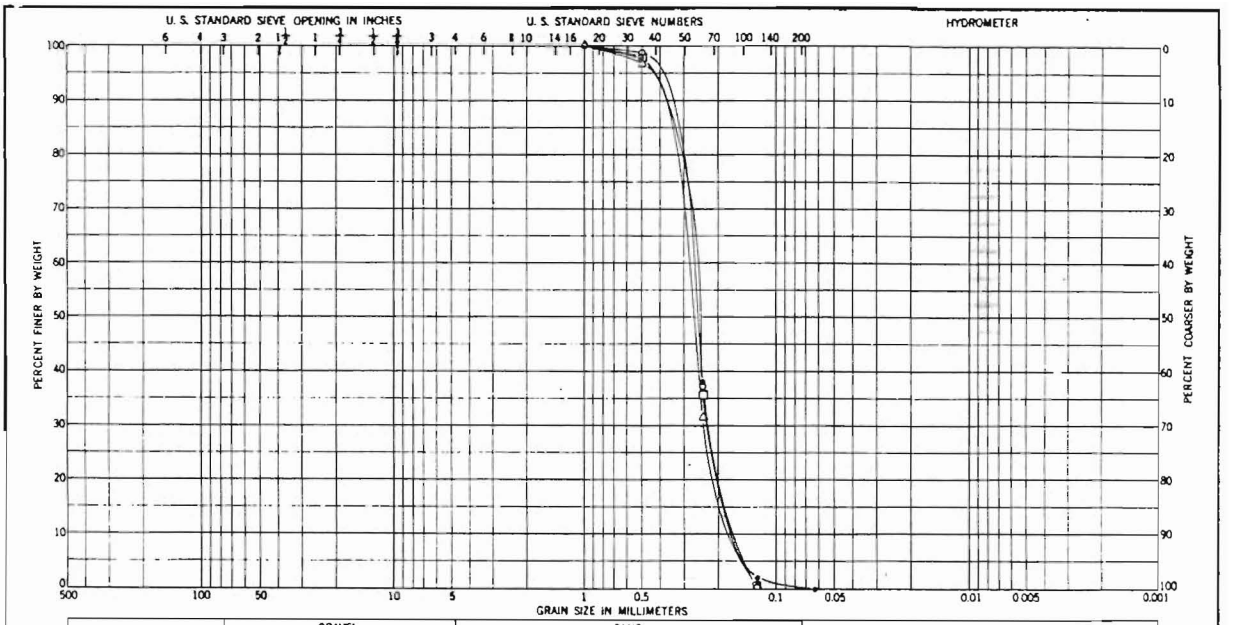
Area Siuslaw

Boring No. Sampled on 2 Oct 84

Date NOV 20 (85-SH-730)

GRADATION CURVES NPD

Figure C-10
Gradation Curves



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids, %			
S-2-1 ○	50 ft	Poorly Graded SAND (SP)		0.6		
S-2-2 △	60 ft	Fine SAND (SP)		0.5		
S-2-3 □	70 ft	Fine SAND (SP)		0.6		
S-2-4 ●	84 ft	Fine SAND (SP)		0.6		

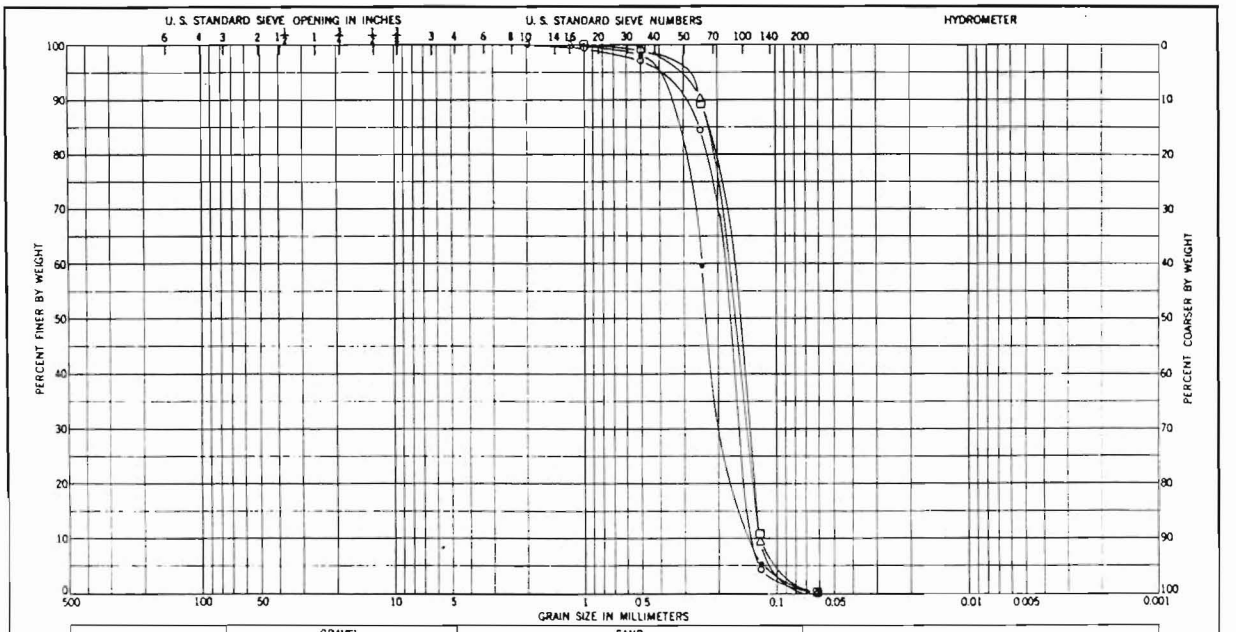
GRADATION CURVES NPD

Project GENERIC OCEAN DISPOSAL SITES

Area Siuslaw

Boring No. Sampled on 2 Oct 84

Date NOV 29 1984 (85-SH-730)



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids, %			
S-3-1 ○	50 ft	Fine SAND (SP)		0.9		
S-3-2 △	70 ft	Fine SAND (SP)		0.8		
S-3-3 □	80 ft	Fine SAND (SP)		0.9		
S-3-4 ●	100 ft	Fine SAND (SP)		0.5		

GRADATION CURVES NPD

Project GENERIC OCEAN DISPOSAL SITES

Area Siuslaw

Boring No. Sampled on 2 Oct 84

Date (85-SH-730)

Figure C-11
Gradation Curves

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APPENDIX D

Recreational Use

APPENDIX D

RECREATIONAL USE

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RECREATIONAL USE

Introduction

1.01 This report identifies the major recreational use areas within the Zone of Siting Feasibility (ZSF) at the mouth of the Siuslaw River. This information was compiled to determine the potential impacts of disposal operations on recreation.

Recreational Use Areas

1.02 The attached map identifies the major recreational use areas located within the ZSF. The area receives recreational use year-round with the heaviest use occurring from May through October. The area is particularly popular with fishermen because of the excellent fishing opportunities in the Siuslaw River and nearby freshwater lakes. Other recreational activities include camping, picnicking, beachcombing and sightseeing.

1.03 Beginning at the south jetty and continuing south along the coast for the entire length of the ZSF is the Oregon Dunes National Recreation Area (NRA). This portion of the recreation area contains no developed facilities other than a paved road. This road 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 Oregon Dunes NRA is a popular area for off road vehicles; however, this portion of the NRA is closed to vehicles during the summer months.

1.04 The northern half of the ZSF contains two public recreation areas. Heceta Beach Park is a county operated picnic area which provides access to the beach. The other facility, also operated by the county, is Harbor Vista Park. This park offers overnight camping facilities and is popular with anglers.

1.05 The Siuslaw River Jetty fishery is popular and accounts for a relatively high number of angler use days. These 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 spearfishing. This is a very specialized form of recreation and accounts for only a small percentage of the total visitor use at the Jetties.

1.06 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. The salmon fishing is most popular from May through September when climatic conditions are more predictable and salmon are feeding off of the river's mouth prior to the fall spawning runs.

1.07 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.

1.08 The lower part of the Siuslaw River from the Hwy 101 bridge to the mouth receives the highest recreational use in the area. The number of sea run cutthroat (*Salmo clarki*) 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 (*Oncorhynchus tshawytscha* and *Oncorhynchus kisutch*) fishing opportunities.

1.09 Beachcombing, sightseeing and clamming are popular activities along the entire coastline within the ZSF. 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

1.10 The dispoasl sites are located in a salmon fishing area. Completion of the Jetty extensions has meant greater use of the offshore fishery by sport fisherman. The combination of these two factors increases the chance of conflicts between disposal operations and recreationalists. These conflicts could include time delays for recreational boaters caused by the passing of the dredge, an increase in navigation hazards during congested periods and disruption of fishing activity as the dredge passes through popular fishing sites. Most of these conflicts can be considered an inconvenience rather than a threat to recreational activity. The only serious threat is the potential for collision between recreational boaters and dredge traffic. Confrontations of this nature have been rare because the dredge moves at a slow speed, the dredging season is from April through October and the dredge is only operating at the mouth to the Siuslaw for 7 to 18 days a year. There is no plan to increase the quantity of material currently dredged at the mouth of the Siuslaw in the future. Unless there is a significant change in equipment or operational procedures, the potential for collisions will remain low as it has in the past.

1.11 As dredged material is deposited at the disposal site the surrounding water conditions will deteriorate. This condition will result in a reduced visual quality of the area, possibly disrupt feeding patterns of sport fish and may impair underwater diving conditions. These situations would be temporary and normal conditions would return quickly as the sediment has settles.

Conclusion

1.13 Deposition of dredged material in the two proposed sites will have little impact on existing recreation in the ZSF. At the time of actual disposal, water conditions will be degraded. Any impact this may have on recreational fishing, underwater diving conditions, or the visual quality of the area, should only be temporary. Some inconveniences will be experienced by recreational boaters and fishermen but overall disposal operations appear to pose no serious threat to recreation.

1.14 If future studies indicate that disposal operations are either detrimental to ocean fauna, are found to be disrupting sediment deposition along the coastline or are responsible for any longterm term water quality problems further information should be collected to determine more specifically what extent these impacts will have on recreation. 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.

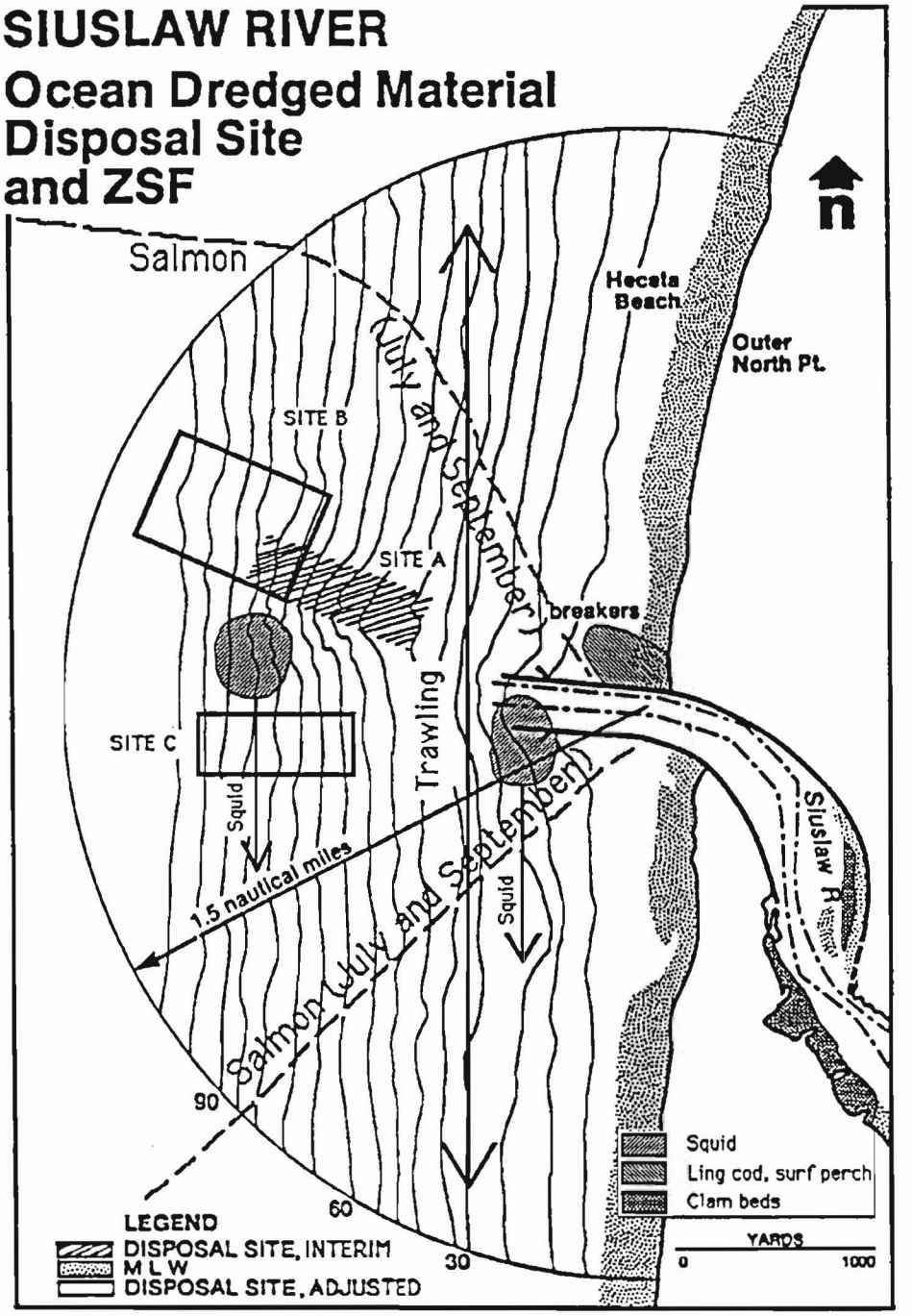

Figure D-1
Major Recreational Use Areas

APPENDIX E

Cultural Resources

APPENDIX E

Cultural Resources

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CULTURAL RESOURCES

Introduction

1. The following discussion of the Siuslaw Ocean Dredged Material Disposal Site focuses on the potential for historic shipwrecks within the project area. Some brief remarks concerning the prehistory of the area are also included in this report, although the likelihood of finding prehistoric sites within the study area is probably remote.

Prehistoric Potential

2. Two archeological surveys have been conducted within the lower estuary of the Siuslaw River. These surveys were project specific, one survey conducted by Rob Freed who evaluated upland disposal sites along the Siuslaw River and another survey by Rick Pettigrew for highway improvements along the northern bank of the Siuslaw River. Neither of these surveys resulted in the location of prehistoric or historic cultural resources. (Oregon State Historic Preservation Office Site Files)

3. An unconfirmed but substantial prehistoric occupation is most likely present with 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 8000 years before the present with cultural markers indicating an intensified occupation between 5200 and 3000 years ago. The site contains substantial faunal information indicating not only the use of mollusks and fish from the marine environment, and upland game such as deer and elk but also the use of whales as a food source. Absence of artifacts indicating a technology that may have been used to hunt whales equipment, 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.

4. The site also provides information on the geomorphology and paleoenvironment of the coastal setting of 5,200 to 3,000 years ago. This site is located approximately 2 miles inland from the active beachline. Analysis of geomorphic data although not conclusive suggests 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); paleopollen studies indicate vegetation changes overtime attributed to the destruction of near shore forest environment as dunes spread inland; marine faunal remains, shell fish, are of the type which are characteristic of a interior bay; and the presence of articulated whale skeletal remains, the whales could not have be carried from the beachline 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

5. 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 coastal range (Frachtenberg,1900:441), although one informant extended their range..."as far east as Eugene City.(Beckham, et. al. 1982:230) At least one major village site is reported on the south shoreline of the lower portion of the estuary.

6. The Siuslaw subsistence pursuits included exploitation of the anadromous fish runs, the marine resources of the near shore ocean environment and the estuary, deer and elk of the uplands of the coastal range and the floral resources of the wetlands and upland meadows. (Beckham,et.al. 1982:99)

Historical Settlement

7. 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:xvi)

8. 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, 1979:55)

9. The historic development on the Siuslaw River occurs 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.

10. 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: and William Kyle's cannery (1884) and lumber mill 1890's (Beckham, et.al. 1982:259-260); and the Rose Hill Cannery. A shipyard was located near the Rose Hill Cannery, (U.S.A.C.E.,1889:Lyell:8) where small schooners where built. (Dicken and Dicken, 1979:94)

11. 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.,1982:262)

12. 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 wreck occurring before this period was of the **FAWN** in 1856, bringing supplies to the military at Fort Umpqua. (Beckham, 1969:unpaginated)) Moreover, much of the inbound trade brought supplies for the canneries rather than goods for a pioneering or developing community. (U.S.A.C.E.:Lyell, 1889:7) Wrecks of vessels supplying the Siuslaw River settlements started to occur after 1880. The first shipwreck, the **OLIVIA SCHULTZE**, carrying salmon and barrel staves (for barrels of salted preserved salmon) wrecked in 1880. (West,nd:(1):37)

NAVIGATIONAL IMPROVEMENTS

13. At the urging of local residents the Siuslaw area was evaluated by the staff of the Portland District, U.S.A.C.E. to determine whether the construction of navigation improvements were warranted by local shipments. Following the first survey in 1886, Captain Powell recommended against improvements, because of the areas small population and isolation. 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, 1983:85-86;) Records associated with these reviews describe the Siuslaw community developing around the canneries, lumbering and small scale farming. In 1889, canned salmon, live stock, wool, furs and hide, and lumber involved a trade valued in the neighborhood of $200,000. In bound trade primarily supplied the canneries (U.S.A.C.E. 1889:(Lyell),2-8)

Cultural Resources

14. The majority of our background research has been directed at documenting the presence of historic cultural resources, specifically shipwrecks within the ODMDS study areas. This documentary effort forms the essential background for evaluating potential project effects on cultural resources by defining the most likely cultural resource(s) within the project area. Based on investigations of Ports along the Oregon Coast including studies at the mouth of the Columbia River (U.S.A.C.E., 1987 Oct), Yaquina Bay (U.S.A.C.E.,1987 Oct), Coquille River (U.S.A.C.E., 1985 April), Chetco River (U.S.A.C.E.,1988 July) and Tillamook Bay (U.S.A.C.E., 1990) historic shipwrecks are the most likely cultural resources present in the project area's offshore location.

15. A shipwreck data base has been developed from the information complied during background research. This data base contains records of shipwrecks for each coastal project area. The data base includes information on vessel type, size, and cargoes. This information can be used as supporting evidence to confirm whether a wreck site is the vessel identified as wrecked in that location.

WRECKS WITHIN THE SIUSLAW SHIPWRECK DATABASE

16. The Siuslaw Shipwreck Data Base covers an area extending 7 miles south, 10 miles north, and within a .1 mile or less of the entrance; in addition 2 wreck sites in the Siuslaw estuary are also included in the Data Base. Forty-one documented wrecks have occurred within this area. These wrecks are shown on Table 1.

TABLE 1: SHIPWRECKS LOCATED NEAR THE SIUSLAW RIVER

VESSEL/WRECK WRECK	WRECK SITE	GENERAL TYPE	SALVAGED	CITATION
ALBION 01/??/1895	Estuary	schooner	no	THE WEST 2/1/1895
ALICE KIMBAL 10/12/1904	SoBeach	2 mast schooner	no	Gibbs 1957:285; West,ND(2):22
ANVIL 04/11/1913	NoBeach	gas schooner	no	THE WEST 4/18/1913 West,nd(3):19
AUGUSTA 11/27/1888	Beach	steam schooner	Refloated	West,nd(1):49-50
BERWICK 02/05/1900	Beach	schooner	Refloated	THE WEST 2/9/1900
BERWICK 03/13/1908	Bar	gas schooner	no	THE WEST 3/20/1908
CHARLES NELSON 11/08/1903	Offshore	steam schooner	yes	West,nd.:17
DEL NORTE 06/11/1904	Beach	schooner	Refloated	THE WEST 6/17/1904 THE WEST 7/1/1904
EMMA UTTER 12/18/1886	Beach	schooner	yes	West,nd., (1):47
FAWN 11/21/1856	Beach	brig	no	Gibbs 1971:46-49
FREDERICK 04/03/1914	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 02/14/1892	Beach	steamer	Refloated	THE WEST 2/26/1892
GRACE DOLLAR 09/05/1915	Beach	steel steam schooner	Refloated	THE WEST 9/10/1915
HARRISON 09/02/1892	Beach	steamer	no	THE WEST 9/9/1892
HUGH HOGAN 04/28/1914	Surf Zone	3 masted schooner	yes	The West 5/1/1914; 5/8/1914
HUMBOLDT WOODSMAN 08/18/1960	Jetty	barge	no	West nd.,(6):21
KLIHYAM 09/27/1958	Surf Zone	tug	no	Oregonian 9/28/1950
L. ROSCOE 01/12/1907	Beach	steam tug	yes	West, nd.,(2):39

MAGGIE 02/05/1900	Surf Zone	steam tug	refloated	THE WEST 2/9/1900
MAYFLOWER 08/15/1908	Surf Zone	schooner	yes	West,nd.,(2):55
MISCHIEF 06/??/1887	Beach	scow schooner	refloated	West, nd.,(1):48
NETTIE SUNDBERG 01/16/1902	Beach	2 masted schooner	no	The West 1/17/1902
NETTIE SUNDBERG 12/28/1902	Bar	schooner	no	Gibbs 1957:284 Marshall 1982:74
NORA 02/??/1908	Beach	gasoline launch	no	West nd.,(2):52
OCEAN SPRAY 11/17/1903	Estuary	schooner	no	THE WEST 11/20/1903
OLIVIA SCHULTZE 05/01/1880	Beach	schooner	yes	Gibbs 1957:278; West, nd.(1):37
P.S. No.91 01/??/1952	Offshore	unknown	yes	Gibbs 1957:307
RANGER 12/??/1911	Beach	gas boat	yes	West nd.(3):9
RECORD 05/??/1891	Surf Zone	steamer	refloated	West nd.,(1):59
RESTLESS 10/13/1919	Bar	steamer	yes	West nd.,(3):59
ROBARTS 12/28/1901	Beach	steam tug	refloated	THE WEST 1/3/1902
ROBARTS 01/12/1907	Beach	steam tug	yes	THE WEST 1/18/1907
ROBERT & MINNIE	Surf Zone	schooner	no	THE WEST 1/18/1907
S. DANIELSON 11/06/1892	Surf Zone	2 masted schooner	refloated	THE WEST 11/15/1892 Coos Bay Times 2/12/1907
S.DANIELSON 10/06/1894	Surf Zone	2 masted schooner	refloated	West, nd.,(1):67
S.DANIELSON 02/24/1900	Bar	2 masted schooner	refloated	THE WEST 3/2/1900
W.H.HARRISON 09/02/1893	Surf Zone	steamer	refloated	West, nd.,(1):67
W.H.HARRISON 10/??/1900	Beach	steamer	yes	West,nd.,(2):3
WING AND WING	Surf Zone	2 masted schooner	yes	West,nd.,(2):12

17. These wrecks have the following distribution:

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

18. Unlike some of the other coastal areas, the wrecks which have occurred in the Siuslaw Study area are sufficiently reported that their general provience is known.

WRECKS WITHIN THE SIUSLAW ODMDS STUDY AREA

19. Only a percentage of the wrecks included in the Siuslaw Shipwreck data base have occurred within the ODMDS study area. The study area is defined as that area within a 1.5 mile radius of the outlet of the Siuslaw River. Of the 41 wrecks in the Siuslaw River Database, 36 have occurred within the ODMDS study area.

20. The 36 wrecks have the following distribution:

20 wrecks (56%) have been deposited on the beaches
10 wrecks (28%) in the surf zone
4 wrecks (11%) on the bar
0 wrecks off shore
2 wrecks (6%) in the estuary
2 wrecks (6%) on the jetty

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

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

22. The proposed project, disposal of material dredged from the Federally Authorized Siuslaw River Channel will not affect any of these wreck sites. Two disposal sites are proposed for the material dredged from the Siuslaw River (see Figure E-1). Site B's SE corner is located approximately 3,000 feet NW of the entrance to the Siuslaw River; and Site C's NE corner is located approximately 1800 feet SW of the entrance. Based on the research developed in this report there are no known wrecks offshore of the Siuslaw River mouth.

23. Undocumented wrecks are also possible within the nearshore environment. Earth Sciences, Inc., (Palo Alto, California) and GeoRecon Int. Seattle, Washington) evaluated the study area using side scan sonar. Though 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 where noted which might indicate the presence of an undocumented shipwreck. Based on these results it seems unlikely that the project will affected an undocumented wreck.

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APPENDIX F

Comments and Coordination

APPENDIX F

Comments and Coordination

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Letters

National Marine Fisheries Service, May 20, 1991

U.S. Fish and Wildlife Service, July 7, 1992

Oregon State Historic Preservation Office, June 29, 1992

Oregon State Department of Land Conservation and Development, (not received at time of press)

APPENDIX F

COMMENTS AND COORDINATION

Comments

1. The Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) requires that, for a site to receive a final ODMDS designation, the site must satisfy the general and specific disposal site criteria set forth in 40 CFR 228.5 and 228.6, respectively. The final designation procedures also require documentation of recommended disposal site compliance with MPRSA and with the following laws:

National Environmental Policy Act of 1969,

Endangered Species Act of 1973,

National Historic Preservation Act of 1966, and the

Coastal Zone Management Act of 1972, all as amended.

2. The data provided in this document was compiled to satisfy these laws and has been coordinated with appropriate and necessary State and Federal agencies.

Coordination

3. The procedures used in this ODMDS final designation study have been discussed with the following agencies:

Oregon Department of Fish and Wildlife,

Oregon Department of Environmental Quality,

Oregon Division of State Lands,

Oregon Department of Land Conservation and Development,

U.S. Coast Guard,

U.S. Fish and Wildlife Service,

National Marine Fisheries Service, and

U.S. Environmental Protection Agency.

4. Statements of consistency or concurrence regarding three State or Federal laws are required. The statutes and responsible agencies are:

Coastal Zone Management Act of 1972, as amended	Oregon Department of Land Conservation and Development
National Historic Preservation Act of 1966, as amended	Oregon State Historic Preservation Officer
Endangered Species Act of 1973, as amended	U.S. Fish and Wildlife Service National Marine Fisheries Service

5. Consistency or concurrence letters from the above agencies are included in this appendix or will be obtained as part of the final designation process. State water quality certifications, as required by Section 401 of the Clean Water Act, will be obtained for individual dredging actions.

6. A formal public involvement and review program designed to receive comments from all State and local agencies, private groups and individuals will be coordinated by EPA upon submittal of this document requesting final site designation.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E.
BIN C 15700, Building 1
Seattle, Washington 98115

F/NWR3: 1514-04-020 jbn

MAY 20 1991

RECEIVED
MAY 22 1991
REG & ENV RES BR

Robert E. Willis, Chief
Fish & Wildlife Branch
U.S. Army Corps of Engineers
Portland District
P.O. Box 2946
Portland, OR 97208-2946

Dear Mr. Willis:

This is in response to your April 11, 1991 letter regarding an Endangered Species Act (ESA) biological assessment for the proposed designation and subsequent use of the Offshore Dredged Material Disposal Site, near the Siuslaw River entrance, Lane County Oregon. We have reviewed the biological assessment and concur with your determination that populations of threatened/endangered species under our purview are not likely to be adversely affected by the proposed actions.

This concludes consultation responsibilities under Section 7 of the ESA. However, consultation should be reinitiated if new information reveals impacts of the identified activities that may adversely affect listed species or aquatic organisms, the activity is subsequently modified, or a new species is listed or critical habitat determined that may be affected by the identified activity.

If you have any new information or questions concerning this consultation, please contact Brent Norberg at (206) 526-6140.

Sincerely,

Rolland A. Schmitten
Regional Director

cc: F/PR2 - Pat Montanio

DEPARTMENT OF THE ARMY
PORTLAND DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2946
PORTLAND, OREGON 97208-2946

Reply to
Attention of:

April 11, 1991

Planning and Engineering Division

Mr. Rolland Schmitten
Regional Director
National Marine Fisheries Service
7600 Sand Point Way, NE.
BIN C15700
Seattle, Washington 98115

Dear Mr. Schmitten:

Pursuant to the requirements of the Endangered Species Act of 1973, as amended, we are forwarding a biological assessment for species under your jurisdiction that could be impacted by designation of Offshore Dredged Material Disposal Sites off the Siuslaw River entrance, Lane County, Oregon. We have determined that the proposed offshore disposal sites should have no affect on listed species.

Should you require any additional information, please contact Geoff Dorsey of my staff at (503) 326-6482.

Sincerely,

Robert E. Willis
Chief, Resource Protection and
Fish and Wildlife Section

Enclosure

CF:
Mark Siipola, CENPP-PE-HR
Al O'Connor, CENPP-PE-PF

BIOLOGICAL ASSESSMENT

FOR

GRAY, HUMPBACK, BLUE, FIN, SEI, RIGHT, AND SPERM WHALES,

LEATHERBACK SEA TURTLES,

NORTHERN SEA LIONS,

AND

SACRAMENTO RIVER WINTER-RUN CHINOOK SALMON

AT

SIUSLAW RIVER OCEAN DREDGED MATERIAL DISPOSAL SITES

FOLORENCE, OREGON

PROJECT DESCRIPTION

The Siuslaw River Offshore Dredged Material Disposal Sites (ODMDS) are situated approximately one mile offshore from the Siuslaw River entrance (Figure 1). The northern ODMDS has dimensions of 3000 feet by 2000 feet and is situated in an area with water depths of 90-105 feet. The southern ODMDS has dimensions of 3000 feet by 1000 feet and occurs in waters 90-105 feet in depth. Cumulative acreage encompassed by the disposal sites is approximately 207 acres. Primary use of the disposal sites will be for material dredged from the federally authorized navigation channel at Siuslaw River. The sites may also be used for deposition of material dredged during other actions regulated under the Marine Protection, Research, and Sanctuaries Act of 1972.

Two adjusted offshore disposal sites are being sought for final designation to allow for a flexible response to weather-related sea conditions. The southern site would be used for disposal during normal summer-weather conditions. Use of the northern disposal site would occur during "winter-weather conditions" that occassionally occur during the dredging season. Seabed drifter studies and field observations indicate disposal of dredged material at the northern site could be carried back into the entrance by ocean currents during normal summer-weather conditions.

Areas within the vicinity of the ODMDS sites have been used for dredged material disposal since 1929. An interim site was designated in 1977 (40 CFR 228.12) by EPA. Since 1977, 2.5 million cubic yards (mcy) have been placed at the interim offshore disposal site. Average annual volume for the last 10 years was 205,255 cy from the entrance bar and navigation channel. Extension of the jetties in the 1980's resulted in additional dredging requirements; the long-term estimated average annual dredging volume for the Siuslaw River entrance and

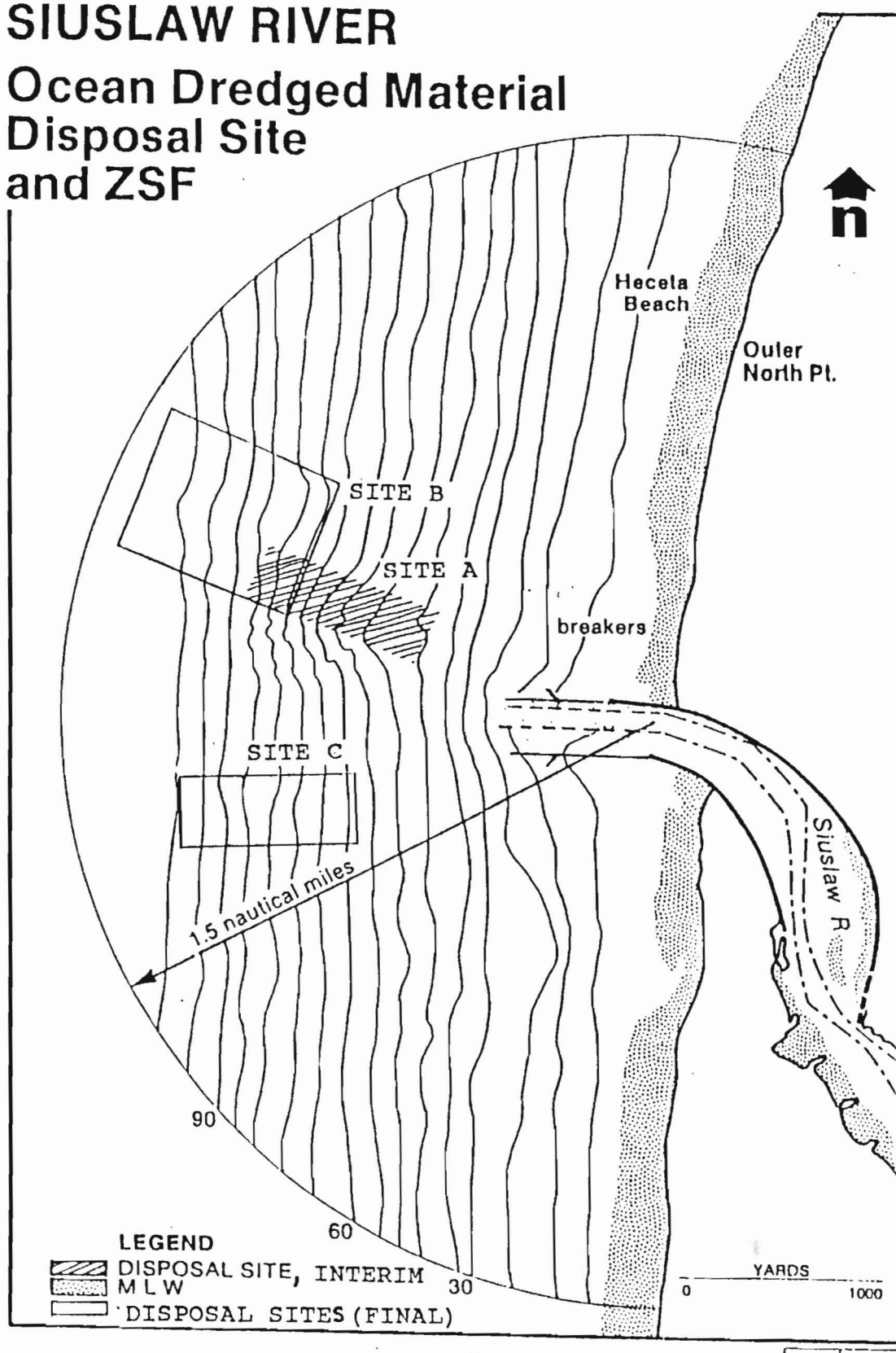

Figure 1
Siuslaw River ODMDSs and ZSF

navigation channel is 94,000 cy. Material deposited to date has consisted entirely of sand. Native surface sediments are classified as moderately to well sorted fine sand and are distinct from dredged material which is considered poorly graded sand. This size difference is considered minor and sediment compatibility should not be a problem. Some mounding of sediments has occurred at the interim disposal site in recent years. This has been attributed to above average disposal quantities for the last several dredging seasons and a mild wave climate during the winter of 1987-88. Dredged material normally disperses from the site in the littoral drift system with movement expected to be to the north and offshore during the winter and lesser movement to the south in summer.

Future dredged material disposal may include fine grained material from the Siuslaw estuary and locations as far upstream as Mapleton. In the event of fine-grained material disposal, the insitu disposal site may experience increases in the silt, clay and organic content. The disposal area is within a high energy wave environment, and dispersion of fine-grained material should be rapid. Quantities of fine-grained material are expected to be limited. Deposition of fine-grained sediment is not expected to pose a problem given the high energy environment into which they will be placed and the limited quantities for placement.

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Future dredging actions are anticipated to be accomplished primarily by hopper dredging because sea conditions at the entrance preclude pipeline dredging and the estuary and surrounding lands provide few acceptable inwater and/or upland disposal locations.

Dredging (hopper) may occur from April through October although dredging actions primarily occur in May and June with followup work occurring later in the season. The limited time frame for dredging is imposed by storms and rough sea conditions from November to April. Production rate for the dredge Yaquina at the Siuslaw River entrance is approximately 12,000 cy per day given a maximum haul distance of 1.5 nautical miles. Under optimum conditions and given an average disposal quantity of 205,255 cy, approximately 18 days would be required to remove sediments from the Siuslaw River entrance and navigation channel. Eight days, approximately, would be required to remove material if dredging volumes were at the historical average of 94,000 cy. However, distance from shoal to ODMDS, shoal depth, fog, sea conditions, and sediment type all influence production rates.

Benthic invertebrates which characterize the sand environments of the ODMDS sites are polychaetes, annelids and numerous species of cumaceans, gammarids, molluscs and snails. The species inhabiting the sand environments are generally more mobile types which tolerate or require high sediment flux.

GRAY WHALES

Coastal waters of Oregon serve as a migrational corridor for gray whales moving to and from their breeding, calving, and assembly areas along Baja California, Mexico and their primary foraging areas in the northern Bering and southern Chukchi Seas (Darling 1984).

Southward migration occurs off Oregon between early December and mid-February, with pregnant females being the first to pass southward. (Herzing and Mate 1984). Southbound whales typically occur off Oregon in water less than 90 meters deep, with the majority of migrants occurring in water 40-60 m deep, located between 1.6 and 3.2 km offshore (Herzing and Mate 1984).

The northbound migration is comprised of two groups of whales migrating in two phases. The first phase begins migration between mid-February and April and consists of whales without calves. The second group consists largely of whales with calves, with migration beginning between late April and May (Herzing and Mate 1984). Generally, whales comprising the first phase tend to migrate further offshore, with immatures showing a preference for migration closer to shore (Herzing and Mate 1984). Northward cow/calf migration typically occurs close to shore. Herzing and Mate (1984) observed that 90% of the whales migrating during the later phase, traveled within 800 m of the shore; during the final three weeks of migration, 90% traveled within 100 m of shore.

A portion of the eastern Pacific population of gray whales does not migrate to the northern seas; these whales spend summer offshore of California, Oregon, Washington and British Columbia. Mate estimated a summering population of 75 whales off the coast of Oregon in 1979 (Darling 1984). Current population estimates by Mate indicate an increase to 100-200 summering whales (B. Mate, pers. convers., 1990). Information regarding summering gray whale distribution off Oregon is patchy. It appears that most summering gray whales occur between Winchester Bay (Umpqua River) and Cascade Head, near Lincoln City (B. Mate, pers. comm., 1990). These summering gray whales occur in scattered, small groups or as individuals. There was reportedly a cow/calf pair summering off Coos Bay in 1990 (Jan Hodder, OIMB, pers. comm. 7-90). Three small groups have been reported elsewhere in Oregon during 1990 (Beverly Lund, pers. comm. 7-90); these include approximately 6 individuals between Boiler Bay and Yaquina Head, a group between the south Jetty of Yaquina Bay and Seal Rock, and a group at Gold Haven near Sea Lion Caves.

There are occassional reports of gray whales occurring in coastal estuaries including the Columbia River, Tillamook Bay, Yaquina Bay, Siuslaw River, and Coos Bay (B. Mate, pers. comm., 1990). Apparently it is not uncommon for gray whales to occur between the Highway 101 bridge and the jetties at Yaquina Bay; these observations include north and south bound migrants and summering gray whales. Summering gray whales have been observed in the mouth of the Siuslaw River between the jetties by Corps personnel and other observers have recorded them as far upriver as Mapleton on the Siuslaw. Operators of the charter boat Siggi-G out of Garibaldi reported a gray whale near buoy six, Tillamook Bay entrance channel, in late spring 1990; it is not known whether this represented a migrant or summering gray whale. A whale, species unknown, was observed just north of Tillamook Bay in June 1989 less than one-half mile offshore.

The most recent study of summering whales off Oregon was conducted by Sumich (1984). Summer sightings were defined as those which occurred between 1 June and 15 September. Sumich reported over 1200 gray whale sightings during a 1977-1980 study off coastal Oregon. A 100 km section of coastline from the Siuslaw River to Government Point just north of Depoe Bay, appeared to be relatively important to gray whales. In 1977, 60% of the 460 observations occurred within this 100 km section. Sumich reported a maximum observed occurrence of 0.2-0.3 whales/km over the 100 km study area during the 1977 and 1978 studies. It was not determined whether whales were more numerous along this section, or simply easier to detect. Whale distribution within the 100 km section varied between 1977 and 1978; in 1977 whales were most commonly observed in the southern half of the study area, in contrast to 1978 when whales were more frequently observed in the northern half of the study area. Sumich noted that site specific use also varied daily; thus, a period of maximum occurrence was undetectable. Additionally, weather, sea state, observer effort, the presence or absence of strategic observation points, and the unreliability of aerial counts due to the predominant occurrence of gray whales in surf and foam lines (which makes them difficult to detect) also contribute to the large variation in observed abundance. Because of these factors, Sumich considered his abundance estimate of 0.2-0.3 whales/km to be conservative.

Sumich (1984) noted that the primary activity of summer gray whales off the Oregon coast appears to be feeding. Benthic infauna, primarily gammarid amphipods and polychaete worms are the principal food items of gray whales (Rice et al 1984). Migrating whales feed, to some extent, on benthic organisms at the mouths of rivers and estuaries (Nerini 1984). Pelagic foraging by gray whales is thought to be rare (Nerini 1984), though Sumich (1984), suggests that offshore sightings may be an indication of pelagic feeding.

Sumich noted that nearshore locations with silty sediments appear to be foraging areas for gray whales; presumably because of high amphipod populations in silty sediments (D. Hancock,

USACE pers. comm., 1985). Gray whales also frequented surf or foam lines. A pod of whales summering near Boiler Bay, OR (1990), was reported to have been feeding in kelp beds (Beverly Lund, pers. comm. 1990).

Sumich (1984) postulates that whales which summer off Oregon may gain energetic benefit by shortening their migration. He further noted that the whales off Oregon consisted predominantly of immature or small mature individuals. Mate has also indicated that the majority of whales summering off Oregon appear to be immature (Beverly Lund pers. comm. 1990). Gray whales that summer off British Columbia have been documented to return to within 150 km of an established location, with some individuals reportedly having returned for up to 8 consecutive years (Darling 1984). As such, Darling argues that these whales are not cutting their migration short, but that they are intentionally seeking out and utilizing available "pockets" of habitat. Although a through investigation of the age structure of these whales has not been made, Darling (1984) believes that these populations may also be composed primarily of young individuals.

DISCUSSION

Typically, disposal operations at the ODMDS will occur during the latter part or after conclusion of Phase B of the northward migration of gray whales. Dredging and disposal would not occur during the southward migration. Should disposal operations occur when whales are present, it is unlikely that gray whales would be impacted as disposal operations are intermittent in nature and confined to a limited area. We would anticipate some potential for avoidance of the immediate disposal area. As material to be disposed is not contaminated, we anticipate no impacts from contaminants on migrant or summering gray whales. Summering whales do occur in this area of the Oregon coast. Further, the disposal area is offshore and not typical of areas used by foraging gray whales which summer off Oregon's coast.

CONCLUSION

We conclude that designation and subsequent use of the Siuslaw River Entrance ODMDS sites will have "no affect" on gray whales.

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HUMPBACK, RIGHT, FIN, BLUE, SEI, AND SPERM WHALES

These species may occur in the project area but information on numbers, distribution, and feeding habits is lacking other than in a general sense. Occurrence of blue whales off the Oregon coast is primarily in May-June and August-October (Rice 1974 in Maser et al. 1981). Blue whales typically occur offshore as individuals or in small groups. Blue whales winter well south of Oregon as do fin whales (Maser et al. 1981). Fin whales do range off the Oregon Coast during summer. Whaling records indicate that fin whales were primarily harvested off Oregon from May-September (Maser et al. 1981). Sei whales also winter south of Oregon. Based upon information from central California, Sei whales probably occur in southward migration off the Oregon coast in late summer - early fall (Maser et al. 1981). Based upon catch records, humpbacks primarily occur off the Oregon coast between April and October with peak numbers occurring during June, July, and August (Maser et al. 1981). Sperm whales occur as migrants and some may summer off the Oregon coast (Maser et al. 1981). Strandings have occurred along the Oregon coast. Right whales may occur off the Oregon coast during winter; summer distribution is in cool waters north of 50 degrees north latitude (Maser et al. 1981).

DISCUSSION

Discussions with Bruce Mate and other observers have indicated that these species of whales are rather infrequent visitors to the vicinity of coastal jetties, entrance channels and bays.

CONCLUSION

Given the nature of the project and whale use/occurrence in the project area, we have determined that there will be no effect to these whale species from use of the Siuslaw River Entrance ODMDS disposal sites.

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NORTHERN (STELLER) SEA LION

Northern sea lions breed along the west coast of north America from San Miguel in California's Channel Islands, to the U.S.S.R.'s Kurile Islands and the Okshotsk Sea in the western north Pacific Ocean. There is no evidence to indicate that there are separate populations throughout this range (NMFS 1990). The northern sea lion subpopulation which occurs off California has been declining since the 1920's, with a more rapid rate of decline since 1960 (Gentry and Winthrow 1986). The Alaskan population has undergone an 60% decline since 1985 (ODFW 1990), prompting the emergency listing of the species throughout it's range.

Northern sea lions are year-round residents along the Oregon coast. The subpopulation off Oregon is second in size to the Alaskan subpopulation (Brown 1988). Northern sea lions are known to haul out at a minimum of ten sites off Oregon; two of these sites, Rogue and Orford Reefs, are rookeries. Other important haulout sites include Ecola State Park, Sea Lion Caves, Columbia River South Jetty, Three Arch Rock, Cape Arago, and Seal Rock. The south jetty of the Columbia River and Three Arch Rock appeared to be used primarily during the winter (Brown 1988).

In contrast to the Alaska and California subpopulations, statewide population counts for Oregon have remained fairly stable. In 1984 and 1985, year-round counts ranged from 769 to 2352. During this survey, peak counts (2352) were made on May 21 & 23, 1984 with haulout attendance greatest at Ecola State Park, Sea Lion Caves, Orford Reef and Rogue Reef (Brown 1988). Peak attendance at the two Oregon rookeries occurs during May, June and July. Sea lions begin to leave the rookeries in August. Males are the first to leave, followed by females within a few months (Gentry and Winthrow 1978). The number of sea lions using Orford Reef has declined since 1986. It is not certain, but the decline may be related to a rapidly growing sea urchin fishery in the area (ODFW 1990). Seasonal shifts in the use of haul out sites is common among northern sea lions. Northern sea lion numbers appear to be lower off Oregon in the winter than summer, though it is not known where these animals may be migrating to or wintering. Northern sea lions forage at river mouths and near-shore areas along the coast. Roffe and Mate (1984) studied the feeding habits of pinnipeds, including northern sea lions in the Rogue River estuary, Oregon in 1984. It was determined that the

sea lions fed most heavily on Pacific lamprey. A variety of environmental correlations were studied with respect to feeding, and it was determined that the factor which most affected feeding habits was proximity to the mouth of the river. Although sea lions have been accused of damaging the commercial salmon fishery in several locations along the West Coast, studies have shown that sea lions generally consume less of these fish than thought, and in fact, that salmon comprise a relatively small proportion of their diet (Gentry and Winthrow 1978). Roffe and Mate (1984) determined that, of observed surface feeding, only 2% was on salmon. The main food items for northern sea lions in the Rogue River estuary appeared to be lamprey (26.8%) and non-salmonid fishes (32.4%) (Roffe and Mate 1984).

DISCUSSION

The nearest haulout area to Siuslaw River Entrance ODMDS sites for northern sea lions is Sea Lion Caves, which is well north of the ODMDS. Abundance of sea lions at Sea Lion Caves is highest during summer and winter; spring and fall are characterized by lower populations (Brown 1988) although records indicate in excess of 300 animals in mid-April.

Foraging by this species would be expected to occur in the project vicinity although the extent of foraging activities at the immediate project site is unknown. It is unlikely that northern sea lions would be impacted as disposal operations are intermittent in nature and confined to a limited area. We would anticipate some potential for avoidance of the immediate disposal area. As material to be disposed is not contaminated, we anticipate no impacts from contaminants on northern sea lions.

CONCLUSION:

The project may result in some localized avoidance around the immediate dredging and disposal area by northern sea lions. However, the project should have "no affect" on the status of the population nor should the survival of individuals be affected by the proposed action.

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LEATHERBACK SEA TURTLE

Leatherback sea turtle occurrences off the Oregon Coast are associated with the appearance of albacore. Albacore occurrence, and very likely that of leatherback sea turtles, is strongly associated with the warm waters of the Japanese Current which tends to approach the Oregon Coast in late summer. Typically, warm water associated with the Japanese Current does not closely approach the Oregon Coast (i.e. 1-5 miles), generally occurring 30-60+ miles offshore. During El Nino events, warm water may occur much closer to the Oregon coast than usual.

DISCUSSION

Leatherback sea turtles generally occur well offshore from the project location with only occasional individuals occurring in nearshore, colder waters. It is expected that leatherback sea turtles would only be casual visitors to the project area. Therefore, we expect the project to have "no effect" on this species.

SACRAMENTO RIVER WINTER RUN CHINOOK SALMON

The Sacramento River winter-run chinook salmon is not expected to occur in significant numbers in the vicinity of the project. This species is thought to primarily occur offshore in deep water from Fort Bragg to Monterey, California (ECOS INC. 1990). Coded wire tag recovery information compiled by the Alaska Fisheries Science Center, National Marine Fisheries Service, indicates that tagged chinook salmon released in the Sacramento River drainage have been recovered from foreign and joint venture trawl fisheries off Oregon. These tagging programs involve fall chinook salmon and not winter run chinook salmon, though. It does serve as an indication that Sacramento River winter run chinook salmon may occur off the Oregon coast.

The limited extent of habitat affected by disposal operations, intermittent nature of disposal events, and lack of contaminants associated with disposal materials indicate that the project will have "no affect" on Sacramento River winter run chinook salmon.

In addition to Sacramento River winter run chinook salmon, five salmonid species are listed as candidates for Federal classification as threatened and/or endangered species. Species

proposed for listing are Salmon River Basin sockeye salmon, Snake River fall, summer, and spring chinook salmon, and lower Columbia River coho salmon.

Miller et al. (1983) noted that the largest catches of adult coho salmon of Columbia River origin in the ocean fishery have been off northern California to southern Oregon. They also indicated that spring chinook salmon of Columbia River origin apparently migrate north for rearing. Discussions with John Williams of NMFS, Seattle, indicate that available information indicates that Snake river chinook and sockeye stocks migrate north for rearing. Information is preliminary and not complete, however.

CONCLUSION

The limited extent of habitat affected by disposal operations, intermittent nature of disposal events, and lack of contaminants associated with disposal materials indicate that the project will have "no affect" on Sacramento River winter run chinook salmon or on the candidate stocks. Most fish from runs of concern, except lower Columbia River coho stocks, are probably absent from the area.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Portland Field Station
2600 S.E. 98th Avenue, Suite 100
Portland, Oregon 97266

July 7, 1992

Ref: 1-7-92-I-460

Robert E. Willis
Chief, Resource Protection and
Fish and Wildlife Section
Department of the Army
Portland District, Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208-2946

Dear Mr. Willis:

This responds to your May 14, 1992, letter that was received by us on May 20, 1992, requesting concurrence under Section 7 of the Endangered Species Act of 1972, as amended, on the biological assessment for the Federally-proposed as threatened marbled murrelet (*Brachyramphus marmoratus*) and the Federally-listed as endangered brown pelican (*Pelecanus occidentalis*) at the Siuslaw Oregon Dredged Material Disposal Sites.

The disposal sites are located approximately 1 mile offshore from the Siuslaw River entrance. The northern disposal site is approximately 3,000 feet by 2,000 feet and is situated in an area with water depths of 90 to 105 feet. This site would be used during "winter weather conditions" when deposited material would be less likely to be carried back to the river entrance by ocean currents. The southern disposal site is approximately 3,000 feet by 1,000 feet and is situated in an area with water depths of 90 to 105 feet. This site would be used for disposal during normal summer weather conditions. Primary use of the disposal sites will be for material dredged from the Siuslaw River navigation channel. The sites may also be used for deposition of material dredged during other actions regulated under the Marine Protection, Research, and Sanctuaries Act of 1972.

Based upon the information provided in your biological assessment, we concur with your conclusion that the proposed dredge disposal would warrant a "no effect" determination for the brown pelican and marbled murrelet.

We appreciate your concern for proposed and listed species. If you have questions regarding this response, or if we can be of any further assistance, please contact us at the above address or by telephone at (503) 231-6179.

Sincerely,

Roger E. Porterstrasse
for Russell D. Peterson
Field Supervisor

RRS:rs:92I460

cc: ODFW (nongame)

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JUL 9 1992
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May 14, 1992

Planning and Engineering Division

Mr. Russell D. Peterson
Field Supervisor
U.S. Fish and Wildlife Service
2600 S.E. 98th, Suite 100
Portland, Oregon 97266

Dear Mr. Peterson:

Pursuant to the requirements of the Endangered Species Act, we have prepared the enclosed biological assessment addressing species potentially impacted by the designation and use of the Siuslaw Ocean Dredged Material Disposal Site.

We have concluded that the proposed actions will have no effect on the continued existence of marbled murrelets or brown pelicans.

Should you require any additional information, please contact Mr. Mark Smith of my staff at (503) 326-6481.

Sincerely,

Robert E. Willis
Chief, Resource Protection and Fish
and Wildlife Section
Regulatory and Environmental
Resource Branch

Encl

Copies Furnished:

CENPP-OP-N (Beach)
CENPP-PE-HR (Siipola)

BIOLOGICAL ASSESSMENT

FOR

MARBLED MURRELET AND BROWN PELICAN

AT

SIUWSLAW OREGON DREDGED MATERIAL

DISPOSAL SITE

Project Description

The Siuslaw River Offshore Dredged Material Disposal Sites (ODMDS) are situated approximately one mile offshore from the Siuslaw River entrance (Figure 1). The northern ODMDS has dimensions of 3000 feet by 2000 feet and is situated in an area with water depths of 90-105 feet. The southern ODMDS has dimensions of 3000 feet by 1000 feet and occurs in waters 90-105 feet in depth. Cumulative acreage encompassed by the disposal sites is approximately 207 acres. Primary use of the disposal sites will be for material dredged from the federally authorized navigation channel at Siuslaw River. The sites may also be used for deposition of material dredged during other actions regulated under the Marine Protection, Research, and Sanctuaries Act of 1972.

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Benthic invertebrates which characterize the sand environments of the ODMDS sites are polychaetes, annelids and numerous species of, gammarids, molluscs and snails. The species inhabiting the sand environments are generally more mobile types which tolerate or require high sediment flux.

MARBLED MURRELET

Off the coast of Oregon, marbled murrelets are most frequently observed within 1.5 miles of shore (Marshall 1988); they typically forage just beyond the breaker-line (Marshall 1988) and along the sides of river mouths where greater upwelling and less turbulence occurs. Murrelets forage within the water column; prey items include invertebrates and small fish such as anchovy, herring and Pacific sandlance (Marshall 1988).

In Oregon, marbled murrelets nest in old growth/mature forests and require a large moss covered flat coniferous branch for nesting. Murrelets lay only one egg, hence their reproductive rate is low. Both sexes share in egg incubation; flights between foraging areas and nest are thought to occur primarily at dusk and dawn. The marbled murrelet nesting season extends between mid-April and late September (56 FR 28362).

The decline in marbled murrelet populations is attributed primarily to the loss of nesting habitat along the coast. Secondary threats to the species are indicated as gill-net fishing and oil spills (56 FR 28362).

The concentrations of murrelets offshore appears to be correlated with areas of remaining coastal old-growth forests (56 FR 28362). Seasonal distribution patterns indicate that some local winter migration may occur.

Research aimed at determining population and distribution of marbled murrelets in Oregon is ongoing. No nesting marbled murrelets have been identified near of the Siuslaw River ODMDS, but summer foraging concentrations at the mouth indicated that nesting is likely to occur in the vicinity (Marshall, 1988).

The primary concern with regard to coastal dredging projects is the potential impact to murrelet prey resources. We do not anticipate that dredging or disposal will affect murrelet prey resources near the mouth of the Siuslaw River. In general short term, sporadic dredging does not affect fish and invertebrates within the water column. Disposal operations would cause some temporary water column turbidity, however due to the intermittent and confined nature of the operation, and lack of contaminants associated with disposal materials, we do not anticipate these activities will affect marbled murrelets.

BROWN PELICAN

The brown pelican is typically found along the southern Oregon Coast from June to November. Concentrations typically occur first at estuaries along the southern Oregon coast and then spread northward. The movement into Oregon waters occurs post breeding and is an annual event. Immature birds comprise the majority of birds present. Brown pelicans apparently feed on anchovies which are common in the lower estuaries throughout the summer. Foraging occurs in the bays, river mouths and the surf zone. Resting areas include spits, offshore rocks, beaches and jetties.

Dredging and disposal operations may impact brown pelicans slightly by displacing the birds during operations. This impact is expected to be minor due to the limited timing of operations and amount of available habitat.

CONCLUSION

We conclude that designation and subsequent use of the Siuslaw River ODMDS site will have "no affect" on marbled murrelets or brown pelicans.

LITERATURE CITED:

Federal Register Vol. 56, No. 119, June 20, 1991. Proposed Rule - Marbled Murrelet

Marshall, David B. 1988. Status of the Marbled Murrelet in North America With Special Emphasis on Populations in Washington, Oregon and California. Audubon Society of Portland 41 pp.

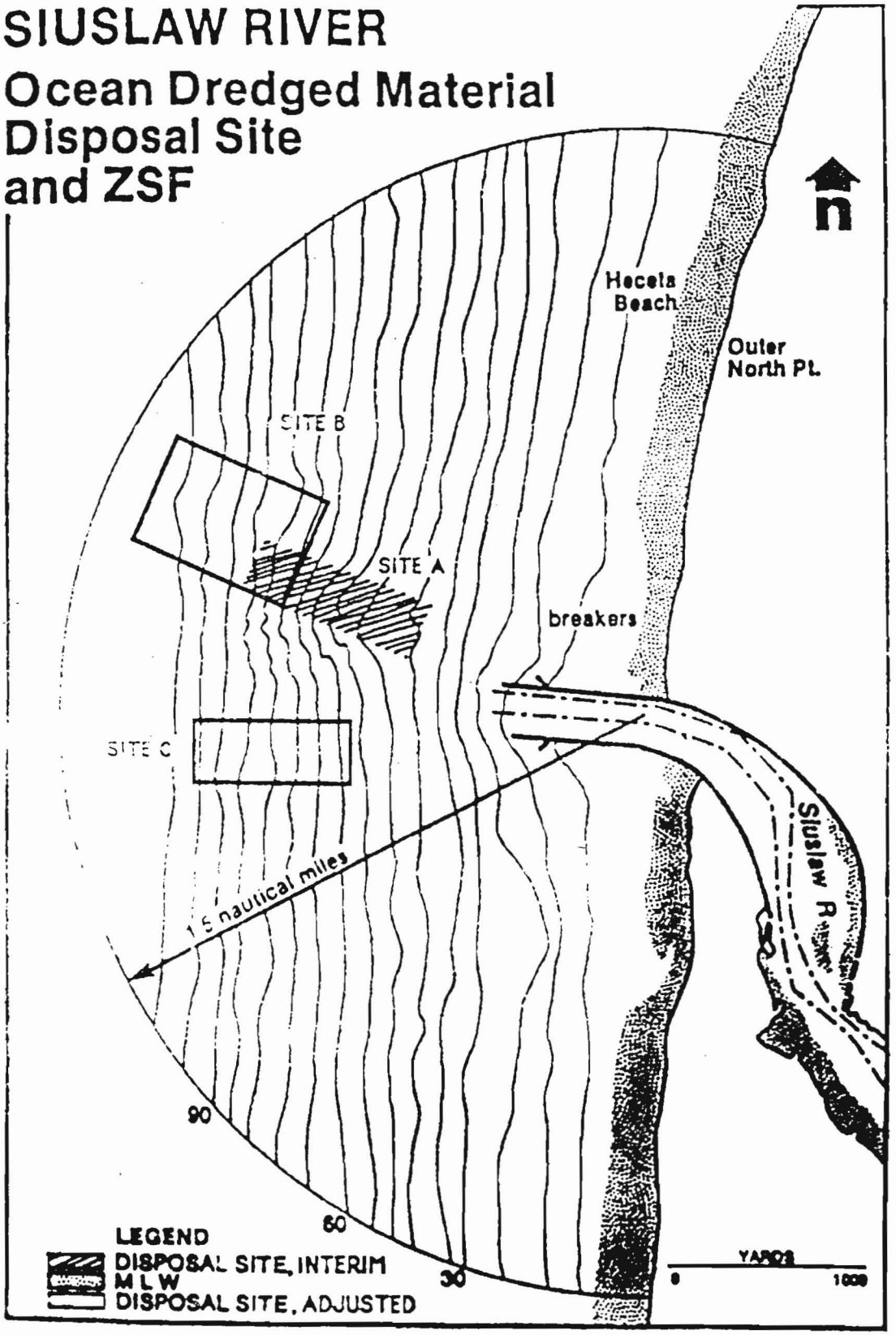

SIUSLAW RIVER
Ocean Dredged Material
Disposal Site
and ZSF
Heceta
Beach
Outer
North Pt.
SITE B
SITE A
breakers
SITE C
Siuslaw R.
5 nautical miles
90
60
30
LEGEND
DISPOSAL SITE, INTERIM
MLW
DISPOSAL SITE, ADJUSTED
YARDS
0
1000

Figure 1.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Portland Field Station
2600 S.E. 98th Avenue, Suite 100
Portland, Oregon 97266

RECEIVED
APR - 7 1992
REG & ENV RES BR

April 1, 1992

Ref: 1-7-92-SP-319

Mr. Robert E. Willis
Chief, Resource Protection and Fish and Wildlife Section
Portland District, U.S. Army Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208-2946

RE: Siuslaw Offshore Dredged Material Disposal Sites (ODMDS)

Dear Mr. Willis:

As requested by your letter, dated March 5, 1992, and received by us on March 5, 1992, we have attached a list of endangered and threatened species that may be present in the area of the proposed Siuslaw ODMDS, Townships 17 and 18 South, Ranges 11-13 West. The list fulfills the requirement of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act of 1973, as amended (16 USC 1531 et. seq.). The Corps' requirements under the Act are outlined in Attachment B.

Should your biological assessment determine that a listed species is likely to be adversely affected by the project, the Corps should request formal Section 7 consultation through this office. Even if your biological assessment shows a "no effect" or "beneficial effect" situation, we would appreciate receiving a copy for our information.

Your interest in endangered species is appreciated. If you have any additional questions regarding your responsibilities under the Act, please call Laura Todd at our office, phone (503) 231-6179 or FTS 429- 6179. All correspondence should include the above referenced case number.

Sincerely,

Roger E. Tonderstrasse
for Russell D. Peterson
Field Supervisor

Attachments

LT:lt/92SP319.ltr (LT5)
cc: PFO-ES
ODFW (Nongame)
ONHP

printed on unbleached, recycled paper

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE PROPOSED SIUSLAW OFFSHORE DREDGED MATERIAL DISPOSAL SITE 1-7-92-SP-319

LISTED SPECIES[1/]

Birds

Brown pelican	*Pelecanus occidentalis*	E

PROPOSED SPECIES[2/]

Birds

Marbled murrelet	*Brachyramphus marmoratus*	T

(petitioned January 15, 1988; proposed June 20, 1991; 56(119)FR 28362-28367)

CANDIDATE SPECIES

None

(E) - Endangered *(T) - Threatened* *(CH) - Critical Habitat*
(S) - Suspected *(D) - Documented*

(C1)- Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

(C2)- Category 2: Taxa for which existing information indicates may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

(3A)- Category 3A: Taxa for which the Service has persuasive evidence of extinction.

(3B)- Category 3B: Names that on the basis of current taxonomic understanding do not represent taxa meeting the Act's definition of "species."

(3C)- Category 3C: Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat.

* *If a vertebrate or plant, a single asterisk indicates taxon is possibly extinct. If an invertebrate, a single asterisk indicates a lack of information for the taxon since 1963.*

** *Consultation with National Marine Fisheries Service required.*

1/ *U. S. Department of Interior, Fish and Wildlife Service, July 15, 1991, Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12.*

2/ *Federal Register Vol. 56, No. 119, June 20, 1991, Proposed Rule-Marbled Murrelet*

Rec'd 3/9/92
5

DEPARTMENT OF THE ARMY
PORTLAND DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2946
PORTLAND, OREGON 97208-2946

Reply to
Attention of:

March 5, 1992

Planning and Engineering Division

Mr. Russell D. Peterson
Field Supervisor
U.S. Fish and Wildlife Service
2600 SE. 98th, Suite 100
Portland, Oregon 97266

Dear Mr. Peterson:

Pursuant to the requirements of the Endangered Species Act of 1973, as amended, we are requesting a list of threatened and endangered species potentially impacted by designation and operation of the Siuslaw Offshore Dredged Material Disposal Sites.

Two sites near the presently used interim site are proposed for future use (Figure 1). The northern site is located approximately 2,000 feet northwest of the interim site in water depths of 90-105 feet. Dimensions of the northern site are 3,000' by 2,000 feet (138 acres). The southern site is located south of both the interim site and the entrance channel in water depths of 90-105 feet. Site dimensions are 3,000 feet by 1000 feet and enclose 69 acres.

Sediments dredged from the Federally authorized Siuslaw River Navigation Channel would be placed at these locations. They may also be used for disposal of material dredged during other actions authorized under the Marine Protection, Research and Sanctuaries Act (MPSRA) of 1972. The average annual quantity of dredged material disposed offshore from 1958-1990 is 156,611 cy; range 50,831-388,630 cy. Material placed offshore is almost entirely sand. Any future disposal of fine-grained materials at the site would have to be in accordance with Section 103 of the MPSRA.

Please contact Geoff Dorsey (503) 326-6481 of my staff should you have any questions or require clarification of elements of the biological assessment.

Sincerely,

Robert E. Willis
Chief, Resource Protection and
Fish and Wildlife Section

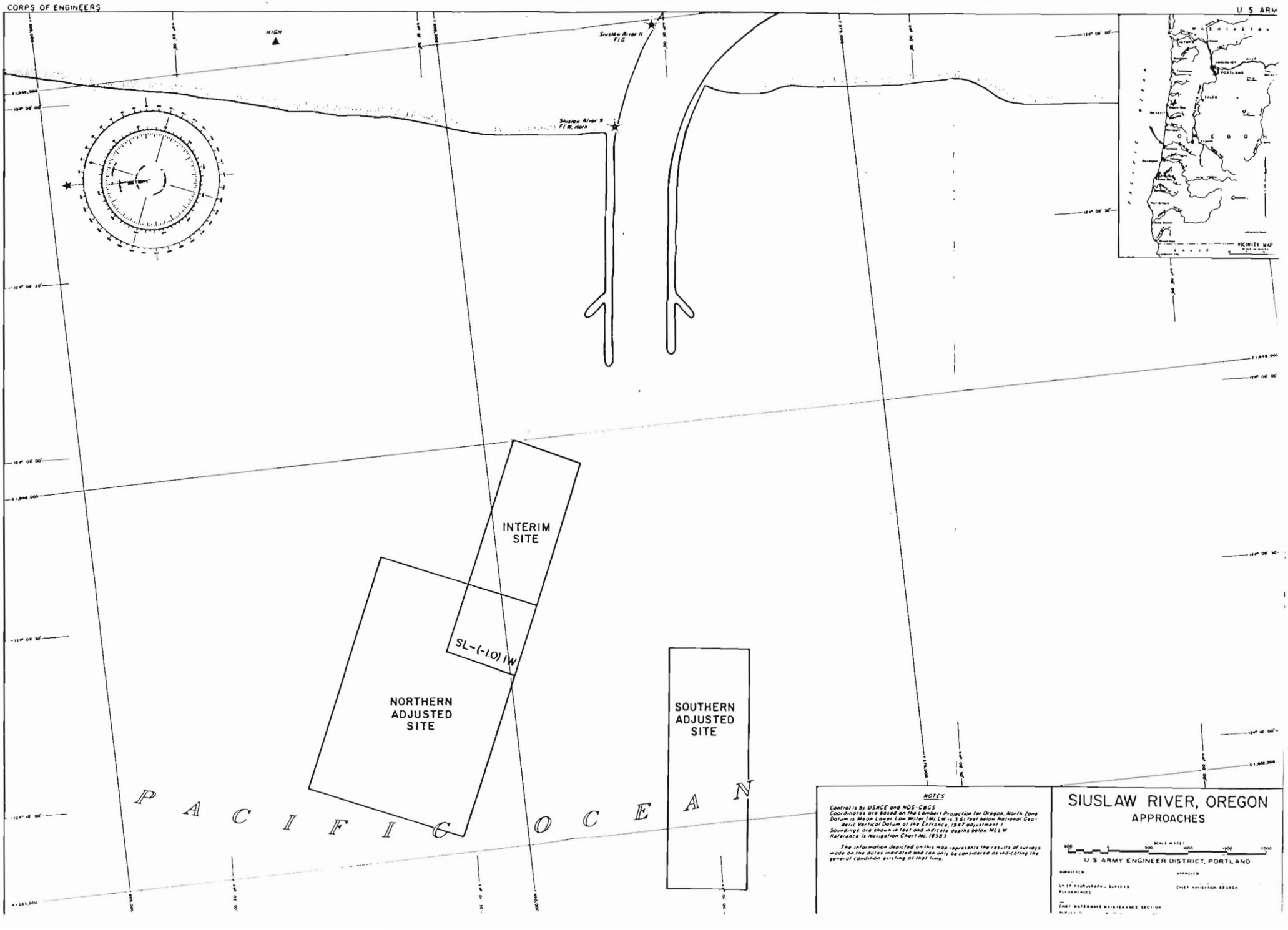
Enclosure

Copy Furnished:

CENPP-PE-HR (Siipola)

CF: CENPP-PE-HR (Siipola)

Figure 1.


CORPS OF ENGINEERS
U S ARM
HIGH
Siuslaw River 11
F1G
Siuslaw River 9
F1W, Horn
INTERIM SITE
SL-(-1.0) 1W
NORTHERN ADJUSTED SITE
SOUTHERN ADJUSTED SITE
P A C I F I C O C E A N
NOTES
Control is by USACE and NOS-CBGS
Coordinates are based on the Lambert Projection for Oregon, North Zone
Datum is Mean Lower Low Water (MLLW is 5.61 feet below National Geodetic Vertical Datum of the Entrance, 1947 adjustment)
Soundings are shown in feet and indicate depths below MLLW
Reference is Navigation Chart No. 18583
The information depicted on this map represents the results of surveys made on the dates indicated and can only be considered as indicating the general condition existing at that time.
SIUSLAW RIVER, OREGON
APPROACHES
SCALE IN FEET
U S ARMY ENGINEER DISTRICT, PORTLAND
SUBMITTED
APPROVED
CHIEF HYDROGRAPH - SURVEYS
RECOMMENDED
CHIEF NAVIGATION BRANCH
CHIEF WATERWAYS MAINTENANCE SECTION

Oregon

STATE
HISTORIC
PRESERVATION
OFFICE

Parks & Recreation
Department

June 29, 1992

W B Paynter
Planning & Engineering Division
Portland Corps of Engineers
PO Box 2946
Portland OR 97208-2946

RE: Offshore Disposal Areas
T18S, R12W
Lane County

Our office has reviewed the cultural resource evaluation report by Michael Martin and concur the projects should have "no effect" on sites on, or eligible for inclusion on, the National Register of Historic Places.

Sincerely,

Dr. Leland Gilsen
SHPO Archeologist

LG:jn
OFFSHORE.LTR

RECEIVED
JUL 2 1992
REG & ENV RES BR

525 Trade Street SE
Salem, OR 97310
(503) 378-5001
FAX (503) 378-6447

DEPARTMENT OF THE ARMY
PORTLAND DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2946
PORTLAND, OREGON 97208-2946

Reply to
Attention of:

June 8, 1992

Planning and Engineering Division

Dr. Leland Gilsen
Archeologist
State Historic Preservation Office
525 Trade Street, SE
Salem, Oregon 97310

Dear Dr. Gilsen:

The Portland District, U.S. Army Corps of Engineers is proposing to designate two disposal sites, Site B and Site C, for materials dredged from the Siuslaw River Federally Authorized Navigation Channel. Site B and Site C will replace the Interim (A) disposal site which has been used as a disposal area since its designation by the Environmental Protection Agency in 1977. The locations of Site B and Site C, are indicated on the project map enclosed with the attached copy of the report.

The latitude and longitude of area B is:

44 01'32"N., 124 09'37" W.,
44 01'22"N., 124 09'02" W.,
44 01'14"N., 124 09'07" W.,
44 01'24"N., 124 09'42" W.

The latitude and longitude of area C is:

44 01'49.94" N., 124 09'58.44" W.,
44 01'39.03" N., 124 09'20.26" W.,
44 01'20.67" N., 124 09'30.33" W.,
44 01'31.57" N., 124 10'08.51" W.

A review of the latest published version of the National Register of Historic Places and addenda shows that the project area does not contain any registered properties or properties eligible for nomination to the National Register of Historic Places. The cultural resource potential of this area was evaluated by Mr. Michael A. Martin. Based on the location of the project area, shipwrecks are the most probable cultural resource in the project area; however, analysis of wreck distribution indicates that no wrecks have sunk offshore of the outlet of the Siuslaw River. Therefore, we believe that no cultural resources will be affected by use of the proposed dredged material disposal sites.

Please review the enclosed report and provide us with a letter of concurrence or comment. If you have questions concerning the report or require additional information regarding the project, please contact Mr. Michael Martin at (503)-326-4974.

Sincerely,

Enclosure

W. B. Paynter
Chief, Regulatory and Environmental
Resource Branch
Planning and Engineering Division

SIUSLAW RIVER
Ocean Dredged Material Disposal Site

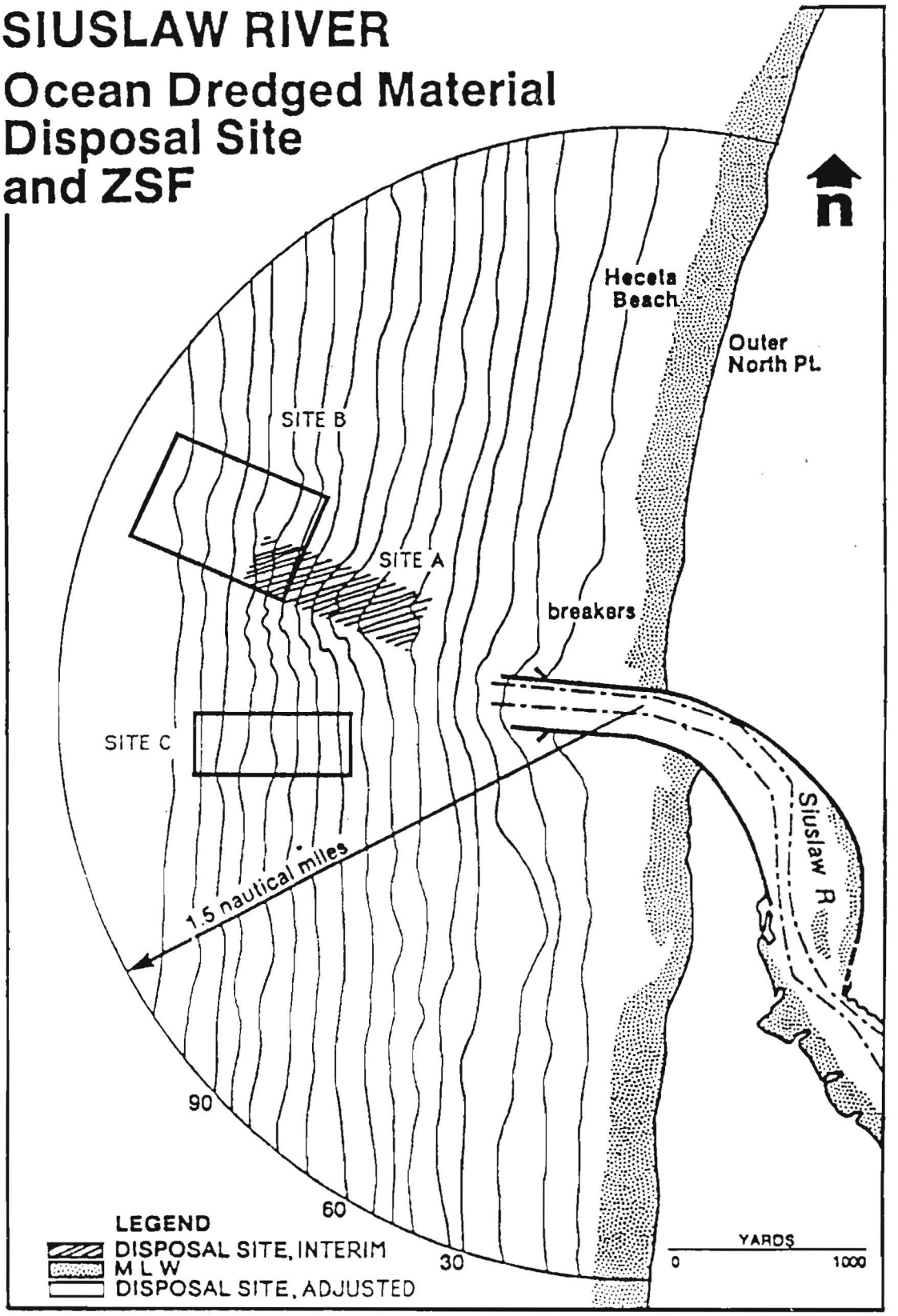
CULTURAL RESOURCE REVIEW

Prepared By: Michael A. Martin
Staff Archeologist, Portland District, U.S.A.C.E.

March 1992

SIUSLAW RIVER

Ocean Dredged Material Disposal Site and ZSF



Introduction:

The following discussion of the Siuslaw Ocean Dredged Material Disposal Site focuses on the potential for historic shipwrecks within the project area. Some brief remarks concerning the prehistory of the area are also included in this report, although the likelihood of finding prehistoric sites within the study area is probably remote.

Prehistoric Potential:

An unconfirmed but substantial prehistoric occupation is most likely present somewhere within the estuary of the Siuslaw River. One of the oldest dated site along the Oregon Coast is located immediately to the south of the Siuslaw River. Along the shoreline of Tahkenitch Lake is an archeological site with a prehistoric occupation extending back as far as 8000 years before the present with cultural markers indicating an intensified occupation between 5200 and 3000 years ago. The site contains substantial faunal information indicating not only the use of mollusks and fish from the marine environment, and upland game such as deer and elk but also the use of whales as a food source. Absence of artifacts indicating a technology that may have been used to hunt whales, as well as, a historically documented tradition of scavenging whales, suggests that prehistoric inhabitants took advantage of stranded whales rather than procuring them through hunting.

The site also provides information on the geomorphology and paleoenvironment of the coastal setting of 5200 to 3,000 years ago. This site is located approximately 2 miles inland from the active beachline. Analysis of geomorphic data, although not conclusive, suggests 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 as found today. Marine faunal remains include both shell fish, of the type found in interior bay environments and the presence of articulated whale skeletal remains. The presence of articulated whale remains is evidence that the site had direct access to the ocean at the time of its prehistoric occupation and that a substantial environmental change has occurred leading to the sites present location 2 miles inland from the ocean. Local environmental changes are further support by paleopollen studies which document the spread of coastal dunes over a near shore forested environment following the early prehistoric occupation at the site. Hypothesizes 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)

Prehistory of the Siuslaw Estuary.(Potential)

The Siuslaw estuary has many of the same marine/estuary resources

that where recovered at the Tahkenitch Lake Site. Moreover, historic documents indicate a substantial Native American presence, both at contact and during the EuroAmerican settlement period. However, a systematic archeological inventory of the estuary has not been undertaken and the number of sites, their extent and duration is unknown. Only two archeological surveys have been conducted within the lower estuary of the Siuslaw River; these surveys where project specific, encompassed small areas and did not document the presence of prehistoric sites within those limits. (Oregon State Historic Preservation Office Site Files)

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 coastal range (Frachtenberg,1900:441), although one informant extended their range..."as far east as Eugene City." (Beckham, et. al. 1982:230) 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, the marine resources of the near shore ocean environment and the estuary, deer and elk of the uplands of the coastal range and the floral resources of the wetlands and upland meadows. (Beckham,et.al. 1982:99)

Historical Settlement:

Historical settlement of the Siuslaw River drainage began in the upper reaches of the Siuslaw River. The lower reaches where, 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:xvi)

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, 1979:55)

The historic development on the Siuslaw River occurs 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 where 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: and William Kyle's cannery (1884) and lumber mill 1890's (Beckham, et.al. 1982:259-260); and the Rose Hill Cannery. A shipyard was located near the Rose Hill Cannery, (U.S.A.C.E.,1889:Lyell:8) where small schooners where built. (Dicken and Dicken, 1979:94)

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.,1982:262)

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 wreck occurring before this period was of the **FAWN** in 1856, bringing supplies to the military at Fort Umpqua. (Beckham, 1969:unpaginated)) Moreover, much of the inbound trade brought supplies for the canneries rather than goods for a pioneering or developing community. (U.S.A.C.E.:Lyell, 1889:7) Wrecks of vessels supplying the Siuslaw River settlements started to occur after 1880. The first shipwreck, the **OLIVIA SCHULTZE**, carrying salmon and barrel staves (for barrels of salted preserved salmon) wrecked in 1880. (West,nd:(1):37)

NAVIGATIONAL IMPROVEMENTS:

At the urging of local residents the Siuslaw area was evaluated by the staff of the Portland District, U.S.A.C.E. to determine whether the construction of navigation improvements were warranted by local shipments. Following the first survey in 1886, Captain Powell recommended against improvements, because of the areas small population and isolation. 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, 1983:85-86;) Records associated with these reviews describe the Siuslaw community developing around the canneries, lumbering and small scale farming. In 1889, canned salmon, live stock, wool, furs and hide, and lumber involved a trade valued in the neighborhood of

$200,000. In bound trade primarily supplied the canneries (U.S.A.C.E. 1889:(Lyell),2-8)

Cultural Resources:

The majority of our background research has been directed at documenting the presence of historic cultural resources, specifically shipwrecks within the ODMDS study areas. This documentary effort forms the essential background for evaluating potential project effects on cultural resources by defining the most likely cultural resource(s) within the project area. Based on investigations of Ports along the Oregon Coast including studies at the mouth of the Columbia River (U.S.A.C.E., 1987 Oct), Yaquina Bay (U.S.A.C.E.,1987 Oct), Coquille River (U.S.A.C.E., 1985 April), Chetco River (U.S.A.C.E.,1988 July) and Tillamook Bay (U.S.A.C.E., 1990) historic shipwrecks are the most likely cultural resources present in the project area's offshore location.

A shipwreck data base has been developed from the information complied during background research. This data base contains records of shipwrecks for each coastal project area. The data base includes information on, vessel type, size, and cargoes. This information can be used as supporting evidence to confirm whether a wreck site is the vessel identified as wrecked in that location.

WRECKS WITHIN THE SIUSLAW SHIPWRECK DATABASE:

The Siuslaw Shipwreck Data Base covers an area extending 7 miles south, 10 miles north, and within a .1 mile or less of the entrance; in addition 2 wreck sites in the Siuslaw estuary are also included in the Data Base. Forty-one documented wrecks have occurred within this area. These wrecks are shown on Table 1.

SHIPWRECKS LOCATED NEAR THE SIUSLAW RIVER

VESSEL/WRECK WreckDate	GENERAL WRECK SITE	TYPE	SALVAGED	CITATION
ALBION 01/??1895	Estuary	schooner	no	THE WEST 2/1/1895
ALICE KIMBAL 10/12/1904	SoBeach	2 mast schooner	no	Gibbs 1957:285; West,ND(2):22
ANVIL 04/11/1913	NoBeach	gas schooner	no	THE WEST 4/18/1913 West,nd(3):19
AUGUSTA 11/27/1888	Beach	steam schooner	Refloated	West,nd(1):49-50
BERWICK 02/05/1900	Beach	schooner	Refloated	THE WEST 2/9/1900
BERWICK 03/13/1908	Bar	gas schooner	no	THE WEST 3/20/1908
CHARLES NELSON 11/08/1903	Offshore	steam schooner	yes	West,nd.:17
DEL NORTE 06/11/1904	Beach	schooner	Refloated	THE WEST 6/17/1904 THE WEST 7/1/1904

EMMA UTTER 12/18/1886	Beach	schooner	yes	West,nd., (1):47
FAWN 11/21/1856	Beach	brig	no	Gibbs 1971:46-49
FREDERICK 04/03/1914	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 02/14/1892	Beach	steamer	Refloated	THE WEST 2/26/1892
GRACE DOLLAR 09/05/1915	Beach	steel steam schooner	Refloated	THE WEST 9/10/1915
HARRISON 09/02/1892	Beach	steamer	no	THE WEST 9/9/1892
HUGH HOGAN 04/28/1914	SurfZone	3 masted schooner	yes	The West 5/1/1914; 5/8/1914
HUMBOLT WOODSMAN 08/18/1960	Jetty	barge	no	West nd.,(6):21
KLIHYAM 09/27/1958	SurfZone	tug	no	Oregonian 9/28/1950
L. ROSCOE 01/12/1907	Beach	steam tug	yes	West, nd.,(2):39
MAGGIE 02/05/1900	SurfZone	steam tug	refloated	THE WEST 2/9/1900
MAYFLOWER 08/15/1908	SurfZone	schooner	yes	West,nd.,(2):55
MISCHIEF 06/??/1887	Beach	scow schooner	refloated	West, nd.,(1):48
NETTIE SUNDBERG 01/16/1902	Beach	2 masted schooner	no	The West 1/17/1902
NETTIE SUNDBERG 12/28/1902	Bar	schooner	no	Gibbs 1957:284 Marshall 1982:74
NORA 02/??/1908	Beach	gasoline launch	no	West nd.,(2):52
OCEAN SPRAY 11/17/1903	Estuary	schooner	no	THE WEST 11/20/1903
OLIVIA SCHULTZE 05/01/1880	Beach	schooner	yes	Gibbs 1957:278; West, nd.(1):37
P.S. No.91 01/??/1952	Offshore	unknown	yes	Gibbs 1957:307
RANGER 12/??/1911	Beach	gas boat	yes	West nd.(3):9
RECORD 05/??/1891	SurfZone	steamer	refloated	West nd.,(1):59
RESTLESS 10/13/1919	Bar	steamer	yes	West nd.,(3):59
ROBARTS 12/28/1901	Beach	steam tug	refloated	THE WEST 1/3/1902
ROBARTS 01/12/1907	Beach	steam tug	yes	THE WEST 1/18/1907
ROBERT & MINNIE 04/16/1895	SurfZone	schooner	no	THE WEST 1/18/1907
S. DANIELSON 11/06/1892	SurfZone	2 masted schooner	refloated	THE WEST 11/15/1892 Coos Bay Times 2/12/1907
S.DANIELSON 10/06/1894	SurfZone	2 masted schooner	refloated	West, nd.,(1):67
S.DANIELSON 02/24/1900	Bar	2 masted schooner	refloated	THE WEST 3/2/1900
W.H.HARRISON 09/02/1893	SurfZone	steamer	refloated	West, nd.,(1):67
W.H.HARRISON 10/??/1900	Beach	steamer	yes	West,nd.,(2):3
WING AND WING	SurfZone	2 masted schooner	yes	West,nd.,(2):12

These wrecks have the following distribution:

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

Unlike some of the other coastal areas, the wrecks which have occurred in the Siuslaw Study area are sufficiently reported that their general provenience is known.

WRECKS WITHIN THE SIUSLAW ODMDS STUDY AREA:

Only a percentage of the wrecks included in the Siuslaw Shipwreck data base have occurred within the ODMDS study area. The study area is defined as that area within a 2 mile radius of the outlet of the Siuslaw River. Of the 41 wrecks in the Siuslaw River Database, 36 have occurred within the ODMDS study area.

The 36 wrecks have the following distribution:
20 wrecks (56%) have been deposited on the beaches
10 wrecks (28%) in the surf zone
4 wrecks (11%) on the bar
0 wrecks off shore
2 wrecks (6%) in the estuary
2 wrecks (6%) on the jetty

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

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

The proposed project, disposal of material dredged from the Federally Authorized Siuslaw River Channel will not affect any of these wreck sites. Two disposal sites are proposed for the material dredged from the Siuslaw River. (see Figure). Site B's SE corner is located approximately 3000 feet NW of the entrance to the Siuslaw River; and site C' NE corner is located approximately 1800 feet SW of the entrance. Based on the research developed in this report there are no known wrecks

offshore of the Siuslaw River mouth.

Undocumented wrecks are also possible within the nearshore environment. Earth Sciences, Inc., (Palo Alto, California) and GeoRecon Int. Seattle, Washington) evaluated the study area using side scan sonar. Though 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 where noted which might indicate the presence of an undocumented shipwreck. Based on these results it seems unlikely that the project will affected an undocumented wreck.

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