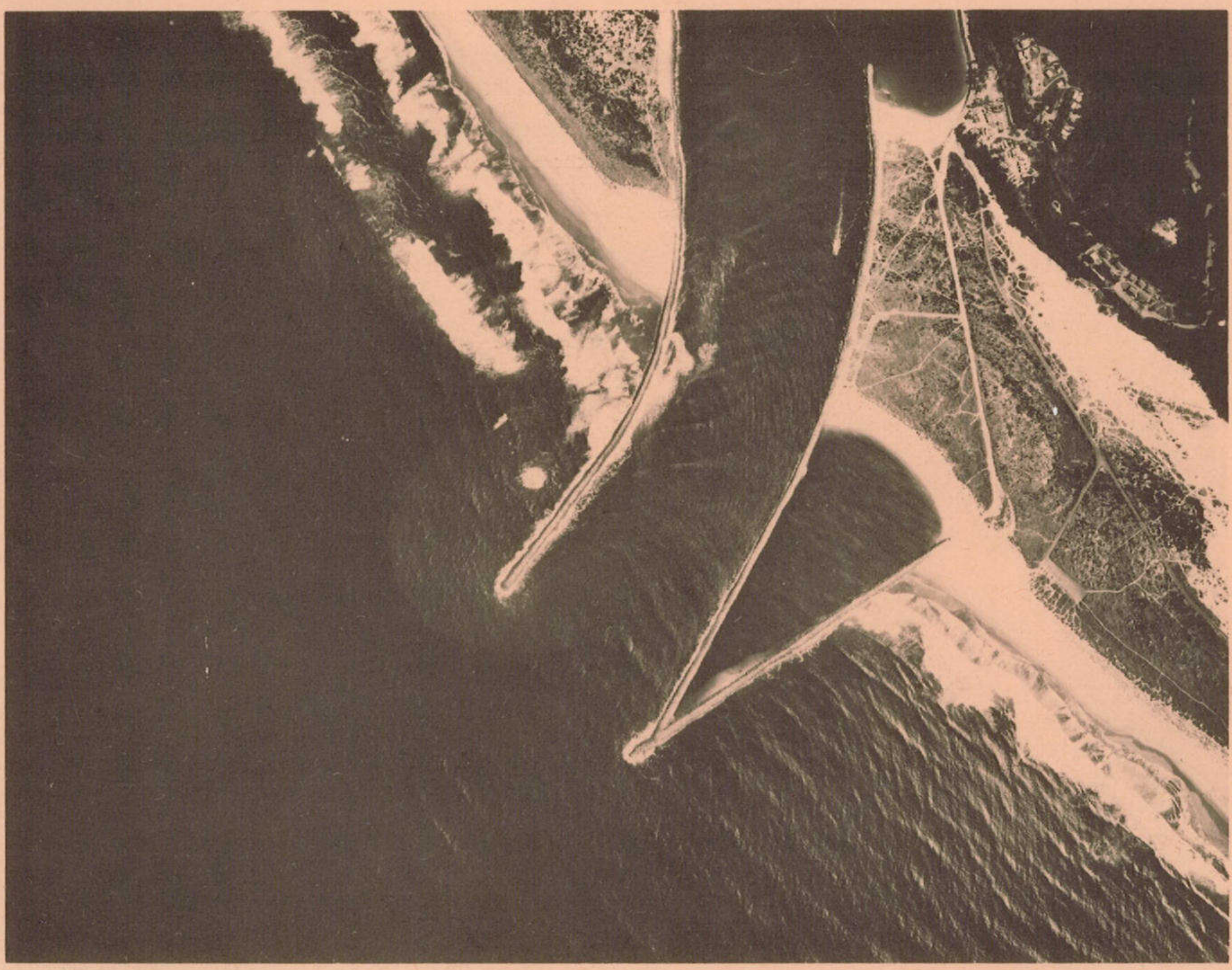
US Army Corps
of Engineers
Portland District

Umpqua Ocean Dredged Material Disposal Site Evaluation



Final Report

April 1989

UMPQUA OCEAN DREDGED MATERIAL DISPOSAL SITE EVALUATION

Portland District

US ARMY CORPS of ENGINEERS

FINAL REPORT

May 1989

Syllabus

This report was prepared by the Portland District, Corps of Engineers, to describe conditions at the existing interim ocean dredged material disposal site (ODMDS) at Umpqua 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 of 1969,
Endangered Species Act of 1973,
National Historic Preservation Act of 1966, and the
Coastal Zone Management Act of 1972, all as amended.

The Umpqua 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 site. The adjusted site is located 2800 feet north of the interim site and is the recommended site for final designation. The adjusted ODMDS (with final designation) will be used to dispose of sediments dredged by the Corps to maintain the Federally authorized navigation project at Umpqua River. It will 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.

UMPQUA OCEAN DREDGED MATERIAL

DISPOSAL SITE EVALUATION

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PURPOSE AND NEED

Purpose

1. The purpose of this evaluation study is to provide documentation in support of a final designation of an ocean dredged material disposal site (ODMDS). This study will determine if the existing interim ODMDS at Umpqua River, Oregon, designated by the U.S. Environmental Protection Agency (EPA) in 40 CFR 228.12, fully meets 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 interim site. 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 Umpqua 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 Umpqua River ocean disposal site 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. This report contains 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. A memorandum of understanding was developed and signed 15 August 1988 between the Environmental Protection Agency, Region 10 and the Army Corp of Engineers,

North Pacific Division to facilitate final designation and management of Ocean dredged material disposal sites.

3. The existing ODMDS at Umpqua received an interim designation from EPA in 1977 as defined in 40 CFR 228.12(a). A disposal site, given final designation, will be used to dispose of sediments dredged by the CoE to maintain the Federally authorized navigation project at Umpqua 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 site will be, a necessary part of maintenance on the authorized project. The Umpqua 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 tugs, barges and commercial 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 11.7;

e. To provide a harbor of refuge, and,

f. Maintain stable channel depths throughout the year.

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, State and National economy.

6. Ocean disposal of dredged materials is required for maintenance work near the river entrance. A hopper dredge must be used for the dredging work because the rough seas encountered at the entrance are not suitable for operation of a pipeline dredge. Upland disposal of dredged material from a hopper dredge is not economical due to the need to double handle the material. Therefore, dredged material disposal must occur at an in-water site. There

are suitable sites in the estuary, but the maintenance dredging exceeds the in-bay capacity. Also, in-bay disposal would cause greater adverse environmental impacts than ocean disposal. Estuarine habitats are generally more productive and far less extensive than are nearshore 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 Umpqua River enters the Pacific Ocean near the town of Reedsport, Oregon, approximately 180 miles south of the Columbia River (see figure 1). The river constitutes a navigable approach to Winchester Bay, Reedsport and Gardiner. The Umpqua River has the third largest drainage basin on the Oregon coast after the Rogue River and Columbia, and has the fourth largest estuary. The estuary is fed by two rivers, the Umpqua and the smaller Smith. The watershed encompasses part of the Coast Range, with the Umpqua River extending into the Cascades. The estuary is fed mainly by the Umpqua River, which drains 4560 square miles. Mean monthly discharge for the Umpqua is highest in January at about 18,000 cfs, and lowest in September at about 1,200 cfs. Mean annual discharge is about 8,200 cfs. The coastal zone of the littoral cell consists of a one to two mile wide plain covered by active and stabilized sand dunes backed by the mature upland ecosystem of the Coast Range. The Umpqua River is the major source of sediment in the littoral cell. The Umpqua River estuary covers 6,430 acres.

8. The Portland District, Corps of Engineers has been responsible for maintenance of navigable waterways of the North Pacific Coast since 1871. Navigation on the Umpqua obtained early importance because of the gold rush in southern Oregon during the 1850's. Channel improvements began in 1871. Due to navigational problems caused by strong rotary currents within the mouth of the Umpqua, construction of an 8000 foot north jetty was authorized in 1922, with construction of a south jetty being authorized in 1930. Subsequent dredging began in 1924. In 1980, a training jetty was completed on the south side of

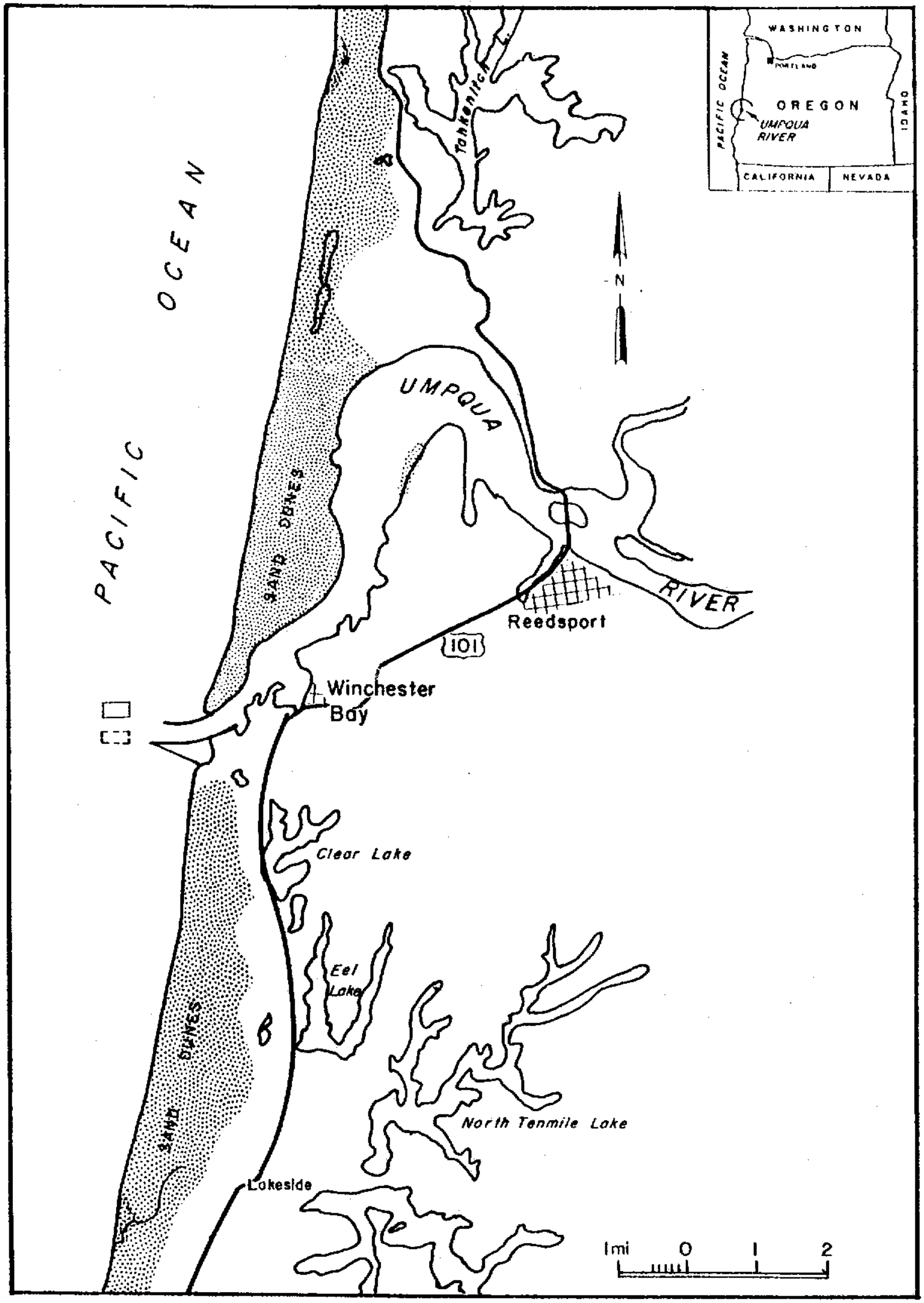

Figure 1
General Location of Umpqua River

the channel. Also, to take advantage of the deep water off the south jetty and reduce maintenance, the entrance to the channel was realigned to the south in 1982. Besides the jetties, the presently authorized project includes entrance channels and turning basins.

Portions of the authorized project considered in this report are:

a. An entrance channel 26 feet deep and 400 feet wide;

b. A river channel 22 feet deep and 200 feet wide to RM 11.0 ;

c. A turning basin 22 feet deep, 600 feet wide, and 1000 feet long at Reedsport;

d. A side channel 22 feet deep and 200 feet wide from the main channel at RM 8 to a turning basin 22 feet deep, 500 feet wide and 800 feet long at Gardiner.

e. Winchester Bay Channel - 16 feet deep, 100 feet wide and 3100 feet long, a turning basin 12 ft deep, 175 ft wide by 300 ft long, an east boat channel, 16 feet deep, 100 feet wide, 500 feet long then 12 feet deep, 75 feet wide by 950 feet long, and a west boat channel 16 feet deep, 100 feet wide by 4300 feet long.

9. The frequency of maintenance dredging depends upon the volume of sediments transported into the estuary and the frequency and severity of storm conditions. An average annual volume of dredged material for the last 21 years has been 312,190 cubic yards (cy) from the entrance bar and channel. Of this amount 147,349 cy was from the entrance bar. 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 to meet 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, or areas in the same vicinity, have been used by Portland District since 1924. The interim 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 for an adjusted site from EPA.

11. The site designated interim in 40 CFR 228.12 was entitled,"Umpqua River Entrance" and has the following coordinates:

43 40'07" N., 124 14'18" W.,
43 40'07" N., 124 13'42" W.,
43 39'53" N., 124 13'42" W.,
and 43 39'53" N., 124 14'18" W.

The approximate location of this site is one mile from the Umpqua River entrance, with dimensions of 3600' x 1400' and an average depth of 90 feet. The interim site and adjacent areas are the subject of this evaluation study to determine feasibility for final EPA ocean disposal site designation.

12. The U.S. Coast Guard has raised some concern with the location of the interim site with respect to the marked approach channel. The approach channel was re-aligned, in response to changes in the entrance jetties, after the interim site was designated. As a result, the approach channel became aligned directly over the interim disposal site. Potential conflicts could occur with the dredge and local ships during disposal activities and navigational problems could develop if significant mounding occurs at the disposal site. Review of data and information within the ZSF indicates another suitable site 2800 feet to the north of the interim site. The adjusted site is located in slightly deeper water, with an average depth of

105 feet, and has the following coordinates:

43 40'35" N., 124 14'22" W.,
43 40'35" N., 124 13'46" W.,
43 39'21" N., 124 13'46" W.,
and 43 39'21" N., 124 14'22" W.

This is the site recommended for final designation in this report.

13. Channel improvements began on the Umpqua in 1871. Since 1924, over 14.2 million cubic yards have been disposed at sea with over 3.2 million cubic yards disposed in the designated offshore site. Between 1968 and 1988 annual disposal has averaged 147,349 cy, with a maximum of 313,632 cy and a minimum of 500 cy. Dredging that contributes to offshore disposal is done to maintain the entrance channel 26 ft deep and 400 ft wide. Maintenance of the areas have been via hopper dredge. Shoaling occurs between the jetties from river mile -0.5 to about -0.8, and outside the jetties at about mile -1.2. The training jetty built on the south side of the channel in 1980 is intended to alleviate the shoaling between the jetties. Inwater disposal sites have been used within the estuary at river miles (RM) 8.9, 6.8, 5.0, 3.1, 1.6, and 0.8. From 1968-88 an average of 312 thousand cubic yards has been disposed annually in the inwater sites. Due to potential environmental conflicts, inwater disposal has been limited, with an average in-water disposal of 180,000 cy in the last 5 years.

Dredged Material

14. The average annual quantity of dredged material disposed offshore from 1968 to 1988 is 147,349 cy, consisting entirely of sand. The maximum and minimum quantities during this period were 313,632 cy and 500 cy, respectively. The annual volumes are given in appendix B, table B-1. Projections indicate yearly dredging quantities will be consistent with the 1968-1988 average for sandy material. Fine grained dredged material may be deposited at the final ocean disposal site in the future following the permitting requirements of section 103 of the MPRSA. Currently sand with fine grained fractions is dredged from Winchester Bay and Gardiner Channel. Dredging within Winchester Bay would be less than 40 thousand cubic yards on an infrequent schedule.

Disposal Site

15. The ocean bed in the vicinity of the Umpqua ZSF is characterized by a bulging outward of the bathymetric contours in front of the mouth of the Umpqua River, and an otherwise featureless slope that increases slightly from the north to the south (figure 4). A mile and a half north of the Umpqua's mouth the average slope is about 75 ft/mile between the 24 ft and 156 ft contours. Two miles south of the entrance the slope has increased to about 90 ft/mile. The slope also shows a general increase with distance offshore. The bulge in front of the mouth is evident to a depth of 130 ft, after which depth contours are straight. The disposal site is centered on the crest of the bulge, with the adjusted site located north of the bulge.

Compatibility of Sediment

16. The range of variation in grain size is similar for both the dredged material, from the entrance bar, and the offshore sediments (appendix C). Dredged materials deposited at the ODMDS historically has come from the entrance bar, the entrance to Winchester boat basin, and in the main river channel up to River mile 3. Future materials may come from as far up as RM 13. The grain size distribution curves for Umpqua River sediments from these areas show well-sorted fine sands with median grain sizes between 0.2 and 0.3 mm. Disposal site sediments are also well-sorted fine sands with median grain size approximately 0.3 mm. The percentage of volatile solids in the Umpqua River channel are within the range exhibited by offshore sediments. Volatile solids for the disposal site range from 0.4 to 0.8 percent, and range from 1.0 to 2.2 percent in the reference stations.

17. Future use of the disposal site may include the disposal of fine-grained sediment from Winchester bay, or further upstream in the vicinity of the towns of Reedsport and Gardiner. Potential fine grain material would be subject to chemical and possible biological testing to determine suitability for inwater disposal in compliance with MPRSA. 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. Except for the possibility of fine-grain sediments, Umpqua 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 problem.

Effects of Previous Disposal

18. The most recent bathymetric survey (1988) showed some mounding in the 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 recent mounding can be attributed to above average disposal during the 1988 dredging season 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 1988 survey.

Economic Geology

19. There are no accumulations of heavy minerals or gravel along the coast in the vicinity of the mouth of the Umpqua 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 Umpqua, 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

20. The procedures used to evaluate the Umpqua ODMDS 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 location that a disposal site can be located and still have an 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.

21. 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

22. This report will constitute a site evaluation study, as required in 40 CFR, Parts 228.4(e), 228.5, 228.6, 228.9, and 228.12. The main body of this 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.

23. 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

24. The MPRSA requires that site evaluation be performed prior to final designation for continued use of an ocean disposal site. 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."

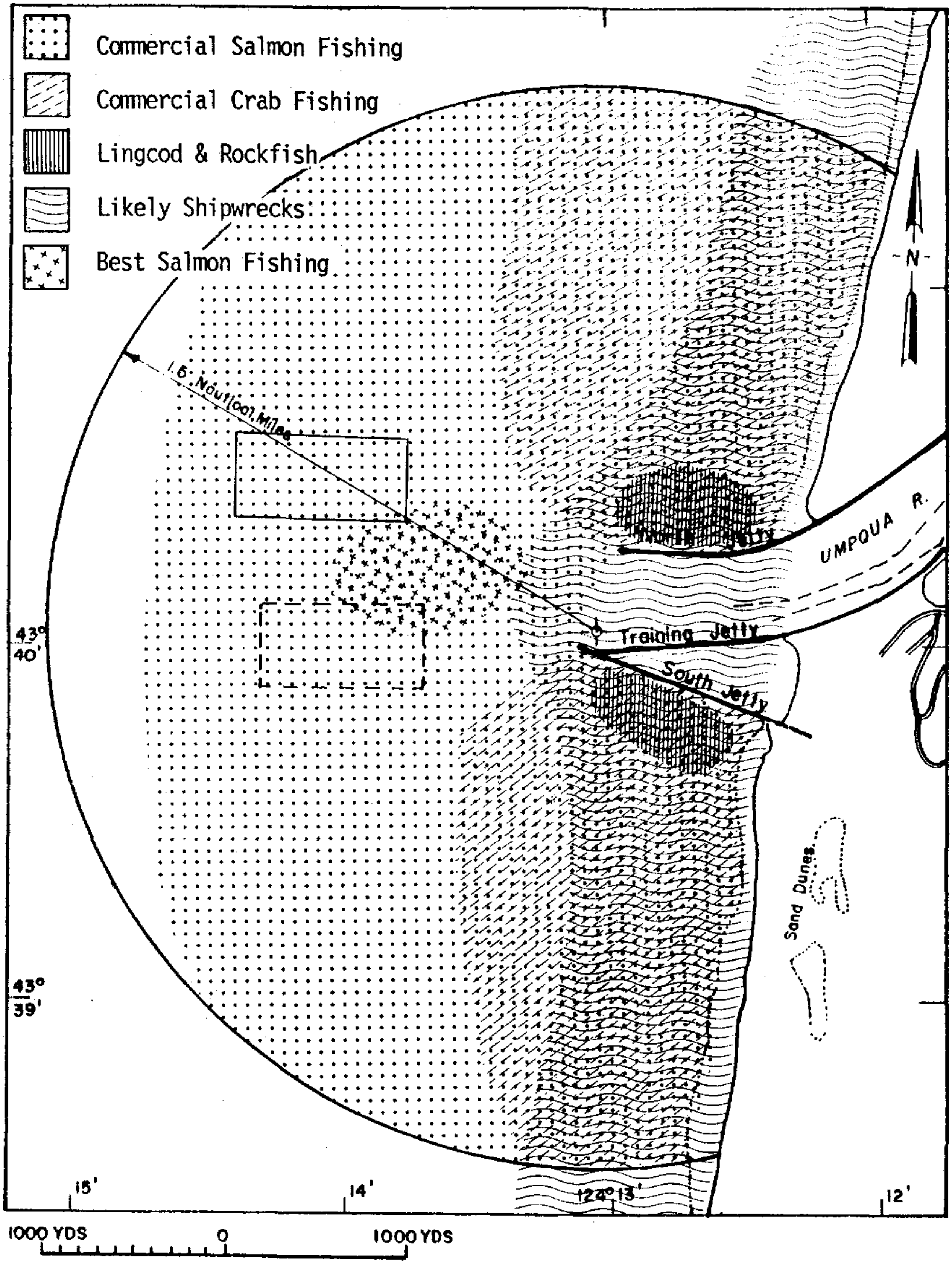

Figure 2

Overlay Evaluation of Individual Resources

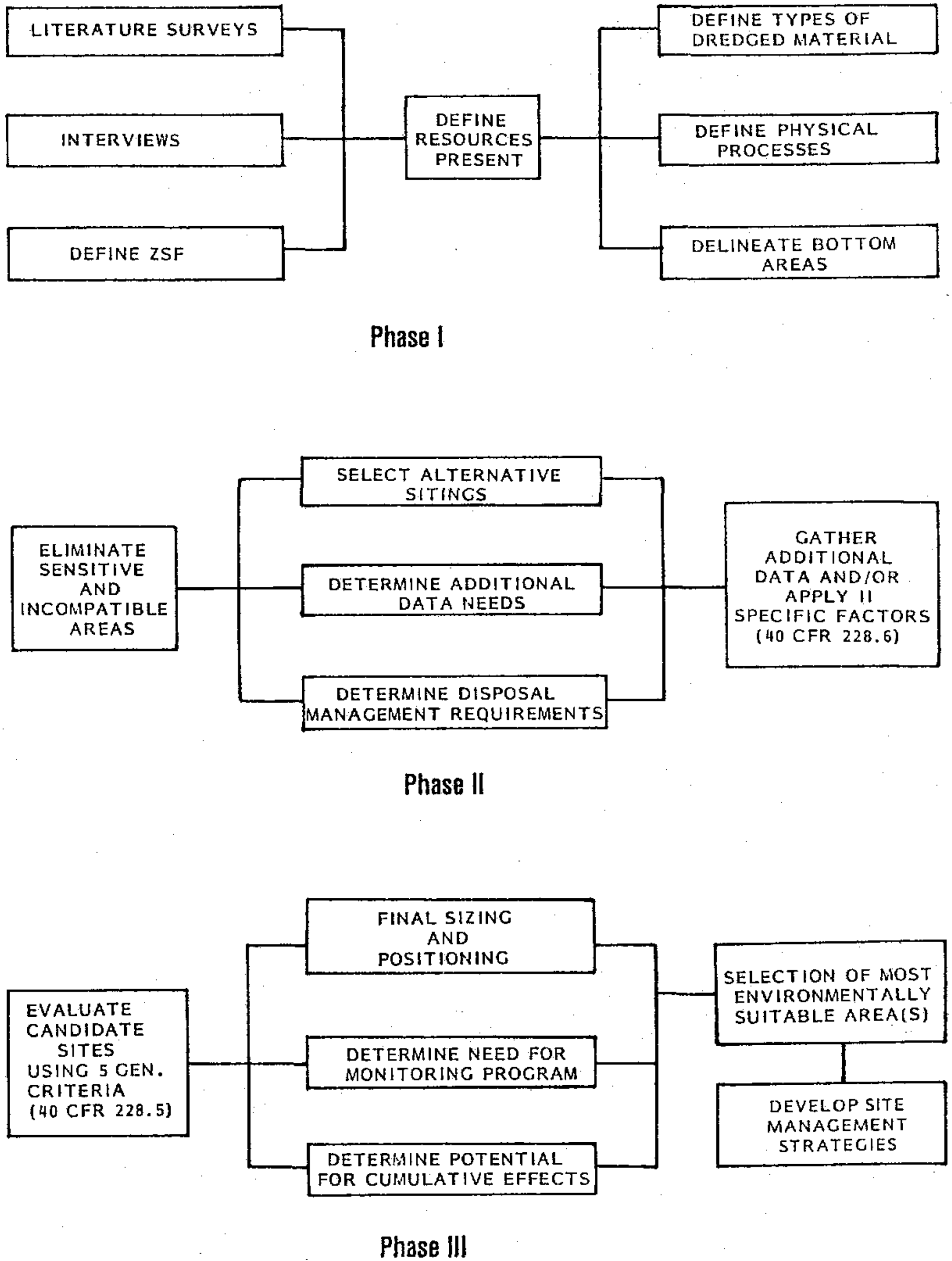

Figure 3
Overall Process for ODMDS Evaluation

25. 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

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

27. This approach will be employed for the Umpqua River interim 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 a suitable adjusted site was located north of the interim site.

Zone of Siting Feasibility (ZSF).

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

29. 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 volume per dredging unit, the time capability of equipment to dredge and haul the material to the disposal area, and the amount of time available annually to accomplish the necessary maintenance dredging.

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 material 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.

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 shellfisheries, 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 shellfishery.

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

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

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

30. 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 during the winter in the Northeastern Pacific ocean. The rough sea conditions create unsafe conditions during that time of year, thus cause dredging to be infeasible. 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 hauling distance. The limited operating time available for completing the maintenance dredging along the Oregon coast requires a combination of government and private dredges. Longer hauling distances increase vessel operating costs and the time required for completion of the work. Based on these factors, the practical limit of the Umpqua ZSF is 1.5 nautical miles (nmi).

31. Most of the maintenance dredging is done with government owned dredges. Analyzing the availability of work on the West Coast and that of contractor dredges capable of dredging this port, and the relatively small amount of material to be removed annually, it is unlikely that more than two pieces of contractor equipment would be available in any year. Often the Corps may find there are not any contractor-owned dredge available during the months permitted by favorable weather and sea conditions. Portland District is limited by congressional action on the number of days which it can operate the government owned hopper dredge. Currently, 230 days are authorized, and must be allocated to most of the ports on the West Coast, including Umpqua. Production capability of the dredge Yaquina at this port is approximately 20,000 cubic yards per day, provided the haul distance is not more than 1.5 miles from the entrance. A disposal area located at a greater distance would reduce the production rate of the dredge. Therefore the outer limit of the ZSF is controlled by the capability of the available dredging plant and the limited dredging time period imposed by weather and sea conditions on the Oregon coast.

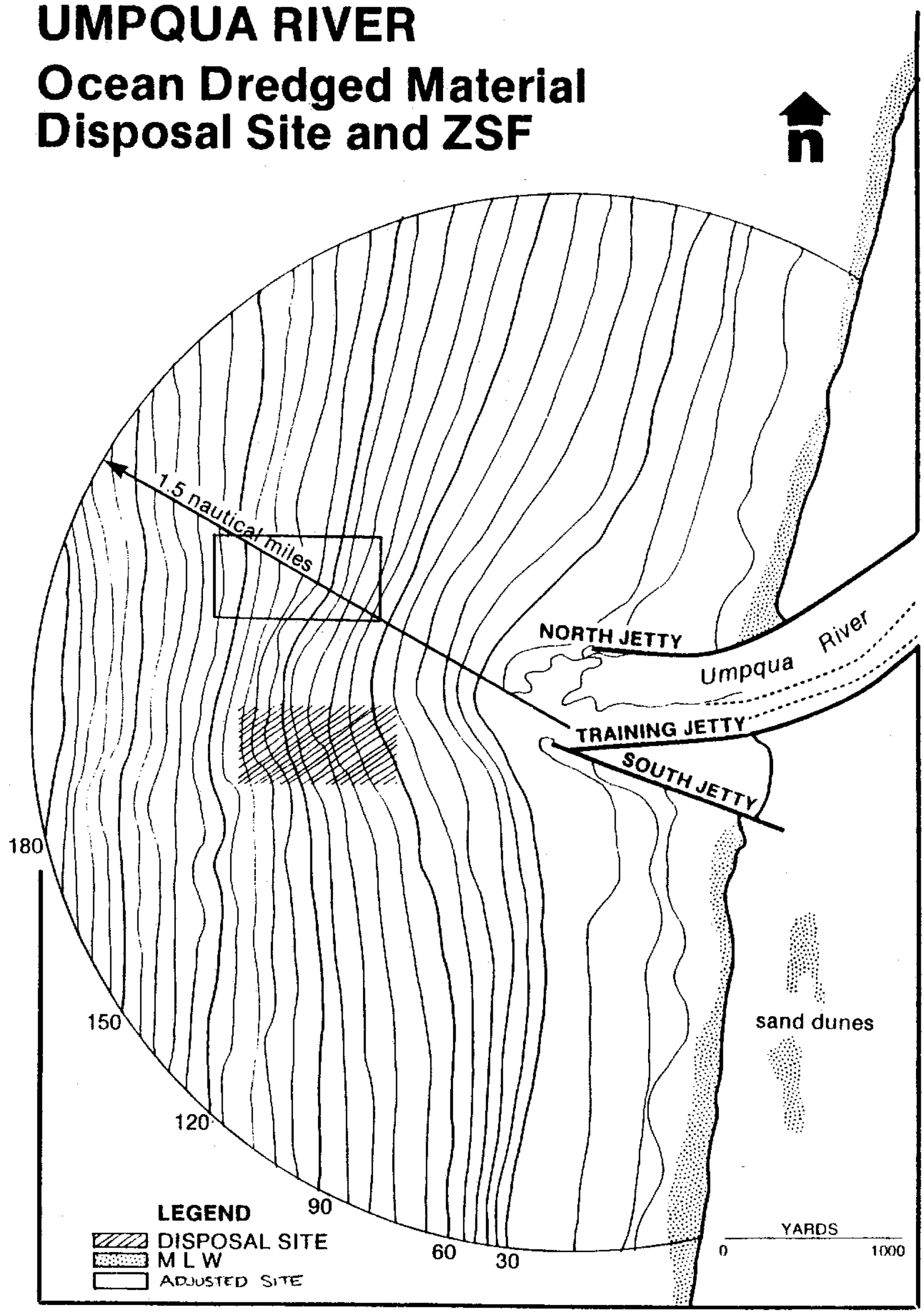

Figure 4

Umpqua River ODMDS and ZSF

ALTERNATIVES

32. 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. Several inwater disposal sites exist upstream in the Umpqua but are not suitable for disposal of dredged material from the river mouth. Use of in-bay sites is undesirable due to the limited capacity of the existing in-bay disposal areas, and the potential environmental conflicts.

Upland Disposal

33. Upland disposal is not feasible for economic and environmental reasons. The local sponsor has not been able to identify any upland disposal options at this time; although beneficial uses of the dredged material is currently under investigation. Potential problems with upland disposal include both environmental and economic impacts. The project is bordered on both sides by the Oregon Dunes NRA and county parks, 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 impacts of dredging an in-water estuarine site. Another adverse impact of upland disposal is that naturally occurring sediments would be removed from the littoral transport system and could cause erosion of nearby shorelines over the long term.

Sites off Continental Shelf

34. Potential disposal areas located off the continental shelf in the Umpqua river area would be at least 15 nmi offshore, in water depths of 600 feet or greater. The haul distance to a site beyond the shelf is considerably greater then the 1.5 nmi limit of the Umpqua ZSF, making the site economically prohibitive. The project could not be maintained if a slope site was required. Off continental shelf disposal would also remove large quantities of natural sediments from the nearshore littoral transport system, a system

that functions with largely non-renewable 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.

35. Benthic and pelagic ecosystems near the shelf 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. Lower density silt/clay and organic components of sediments could remain suspended in density layers of the pycnocline, with potential transport inshore and to the surface in seasonal upwelling events. 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 nearbottom currents could occur.

36. 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

37. Three alternatives for ocean disposal within the ZSF are considered for the Umpqua project:

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

Terminating the use of ocean disposal would be considered if continued use caused adverse, longterm impacts to the existing resources. Since the current disposal activity has not created any longterm adverse effects, termination of ocean disposal is not a preferred alternative. Both the interim and adjusted site are located in a minimum resource impact area, with exception of the navigation marked approach channel over the interim site. Even though the interim site has been impacted by previous disposal, (ie depression in benthic community) recovery of the benthos would occur within a few recruitment seasons. Thus, the density of the benthic community would decrease in the adjusted site,if used, and the density in the interim site would return to normal levels in one to two years. Since the current marked approach channel is located directly over the interim site, and there are no longterm adverse impacts in the interim site, designation of the adjusted site is the preferred alternative.

APPLICATION of ELEVEN SPECIFIC CRITERIA (40 CFR 228.6)

Overview

38. The determination of whether or not to continue disposal at the interim ODMDS 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 disposal site. 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)

39. Figure 4 shows the location of Umpqua interim and adjusted ODMDSs, along with bottom contours. The interim site lies in 60 to 114 feet of water, approximately 1.0 nautical mile offshore of the entrance to the Umpqua River. The adjusted site lies in 66 to 130 feet of water. Coordinates were presented in the Purpose and Need Section of this report. Both sites have a center line on a 270 degree azimuth. Bottom topography within both sites is varied and is presented in detail in appendix B.

Distance from Important Living Resources (2)

40. Aquatic resources of the site are described in detail in appendix A. The existing disposal site is located in the nearshore area and many nearshore pelagic organisms occur in the water column over the site. 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 Umpqua are not critical to the overall coastal population. Based on evidence from previous zooplankton and larval fish studies, it appears that there will be no impacts to organisms in the water column (Sullivan and Hancock, 1978).

41. 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.

Fisheries

42. The nearshore area off the mouth of the Umpqua supports a variety of pelagic and demersal fish species. Pelagic species include anadromous salmon, steelhead, cutthroat trout, striped bass and shad that migrate through the estuary to upriver spawning areas (ODFW, 1979). Other pelagic species include the Pacific herring, anchovy, surf smelt, and sea perch. Surf smelt in particular are in nearshore areas and in the estuary in large numbers during the summer (ODFW, 1979).

43. Demersal species present in the nearshore area were sampled in September, 1984 and in January, 1985. The most abundant species collected was the night smelt in January. Other dominant species included Tom cod in both surveys, Sandlance in January, prickle breasted poacher and speckled sanddab in September, and sandsole in January. The mean density of fish and crabs was significantly greater in January than in September, with more individuals collected in the shallower depths (60 to 70 feet). Diversity of species generally increased with depth though these relationships were not as consistent for the September data. Length frequency data indicated that most

fish collected were juveniles. Dungeness crab collected in September were primarily young-of-year (< 25 mm), while in January they were larger and probably adults (> 100 mm).

44. 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). Most of the flatfish species occur over sandy bottom types. Dungeness crab occur to the north and south of the jetties, with in Winchester Bay, and both inside and offshore of the bar.

45. Squid eggs are intolerant to low salinity. Because the Umpqua's freshwater plume lowers the nearshore salinity, squid spawning does not occur near the disposal site. Adult squid do frequent the area, but as they are highly motile, disposal activities probably will not adversely effect them (personal communication w/ ODFW).

46. 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, leatherback sea turtle, and Grey, Humpback, Blue, Fin, Sei, Right, and Sperm whales are the species listed NMFS and USF&WS. Based on previous biological assessments conducted along the Oregon coast regarding impacts to the brown pelican and the gray whale, no impact to either species is anticipated from the project. Letters of response are included in appendix F.

Distance from Beaches and other Amenities (3)

47. The interim disposal site is 850 ft from the end of the jetties and 1900 ft from the nearest beach. The adjusted site is 1200 feet from the end of the jetties and 2200 feet from the nearest beach. There are no rocks or pinnacles in the vicinity of either site.

Types and Quantity of Disposal Material (4)

48. The final disposal site will receive dredged materials transported by either government or private contractor hopper dredges. The current dredges available for use at Umpqua have hopper capacities from 800 to 6,000 cubic yards. This would be the range in volumes of dredged material disposed of in any one dredging/disposal cycle. The approximately 180,000 cubic yards estimated to be removed annually from Umpqua can be placed at the site 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.

49. Material dredged for offshore disposal comes from bars forming at the mouth of the Umpqua. 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 has been excluded in previous disposal activities from further biological and chemical testing as discussed in 40 CFR 227.13b. Fine grain materials placed in the final site would receive chemical and biological testing, if appropriate, as outlined in 40 CFR 227.13c to supplement existing information. Appendix C gives the results of sediment analysis performed on sand presently ocean disposed. Tables C-6 through C-7 deal with contaminants. Appendix C provides grainsize information for the dredged area and the disposal sites (see figures C-5 to C-15). It also includes a discussion of physical and chemical characteristics of fines that might be considered for ocean disposal.

Feasibility of Surveillance and Monitoring (5)

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

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

51. The sediments dredged from the Umpqua River entrance are predominantly marine sands and fluvial gravels. Although the Umpqua 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 slight bias in transport to the south year-round, with some northward transport in summer only. The more probable sediment transport system at the disposal site is a general movement southward and deeper from the site, with a northward movement at greater depths. The constantly varying river outflow combines with tidal flows to produce a highly variable influence on the nearshore circulation.

52. 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 Umpqua 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 Disposal (7)

53. Average annual volume of dredged material disposed offshore from 1968 to 1988 was 147,349 cubic yards. The maximum and minimum quantities of sandy material were 313,632 and 500 cubic yards respectively. Appendix B, table B-1 gives the volumes of material disposed of in the last 21 years. The adjusted site has not received any dredged material disposal.

54. Detailed offshore bathymetry at the mouth of the Umpqua River shows a bulge in bottom contours between approximately -60 and -120 feet at the location of 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 through 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 5 years. A post dumping survey in August of 1988 indicates some recent mounding within the interim site. The recent mounding may be attributed to above average disposal during the 1988 dredge season and mild wave climate during the winter of 1987-88. The interim site will be surveyed prior to disposal in 1989 to determine the effects of the winter wave climate on the mound. A general seaward movement of contours between 1984 and 1985, as indicated in figure 5, may be the result of seasonal variation or the effect of changes induced by El Nino.

55. 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 of are physically similar to the sample collected in close proximity to the disposal site (appendix B), and no chemical contaminants are present in higher concentrations in either one (tables C-1 and C-2). The elutriate analysis discussed in appendix C also showed minimal contaminant releases during this simulated disposal operation with receiving water from the interim disposal site.

Interference with Other Uses of the Ocean (8)

a. Commercial and Recreational fishing.

56. Major commercial and recreational fisheries occur in and around the disposal site. Coho and chinook salmon are taken in a nearshore commercial troll fishery. Annual commercial harvests of coho and chinook salmon from 1980 to 1985 ranged from 0 (1984) to 533,563 (1982) and 43,310 (1981) to 227,780 (1985) pounds respectively (ODFW Pounds and Value of Commercially Caught Fish and Shellfish Landed in Oregon, Annual Reports). Salmon support a good recreational fishery centered off the Umpqua bar. Both commercial and

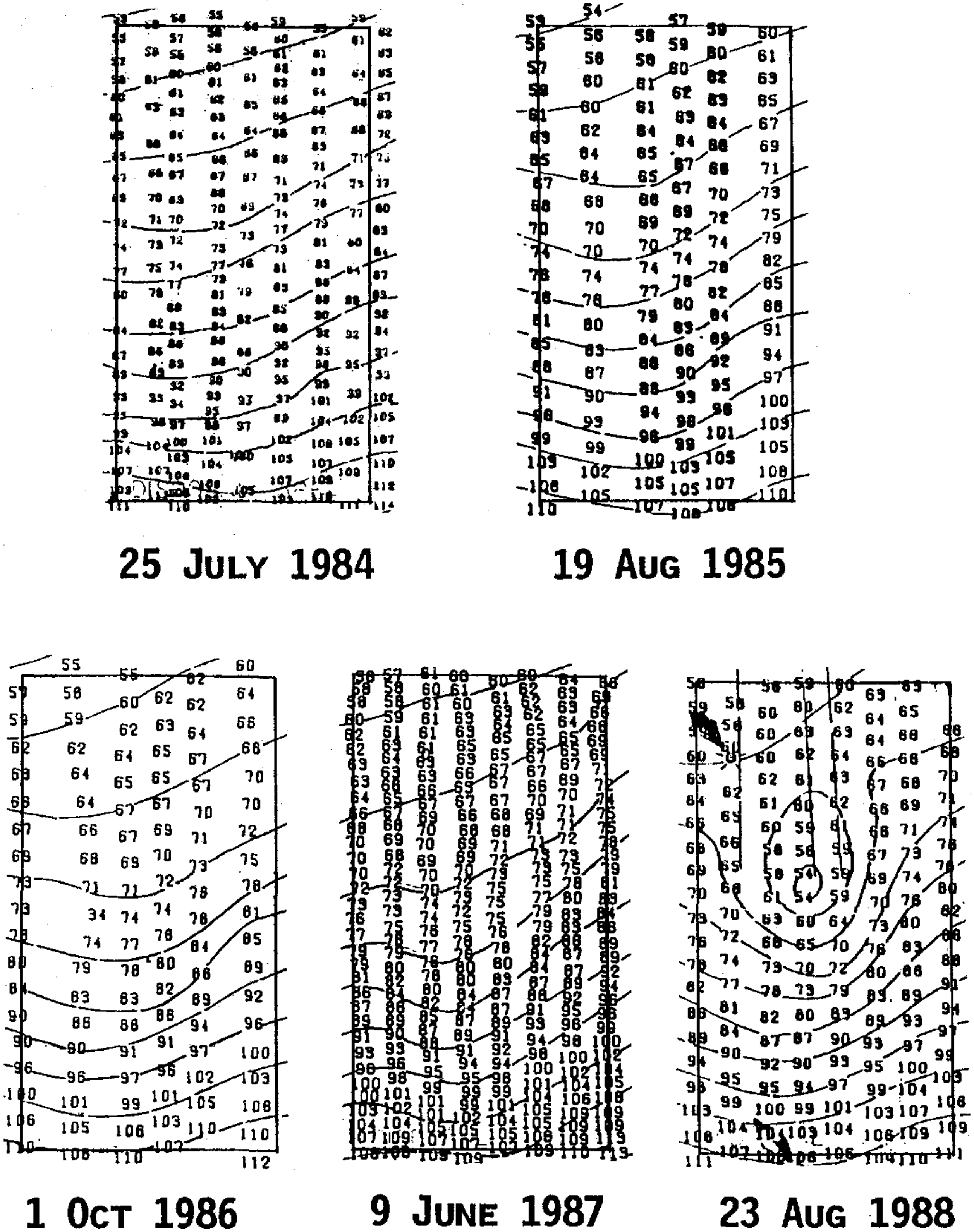

Figure 5
Umpqua River ODMDS Bathymetry

recreational fishing seasons generally begin in June and run through October, subject to catch quotas set by ODFW.

57. The recreational Dungeness crab fishery takes place mainly within Winchester Bay. Some commercial crab sites are within close proximity to the disposal site. Figure A-9 (page A-20) shows the general location of the commercial fishing areas. The offshore commercial crab harvest from 1980 to 1985 ranged from 374,470 (1983) to 1,200,730 (1980) pounds landed (ODFW Annual Reports). Mussels and shrimp support a small commercial fishery. Mussels are collected in nearshore areas, and shrimp are taken in deep waters well away from the disposal area. Annual commercial harvests of shrimp from 1980 to 1986 ranged from 430 (1984) to 689,707 (1980) pounds.

b. Offshore Mining Operations

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

59. No significant conflicts with commercial navigation traffic have been reported. Potential conflicts may exist at the interim site since the site is currently located directly under the navigation marked approach channel. Conflicts at the adjusted site are not expected due to the light traffic in the Umpqua River area and the sites location away from the marked approach channel. This situation is not expected to change substantially. The potential navigational hazards are shown in figure 6.

d. Scientific.

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

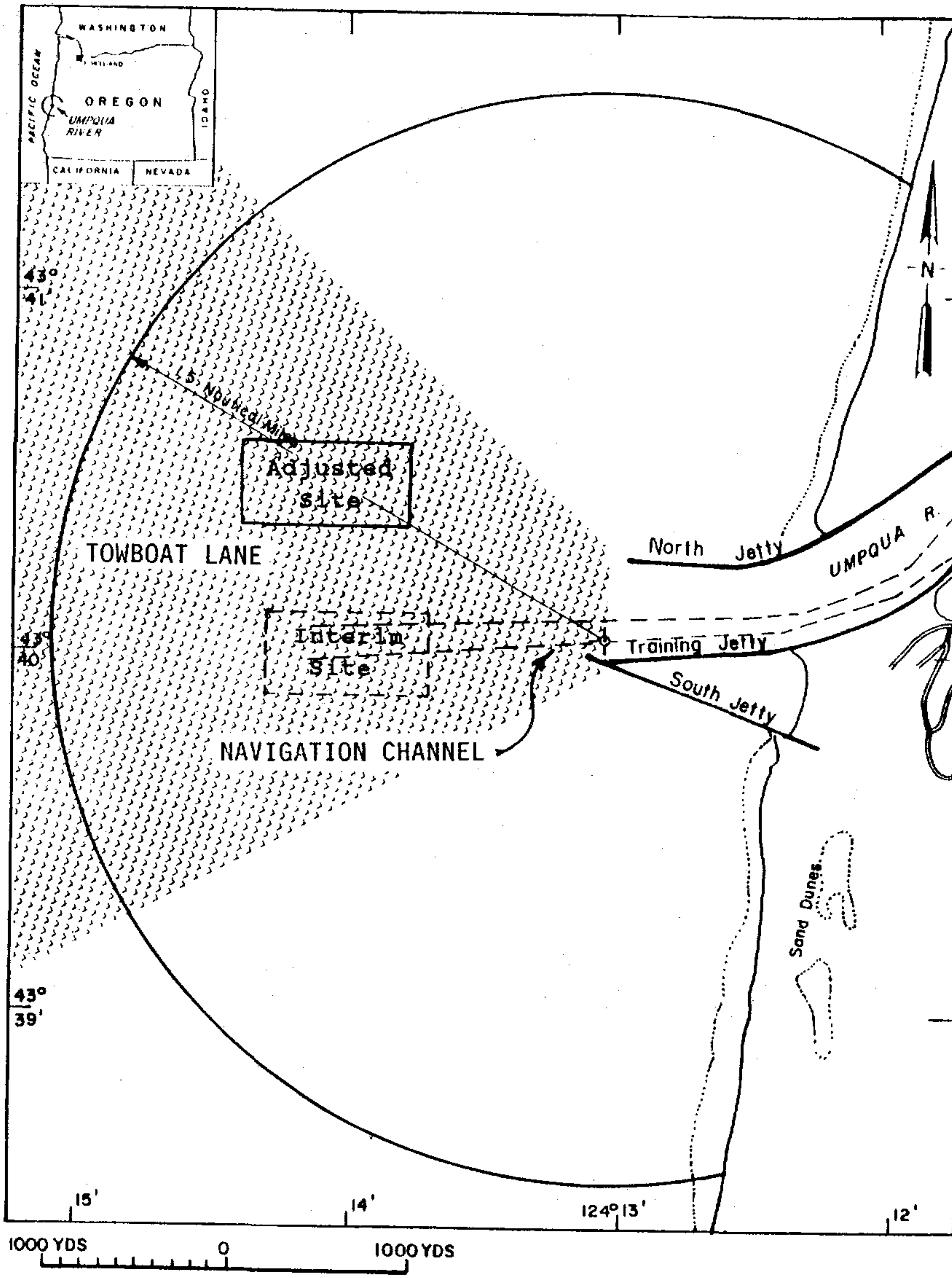

Figure 6
Navigational Hazards

e. **Coastal Zone Management.**

61. Local comprehensive land use plans for the Umpqua area will be reviewed 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.

62. 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 is included in appendix F, "Comments and Coordination".

Existing Water Quality and Ecology (9)

63. 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. Such impacts are not expected from dredged material disposal at the Umpqua ODMDS.

64. 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 should recover to normal levels.

Potential for Recruitment of Nuisance Species (10)

65. Nuisance species are considered as any undesirable organism not previously existing at the disposal site and either transported to or recruited there because of the disposal of dredged materials and capable of establishing themselves there. 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 from 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 then 40 thousand cy every four years). Any fine grain material disposed in the site would be subject to water quality criteria or other state sediment quality guidelines, and would not have significant chemical levels. The high energy wave and current environment would tend to 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 habitat or contaminant levels are unlikely to change over the longterm.

Existence of Significant Natural or Cultural Features (11)

66. The cultural resource literature search of the Umpqua 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 Umpqua 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 then 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.

67. 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 Umpqua ODMDS is removed from these areas.

68. It has been determined, based on the considerations in appendix E, that there will be no cultural resources impacts from designation of the Umpqua ODMDS. 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

69. 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.)

70. 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

71. 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 is. The interim site is located over the approach channel and could cause navigational hazards during disposal activities. As the figure shows, the adjusted site is within a minimal conflict area 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.)

72. 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 shellfisheries. 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 Umpqua 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.)

73. The evaluation indicates that the adjusted disposal site would meet the environmental criteria and factors established in 40 CFR 228.5 and 228.6. Currently the marked approach channel is positioned directly over the interim site. Potential conflict between vessels could occur during dredging and disposal activities and navigational problems could develop if mounding occurs within the site. The most recent bathymetric survey (1988) showed some mounding in the disposal area. Past surveys do not show any mounding from disposal activities. The recent mounding may be attributed to above average disposal during the 1988 dredging season and mild wave climate during the winter of 1987-88. The interim and adjusted sites are environmentally acceptable for the types and quantities of dredged material currently disposed.

Size of Sites (d.)

74. The fourth general criterion requires that the size, configuration and location of the site will be evaluated as part of the study. The recommended Umpqua River adjusted ODMDS is a rectangle 3600 ft x 1400 ft. This disposal site is considered dispersive and is of adequate size to accommodate the annual volumes of material normally ocean-disposed at Umpqua. Public notices issued for ocean disposal operations at various Federally authorized projects, as required by MPRSA, generally have not generated concerns about significant impacts from their use. Also, no comments have been received about the size or shape of the interim disposal site. The Umpqua site is located close enough to shore and harbor facilities that monitoring and surveillance programs, if required, could easily be accomplished.

Sites Off the Continental Shelf (e.)

75. Any possible disposal sites off the continental shelf in the Oregon area are at least 20 nautical miles offshore. By contrast, the Umpqua ZSF extends a maximum of only 1.5 nautical miles from shore. The project could not be maintained economically with the current dredging technology 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, either economically or possibly environmentally.

CONFLICT MATRIX ANALYSIS

76. 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.

Summary of Environmental Effects/Affects

77. The proposed action is the designation of an ocean disposal site for the disposal of dredged material. Designation of the ODMDS site would not have any direct environmental effects, but it would subject the site to use as an ocean disposal area. Therefore, this document addresses the likely effects of disposal at the site based upon the current O&M dredging program for the Umpqua 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.

78. A brief summary of the physical, biological and socio-economic environments at the proposed disposal site are presented in the following two sections: Affected Environment, and Environmental Effects. The summaries are the basis for evaluating the suitability of the site for ocean disposal. The information is formatted for use in NEPA documentation. More detailed information on the affected environment is presented in the appendices.

Table 3

Conflict Matrix

UMPQUA 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			●			1, 6, 8, 11	a
2. Physical Sediment Compatibility		●			POSSIBLE DISPOSAL of FINES	3, 4, 9	b, c, d
3. Chemical Sediment Compatibility		●			TEMPORARY ELEVATION of SOME CONTAMINANTS w/ FINE GRAIN DISPOSAL	3, 4, 7, 9	a, b, c, d
4. Influence of Past Disposal			●			5, 7, 9, 10	a, b, d
5. Living Resources of Limited Distribution			●			2, 3, 6, 8, 11	a, b, d
6. Commercial Fisheries		●			SALMON	2, 8	a, b
7. Recreational Fisheries		●			SALMON	2, 8	a, b
8. Breeding/Spawning Areas		●			SNOWY PLOVER, MURRES	2, 8	a, b
9. Nursery Areas		●			ENGLISH SOLE	2, 8	a, b
10. Feeding Areas		●			SANDERLINGS, PELAGIC BIRDS MARBLED MURRELETS, BROWN PELICANS	2, 8	a, b
11. Migration Routes		●			PELAGIC BIRDS, SHOREBIRDS, PEREGRINES GREY, HUMPBACK, BLUE, FIN, SEI, RIGHT & SPERM WHALES	2, 8	a, b
12. Critical Habitats of Threatened or Endangered Species			●			2, 8	a, b
13. Spatial Distribution of Benthos			●			2, 8, 10	a, b
14. Marine Mammals		●			HARBOR SEALS, NORTHERN & CALIFORNIA SEA LIONS, WHALE MIGRATION ROUTE	2, 8	a, b
15. Mineral Deposits			●			1, 8	a, b, e
16. Navigation Hazard		●			SMALL BOATS NAVIGATING AROUND DREDGE	1, 8	a, b, d
17. Other Uses of Ocean (cables, pipelines, etc.)			●			8	a, b, d
18. Degraded Areas			●			4, 6, 7	a, b, d
19. Water Col. Chem./Phys. Characteristics		●			SLIGHT INCREASE IN TURBIDITY IN SITE DURING DISPOSAL	4, 6, 9	a, b, d
20. Recreational Uses		●			INCONVENIENCE TO RECREATIONAL FISHING BOATS (NAVIGATIONAL DELAYS)	2, 8, 11	a, b, c, d
21. Cultural/Historic Sites			●			11	b
22. Physical Oceanography: Waves/Circulation			●			1, 3, 6, 7	a, b, d
23. Direction of Transport/Potential for Settlement			●			1, 3, 6 7	a b d
24. Monitoring			●			5	c
25. Shape/Size of Site (orientation)			●			1, 4, 7	d
26. Size of Buffer Zone			●			2, 3, 4, 7, 11	b, d
27. Potential for cumulative Effects			●			4, 7	c, d

AFFECTED ENVIRONMENT

Physical Environment

79. The topography of the seabed in the vicinity of the proposed disposal site is fairly uniform. The contours generally form a bulge sloping seaward. Depths at the site range from 60 to 114 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.

80. Bottom sediments range from fine sand to medium sand. Finer 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 removed offshore by currents. The zone of active sediment movement in the area extends to a depth of about -150 feet. The thinness of the sediment layer over the basaltic bedrock indicates that there is no long term accumulation of sediment offshore from the Umpqua River estuary.

81. The materials dredged from the mouth of the Umpqua River are medium to coarse sands with occasional gravels similar in range to the existing nearshore sediments. Dredging volumes for the past 7 years range from 91 to 313 thousand cubic yards, averaging 202 thousand cubic yards per year.

82. Water and sediment quality in the vicinity of the channel entrance and disposal site is typical for seawater of the Pacific Northwest with only one known source of pollutants. International Paper company (Gardiner) filed for a permit in 1963 for an ocean outfall located approximately 4 miles north of the mouth of the Umpqua River. The effluent from the outfall is from a log storage pond and monthly reports are filed with the Oregon Department of Environmental Quality. Bioassay studies are done semi-annually, and results are submitted to Oregon DEQ. The effects of the outfall should not have any impacts on either the interim or the adjusted disposal sites.

Biological Environment

83. The disposal site is 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.

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

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

86. Numerous species of birds and mammals occur in the pelagic, nearshore, and shoreline habitats in and surrounding the proposed disposal site. Principal shorebird species found onshore 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. Pelagic birds (e.g. shearwaters, murres) probably use the ZSF and adjacent waters for foraging. Marbled murrelets are generally located within 1.5 km of sandy shores, typically just outside the breakers. Mammals within the ZSF include seals, sea loins, Gray, Humpback, Blue, Fin, Sei, Right, and Sperm whales and the Leatherback turtle.

Socio-economic Environment

87. The Umpqua River enters the Pacific Ocean near the City of Reedsport, Oregon, and navigation on the river is critical to the local economy. The City of Reedsport has a population of 4969 (1985), while Douglas County's population is 93,000 (1985).

88. The Winchester Bay area is popular with recreationists because of the spectacular coastal scenery and excellent fishing opportunities both offshore and in the Umpqua 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. Sand, gravel and crushed rock make up the bulk of commerce out of the Umpqua River (based on short tons).

89. Lumber and other wood products barged from Gardiner and Reedsport are a significant component of the local economy. No significant mineral or petroleum deposits are known to exist in the vicinity of the recommended disposal site.

90. 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 Umpqua ODMDS is removed from these areas; therefore, there should be no cultural resource impacts from designation of the Umpqua ODMDS.

ENVIRONMENTAL EFFECTS

General

91. The proposed action is the designation of a site for ocean disposal of dredged material. Designation of the site would not have any direct environmental effects, but it would subject the site to use as an ocean disposal area. Therefore, this document addresses the likely effects of disposal at the site based upon the current Operation and Maintenance dredging program for the Umpqua 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

92. Disposal of the expected dredged material at the proposed disposal site would not have a significant effect on the physical environment. In the past material dredged for offshore disposal has come from bars forming in the estuary and at the mouth of the Umpqua. 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 Umpqua estuary ranges in size from silt to medium sand. Most 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 site. 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 south 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 ODMDS with the average disposal quantities. As indicated by the 1988 bathymetry survey, above average disposal quantities may cause mounding.

93. The sand is expected to remain clean, and continue to contain contaminants of concern in significant levels, and would be excluded from further biological and chemical testing as discussed in 40 CFR 227.13b. Fine grain materials placed in the final site would receive chemical and biological testing, if appropriate. Therefore, disposal would not introduce significant contaminants to the sediments at the disposal site or degrade the longterm

water quality in or adjacent to the site.

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

Effects on Biological Environment

95. 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.

96. 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.

97. The brown pelican, the Gray, Humpback, Blue, Fin, Sei, Right, and Sperm whales and the Leatherback turtle. are the only endangered species indicated by the USFWS and NMFS as likely to occur in 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

98. The designation of an ocean disposal site for dredged material off the mouth of the Umpqua River would allow the continued maintenance of the navigation channel. This would result in waterborne commerce remaining an important component of the local and national 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 or unusable. Shipping and fishing traffic would have to be directed through other ports and the

local economy would suffer.

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

100. 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.

101. 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.

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

103. In reviewing proposed ocean disposal sites for consistency with the Coastal Zone Management (CZM) plan, they are evaluated against Oregon's Statewide Goal 19 (Ocean Resources). Local jurisdiction does not extend beyond the baseline for territorial seas and, 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 and based on sound information and on 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.

104. 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 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 shellfisheries, and regions of heavy commercial or recreational navigation". Monitoring is to be conducted at ocean disposal sites; and if adverse effects are observed, 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

105. Procedures used in this evaluation and designation of the recommended final site have 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

106. The agencies were briefed on evaluation techniques and existing information was requested of 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 are included in appendix F.

107. Coordination with Region 10, EPA, was maintained throughout the site designation studies and during preparation of this site evaluation report. A copy of the draft report was reviewed by EPA. This site evaluation report will be submitted to Region 10, EPA, with a request for final designation of the adjusted Umpqua ODMDS. EPA has voluntarily committed to prepare and circulate an EIS for final site designation actions.

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 of the final Report. 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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Appendix A

Living Resources

Introduction

1.01 Information on aquatic resources was obtained from a variety of sources including a field sampling program conducted by the National Marine Fisheries, Hammond, Oregon, Laboratory during September 1984 and January 1985. A variety of published and unpublished reports, thesis, and personal communications with the ODFW Marine Resources Division biologists were also used. Critical living resources were determined primarily by whether the resource was unique to the area or was in limited abundance along the Oregon coast.

Plankton and Fish Larvae

1.02 Distribution and abundance of inshore plankton species vary depending upon nearshore 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. Species present 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 season consists of species from the transitional or Central Pacific water masses.

1.04 No specific data is available for the area offshore from the Umpqua River. However, Peterson and Miller (1976) and Peterson et al. (1979) have sampled the zooplankton community off the Yaquina River and found copepods to be the dominant taxa. The species present varied with season, of the 58 total 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 in table A-1. In general winter species are less abundant than summer species.

Table A-1

Dominant Copepod 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	OIithona similis

1.05 Other taxa collected were less abundant than the copepods except for a few organisms during certain times of the year. A list of the other taxa collected is given in tables A-2 and A-3.

1.06 The other plankton species of importance is the megalops larval stage of the Dungeness crab (Cancer magister). Lough (1976) has reported that megalops occur inshore 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 near shore and in the estuary.

1.07 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).

1.08 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 were from both groups. The break between the coastal and transitional groups occurred at the continental slope.

Table A-2
Other Taxa Collected

TAXA	TOTAL RELATIVE DENSITY			FREQUENCY		
	1969	1970	1971	69	70	71
Calanus 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
Scyphomedusae	22.9	70.9	22.8	13	28	22
decapod shrimp 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
unidentified 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	870.1[a]	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 a single observation of 760 individuals/m^3.

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

Total relative density and frequency of occurrence of other holoplanktonic taxa and meroplankton taken within 18 km of the coast during 1969, 1970 and 1971 upwelling seasons. Table entries are sums of average abundances at each of four stations.[1]

Table A-3
Other Taxa Collected

TAXA	TOTAL RELATIVE DENSITY			FREQUENCY		
	1969-70	1970-71	1971-72	69-70	70-71	71-72
Calanus nauplii	1188.7a	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	14.5	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
Podon leukarti	126.3a	27.3	116.4a	4	2	4
Pteropods (*Limacina*)	66.0	88.0	14.2	17	15	13
Chaetognaths	62.9	47.4	22.4	20	19	13
Oikopleura spp.	551.9	101.2	75.6	22	16	15
Ctenophores	7.0	6.2	10.3	8	8	9
Scyphomedusae	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
decapod shrimp 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	16.8	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
annelids lacking 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 result 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, ostracods, cumaceans, siphonophores, *Sagitta scrippsii*, *S. bierii*, *S. minima*, *Lepas* nauplii, other unidentified barnacle nauplii, echinoderm bipinnaria, imm. starfish, imm. sea urchins, planula larvae, trochophores, foraminifera, radiolarians, *Tomopteris*, cyphonautes larvae, other fish eggs, and six miscellaneous unidentified meroplanktonic taxa.

Total relative density and frequency of occurrence of other holoplanktonic and meroplanktonic taxa taken within 18 km of the coast during three winters. Table entries are sums of relative densities at each of four stations.[1]

1.09 The coastal group is dominated by smelts (Osmeridae), (>50 percent of the larvae collected), and to a lesser extent the English sole (Parophrys vetulus), sanddab (Citharichthys Sordidus), starry flounder (Platichthys stellatus), and tom cod (Microgadus proximus). Maximum abundance occurred from February to July when greater than 90 percent of the coastal larvae were collected. Two peaks of abundance were present during this period, one in February to March (24 percent of larvae) and one following upwelling in May to July (68 percent of larvae). 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	February to March	May to July
Smelt (Osmeridae)	1.51*	4.12
English sole (Parophrys vetulus)	4.09	
Sandlance (Ammodytes hexapterus)	1.76	
Sanddab (Citharichthys Sordidus)	1.73	2.21
Tom Cod (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.

1.10 The larval species present in the inshore coastal areas were similar and had the same peaks of abundance as those collected in the Yaquina Estuary, (Pearcy & Meyers, 1974); however, the dominate species differed. In Yaquina Bay two species accounted for 90 percent of the species collected, the bay goby (Lepidogobius lepidus) and the Pacific herring (Clupea harengus pallasi). Neither were present or common in the inshore coastal area. Some of the common coastal species such as English sole and starry flounder also use the estuary as juvenile rearing areas.

Benthic Invertebrates

1.11 Benthic invertebrates play an important role in secondary productivity of nearshore marine systems. Not only are they 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.

1.12 Knowledge of the benthic communities off of the nearshore central Oregon coast is scant. A literature review conducted by the Portland District indicated that only six quantitative benthic studies have been conducted in nearshore coastal waters off Oregon.

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. 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 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 To provide site specific information on the infauna and epifauna to supplement the existing data and characterize the Umpqua interim and adjusted disposal sites, Portland District contracted with the National Marine Fisheries Service, Hammond Laboratory to collect and analyze benthic samples as described in Emmett et al (1987).

1.15 Stations were located on the 60, 70, 80, 90, 100 and 110 foot depth contours along the center line of the interim disposal site and also along transects to the north (adjusted site) and to the south. Figure A-1 shows the location of the sampling sites and transects. Two reference transects were also sampled north and south of the disposal sites. The reference transects were located far enough north and south to be out of the influence of disposal at the interim site, and are labeled UR-# on figure A-1. Samples were collected during two seasons,

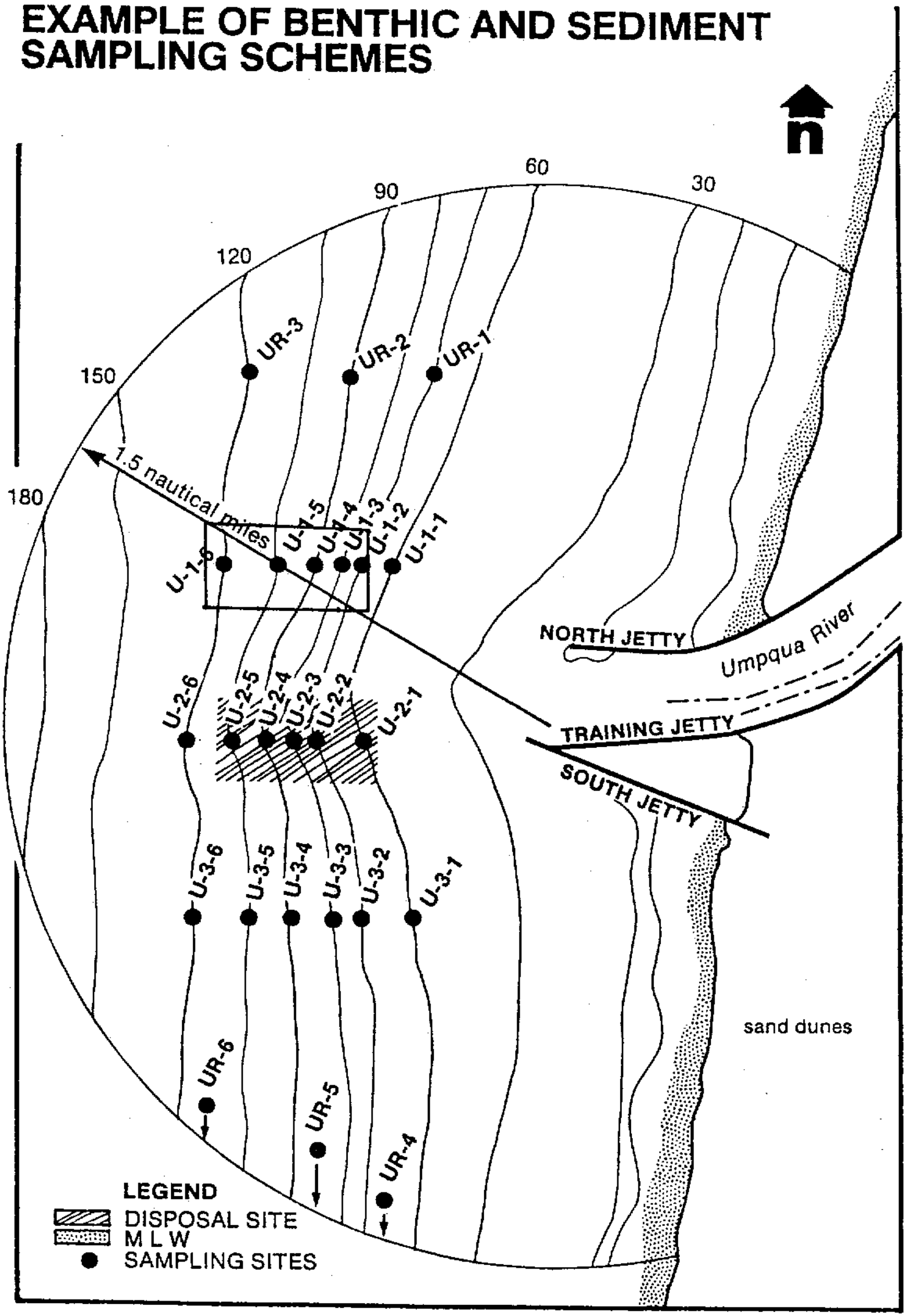

Figure A-1

Sample Site Locations

September 1984, and January 1985. Six replicate bottom samples were taken from each of the 24 stations using a modified Gray- O'Hara box corer which sampled a 0.096 m area of the bottom. One sample from each station was sent to the CoE North Pacific Division Materials Testing Laboratory for determination of sediment 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. Infaunal organisms were then picked from the sediment, counted and identified to the lowest practical taxon.

Results

1.16 Sediments from all of the stations sampled in the region of the Umpqua River Interim ODMDS Site consists of medium to fine grained sand inside the disposal site (median d=0.3 mm), and fine grained sand outside of the interim site (median d=0.16 mm). The adjusted site consists of a fine grained sand (median d=0.17 mm).

1.17 The species composition of the area within and adjacent to the Umpqua interim ODMDS was found to be typical of nearshore high energy environments (Emmett, et al., 1987). The infaunal community is characterized predominately by polychaete worms and gammarid amphipods. In Sept(84), polychaete worms were the dominant taxanomic group with very large abundances at the north and south transect lines. In Jan(85), amphipods became the dominant group with densities over 4000/sq m at some stations. Depressed densities were recorded at the 70-110 ft deep stations which lie on the transect through the center of the interim disposal site, (stations U-2-3 to U-2-6). The species of invertebrates inhabiting the sandy portions of the study area,(Polychaete annelids and gammarid amphipods) are the more motile psammnitic (sand-dwelling) forms which tolerate or require high sediment flux. They are typical of other shallow water disposal sites such as Coos Bay sites "E" and "F" (Hancock et al., 1981).

1.18 Figure A-2 compares mean infaunal densities (for five replicate box core samples) at the four stations within the interim site, the adjusted site, the south transect and the north and south reference stations combined. The transects to the north (adjusted site) and south of the disposal site and the reference stations had significantly higher densities than the interim disposal site. Depressed densities in the interim site were observed during both the Sept(84) and the Jan(85) surveys.

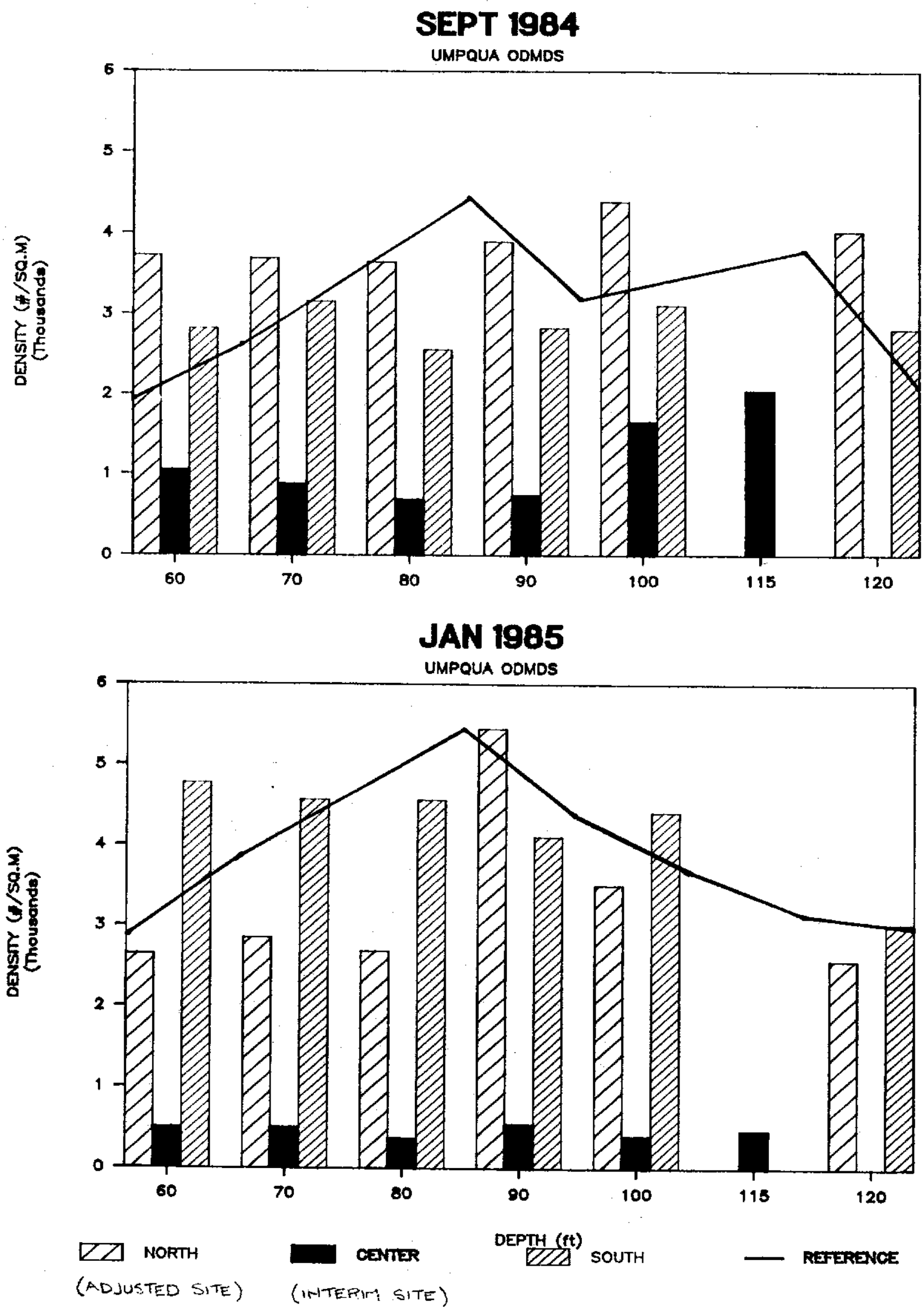

Figure A-2
Density of Benthic Infauna

Further, the nearshore stations in the interim site appear to have lower densities than the deeper stations. The survey indicates that past disposal of dredged material may have reduced the abundance of benthic infauna within the interim site, but not outside the site as indicated by the north and south reference stations. Dredged material disposal in 1984 occured during 23-28 August and 15-27 September; which coincided with the sampling date. Dredged material disposal in 1985 occured from 30 May to 30 September; this was three months before the sampling. These results appear consistent with our current and past hopper dredge disposal activities since the inner portion of the interim site receives more intense disposal activity than the deeper areas further offshore.

1.19 Figure A-3 compares diversity (H') species richness and equitability (J') of benthic infauna by depth for the Umpqua interim offshore disposal site, the adjusted site, the south transect and the reference stations to the north and south. The values for each of these factors were found to be very similar for each station in the study area. However, values for the center transects suggest a reduction in standing stock from smothering, dilution or resulting from the observed shift to coarser grain size. Impacts outside the interimdisposal site were not observed.

1.20 Mean densities (#/m^2) along the northern transect (adjusted site) increase with increasing water depth, ranging from 3638 to 4381 organisms/m^2 in September(84) and 2567 to 2846 organisms/m^2 in January(85). The middle transect, (interim site), ranged from 683 to 2044 in Sept(84) and 365 to 540 in January(85). The southern transect ranged from 2808 to 3154 in September(84) and 3031 to 4777 in January(85).

Macroinvertebrates

1.21 The dominant commercially and recreationally important macroinvertebrate species in the inshore coastal area are shellfish and Dungeness crabs . Shellfish distribution is shown in figure A-4. Razor clam beds are located north of the jetty along the beach. Recruitment to the inshore beaches comes from the subtidal spawning areas. Gaper, softshell, butter and bentnose clams are present in large numbers near the mouth and upriver in the estuary proper. Dungeness crab adults occur on sandflat habitat along the entire Oregon coast. They spawn in offshore areas and the juveniles rear in the estuary.

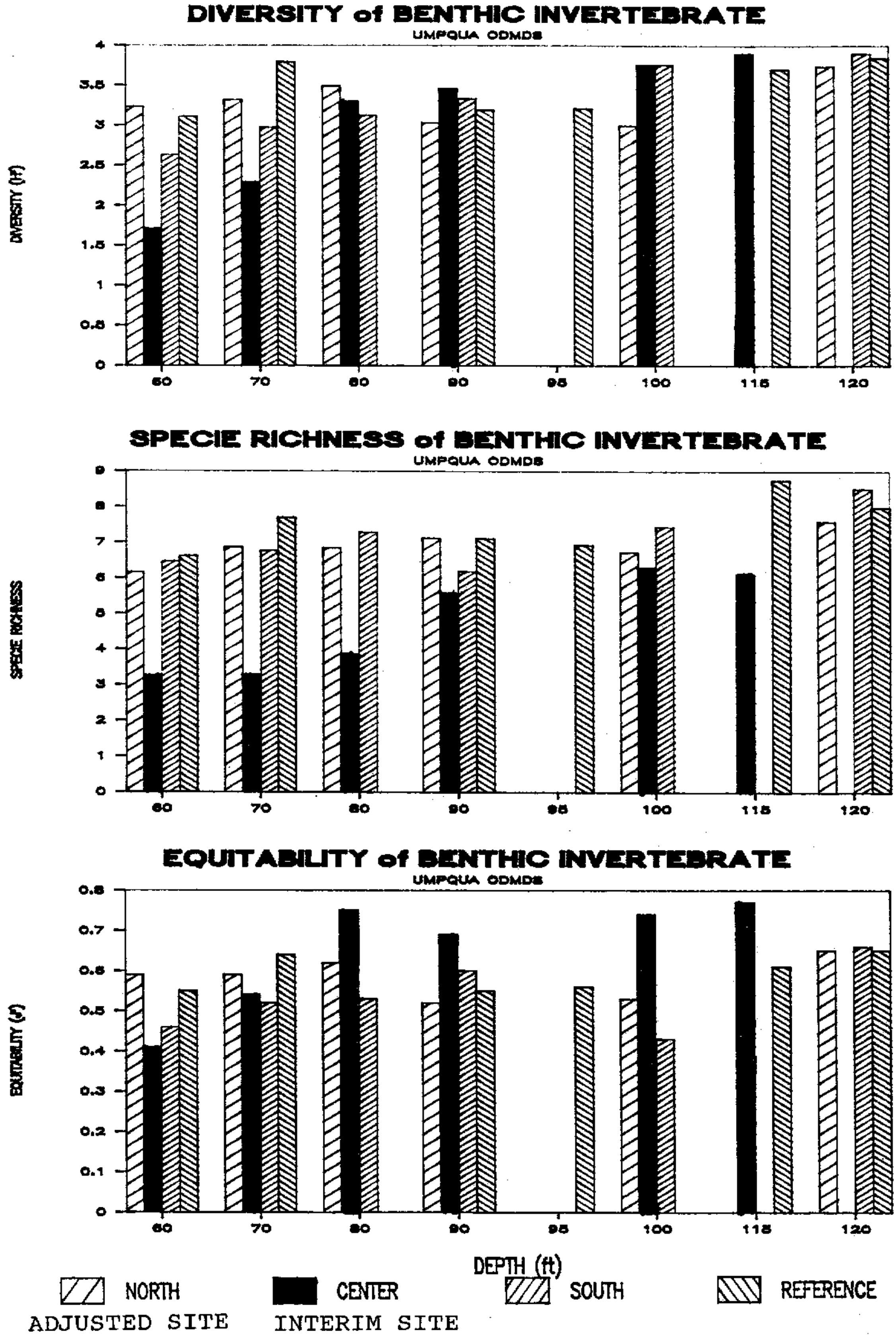

Figure A-3

Diversity, Species Richness and Equitability

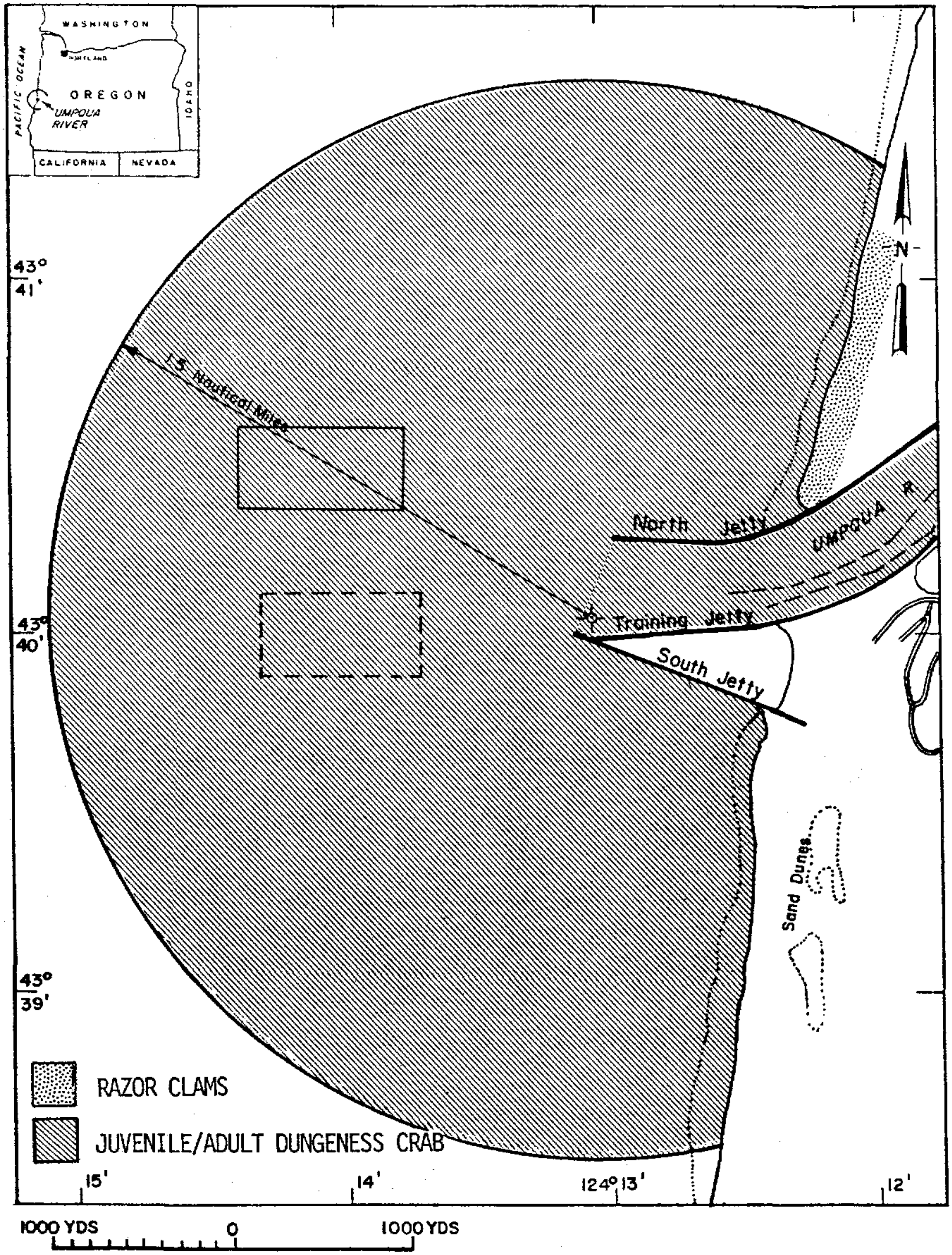

Figure A-4
Shellfish Distribution

1.22 The Oregon Department of Fish and Wildlife (ODFW) has not identified a major squid spawning area off the Umpqua estuary.

Fisheries

1.23 The nearshore area off the mouth of the Umpqua supports a variety of pelagic and demersal fish species. Pelagic species include anadromous salmon, steelhead, cutthroat trout, striped bass and shad that migrate through the estuary to upriver spawning areas (ODFW, 1979). Other pelagic species include the Pacific herring, anchovy, surf smelt, and sea perch. Surf smelt in particular are in nearshore areas and in the estuary in large numbers during the summer (ODFW, 1979).

1.24 Though migratory species are present year-round, individual species are only present during certain times of the year. Figure A-5 shows the species of fish and their periods of occurrence off the Umpqua River.

1.25 Demersal species present in the nearshore area were sampled in September, 1984 and in January, 1985 by the National Marine Fisheries Service laboratory in Hammond (Emmett et al, 1987). Samples were taken with a 8 meter semiballon shrimp trawl with a 38.1 mm mesh main net and 12.7 mm cod end liner. One trawl approximately 10 minutes long was taken along the 60, 70, 80, 90, 100 and 115 depth contours of the mouth of the Umpqua (Figure A-6). Fish and macro invertabrate species collected and their density are given in table A-5. The most abundant species collected was the night smelt in Jan(85). Other dominant species included Tom cod in both surveys, Sandlance in Jan(85), prickle breasted poacher and speckled sanddab in Sept(84), and sandsole in Jan(85). The mean density of fish and crabs was significantly greater in January than in September, with more individuals collected in the shallower depths (60 to 70 feet) (Figure A-7). Diversity of species generally increased with depth though these relationships were not as consistent for the Sep(85) data (table A-6). Length frequency data indicated that most fish collected were juveniles (Figure A-8). Dungeness crab collected in September(84) were primarily young-of-year (< 25 mm), while in January they were larger and probably adults (> 100 mm).

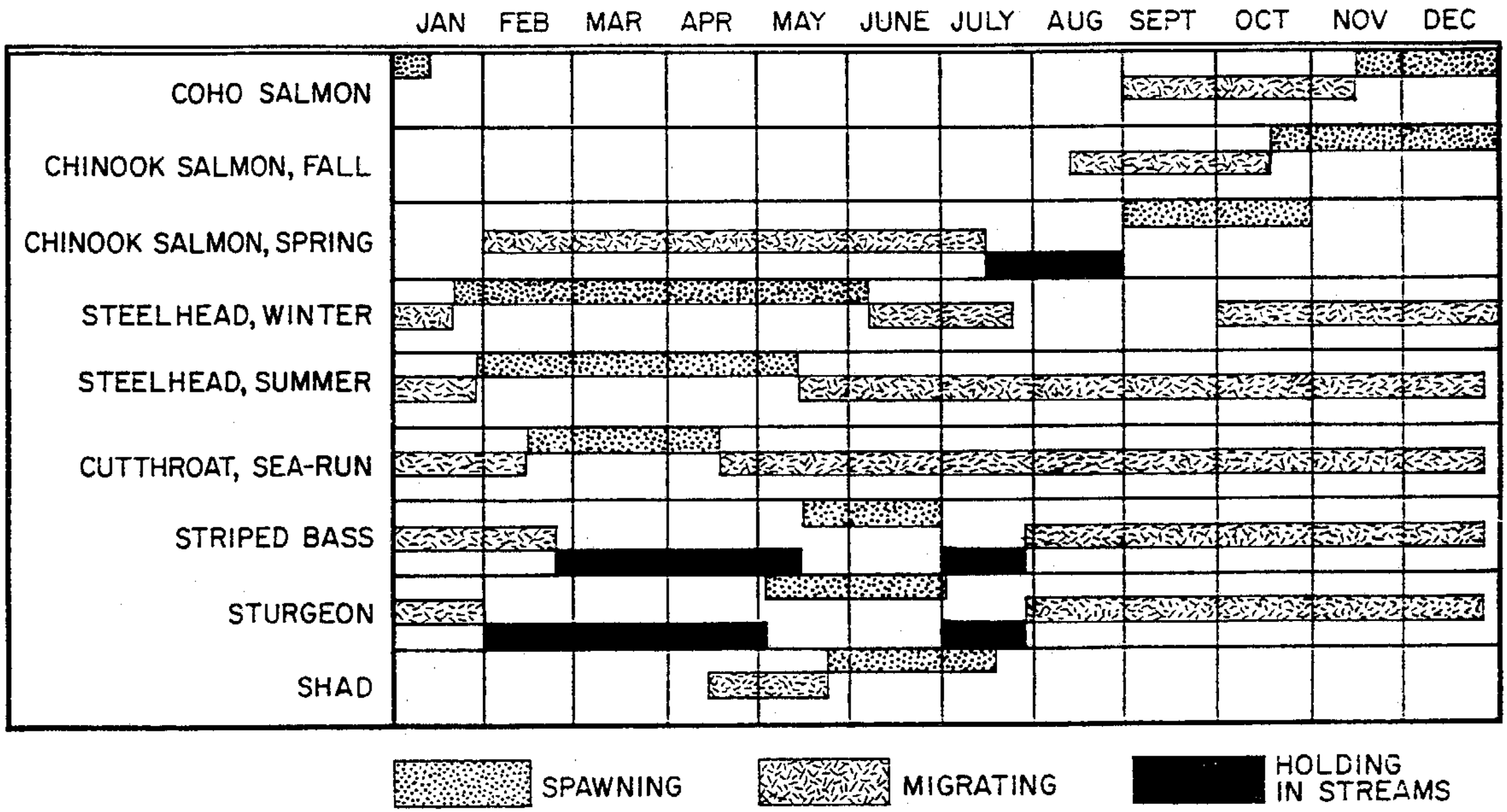

Figure A-5
Species of Fish and Seasonal Occurrence (ODFW, 1979)

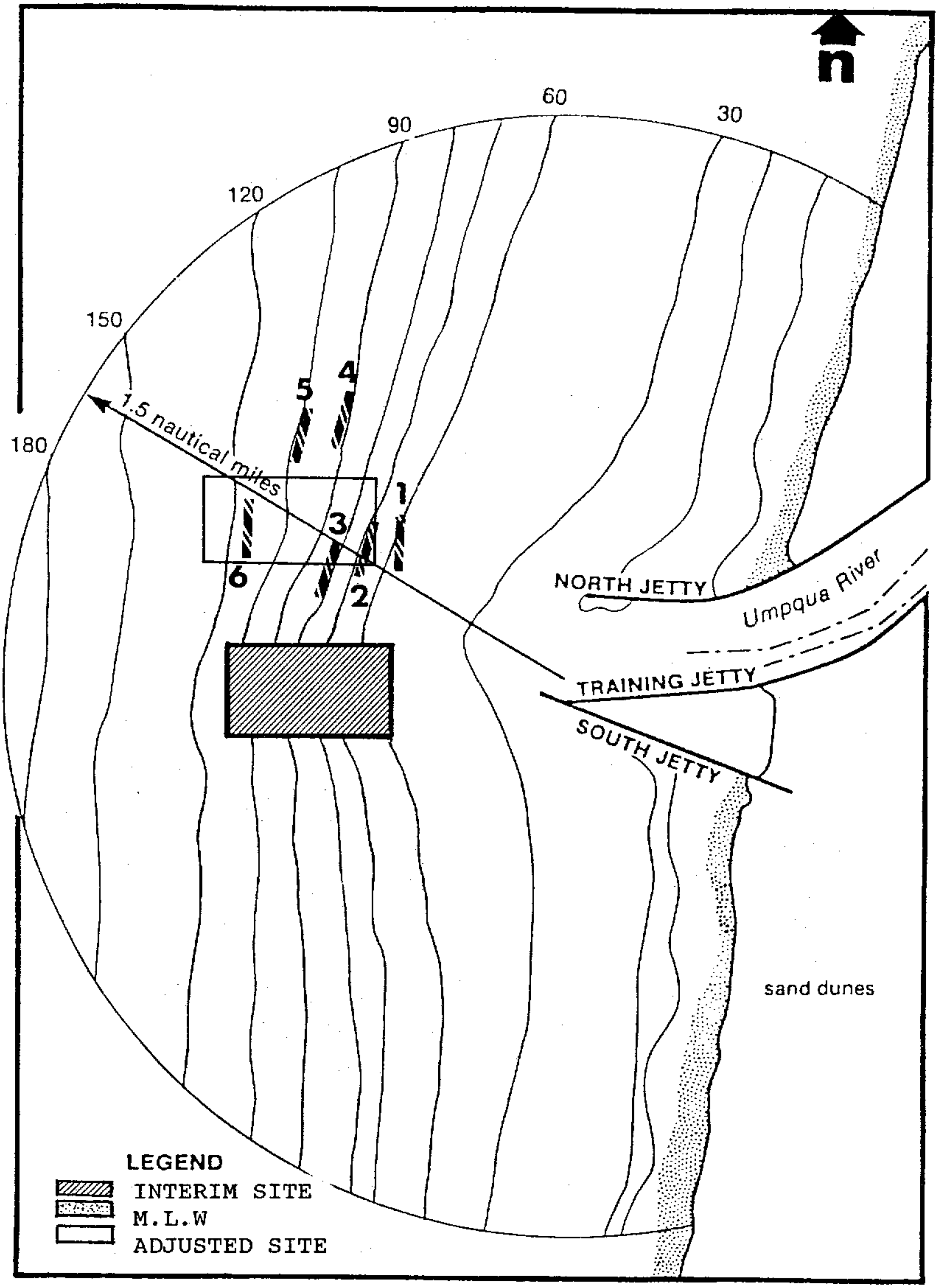

Figure A-6
Trawl Site Locations

Table A-5

Catch Data for Fish and Crab

Species	Survey 1 (SEPT. 84)		Survey 2 (JAN 85)	
	Total number captured	Mean number per ha	Total number captured	Mean number per ha
Spiny dogfish	0	0	1	1
Big skate	5	3	3	2
American shad	0	0	82	38
Northern anchovy	2	1	0	0
Whitebait smelt	0	0	7	3
Night smelt	9	6	6,131	2,766
Longfin smelt	0	0	1	1
Unid. juvenile smelt	1	1	1	1
Pacific tomcod	228	136	298	136
Larval groundfish	0	0	2	1
King-of-the-salmon	1	1	0	0
Bay pipefish	1	1	8	4
Shiner perch	4	3	37	18
Spotfin surfperch	0	0	35	16
Wolf-eel	3	2	0	0
Pacific sand lance	0	0	250	115
Lingcod	1	1	0	0
Pac. staghorn sculpin	3	2	56	27
Cabezon	0	0	1	1
Warty poacher	45	28	2	1
Tubenose poacher	21	13	5	2
Pricklebreast poacher	388	241	65	30
Pacific sanddab	0	0	24	12
Speckled sanddab	248	154	71	33
Butter sole	5	3	25	12
English sole	73	47	61	28
C-O sole	4	2	0	0
Sand sole	79	49	307	146
Larval flatfish	1	1	1	1
Dungeness crab	27	17	17	8
Red rock crab	1	1	0	0
Cancer gracilis	0	0	2	1
Kelp crab	1	1	0	0
Pugettia richii	1	1	0	0
TOTAL	1,152	715	7,493	3,404

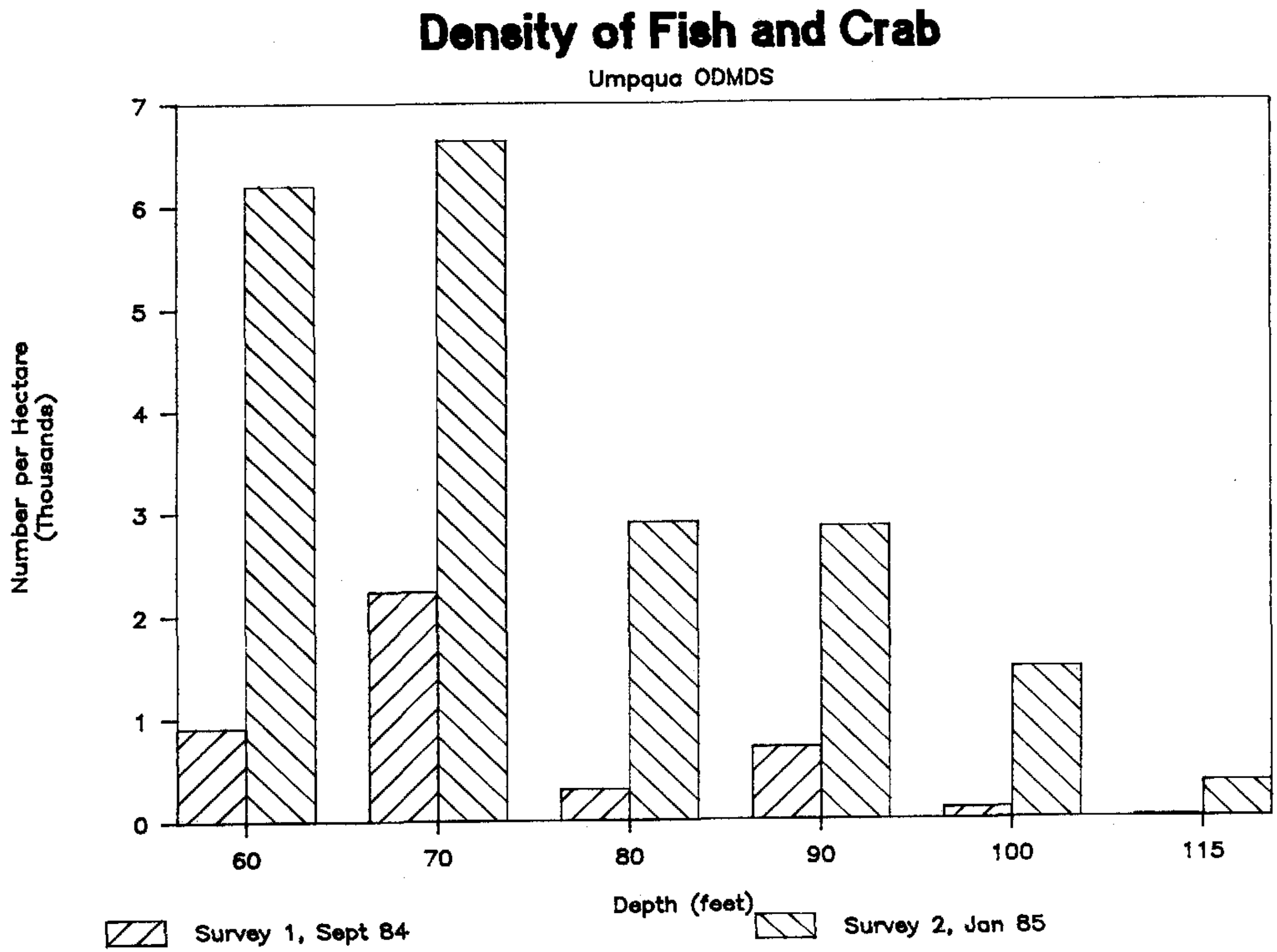

Figure A-7
Density of Fish and Crab

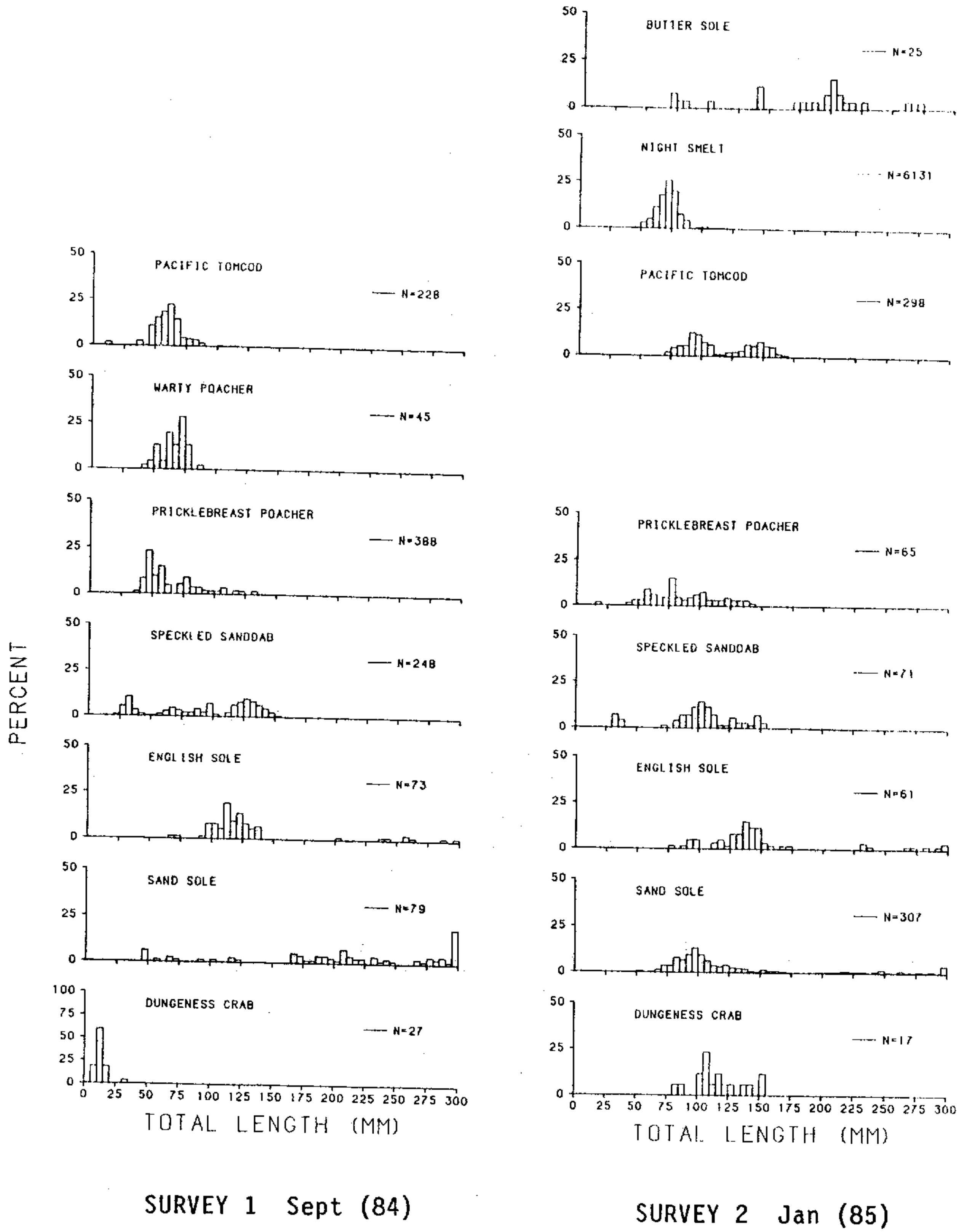

Figure A-8
Length Frequency Distributions Jan(85)

Table A-6

Summary of Trawl Data

Survey 1 , September 1984

Station and Depth (ft)	Number of Species	Number per hectare	Density (g/ha)	H'	J	SD	SR
U-1 (60)	14	911	24,268	2.39	0.63	0.73	2.36
U-2 (70)	13	2,235	49,239	2.25	0.61	0.70	1.88
U-3 (80)	10	302	17,043	1.67	0.50	0.47	1.94
U-4 (90)	13	704	28,356	2.53	0.68	0.71	2.32
U-5 (100)	9	103	5,310	2.44	0.77	0.72	2.49
U-6 (115)	3	13	1,248	1.50	0.95	0.63	1.44
Mean	10	711	20,911	2.13	0.69	0.66	2.07

Survey 2 , January 1985

Station and Depth (ft)	Number of Species	Number per hectare	Density (g/ha)	H'	J	SD	SR
U-1 (60)	14	6,201	21,102	0.58	0.15	0.14	1.69
U-2 (70)	12	6,634	18,868	0.44	0.12	0.10	1.40
U-3 (80)	17	2,900	22,571	1.52	0.37	0.42	2.30
U-4 (90)	20	2,853	29,681	1.65	0.38	0.44	2.76
U-5 (100)	17	1,472	27,982	2.85	0.70	0.81	2.54
U-6 (115)	12	345	12,393	2.51	0.70	0.72	2.36
Mean	15	3,401	22,100	1.59	0.40	0.44	2.18

Commercial and Recreational Fisheries

1.26 Major commercial fishing areas are shown in figure A-9. The predominant commercial fishery is for salmon, Dungeness crab and bottom fish. Salmon trolling and crab fishing done over most of the ZSF.

1.27 Commercial landings for the Winchester Bay in 1986, as compiled by ODFW (1988) were:

Bottom Fish	758,984	lbs
Salmon	309,737	lbs
Dungeness Crab	465,544	lbs
total	1,534,265	lbs

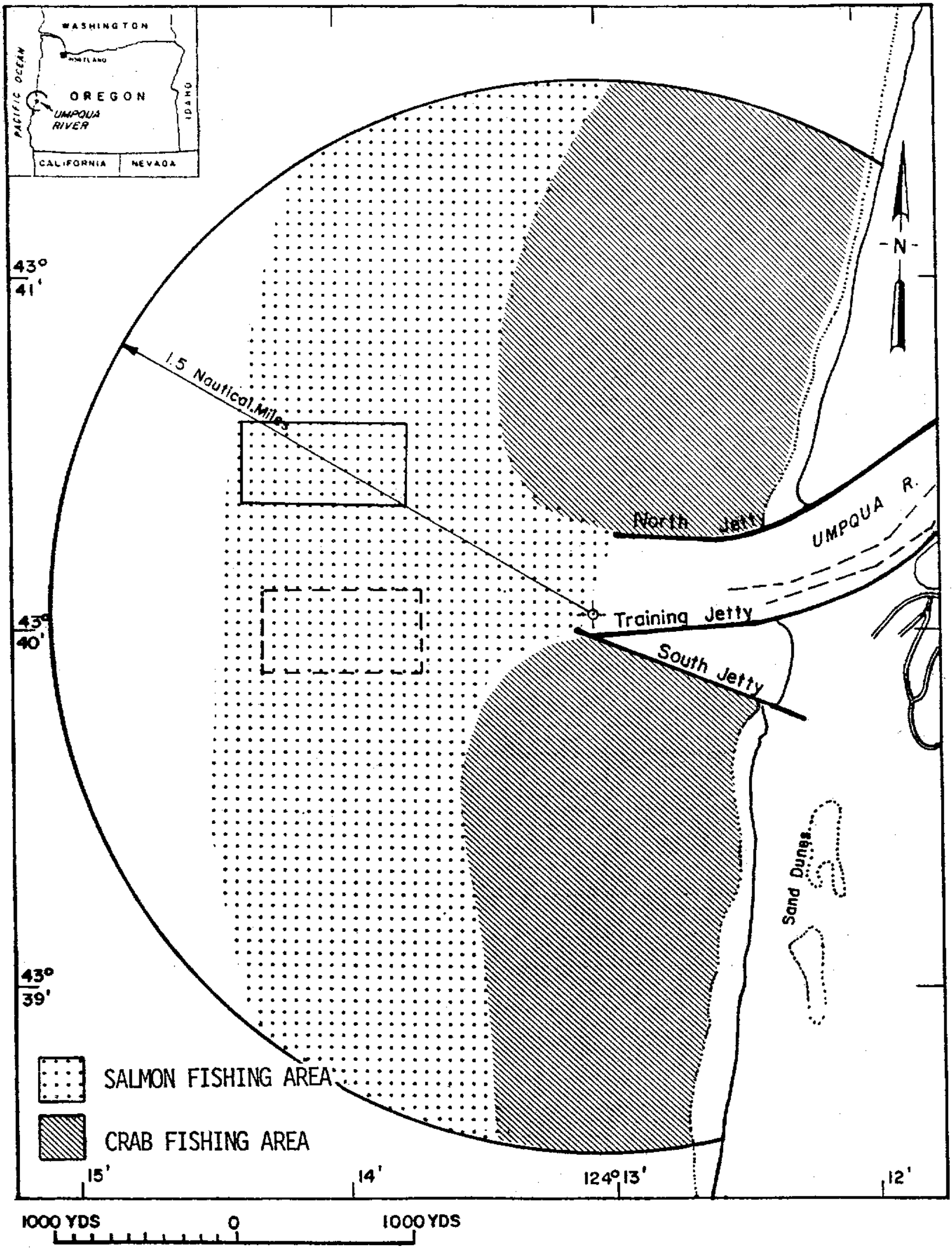

Figure A-9

Commercial Fishing Areas

1.28 The principal recreational fishing that occurs off the Umpqua River is for salmon. Salmon fishing is done by charter and private boat and occurs in the same areas as the commercial fishery, but generally closer to shore.

Wildlife

1.29 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 distribution and abundance of bird species is from the Seabird Colony Catalog (Varoujean 1979) and Pacific Coast Ecological Inventory (USFWS 1981), except as indicated. Shorebirds 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. 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. Information on most species of shorebirds is lacking, therefore their abundance and distribution can only be addressed in general terms. Several species of special concern, bald eagle, peregrine falcon, marbled murrelet and brown pelican occur along the coast and may use the ZSF or the surrounding areas. Pelicans and peregrine falcons are often associated with spits, ocean beaches and offshore rocks. Pelagic birds (e.g. shearwaters, murres) probably use the ZSF and adjacent waters for foraging. Marbled murrelets are generally located within 1.5 km of sandy shores, typically just outside the breakers.

1.33 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. Harbor seals and sea lions are primarily transient in the project area. Hauling out occurs within the estuary and on the jetties. Whales are known to occur throughout coastal waters primarily during migrations, but population estimates and information on areas of special use generally are not available.

1.34 Habitats and species within the ZSF (Fig. A-10) may be affected, and include the area north of the Umpqua River which is used as a nesting and wintering area by the western snowy plover. Western snowy plovers are listed by the State of Oregon as threatened. Brown pelicans, a federally listed endangered species, use the north spit area at the mouth of the Umpqua River and forage in the estuary and nearshore areas. Murres, with young, dispersing from nesting colonies will occur in the ZSF; conflict with the disposal operations should be minimal due to the limited presence of the dredge.

1.35 Several important wildlife areas outside the ZSF potentially could be affected by disposal of dredged material. Western snowy plovers congregate and nest in the area around the mouth of the Tahkenitch River and the area from the Umpqua River south to Tenmile Creek. Beaches within the northern portion of the Oregon Dunes NRA which support high densities of sanderlings could possibly be impacted.

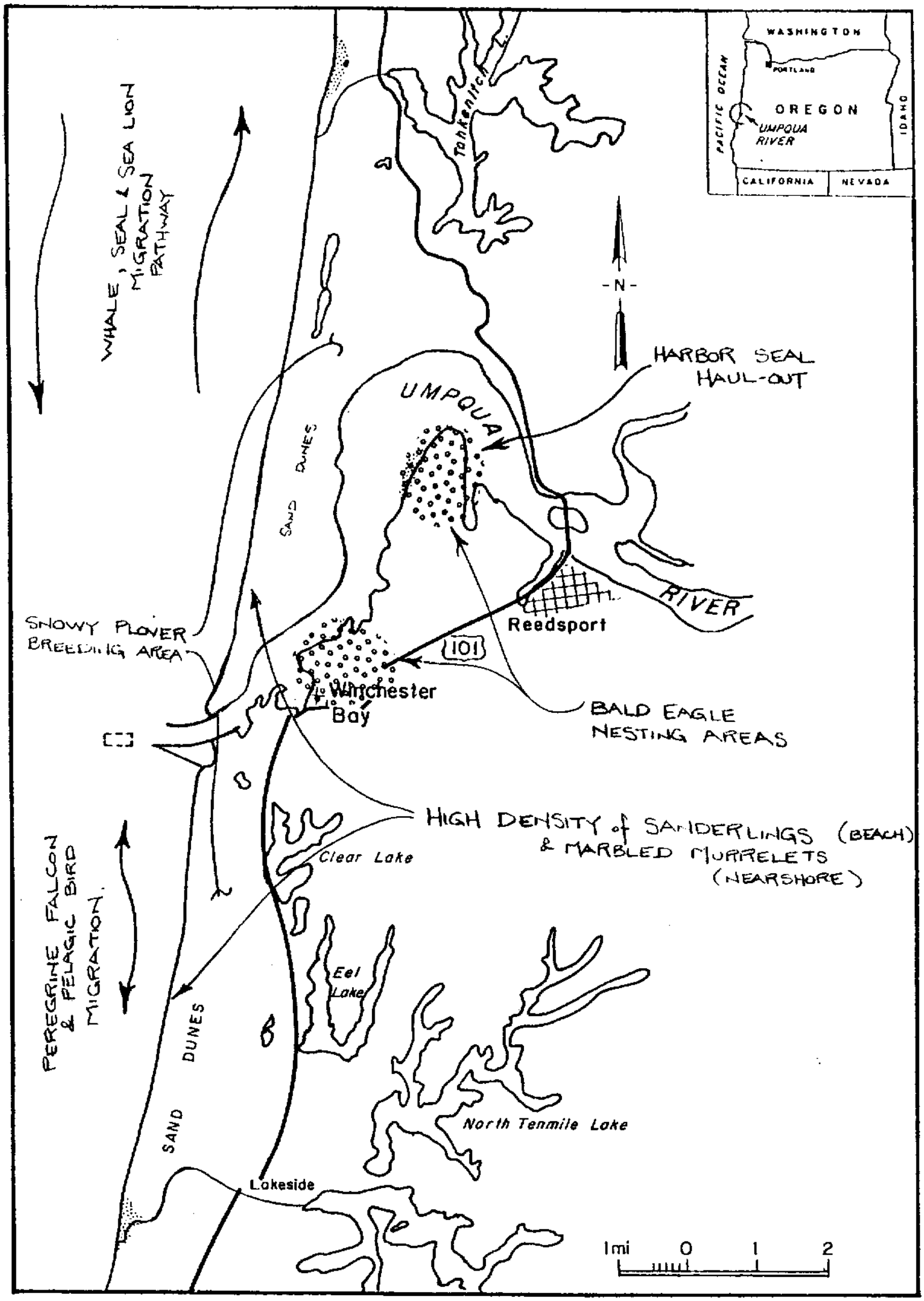

Figure A-10
Wildlife Areas

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Appendix B

Geological Resources, Oceanographic Processes
and Sediment Transport

APPENDIX B

GEOLOGIC RESOURCES, OCEANOGRAPHIC PROCESSES AND SEDIMENT TRANSPORT OF THE UMPQUA ZSF

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GEOLOGICAL RESOURCES

Regional Setting

1.1 The esturary of the Umpqua River opens into the Pacific Ocean about 180 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 Umpqua littoral cell. The estuary is fed by two rivers, the Umpqua, and the smaller Smith. The watershed encompasses part of the Coast Range, with the Umpqua River extending into the Cascades. The coastal zone of 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 lower portion of the Umpqua River is bordered by broad alluvial flats. The continental shelf off the mouth of the Umpqua is abut 30 km wide. Just to the north it bulges outward, forming the Heceta Bank. Between Siuslaw and Yaquina the shelf is at its widest along the Oregon coast, extending over 70 km offshore. Sand covers the shelf at the Umpqua for about 3 km out from the shore. From there a thin layer of mud (1 to 3 cm thick) mantle 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, the 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 Umpqua River are in the southern portion of the Coast Range. The 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 an 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 Umpqua.

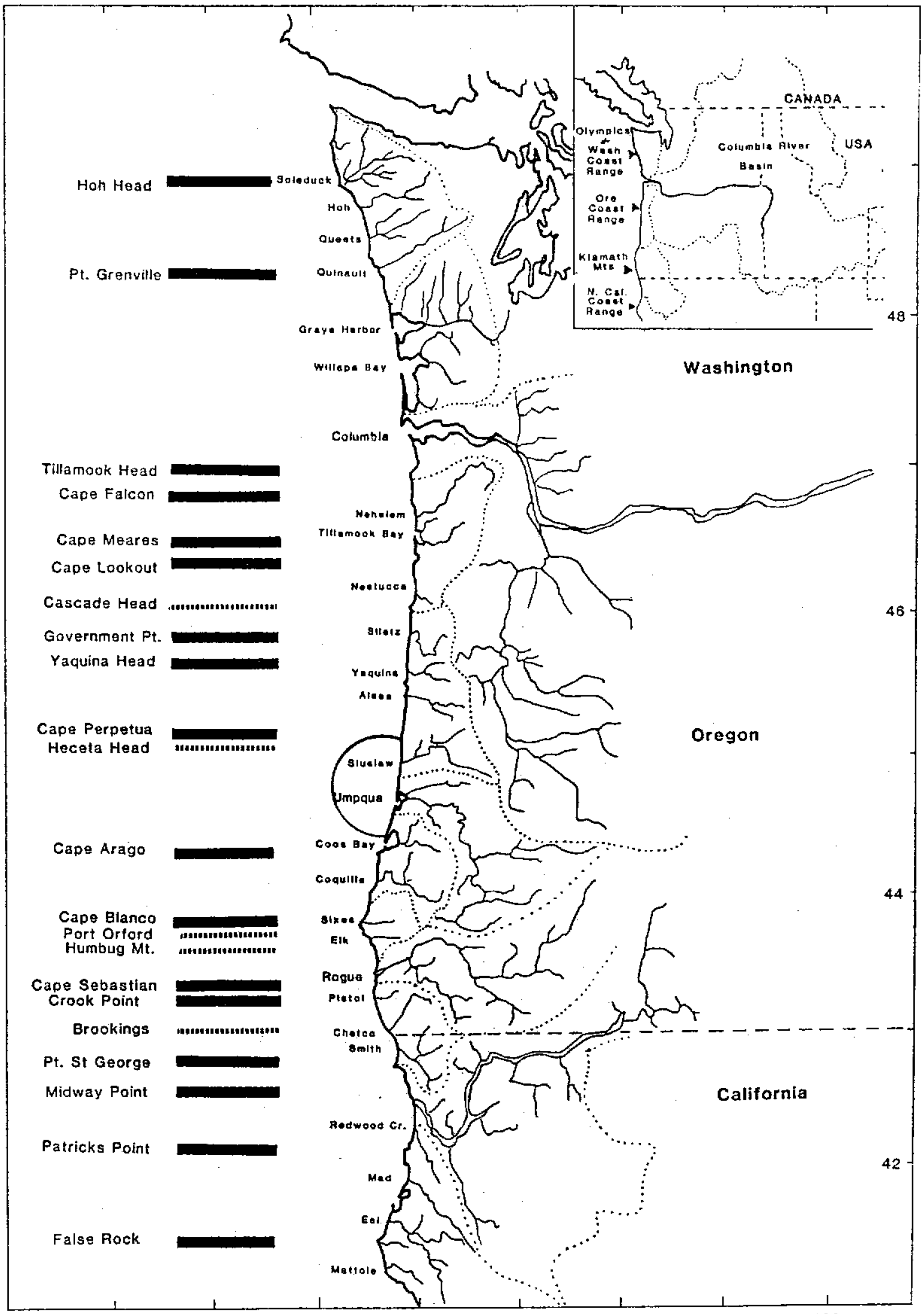


Figure B-1

Umpqua Littoral Cell Location

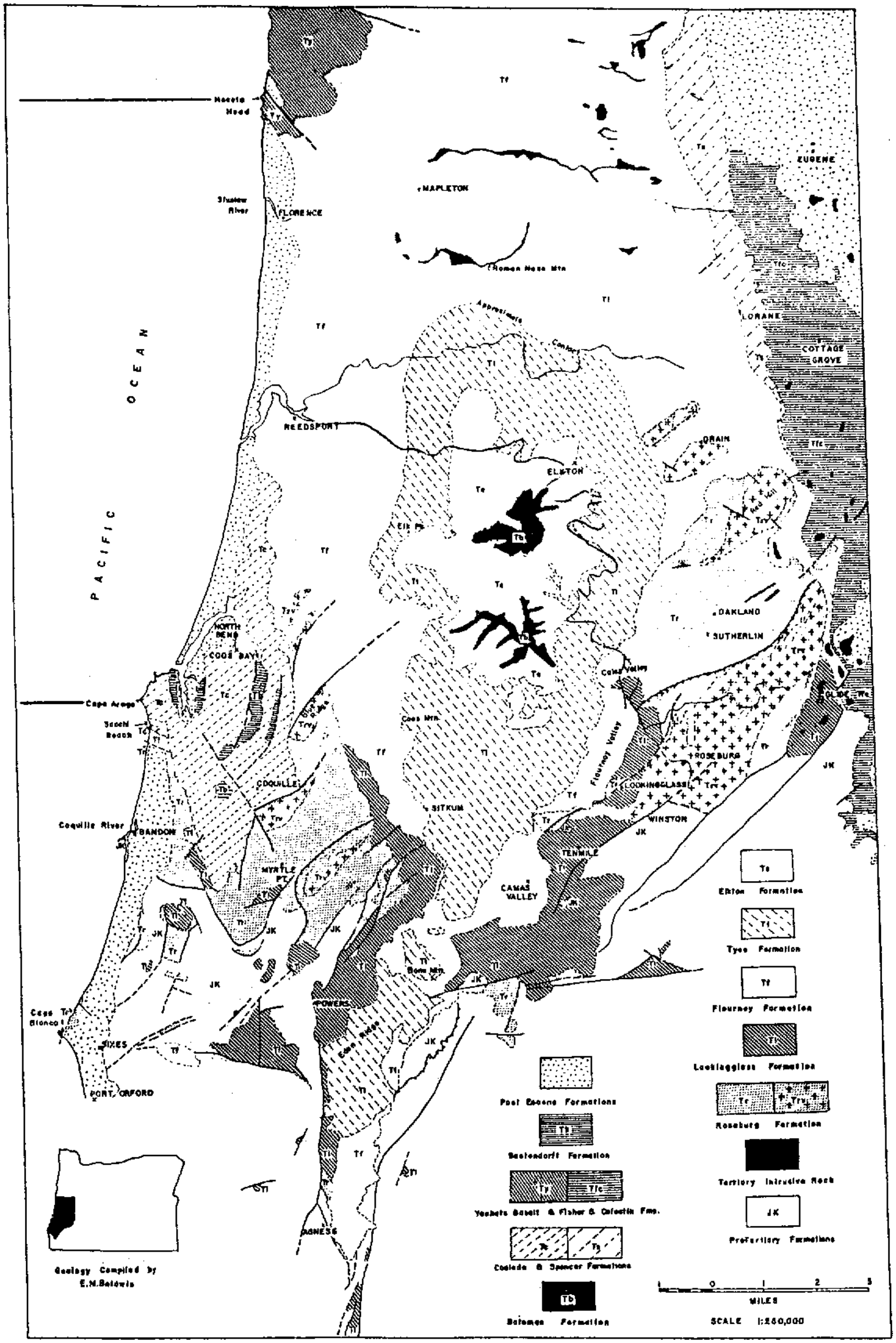


Figure B-2

Coastal Geology near Umpqua

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 Umpqua'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 Umpqua River rises in the Cascade Range, and the upper reaches pass through Mesozoic rocks of the northwest corner of the Klamath Mountains. For the most part, though, it flows through Eocene formations of the Coast Range. The most inportant of these are the Roseburg formation to the east, 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 layers 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 Umpqua 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 Umpqua, no significant quantities of oil and gas has been found. (Gray and Kulm 1985).

Sediments

1.7 The Umpqua River is the major source for sediment in the littoral cell. It is fed by the Umpqua and Smith Rivers, with a combined drainage basin of 5,042 sq. miles. Mean monthly discharge is highest in January at about 18,000 cfs, and lowest in September at about 1,200 cfs. Mean annual discharge is about 8200 cfs, which gives a six hour mean discharge of $1.77x10^8$ cf. The estuary of the Umpqua River covers 6,430 acres. The diurnal tidal prism is $16x10^8$ cf, which divided by the six-hour discharge gives a hydrographic ratio of 9. This means that the estuary is fluvially dominated, and therefore that a large portion of the fluvial sediments will be transported out the mouth and into the sea. The Siuslaw River estuary has a hydrographic ratio of 6, so it too is fluvially dominated and should be a contributor of 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 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 size of the material dredged from the Umpqua River, it seems that it is primarily fluvial in origin. Because the Umpqua is fluvially dominated most of the Umpqua's sediment load should eventually be carried out into the ocean. This means that the net contribution of dredging to the sediment budget is much smaller than the amount naturally carried offshore.

1.10 Offshore disposal of dredge material at Umpqua began in 1924. Since then, more than 14.2 million cy have been dumped at sea. Between 1968 and 1988 annual disposal has averaged 147,349 cy, with a maximum of 313,632 cy and a minimum of 500 cy. The dredging that contributes to offshore disposal is done to maintain the entrance channel 26 ft deep and 400 ft wide. Shoaling occurs between the jetties from river mile -0.5 to about -0.8, and outside the jetties at about mile -1.2. The training jetty built on the south side of the channel in 1980 is intended to alleviate the shoaling between the jetties.

Table B-1
Umpqua River Dredging History

Year	Quantities Dredged Total	Quantities Dredged Entrance Bar	Year	Quantities Dredged Total	Quantities Dredged Entrance Bar
1968	103,400	35,600	79	486,272	313,632
69	305,000	97,000	80	587,050	217,850
70	80,200	13,000	81	262,323	209,891
71	178,400	18,100	82	494,321	264,410
72	122,950	500	83	216,705	135,950
73	124,950	62,300	84	399,150	161,441
74	161,571	175,851	85	290,451	139,813
75	470,005	244,795	86	334,230	94,946
76	450,700	220,970	87	407,184	152,369
77	275,750	92,800	88	266,188	263,118
78	539,200	180,000			
			total	6,556,000	3,094,336
			21 year average	312,190	147,349

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

1.12 The surface sediments of the Umpqua 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 disposal site the sediment is medium sand, with an average mean grain size of 0.33 mm, and a range of variation from 0.26mm and 0.40 mm. The transition between the native and dredge sediments appears to be abrupt. For native sediments, there may be a slight tendency for fining with increased depth.

1.13 Two sediment sampling surveys using the same stations were conducted in September 1984 and January 1985. Figure B-3 shows the location of the sampling sites in relation to the Umpqua ZSF (zone of siting feasability). Change in the grain size was not consistent within the ZSF. Thirteen of the 18 stations outside of the disposal site showed a decrease in grain size, while 4 of the 6 disposal site stations increased in grain size. For the most part the change in grain size was inconsequential, with 11 of the external stations showing a change less than or equal to 0.1 phi. Only two changed more than 0.3 phi. Within the disposal site the change was usually greater. Two stations increased by more that 0.35 phi. Increase in grain size outside the disposal site was located in the deeper half of the ZSF adjacent to the site. In no case did a change in grain size bring the sediment outside the disposal site as close as 0.6 phi to the dredge material. From this information it is not possible to infer movement of dredge material from the disposal site. Conversely, blanketting of the disposal site by native sediments does not seen to have occurred. The material dumped at the offshore disposal site is dredged from the outer channel bar and the entrance of the Umpqua River. Samples taken from these areas in January, 1979, had median grain sizes of 0.30 mm and 0.225 mm. This is coarser than the native offshore sediment, a difference that is, as noted above, also seen in the offshore disposal area.

TABLE B-2

Umpqua River Entrance Samples

Sample	Location	Date	D50	D90	%Fines
A		2/81	0.30	---	-
B		4/85	0.225	---	-

Note: Grain size given in millimeters.

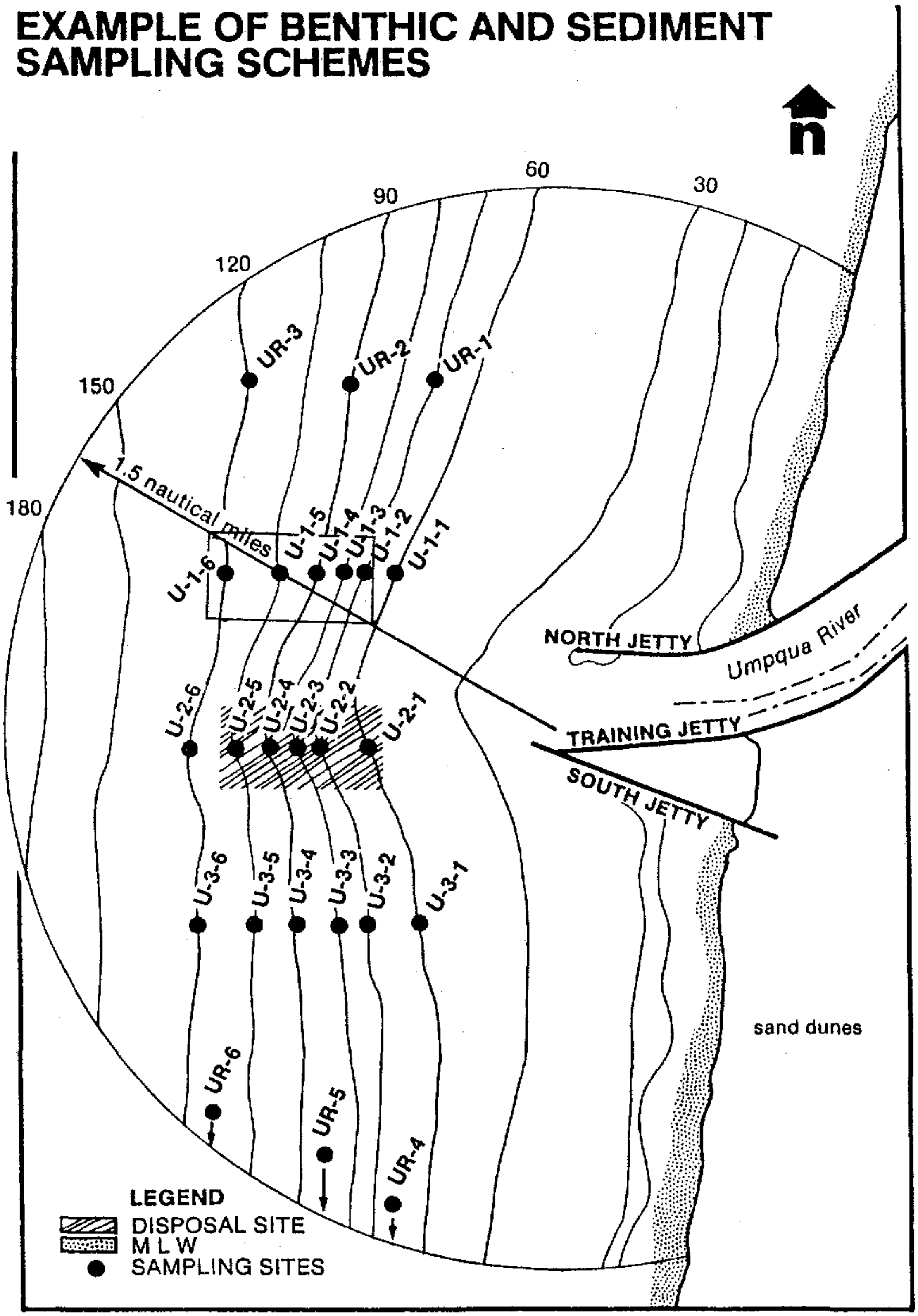


Figure B-3

Umpqua ZSF and sample locations

TABLE B-3
Umpqua Offshore Sediment Samples

Site	Mz	D50	D90	% fines	date
ur-1	0.16	0.16	0.22	1	3 Sept 1984
ur-1	0.16	0.16	0.22	1	
ur-3	0.16	0.16	0.21	1	
ur-4	0.21	0.20	0.32	0	
ur-5	0.17	0.16	0.23	0	
ur-6	0.16	0.15	0.205	1	
ul-1	0.19	0.19	0.25	0	
ul-2	0.19	0.19	0.245	1	
ul-3	0.17	0.18	0.24	1	
ul-4	0.14	0.13	0.17	6	
ul-5	0.18	0.18	0.24	1	
ul-6	0.17	0.18	0.23	4	
u2-1	0.33	0.34	0.50	1	
u2-2	0.28	0.26	0.41	1	
u2-3	0.34	0.35	0.52	1	
u2-4	0.35	0.38	0.55	0	
u2-5	0.31	0.31	0.48	0	
u2-6	0.28	0.25	0.36	0	
u3-1	0.18	0.18	0.25	0	
u3-2	0.18	0.18	0.25	1	
u3-3	0.17	0.16	0.24	0	
u3-4	0.125	0.13	0.16	9	
u3-5	0.16	0.16	0.22	1	
u3-6	o.16	0.15	0.22	1	
ur-1	0.16	0.16	0.225	2	27 Jan 1985
ur-2	0.15	0.15	0.25	3	
ur-3	0.15	0.16	0.22	3	
ur-4	0.18	0.18	0.26	2	
ur-5	0.16	0.17	0.28	1	
ur-6	0.17	0.18	0.22	2	
ul-1	0.18	0.17	0.25	1	
ul-2	0.16	0.16	0.205	3	
ul-3	0.16	0.16	0.21	1	
ul-4	0.15	0.16	0.225	4	
ul-5	0.15	0.16	0.22	7	
ul-6	0.17	0.17	0.26	1	
u2-1	0.3	0.31	0.44	0	
u2-2	0.28	0.28	0.38	0	
u2-3	0.30	0.31	0.40	0	
u2-4	0.34	0.34	0.57	0	
u2-5	0.35	0.34	0.54	0	
u2-6	0.34	0.35	0.49	0	
u3-1	0.18	0.18	0.23	1	
u3-2	0.16	0.16	0.225	2	
u3-3	0.16	0.16	0.205	2	
u3-4	0.16	0.16	0.20	2	
u3-5	0.16	0.16	0.20	2	
u3-6	0.16	0.16	0.20	2	

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

Conditions in the ZSF

1.14 Bedrock is not exposed within the Umpqua River study area. However, the geologic map of the Reedsport Quadrangle (Beaulieu and Hughes, 1975) indicates that the study area is underlain by the Flournoy Formation of middle Eocene age, which consists of rhythmically bedded hard sandstone and siltstone. The sub-bottom profiles 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 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). The offshore mapping of Clarke and others (1981) extends to within three miles of the ZSF. By extrapolation, it appears that Unit 1 overlies Unit 3 in the study area. A breached anticline trending N12W can be projected into the western edge of the study area. No faults identified in either onshore or offshore mapping are projected into the ZSF. (From USACE 1986)

1.15 The ocean bed in the vicinity of the Umpqua ZSF is characterized by a bulging outward of the bathymetric contours in front of the mouth of the Umpqua River, and an otherwise featureless slope that increases from the north to the south. A mile and a half north of the Umpqua's mouth the average slope is about 75 ft/mile between the 24 ft and 156 ft contours. Two miles south of the entrance the slope has increased to about 90 ft/mile. The slope also shows a general increase with distance offshore. The bulge in front of the mouth is evident to a depth of 130 ft, after which the contours are straight. The disposal site is centered on the crest of the bulge.

1.16 Six bathymetric surveys were made between 1979 and 1985. Based on these surveys 4 profiles were constructed for each of the dates and compared to observe changes through time. Three of the profiles were oriented downslope, one over the bulge and one each to the north and south. The forth profile crossed the bulge at right angles to the other profiles. Figure B-4 shows the location of the profiles. Most of the changes noted occurred after 1982. There was little net change along the north profile between 1979 and 1985. The south profile, however, showed net aggradation over its entire length of 1 to 4 feet. The bulge showed the greatest

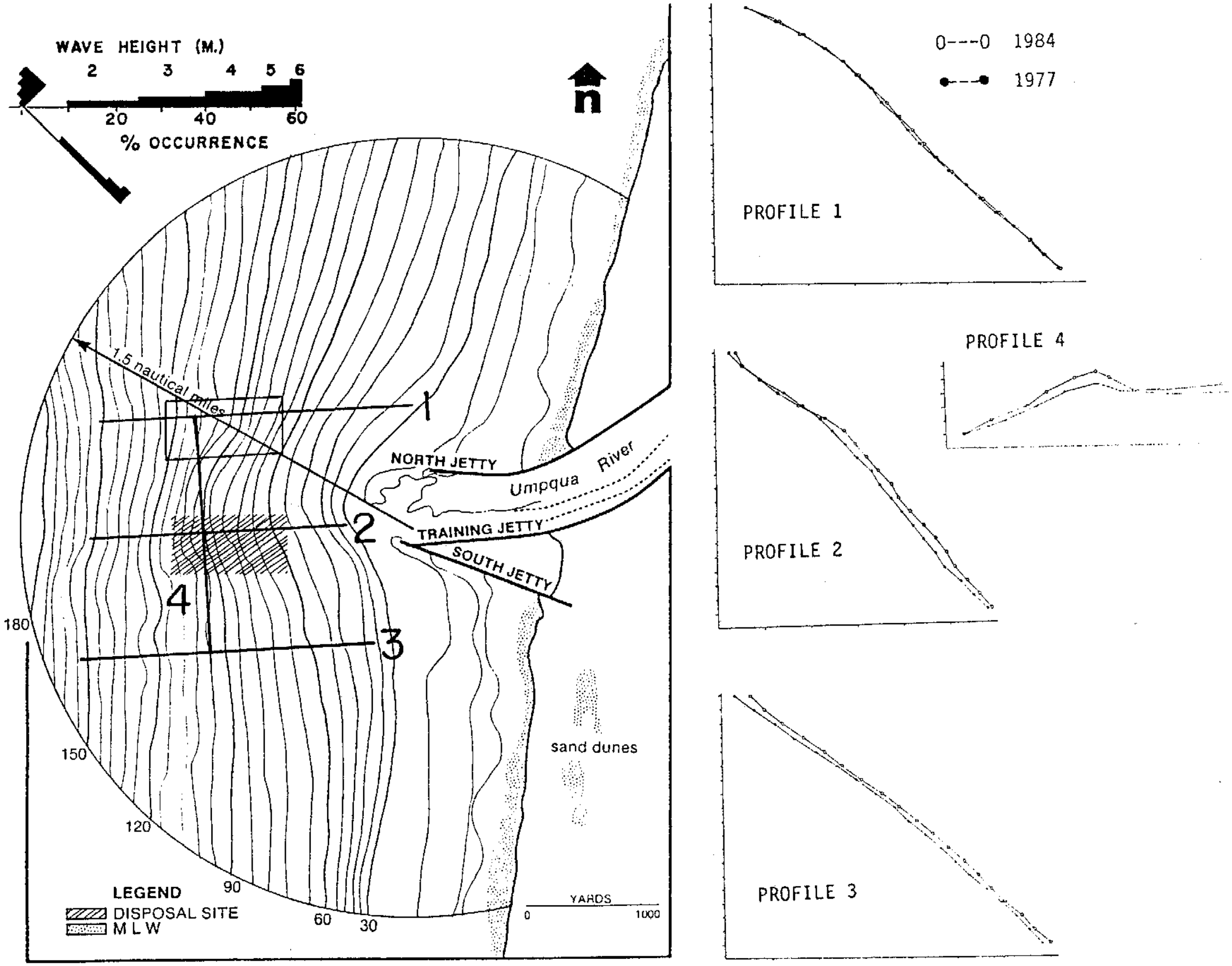


Figure B-4
Umpqua ZSF, Bottom Profiles

change, showing a maximum aggradation of 6 feet. The aggradation was evident from a depth of 66 ft down to the end of the profile. The cross sectional profile showed the greatest increase at the highest part of the profile. The correspondence between the depth of the aggradation of the bulge and the nearshore edge of the disposal site, plus the centering of the accumulation points towards disposal as being the cause of the aggradation of the bulge. The bulge itself is probably the ebb delta of the Umpqua River. The cause of the aggradation south of the mouth is uncertain. The absence of aggradation prior to 1982 has not been explained. In all probability it is the result of a combination of factors, including the amount of material disposed, the discharge from the Umpqua, and the wave climate between 1979 and 1982.

1.17 Figure B-5 shows the results of the 1984 sidescan sonar survey of the Umpqua ZSF. The area surveyed by sidescan sonar is primarily fine sand. Sand waves were observed extending from a couple of thousand feet north of the Umpqua's mouth to about a mile south, and to a depth of about 48 feet. A thin band of what is interpreted as "coarse sand/or gravel" is found both north and south of the mouth. No samples have been taken from these bands to confirm the interpretation, and the band may instead be sand dollar beds.

1.18 Figure B-6 shows two seismic profiles which cross the study area from ENE to WSW, essentially parallel with the slope. The layer of unconsolidated sediment is quite thick, varying between 120 to over 150 feet thick. About halfway down to bedrock there is an intermediate reflector. This layer may represent a temporary change in the depositional environment, a thin layer of denser material such as ash, or overconsolidation of sediments by dessication during a low stand of sea level. The bedrock surface is fairly irregular.

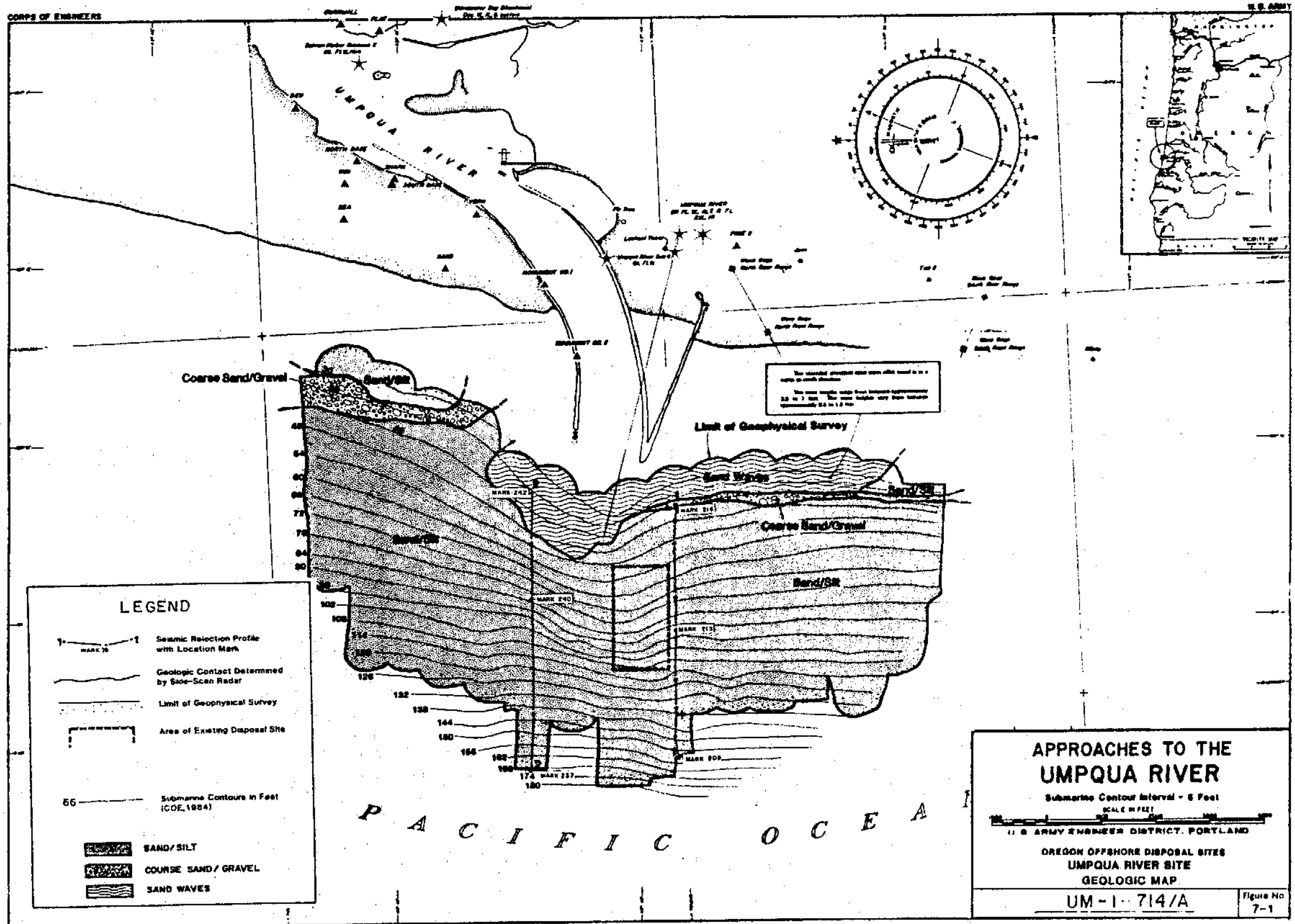
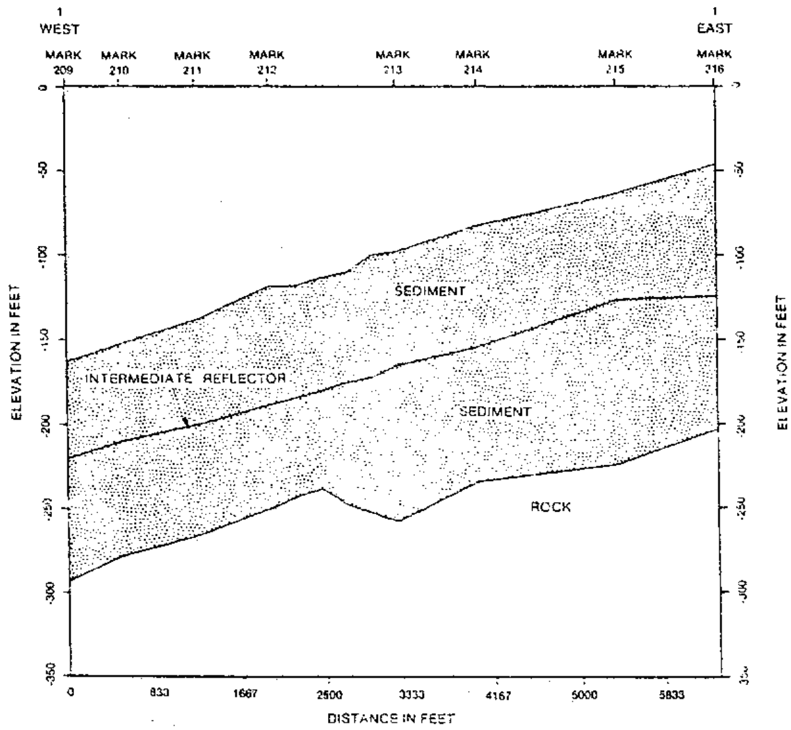


Figure B-5
Sidescan Map



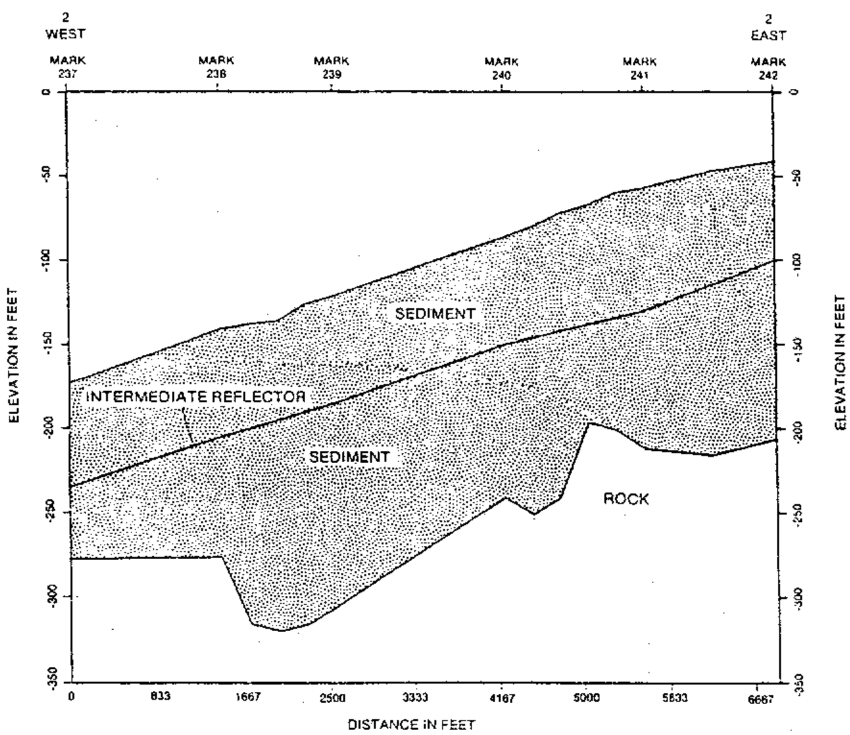
LEGEND

UMPQUA RIVER PROFILE NUMBER 1

ELEVATION DATUM IS MLLW
FROM FATHOMETER RECORDINGS

LOCATION BY PORTLAND DISTRICT, COE

NOTES ON BEDROCK GEOLOGY:
Bedrock probably consists of the Floumoy Formation - rhythmically bedded hard sandstone and siltstone (middle Eocene).



LEGEND

UMPQUA RIVER PROFILE NUMBER 2

ELEVATION DATUM IS MLLW
FROM FATHOMETER RECORDINGS

LOCATION BY PORTLAND DISTRICT, COE

NOTES ON BEDROCK GEOLOGY:
Bedrock probably consists of the Floumoy Formation - rhythmically bedded hard sandstone and siltstone (middle Eocene).

Figure B-6
Seismic Profiles

OCEANOGRAPHIC PROCESSES

Coastal Circulation

2.1 Coastal circulation near the Umpqua 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 contribute to strong northward currents. During the summer, high pressure systems dominate and waves and winds 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-7 shows the predominant Oregon coastal circulation.

Ocean Waves and Tide

2.2 Ocean waves arriving at Umpqua are generated by distant storms and by 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 sea and 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 from 1956-1975 near Umpqua are presented as a wave rose diagram in Figure B-4. Sixty-six percent of waves are from within 22 1/2 degrees of due west with 41 percent of the waves over 3 meters high. Only 7 percent of waves are from the southwest but all are over 3 meters high. Waves from the northwest occur 26 percent of the time with only 5 percent over 3 meters high. The larger waves are usually from the west-southwest and occur during winter months.

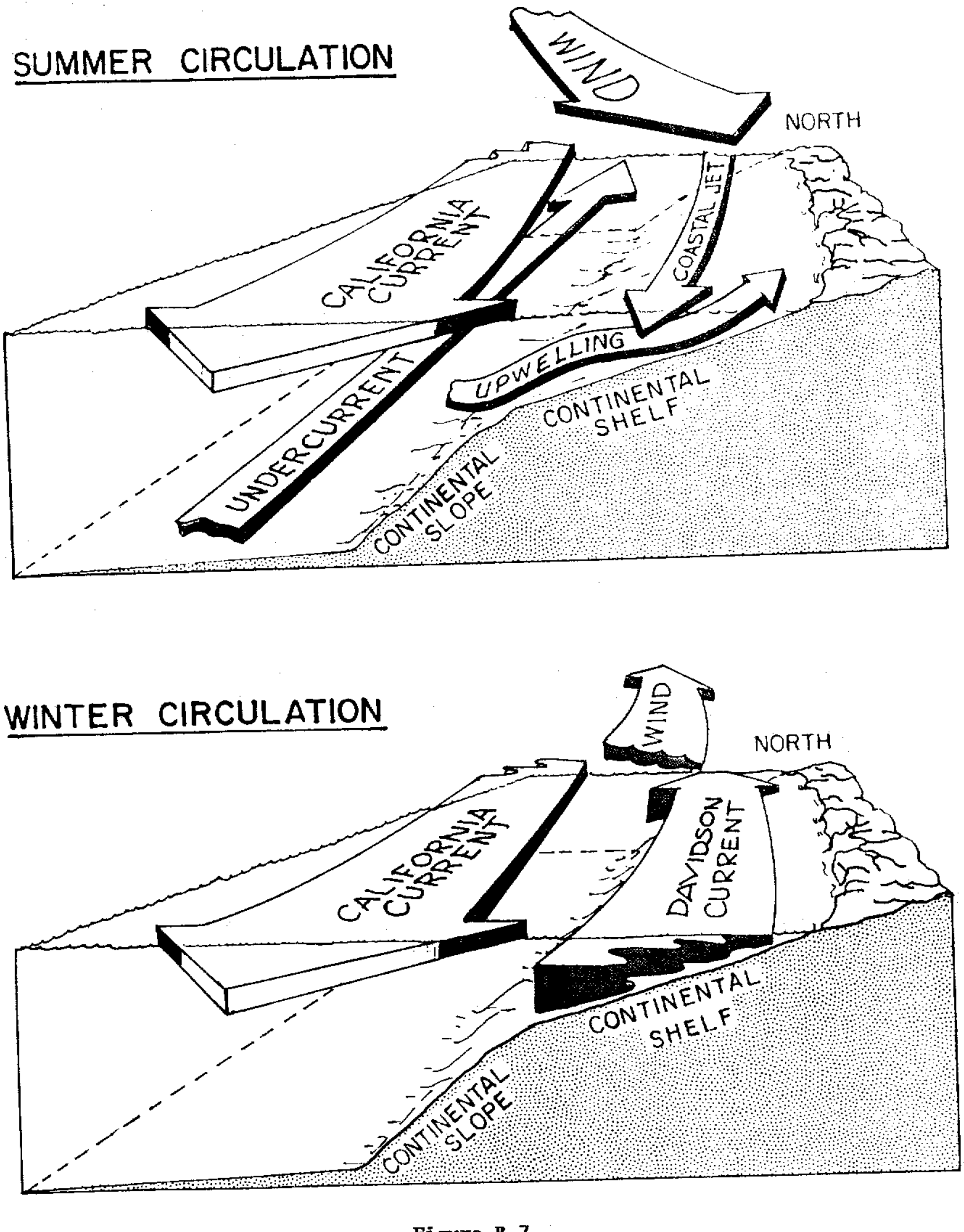


Figure B-7

Oregon Coastal Circulation

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. Thus the 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.

Local Processes

2.5 The Umpqua ocean disposal site is within 1 mile of the estuary entrance. The Umpqua River has the second largest drainage basin on the Oregon coast after the Rogue River and the third largest estuary. The Minimum and maximum flows presented in table B-4 indicate the highly variable in river flow. This constantly varying river outflow combines with tidal flows to produce a highly 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 Umpqua shows little or no longterm 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

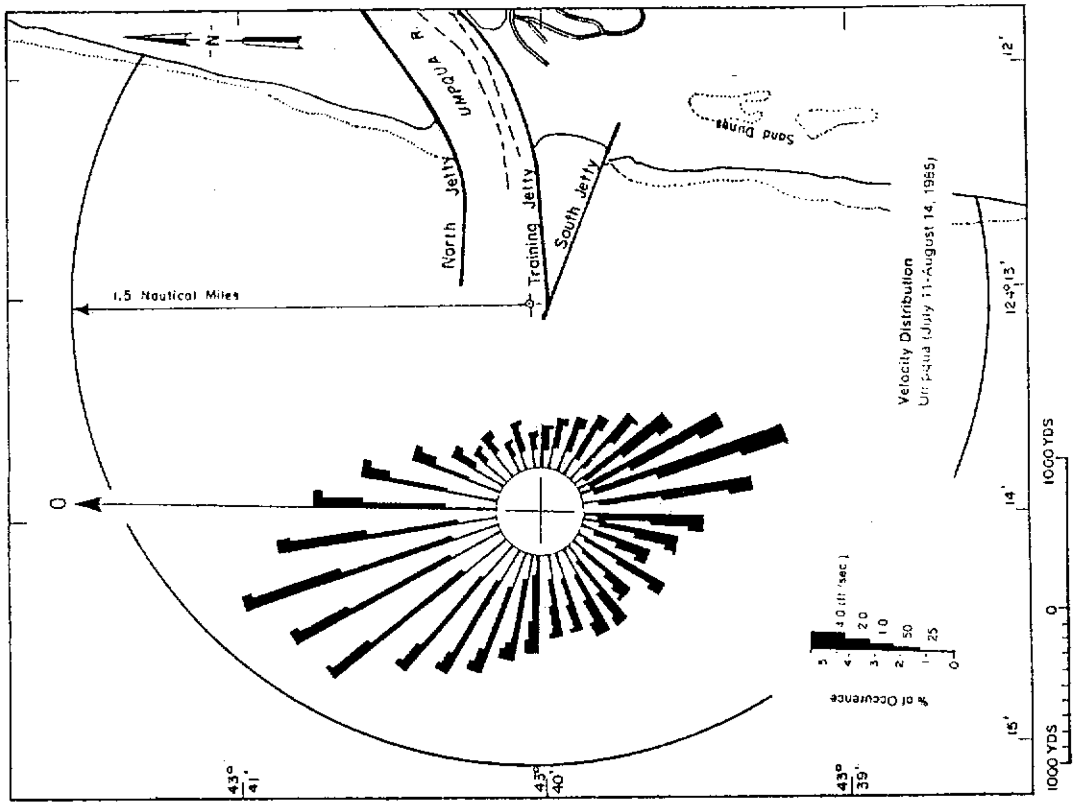
Physical Characteristics of the Umpqua River

Drainage Basin Area (sq. mi.)	5042
Estuary Surface Area (ft^2)	2.9 x 10^8
Mean Tide Range (ft.)	5.1
Diurnal Tide Range (ft.)	6.9
Mean Tidal Prism (ft^3)	12 x 10^8
Diurnal Tidal Prism (ft^3)	16 x 10^8
Minimum Annual Flow (cfs)	1200 (September)
Maximum Annual Flow (cfs)	18,300 (January)
Mean Annual Flow (cfs)	8,200
Extreme Discharge (cfs)	265,000 (1964)
Mean Hydrgraphic Ratio (HR)	9
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 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 riverflows. The variation in HR shows that the Umpqua probably discharges sediment on an annual basis, but may trap marine sands during the summer months.

Site Monitoring at Umpqua

2.7 Current meters were deployed near the Umpqua ocean disposal site in 1985 and 1986. The meters were attached to moorings at depths from 78 to 95 feet. Bottom current records were obtained from April 12-May 9 and from July 11-August 14 in 1985 and March 27-May 5 in 1986. These periods were picked to represent typical winter and summer conditions, however, the transition to summer conditions can begin as early as April. Figures 8 and 9 shows the daily average bottom current speed and direction for summer and winter records.



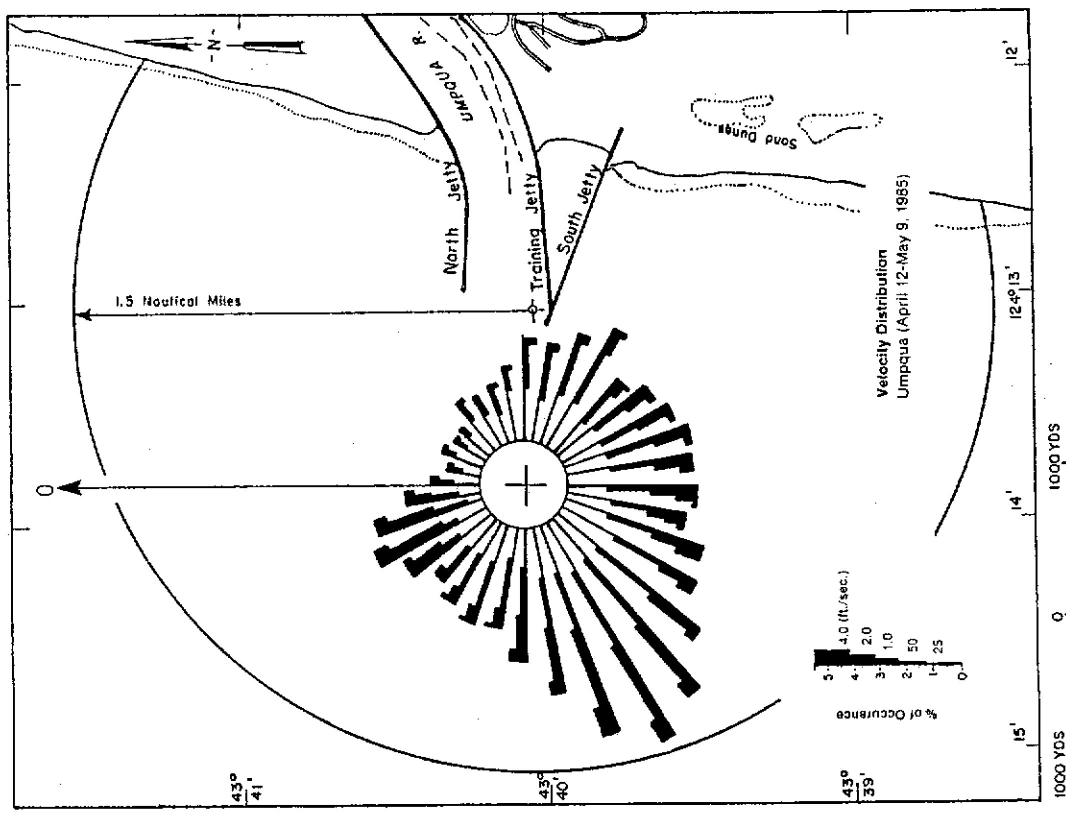
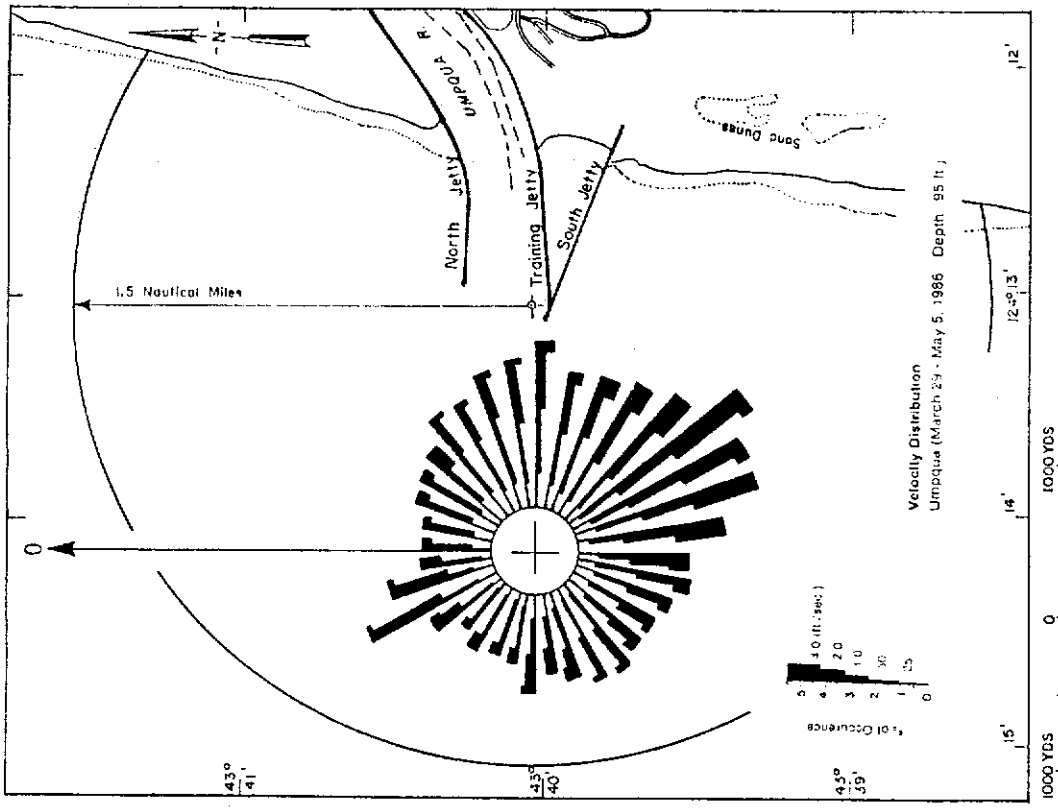


Figure B-8

Current Velocity for 1985



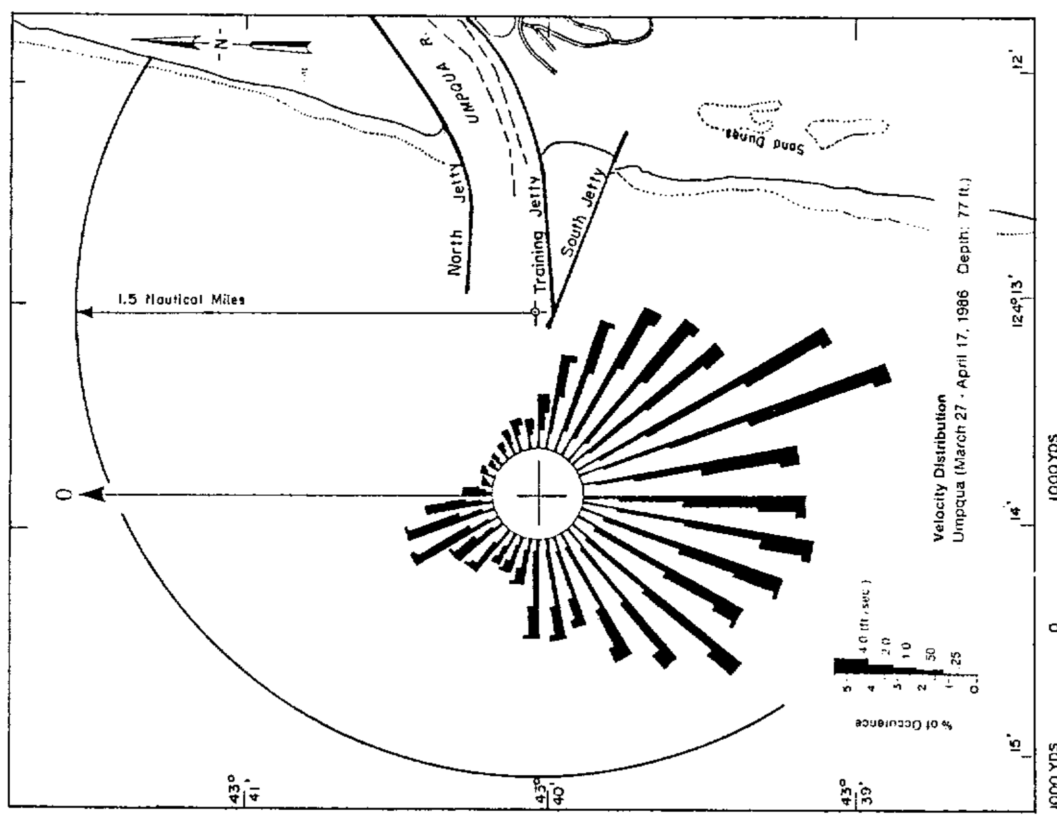


Figure B-9

Current Velocity for 1986

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 prelevant the current in that direction. The width of the bar represents the range of velocity, ie., the thicker the bar, the faster the current.

2.8 Summer currents in 1985 were more frequently to the north, but the strongest currents were to the south. There were minimal onshore-offshore currents. Bottom currents in winter 1985 had a strong offshore component and were frequently southward. During winter 1986 there were two meters at different depths. The shallow site had currents that were predominantly southward and offshore. The deeper site had currents that were predominantly southward and onshore. None of the winter records in 1985 or 1986 had a significant northward component.

2.9 There are several sources of wave data for Umpqua. Wave records near the ocean disposal site were obtained by OSU from March 17-30 and from July 12-24 in 1985 and from March 28-April 3 in 1986. Wave records were obtained by Scripps from May 1984 to June 1985 near the site at a depth of -130 feet. Wave data from Coquille for 1985 and wavemeter data from Newport from 1971-81 are also available for comparison. Figure B-10 shows the 10-year average monthly significant wave height from Newport compared with monthly averages for both Umpqua and Coquille. The monthly average at Umpqua is pretty consistently above Coquille and the 20-year Yaquina averages. The Umpqua and Coquille monthly averages show the same low in January and high in March of 1985. The daily histogram shows how variable wave height can be with peaks occasionally exceeding the monthly average.

2.10 Detailed current measurements have been obtained from another study conducted at Coos Bay, Oregon. Seasonal measurements made over two-week periods showed currents at the 25-m-deep disposal site averaged between 20 and 30 cm/s at one-third the water depth during the summer and between 30 and 60 cm/s during the winter and spring. Near-bottom currents were generally between 10 and 20 cm/s with downslope flow components predominating over upslope components. Near-bottom waters exhibited downslope movement to depths in excess of 40 m during the summer and deeper than 70 m during the winter. Similar conditions are expected to exist at the interim Umpqua disposal site since both sites are in similar depth regimes.

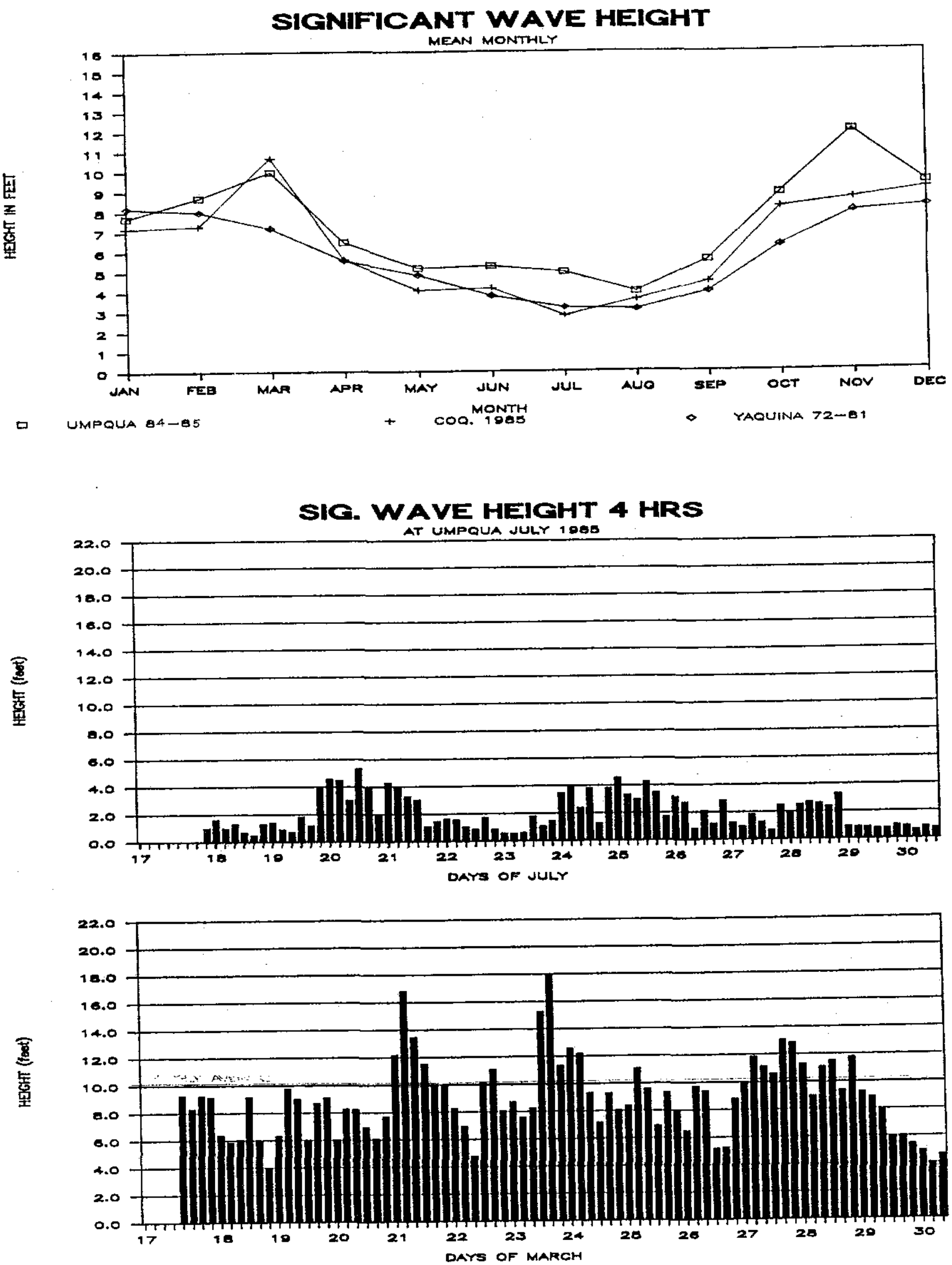


Figure B-10

Seasonal Waves for Coquille, Yaquina, Umpqua

SEDIMENT TRANSPORT

The Littoral System

3.1 At the Umpqua dredging project there is a need to locate an offshore disposal site 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 Umpqua 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. The outer shoal zone is affected by wave conditions regularly enough to cause significant onshore-offshore transport. Using Hallermeier (1981) and longterm 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 sediment in the 0.2 mm sand size, common off the Oregon Coast. Using the Coos Bay data the probability of wave-induced sand movement is very small beyond a depth of about 150 feet. Various sedimentologic studies have suggested an offshore limit of modern sand movement at the 60 foot depth, while others push this limit out to over 100 feet.

Umpqua Littoral Cell

3.3 Figure B-2 shows the Umpqua 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 correlates with the littoral sand mineralogies as well as 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. Figure B-11 represents the type of litteral sediment transport system present at Umpqua.

3.4 The beach and dune area was described by Dicken (1961) as "in a state of near stability", whereas Cooper (1958) describes the dune complex around the mouth of the Umpqua as undergoing very slow erosion. Using erosion rates for similar shorelines in Lincoln County (Smith, 1978) would result in less than a foot of erosion per year but almost 400,000 cubic yards per year along the entire littoral cell. This is comparable to the potential sediment supplied by the Umpqua, not to mention any Siuslaw sedimentation.

Table B-5 identifies the possible sources and losses of littoral sediments in the littoral cell:

TABLE B-5

Sources & Losses in the Littoral Cell

SOURCES	LOSSES
1. Rivers	1. Coos Bay
Umpqua	2. Dune Growth
Siuslaw	3. Headland Bypassing
2. Erosion	4. Offshore Transport
Dunes	5. Ocean Disposal
Terraces	
Seacliffs	
3. Headland Bypassing	
4. Onshore Transport	

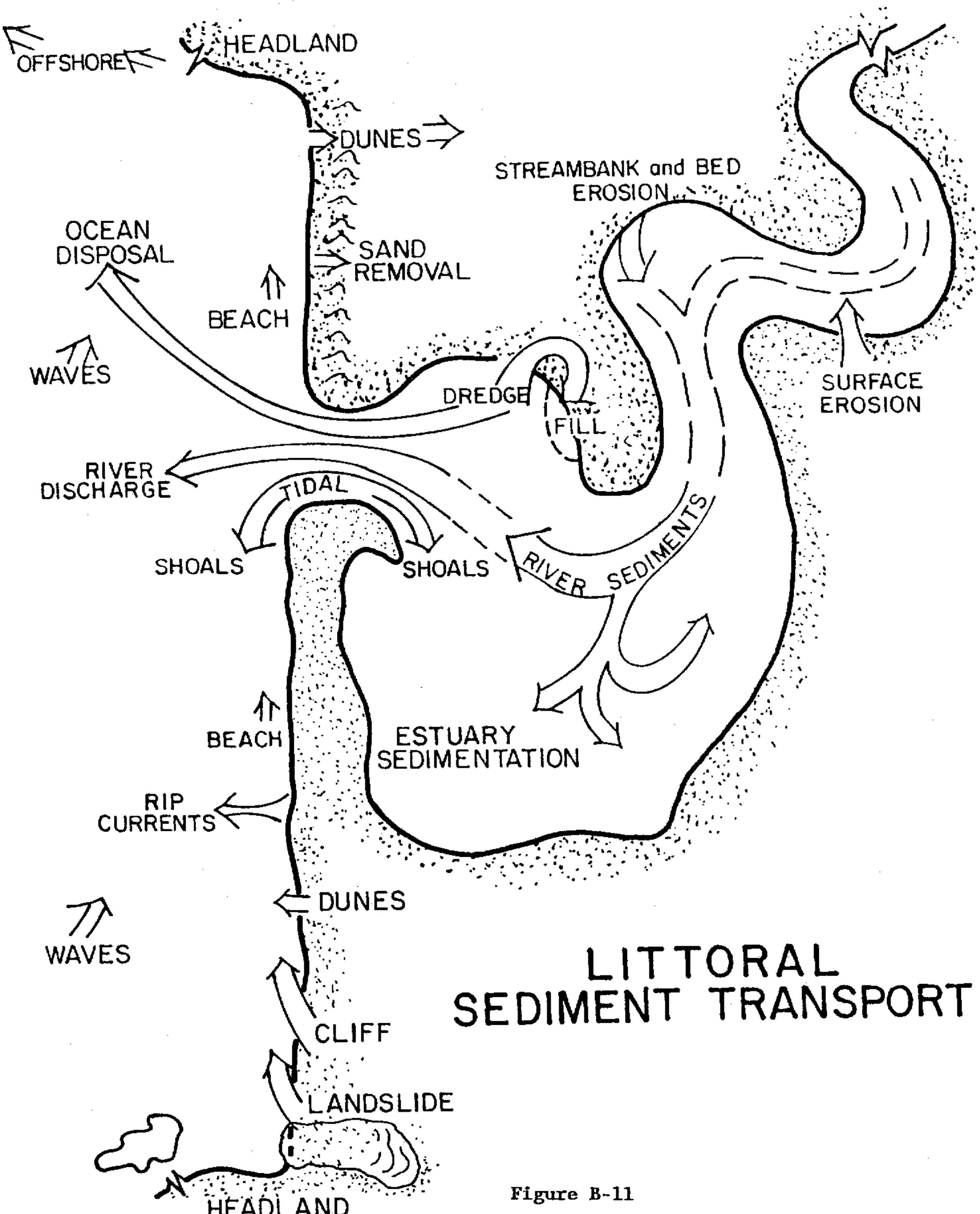


Figure B-11

Littoral System

Umpqua Sediment Transport

3.5 . Although the Umpqua 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 slight bias in transport to the south year-round, with some northward transport in summer only. This is also mentioned by Cooper (1958) as a factor causing the more massive sand dunes to occur south of the Umpqua. Peterson (personal communication) describes Umpqua sediment as dominant throughout the offshore indicating transport in both directions.

3.6 The OSU wave records were analysis for direction as well as period and significant height. The wave data and current data together with grain size and depth were used to compute a predicted sediment transport amount and direction. These were summed over the period of record and are shown on figure B-12. From 18-30 March, 1985, the predicted transport was 22 cubic meters to the north-northwest and 12 cubic meters to the south-southwest. From 28 March to 3 April, 1986, the predicted transport was 10 cubic meters to the southwest. Very little transport (0.5 cubic meters) occurred from 7-11 July, 1985 to the northwest. The length of vector, on figure B-12, is proportional to the quantity of transport.

3.7 Figure B-12 illustrates the probable sediment transport in the Umpqua ZSF. There is probably a net southward transport north of the jetties out over 30 foot depth which causes the entrance shoal at the north jetty. This southward transport shifts farther offshore south of the jetties, being influenced by the tidal discharges of the Umpqua River. Nearshore transport to the south is toward the south jetty. The interim disposal site is influenced by the tidal/river current, being inline with teh channel. The adjusted site, to the north, should be away from these southern trending currents. Consequently, any sediment transport from the adjusted site should be to the north or offshore.

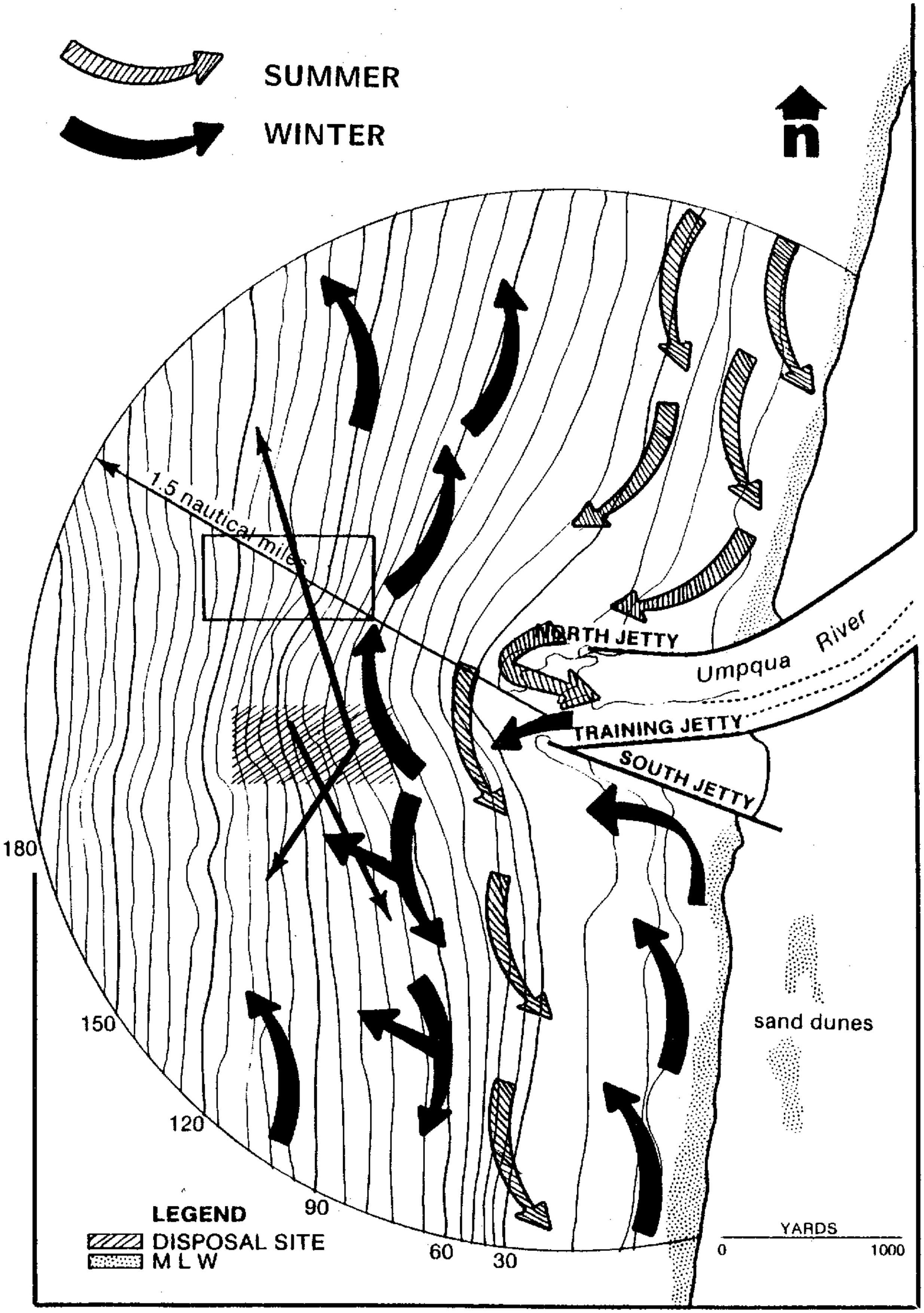


Figure B-12
Sediment Transport at Umpqua

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Appendix C

Sediment and Water Quality

APPENDIX C

Sediment and Water Quality

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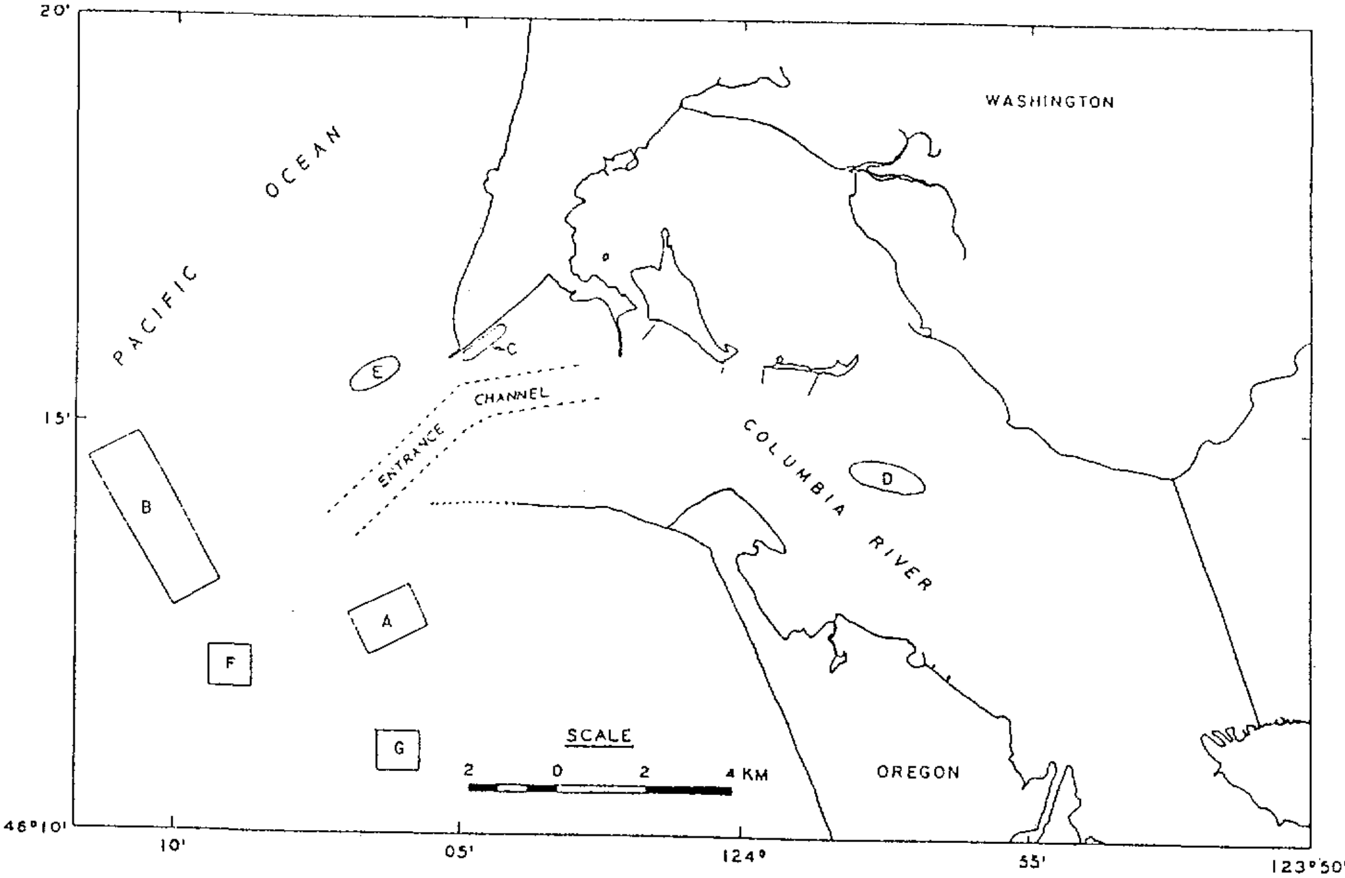
General

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 Umpqua are similar in grain size to those at the disposal site. Because of their coarse nature, similarity to ODMDS sediments, isolation from known existing or historical contaminant sources, and the presence of strong hydraulic regimes, 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 navigation channel sands and fines in the Umpqua estuary, however, and are presented in this appendix. Also, some chemical tests have been run in the past and are 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. If fine sediments are ocean disposed at Umpqua, 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).



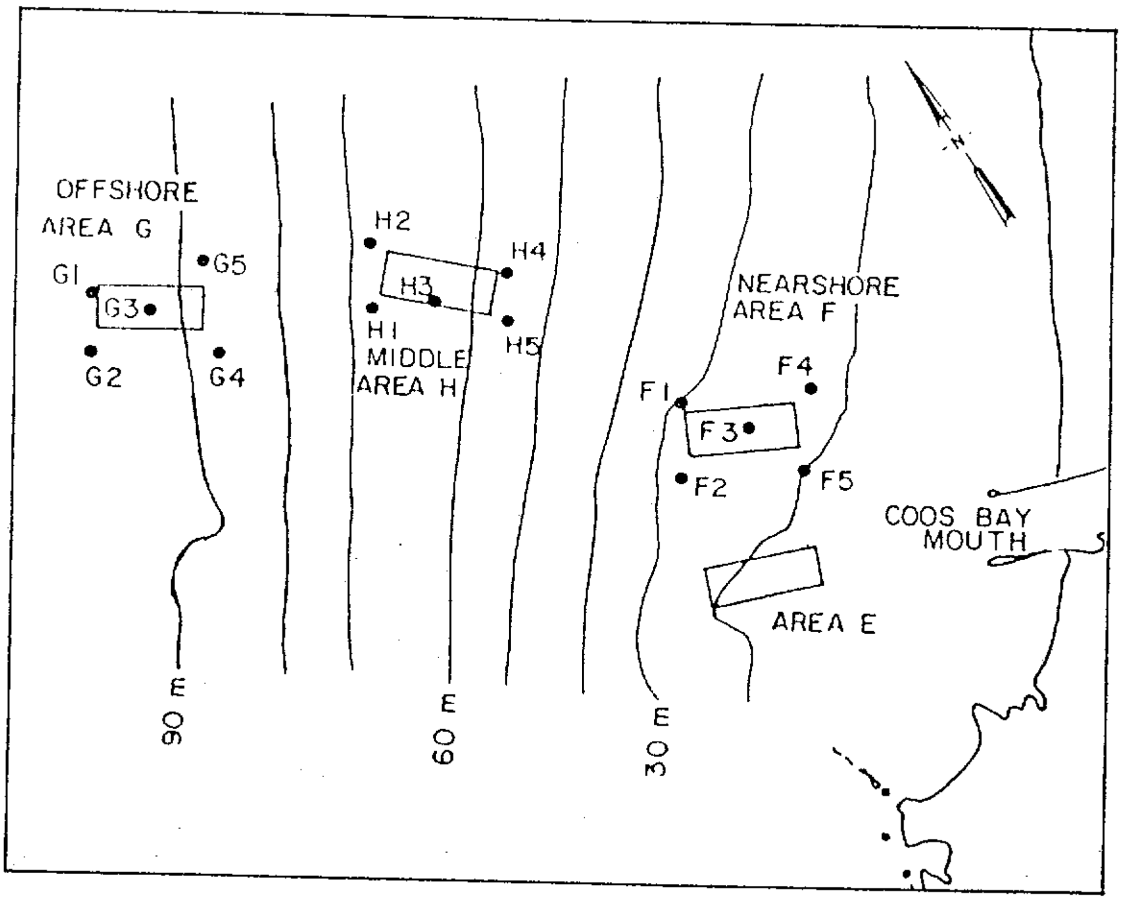
Columbia River entrance channel and ODMDS, including experimental disposal site G (From Boone et al. 1978).

Figure C-1
Columbia River Entrance Channel and ODMDS

1.3 Monitoring results 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 elevation of toxic heavy metals, including Cu, Zn, Cd, and Pb, with some nontoxic elevation 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 elevations 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 area G. They 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.

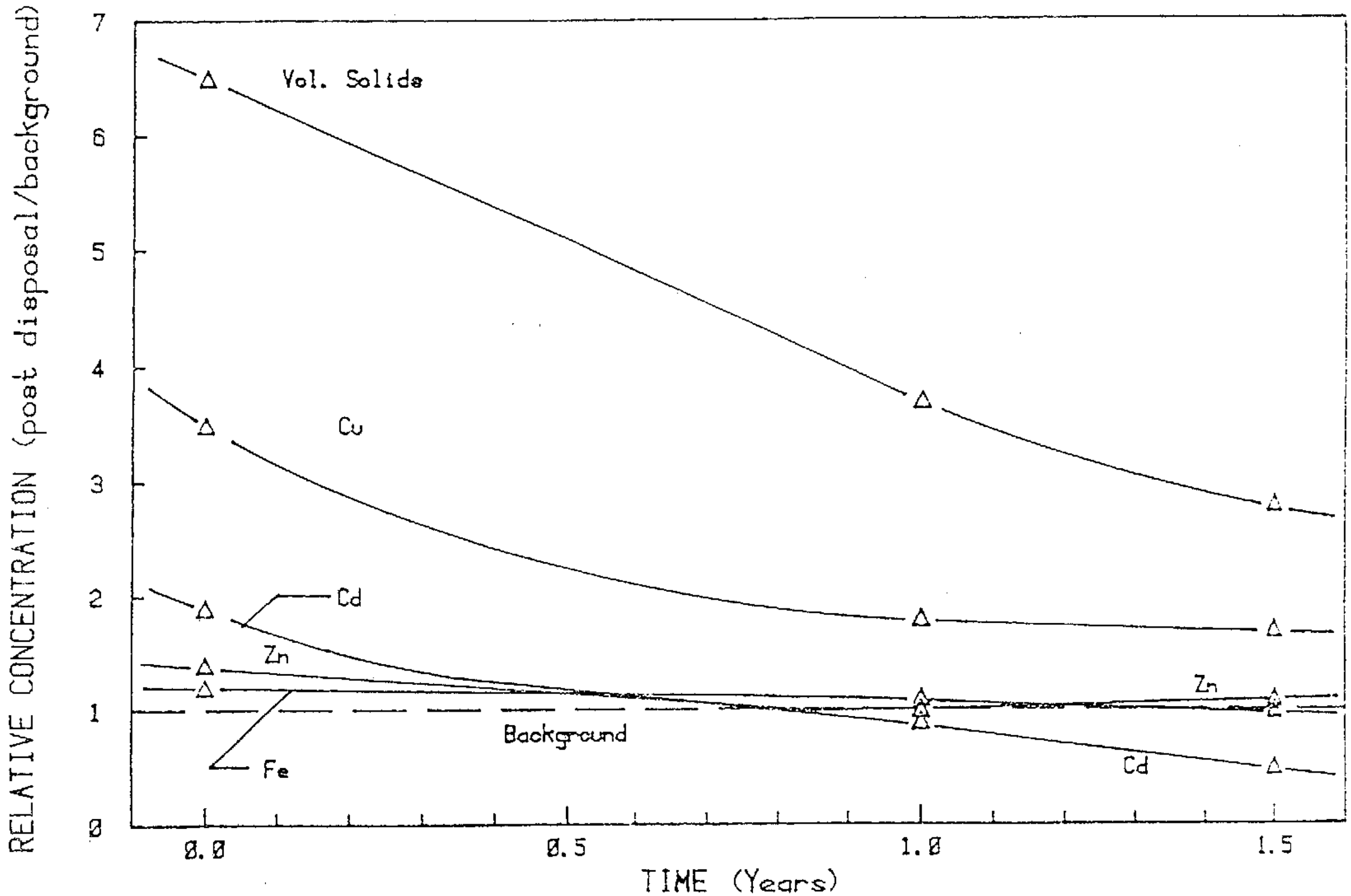
1.4 An evaluation of areas offshore of Coos Bay was conducted under Corps contract by Oregon State University researchers persuant to designation of a new ODMDS for fine grain sediments from upper Coos Bay and Isthmus Slough (Hancock et al. 1984, Nelson et al. 1984, Sollitt et al. 1984, U.S.A.C.E. Portland 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. Elevations in ammonia, Cu, and Mn were observed during disposal that in some cases were at the threshold of acute toxicity. However, these elevations were of short duration. No substantial elevations of other



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



Coos Bay ODMDS: Recovery of selected sediment chemical parameters at disposal site-samples containing dredged materials (From Sollitt et al. 1984).

Figure C-3

Coos Bay ODMDS: Recovery of Selected Sediment Chemical Parameters at Disposal Site-Samples Containing Dredged Material 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 was found to be the most sensitive and reproducible indicator of levels of contaminants and its use was suggested as a montoring tool to utilize during further disposal operations at site H.

Sediment and Water Quality of Umpqua Sands

2.1 Sediment samples from the main channel of the Umpqua Federal navigation project were collected by the Portland District, Corps of Engineers in October of 1980 as part of a coastal evaluation of authorized federal navigation channels. The offshore disposal site at Umpqua was sampled in January, 1985. Locations of these sampling stations are given in figure C-4 and table C-1.

2.2 Physical sediment, bulk sediment, and elutriate analyses were performed on the samples for several organic and inorganic parameters. Details of the sampling, lab analysis and procedures can be found in U.S. Geological Survey open file report 82-922. A summary of results of tests from that publication appears in the following sections.

2.3 Basic water quality parameters were taken in the field during collections of sediment samples. Results of the field measurements, collected with an automated multi-parameter water quality analyzer, are given in table C-2. Measurements reported in the table were taken at Umpqua River mile (RM) 0.0, which is immediately inshore of the disposal site. The water quality parameters fall within the normal ranges expected for near shore ocean waters off the Oregon Coast.

2.4 Dredged materials deposited at the ODMDS come from the entrance bar, entrance to the Winchester boat basin, and in the main river channel up to RM 11. The grain size distribution curves for Umpqua River sediments from these areas show well-sorted fine sands with median grain sizes between 0.2 and 0.3 mm (figures C-5 - C-7). Disposal site sediments are also well-sorted fine sands with median grain size approximately 0.3 mm (figures C-8 and C-9). Thus, Umpqua dredged sediments are very similar to sediments at the ODMDS.

2.5 The percentage of volatile solids in the Umpqua River channel (table C-3) are within the range exhibited by offshore sediments. The percentages of volatile solids in the disposal site sediment samples, however, are all less than 0.8 (table C-4), which are less than those in reference transects (table C-5). The difference in volatile solids is probably related to the coarser grain size of the sediments at the disposal site and those dredged from the channel.

Table C-1

Location of Sampling Sites at Umpqua

Site No.	Site Designation	Collection Date	Site Location Latitude	Site Location Longitude	Remarks
1	Umpqua RM 0.0	10-29-80	43 40'09"	124 12'11"	
2	Winchester Bay	10-28-80	43 40'58"	124 11'02"	mouth/boat basin.
3	Umpqua RM 2.4	do.	43 41'31"	124 10'15"	
4	do. 2.6	do.	43 41'38"	124 10'00"	
5	do. 2.8	do.	43 41'45"	124 09'49"	

Table C-2

Water Quality Data , Umpqua River

River Mile Parameter	0.0	0.0
Depth	S	B
Dissolved Oxygen (mg/l)	10.32	*
Conductivity (mmho/cm)	53.3	53.6
Salinity (g/l)	35.2	35.4
ORP	207	207
Temperature (C)	12.7	12.7
pH	8.01	8.02
Turbidity (ntu)	0.7	0.4
Time	1022	1027
Fathometer reading		45

2.6 Sediments from both the channel and the disposal site are similar to those from reference areas (figures C-10 - C-15). Sediment and elutriate analyses showed sediments dredged from the channel to be clean sand, well within the background range expected at Umpqua (tables C-4 - C-7). Therefore, there should be no problem with designation of the offshore site for continued disposal of these sediments.

Table C-3
Volatile Solids in Dredged Material

Sample #	Date	Location	% Volatile Solids
2	Oct 1980	mouth of boat basin	1.44
3	Oct 1980	R.M. 2.4	1.37
5	Oct 1980	R.M. 2.8	1.73

Table C-4
Volatile Solids in Disposal Site

Sample #	Date	% Volatile Solids
U-2-1	Jan 1985	0.6
U-2-2	Jan 1985	0.7
U-2-3	Jan 1985	0.4
U-2-4	Jan 1985	0.7
U-2-5	Jan 1985	0.8
U-2-6	Jan 1985	0.7

Table C-5
Volatile Solids in Reference Transects

Sample #	Date	% Volatile Solids
UR-1	Jan 1985	1.1
UR-2	Jan 1985	1.4
UR-3	Jan 1985	1.5
UR-4	Jan 1985	1.0
UR-5	Jan 1985	1.3
UR-6	Jan 1985	1.3
U-1-1	Jan 1985	1.5
U-1-2	Jan 1985	1.4
U-1-3	Jan 1985	1.2
U-1-4	Jan 1985	1.3
U-1-5	Jan 1985	2.2
U-1-6	Jan 1985	1.2
U-3-1	Jan 1985	1.1
U-3-2	Jan 1985	1.0
U-3-3	Jan 1985	1.3
U-3-4	Jan 1985	1.2
U-3-5	Jan 1985	1.3
U-3-6	Jan 1985	1.3

Table C-6

Dissolved Chemicals in Native Water and Elutriates

[FOR TYPE OF SAMPLE, REFER TO CODES: NE-NATIVE ESTUARINE WATER, NH-NATIVE EURYHALINE WATER, NF-NATIVE FRESH WATER, EE-ELUTRIATE WITH ESTUARINE WATER, EH- ELUTRIATE WITH EURYHALINE WATER, EF-ELUTRIATE WITH FRESH WATER, BM-BOTTOM MATERIAL. THE NUMBER FOLLOWING THE TWO DIGIT CODE INDICATES: FOR NATIVE WATER SAMPLES, THE NUMBER OF SAMPLES ANALYZED AND FOR ELUTRIATES, THE RESPECTIVE MIXING WATER. VALUES = '--' INDICATE THAT A CHEMICAL ANALYSES HAS NOT BEEN MADE.]

SITE NO.	SITE DESCRIPTION	CODE	DATE	CADMIUM (UG/L AS CD)	CHROMIUM (UG/L AS CR)	COPPER (UG/L AS CU)	IRON (UG/L AS FE)	LEAD (UG/L AS PB)	MANGANESE (UG/L AS MN)	MERCURY (UG/L AS HG)	ZINC (UG/L AS ZN)	CARBON, ORGANIC (MG/L AS C)	NITROGEN, AMMONIA (MG/L AS N)
1	UMPQUA RM 0.0	NE1	10/29/80	3	<1	5	120	2	30	<0.1	30	2.4	--
9	UMPQUA RM 7.8	NE2	10/30/80	2	<1	3	50	1	30	<0.1	20	2.4	--
2	WINCHESTER BAY	EE1	10/28/80	2	<1	5	160	2	220	0.1	40	7.6	1
3	UMPQUA RM 2.4	EE1	10/28/80	1	<1	3	170	<1	60	<0.1	20	11.0	0.9
4	UMPQUA RM 2.6	EE1	10/28/80	3	<1	3	170	2	30	<0.1	30	5.3	0.09
5	UMPQUA RM 2.8	EE1	10/28/80	1	<1	3	170	3	20	<0.1	30	3.3	0.26
6	UMPQUA RM 5.2	EE2	10/28/80	<1	1	3	90	3	190	<0.1	40	2.7	--
6	UMPQUA RM 5.2	EE1	10/28/80	3	10	3	200	2	240	<0.1	50	3.4	--
7	UMPQUA RM 6.4	EE2	10/28/80	1	3	2	60	4	110	<0.1	20	5.9	0.1
8	UMPQUA RM 6.5	EE2	10/29/80	1	2	2	60	4	70	<0.1	20	2.0	0.08
8	UMPQUA RM 6.5	EE1	10/29/80	1	2	2	120	1	130	<0.1	30	1.7	0.04
9	UMPQUA RM 7.8	EE2	10/29/80	1	1	2	100	1	670	<0.1	20	6.4	--
9	UMPQUA RM 7.8	EE1	10/29/80	1	2	3	280	<1	910	<0.1	40	5.1	--
10	UMPQUA RM 8.1	EE2	10/30/80	3	2	3	50	3	130	<0.1	30	2.8	0.22
11	UMPQUA RM 8.7	EE2	10/30/80	--	40	2	60	<1	90	<0.1	30	2.5	0.07
12	UMPQUA RM 9.1	EE2	10/29/80	--	2	2	60	2	1500	<0.1	30	3.9	2.4
13	UMPQUA RM 9.6	EE2	10/30/80	1	1	1	70	2	180	<0.1	20	3.6	--
14	UMPQUA RM 10.5	EE2	10/30/80	3	3	6	60	<1	220	<0.1	30	2.0	--
15	UMPQUA RM 11.4	EE2	10/30/80	2	3	4	50	4	180	<0.1	20	2.0	0.37
15	UMPQUA RM 11.4	EE1	10/30/80	2	3	3	110	4	120	<0.1	30	2.8	0.03

Table C-7

Dissolved Insecticides and Herbicides in Native Water and Elutriates

[FOR TYPE OF SAMPLE, REFER TO CODES: NE-NATIVE ESTUARINE WATER, NH-NATIVE EURYHALINE WATER, NF-NATIVE FRESH WATER, EE-ELUTRIATE WITH ESTUARINE WATER, EH- ELUTRIATE WITH EURYHALINE WATER, EF-ELUTRIATE WITH FRESH WATER, BM-BOTTOM MATERIAL. THE NUMBER FOLLOWING THE TWO DIGIT CODE INDICATES: FOR NATIVE WATER SAMPLES, THE NUMBER OF SAMPLES ANALYZED AND FOR ELUTRIATES, THE RESPECTIVE MIXING WATER. VALUES = '--' INDICATE THAT A CHEMICAL ANALYSES HAS NOT BEEN MADE.]

SITE NO.	SITE DESCRIPTION	CODE	DATE	ALDRIN (UG/L)	AME-TRYNE (UG/L)	ATRA-TONE (UG/L)	ATRA-ZINE (UG/L)	CHLOR-DANE (UG/L)	CYAN-AZINE (UG/L)	CYPRA-ZINE (UG/L)	DDD (UG/L)	DDE (UG/L)	DDT (UG/L)	DI-ELDRIN (UG/L)	ENDO-SULFAN (UG/L)
1	UMPQUA RM 0.0	NE1	10/29/80	<.01	<.1	<.1	<.1	<.1	<.1	<.1	<.01	<.01	<.01	<.01	<.01
9	UMPQUA RM 7.8	NE2	10/30/80	<.01	<.1	<.1	<.1	<.1	<.1	<.1	<.01	<.01	<.01	<.01	<.01
2	WINCHESTER BAY	EE1	10/28/80	--	<.1	<.1	<.1	--	<.1	<.1	--	--	--	--	--
6	UMPQUA RM 5.2	EE2	10/28/80	<.01	<.1	<.1	<.1	<.1	<.1	<.1	<.01	<.01	<.01	<.01	<.01
6	UMPQUA RM 5.2	EE1	10/28/80	<.01	<.1	<.1	<.1	<.1	<.1	<.1	<.01	<.01	<.01	<.01	<.01
8	UMPQUA RM 6.5	EE2	10/29/80	<.01	<.1	<.1	<.1	<.1	<.1	<.1	<.01	<.01	<.01	<.01	<.01
8	UMPQUA RM 6.5	EE1	10/29/80	<.01	<.1	<.1	<.1	<.1	<.1	<.1	<.01	<.01	<.01	<.01	<.01
9	UMPQUA RM 7.8	EE2	10/29/80	<.01	<.1	<.1	<.1	<.1	<.1	<.1	<.01	<.01	<.01	<.01	<.01
9	UMPQUA RM 7.8	EE1	10/29/80	<.01	<.1	<.1	<.1	<.1	<.1	<.1	<.01	<.01	<.01	<.01	<.01

SITE NO.	SITE DESCRIPTION	CODE	ENDRIN (UG/L)	HEPTA-CHLOR (UG/L)	HEPTA-CHLOR EPOXIDE (UG/L)	LINDANE (UG/L)	METH-OXY-CHLOR (UG/L)	MIREX (UG/L)	PCB (UG/L)	NAPH-THA-LENES, POLY-CHLOR. (UG/L)	PER-THANE (UG/L)	PROME-TONE (UG/L)	PROME-TRYNE (UG/L)	PRO-PAZINE (UG/L)
1	UMPQUA RM 0.0	NE1	<.01	<.01	<.01	<.01	<.01	<.01	<.1	<.1	<.1	<.1	<.1	<.1
9	UMPQUA RM 7.8	NE2	<.01	<.01	<.01	<.01	<.01	<.01	<.1	<.1	<.1	<.1	<.1	<.1
2	WINCHESTER BAY	EE1	--	--	--	--	--	--	--	--	--	<.1	<.1	<.1
6	UMPQUA RM 5.2	EE2	<.01	<.01	<.01	<.01	<.01	<.01	<.1	<.1	<.1	<.1	<.1	<.1
6	UMPQUA RM 5.2	EE1	<.01	<.01	<.01	<.01	<.01	<.01	<.1	<.1	<.1	<.1	<.1	<.1
8	UMPQUA RM 6.5	EE2	<.01	<.01	<.01	<.01	<.01	<.01	<.1	<.1	<.1	<.1	<.1	<.1
8	UMPQUA RM 6.5	EE1	<.01	<.01	<.01	<.01	<.01	<.01	<.1	<.1	<.1	<.1	<.1	<.1
9	UMPQUA RM 7.8	EE2	<.01	<.01	<.01	<.01	<.01	<.01	<.1	<.1	<.1	<.1	<.1	<.1
9	UMPQUA RM 7.8	EE1	<.01	<.01	<.01	<.01	<.01	<.01	<.1	<.1	<.1	<.1	<.1	<.1

Table C-8

Total Recoverable Chemicals in Bottom Material

[FOR TYPE OF SAMPLE, REFER TO CODES: NE-NATIVE ESTUARINE WATER, NH-NATIVE EURYHALINE WATER, NF-NATIVE FRESH WATER, EE-ELUTRIATE WITH ESTUARINE WATER, EH- ELUTRIATE WITH EURYHALINE WATER, EF-ELUTRIATE WITH FRESH WATER, BM-BOTTOM MATERIAL. THE NUMBER FOLLOWING THE TWO DIGIT CODE INDICATES: FOR NATIVE WATER SAMPLES, THE NUMBER OF SAMPLES ANALYZED AND FOR ELUTRIATES, THE RESPECTIVE MIXING WATER. VALUES = '--' INDICATE THAT A CHEMICAL ANALYSES HAS NOT BEEN MADE.]

SITE NO.	SITE DESCRIPTION	CODE	DATE	ARSENIC (UG/G)	BARIUM (UG/G)	BERYLLIUM (UG/G)	CADMIUM (UG/G)	CHROMIUM (UG/G)	COPPER (UG/G)	CYANIDE (UG/G)	IRON (UG/G)	LEAD (UG/G)	MANGANESE (UG/G)	MERCURY (UG/G)
6	UMPQUA RM 5.2	BM	10/28/80	4	5	<1	<1	13	7	<0.5	7700	10	110	0.05
8	UMPQUA RM 6.5	BM	10/29/80	4	5	<1	<1	15	8	<0.5	9100	10	99	0.02
9	UMPQUA RM 7.8	BM	10/29/80	3	10	<1	<1	13	8	<0.5	7500	10	61	0.03
11	UMPQUA RM 8.7	BM	10/30/80	2	10	<1	<1	18	10	<0.5	13000	10	110	0.03
12	UMPQUA RM 9.1	BM	10/29/80	4	10	<1	<1	15	8	<0.5	9200	10	200	0.04
15	UMPQUA RM 11.4	BM	10/30/80	4	10	<1	1	13	10	<0.5	7300	<10	130	0.03

SITE NO.	SITE DESCRIPTION	CODE	NICKEL (UG/G)	ZINC (UG/G)	CARBON, INORGANIC (G/KG)	CARBON, INORG + ORGANIC (G/KG)	NITROGEN, NH4 (MG/KG) AS N	NITROGEN, NH4 + ORG. (MG/KG) AS N	PHOSPHORUS (MG/KG)
6	UMPQUA RM 5.2	BM	20	22	0.0	2	6	160	370
8	UMPQUA RM 6.5	BM	20	23	0.1	2	2	117	410
9	UMPQUA RM 7.8	BM	20	22	0.0	7	20	300	340
11	UMPQUA RM 8.7	BM	20	26	0.0	3	4	130	410
12	UMPQUA RM 9.1	BM	20	24	0.0	4	19	210	420
15	UMPQUA RM 11.4	BM	20	21	0.0	1	2	110	440

Table C-9

Total Recoverable Insecticides and Herbicides in Bottom Material

[FOR TYPE OF SAMPLE, REFER TO CODES: NE-NATIVE ESTUARINE WATER, NH-NATIVE EURYHALINE WATER, NF-NATIVE FRESH WATER, EE-ELUTRIATE WITH ESTUARINE WATER, EH- ELUTRIATE WITH EURYHALINE WATER, EF-ELUTRIATE WITH FRESH WATER, BM-BOTTOM MATERIAL. THE NUMBER FOLLOWING THE TWO DIGIT CODE INDICATES: FOR NATIVE WATER SAMPLES, THE NUMBER OF SAMPLES ANALYZED AND FOR ELUTRIATES, THE RESPECTIVE MIXING WATER. VALUES = '--' INDICATE THAT A CHEMICAL ANALYSES HAS NOT BEEN MADE.]

SITE NO.	SITE DESCRIPTION	CODE	DATE	ALDRIN (UG/KG)	CHLORDANE (UG/KG)	DDD (UG/KG)	DDE (UG/KG)	DDT (UG/KG)	DIELDRIN (UG/KG)	ENDOSULFAN (UG/KG)	ENDRIN (UG/KG)	HEPTACHLOR (UG/KG)	HEPTACHLOR EPOXIDE (UG/KG)	LINDANE (UG/KG)
6	UMPQUA RM 5.2	BM	10/28/80	<.1	<1	0.1	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
8	UMPQUA RM 6.5	BM	10/29/80	<.1	<1	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
9	UMPQUA RM 7.8	BM	10/29/80	<.1	<1	0.2	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
11	UMPQUA RM 8.7	BM	10/30/80	<.1	<1	0.3	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
12	UMPQUA RM 9.1	BM	10/29/80	<.1	<1	0.2	0.1	0.3	<.1	<.1	<.1	<.1	<.1	<.1
15	UMPQUA RM 11.4	BM	10/30/80	<.1	<1	0.1	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1

SITE NO.	SITE DESCRIPTION	CODE	METHOXYCHLOR (UG/KG)	MIREX (UG/KG)	PCB (UG/KG)	PCN (UG/KG)	PERTHANE (UG/KG)	SILVEX (UG/KG)	TOXAPHENE (UG/KG)	2,4-D (UG/KG)	2,4,5-T (UG/KG)	2,4-DP (UG/KG)
6	UMPQUA RM 5.2	BM	<.1	<.1	<1	<1	<1	<.1	<1	<.1	<.1	<.1
8	UMPQUA RM 6.5	BM	<.1	<.1	<1	<1	<1	<.1	<1	<.1	<.1	<.1
9	UMPQUA RM 7.8	BM	<.1	<.1	--	--	<1	<.1	<1	<.1	<.1	<.1
11	UMPQUA RM 8.7	BM	<.1	<.1	<1	<1	<1	<.1	<1	<.1	<.1	<.1
12	UMPQUA RM 9.1	BM	<.1	<.1	<1	<1	<1	<.1	<1	<.1	<.1	<.1
15	UMPQUA RM 11.4	BM	<.1	<.1	<1	<1	<1	<.1	<1	<.1	<.1	<.1

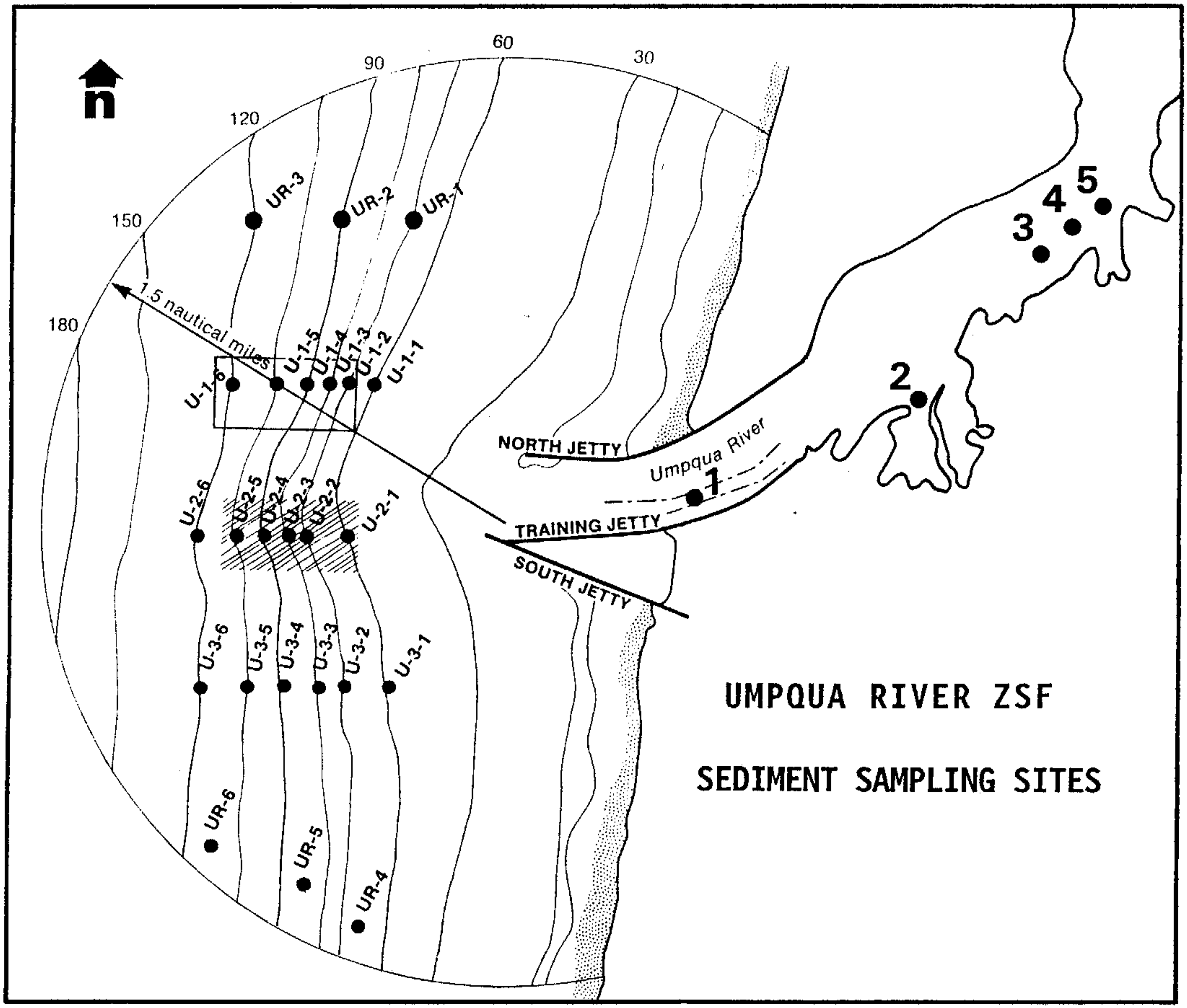


Figure C-4
Sample Site Locations

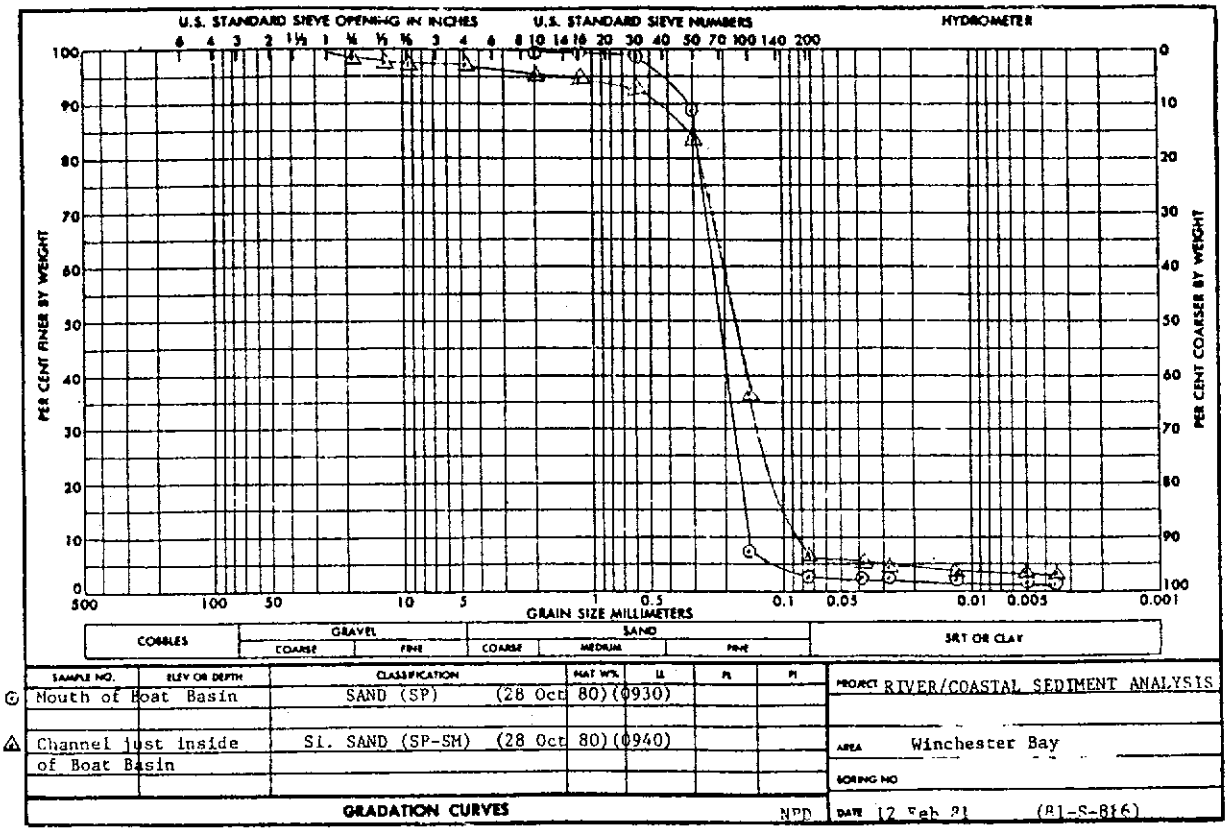


Figure C-5

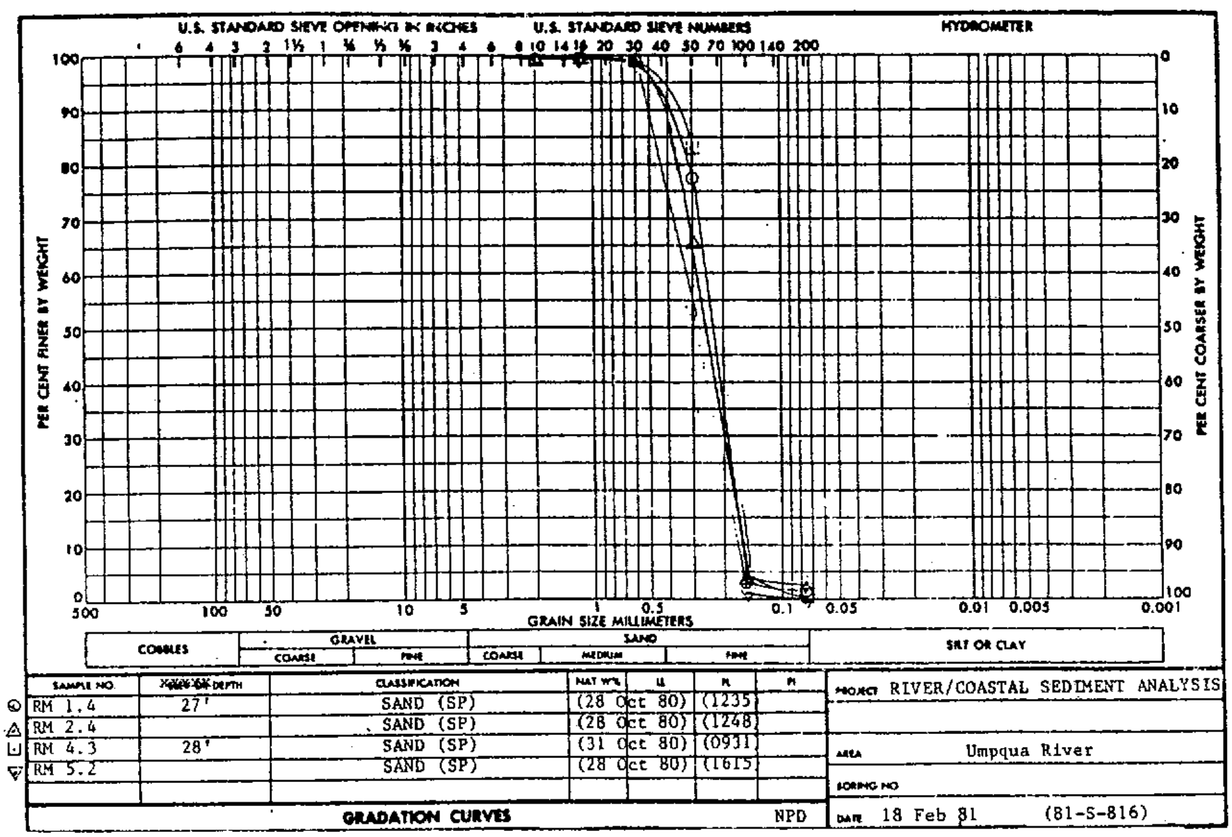
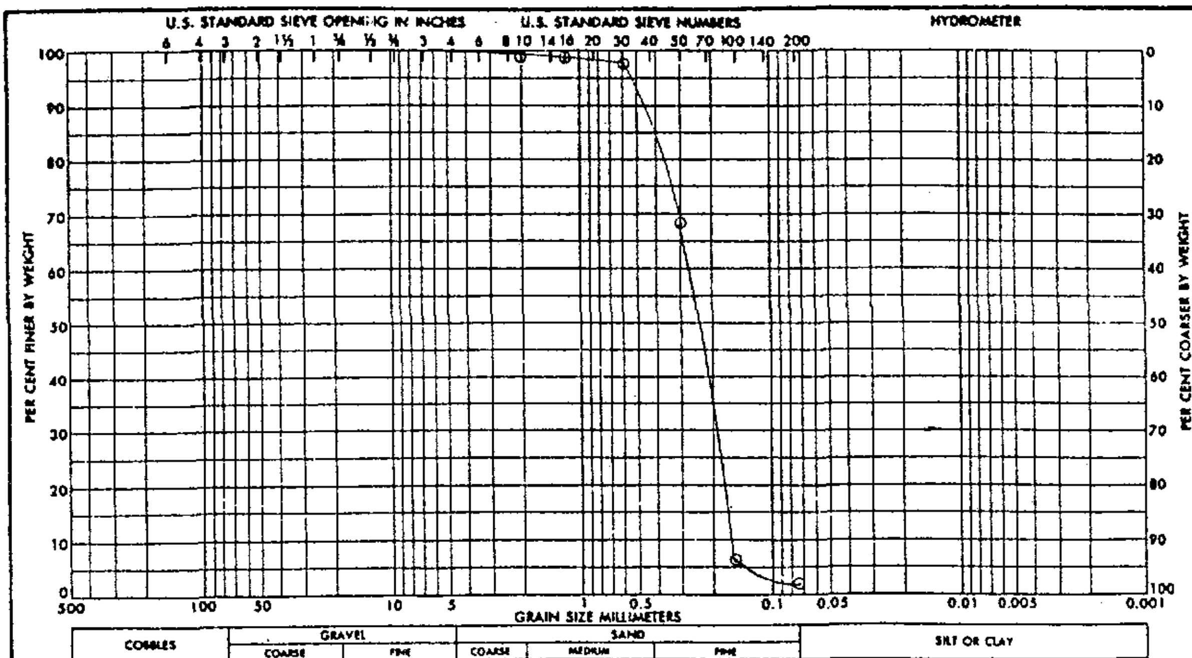


Figure C-6

Gradation Curves



SAMPLE NO.	[illegible]	CLASSIFICATION	NAT W%	LL	PL	PI
RM 2.8	28 Oct 80	SAND (SP)				

GRADATION CURVES NPD

PROJECT RIVER/COASTAL SEDIMENT ANALYSIS

U.S.G.S.

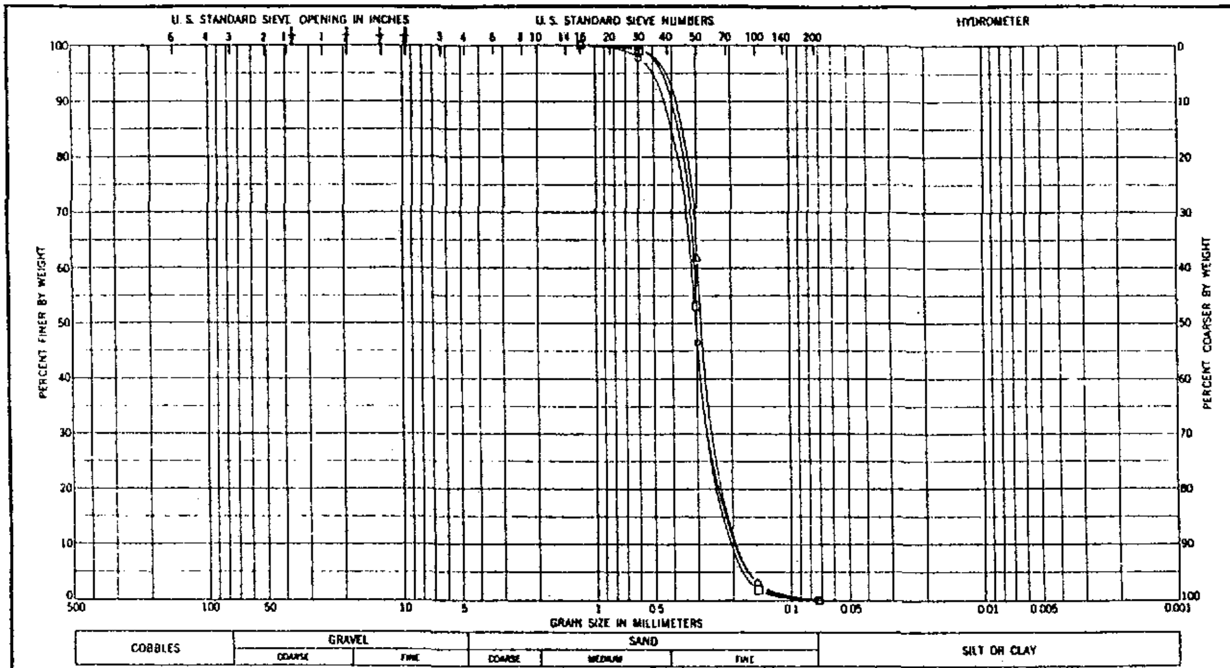
AREA Umpqua River

BORING NO.

DATE 28 Jan 81 (81-S-816)

Figure C-7

Gradation Curve

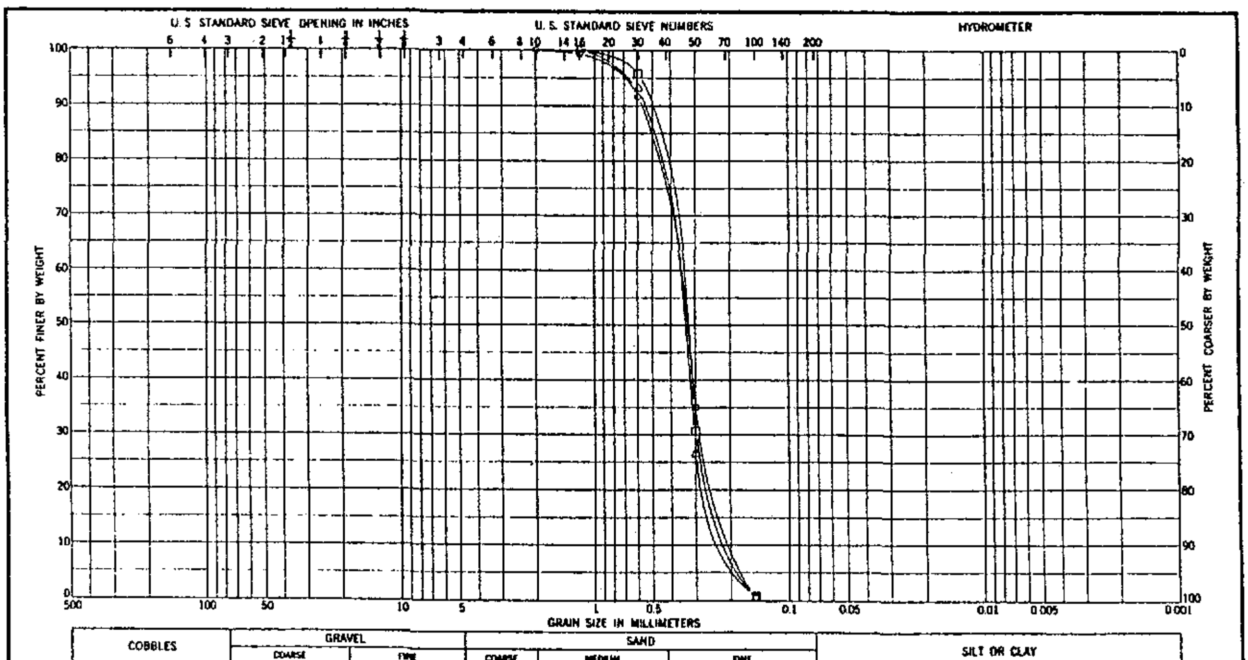


Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
				Volatile Solids, %		
U-2-1	o	Poorly Graded SAND (SP)		0.6		
U-2-2	Δ	Poorly Graded SAND (SP)		0.7		
U-2-3	□	Poorly Graded SAND (SP)		0.4		

Project: GENERIC OCEAN DISPOSAL SITES
Area: Umpqua
Boring No: Sampled 27 Jan 85
Date: MAY 8 [illegible] (85-SH-730)

GRADATION CURVES NPD

Figure C-8



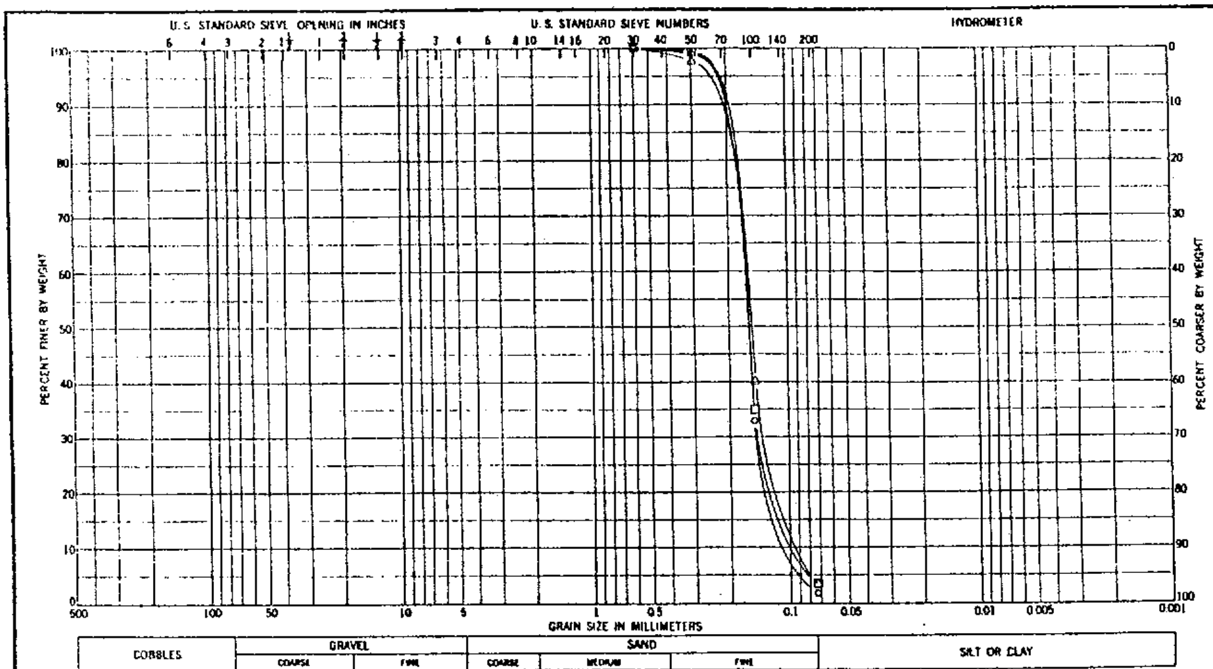
Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
				Volatile Solids, %		
U-2-4	o	Poorly Graded SAND (SP)		0.7		
U-2-5	Δ	Poorly Graded SAND (SP)		0.8		
U-2-6	□	Poorly Graded SAND (SP)		0.7		

Project: GENERIC OCEAN DISPOSAL
Area: Umpqua
Boring No: Sampled 27 Jan 85
Date: MAY 8 [illegible] (85-SH-730)

GRADATION CURVES NPD

Figure C-9

Gradation Curves

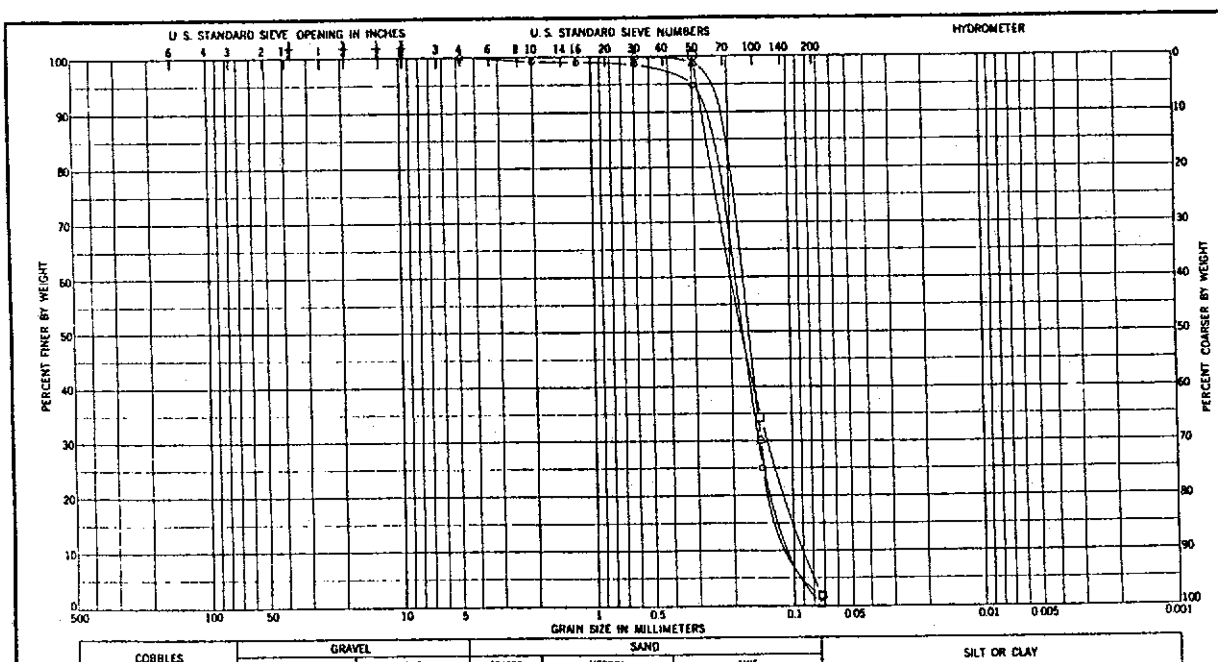


Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids,%			
UR-1	o	Fine SAND (SP)		1.1		
UR-2	Δ	Fine SAND (SP)		1.4		
UR-3	□	Fine SAND (SP)		1.5		

GRADATION CURVES NPD

Project GENERIC OCEAN DISPOSAL SITES
Area Umpqua
Boring No. Sampled 27 Jan 85
Date MAY 8 1985 (85-SH-730)

Figure C-10



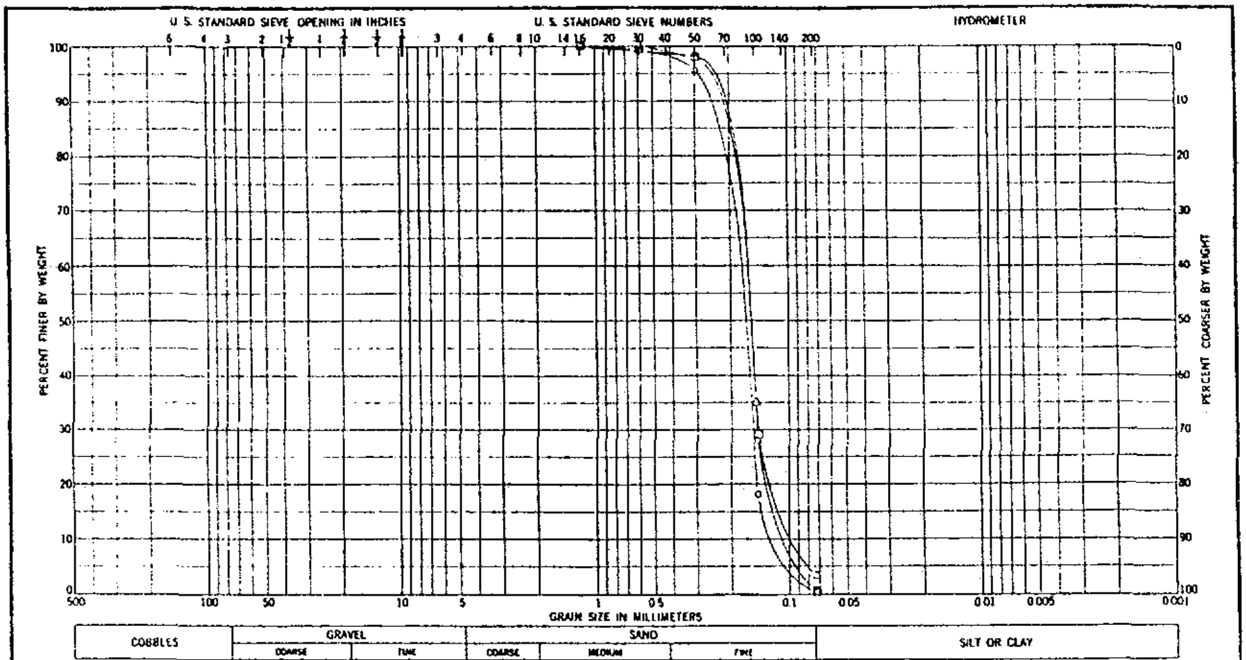
Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids,%			
UR-4	o	Fine SAND (SP)		1.0		
UR-5	Δ	Fine SAND (SP)		1.3		
UR-6	□	Fine SAND (SP)		1.3		

GRADATION CURVES NPD

Project GENERIC OCEAN DISPOSAL SITES
Area Umpqua
Boring No. Sampled 27 Jan 85
Date MAY 8 1985 (85-SH-730)

Figure C-11

Gradation Curves

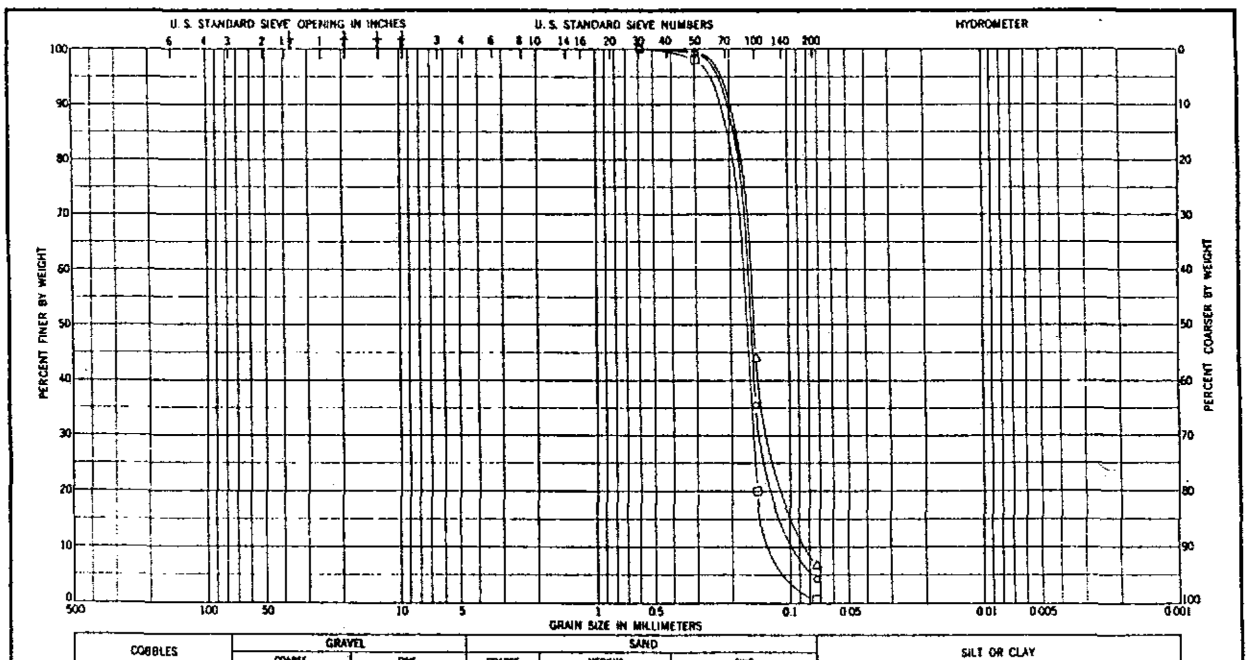


Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids, %			
U-1-1	○	Fine SAND (SP)		1.5		
U-1-2	△	Fine SAND (SP)		1.4		
U-1-3	□	Fine SAND (SP)		1.2		

GRADATION CURVES NPD

Project GENERIC OCEAN DISPOSAL SITES
Area Umpqua
Boring No. Sampled 27 Jan 85
Date MAY 8 [illegible] (85-SH-730)

Figure C-12



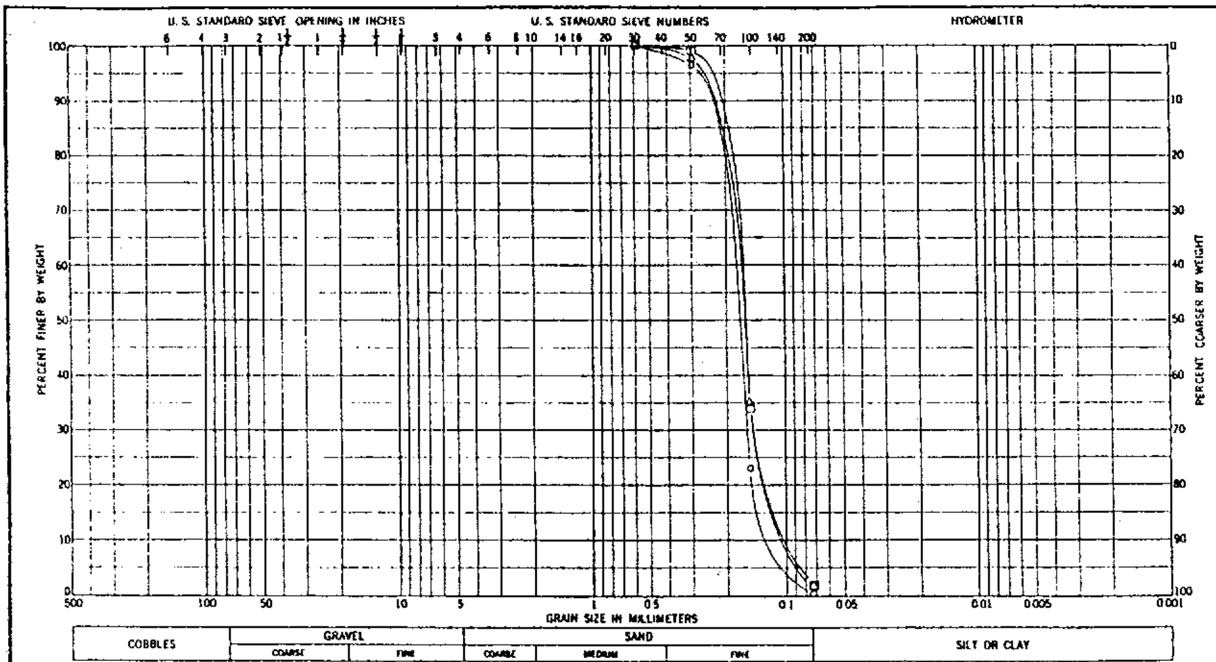
Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids, %			
U-1-4	○	Fine SAND (SP)		1.3		
U-1-5	△	Silty Fine SAND (SP-SM)		2.2		
U-1-6	□	Fine SAND (SP)		1.4		

GRADATION CURVES NPD

Project GENERIC OCEAN DISPOSAL SITES
Area Umpqua
Boring No. Sampled 27 Jan 85
Date MAY 8 [illegible] (85-SH-730)

Figure C-13

Gradation Curves



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids, %			
U-3-1	o	Fine SAND (SP)		1.1		
U-3-2	△	Fine SAND (SP)		1.0		
U-3-3	□	Fine SAND (SP)		1.3		

Project GENERIC OCEAN DISPOSAL SITES

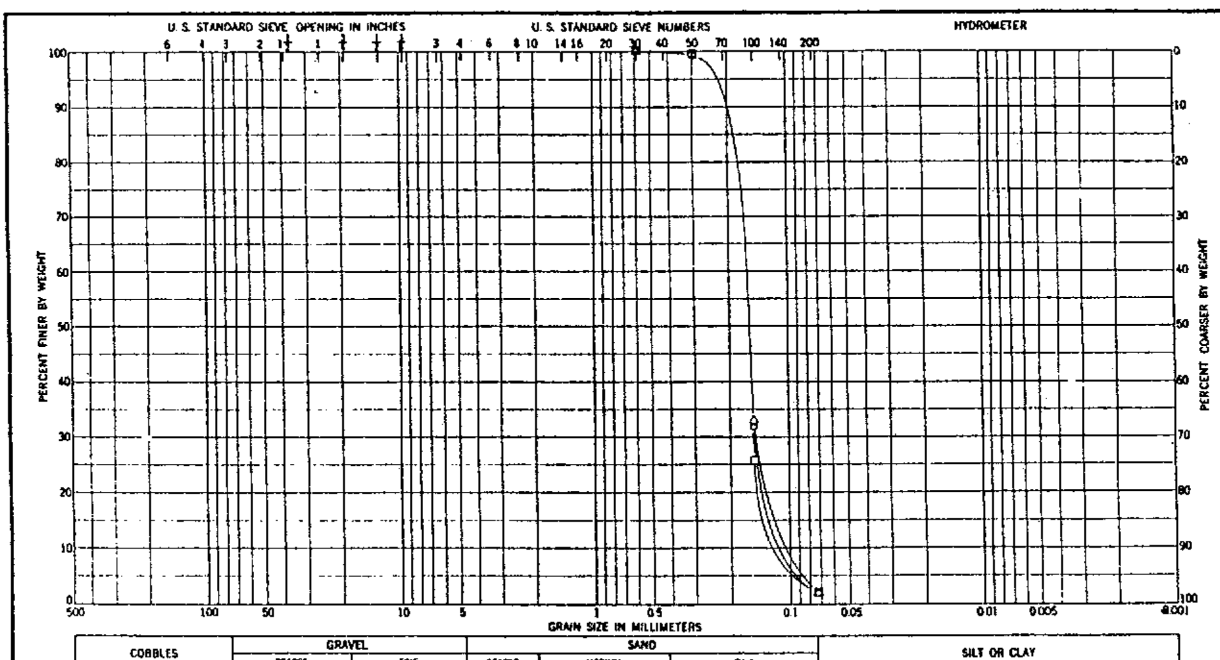
Area Umpqua

Boring No. Sampled 27 Jan 85

Date MAY 8 1985 (85-SH-730)

GRADATION CURVES NPD

Figure C-14



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
			Volatile Solids, %			
U-3-4	o	Fine SAND (SP)		1.2		
U-3-5	△	Fine SAND (SP)		1.3		
U-3-6	□	Fine SAND (SP)		1.3		

Project GENERIC OCEAN DISPOSAL SITES

Area Umpqua

Boring No. Sampled 27 Jan 85

Date MAY 8 [illegible] (85-SH-730)

GRADATION CURVES NPD

Figure C-15

Gradation Curves

Quality of Fine Sediments

3.1 Fine sediments from the Federal portion of the Winchester Bay boat basin navigation channel have undergone both biological (Ecological Analysts, Inc. 1981) and chemical (USACE Portland District, unpublished data 1987) testing to evaluate potential for toxicity effects at the ODMDS. Test results are described below.

Bioassays

3.2 Liquid, suspended particulate, and solid phase bioassays and bioaccumulation tests were conducted under contract to USACE Portland District by Ecological Analysts, Inc., during April - August 1981. Surface sediments were collected by Ponar grab from five locations in the Salmon Harbor and Winchester Bay boat basins (Figure C-16). A single composite of the 5 stations was used as the test sediment, as agreed to between CoE Portland District and EPA Region 10. Reference sediments were collected from 3 stations immediately inshore of the interim-designated ODMDS. Test species included:

Liquid and suspended particulate phases:

Calanus pacifica -- copepod
Crangon franciscorum -- bay shrimp
Parophrys vetulus -- juvenile English sole

Solid phase:

Rhepoxynius abronius -- burrowing amphipod
Macoma inequinata -- filter-feeding infaunal bivalve
Abarenicola pacifica -- deposit-feeding polychaete

Bioaccumulation: A. pacifica

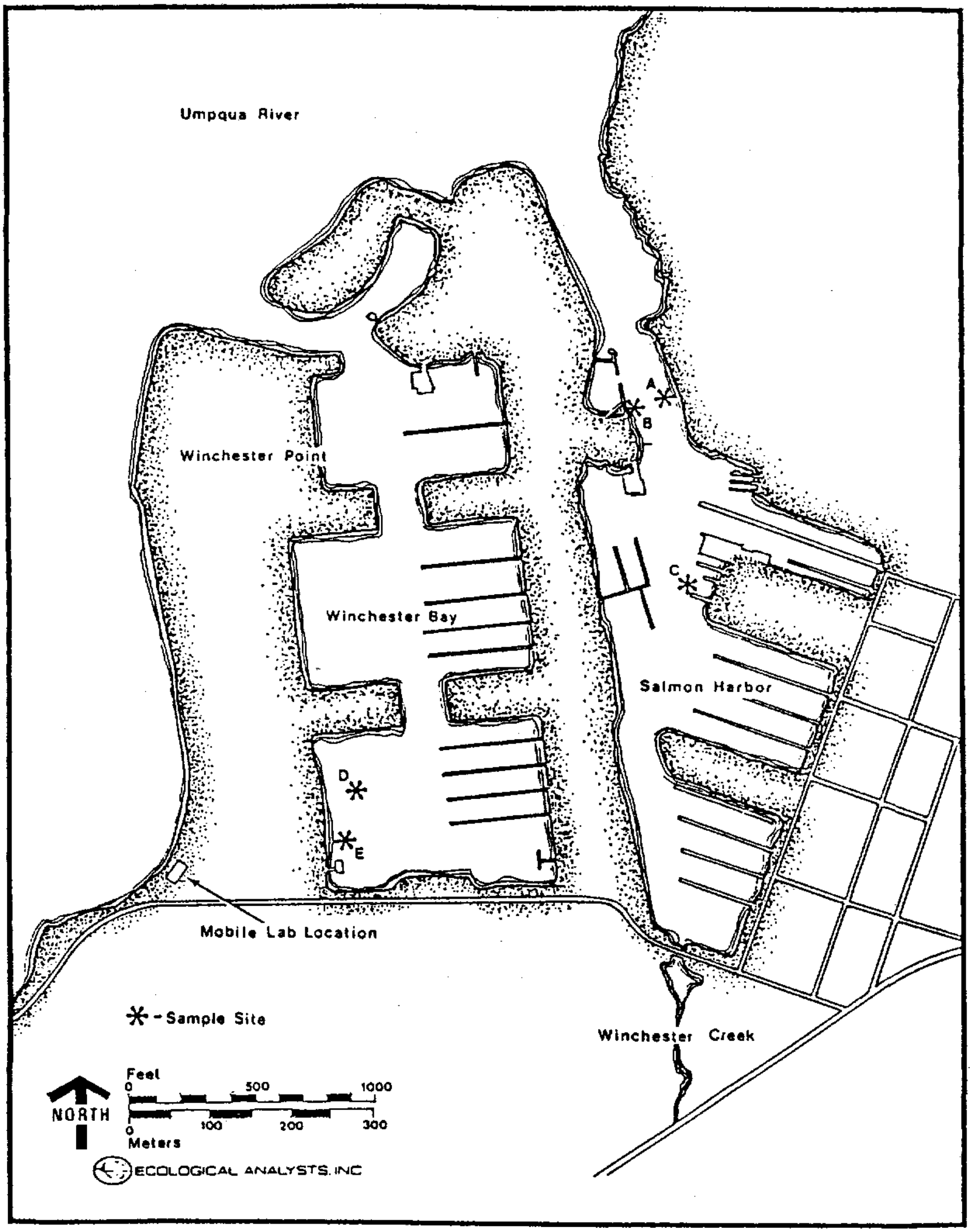


Figure C-16

Locations of the Dredge Material sampling sites at Winchester Bay, Oregon.

3.3 The liquid and suspended particulate tests were conducted for 96 hours under static, aerated conditions. Significant mortality occurred for C. franciscorum exposed to 100% liquid phase test sediments. Survival percentages were: reference control, 85%; liquid phase test, 45%; and suspended particulate phase test, 82% survival. The report authors attributed this mortality to lack of food for test animals in the liquid phase, which is filtered, rather than contaminant effects. It was estimated that "the limiting permissible concentration (LPC) of the liquid phase after initial mixing at the disposal site would not be exceeded". No other mortality was observed in these two phases.

3.4 Significant mortality was observed in flow-through 10-day solid phase tests for R. abronius. Reference survival was 91% while test sediment survival was 69%, averaged over the 20 replicates run for each condition. Net decrease in survival was, therefore, 22%. The report authors attributed the mortality to a combination of contaminants and physical incompatibility of the fine grained test sediments, since R. abronius prefers sandy substrates. No other significant solid phase mortality occurred. In the A. pacifica bioaccumulation tests, tissue accumulation showed no significant elevations of any contaminants tested when compared between dredging site and reference sediments.

Physical/Chemical Testing

3.5 Sediment physical and chemical analyses were completed in July 1987 for samples from 12 stations in the two Winchester Bay boat basins (Figure C-17). Results showed a mixture of sediment types with coarser sediments located near the basin entrances and fine sediments inside (Table C-10). Some of the fine sediments have high organic and clay content, with several stations showing ranges of 7 - 15% organics and 8 - 24% clays. Coarse sediment areas are presently dredged annually with disposal in a nearby dispersive estuarine in-water site.

3.6 Bulk and elutriate chemical analysis results showed that sediments do not have high contaminant levels (Table C-11). The mercury value for WB-12, in the west basin, was somewhat elevated at 0.134 ug/g. However, toxicity effects for mercury at this level would not be expected at the recommended ODMDS.

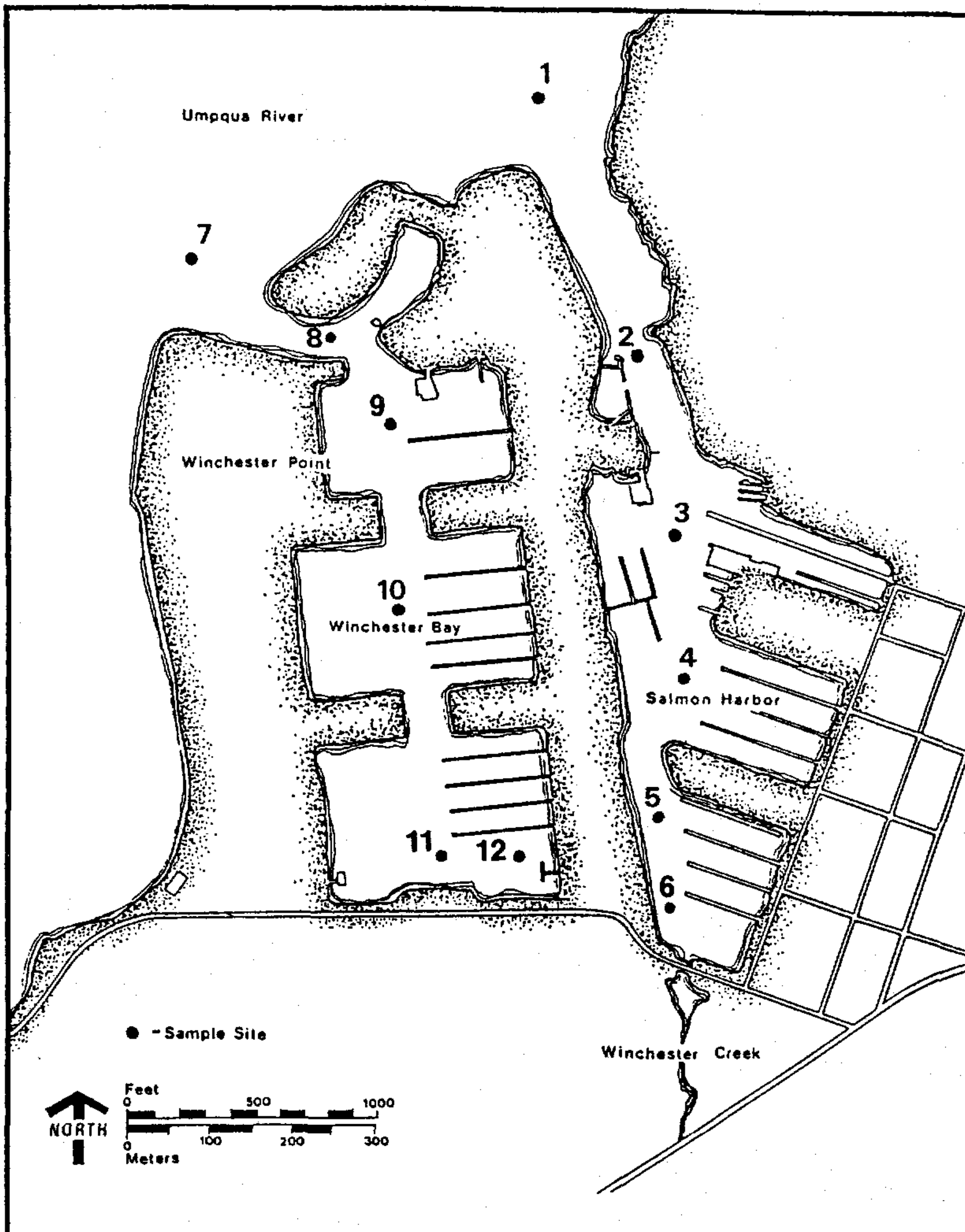


Figure C-17
Station Locations for 1987 Sediment Quality survey at Winchester Bay, Oregon

Table C-10
Physical Characteristics of Sediments Collected July 1987 at Winchester Bay, Umpqua Estuary

Sample No.	Soil Class.	% Gravel	% Sand	% (1) Fines	D50 (mm)	Organic Content	% (2) Clay
1	Sand	3.5	95.5	1.1	0.27	1.9	-(3)
2	Sand	0	95.3	4.7	0.17	4.5	-
3	Sandy Silt	0	30.0	70.0	0.031	13.4	15.1
4	Sandy Silt	0	17.5	82.5	0.050	6.9	7.7
5	Sand	0	95.7	4.3	0.25	1.6	-
6	Silt	0	8.6	91.4	0.013	11.7	23.9
7	Sand	0	99.7	0.3	0.20	1.4	-
8	Sand	0	95.7	4.3	0.16	4.2	-
9	Sandy Silt	0	32.5	67.5	0.032	15.0	12.2
10	Silt	0	13.3	86.7	0.015	9.9	20.5
11	Silty Sand	0	60.7	29.3	0.14	4.2	12.3
12	Silty Sand	0	62.7	37.3	0.12	5.5	11.0

Notes: (1) Silt/Clay <62u grain diameter

(2) Clays <4.5u grain diameter, clay content based on material suspended at end of hydrometer analysis.

(3) Clay not estimated due to insufficeint quantity of fines for a hydrometer analysis

Table C-11

Concentrations of Metals and Elutriates in Sediments from Winchester Bay, Umpqua Estuary

Concentrations of Metals in Sediments Digested by EPA Method 3050 for Umpqua ug/g Dry Weight (Fe in %)

Sample	Hg	As	Cd	Cr	Cu	% Fe	Mn	Ni	Pb	Zn
WB-3&4 comp	0.079	8.6	0.23	61.4	35.3	2.90	222	70.4	7.65	70
WB-5	0.064	5.6	0.17	47.9	27.4	2.48	187	57.8	6.25	62
WB-6 rep 1	0.082	8.6	0.19	66.1	39.2	3.38	267	75.4	9.13	84
WB-6 rep 2	0.079	6.6	0.20	63.8	39.2	3.26	252	80.5	7.76	86
WB-9&10 comp	0.074	7.4	0.22	59.3	37.2	3.08	227	70.4	7.42	76
WB-11	0.044	5.1	0.14	36.5	25.5	2.02	135	40.2	4.55	52
WB-12	0.134	7.8	0.16	75.2	47.1	3.50	232	83.0	8.84	90

pH and Concentrations of Metals and Ammonia in Recieving Waters Seawater and Sediment Elutriates for Umpqua ug/l (except NH(3) in mg/l)

Sample	Hg	As	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn	NH(3)	pH
WB Receiving Water	0.0006	1.5	0.087	0.17	0.70	12.0	4.31	1.77	0.43	5.89	0.13	7.45
WB-6 Elutriate rep1	0.0013	14.5	0.006	0.31	0.31	384.0	1640.0	5.14	0.22	1.19	5.55	7.53
WB-6 Elutriate rep2	0.0012	15.9	0.003	0.25	0.25	519.0	2040.0	4.72	0.03	0.58	6.52	7.52
WB-11 Elutriate	0.0011	5.9	0.007	0.38	0.38	104.0	305.0	1.85	0.19	1.32	1.70	7.78

Chromium values for all samples were high, with a range of 36.5 - 75.2 ug/g, but showed no relationship with sediment type or proximity to moorage areas. Some Oregon estuaries have high background chromium levels and these data indicate a similar phenomenon at Umpqua. The same samples and composites were analyzed for organic contaminants, including pesticides, PCBs, and PAHs. None were detected in any samples.

3.7 While bioassay results indicated some potential for Winchester Bay sediments to cause mortality at the ODMDS, later testing results showed a lack of high contaminant levels in the Federal channel. Some of the original bioassays had to be rerun because of excessive reference and control mortality (Ecological Analysts, Inc. 1981). Therefore, mortality could have been caused by several factors related to test conditions as well as contaminants. Considering the dispersive nature of any location within the Umpqua ZSF for fine sediments, toxicity effects would not be expected from ocean disposal of Winchester Bay sediments.

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U.S. Army Corps of Engineers, Portland District. 1984. Coos Bay offshore disposal site investigation, summary. U.S.A.C.O.E., Portland District, Portland, OR. 31 pp.

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Appendix D

Recreational Use

APPENDIX D
RECREATIONAL RESOURCES

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General

1.1 This section identifies the major recreational use areas within the zone of Siting Feasability (ZSF) at the mouth of the Umpqua River. Figure D-1 shows the ZSF in relation to the Umpqua River. The information was compiled to determine the potential impacts of disposal operations on recreation.

Recreational Use Areas

2.1 All ocean frontage within the ZSF is publicly owned, making this area popular with recreationists. Figure D-1 shows the major recreational use areas located within the ZSF. The Umpqua River and its associated offshore waters are known as one of the best salmon fishing areas along the Pacific Coast. Although the area receives recreational use year-round, the most popular months are from May through September. Primary activities include fishing, camping, beachcombing, off roading and sightseeing.

2.2 The coastal land north of the Umpqua River is part of the Oregon Dunes National Recreational Area. This portion of the Oregon Dunes has limited access and has no developed recreational facilities. The beach is open year round to motorized vehicles and off roading is a popular activity. The dune area behind the beach is popular among hikers who enjoy a more primitive hiking experience.

2.3 Directly south of the Umpqua River is public land administered by Douglas County. Camping and Picnic facilities are provided for public use. In addition, the county maintains a road which parallels the beach and provides access to the Umpqua Lighthouse State Park and sand dunes within the ODNRA (Oregon Dunes National Recreation Area). All of the recreation facilities at the state park are located inland away from the ZSF beach front.

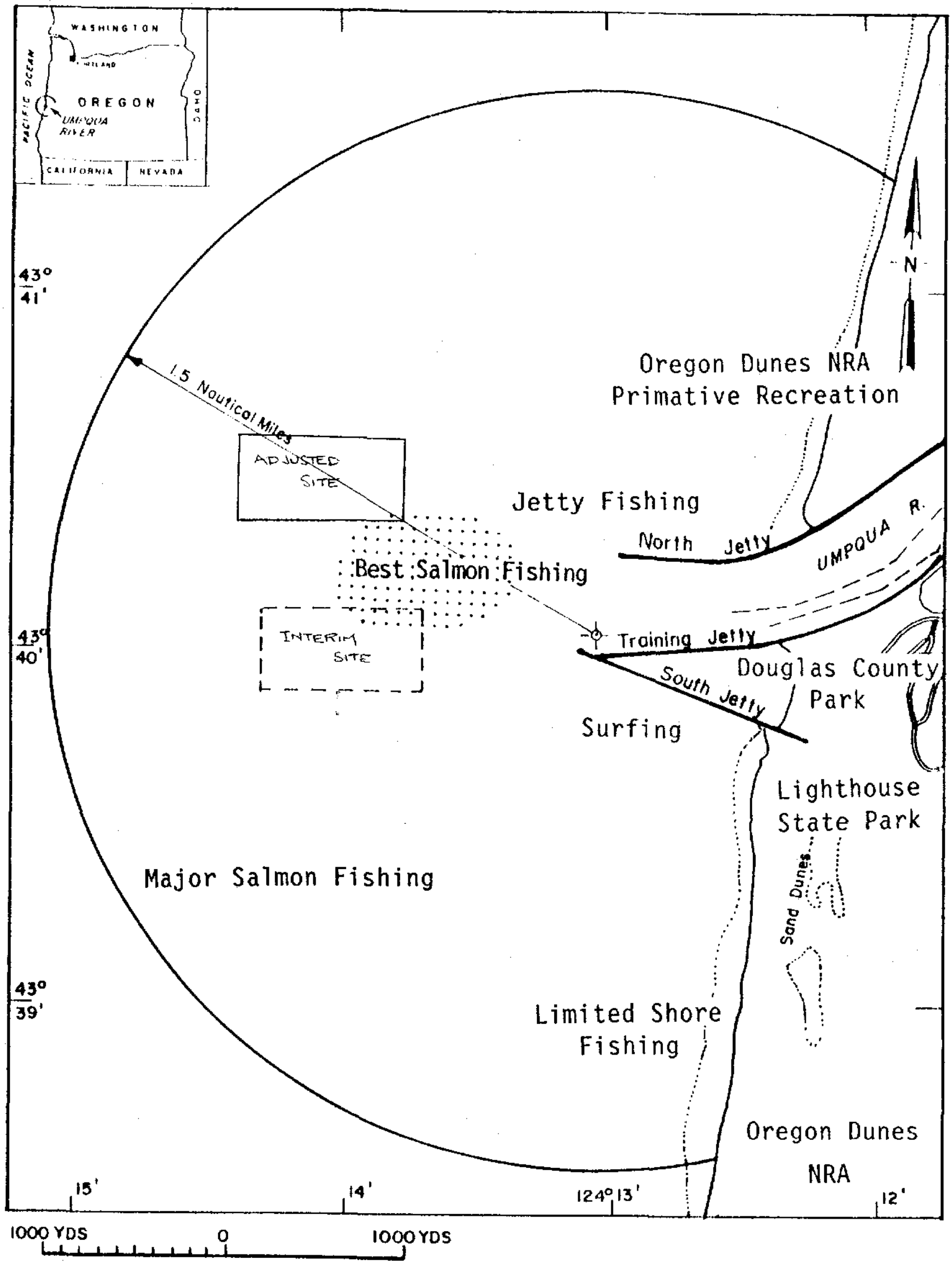

Figure D-1
Recreational Use Areas

2.4 Oregon Dunes NRA borders the state land and continues south along the coast to Coos bay. There are no developed recreational facilities in the ODNRA within the ZSF boundary. Unlike the beach area in the nothern half of the ZSF, the entire length of the beach in the southern half of the ZSF is closed to motorized vehicles. The most common activities occuring in this portion of the ZSF are fishing, beachcombing, sightseeing and hiking. The southern portion of the Oregon Dunes NRA has developed access, thus receives much higher public use than the area north of the river.

2.5 The Umpqua River jetty fishery is well known and accounts for a high number of angler use days. The south jetty is the principle fishing area because of the easy access. A popular place for fishing and crabing the entrance channel is off the old U.S. Coast Guard pier on the south side of the channel. Peak months of activity on the jetties are June, July and August. Most crabs are taken from the main channel by individuals in boats, although some are taken directly off the U.S.C.G. pier. The most popular months for crabbing are June through September.

2.6 Salmon fishing is the most popular type of offshore recreation. Both private and charter boats fish the waters throughout the western third of the ZSF. A well known area lies just beyond the mouth of the river, where salmon fishing is productive. Bottom fishing is also popular but is limited to areas outside the ZSF. Sport angling occurs primarily during summer months when salmon are feeding nearshore before beginning the fall spawning migrations.

Impacts of Disposal Operation

3.1 The disposal site identified on the map is located within a major salmon fishing area and is directly adjacent to one of the most popular and productive salmon fishing sites offshore of the Umpqua River. Any conflicts between disposal operations and recreationists would occur as the vessel was in route to the disposal site. 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 passed through popular fishing areas. Most of these conflicts could be considered an inconvenience rather than a threat to the recreational activity. The only serious threat is the potential for collision between recreational boaters and dredge traffic. Confrontations of this type are rare because the dredge moves at a slow speed. Unless there is significant change in equipment or operational procedures, the potential for collisions will remain low.

3.2 When the dredge material is deposited at the disposal site the surrounding turbidity will increase. This would result in reduced visual quality of the area and could possibly disrupt the feeding patterns of sport fish. Both of these situations would be temporary and normal conditions would return as soon as the disposed material settles.

3.3 Sediment deposition along the beach is another possible consequence of disposal operations that could affect recreational activity. If the dredge material had a different color or texture than the existing material, the results could be a reduction in the visual quality of the area. There has not been any accumulation of dredged material on the beaches from past or present offshore disposal activities, nor has there been any adverse effects to recreational activities.

Conclusion

4.1 Continued use of the current disposal site should have little impact on existing recreation. During disposal operations, water turbidity will increase. Any impact this may have on recreational fishing or visual quality of the area will only be temporary. Some inconveniences will be experienced by recreational boaters and fishermen, but overall disposal operations appear to cause no serious threat to recreation.

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

Appendix E

Cultural Resources

Appendix E
Cultural Resources

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Appendix E
Cultural Resources
Umpqua ZSF

Introduction

1.1 The cultural resource statement for the Umpqua ODMDS is organized in the following manner. Prehistoric cultural resource potential is reviewed and evaluated first. Then follows a brief discussion of the areas historic settlement and development highlighting the major themes. This description is sketched with an emphasis on ocean going vessels and their use in exploration, trade with the Indians, settlement and development of the region. Following this section is a statement on shipwrecks as cultural resources, a Table listing the shipwrecks of the Umpqua vicinity and project area with a comment on the wrecks. A Shipwreck Locational Model is discussed next and used to evaluate the site for unreported wrecks. The report concludes with the results of the evaluation and a side scan sonar study (field investigation) of the proposed Umpqua Disposal Site.

Study Area

1.2 The Umpqua Study area incompasses an area of 1.5 nautical miles in radius with its center point at the entrance of the Umpqua River. This area is considered the zone of siting feasibility (ZSF), and is determined by the economic haul distance of the current dredges. Within this area is located the interim disposal site, and the adjusted disposal site. The interim disposal site is 1500 yards (east-west) x 500 yards (north-south) ; its SW corner is located approximately 2000 yards west of the end of the North Jetty.

CULTURAL RESOURCES

Prehistoric Sites

2.1 Analysis of the prehistoric cultural resource potential suggests two possibilities: (1) Sites from the early colonization of the "new world" by the antecedents of the American Indians and (2); sites or artifacts reflecting the procurement of food resources by more recent Indians in the shallow near-shore environments.

2.2 The initial colonization of the North American continent is thought to have occurred during the last phases of the Pleistocene. During the terminal phases of the Pleistocene, approximately 12,000 to 60,000 years ago, sea levels ranged from 60 meters to 300 meters lower than there present position, a consequence of the glacial phases of the Pleistocene. Lowering of the sea level left a broad exposed coastal plain which in many places extended miles beyond the present coastline. Archeologists concerned with the problem of the arrival of humans in the North American continent point to a coastal route as a likely path for these early migrants. (Fladmark, 1983:12-41) It is possible that some of the earliest prehistoric sites maybe present on the seabed within the nearshore environment of the Oregon coastline.

2.3 In order to initiate an offshore survey for early prehistoric sites, the following criteria should be met:

(1) early prehistoric sites should be present within a reasonable distance of the project area. Presence of early sites on land would at least give some basis for suspecting their presence in an offshore area.

(2) The study area should contain or be likely contain undisturbed sediments from this time period. Though some reviewers consider the possibility of site survival low as the sea advanced to its present elevation and shoreline (Aikens, 1984:70) there are scattered examples of inundated sites that have with stood the high energy of heavy surf and waves. (Cressman,1977:fig.20:48;179).

(3) the survey area should be within an area that would have been exposed during the expected time frame of the initial colonization of the North American continent.

2.4 (1) Review of site information for the Umpqua area does not include sites older than 4000 years, although a site estimated at 7000 years or more is located on the Rogue River, on the southern Oregon Coast line. (Ross, 1986). These sites though of considerable antiquity still post date the end of the Pleistocene rise in sea-level. (2) Historic information indicates that the project area (the disposal site) is within a high energy, erosional area. An 1887 chart of the area shows depths averaging between 50 and 60 feet (U.S.C.G.S.,1887), while more recent surveys indicate depths of 90 to 120 feet (figure E-1). The disparity in depths suggests that substantial erosion of the area has occurred since the jetty's stabilized the channel and the Umpqua River outlet. And (3) though the seafloor within the project site would have been exposed 18,000 years ago (U.S.A.C.E., 1987:E-3), its likely that (given (2)) these depths are recent, and are not relic surfaces from 18,000 years ago. Consequently, the conditions for early sites are not present within the study area.

2.5 The probability is also remote that there are more recent prehistoric sites in the study area. Evidence gathered from archaeological sites located on coastal shorelines indicates that prehistoric Native Americans occupying the Oregon Coast line concentrated their subsistence activities within the estuaries and the near shore ocean environments. There is little evidence that these Indians engaged in an offshore fishery. Within the Umpqua estuary a prehistoric archeological site, the Umpqua-Eden, provides evidence of this use. Bone fishhooks, harpoons, and barbs from fishing spears, and a netweight were recovered during testing. Faunal remains from the site included "whale, stellar sea lion, harbor seal, and sea otter, while fishes included salmon and starry flounder...Shellfish...made up a large percentage of the midden deposit itself." (Aikens, 1984:74, citing Ross and Snyder 1979). Unlike the Indians of the northwest Washington and some further north, the Indians of the Oregon coastline did not hunt whales. The presence of whale remains in archeological sites are likely from scavenged beached whales. (Lewis and Clark, 1969:(3):309)

2.6 A number of places occupied by the historic lower Umpqua Indians are present within the estuary. Closest to the project area are two sites in the Winchester Bay vicinity. One of the sites is reported in Winchester Bay and the other near the outlet in the vicinity of the lighthouse. (Dorsey, 1890:231)

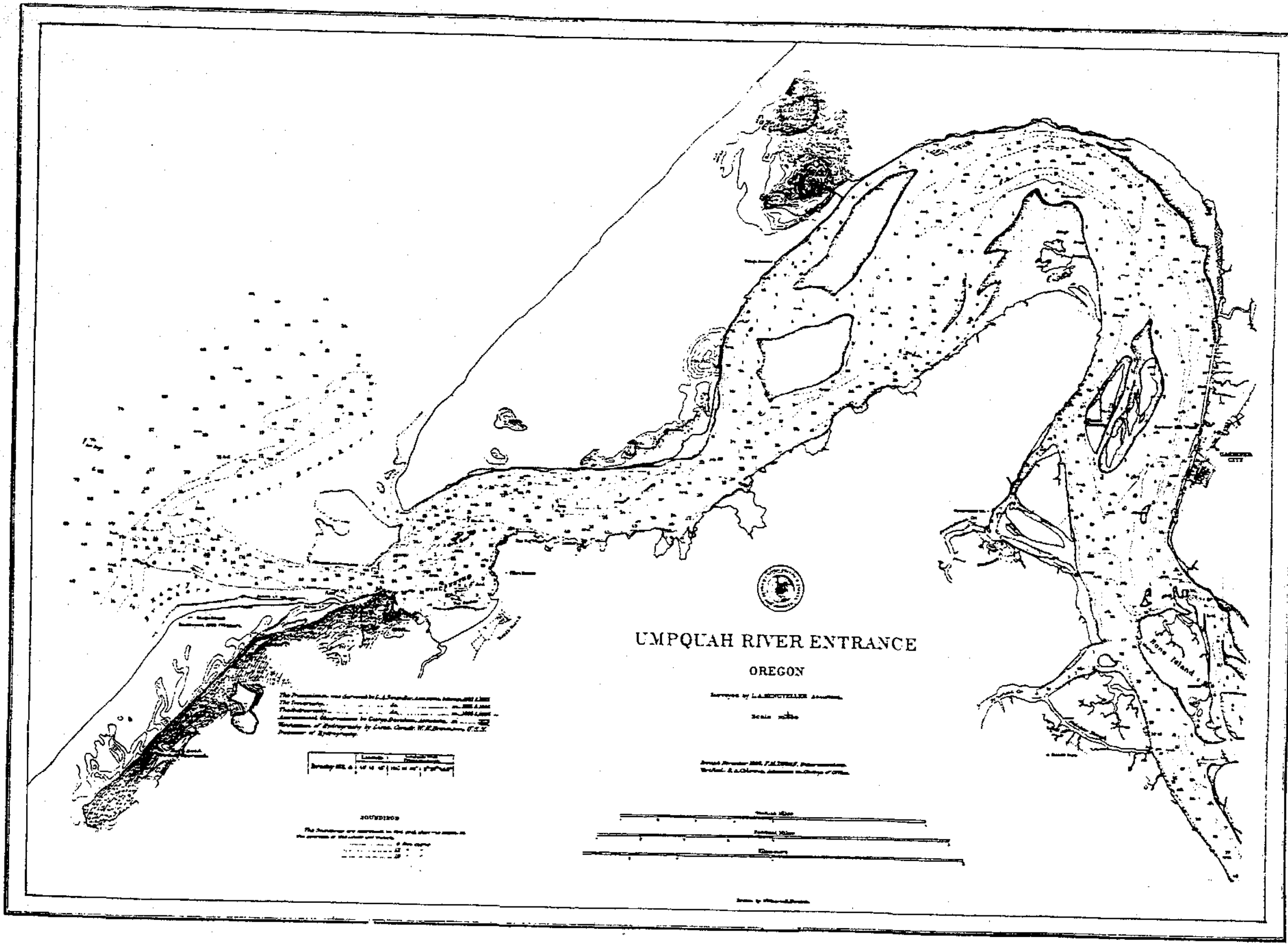

Figure E-1, Umpqua River Entrance in 1887 , (USCGS,1887)

2.7 The lower Umpqua Indians participated in a resource procurement strategy which emphasized the same resources as those recovered in the Umpqua-Eden Site. These included clams, flounder, mussels, chitons, barnacles, crabs, and salmon caught in fixed fish traps, weirs, where the fish were speared, clubbed or netted (Beckham, 1986:28); whales were also scavenged when they drifted onto the beaches (Beckham,1986:28 citing Frachtenberg,1914)

2.8 It is very unlikely that prehistoric sites of more recent periods, (4000BP) or from the ethnographic/historic period are present within the project area. Subsistence activities within the study area were limited to procurement, and would not produce archeological deposits. It is possible that fishhooks, stone weights, and other non perishable elements of a near-shore procurement technology are present.

HISTORICAL CULTURAL RESOURCES

3.1 Two recent histories of the southern Oregon Coast have provide background for this report. Beckham (1986) has provided the definitive history of Douglas County and the Umpqua River drainage and Douthit (1986) has written a general narrative history of south coastal Oregon. Pertinent background for this report are those aspects of the areas history that involve the movement of people and goods by ocean going vessels.

Maritime fur trade:

3.2 Following the exploring expeditions of Captain James A. Cook in the 1770's and the official report published in 1784 a maritime fur trade of relatively unknown dimensions developed along the northwest coast of North America.(Johannsen and Gates, 1957:31-34,37) By the mid 1780's the coast of Oregon was visited frequently by maritime fur traders in pursuit of sea otter and other furs. The trade for fur otter, was carried on by sailing vessels vessels whose masters and merchants bartered European manufactured trade goods with various coastal Indian groups. Successful traders became familiar with the coast, passages over bars into the bays and estuaries of coastal rivers, the types of goods the Indians preferred, how to conduct the barter, and transport of the furs to markets along the coast of mainland China.

3.3 The historic literature of this period, provides only a glimpse of the fur trade. The actual extent and details of the trade are relatively obscure. The maritime fur trade was characterized by an aggressive entrepreneurial spirit driven by potentially great profits. Each national group evolved its own separate manner of conducting the trade though they all operated under conditions of secrecy in order to protect their places of trade and methods from the competition. (Howay and Elliott, 1929:202)

3.4 Other factors also influenced the inherent secrecy of the trade. Vessels under the British flag were forced by terms of government granted monopolies to the South Seas and East Indian Trading Companies to purchase licenses and to pay royalties to the companies when they traded for furs on the northwest coast and when they sold/bartered their furs to the Chinese.(Johannsen and Gates, 1957:40) In order to avoid royalty payments to the Trading Companies, some British trading vessels sailed under the flags of other nations without the benifit of trading licenses.

3.5 Absence of records was part of the operating procedures of the trade. Where documentation exists, it is rarely detailed. The purpose of the fur trade was profit, not knowledge. The primary sources of this period, the logs and journals of ship Captains and merchants, are the terse description of the trade with the Indians which do not provide the comprehensive statements found in later journals of expeditions such as, Lewis and Clark's, or others with a broader interest in the area.

3.6 Based on the above information, it is likely that wrecks of the maritime fur trade are present along the Oregon Coast. The number of vessels that participated in the fur trade is unknown. Johansen and Gates, state that "between 1785 and 1789 sixteen British vessels" operated along the coast (Johansen and Gates, 1957:41); between, 1784-1809, at least 70 American vessels participated in the trade. (Johansen and Gates, 1957:58) They also infer the presence of unregistered vessels participating in the trade. Lewis and Clark, discussed the trade with the Indians at the mouth of the Columbia River. The Indians provided them with some information on twelve vessels and traders who used Baker Bay as an anchorage.(Lewis and Clark, 1969:(3)306-307)

This count does not distinguish between American or British vessels, nor how long these vessels engaged in the trade but it does indicate an active trade continuing into 1806. More detailed study of the historic record and field investigations to locate shipwrecks of the era will be necessary before an accurate estimate of the wrecks of the fur trade can be made.

3.7 By the late 1820's the target animal of the fur trade in the Pacific Northwest shifted to beaver. In order to maximize the return overland trapping brigades made up of fur hunters in the employ of fur trading companies carried out the hunt. Between 1820's and 1850's the Hudson Bay Company established and operated a major fur trading base, Fort Vancouver on the middle Columbia River. The operation also included smaller posts. One post, Fort Umpqua, was located at the confluence of Elk Creek and the Umpqua River. The labor of the trapping brigades was supplemented by a minor trade with the Indians.

3.8 The fur trading post, the trapping brigades, and the trade with the Indians was partially supported by supply vessels from Company headquarters in Great Britain and by overland freight canoes from fur trade depots in the Great Lakes region. As the trade grew the Hudson Bay Company, developed a policy requiring the major company bases to develop their own local agricultural farms to reduced dependence on supply vessels and expensive imported goods. An extensive farming network was developed and operated from Fort Vancouver. Local produce and cattle supplied the trapping brigades. Shipping was reduced mostly to transporting furs to various markets and importing of items that could not be grown or produced at the Forts.

3.9 American interests in the Oregon Territory continued to grow despite the presence of the Hudson Bay Company. In 1828, the American trapper and explorer, Jediah Smith crossed the lower Umpqua River and camped near present day Scottsburg. The party incited the Indians over attempts to recover an ax stolen by an Indian from one of Smith's men. The lower Umpqua's attacked the party of 22 men leaving only Smith and two partners as survivors. The attack by the Indians initiated a period of increasing hostilities and conflicts aggravated by growing numbers of white settlers and miners that ended in the late 1850's with the establishment of the U.S. Army's, Fort Umpqua near the mouth of the River.(Beckham,1969) Indians from Umpqua River, Coos Bay and the Siuslaw were kept on a reserve in the vicinity of the Fort. (Douthit, 1986:119) Sailing vessels and steamers carried supplies and personnel to man the post. One of the vessels, the **FAWN** carrying supplies for the post wrecked off the Siuslaw River.(Beckham,1969) The Army's Fort Umpqua was abandoned in the early 1860's. The Indians were moved to reservations up the coast.

Settlement Period:

3.10 Settlement began along then shorelines of the Umpqua estuary during the late 1840's and 1850's. The Klamath Exploring expedition entered the Umpqua estuary aboard the chartered schooner **SAMUEL ROBERTS**. (Schofield,1916:355-357) Members of the expedition platted the settlements of Winchester, Umpqua City, Scottsburg, and Elkton. The Expedition "explored" the Umpqua River and some of its tributaries noting the presence of small pioneering settlements and homesteads along Elk Creek (Beckham, 1986:73).

3.11 With the platting of the towns, settlement slowly emerged. One of the first commercial structures, The Gardiner Mill Company, a saw mill at Gardiner, was built in 1863 from timbers salvaged from the army's abandoned blockhouse at Fort Umpqua (Douthit, 1986:110). The local economy developed and expanded primarily around the timber resources of the region. In addition, mining, the commercial salmon canning industry and agricultural products provided some diversity within the regional economy. (Beckham, 1986:191-234) These products were transported to their various markets by vessels of the coastal trade. Numerous wrecks from this period are distributed along the Oregon Coast line.

3.12 The U.S. Army Corps of Engineers entered the history of the coast with its historic mission to promote regional development by providing and improving the commercial navigational system. In the 1870's the Corps of Engineers, at the urging of local concerns, attempted to improve the navigability of the Umpqua River by removing rock obstructions from the streambed. The work was undertaken to make it possible to operate steamboats from Scottsburg (head of tide water) to Roseburg. However, even with these improvements the river was to swift and shallow for commercial shipping. The next set of improvements involved the construction of the North Jetty (1930) and the South Jetty (1930) and a 22 foot deep ship channel to Reedsport (1933). The ship channel supported the shipping of lumber from the mills in Gardiner and Reedsport. (Willingham, 1983:141)

3.13 From the early maritime fur trade, the exploration period, the establishment of Fort Umpqua, the early settlement period, and the period of regional development, the principal means of moving people and commodities was by ocean going vessels. Ships, schooners and vessels of the coastal trade, carried explorers, traders, and supplies for the settlements, the pioneer communities, the loggers and the miners of the Umpqua region. In turn these vessels carried out the furs that were taken in trade with the Indians, information on the areas settlement potential from the exploring expeditions, and later the goods produced in the region: the sawn lumber, canned salmon, gold and agricultural produce of the settlement to the outside markets.

Cultural Resources

3.14 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., 1987Oct), Yaquina Bay (U.S.A.C.E.,1987 Oct), Coquille River (U.S.A.C.E., 1985 April) and the Chetco River (U.S.A.C.E.,1988 July) historic shipwrecks are the most likely cultural resources present in the project area's offshore location.

3.15 A shipwreck data base has been developed from the information complied during background research. This data base contains records of shipwrecks from 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.

SHIPWRECKS OF THE UMPQUA RIVER

A Test of the *Shipwreck Locational Model:*

4.1 Shipwrecks, the tangible remains of the trade, settlement and development periods are present within the study area. Location and study of these wrecks can provide insights into the periods of this regions history. For some aspects of the areas history, wreck sites maybe the only form of documentation, adding new and critical data. For others, wrecks will fill out our knowledge of the historic period informing us of the lifeways of the recent past.

4.2 The Umpqua River Shipwreck Data Base covers an area extending 2 miles south, 9 miles north, and 20 miles west of the Umpqua River mouth; in addition some wrecksites in the interior estuary of the Umpqua River are also included in the Data Base. Fify-one documented wrecks have occurred within this area. These wrecks are shown on Table 1.

4.3 These wrecks have the following distribution: 28 wrecks (55%) have been deposited on the beaches; 2 wrecks (3%) in the surf zones; 8 wrecks (16%) on the bar at the mouth of the Umpqua River; and 5 (10%) offshore; 6 (12%) in the Umpqua River esturary; 1 on the jetty; and 1 wreck, (the OREGON, 1854),has an unknown wreck province.

4.4 Forty-seven of these wrecks have occurred within the ZSF study area. (An area of 1.5 nautical miles in radius centering on the mouth of the Umpqua River; not including the 6 interior wrecks in this sample, limiting further statements to only those wreck sites that might be affected by the projects. Of the 41 wrecks in the study area; 26 wrecks (55%) have occurred on the beaches; 2 wrecks (4%) in the surf zone; 8 wrecks (17%) on the bar; and 3 wrecks (6%) offshore; and 1 of unknown province.

4.5 Further analysis of the wrecks indicates that at least 21 of these wreck have been salvaged or refloated, leaving 23 for further study. Of these one vessel the **CABEB CURTIS** was reported wrecked and abandoned on the bar. Given that the bar has been the site of jetty construction maintance dredging and increased scouring through channelization of the current, this vessel is unlikely to have survived within the vicinity of the bar. In addition two of

Table E-1

Shipwrecks of the Umpqua River

Vessels	Wreck Dates	Wreck Sites	Salvaged	Sources
ADMIRAL NICHOLSON	05/16/1924	bar	salvaged	Oregonian 5/17/1924
CABEB CURTIS	02/20/1851	bar	abandoned	Gibbs 1957:272, West Vol.1 n.d.:23
COLUMBIA	11/08/1858	bar	salvaged	West, Vol.1, n.d.:13
GLEANER	12/30/1917	bar	refloated	West Vol.3, n.d.:53
HUNTER	11/07/1902	bar	salvaged	West Vol. 2 n.d.:13
RALPH	10/05/1899	bar	salvaged	Coos Bay Times 02/12/1907 West Vol 1 n.d.:85
SAN GABRIEL	01/01/1913	bar?	refloated	West Vol.3 n.d.:16
ADEL	02/19/1949	bar????	refloated	Port Umpqua Courier
ALMIRA	01/09/1852	beach	abandoned	Marshall 1982:72 Wright 1967:42
BOBOLINK	10/??/1873	beach	salvaged	West vol.1 n.d.:24, Wright 1967:211
ENTERPRICE	05/23/1873	beach	salvaged	West Vol.1 n.d.:23
EVA	11/07/1915	beach	refloated	West Vol. 3 n.d.:38
FEARLESS	11/20/1889	beach	abandoned	West Vol. 1,n.d.:55-55 , Wright 1967:371
G.C. LINDAUER	05/16/1924	beach	abandoned	Oregonian 5/17/1924
GAZELLE	07/03/1922	beach	salvaged	Port Umpqua Courier 7/7/1922, 7/28/1922
LILY	10/21/1909	beach	salvaged	West Vol 2 n.d.:63
LOO CHOO	07/15/1855	beach	abandoned	Gibbs,1957:273 Wright 1967:68
LOUISE	04/14/1903	beach	refloated	West Vol.2, n.d.:15 Coos Bay TImes 2/12/1907
LUCY	4/14/1903	beach	Refloated	West Vol. 2 n.d.:15 Coos Bay Times 2/12/1907
MARY AND IDA	5/11/1893	beach	refloated	West Vol 1 n.d.:26

Table E-1 (cont)
Shipwrecks of the Umpqua River

Vessels	Wreck Dates	Wreck Sites	Salvaged	Sources
NASSAU	07/22/1852	beach	abandoned	West Vol 1 n.d.:5 Wright 1967:43
PEERLESS	02/12/1882	beach	salvaged	West Vol 1 n.d.:41
ROANOKE	02/02/1853	beach	abandoned	Wright 1967:49 West Vol 1 n.d.:6
SADIE	02/18/1906	beach	salvaged	West Vol 2 n.d.:35-36
SEA OTTER	08/22/1808	beach	abandoned	Gibbs 1957:71, 139-140
SPARROW	12/04/1875	beach	salvaged	Wright 1967:230 West Vol. 1 n.d.:31
TACOMA	01/29/1883	beach	abandoned	Wright 1967:313 West vol 1 n.d.:42-43
TRUCKEE	11/18/1897	beach	abandoned	Oregonian 11/19/1897
UNA	03/27/1892	beach	refloated	Coos Bay Times 2/12/1907 West Vol.1 n.d.:62
UNA	01/21/1893	beach	refloated	West vol.1 n.d.:65
WASHOUGAL	08/??/1936	beach	abandoned	West Vol.4 n.d.:53
WASHTUCNA	07/04/1922	beach	refloated	Port Umpqua Courier 7/7/1922, 8/18/1922
WILHEMINA	01/22/1911	beach	salvaged	West Vol. 3 n.d.:13 Marshall 1982:75
ZAMPA	11/11/1891	beach	refloated	Coos Bay Times 2/12/1907 West Vol. 1 n.d.:60
ALPHA	02/03/1907	beach	refloated	Marshall,1982:73
MELDON	03/16/1873	beach/bar	abandoned	Wright 1967:211:Marshall 1982:74
ADEL	02/10/1920	interior	abandoned	West Vol. 3 n.d.:61
JUNO	10/31/1906	interior	refloated	West Vol.2 n.d.:37
MARIE JOAN	8/18/1936	interior	salvaged	Port Umpqua Courier 8/21/1936
ORK	11/24/1864	interior	abandoned	Gibbs 1957:275 Marshall 1982:75
WASHTUNCA	08/18/1922	interior	abandoned	Port Umpqua Courier 8/18/1922
BOSTONIAN	10/01/1850	interior??	abandoned	West, n.d.:3-4 Marshall, 1982:73

the offshore wrecks are located a substantial distance from the project area. The **PHIL SHERIDAN** is reported sunk 15 miles off the mouth of the Umpqua and the **FLORANCE**, 20 miles off the mouth. Neither of these wrecks is within the project area. The other three offshore wrecks are too recent to be important cultural resources.

4.6 There are 18 potentially significant wrecks or remnants of wrecks within the Umpqua study area, however, none of these wrecks are within the area that will be directly affected by disposal of material dredged from the ship channel or the bar. These wrecks have the following distribution:

Beach	11	Surf Zone	2
Interior	4	Unknown	1

4.7 These wrecks range in age from the wreck of the **SEA OTTER** in 1808, through a group of vessels wrecked in the 1850s, to vessels wrecked in the 1980s. Wreck sites include good preservation contexts, the beach and surf zone. Wrecks in similar settings have include major structural elements, such as keels, frames, cargo hold(s), and associated cargo. Discovery of these features and artifacts will provide significant information on the fur trade, and the historic development of the Umpqua River region.

Shipwreck Locational Model:

4.8 Data collected on known wrecks has been compiled and used to develop a general model predicting the likely location of wrecks along the Oregon Coast line (SEE FIG.1). Analyzing this information has produced the following wreck site distributions: (1) The areas with the highest likelihood of historic wrecks are the beaches and past surf zones. (In some cases historic surf zones can be surprisingly distant from their current positions. In the Astoria area, the wreck sites of two vessels are considerably inland from the present surf zone.) (2) The next most likely areas are located in the shallow near shore environments, for example the present surf zones and in the vicinity of navigation hazards, such as reefs and areas of shoalling. (3) The least likely areas are those beyond the nearshore environment in places of increasing water depth. The wrecks of the Umpqua River Data Base support this distribution.

4.9 The majority of shipwrecks occur during particular seasons of the years suggesting that wreck sites are a product of natural forces which operate on a vessel after it has been damaged, loses power and/or steerage. The majority of shipwreck occur during the late fall-winter-early spring storm season. Research suggests that vessels are typically damaged while approaching the entrances of river Ports and landings along beaches. When vessels are damaged or loose power near the shoreline they are trapped by nearshore ocean currents and pushed by the predominantly onshore winds of the late fall-winter-early spring storm period into the coast and toward the beaches.

4.10 These causal factors also operate on that small set of special cases, the derelict vessels that drift from their point of damage whether its along the coastal waters of Japan or along the ocean trade routes miles off the coast. Though the absolute number of derelict vessels cannot be determined, when these vessels appear along the Oregon coast during the storm season, they too drift towards the shore carried by coastal ocean currents and are brought into the beaches and surf zones by the on shore winds of the storm season. It is my guess that the majority of derelicts are beached during the late-fall winter early spring storm season, rather than being randomly distributed throughout the year.

4.11 An important element of this study is determining the probable location of undocumented wrecks. Modeling shipwreck distributions and defining the causes is important for identifying the probable sites of undocumented wrecks. Though it is likely that the majority of wrecks sites are reported in the historic literature, it is certain that unidentified wreck sites are also present. The history of early exploration, fur trade and the colonization period indicates that many vessels operated in a manner that did not always leave documentation of thier presence in a specific area. As examples: (1) Early exploring/fur trading expeditions operated along an unknown coast line. There may have been instances where these vessels, reconnoitering and trading on an unknown coast line, were wrecked and lost without witnesses or records. (2) In some cases fur traders pursuing profits operated illegally in other countries territorial waters or without proper authorization from their own countries. Little if any documentation would be available to demonstrate the presence or loss of these vessels except the location of wrecks of this period. (3) Though infrequent, there is some evidence of Spanish Galleons lost while on transoceanic routes from the far east to destinations along the southern California Coast line. These where secret crossing. It is possible that wrecks of Spanish Galleons and/or merchant ships are present along the Oregon Coast. (Beals and Steele,1981:24-26) (4) And in some cases vessels are lost along shorelines of their own coastal areas, become delict hulks and drift on ocean currents to foreign coastlines and beaches. For example, numerous Japanese cargo and fishing vessels (Junks) have drifted onto the shore of the northwest coast after being damaged along the islands of Japan. (Brooks,1875)

4.12 Based on the locations of known wreck sites, the shipwreck model predicts a similar wreck pattern for undocumented wreck sites. In the case of undocumented shipwrecks the model assumes that the basic natural forces of ocean currents and winds as determined by the season are the primary causes of wreck distributions along the Oregon Coast. This pattern is probably a constant throughout the maritime history of the Northwest Coast.

Uses of the Model

4.13 The shipwreck model has two purposes: As a planning tool for the ODMDS projects or similar civil works the model can be used to guide the evaluations of work areas by excluding the high probability locations from planning studies. Used in this manner, the model can help reduce project costs by orienting work toward low probability areas and preserve cultural resources by avoiding them. (2) In addition the model can be used as a locational device to focus historical archeological investigations in areas where wrecks are likely to occur, or if a researcher desires to locate wrecks with the densest level of information to areas further offshore from the typical wreck site.

4.14 The model, however, cannot be used to avoid cultural resource investigations. Basically, the model predicts a general shipwreck distribution within each project area, however, each place has its own unique historic potential despite the fact that wrecks cluster on beaches and within shallow nearshore environments. Historic Preservation Legislation acknowledges the uniqueness of historic events by requiring evaluation of all project areas, not just the most likely areas. This requirement is important for the preservation of historical archeological resources. For example, shipwreck events are not as frequent as many popular accounts lead one to believe, especially when compared to the number of successful voyages. Commercial shipping was a very successful operation with thousands of tons of goods reaching their destinations, the benefits clearly offset the small number of vessels that were lost. For preservation values, the absolute number of potentially significant shipwrecks is probably small.

4.15 In addition, the likelihood that wrecks will be preserved and will be available for future study is not necessarily assured. Wrecks are not only preyed upon by professional salvors, treasure hunters and pioneers who saw wrecks as a source of "raw" materials, but are also lost to marine organisms and broken apart by the mechanical forces of wave energy and ocean currents. Most shipwrecks on beaches and in near shore environments are probably reduced to remnants of major structural elements (keels, frames), although it is possible that artifacts are present, distributed around the wreck buried under beach sands (Delgado, nd.). At a minimum these wreck sites are significant as part of a comparative study collection with each wreck providing data on a particular aspect of shipping. This information may range from data on ship construction to places of trade or origin based on artifacts as simple as ballast material. The offshore wrecks, however, may be in a class by themselves. These wrecks, relatively fewer in number are generally beyond easy accessibility and maybe in a preservation environment superior to those wrecks in more exposed locations. Archeological data at these sites will probably be richer, including a higher density of artifacts and, possibly, substantial remnants of a vessels wooden structure.

Project Site Evaluation

4.16 The proposed disposal site is unlikely to contain shipwrecks. The model indicates that shipwrecks are clustered on the beaches and in the surf zones. Figure E-2 shows the shipwreck frequencies for the Umpqua ZSF. This distribution is consistent with the known wrecks of the Umpqua River Region. In 1887 this area was beyond the beach, surf zone and bar of the Umpqua River.(U.S.C.G.S, 1887) Ships wrecked or damaged in the vicinity of the disposal area would more likely have been driven into the surf zone or onto the north or south beaches then to have sunk. Within this area, the possibility that wrecks sunk in the vicinity or on the disposal site is also low. The location of the disposal site has under gone substantial erosion since the depth sounding of 1887. In 1887 depths in this area averaged, 50 to 60 feet (U.S.C.G.S., 1887), recent soundings indicate depths of 80 to 90 feet (Earth Science Assoc.

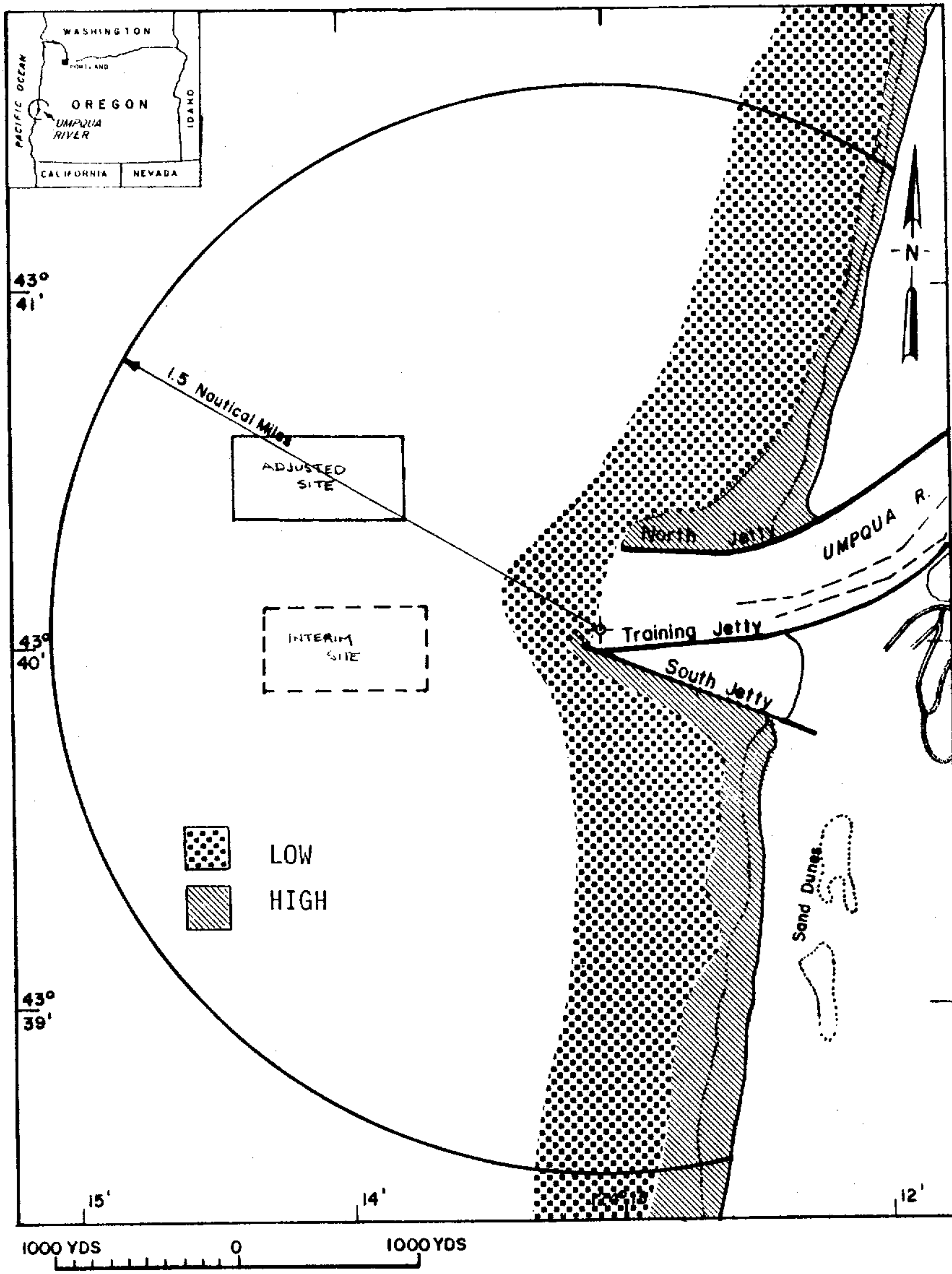

Figure E-1
Shipwreck Frequencies

and GeoRecon International, 1985); it is likely that this increase in depth is a consequence of the scouring of the area by the confinment of the Umpqua River between the south and north jetties. It is likely that any wrecks in the area would probably have been (1) eroded out and moved by the current or (2) if still present their visibility increased as the sediments where flushed away and the remnants of the wreck settled onto a new surface. Field surveys of the project area and vicinity by side scan sonar do not support either of these possibilities.

4.17 Side scan sonar surveys were conducted within the study area to determine if evidence of shipwrecks was present. Evidence may include the presence of structural remains of ships, sediment mounding indicating the burial of vessels, and/or ballast or cargo remnants marking the site of a decayed vessel. No shipwreck signature or other evidence of a shipwreck was recorded by the sonar investigation. (Earth Science Assoc. and GeoRecon International, 1985)

4.18 Though the presence of a shipwreck in the disposal area is unlikely, there is a strong likelihood that remnants of wrecks maybe present north of the north jetty. This area, formerly a surf zone and beach is the location of numerous wrecks. In addition, the preservation context of this area has been enhanced by the construction of the north jetty; a substantial amount of sand has accretted in this area as a consequence of the constuction of the jetty. The area that is now beach includes both former beachlines and surf zones. Evaluation of this area by proton magnetometer may result in the location of known as well as undocumented shipwrecks.

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Appendix F

Comments and Coordination

Appendix F
Comments and Coordination

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Letters

National Marine Fisheries Service, October 25, 1988
National Marine Fisheries Service, February 13, 1989
U.S. Fish and Wildlife Service, May 1, 1989
Oregon State Historic Preservation Office, April 13, 1989
Oregon State Department of Land Conservation and Development, March 16, 1989

Appendix F

COMMENTS AND COORDINATION

Comments

1.1 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.

1.2 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

1.3 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
U.S. Coast Guard
U.S. Fish and Wildlife Service
National Marine Fisheries Service, and
U.S. Environmental Protectione Agency.

1.4 Statements of consistency or concurrence were sought regarding three State or Federal laws. 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

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

1.6 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 C15700, Bldg. 1
Seattle, WA 98115

F/NWR3: 1514-04 js

OCT 25 1988

Mr. Richard N. Duncan
Chief, Fish and Wildlife Branch
Department of the Army
Portland District Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Mr. Duncan:

This is in response to your September 29, 1988, letter regarding endangered and/or threatened species that may be present in the vicinity of the Umpqua River Offshore Dredged Material Disposal Site.

Enclosed is a list of endangered and/or threatened species under the jurisdiction of the National Marine Fisheries Service (NMFS) that may occur offshore of the Umpqua River. Also, enclosed for your information is a special edition of Marine Fisheries Review entitled "The Status of Endangered Whales". There are no candidate species in this area under review by NMFS for proposed listing under the Endangered Species Act. Please contact Joe Scordino at (206) 526-6140 if you need any additional information.

Sincerely,

Rolland A. Schmitten
Regional Director

Enclosures

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

ENDANGERED AND/OR THREATENED SPECIES OFF WASHINGTON AND OREGON

under the jurisdiction of
NATIONAL MARINE FISHERIES SERVICE

MARINE MAMMALS

Gray Whale	Eschrichtius robustus
Humpback Whale	Megaptera novaeangliae
Blue Whale	Balaenoptera musculus
Fin Whale	Balaenoptera physalus
Sei Whale	Balaenoptera borealis
Right Whale	Balaena glacialis
Sperm Whale	Physeter macrocephalus

MARINE TURTLES

Leatherback Sea Turtle	Dermochelys coriacea

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Northwest Region
7600 Sand Point Way N.E.
BIN C15700, Building 1
Seattle, WA 98115

FEB 13 1989

F/NWR3: 1514-04 js

Mr. Lauren J. Aimonetto
Chief, Planning Division
Department of the Army
Portland District Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Mr. Aimonetto:

This is in response to your December 8, 1988, letter regarding an Endangered Species Act (ESA) biological assessment as supplemented on February 6, 1989, for the Umpqua River Offshore Disposal project. We concur with your determination that populations of endangered/threatened species under our purview are not likely to be adversely affected by the proposed action.

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 their critical habitat, the identified activity is subsequently modified, or a new species is listed or critical habitat is determined that may be affected by the identified activity. If you have any new information or questions concerning this consultation, please contact Joe Scordino at (206) 526-6140.

Sincerely,

William L Robinson
for Rolland A. Schmitten
Regional Director

cc: F/PR - Nancy Foster

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Portland Field Office
727 NE 24th Avenue
Portland, OR 97232

RECEIVED
MAY 11 1987
NPPPL-FW

May 1, 1987

1-7-87-SP-92

Richard N. Duncan
Portland District Corps of Engineers
P. O. Box 2946
Portland, OR 97208-2946

Dear Mr. Duncan:

As requested by your letter, dated April 10, 1987, and received by us on April 16, 1987, we have attached a list of endangered and threatened species that may be present in the area of the proposed dredged material disposal sites located offshore of the Umpqua, Chetco, Coquille, and Rogue River entrances. From phone conversations with Geoff Dorsey of your staff, we understand these areas are located approximately one mile straight out from the river entrances in 60 to 90 feet of water and are about 1 square mile in size. The list fulfills the requirement of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act of 1973, as amended. The Corps of Engineers 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 of Engineers 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 David M. Sill at our office, phone (503) 231-6179 or FTS 429-6179. All correspondence should include the above referenced case number.

Sincerely,

Russell D. Peterson

Russell D. Peterson
Field Supervisor

Attachments

cc: R1 FWE-SE
PFO-ES
ODFW (Nongame)
ONHP

RECEIVED
MAY 6 1987
REGULATORY BR.

5SP-92:05/01/87

Attachment A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE PROPOSED DREDGED MATERIAL DISPOSAL SITES LOCATED OFFSHORE OF THE UMPQUA, CHETCO, COQUILLE, AND ROGUE RIVER ESTUARIES
STATE OF OREGON
1-7-87-SP-92

LISTED SPECIES[1/]

Brown Pelican	*Pelecanus occidentalis*	(E)

PROPOSED SPECIES

None

CANDIDATE

None

(E) - Endangered (T) - Threatened (CH) - Critical Habitat

[1/] U. S. Department of Interior, Fish and Wildlife Service, Jan 1986, Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12.

NEIL GOLDSCHMIDT

Department of Transportation

STATE HISTORIC PRESERVATION OFFICE

Parks and Recreation Division

525 TRADE STREET S.E., SALEM, OREGON 97310

April 13, 1989

Lauren J. Aimonetto
Planning Division
Portland District of Engineers
PO Box 2946
Portland, OR 97208-2946

RE: Umpqua River Channel and Bar
Off-shore Disposal Site
Douglas County

Our office has reviewed the cultural resource report by Michael Martin for the Umpqua River off-shore disposal site which was surveyed using side scan sonar by Earth Sciences out of Palo Alto, California and GeoRecon International of Seattle, Washington. Since no shipwrecks or features were noticed that might indicate the presence of wrecks or wreck sites, we concur that the proposed project would have "No Effect" on sites on, or eligible for inclusion on, the National Register of Historic Places. If you have any questions you can contact Dr. Leland Gilsen at 378-5023.

Sincerely,

D. W. Powers, III
Deputy SHPO

DWP:LG:jn
BAR.LTR

NEIL GOLDSCHMIDT
GOVERNOR

Department of Land Conservation and Development

1175 COURT STREET NE, SALEM, OREGON 97310-0590 PHONE (503) 373-0050

March 16, 1989

Lauren J. Aimonetto
Chief, Planning Division
Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208-2946

RE: Umpqua Ocean Dredged Material Disposal Site Evaluation

Dear Mr. Aimonetto:

Thank you for the opportunity to review the draft Ocean Disposal Site Evaluation for the Umpqua River Navigation Project. You have requested that the Department concur with the Corps' determination that the project is consistent with the Oregon Coastal Management Program (OCMP).

The site evaluation report includes findings against Statewide Planning Goal 19, Ocean Resources, which is the most applicable policy of the OCMP. The report does a commendable job of assessing the compatibility of continued dredged material disposal at the interim site with Goal 19 requirements and the criteria of the Marine Protection, Research and Sanctuaries Act. The Department concurs that final designation of the interim disposal site is consistent with the OCMP.

The Department understands that EPA will carry out a formal public involvement program during the final site designation process. The Department may reexamine the consistency of the project with the OCMP during the EPA process if new information is available at that time.

Thank you for the opportunity to review the document for consistency with the OCMP. Please contact Nancy Wittpenn of my staff if you have any questions.

Sincerely,

Craig Greenleaf
Acting Director

CG:NW
<per>

cc: Steve Stevens, COE
Glen Hale, DLCD