FACTUAL DETERMINATIONS

UMPQUA RIVER FEDERAL NAVIGATION PROJECT
October 1980

1. Synopsis. Sediment samples were obtained for elutriate and physical analyses from the Umpqua River Federal navigation channel at river miles (RM) 1.8, 2.4, 2.6, 2.8, 5.2, 6.4, 6.5, 7.8, 8.1, 8.7, 9.1, 9.6, 10.5, and 11.4. Additional sediment samples were collected at existing inwater disposal sites. Water samples from RM 0.0 and 7.8 were collected for use in the elutriate tests and were chemically analyzed for comparison with eluates. Results were evaluated in accordance with Federal regulations for dredged and fill material (40 CFR 230).

BACKGROUND

2. The Umpqua River and its tributaries are located in Oregon's mid-coastal region (figure 1). The drainage area covers 4,560 square miles and the estuary is the third largest in the State.[1] Annual riverflows range between 2.8 and 12 million acre-feet. The mean tidal height at the mouth of the river is 6.9 feet above mean lower low water (mllw) with an extreme of 11 feet. Tidewater extends up to the town of Scottsburg (RM 27.5).

3. The U.S. Army Corps of Engineers is responsible for maintaining an 8,000-foot-long north jetty, a 4,200-foot-long south jetty, and a training jetty connecting the west end of the south jetty to the shore on a tangent parallel to the navigation channel. Additionally, the Corps provides an entrance channel 26 feet deep and 200 feet wide; a river channel 22 feet deep and 200 feet wide to Reedsport (RM 11.9); and a turning basin at Reedsport 22 feet deep, 600 feet wide, and 1,000 feet long. A side channel 12 feet deep and 100 feet wide extends into Winchester Bay with a mooring and turning basin 12 feet deep, 175 feet wide, and 300 feet long located at this inner end. Another side channel, 22 feet deep and 200 feet wide extends from RM 8 to Gardiner and includes another turning basin 500 feet wide and 800 feet long.

4. Net transport of material along the coast near Umpqua Bay is southward, and there is some erosion south of the south jetty.[1] Movement of sand sediments around the north jetty and into the estuary during high tide has been observed on aerial photographs. Sediments transported to the estuary from its drainage basin are estimated at 564,000 tons annually.

5. Each year approximately 250,000 cubic yards of sediment are dredged from the entrance channel and 260,000 cubic yards are dredged from other portions of the navigation channel by agitation, hopper and pipeline dredges. Entrance channel dredged sediments have been discharged at a designated, interim ocean disposal site located in the Pacific Ocean, directly west of the south jetty. River sediments have been released at four inwater sites denoted as "A", "B", "C", and "D" located between Winchester Bay and Gardiner, Oregon (figure 1). Inwater disposal sites correspond to RM 2.7, 4.1, 6.8, and 7.8, respectively.

6. Section 404 of the Clean Water Act, EPA guidelines (40 CFR 230), and Portland District, Corps of Engineers' guidelines specify that sediment from the dredging and disposal sites must be evaluated prior to dredging to determine if significant physical, chemical, or biological impacts will result from disposal operations. If sediment consists of fine-grained material (i.e., 20 percent by weight of particles smaller than 0.074mm in diameter) and contains more than 6 percent organic material or volatile solids, chemical data is obtained to determine if harmful levels of contaminants are present.[2]

7. Previous sampling efforts at several points within the estuary from November 1970 to August 1971 showed the following: (1) sediments contained 0.91 to 3.27 percent organic material; (2) sediment void ratios ranged between 0.77 and 0.97; and (3) the mean grain size indicated that sediments were predominantly fine sand.

8. The primary point source polluters of the Umpqua River are listed in table 1 . They include sewage wastes, lumber wastes, ship maintenance, and cannery types of discharges. These various industries can affect sediment quality and all are located below RM 12. The major industries upstream of RM 12 are forest products, agriculture, mining and smelting.

9. Areas of particular concern in regards to disposal operation impacts are parks, national and historical monuments, national seashores, wilderness areas, research sites, municipal and private water supplies, fisheries, sanctuaries, refuges, wetlands, mudflats, recreational areas, and vegetated shallows. Also of concern are a disposal project's impacts on esthetics.

10. There are 16 proposed natural areas in the Umpqua River watershed.[12] To date, none of these have received official designation by State or Federal agencies and only three are located along the navigation channel. These three (The Point, Steamboat Island, and Leeds Island) would not be directly affected by disposal operations. Indirect effects are possible as a result of shoaling or sediment transport but these are expected to be insignificant.

11. Eelgrass, salt marsh, clam beds, and mudflats are located along both sides of the navigation channel. Clams and Dungeness crab support a small commercial and sport fishery in the estuary.

METHODS

12. Sediment samples for elutriate and physical tests were collected on 28-31 October 1980 at 19 locations in the Umpqua estuary between RM 0.0 and 12.0. Sediments were obtained with the Corps' 22-foot trihull, FORT STEVENS. This boat was also used to obtain water and benthos samples. Field notes are presented in table 2.

13. Sediment samples collected for chemical analyses underwent both elutriate and bulk sediment chemical analyses. Water samples were used in performing the elutriate tests and were analyzed to provide background data on the water quality at the dredged material disposal sites.

14. Sediments sampled for chemical analyses were obtained with a 220-pound, 9-foot-long gravity corer which was equipped to obtain 2-foot cores in detachable, 2-5/8 inch diameter, acid-cleaned core liners. The core liners were made of transparent cellulose butyrate acetate and were sealed with polyethylene caps.

15. An acid-cleaned, stainless steel core catcher was attached to the mouth of each core liner to facilitate retention of the sediment sample during retrieval of the corer. The core catchers were removed before storing the samples in ice for transport to the analytical laboratory. This sampling method provided relatively undisturbed and well-preserved sediment samples. Upon reaching the laboratory, the samples were extruded, composited, and subsampled for elutriate, bulk chemical, and/or physical analyses.

16. A 9 by 9-inch, 45-pound Ponar grab sampler was used to obtain benthic samples. It was also used at those stations where insufficient sediment was obtained in the core samples to allow subsampling them for physical analyses. The benthic samples were sieved through 30 mesh wire. The retained fraction was then preserved with formaldehyde and stored for future analysis. Benthic data are not presented here.

17. A Hydrolab 8000 water quality testing system was used to measure dissolved oxygen, pH, oxidation reduction potential (ORP), conductivity, and temperature at various sites in the Umpqua estuary.

18. The majority of the elutriate and all of the bulk sediment analyses were performed by U.S. Geological Survey (USGS) following the procedures discussed in the USGS publication, "Native Water, Bottom Material, and Elutriate Analyses of Selected Estuaries and Rivers in Western Oregon and Washington."[3] The exceptions to this are cyanide, phenolics, orthophosphate, and phosphate elutriate analyses. These were performed by the Corps' North Pacific Division Materials Laboratory on eluate provided by USGS using methods described in the 14th Edition of Standard Methods for Examination of Water and Wastewater.[4] All chemical methods used have been coordinated with and approved by the Environmental Protection Agency.

19. Elutriate analyses were performed using estuarine water from RM 7.8 and ocean water from RM 0.0. Water was collected with a Scott-modified, Van Dorn water sampler. The water was transferred into acid-cleaned, collapsible, polyethylene containers and stored with ice for transport to the laboratory.

RESULTS

20. Physical Characteristics. The physical characteristics of sediments collected in the Umpqua River navigation channel are presented in tables 3-6 and figures 2-8. The void ratio ranged between 0.833 and 1.292 in the channel and 0.818 and 2.062 at the four disposal sites. The percent volatile solids is a measure of combustible organic material. Channel sediments contained 0.85 to 3.6 percent volatile solids whereas disposal site sediments contained 1.01 to 5.96 percent volatile solids. The density of channel sediments varied between 2,646 and 2,679 g/l and disposal site sediments had similar ranges of 2,644 to 2,716 g/l which are median values. The roundness grade, which reflects the ability of sediments to resist displacement, was variable throughout the river.

21. The grain size distribution curves for the Umpqua navigation channel and proposed disposal sites indicate that sediments are composed of uniformly graded, fine sand with less than 8 percent silt/clay. Disposal site B was an exception. The north end of this site contains well graded material with 52 percent silt/clay.

22. Chemical Characteristics.

a. Water Quality. Data collected on water quality are presented in table 7. The temperature and pH were within normal ranges at all locations. The dissolved oxygen concentration was saturated throughout the water column. The conductivity ranged between 29.3 and 53.6 mmho/cm (18.1 to 35.4 ppt salinity) and undiluted seawater extended up to RM 4.3 at the time of measurement (31 October 1980). Turbidity was minimal (0.5 to 3.5 NTU). The ORP values indicated that normal oxidizing conditions were present at all the sampling points. All parameters measured indicated that water quality was good and within established guidelines.

b. Chemical Analyses. Chemical analyses based upon elutriated sediment samples and water samples collected from the Umpqua navigation channel and proposed disposal sites are presented in tables 8 and 9. Results of bulk sediment analyses are presented in table 10. There are no water quality

guidelines that apply to estuarine waters. EPA guidelines are promulgated for freshwater or marine environments. Individual samples were elutriated with ocean water or estuarine water and compared to marine or freshwater guidelines.[5,6,7] These guidelines provide for the protection of fish and other aquatic life and for recreation in accordance with the 1983 goal of Public Law 92-500. The critera were established primarily as a tool for evaluating long-term discharges from industrial point sources, not for assessing intermittent releases from dredged material discharge operations and long-term releases from discharged sediments. However, they provide protective guidelines for use in assessing disposal activities.

c. EPA guidelines are not established for all the substances measured. In these cases, the results are compared to guidelines established by Portland District, Corps of Engineers.[2] It should be remembered that the various guidelines are not rigid standards and are used only for purposes of comparison. Substances which exceed the various guidelines are cadmium, manganese, nitrogen (ammonia), and phenols.

d. Cadmium was released from elutriated sediment samples at concentrations of 1 to 3 ug/l. The ambient level measured in receiving water samples was 2 ug/l at RM 7.8 (salinity was 12 ppt) and 3 ug/l at RM 0.0 (salinity was 26 ppt). The freshwater guideline for cadmium is dependent upon water hardness and ranges between 1.5 and 6.3 ug/l for hardness values of 50 to 200 mg/l. Marine guidelines stipulate that cadmium should not exceed 59 ug/l at any time and that chronic levels should not exceed 4.5 ug/l. Cadmium is a highly toxic heavy metal which is not needed for metabolism but accumulates in certain body tissues. It is excreted very slowly and organisms such as salmonids and cladocerans are particularly sensitive to dissolved cadmium. Toxicity is affected by a variety of factors such as salinity, pH, temperature, water hardness, and the presence of other heavy metals such as lead or zinc. The levels of cadmium in eluates reported here match high background levels and thus do not originate from sediment elutriation such as would occur during dredged sediment disposal activities.

e. Manganese was released from sediments elutriated with estuarine water at levels ranging from 70 to 1500 ug/l. Sediments elutriated with ocean water

released 20 to 910 ug/l. Ambient manganese concentration was 30 ug/l at both receiving water collection sites (RM 0.0 and 7.8). The freshwater guideline is 50 ug/l and applies only to drinking water. The marine criterion is 100 ug/l and applies to consumers of mollusks. Manganese is a micronutrient which rapidly precipitates out of the water column and is relatively nontoxic.

f. Nitrogen (ammonia). The concentration of ammonia in estuarine eluates ranged between 0.09 and 3.1 mg/l. Ammonia dissolves in water to an un-ionized (NH_3) and ionized species. The un-ionized form is toxic in freshwater and its relative concentration is dependent on pH and temperature.[5] Dredged sediment from the Umpqua River would release an initial concentration of un-ionized ammonia ranging between 0.002 and 0.04 mg/l. The freshwater guideline for un-ionized ammonia is 0.02 mg/l and there is no marine criterion. Since ammonia only slightly exceeds the guideline value at one of eleven sampling stations (RM 9.1), no significant, ammonia-related impacts to water quality are expected.

g. Phenols. The concentration of phenols ranged between 3 and 86 ug/l for sediment samples elutriated with estuarine water and 3 to 46 ug/l for samples elutriated with ocean water. The concentration of phenols in the eluate samples exceeded the 1976 EPA guidelines[5] for phenolic compounds (1 ug/l). However, new guidelines,[6] ranging between 30 and 500,000 ug/l, have been published which delineate between a variety of phenolic compounds. The most toxic of these are anthropogenic, chlorinated phenols. High background levels of 100 to 200 ug/l for phenols in eluate samples are frequently measured in the Pacific Northwest and are associated with the logging industry. It is probable that phenols released from the sediment samples resulted from wood processing activities and chlorinated phenols are present in only insignificant concentrations.

h. Bulk Sediment Analyses indicated that Umpqua navigation channel sediments contained moderately high amounts of arsenic. The bulk sediment analysis gives an indication of indigenous substances that can potentially become soluble. However, it must be remembered that this analysis measures the total level of constituents in sediment, including the chemically unavailable and mineralogically-bound components. The fact that arsenic did not exceed

guideline levels in elutriate analyses indicates that it was tightly bound to the sediments and would not be released during disposal of dredged material.

DISCUSSION

23. The Umpqua navigation channel contains sediments composed of fine sand with less than 8 percent organic material. The dredging and disposal of this material has little potential to cause adverse impacts. Once released, it rapidly falls out of the water column without significantly affecting water quality or esthetic conditions. Impacts can result if large numbers of sessile benthic organisms or aquatic plants are buried. Additional physical impacts can include changes in circulation and current patterns, salinity gradients or covering areas of archeological importance. The extent of these impacts depends upon the location of the disposal areas. There are four inwater disposal sites of which three, designated B, C, and D, have been in continual use since the early 1970's. The sediments at sites C and D have characteristics similar to channel sediments (as could be expected). Disposal of dredged material at these two sites will be placing like-on-like and no significant physical impacts are expected. Disposal site B contained 52 percent silt/clay and 6 percent volatile solids. It appears that this area is a settling basin for fine-grained materials and disposal of dredged channel sediments would cover existing sediments with slightly coarser material. Since this area has also been in continuous use, significant impacts to benthic organisms resulting from placing like-on-unlike are not expected. Cumulative and long-term impacts due to disposal of sand are also expected to be minor. Annual disposal operations at the inwater sites will prevent most aquatic plants and animals from establishing long-lasting populations within the three disposal areas. However, this area is small in proportion to the total size of the estuary.

24. Since Umpqua navigation channel sediments are predominantly sand with low levels of organic material, other types of disposal methods are feasible. The dredged sediments could be placed at a designated ocean disposal site because it meets exclusion criteria under Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972. Currently, only entrance channel

dredged material is deposited in the ocean. Alternatively, side casting could be used as a disposal method as long as a Factual Determination and Finding of Compliance are made to ensure that human use characteristics or areas of ecological significance (i.e., eelgrass beds, spawning areas, hard and soft shell clam habitat, etc.) are not significantly impacted.

25. Chemical analyses showed that the background concentration of cadmium approached maximum allowable guideline values. Elutriate water from sediment samples contained the same amount as in receiving water samples indicating that dredged sediment from the navigation channel would not increase ambient levels during disposal operations. Additionally, bulk sediment analyses showed that cadmium was nondetectable in five of the six samples tested. At RM 11.4, cadmium was detected but was well within guidelines (see table 10). Inwater, flowlane, or ocean disposal of dredged sediments is, therefore, not expected to release cadmium or adversely affect water quality.

26. Aside from the fact that dredging activities are not expected to affect cadmium levels, the ambient concentration of this element is very high and may be cause for concern. EPA guidelines stipulate that the 24-hour maximum concentration of cadmium should not exceed 0.05 ug/l in freshwater (hardness of 200 mg/l) or 4.5 ug/l in saltwater. The background concentrations in estuarine water of the Umpqua River were 3 ug/l at RM 0.0 and 2 ug/l at RM 7.8, far exceeding freshwater criteria and approaching marine values. Many aquatic organisms exhibit sublethal effects to cadmium at levels below 5 ug/l.[8] It is not the purpose of this document to evaluate water quality problems which are related to nondredging activities. However, cadmium is a highly toxic substance and high background levels may warrant further investigation by concerned agencies.

27. Manganese will initially be released from discharged dredged sediments at a concentration exceeding both ambient and guideline levels. Manganese is highly soluble and is frequently released in significant concentrations during elutriate tests.[9] This is the result of reduction of the insoluble, oxidized manganese to a soluble manganese (II) with decreasing pH, ORP, and oxygen such as occurs in sediment samples prior to elutriation. During disposal of dredged sediments, manganese readily combines with oxygen to form MnO_2 which

rapidly precipitates out of the water column. The tolerance levels of aquatic organisms are quite high, ranging between 1,500 and 1,000,000 ug/l. Additionally, it should be noted that the marine criteria of 100 ug/l of manganese for consumers of marine mollusks appears to be invalid. This guideline has been questioned and no case of human poisoning due to consumption of manganese-enriched mollusks is known.[10] For these reasons ocean or inwater disposal of dredged sediments is expected to cause insignificant, short-term water quality impacts due to manganese.

28. Ammonia was present in eluates at levels only slightly above guideline values (0.04 versus 0.02 mg/l). This initial concentration would rapidly decrease to levels below the guideline upon mixing with the receiving water during ocean or inwater disposal activities. Therefore, no significant, ammonia-related impacts are expected.

29. The initial concentration of phenols in the water column will be greater than background levels upon the disposal of Umpqua River dredged sediments. As previously mentioned, high ambient concentrations of phenols are common in the Pacific Northwest and it is unlikely that toxic, chlorinated phenols are present in significant amounts. However, a study is currently being conducted to determine if harmful types of phenolic compounds are being released from sediments dredged from some of Portland District's navigation projects. Until further information becomes available, it is difficult to adequately assess phenolic-related impacts. If naturally occurring phenols are being released then they are subject to rapid biological degradation in addition to dilution during disposal activities. The initial concentration released from dredged sediments will have a short-term impact on water quality and quickly diminish to levels below guideline values.

30. Elutriate tests aid in the assessment of short-term impacts on water quality. However, they do not provide information on long-term impacts. Bulk sediment analyses have limited value as indices of long-term impacts. In the case of the Umpqua River, bulk sediment tests indicate that sediments contain moderately high amounts of arsenic. Arsenic did not become soluble during elutriate tests. However, it is present in the sediments and is subject to dispersal during and after dredging. The distribution of arsenic, in the form

of particulate dredged material, could have long-term impacts on aquatic plants and animals. For example, uptake into clam tissues, especially deposit feeding species, is possible. However, since current procedures are designed to measure short-term effects, an assessment of long-term impacts is largely speculative. Since levels were high at both disposal and dredging sites, no long-term impacts from discharging the sediments in expected.

CONCLUSIONS

31. Inwater disposal of dredged sediments from the Umpqua River Federal navigation channel is not expected to cause significant impacts. Dredged sediments consist of fine sand similar to disposal site sediments with only small quantities of organic material. Chemical analyses indicate that ammonia, manganese and phenols would be released from dredged sediments at concentrations slightly above ambient levels. Release of manganese and ammonia from dredged sediment will be short-term and insignificant. Cadmium levels are the result of high ambient concentrations. Disolved cadmium levels in elutriate tests were the same as ambient levels and significant concentrations of cadmium were not detected in bulk sediment analyses. Phenols would be released from dredged material but impacts to water quality will be short-term and insignificant. A study on phenols is in progress to determine if anthropogenic, chlorinated phenols are present. If so, Umpqua River sediments will be re-evaluated to assess the need for bioassays.

32. Ocean disposal of Umpqua River dredged sediments is not expected to cause adverse impacts because this material is sand and meets exclusion criteria for ocean disposal.

33. Discharged sediments would have no significant impact on wildlife sanctuaries and refuges, municipal and private water supplies, national seashores, parks and historic monuments, wilderness areas, research sites, water-related recreation or esthetics. Since the dredged material will be placed at inwater sites which have been used as disposal areas for many years, no additional impacts to surrounding wetlands, mudflats, vegetated shallows, and recreational and commercial fisheries are expected. Osprey nest in the vicinity of

Winchester Bay.[12] The presence of a hopper dredge may briefly disrupt the area in which these birds feed. For example, the turbidity associated with dredging could affect the ability of osprey to locate prey. However, dredging has been conducted on the Umpqua River for several decades and there is no reason to believe dredging activities have adversely affected the osprey population. Osprey are not nationally classified as threatened or endangered.

RECOMMENDATIONS

34. A Finding of Compliance with the requirements of the "Guidelines for Specification of Disposal Sites for Dredged or Fill Material"[7] is recommended for disposal of dredged material from the Umpqua River Federal navigation channel under the conditions discussed below.

35. Disposal of Umpqua River dredged sediments at inwater disposal areas "A", "B", "C", or "D" complies with 40 CFR 230 guidelines and significant physical, chemical, or biological impacts are not expected.

36. Ocean disposal of Umpqua River navigation channel sediments is in compliance with exclusion criteria set forth in Section 103, Marine Protection, Research, and Sancturaies Act of 1972.[11] This material can be placed at the EPA-designated, interim ocean disposal site (figure 1) near the mouth of the Umpqua River.

37. Upland disposal or side casting disposal methods for sediment dredged from the navigation channel are also feasible. However, Factual Determinations and Findings of Compliance evaluations would be required to insure that areas of ecological, historical or commercial importance are not impacted.

38. Umpqua River dredged material, excluding Gardiner channel sediments, could be used for beach nourishment or restoration projects because it complies with Section 103, paragraph 227.13(b)(2).[11] Gardiner channel sediments do not comply with these provisions due to the presence of a large paper mill adjacent to the channel.

39. Use of the disposal sites should be coordinated with the Environmental Protection Agency, U.S. Fish and Wildlife Service, Oregon Department of Environmental Quality, and other public or private agencies which have expressed interest in such operations.

40. This Factual Determination does not apply to the Winchester Bay Boat Basin. A separate Factual Determination is being prepared to cover that project.

REFERENCES

1. Percy, K.L., et al. 1974. Oregon's Estuaries. Sea Grant College Program, Oregon State University, Corvallis, Oregon.

2. U.S. Army Corps of Engineers. 1980. Supplemental, Interim Procedure for Evaluating and Testing Discharges of Dredged Material. U.S. Army Corps of Engineers, Portland District, Portland, Oregon.

3. Rinella, F.A. and G. Fuhrer, "Native Waters, Bottom Material and Elutriate Analyses of Selected Estuaries and Rivers in Western Oregon and Washington." U.S. Geological Survey, Open File Report 81-__ (in review).

4. American Public Health Association, American Water Works Association, and Water Pollution Control Federation. 1976. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, Washington, D.C. 14th Edition.

5. U.S. Environmental Protection Agency. 1976. Quality Criteria for Water. USEPA 440/9-76-023, Washington, D.C.

6. U.S. Environmental Protection Agency. 1980. Water Quality Criteria Documents; Availability. Federal Register 45(231):79318-79355.

7. U.S. Environmental Protection Agency. 1980. Guidelines for Specification of Disposal Sites for Dredged or Fill Material. Federal Register 45(249):85336-85357.

8. U.S. Environmental Protection Agency. 1980. Ambient Water Quality for Cadmium. USEPA 440/5-80-025, Washington, D.C.

9. Lee, G.F., et al. 1975. Research Study for the Development of Dredged Material Disposal Criteria. U.S Army Engineer, Waterways Experiment Station, Contract Report D-75-4, Vicksburg, MS.

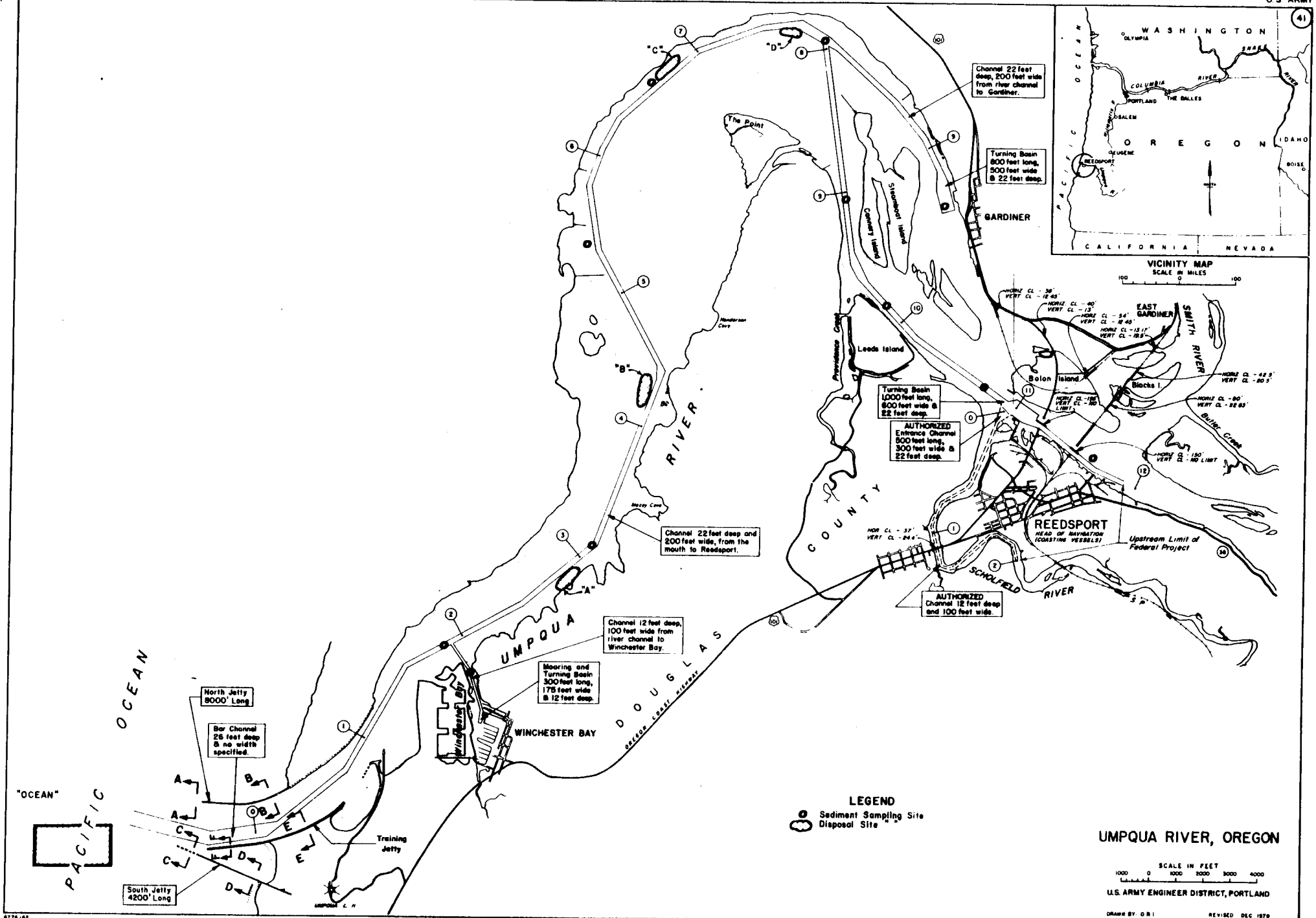
10. Thurston, R.V., et al. (Eds). 1979. A Review of the EPA Red Book: Quality Criteria for Water. Water Quality Section, American Fisheries Society, Bethesda, MD.

11. Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredged Material. 1977. Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

12. Proctor, C.M., et al. 1980. An Ecological Characterization of the Pacific Northwest Coastal Region. 5 Vol. U.S. Fish and Wildlife Service, Biological Services Program FWS/OBS-79/11 through 79/15.

CORPS OF ENGINEERS

U S ARMY



LEGEND

Sediment Sampling Site

Disposal Site "D"

UMPQUA RIVER, OREGON

SCALE IN FEET

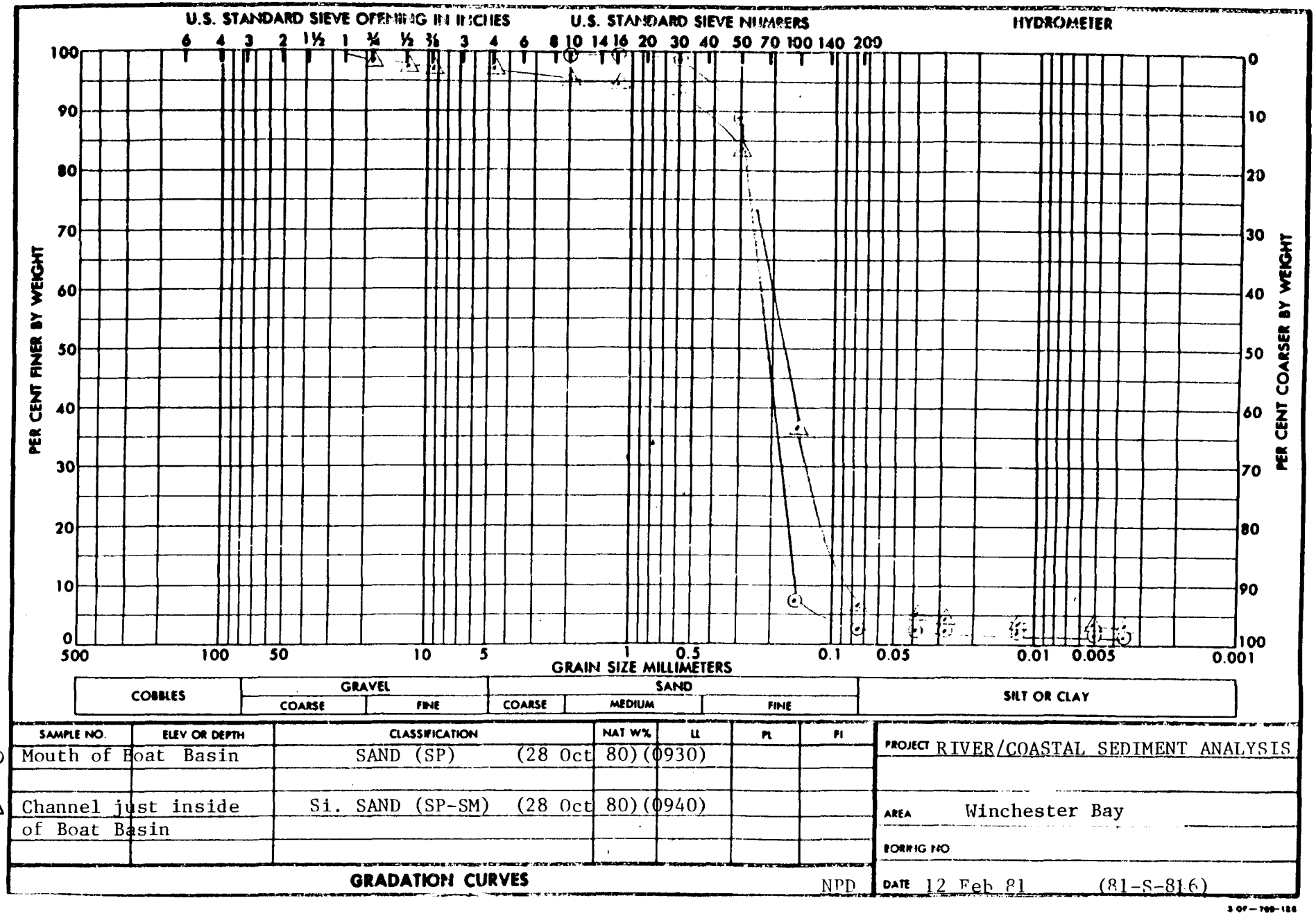
1000 0 1000 2000 3000 4000

U.S. ARMY ENGINEER DISTRICT, PORTLAND

DRAWN BY: O R I REVISED DEC 1979

6776-62

FIGURE 1



	SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
⊙	Mouth of Boat Basin		SAND (SP) (28 Oct 80)(0930)				
△	Channel just inside of Boat Basin		Si. SAND (SP-SM) (28 Oct 80)(0940)				

GRADATION CURVES NPD

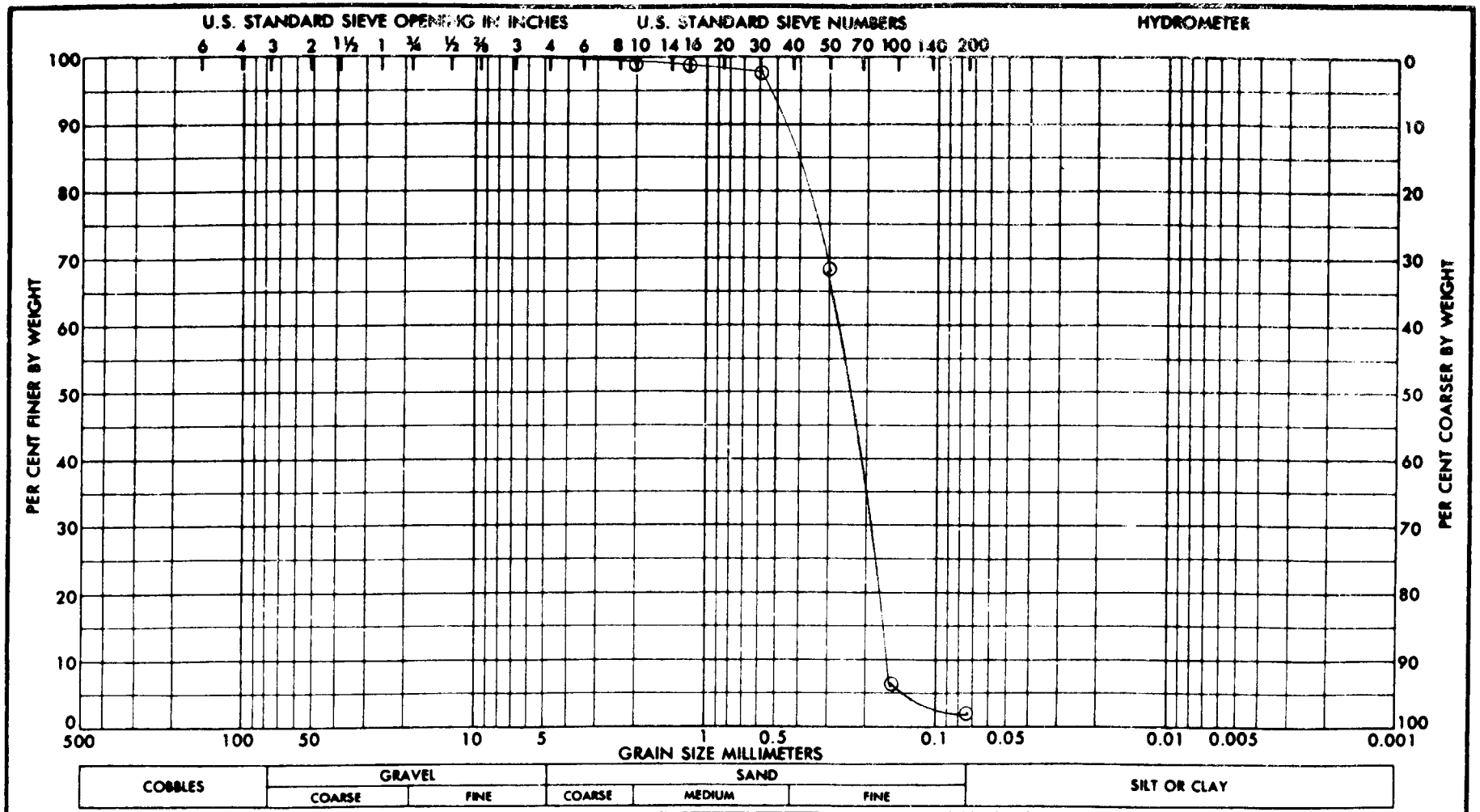
PROJECT RIVER/COASTAL SEDIMENT ANALYSIS

AREA Winchester Bay

BORING NO

DATE 12 Feb 81 (81-S-816)

Figure 2. Grain size distribution curves for sediments collected in the Umpqua River navigation channel.



SAMPLE NO.	~~DEPTH~~	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.

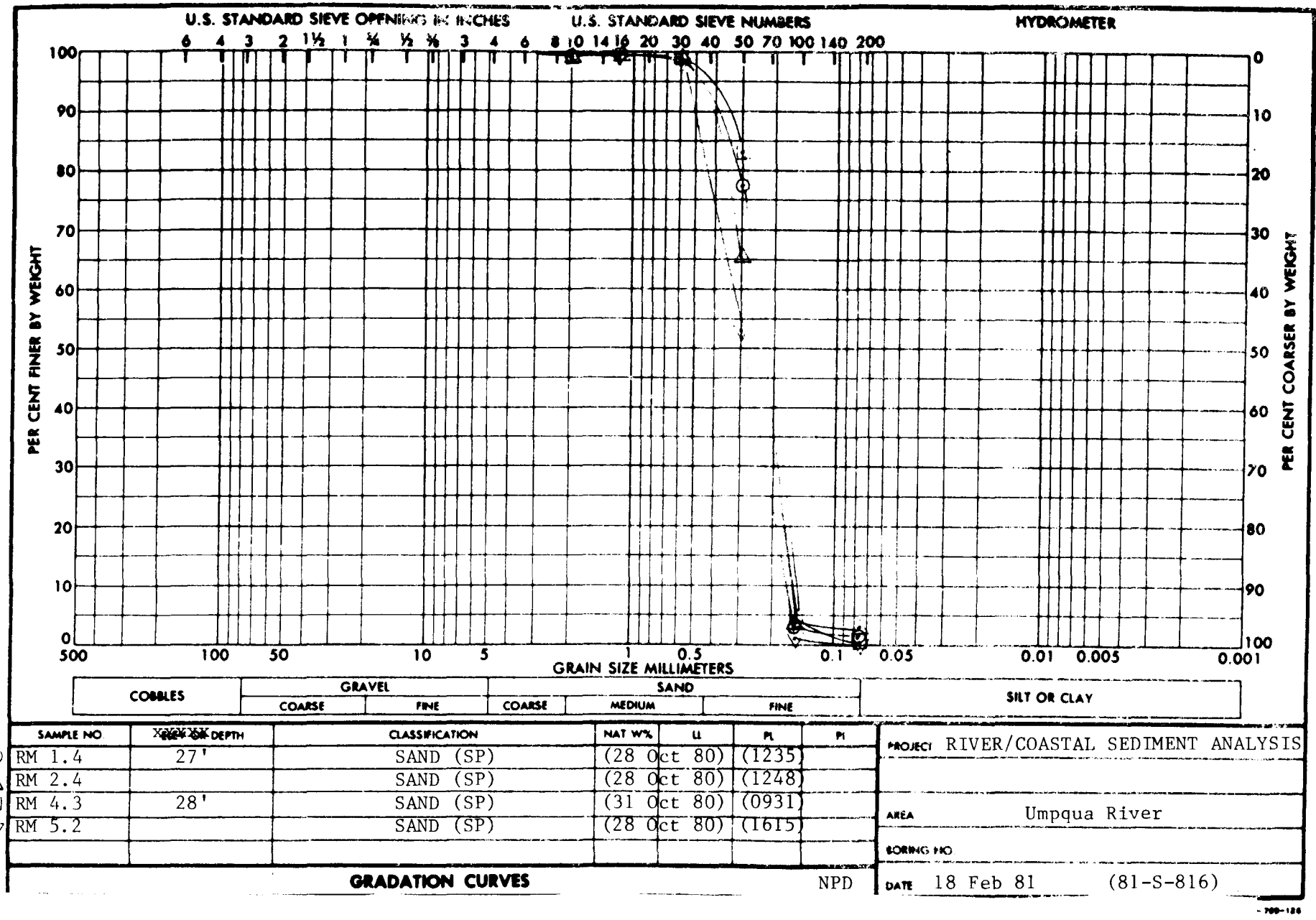
AREA Umpqua River

BORING NO.

DATE 28 Jan 81 (81-S-816)

-186

Figure 3. Grain size distribution curve for sediments collected in the Umpqua River navigation channel.



	SAMPLE NO.	~~DEPTH~~ DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
○	RM 1.4	27'	SAND (SP)	(28 Oct 80)	(1235)		
△	RM 2.4		SAND (SP)	(28 Oct 80)	(1248)		
□	RM 4.3	28'	SAND (SP)	(31 Oct 80)	(0931)		
▽	RM 5.2		SAND (SP)	(28 Oct 80)	(1615)		

GRADATION CURVES NPD

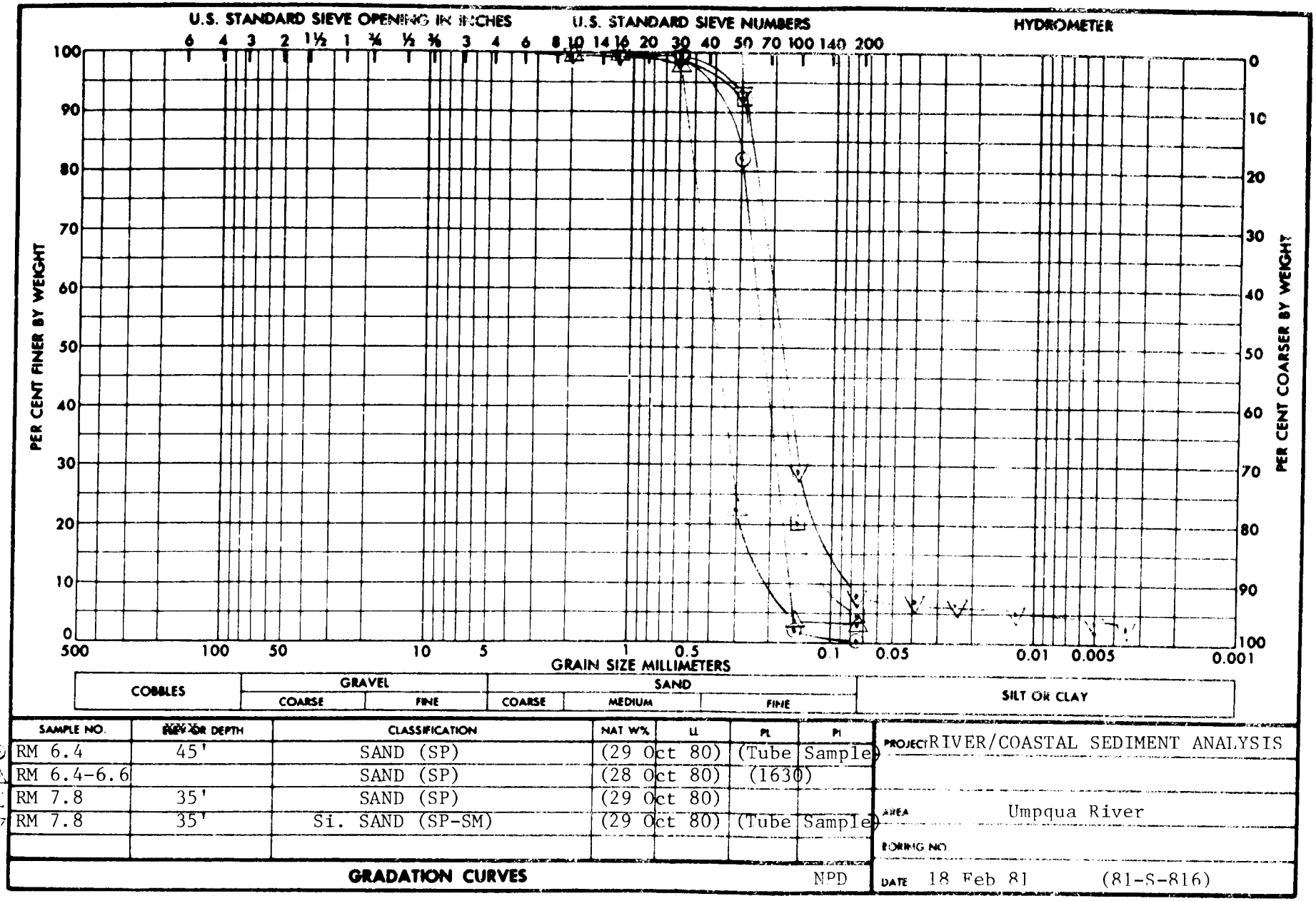
PROJECT RIVER/COASTAL SEDIMENT ANALYSIS

AREA Umpqua River

BORING NO.

DATE 18 Feb 81 (81-S-816)

Figure 4. Grain size distribution curve for sediments collected in the Umpqua River navigation channel.



	SAMPLE NO.	REV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
⊙	RM 6.4	45'	SAND (SP)	(29 Oct 80)	(Tube	Sample)	
△	RM 6.4-6.6		SAND (SP)	(28 Oct 80)	(1630)		
□	RM 7.8	35'	SAND (SP)	(29 Oct 80)			
▽	RM 7.8	35'	Si. SAND (SP-SM)	(29 Oct 80)	(Tube	Sample)	

GRADATION CURVES NPD

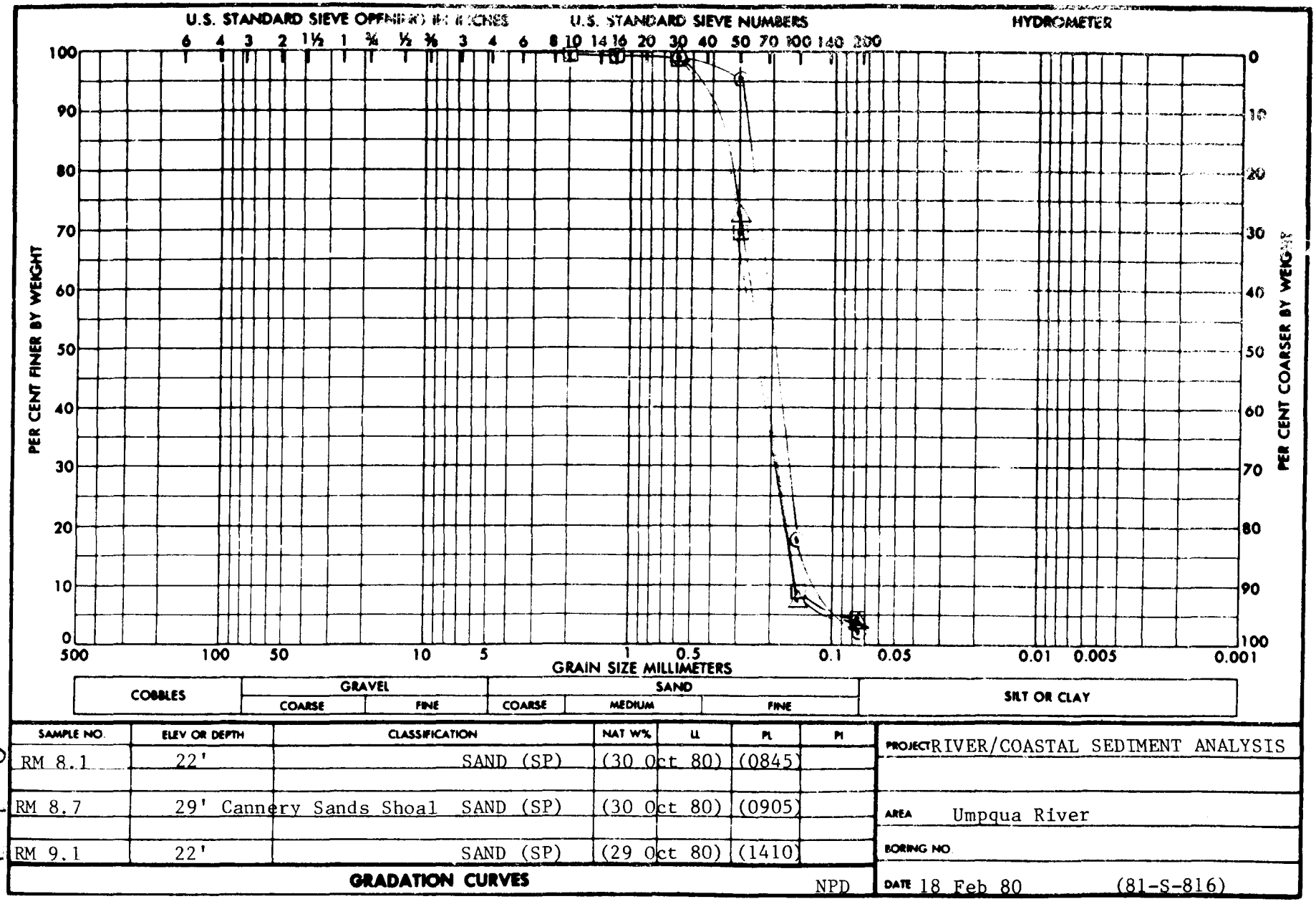
PROJECT RIVER/COASTAL SEDIMENT ANALYSIS

AREA Umpqua River

BORING NO.

DATE 18 Feb 81 (81-S-816)

Figure 5. Grain size distribution curves for sediments collected in the Umpqua River navigation channel.



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
RM 8.1	22'	SAND (SP)	(30 Oct 80)		(0845)	
RM 8.7	29' Cannery Sands Shoal	SAND (SP)	(30 Oct 80)		(0905)	
RM 9.1	22'	SAND (SP)	(29 Oct 80)		(1410)	

GRADATION CURVES NPD

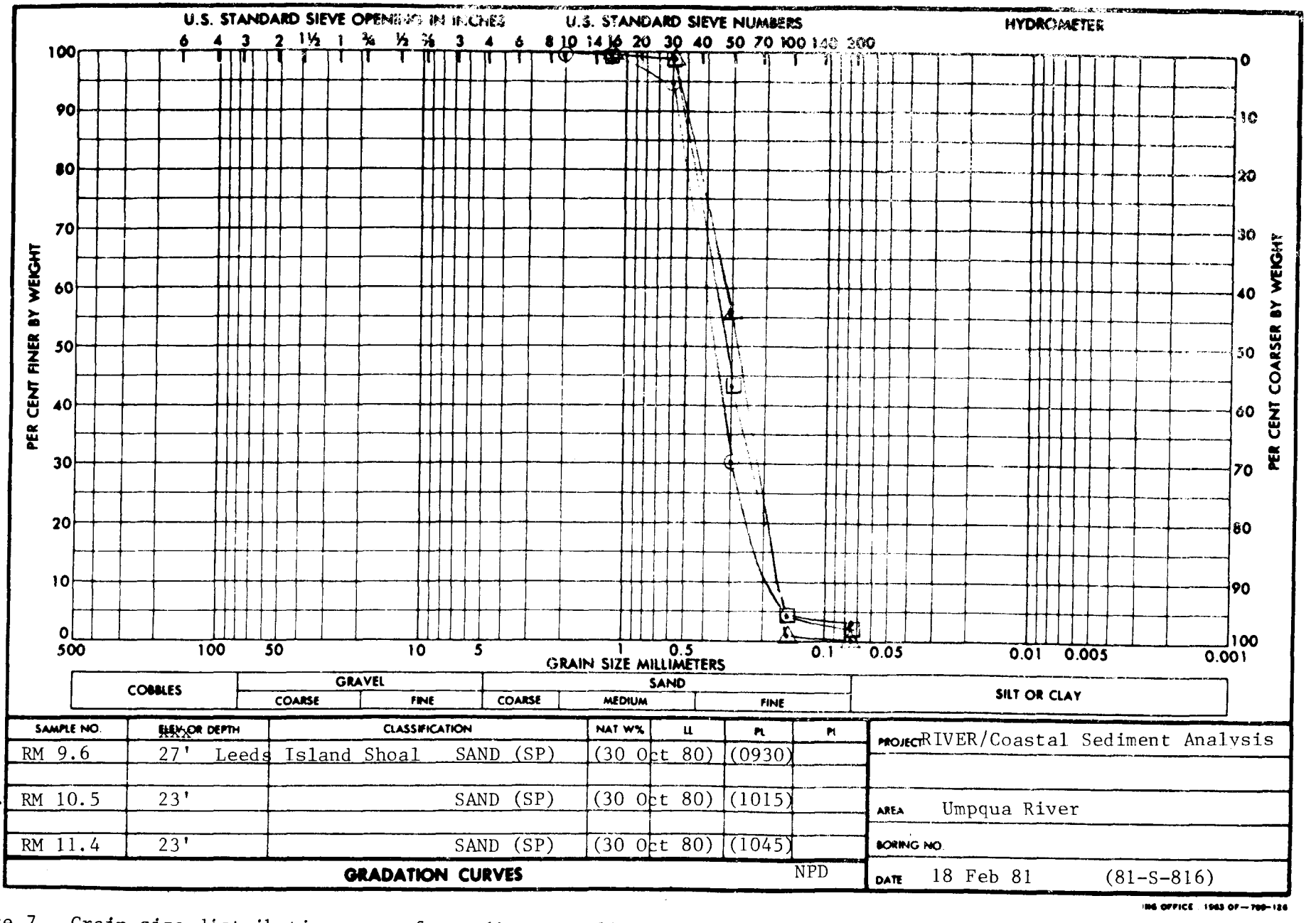
PROJECT RIVER/COASTAL SEDIMENT ANALYSIS

AREA Umpqua River

BORING NO.

DATE 18 Feb 80 (81-S-816)

Figure 6. Grain size distribution curves for sediments collected in the Umpqua River navigation channel and Gardiner Channel.



SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
RM 9.6	27'	Leeds Island Shoal SAND (SP)	(30 Oct 80)		(0930)	
RM 10.5	23'	SAND (SP)	(30 Oct 80)		(1015)	
RM 11.4	23'	SAND (SP)	(30 Oct 80)		(1045)	

GRADATION CURVES NPD

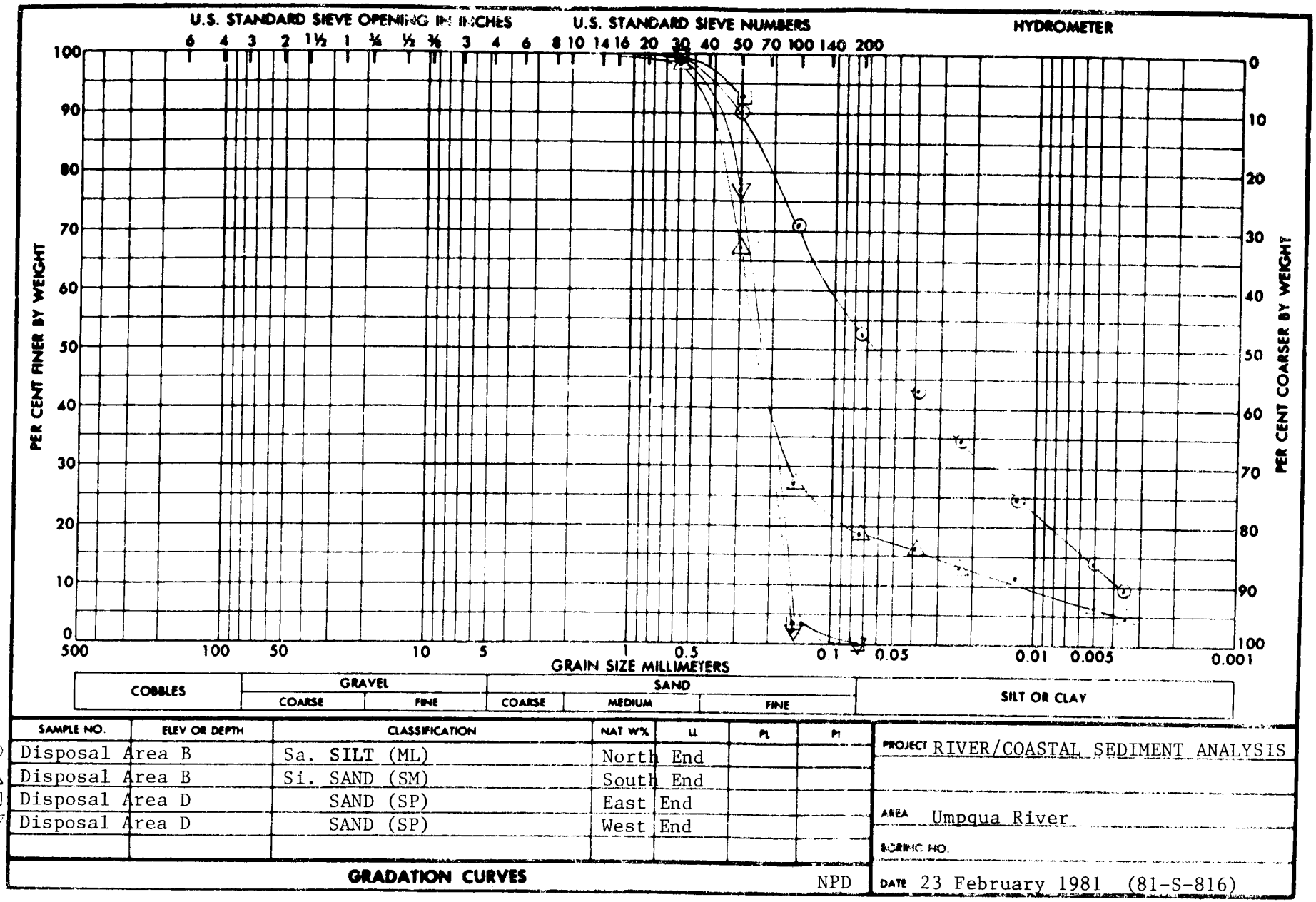
PROJECT RIVER/Coastal Sediment Analysis

AREA Umpqua River

BORING NO.

DATE 18 Feb 81 (81-S-816)

Figure 7. Grain size distribution curve for sediments collected in the Umpqua River navigation channel.



	SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
⊙	Disposal Area B		Sa. SILT (ML)	North End			
△	Disposal Area B		Si. SAND (SM)	South End			
□	Disposal Area D		SAND (SP)	East End			
▽	Disposal Area D		SAND (SP)	West End			

GRADATION CURVES NPD

PROJECT RIVER/COASTAL SEDIMENT ANALYSIS

AREA Umpqua River

BORING NO.

DATE 23 February 1981 (81-S-816)

Figure 8. Grain size distribution curves for sediments collected at disposal areas "B" and "D".

TABLE I

PRIMARY POLLUTANT SOURCES IN THE UMPQUA RIVER AND ESTUARY

Below River Mile 12:

- International Paper Co.
- Bohemia Lumber Co.
- Inner Tidal Seafood
- Reedsport Seafood
- City of Reedsport
- Winchester Bay Sanitary Co.

Above River Mile 12:

- Hanna Nickel Smelting
- Herbert Lumber Co.

TABLE 2. UMPQUA RIVER FIELD NOTES.

Purpose of Sampling 404 evaluation of Navigation Channel Sediments

Date 10-28-80 Wind Slight (from East)

Water Conditions (Wave heights & Direction, Tides, Currents) Smooth

Weather Great - No clouds 45-65° Sampling Vessel Fort Stevens

Sampling Personnel Pam Moore, Frank Rinella, Stu U'Ren, Bob Christensen Sampling Gear Ellard, Ponar, Corer and Scott's Water Bottle

Analytical Laboratory USGS & NPD Laboratory

Comments (Wildlife, Sampling Difficulties, etc.) 7.1 ft. high tide at 0350, 2.4 ft low tide at 1036

Station	Depth	Sampling Time	Sampling Methodology	Sampling Description
RM 1.9	12	0930	Ponar-Benthos	Mouth of Boat Basin
			Composite of 2 tries	(Pectin (5 min); Scallop; Polychaete)
RM 1.9	11	0940	Small Ellard	Boat Basin Channel
			(Composite of 3 tries)	Sand w/wood fiber on top. Medium size snail
				included in size sample.
RM 1.9	11	1045	Corer	2 cores. In middle of basin access channel. From
RM 1.8	12	1230	Small Ellard	Mid-Channel-opposite boat basin.
				Fine to medium sand.
				Ponar got snagged and bent here.

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project)
RM - River Mile

FIELD REPORT

Umpqua River

Purpose of Sampling 404 Evaluation of Navigation Channel Sediments

Date 10-28-80 Wind

Water Conditions (Wave heights & Direction, Tides, Currents)

Weather Sampling Vessel

Sampling Personnel Sampling Gear

Analytical Laboratory

Comments (Wildlife, Sampling Difficulties, etc.)

Station	Depth	Sampling Time	Sampling Methodology	Sampling Description
RM 2.4	35	1246	Small Ellard	Medium Sand w/wood fiber. Disposal site.
RM 2.4	35	1315	Corer (Disposal site 'A')	Upper 6-8" had some clay/silt (clean) which made it cohesive enough to stay in corer. The rest fell out. 2 sample composite.
RM 2.6	38	1400	Corer - A analysis	Lots of shell material with sand.
RM 2.8	33	1445	Benthic-Ponar	Shell & Wood Chips (Nematode)
RM 2.8	33	1445	Corer - A analysis	2 Cores. Homogeneous medium sand. Small amount of wood fiber.

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project)

FIELD REPORT

Umpqua River

Purpose of Sampling 404 Sampling

Date 10-28-80 Wind

Water Conditions (Wave heights & Direction, Tides, Currents)

Weather Sampling Vessel

Sampling Personnel Sampling Gear

Analytical Laboratory

Comments (Wildlife, Sampling Difficulties, etc.)

Station	Depth (ft)	Sampling Time	Sampling Methodology	Sampling Description
RM 4.4	32	1510		Did not sample. Area was dredged the week before.
RM 5.2	20	1530	Benthos - Ponar	No samples taken in channel. Went to N. side of Channel. Benthos sample mostly wood fiber.
RM 5.2	20	1545	Corer - 'B' Analysis	4-cores. Fine sand w/some silt some woodchips.
RM 5.2	20	1600	Small Ellard	Mostly Sand
RM 6.5	45	1635	Ponar - Benthos	Semi-yucky., shells and detrital material, one small bivalve. Gravel, sand and silt.

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project)

FIELD REPORT

Umpqua River

Purpose of Sampling 404 Evaluation

Date 10-29-80 Wind Slight, started from East changed to West in afternoon.

Water Conditions (Wave heights & Direction, Tides, Currents)

Weather Very Good 45-65° Sampling Vessel

Sampling Personnel Sampling Gear

Analytical Laboratory

Comments (Wildlife, Sampling Difficulties, etc.) 5.5' high tide at 0345; 2.8' lowtide at 11:37; 6.5' high tide at 1603

Station	Depth	Sampling Time	Sampling Methodology	Sampling Description
RM 6.5	60'	1215	Corer - B sample	4 cores. First core in 35' of water. Third
			Disposal Site 'C'	core value broke so sample was repeated but part
				of core cap got into sample.
RM 6.4	45'	1230	Cores - A samples	Medium sand. All around hole was sand w/some
			Disposal Site 'C'	organic fiber. Sample was stratified showing
				seasonal deposition. Hole was probably not a
				scouring hole due to presence of organic
				debris.

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project)

FIELD REPORT

Umpqua River

Purpose of Sampling 404 Evaluation

Date 10-29-80 Wind

Water Conditions (Wave heights & Direction, Tides, Currents)

Weather Sampling Vessel

Sampling Personnel Sampling Gear

Analytical Laboratory

Comments (Wildlife, Sampling Difficulties, etc.) Collected Ocean water from RM 0.0 at 1600 to 1705 hours (at high tide) at 20' depth. Maximum depth was 35' at RM 0.0

Station	Depth	Sampling Time	Sampling Methodology	Sampling Description
RM 7.8	35	1300	Cores - Salt & Fresh	Dark globules. Fine sand, silt.
			B- Analysis	First foot of sediment stratified. Detinite odor
RM 7.8	35	1315	Core - Physical Analyses	Sand and silt
RM 7.8	35	1330	Ponar - Benthos	One sand Dab which we discarded. Mostly sand.
				One small bivalve.
RM 9.1	15-22	1450	Ponar - Benthic	Very little material after seiving (Gardiner
				Channel)
RM 9.1	15-22	1500	Cores - 2 cores	Fine to coarse sand w/some silt. No organics.
RM 9.1	15'	1515	Small Ellard - Physical	Uniform Sand

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project)
Salinity of ocean receiving water was approximately 26 ppt.

RM - River Mile

FIELD REPORT

Umpqua River

Purpose of Sampling 404 Evaluation

Date 10-30-80 Wind Slight

Water Conditions (Wave heights & Direction, Tides, Currents) Smooth

Weather Overcast Sampling Vessel

Sampling Personnel Sampling Gear

Analytical Laboratory

Comments (Wildlife, Sampling Difficulties, etc.) 5.4' high tide at 0541 /3.0' lowtide at 1246/ 5.9' high tide at 1712

Station	Depth	Sampling Time	Sampling Methodology	Sampling Description
RM 8.1	22	0845	Small Ellard - Physical	Gardiner Channel. Fine Sand and silt.
RM 8.1	22	0850	Core - 'A'	Fine Sand and Silt.
RM 8.1	22	0855	Ponar - Benthos	Mostly wood fiber.
RM 8.7	29	0900	Core - 'A'	Cannery Sands shoal. Medium to coarse sand
RM 8.7	29	0905	Small Ellard - Physical	Medium to coarse sand.
RM 8.7	29	0910	Ponar - Benthos	Wood fiber
RM 9.6	27	0945	Ponar - Benthos	Coarse Sand

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project)

FIELD REPORT

Umpqua River

Purpose of Sampling

Date 10-30-80 Wind

Water Conditions (Wave heights & Direction, Tides, Currents)

Weather Sampling Vessel

Sampling Personnel Sampling Gear

Analytical Laboratory

Comments (Wildlife, Sampling Difficulties, etc.)

Station	Depth	Sampling Time	Sampling Methodology	Sampling Description
RM 9.6	27	0950	Small Ellard - Physical	Coarse Sand
RM 9.6	27	1000	Corer - A	Required 3 attempts due to sand coarseness. No signs of stratification. Some silt in sample.
RM 10.5	23	1010	Small Ellard - Physical	Medium to Coarse Sand
RM 10.5	23	1020	Core - A	Medium to Coarse sand - Uniform
RM 10.5	23	1030	Ponar - Benthos	Mostly sand. saw 1 small amphipod.
RM 11.4	22	1040	Small Ellard	Medium to coarse Sand

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project)

FIELD REPORT

Umpqua River

Purpose of Sampling

Date 10-30-80 Wind

Water Conditions (Wave heights & Direction, Tides, Currents)

Weather Sampling Vessel

Sampling Personnel Sampling Gear

Analytical Laboratory

Comments (Wildlife, Sampling Difficulties, etc.)

Station	Depth(ft)	Sampling Time	Sampling Methodology	Sampling Description
RM 11.4	22	1055	Ponar - Benthos	Fine shell material, seived easily.
RM 11.5	22	1115	Core - A	Uniform medium to coarse sand small amount of silt.
RM 7.8	30	1300-1355	Fresh Water for analysis	8-20 liter plastic containers
			2 liter Scott Bottle	(salinity was approx. 12 ppt)

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project)
The salt water for the elutriate analyses was obtained on 10-29-80 at 1600. The salt water for the receiving water analysis was collected on 10-31-80 at 1030.

TABLE 3

RIVER/COASTAL SEDIMENT ANALYSIS

Winchester Bay

Sample Identification	Specific Gravity of Water	Density of Matl. in place gms/liter	Density of Median Solids gms/liter	Void Ratio	% Volatile Solids	Roundness Grade
Mouth of Boat Basin Sampled 28 Oct 80 (0930)	* 1.000	1913	2673	0.833	1.44	Subangular to Subround
Channel just inside of Boat Basin Sampled 28 Oct 80 (0940)	* 1.000	1776	2649	1.124	3.60	Subangular to Subround
RM 2.8 28 Oct 80	* 1.000	1821	2696	1.070	1.73	Subangular to Subrounded

* Distilled water used to saturate samples.

TABLE 4

RIVER/COASTAL SEDIMENT ANALYSIS

Umpqua River

Sample Identification	Specific Gravity of Water	Density of Matl. in place gms/liter	Density of Median Solids gms/liter	Void Ratio	% Volatile Solids	Roundness Grade
RM 1.4 27' 28 Oct 80 (1235)	* 1.000	1964	2690	0.753	0.85	Subangular to Subround
RM 2.4 28 Oct 80 (1248)	1.0153	1945	2706	0.818	1.37	Subangular to Subround
RM 4.3 28' 31 Oct 80 (0931)	1.0221	1846	2709	1.047	1.48	Angular to Subangular
RM 5.2 28 Oct 80 (1615)	* 1.000	1881	2729	0.963	1.62	Angular to Subangular
RM 6.4 45' 29 Oct 80 (Tube Sample)	* 1.000	1831	2716	1.066	1.57	Angular to Subangular
RM 6.4-6.6 28 Oct 80 (1630)	1.0153	1781	2721	1.229	1.01	Angular to Subangular
RM 7.8 35' 29 Oct 80	* 1.000	1803	2712	1.132	1.18	Subangular to Subround

* Distilled water used to saturate sample.

TABLE 5

RIVER/COASTAL SEDIMENT ANALYSIS

Umpqua River

Sample Identification	Specific Gravity of Water	Density of Matl. in place gms/liter	Density of Median Solids gms/liter	Void Ratio	% Volatile Solids	Roundness
RM 7.8 35' 29 Oct 80 (Tube Sample)	* 1.000	1745	2707	1.292	4.13	Subangular Subround
RM 8.1 22' 30 Oct 80 (0845)	1.0172	1733	2692	1.340	3.11	Angular to Subangular
RM 8.7 29' Cannery Sands Shoal 30 Oct 80 (0905)	* 1.000	1890	2716	0.929	1.54	Angular to Subangular
RM 9.1 22' 29 Oct 80 (1410)	1.0153	1862	2715	1.008	1.40	Subangular Subround
RM 9.6 27' Leeds Island Shoal 30 Oct 80 (0930)	1.0053	1913	2693	0.869	1.86	Subangular Subround
RM 10.5 23' 30 Oct 80 (1015)	1.0128	1843	2720	1.056	1.81	Angular to Subangular
RM 11.4 23' 30 Oct 80 (1045)	1.0153	1867	2745	1.030	1.14	Angular to Subangular

* Distilled water used to saturate sample.

TABLE 6

RIVER/COASTAL SEDIMENT ANALYSIS

Umpqua River

Sample Identification	Specific Gravity of Water	Density of Matl. in place gms/liter	Density of Median Solids gms/liter	Void Ratio	% Volatile Solids	Roundness Grade
Disposal Area B, North End	1.0057	1548	2667	2.062	5.96	Angular to Subangular
Disposal Area B, South End	1.0047	1761	2690	1.229	2.52	Angular to Subangular
Disposal Area D, East End	1.0022	1798	2706	1.141	1.76	Subround to Subangular
Disposal Area D, West End	1.0022	1834	2718	1.063	1.79	Subround to Subangular

TABLE 7

WATER QUALITY DATA

UMPQUA RIVER

DATE: 31 Oct. 80

SAMPLING PERSONNEL: Pam Moore, Stu U'Ren

WEATHER CONDITIONS: Overcast, 45-50°F.

COMMENTS: (Wildlife, vessel traffic, completion status of training jetty, sampling gear difficulties, sampling vessel, etc.) Two very small bubbles in the DO probe. The depth probe did not work properly

River Mile	11.4	11.4	10.5	10.5	7.8	7.8	8.7	8.7	4.3	4.3	1.4	1.4
Parameter												
Depth	S	B	S	B	S	B	S	B	S	B	S	B
Dissolved Oxygen (mg/l)	9.7	9.8	9.5	9.6	10.2	10.2	10.2	10.1	9.7	10.4	9.8	9.8
Conductivity (mmho/cm)	29.3	30.7	30.4	34.4	38.7	49.2	35.0	40.5	45.6	53.4	52.5	53.3
Salinity (g/l)	18.1	19.0	18.8	21.6	24.6	32.2	22.2	25.9	29.5	35.3	34.6	35.2
ORP	211	211	214	215	219	219	216	219	199	203	202	204
Temperature (°C.)	12.4	12.4	12.3	12.3	12.1	12.3	12.2	12.1	12.2	12.6	12.6	12.7
pH	7.77	7.79	7.75	7.82	7.81	7.98	7.78	7.84	7.90	8.04	7.98	8.03
Turbidity (NTU)	1.8	3.5	1.8	3.0	1.5	1.6	2.1	1.8	1.5	0.5	1.1	0.6
Time	0806	0809	0819	0821	0841	0847	0902	0905	0940	0947	1007	1013
Fathometer Reading (feet)				29		30		23		30		28

S = Surface
B = Bottom

WATER QUALITY DATA

UMPQUA RIVER

DATE: 31 Oct 80 **SAMPLING PERSONNEL:**

WEATHER CONDITIONS: Cloudy with light precipitation

COMMENTS: (Wildlife, vessel traffic, completion status of training jetty, sampling gear difficulties, sampling vessel, etc.)

River Mile	0.0	0.0
Parameter		
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 (^{o}C.)	12.7	12.7
pH	8.01	8.02
Turbidity (NTU)	0.7	0.4
Time	1022	1027
Fathometer Reading (ft.)		45

* Ocean was too rough to allow equilibrium time.

Table 8

Results of Chemical Analyses from Sediments Elutriated with Estuarine Water.
Sediment and Water Samples were collected from the Umpqua River Federal Navigation Project.

PARAMETERS	RM 7.8 (Receiving Water)	RM 5.2	RM 6.4 (Disposal Site C)	RM 6.5 (Disposal Site C)	RM 7.8	RM 8.1 Gardiner Channel	RM 8.7	RM 9.1	RM 9.6	RM 10.5	RM 11.4	Freshwater Guidelines
Arsenic, ug/l	1	1		1	1							440
Barium, ug/l	200	100		100	500							1000
Beryllium, ug/l	0	10		10	0							130
Cadmium, ug/l	2	0	1	1	1	3			1	3	2	1.5
Carbon, Organic, mg/l	2.4	2.7	5.9	2.0	6.4	2.8	2.5	3.9	3.6	2.0	2.0	
Chromium, ug/l	0	1	3	2	1	2	2	2	1	3	3	2,200
Copper, ug/l	3	3	2	2	2	3	2	2	1	6	4	12
Cyanide, ug/l	1	1		0	1							52
Iron, ug/l	50	90	60	60	100	50	60	60	70	60	50	1,000
Lead, ug/l	1	3	4	4	1	3	0	2	2	0	4	74
Manganese, ug/l	30	190	110	70	670	130	90	1500	180	220	180	
Mercury, ug/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1
Nickel, ug/l	4	8		16	8							1,100
Nitrogen, Ammonia mg/l			0.12	0.10		0.28	0.09	3.1		0.00	0.48	.02
Nitrogen, Organic mg/l												
Phenols, ug/l	2	3	42	10	63	43	15	86	25	4	5	
Phosphorus, Total ug/l	105	68		99	72							
Orthophosphate, ug/l	57	57	45	47	72	68	85	53	57	53	53	
Zinc, ug/l	22	40	20	20	20	30	30	30	20	30	20	180
Aldrin, ug/l	0.00			0.00	0.00							3
Ametryne, ug/l	0.0			0.0	0.0							
Atratone, ug/l	0.0			0.0	0.0							
Atrazine, ug/l	0.0			0.0	0.0							
Chlordane, ug/l	0.0			0.0	0.0							2.4
Cyanazine, ug/l	0.0			0.0	0.0							
DDD, ug/l	0.00			0.00	0.00							
DDE, ug/l	0.00			0.00	0.00							1,050
DDT, ug/l	0.00			0.00	0.00							1.1
Dieldrin, ug/l	0.00			0.00	0.00							2.5
Endosulfan, ug/l	0.00			0.00	0.00							.22
Endrin, ug/l	0.00			0.00	0.00							.18
Hept Epox, ug/l	0.00			0.00	0.00							.5
Heptachlor, ug/l	0.00			0.00	0.00							2
Lindane, ug/l	0.00			0.00	0.00							
Methoxychlor, ug/l	0.00			0.00	0.00							.03
Mirex, ug/l	0.00			0.00	0.00							.001
PCB, ug/l	0.0			0.0	0.0							2
PCN, ug/l	0.0			0.0	0.0							
Perthane, ug/l	0.00			0.00	0.00							
Prometone, ug/l	0.0			0.0	0.0							
Prometryne, ug/l	0.0			0.0	0.0							
Propazine, ug/l	0.0			0.0	0.0							
Simazine, ug/l	0.0			0.0	0.0							
Simetone, ug/l	0.0			0.0	0.0							
Simetryne, ug/l	0.0			0.0	0.0							
Silvex, ug/l	0.00			0.00	0.00							10
Toxaphene, ug/l	0.0			0.0	0.0							1.6
2,4-D, ug/l	0.00			0.00	0.00							100
2,4-DP, ug/l	0.00			0.00	0.00							
2,4,5-T, ug/l	0.00			0.00	0.00							

Table 9

Results of Chemical Analyses from Sediments Elutriated with Saltwater.
Sediment and Water Samples were collected from the Umpqua River Federal Navigation Project.

PARAMETERS	RM 0.0 (Receiving Water)	Mouth Winchester Bay Boat Basin	RM 2.6	RM 2.4 (Disposal Site A)	RM 2.8	RM 5.2	RM 6.5 Disposal Site C	RM 7.8	RM 11.4	Marine Guidelines
Arsenic, ug/l	1	1				1	1	1		508
Barium, ug/l	300	300				300	100	300		
Beryllium, ug/l	0	10				20	20	20		
Cadmium, ug/l	3	2	3	1	1	3	1	1	2	59
Carbon, Organic, mg/l	2.4	7.6	5.3	11	3.3	3.4	1.7	5.1	2.8	
Chromium, ug/l	0	0	0	0	0	10	2	2	3	44
Copper, ug/l	5	5	3	3	3	3	2	3	3	
Cyanide, ug/l	1	3				2	3	3		30
Iron, ug/l	120	160	170	170	170	200	120	280	110	
Lead, ug/l	2	2	2	0	3	2	1	0	4	668
Manganese, ug/l	30	220	30	60	20	240	130	910	120	
Mercury, ug/l	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7
Nickel, ug/l	5	7				10	16	11		140
Nitrogen, Ammonia mg/l		1.3	0.12	1.2	0.33		0.05		0.48	
Nitrogen, Organic mg/l		0.80								
Phenols, ug/l	6	34	11	5	46	3	7	11	3	
Phosphorus, Total ug/l	122	88				65	75	83		
Orthophosphate, ug/l	95	47	11	60	46	42	57	55	55	
Zinc, ug/l	30	40	30	20	30	50	30	40	30	170
Aldrin, ug/l	0.00	0.00								
Ametryne, ug/l	0.0	0.0				0.00	0.00	0.00		1.3
Atratone, ug/l	0.0	0.0				0.0	0.0	0.0		
Atrazine, ug/l	0.0	0.0				0.0	0.0	0.0		
Chlordane, ug/l	0.0	0.0				0.0	0.0	0.0		
Cyanazine, ug/l	0.0	0.0				0.0	0.0	0.0		0.09
DDD, ug/l	0.00	0.00				0.0	0.0	0.0		
DDE, ug/l	0.00	0.00				0.00	0.00	0.00		
DDT, ug/l	0.00	0.00				0.00	0.00	0.00		14
Dieldrin, ug/l	0.00	0.00				0.00	0.00	0.00		.13
Endosulfan, ug/l	0.00	0.00				0.00	0.00	0.00		.71
Endrin, ug/l	0.00	0.00				0.00	0.00	0.00		.034
Hept Epox, ug/l	0.00	0.00				0.00	0.00	0.00		.037
Heptachlor, ug/l	0.00	0.00				0.00	0.00	0.00		
Lindane, ug/l	0.00	0.00				0.00	0.00	0.00		.053
Methoxychlor, ug/l	0.00	0.00				0.00	0.00	0.00		.004
Mirex, ug/l	0.00	0.00				0.00	0.00	0.00		.03
PCB, ug/l	0.0	0.0				0.0	0.0	0.0		.001
PCN, ug/l	0.0	0.0				0.0	0.0	0.0		10
Perthane, ug/l	0.00	0.00				0.00	0.00	0.00		
Prometone, ug/l	0.0	0.0				0.0	0.0	0.0		
Prometryne, ug/l	0.0	0.0				0.0	0.0	0.0		
Propazine, ug/l	0.0	0.0				0.0	0.0	0.0		
Simazine, ug/l	0.0	0.0				0.0	0.0	0.0		
Simetone, ug/l	0.0	0.0				0.0	0.0	0.0		
Simetryne, ug/l	0.0	0.0				0.0	0.0	0.0		
Silvex, ug/l	0.00					0.00	0.00	0.00		10
Toxaphene, ug/l	0.0	0.0								
2,4-D, ug/l	0.00					0.0	0.0	0.0		.07
2,4-DP, ug/l	0.00					0.00	0.00	0.00		100
2,4,5-T, ug/l	0.00					0.00	0.00	0.00		
						0.00	0.00	0.00		

TABLE 10

Results of Bulk Sediment Analyses from Samples Collected at the Umpqua River Federal Navigation Project (RM - River Mile).

PARAMETERS	Disposal Site C RM 5.2	RM 6.5	RM 7.8	Gardiner RM 8.7	RM 9.1	RM 11.4	Corps Guidelines
Aldrin, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Arsenic, ug/g	4	4	3	2	4	4	3-8
Barium, ug/g	5	5	10	10	10	10	20-60
Beryllium, ug/g	0	0	0	0	0	0	
Cadmium, ug/g	0	0	0	0	0	1	6
Carbon, Inorganic, g/kg	0.0	0.1	0.0	0.0	0.0	0.0	
Carbon, Organic, g/kg	1.8	1.6	7.1	2.8	4.0	1.3	
Carbon, Total, g/kg	1.8	1.7	7.1	2.8	4.0	1.3	
Chlordane, ug/kg	0	0	0	0	0	0	
Chromium, ug/g	13	15	13	18	15	13	25-75
Copper, ug/g	7	8	8	10	8	10	25-50
Cyanide, ug/g	0	0	0	0	0	0	.10-.25
DDD, ug/kg	0.1	0.1	0.2	0.3	0.2	0.1	
DDE, ug/kg	0.1	0.0	0.1	0.1	0.1	0.1	
DDT, ug/kg	0.0	0.0	0.0	0.0	0.3	0.0	
Dieldrin, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Endosulfan, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Endrin, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Hept Epox, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Heptachlor, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Iron, ug/g	7,700	9,100	7,500	13,000	9,200	7,300	17,000-25,000
Lead, ug/g	10	10	10	10	10	0	40-60
Lindane, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Manganese, ug/g	110	99	61	110	200	130	300-500
Mercury, ug/g	.05	.02	.03	.03	.04	.03	1
Mirex, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Methoxychlor, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Nickel, ug/g	20	20	20	20	20	20	20-50
Nitrogen, NH_4 mg/kg	6.4	1.9	20	3.7	19	1.5	75-200
Nitrogen, NH_4+Org mg/kg	160	117	300	130	210	110	1,000-2,000
PCB, ug/kg	0	0	- -	0	0	0	10,000 HP
PCN, ug/kg	0	0	- -	0	0	0	
Perthane, ug/kg	0.0	0.0	0.0	0.0	0.0	0.0	
Phosphorus, Tot PO_4 mg/kg	370	410	340	410	420	440	420-650
Silvex, ug/kg	0	0	0	0	0	0	
Toxaphene, ug/kg	0	0	0	0	0	0	
Zinc, ug/g	22	23	22	26	24	21	90-200
2, 4-D, ug/kg	0	0	0	0	0	0	
2, 4-DP, ug/kg	0	0	0	0	0	0	
2, 4, 5-T, ug/kg	0	0	0	0	0	0	