SEDIMENT PHYSICAL AND CHEMICAL CHARACTERISTICS
ROGUE RIVER FEDERAL NAVIGATION PROJECT

APRIL 1982

1. Synopsis. Sediment samples were obtained for elutriate, bulk sediment, and physical analyses from the Rogue River Federal navigation channel and within Port of Gold Beach's moorage area (figure 1). Water was collected at approximately river mile (RM) .3 within the Rogue River for use in the elutriate tests. Results were evaluated in accordance with Federal regulations for dredged and fill material disposal (40 CFR 230 and ocean dumping regulations[1,2]).

BACKGROUND

2. The Rogue River is located in southwest Oregon. It discharges into the Pacific Ocean 32 miles north of the California state border. The small incorporated town of Gold Beach is located just to the south of the mouth of the river. The total population from the mouth of the river up to approximately RM 45 is under 2,000 (1980 census).

3. The Federal navigation channel at this project consists of an entrance channel up to approximately RM .7 at which point there is a turning basin 13 feet deep, 500 feet wide, and 650 feet long. The entrance channel is 13 feet deep and 300 feet wide and attaches to a side channel which extends into the moorage basin which is 10 feet deep and 100 feet wide. A small turning basin, 10 feet deep, 150 feet wide, and 600 feet long, is located at the end of this side channel. Two jetties are located at the river entrance which are intended to reduce shoaling within the channel. However, a substantial sand wave forms at the mouth of the river each year and works its way upriver and into the moorage area. Potential improvements to the jetty to prevent this shoal from forming are being investigated. The Portland District, Corps of Engineers maintains these jetties and channels. Sediments obtained from

maintenance dredging operations are discharged into an upland site located at the southwest end of the moorage area or into the EPA-designated, interim, ocean disposal site (DS) which is located approximately 2,000 feet southwest of the mouth of the river. The center coordinates for this DS are 42°24'00"N, 124°27'00"W. Its area is .14 square nautical mile.

4. Regulations promulgated pursuant to Section 103 of the Marine Protection Research and Sanctuaries Act[2] and Section 404 of the Clean Water Act (40 CFR 230),[1,3] and Portland District, Corps of Engineer Guidelines[4] specify that dredged material disposal operations must be evaluated prior to dredging to determine if significant physical, chemical, or biological impacts will result from disposal operations. Data on the physical characteristics of dredging and DS sediment is used to indicate if further chemical and biological data is needed. Generally, if dredged sediments consist predominantly of fine-grained material or contain significant amounts of organic material or volatile solids, and are to be placed on dissimilar material, chemical and/or biological data is obtained to determine if harmful levels of contaminants are present.[4] This report addresses the physical and chemical quality of sediments which must be dredged to maintain the Rogue River Federal navigation channel.

5. Previous sampling efforts within the navigation channel in February 1981 indicated that sediments in the river consisted of sand, whereas material within the moorage area and at the upland disposal site consisted of sandy-silt (figure 2). In addition, sediments within the river contained relatively low volatile solids (less than 2 percent), whereas sediments in the boat basin and disposal site contained over 5 percent volatile solids (table 1). Based on this data, the lack of significant pollution sources, and the large sand contribution from the ocean, no additional chemical analyses are needed of river channel sediments. However, the sediments within the moorage area, by virtue of their high volatile solids and silt content and the point sources in the moorage area proper, were considered unsuitable for disposal at the ocean DS without further testing. Pursuant to this finding, additional sediment samples were obtained in April 1982 and underwent chemical analysis (tables 4 and 5). Physical data was also obtained on these samples to substantiate the 1981 findings (table 1 and figure 3).

METHODS

6. Sediment samples were collected for elutriate, bulk sediment, and physical analyses from a small, port-owned tug. Field notes are presented on table 2. Receiving water samples were collected at approximately RM 2 for use in performing elutriate tests. The water was also analyzed to provide background data on the water quality in the area.

7. The sediment samples were obtained with a 9-by-9-inch, 45-pound Ponar grab sampler. The sediments were emptied into a stainless steel pan and subsequently transferred to two 2-foot-long, 2-5/8-inch-diameter sample containers. These containers were made of transparent cellulose butyrate acetate and were sealed with polyethylene caps. All equipment was acid cleaned. Samples were iced for transportation to the analytical laboratory. Upon reaching the laboratory, the samples were extruded, composited, and subsampled for elutriate, bulk chemical, and/or physical analyses. The elutriate and the bulk sediment analyses were performed by U.S. Geological Survey (USGS) following the procedures discussed in USGS publication, "Native Water, Bottom Material, and Elutriate Analyses of Selected Estuaries and Rivers in Western Oregon and Washington".[5,6] The physical analyses were performed by the Corps' North Pacific Division Materials Laboratory on samples which were provided by USGS. Methodologies used for the physical analyses are those described in the 15th edition of Standard Methods for Examination of Water and Wastewater.[7]

8. The bulk sediment analyses consisted of a soft digestion of the sediments. This type of analysis tests only for those contaminants which are adsorbed to the sediment surface, not those which are mineralogically bound. This is not the same as a hard or total digestion which also measures mineralogically bound contaminants.

9. The water used in the elutriate analyses was collected with a Scott-modified, Van Dorn water sampler. The water was transferred to acid-cleaned, collapsible, polyethylene containers and stored in ice for transport to the laboratory.

10. A Hydrolab 8000 water quality testing system was used to measure dissolved oxygen, pH, oxidation reduction potential (ORP), conductivity, and temperature at the Coast Guard dock (table 3).

11. Physical analyses were performed to determine if sediments met the exclusion criteria set up in Section 227.13(b) of the ocean dumping regulations[2] and Section 230.4-1(b)(1) of the Section 404 regulations.[1] In addition, the grain size of sediments is important in determining physical and chemical impacts of discharge operations. Unconsolidated, fine-grained materials, in comparison to larger grained materials, tend to adsorb more contaminants; suspend more readily thus influencing turbidity levels; form fluid mud layers; and spread further upon discharge. Also, deposits of sediments which are physically different from those at the receiving site can result in an altered benthic population, which may or may not be as productive as the former.[8,9]

12. Elutriate data on the navigation channel sediments are compared to Corps' guidelines and to the analytical data on the receiving water to estimate the water quality impacts of discharging dredged materials. The majority of the guidelines were promulgated in the EPA publication, Quality Criteria for Water,[10] with updates announced in the 28 November 1980 Federal Register,[11] and provide for the protection and propagation of fish and other aquatic life and for recreation in and on the water in accord with the 1983 goals of Public Law (PL) 92-500. The criteria were established in large part for evaluating long-term discharges from industrial point sources, not for assessing intermittent releases from dredged materials discharge operations and long-term releases from discharged sediments. However, they provide protective guidelines for use in assessing water quality impacts of disposal activities. Parameters without specific criterion were assigned guideline values based on available literature and/or State standards.

13. If a parameter was present in greater amounts in the elutriate analyses than in the guidelines and receiving water, dredged material disposal may negatively impact water quality at the DS. To determine the magnitude of the impact, the dilution potential and environmental characteristics of the DS must be considered. During open water disposal such impacts are generally

short-term and insignificant. However, upland disposal can result in a continual overflow which can significantly impact receiving water.

14. The bulk sediment chemical data on the sediments is compared to guidelines to determine if there are significantly high levels of potential contaminants. This data is more useful in assessing potential long-term impacts from open water disposal than are elutriate test results. Of particular concern are those parameters which are readily bioaccumulated, such as pesticides, mercury, and lead. The bulk sediment analyses can also be used to interpret elutriate data since certain parameters may be released at high or low levels during an elutriate test, even though they are not present in a sediment at such levels. The bulk analysis is not a direct measurement of the amount of contaminants which is readily available for chemical reaction and biological uptake; it is just an indicator of potential.

15. Recent research has shown that many aquatic organisms live in delicate balance with potential toxicants.[12,13] Slight increases of contaminants can cause the death of such organisms or affect their detoxification mechanisms in such a manner that they bioaccumulate contaminants to a much greater extent than previously.[14] Since contaminants of anthropogenic origin tend to be loosely adsorbed to the surface layer of sediments rather than mineralogically bound, they tend to be more available for biological uptake than the naturally occurring contaminants. Through elutriate tests and bulk sediment analyses, relative amounts of contaminants of concern in the sediments can be estimated. Comparison of this data to the Corps' guidelines and background levels indicates if excessive contaminant levels are present. If high levels are present, potential impacts of disposal at designated sites are estimated. Further bioassay, biological, and/or bioaccumulation studies may be necessary when such impacts are excessive given the types of contaminants present, the disposal site characteristics, and the dredged material quantities.

RESULTS

16. Physical Characteristics. The sediment from the turning basin, near the docks (site 3) consisted of fine sandy silt with a moderate amount of volatile

solids (6.6 percent). The sample from the access channel (site 2) consisted of silty fine sand and relatively few volatile solids. As such, it more closely resembled the sediments expected from the river. The void ratios were considerably higher in both of these samples than the moorage area sediments which were collected in 1981. Also site 3 sediments had twice the void ratio of site 2. High void ratios indicate a relatively unconsolidated material. The high volatile solids levels and angular characteristics of the sediments probably contributed to the high void ratio. As would be expected from an unconsolidated material, the density of the material in place was relatively low. Disposal of such sediments at an upland disposal site would tend to result in the settlement of more dense, less angular sediments, while other material would become suspended and be more easily carried away by overflow from the facility. Disposal at the ocean disposal site would probably result in rapid dispersal of sediments by current and wave action given the high-energy regime of the Pacific coast. The fine and unconsolidated nature of the sediments could result in the clamshell dredging causing extensive suspension of the sediments in the moorage area.

17. Chemical Characteristics. Both sediment samples underwent elutriate analyses for up to 45 parameters (table 4) as did the receiving water sample from the river. In addition, one of the samples (site 2) underwent bulk sediment analysis for 27 parameters (table 5).

18. The receiving water sample (site 1) contained undetectable to low levels of contaminants of concern when compared to Corps guidelines. The sediments from the turning basin (site 3) released more contaminants during the elutriate test than did the other sample. However, the elutriate analyses indicated little potential for water quality impacts from open water disposal operations. None of the parameters were present above fresh-or-saltwater guidelines in the elutriate or receiving water.

19. Bulk sediment analysis of sediments indicated low levels of all of the contaminants of concern. No significant toxic or bioaccumulative impacts are expected to occur as a result of contaminant content in these sediments.

CONCLUSIONS

20. The sediments from the Port of Gold Beach boat basin contain no significant levels of the contaminants which were measured. This is to be expected given the current restricted usage of the project.

21. The sediments are composed predominantly of fine silt and sand. Also, there is a moderate level of volatile solids, which indicate that the chemical oxygen demand of the sediments could be substantial. Given these factors, upland disposal on an ocean beach could cause esthetic impacts. Upland or inwater disposal in the estuary could result in reduced oxygen levels and increased ammonia content in the receiving waters. These impacts could become significant if large quantities are dredged at any one time and/or the receiving water does not experience adequate mixing. Various discharge management alternatives can minimize such impacts and should be investigated if discharge operations occur in the boat basin during low flow river regimes.

22. No significant chemical impacts are expected from placement of sediments into the ocean DS. Physical impacts would be similar to that which would occur from placement of river sands. The high energy regime of the ocean would be expected to quickly redistribute the sandy silt obtained from the boat basin. These sediments are expected to move offshore rather than accumulate onshore. Given these factors, disposal of the sediments at the interim ocean DS is considered suitable. On the other hand, a permanent ocean disposal site should not be used (or designated) without a site designation study to determine the least sensitive site.

LITERATURE CITATION

1. U.S. Environmental Protection Agency, "Guidelines for Specification of Disposal Sites for Dredged or Fill Material," <u>Federal Register</u>, Vol. 40, Part 230 (Wednesday, December 24, 1980).

2. U.S. Environmental Protection Agency, "Ocean Dumping", <u>Federal Register</u>, Vol. 42, No. 7 (Tuesday, January 11, 1977).

3. <u>Ibid</u>., "Testing Requirements for the Specification of Disposal Sites for Dredged or Fill Material," <u>Federal Register</u>, Vol. 45, No. 249 (Wednesday, December 24, 1980).

4. U.S. Army Engineer District, "Supplemental Interim Procedures for Evaluating and Testing Discharges of Dredged Materials," Portland District, OR (February 1980).

5. Skougstad, Marvin W. et al., <u>Methods for Determination of Inorganic Substances in Water and Fluvial Sediments</u>, U.S. Geological Survey, U.S. Government Printing Office, Washington, D.C. (1979).

6. U.S. Geological Survey, "Native Water, Bottom Material, and Elutriate Analyses of Selected Estuaries and Rivers in Western Oregon and Washington," USGS Open file Report 82-__________(in review).

7. American Public Health Association, American Water Works Association, and Water Pollution Control Federation, <u>Standard Methods for the Examination of Water and Wastewater</u>, 15th Edition, American Public Health Association, Washington, D.C., (1980).

8. McCave, I.N., ed., <u>The Benthic Boundary Layer</u>, Plenum Press, New York (1976).

9. Sollitt, C.U., "Measurement and Modeling of Various Estuarine Geotechnical Properties," <u>Environmental Impacts of Dredging in Estuaries</u>, Sect. IV A, OSU, Corvallis, OR (1977).

10. U.S. Environmental Protection Agency, "Quality Criteria for Water," Washington, D.C. (1976).

11. <u>Ibid</u>., "Quality Criteria Documents; Availability," <u>Federal Register</u>, Vol. 45, No. 23 (Friday, November 28, 1980).

12. Sittig, Marshall, (Ed), "Priority Toxic Pollutants", Noyes Data Corps., Park Ridge, NJ (1980).

13. Bascom, "The Non-toxicity of Metals to Animals in the Sea", Shore & Beach, Vol. 5, No. 2 (April 1982).

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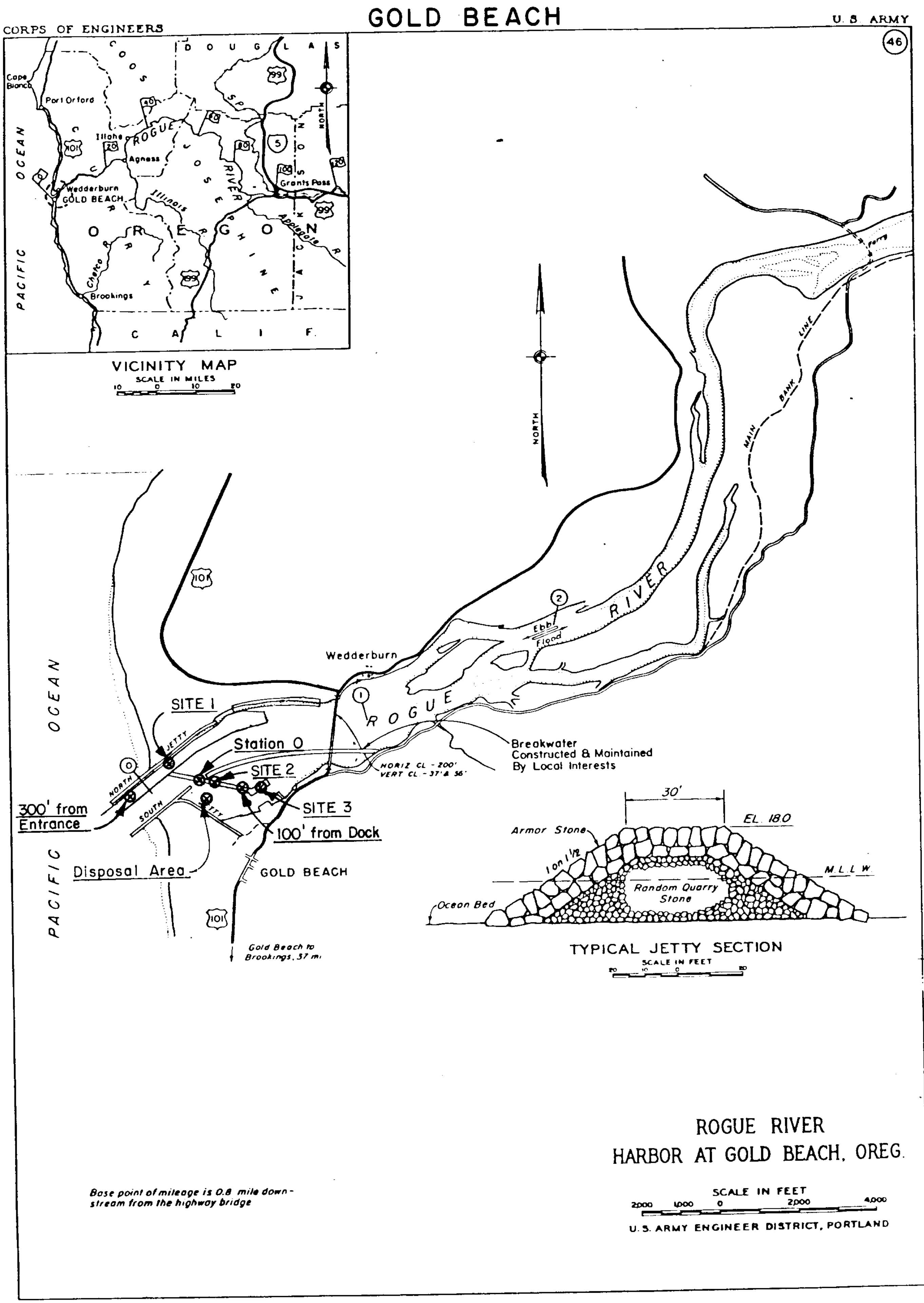

GOLD BEACH
CORPS OF ENGINEERS
U. S. ARMY
46
VICINITY MAP
SCALE IN MILES
Cape Blanco
Port Orford
Illahe
Agness
Wedderburn
GOLD BEACH
Brookings
Grants Pass
PACIFIC OCEAN
O R E G O N
C A L I F.
D O U G L A S
ROGUE RIVER
Wedderburn
SITE 1
Station 0
SITE 2
SITE 3
300' from Entrance
100' from Dock
Disposal Area
GOLD BEACH
NORTH JETTY
SOUTH JETTY
Breakwater Constructed & Maintained By Local Interests
HORIZ CL - 200'
VERT CL - 37' & 56'
Ebb
Flood
MAIN BANK LINE
Ferry
NORTH
Gold Beach to Brookings, 37 mi
30'
EL 18.0
Armor Stone
1 on 1½
M.L.L.W.
Random Quarry Stone
Ocean Bed
TYPICAL JETTY SECTION
SCALE IN FEET
ROGUE RIVER
HARBOR AT GOLD BEACH, OREG.
Base point of mileage is 0.8 mile downstream from the highway bridge
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT, PORTLAND

Figure 1

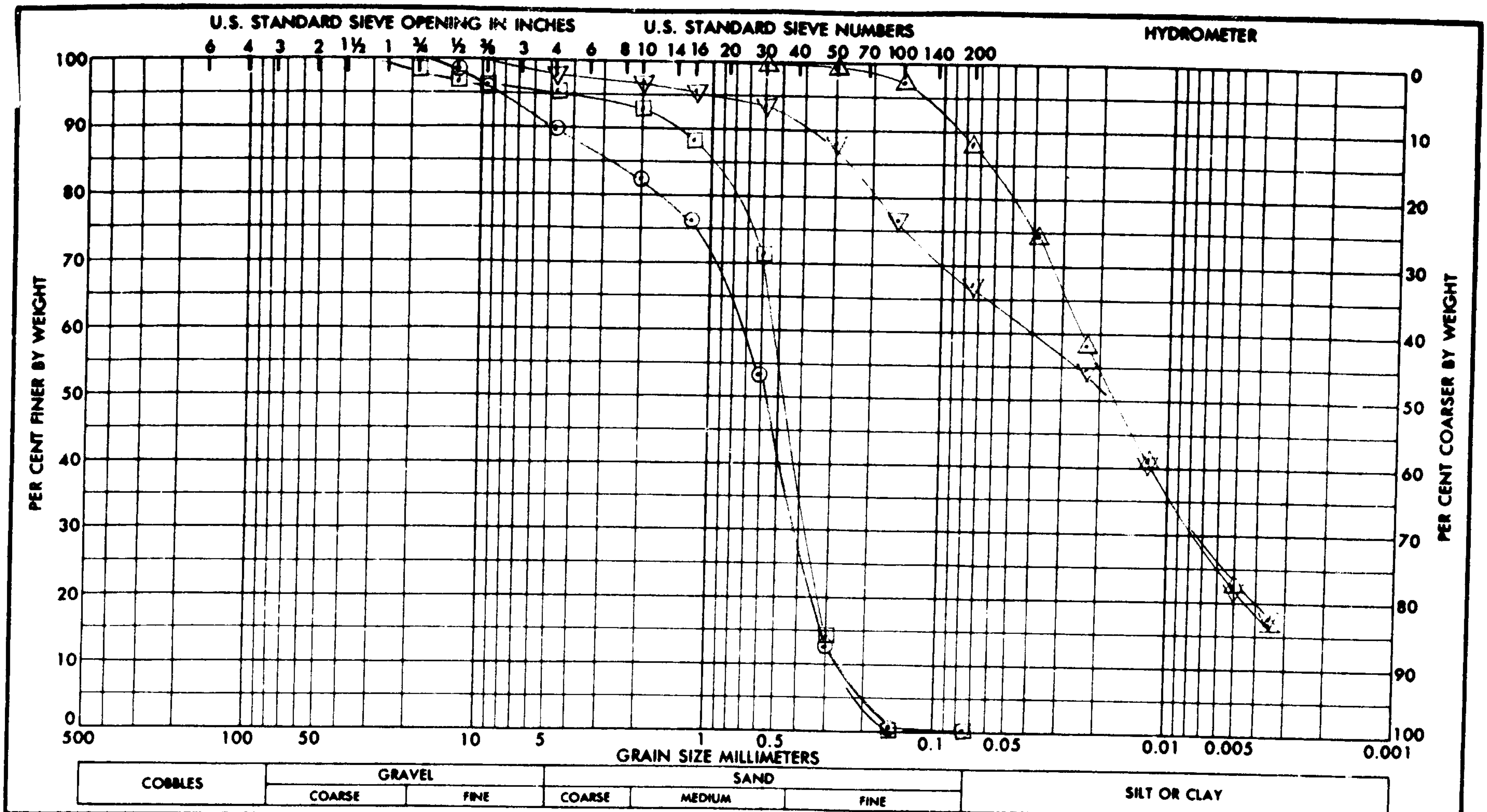


Figure 2

SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
⊙ Entrance to Boat Basin		SAND (SP)	Sta	0+00		
△ Boat Basin 100' from dock		Sa. SILT (ML)				
□ 300' from North Jetty Entrance		SAND (SP)				
▽ Disposal Area		Sa. SILT (ML)				

PROJECT RIVER/COASTAL SEDIMENT ANALYSIS

AREA Rogue River

BORING NO.

GRADATION CURVES

NPD

DATE 23 February 1981 (81-S-816)

ENG FORM 1 MAY 63 2087 REPLACES WES FORM NO 1241, SEP 1962, WHICH IS OBSOLETE.

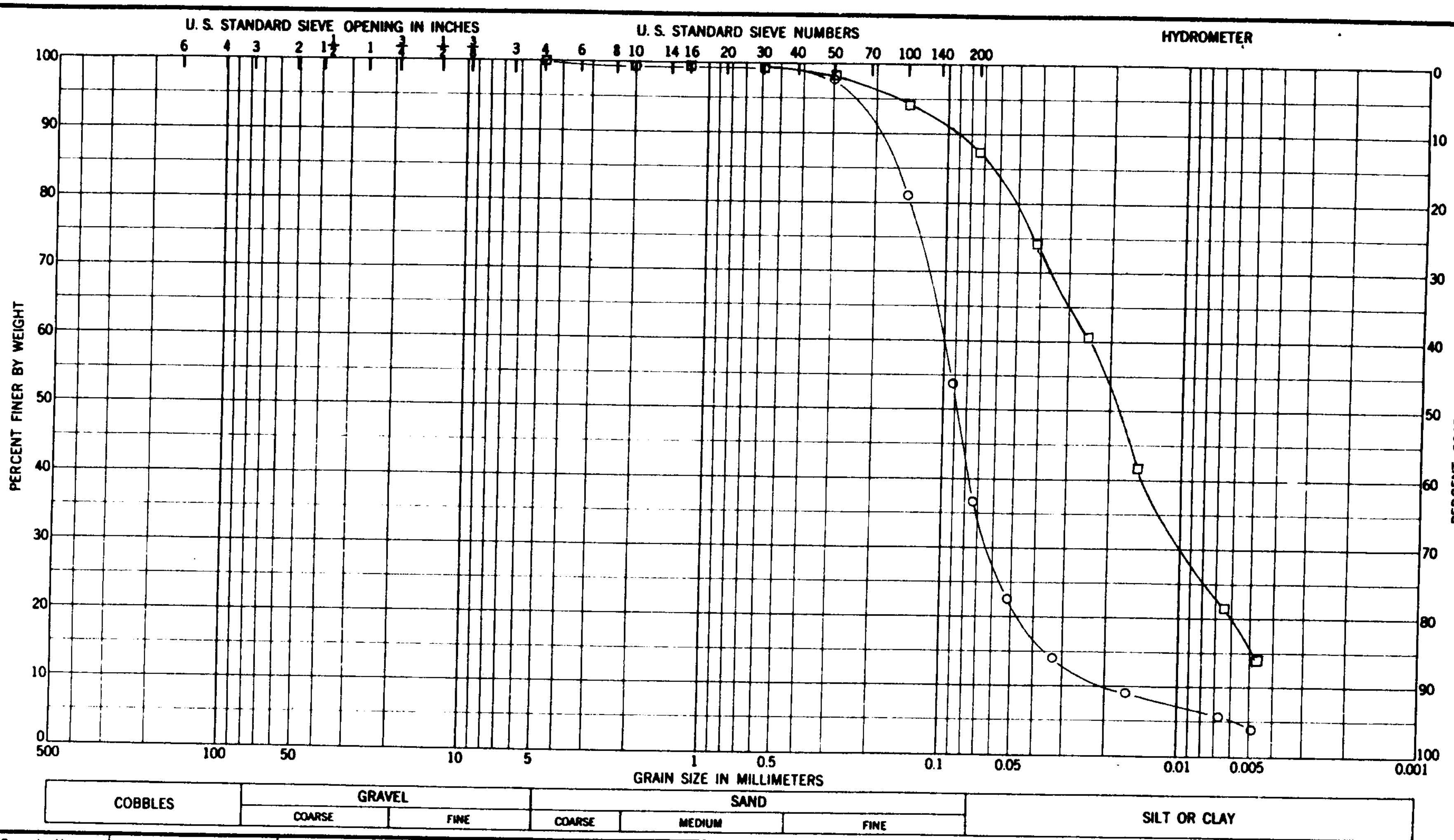
U S GOVERNMENT PRINTING OFFICE 1963 OF—700-126

TABLE 1
1981 and 1982 PHYSICAL SEDIMENT ANALYSES

Gold Beach Boat Basin, Oregon

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
Site 2 4-7-82	1.00 *	1569	2719	2.022	3.8	Angular to Very Angular
Site 3 4-7-82	1.00 *	1338	2698	4.024	6.6	Angular to Very Angular
Site 0+00. Entrance to Boat Basin 2-23-81	1.0002	2095	2793	0.637	1.69	Subround to Subangular
Boat Basin, 100' from Dock 2-23-81	1.0015	1400	2695	3.254	7.67	Angular to Subangular
300' from North Jetty Entrance 2-23-81	1.0000	2024	2817	0.775	1.20	Subround to Subangular
Disposal Area 2-23-81	1.0012	1447	2724	2.864	5.62	Angular to Subangular

* Distilled water used.



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site ER-2	–	Silty Fine SAND (SM)	–	–	–	–
Site EF-3		Fine Sandy SILT				

Project: ROGUE AND CHETCO RIVERS SEDIMENTATION ANALYSIS

Area: Rogue River

Boring No. Sampled 7 Apr 82

Date: (82-H-100)

GRADATION CURVES

NPD

ENG FORM 1 MAY 63 2087

Figure 3

TABLE 2
FIELD REPORT ON SEDIMENT AND WATER SAMPLING

Gold Beach Boat Basin
Rogue River, Oregon

Purpose of Sampling Per Section 404 and 103 requirements.

Date 4-7-82 Wind Slight breeze from west

Water Conditions (Wave heights & Direction, Tides, Currents) Semi-overcast. No rain.

Weather Sampling Vessel Small Tug

Sampling Personnel Pam Moore, Duane Evans Sampling Gear Van Dorn and Ponar

Analytical Laoratory USGS

Comments (Wildlife, Sampling Difficulties, etc.)

Station	Depth	Sampling Time	Sampling Methodology	Sampling Description
2		0845	Ponar	Mid-channel in mouth of basin (50 yards within). Dark sand with large wood pieces. Took many (≈10) drops to get a composite of 2 drops.
3		0915	Ponar	Mid-turning basin. Combination of brownish grey 'clay' and black shiny surface (1/2" thick). Material was gooey and thick. One drop = one sample = 2 core containers.

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project)
Water was collected from mid-river, outside boat basin, at ≈1000, on outgoing tide

TABLE 3
WATER QUALITY DATA
GOLD BEACH

DATE: 4-7-82

SAMPLING PERSONNEL: Pam Moore
Duane Evans

WEATHER CONDITIONS: Overcast, slight breeze

COMMENTS: (Wildlife, vessel traffic, completion status of training jetty, sampling gear difficulties, sampling vessel, etc.) Used Hydrolab 8000 System.

	STATIONS		
Parameter	Off of Dock		In River Opposite Boat Basin
Depth	Surface	Bottom	Bottom
Dissolved Oxygen	12.20	12.54	12.43
Conductivity	.002	.002	.001
ORP	591	573	542
Temperature	7.0	6.9	6.9
pH	7.64	7.73	7.68
Time	0950	0955	0957

TABLE 4
ELUTRIATE AND WATER QUALITY DATA
Gold Beach Boat Basin, Rogue River

	Units	Site 1 Recvng Wtr	Site 2	Site 3	Corps Guidelines Fresh/Salt
Arsenic	UG/L	<1		15	440/508
Barium	UG/L	9		11	
Beryllium	UG/L	<3		<3	130/
Cadmium	UG/L	<3	<3	<3	21/1260
Calcium	MG/L	8.6			
Carbon, Tot Organic	MG/L	1.7		13	
Chromium	UG/L	2	2	5	
Copper	UG/L	2	9	4	12/
Iron	UG/L	78	580	840	1000/
Lead	UG/L	<1	3	<1	74/668
Magnesium	MG/L	4.9	91		
Manganese	UG/L	3		230	/100
Mercury	UG/L	<0.1	0.1	<0.1	.0017/3.7
Nickel	UG/L	5		14	/100
Zinc	UG/L	12	19	16	180/170
Nitrogen, NH4 as N	MG/L	<0.06	.30	1.7	
Nitrogen, NH4+ORG-N	MG/L	0.46		3.1	
Nitrogen, ORG as N	MG/L			1.4	
Nitrogen, NH4 as NH4	MG/L	0.08	.39	2.2	
Calcium	MG/L	8.6			
Magnesium	MG/L	4.9			
Hardness	MG/L	42			
pH Field	UNITS	7.4	8.1	8.0	
Sp. Conductance	UMHOS	97	391	1982	
Strontium	UG/L	52			
Aldrin	UG/L	<0.01		<0.01	3.0/1.3
Chlordane	UG/L	<0.1		<0.1	2.4/.09
DDD	UG/L	<0.01		<0.01	
DDE	UG/L	<0.01		<0.01	1050/14.0
DDT	UG/L	<0.01		<0.01	1.1/.13
Dieldrin	UG/L	<0.01		<0.01	2.5/.71
Endosulfan I	UG/L	<0.01		<0.01	.22/.034
Endrin	UG/L	<0.01		<0.01	.18/.037
Gross PCBS	UG/L	<0.1		<0.1	
Gross PCNS	UG/L	<0.1		<0.1	
Hept Epox	UG/L	<0.01		<0.01	
Heptachlor	UG/L	<0.01		<0.01	
Lindane	UG/L	<0.01		<0.01	.50/.053
Mirex	UG/L	<0.01		<0.01	.001/.001
Perthane	UG/L	<0.10		<0.10	
Toxaphene	UG/L	<1		<1	1.6/.07
Silvex	UG/L	<0.01		<0.01	
2,4-D	UG/L	<0.01		<0.01	
2,4-DP	UG/L	<0.01		<0.01	
2,4,5-T	UG/L	<0.01		<0.01	

TABLE 5
BULK SEDIMENT CHEMICAL DATA

Gold Beach Boat Basin, Rogue River

	Units	Site 3	Corps Guidelines
Aldrin	UG/KG	<0.1	10,000
Arsenic	UG/G	6	3-8
Cadmium	UG/G	<1	6
Chlordane	UG/KG	1	10,000
Chromium	UG/G	20	25-75
Copper	UG/G	20	25-50
DDD	UG/KG	1.0	10,000
DDE	UG/KG	2.3	10,000
DDT	UG/KG	1.9	10,000
Dieldrin	UG/KG	0.1	10,000
Endosulfan	UG/KG	<0.1	10,000
Endrin	UG/KG	<0.1	10,000
PCB	UG/KG	2	10,000
PCN	UG/KG	<1	10,000
Hept Epox	UG/KG	<0.1	10,000
Heptachlor	UG/KG	<0.1	10,000
Iron	UG/G	3100	17,000-25,000
Lead	UG/G	10	40-60
Lindane	UG/KG	<0.1	
Manganese	UG/G	230	300-500
Mercury	UG/G	0.10	1
Mirex	UG/KG	<0.1	10,000
Methoxychlor	UG/KG	0.7	10,000
Perthane	UG/KG	<1	10,000
pH Field	UNITS	8.0	
Specific Conductance	UMHOS/CM	1982	
Toxaphene	UG/KG	<10	10,000
Zinc	UG/G	13	90-200