

CENWP-PE-HR (1110-2-1143a)

MEMORANDUM FOR CHIEF CENWP-CO-N ATTN CENWP-CO-NW

SUBJECT: Transmittal of Completed Report for the 1998 Sediment Evaluation of Federal Channel at Depoe Bay.

1. Reference CENWP-CO-NW 13 November 1997 funding letter, subject: FY98 Funding Letter for Sediment Quality.
2. Nine stations were sampled August 18, 1998. Most material was classified as "sandy silt". Median grain size for all material was 0.14mm, with 73.4% sand and 25.8% fines. No screening levels for chemical analyses were exceeded. Material represented by these samples is suitable for open unconfined in-water disposal.
3. A copy of the completed report has been delivered to the project manager for the study in CO-NW. The study file is located in PE-HR, marks number: 1110-2-1403a.
4. Any further questions should be directed to either Tim Sherman (808-4883) or Mark Siipola (808-4885).

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LLLX4871
30 Sep 98

Depoe Bay
Sediment Sampling Evaluation

Abstract

Nine sediment stations were sampled at Depoe Bay on August 18, 1998 (see Figure 1). A total of 6 samples (includes 1 QC sample & 2 composites) were sent to Sound Analytical Services, Inc. laboratory of Tacoma, WA, for physical and chemical analyses, to include: metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), phenols, phthalates, miscellaneous extractables, and polynuclear aromatic hydrocarbons (PAHs). Tributyltin was run on the 2 composite samples. The screening levels (SL) used are those adopted for use in the draft Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area (1998). This evaluation was conducted following procedures set forth in the Inland Testing Manual (ITM), developed jointly by the Corps and EPA to assess dredged material. Guidelines used are those developed to implement the Clean Water Act (CWA).

The proposed dredge material from this project is acceptable for both unconfined in-water and upland disposal. No significant, adverse ecological impacts are expected as a result of sediment toxicity.

Introduction

The purpose of this report is to characterize the sediment of shoaling with-in Depoe Bay, based on the sampling event described. Reference will be made to the project Sampling and Analysis Plan (SAP) attached to this report. The project description, site history and assessment are detailed in section 1 of the SAP. The sampling and analysis objectives listed below are those stated in the (SAP) (sec. 2.0). This report will outline the procedures used to accomplish these goals.

SAMPLING AND ANALYSIS OBJECTIVES

The sediment characterization program objectives and constraints are summarized below:

- To characterize sediments in accordance with the draft regional dredge material testing manual, the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area.
- Collect, handle and analyze representative sediment, of the purposed dredging prism, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of environmental impact.
- Only physical and chemical characterization will be conducted.

Historical Data

Previous sediment evaluations were conducted in 1980, 1989 and 1994. The 1994 event submitted 4 samples collected from 8 stations within Depoe Bay. Analyses showed a mean grain size of 0.07mm with 47% sand, 45% silt and 10% clay. Chemical analyses do not exceed the 1998 SL (DMEF). This material was deemed suitable for open in-water disposal.

Current Sampling Event

The Corps of Engineers, Portland District personnel, collected 4-gravity core samples and 5 surface grab samples on August 18, 1998. The first 4 samples (DB-GC-01 through 04), taken by gravity core, were fine-grained materials and were composited into 1 sample (no core was retained in 3 tries for sample 04). All samples were dark gray/black silty sand. Core length varied from 24 inches to 12 inches. Samples 05 and 06 were collected with a Ponar box core sampler and composited. Samples 07 and 08 were also grab samples collected by Ponar. Sample 09 was collected from the sediment deposit behind the dam using a hand held gravity core tube. The median grain size for all sediment collected was 0.14mm, with 25.8% fines. As mentioned earlier, samples were sent to Sound Analytical laboratory of Tacoma, WA, for physical and chemical analyses, to include: metals, total organic carbon (TOC), pesticides/PCBs, phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons (PAHs) and tributyltin (TBT).

Sampling and analyses were performed using proper quality control measures, including proper procedures for chain of custody, preservation and cooler receipt. One sample was replicated and analyzed for quality control (QC). Replicate sample data correlation with the primary sample results is acceptable. All laboratory QC is acceptable. Three metals, arsenic, antimony and cadmium, for all samples, were run by a method that failed to reach desired detection limits. They were non-detect at levels above the accepted SL. These metals have not shown elevated levels from past analyses and are not considered problematic. One of 2 composite samples that were run for TBT showed elevated detection limits. The method detection limit for monobutyltin was 0.01ppb above the accepted SL. This sample was non-detect at that level. Elevated detection limits resulted when a low volume of interstitial water was available from extraction. The other TBT sample was non-detect with reporting limits well below the accepted SL.

Results/Discussion

Physical and Volatile Solids: Data for these analyses are presented in Table 1. Three of 5 samples submitted for analysis exceeded 20 % fines and 4 of 5 exceeded 5% volatile solids. Four samples submitted were classified as “sandy silt” (ML) and 1 sample was classified as “sandy elastic silt” (MH). Median grain size for all samples is 0.14 mm, with 73.4.0 % sand and 25.8 % fines. The finer material was located in areas sampled within and around boat docks.

Metals and Total Organic Carbon (TOC): Data for these analyses are presented in Table 2. Low levels of some metals were found in most of the samples collected, but do not approach the SL. The highest level detected was for Zinc, which was 31.7 % of the SL. As mentioned above, three metals, arsenic, antimony and cadmium, for all samples, were run by a method that failed to reach desired detection limits. They were non-detect at levels above our normal SL. These metals have not shown elevated levels from past analyses and are not considered problematic.

Pesticide/PCBs, Phenols, Phthalates and Misc. Extractables: Data for these analyses are presented in Table 3. Four pesticides were found at low levels. The highest level detected was 53.7 % of the SL (the others were <29.0% of the SL). One phenol was detected at a very low level in 4 of 5 samples (1.4% of SL). Four phthalates were detected at low levels in 4 of the 5 samples (highest 13.4% of SL). Benzoic Acid was found in 4 of the 5 samples at low levels (highest 12.3% of SL).

Polynuclear Aromatic Hydrocarbons (PAHs): Data for PAHs is presented in Tables 4 & 5. Low levels of some “low molecular weight” PAHs were found in all samples (7.3% of SL). The highest Total L-PAH detected for an individual sample was 7.6% of the SL. Low levels of some of the “high molecular weight” PAHs were also found in all samples. The highest individual level was 35.0% of the SL (the other were <9.6% of the SL). The highest Total H-PAH detected for an individual sample was 8.1% of the SL.

Organotin (often referred to as Tributyltin (TBT) - interstitial (pore) water: Data for TBT are presented in Table 2. TBT in this report was analyzed using the interstitial (pore) water extraction method of analysis rather than the bulk TBT analysis used in past studies. This method measures more accurately the TBT that is bioavailable to the organism. It has been adopted as the acceptable method in the regional manual (DMEF). Two composite samples were submitted for TBT. One of 2 composite samples that were run for TBT showed elevated detection limits. The method detection limit for monobutyltin was 0.01 above normal SL. This sample was non-detect at that level. Elevated detection limits resulted when a low volume of interstitial water was available from extraction. The other TBT sample was non-detect with reporting limits well below our normal SL.

Conclusion

The screening levels used are those adopted for use in the draft Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area (1998). This evaluation was conducted following procedures set forth in the Inland Testing Manual, developed jointly by the Corps and EPA to assess dredged material and in accordance with 404 (b)(1) guidelines set forth in 40 CFR 230 developed to implement the Clean Water Act. The DMEF was developed in cooperation with the regional federal agencies (Corps and EPA) and state agencies (Oregon DEQ, Washington DOE and DNR). The DMEF Tiered testing approach requires that material in excess of 20% fines and greater than 5% volatile solids, as well as any material with prior history or is suspected (“reason to believe”) of being contaminated, be subjected to chemical as well as physical analyses. Under the Tiered approach, if the chemical analytical results do not exceed the established screening levels, the material is cleared for unconfined in-water disposal. The analyses for this material show

only low level contamination, water quality standards will not be exceeded during dredging and disposal. This material is suitable for, both upland and open in-water, disposal with no adverse unacceptable ecological consequences expected.

References

1. U.S. Army Corps of Engineers, Portland District, Seattle District, U.S. Environmental Protection Agency, Region 10, Oregon Department of Environmental Quality, Washington State Department of Natural Resources. April 1998 (draft document). Dredge Material Evaluation Framework Lower Columbia River Management Area.
2. U. S. Environmental Protection Agency and U. S. Army Corps of Engineers. February 1998. Evaluation of Dredged Material Proposed for Discharge in Inland and Near Coastal Waters – Testing Manual, dated (referred to as the “Inland Testing Manual”).
3. U. S. Environmental Protection Agency and U. S. Army Corps of Engineers. February 1998. Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual, (referred to as the “The Green Book”).
4. Siipola, M. Army Corps of Engineers, Portland District. Jan 1989. Results of 1989 Depoe Bay Sediment Quality Evaluation.
5. Britton, J. and Siipola, M. Army Corps of Engineers, Portland District. Feb 1994. Depoe Bay Sediment Evaluation.
6. Moore, P. Army Corps of Engineers, Portland District. 1980. Depoe Bay Sediment Quality Study.

Table 1, Depoe Bay

Physical Analysis

Sampled August 18,1998

Sample I.D.	Grain Size (mm)			%		
	Median	Mean		Sand	Silt/Clay	Volitle solids
DB-GC-1234	0.08	0.16		57.1	42.9	14.1
DB-P-56	0.07	0.11		52.7	47.3	14.9
DB-P-07	0.16	0.12		97.8	2.2	2.7
DB-P-08	0.23	0.47		78.9	17.8	10.1
DB-P-09	0.14	0.15		80.6	18.8	8.6
DB-P-09 DUP	0.13	0.13		81.3	18.4	9.0
Mean	0.14	0.20		73.4	25.8	10.1
Maximum	0.23	0.47		97.8	47.3	14.9

Table 2, Depoe Bay

Inorganic Metals and TOC

Sampled August 18, 1998

Sample I.D.	As	Sb	Cd	Cu	Pb	Hg	Ni	Ag	Zn	TOC	TBT
	mg/kg (ppm)										ug/kg
DB-GC-1234	<0.14	<.10	<1.0	27	<51	0.21	25	<2.4	160	51000	<0.022
DB-P-56	<0.14	<.10	<1.0	23	<47	<.20	<17	<2.2	170	55000	<0.10
DB-P-56A	<0.14	<.10	<1.0	23	<47	<.26	<17	<2.2	180	51000	-
DB-P-07	<0.14	<.10	<1.0	7.4	<28	<.11	15	<1.3	71	7600	-
DB-P-08	<0.14	<.10	<1.0	12	<38	<.16	<14	<1.8	140	30000	-
DB-P-09	<0.14	<.10	<1.0	7.6	<27	<.12	14	<1.3	68	14000	-
Screening level (SL)	57	150	5.1	390	450	0.41	140	6.1	410		0.15
Mean	-	-	-	16.7	-	0.042	9	-	131.5		-
Maximum	-	-	-	27	-	0.21	25	-	180		-

Symbol (<) = Non-detect(ND) at the Method Detection Limit (MDL).

Pesticides/PCBs, Phenols, Phthalates, Chlorinated Organic Compounds and Extractables

Sample I.D.	Pesticides				Phenols	Phthalates				Extractables
	ug/kg (ppb)									
	Endosul fan I	gamma- BHC (Lindane)	4,4'- DDT	Hepta chlor	3-&4- Methyl phenol	Dimethyl phthalate	Dibenzo furan	Butylbenzyl phthalate	bis(2- Ethylhexyl) phthalate	Benzoic Acid
DB-GC-1234	<0.47	<0.25	<1.8	<0.15	8.5	6.5	<12	<2.1	46	63
DB-P-56	<0.39	<0.21	<1.5	3.7	4.8	<2.0	<11	<1.8	66	56
DB-P-56A	<0.42	<0.22	<1.6	5.3	9.7	<2.5	<13	130	83	21
DB-P-07	<0.2	0.77	<.79	1.4	5.2	<1.2	<6.1	<1.0	87	6.9
DB-P-08	<0.3	<0.16	2	<0.095	9	15	10	<1.4	90	80
DB-P-09	0.72	<0.097	<0.7	<0.057	<2.0	<1.1	<5.9	<0.99	<1.3	<2.1
Screening level (SL)	10	10	6.9	10	670	1400	1200	970	8300	650
Mean	0.12	0.13	0.33	1.7	6.2	2.5	1.7	21.6	62	37.8
Maximum	0.7	0.77	2	5.3	9.7	15	10	130	90	80
PCBs = ND <17.0 (SL = 130)										

Table 4, Depoe Bay

Polynuclear Aromatic Hydrocarbons (PAHs)

Sampled August 18, 1998

Low Molecular Weight Analytes**ug/kg (ppb)**

Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene
DB-GC-1234	<2.1	<3.3	18	6
DB-P-56	7.0	6.6	33	12
DB-P-56A	9.7	7.6	30	20
DB-P-07	<1.1	<1.6	6.9	3.2
DB-P-08	11.0	10	55	17
DB-P-09	<1.0	<1.6	<1.4	<1.6
Screening level	500	560	960	540
Mean	4.6	4	23.8	9.7
Maximum	11	10	55	20
	2-Methylnaphthalene	Naphthalene	Phenanthrene	Total Low PAHs
DB-GC-1234	<5.5	5.5	20	49.5
DB-P-56	<4.9	6.6	74	139.2
DB-P-56A	8.1	12	84	171.4
DB-P-07	5.2	7.2	23	45.5
DB-P-08	7.6	10	110	220.6
DB-P-09	<2.7	<1.9	3.4	3.4
Screening level	670	2100	1500	29000
Mean	3.5	6.9	52.4	
Maximum	8.1	12	110	

Symbol (<) =Non-detect at the method detection limit (MDL).

Table 5, Depoe Bay

Polynuclear Aromatic Hydrocarbons (PAHs)

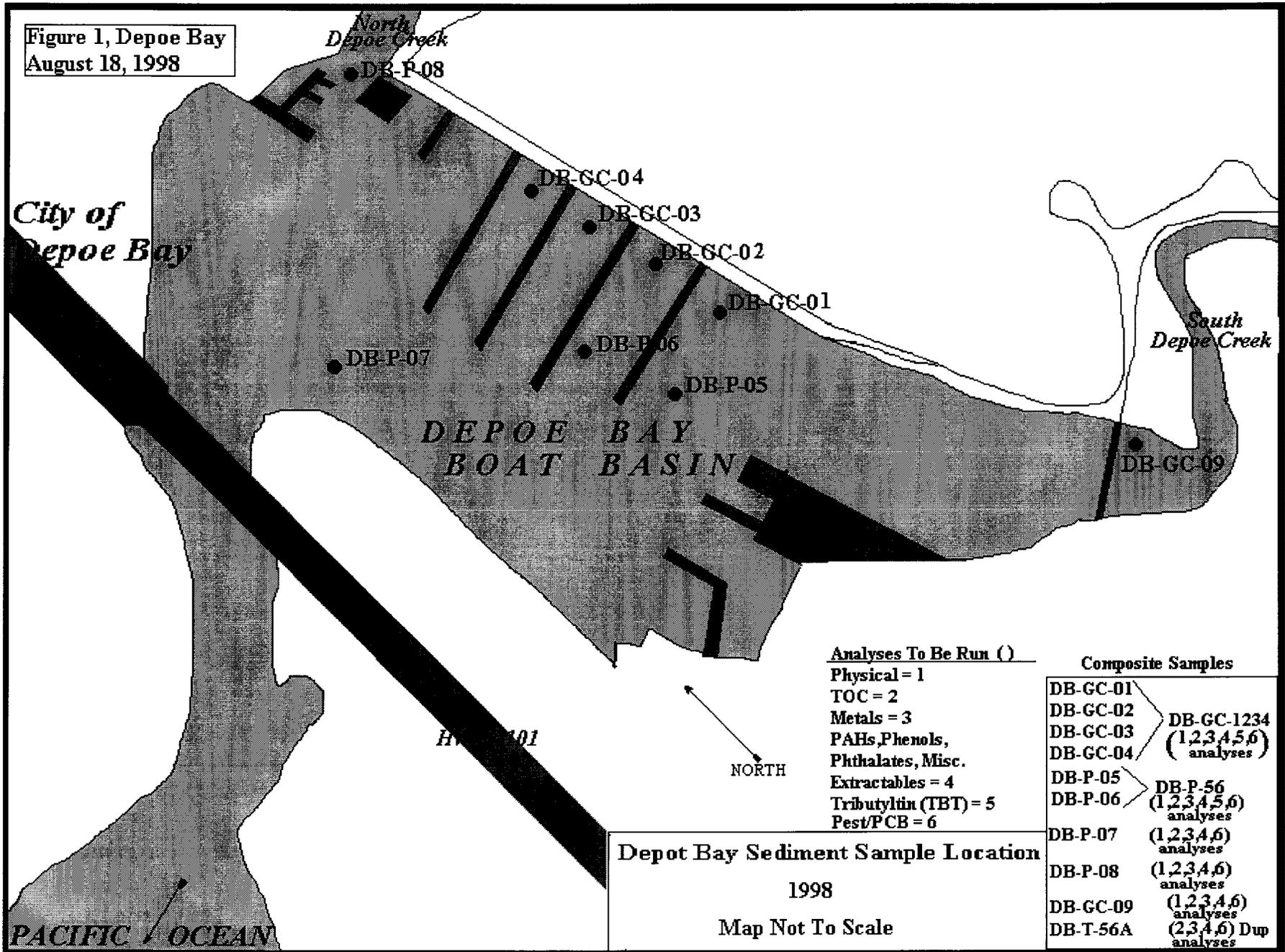
Sampled August 18, 1998

High Molecular Weight Analytes**ug/kg (ppb)**

Sample I.D.	Benzo(a)anthracene	Benzo(b)fluoroanthene	Benzo(k)fluoroanthene	Benzo(g,h,i)perylene	Chrysene	Pyrene
DB-GC-1234	41	51	6	<2.1	47	130
DB-P-56	67	64	13	<1.9	86	140
DB-P-56A	75	74	25	<2.3	100	220
DB-P-07	26	21	12	<2.5	14	41
DB-P-08	110	87	33	<1.4	120	250
DB-P-09	<1.6	<2.3	<2.4	<1.0	<1.6	<0.72
Screening level	1300	(3200 combined)		670	1400	2600
Mean	53.1	49.5	1.3	-	61.2	130.2
Maximum	110	87	33	-	120	250
	Benzo(a)pyrene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Fluoranthene	Total High PAH	
DB-GC-1234	560	<1.7	<1.1	130	966	
DB-P-56	100	<1.5	15	170	655	
DB-P-56A	84	<1.9	<1.2	270	848	
DB-P-07	16	<0.85	<0.53	42	172	
DB-P-08	38	<1.1	<0.71	290	928	
DB-P-09	<1.1	<0.82	<0.51	<1.8	0	
Screening level	1600	230	600	1700	12000	
Mean	133	-	3	150.3		
Maximum	560	-	15	290		

Symbol (<) = Non-detect at the method detection limit (MDL).

Figure 1, Depoe Bay
August 18, 1998



- Analyses To Be Run ()**
- Physical = 1
 - TOC = 2
 - Metals = 3
 - PAHs, Phenols, Phthalates, Misc.
 - Extractables = 4
 - Tributyltin (TBT) = 5
 - Pest/PCB = 6

Composite Samples	
DB-GC-01	DB-GC-1234 (1,2,3,4,5,6) analyses
DB-GC-02	
DB-GC-03	
DB-GC-04	
DB-P-05	DB-P-56 (1,2,3,4,5,6) analyses
DB-P-06	
DB-P-07	(1,2,3,4,6) analyses
DB-P-08	(1,2,3,4,6) analyses
DB-GC-09	(1,2,3,4,6) analyses
DB-T-56A	(2,3,4,6) Dup analyses

Depot Bay Sediment Sample Location
1998
Map Not To Scale

SEDIMENT
SAMPLING & ANALYSIS PLAN
FOR
DEPOE BAY

August 1998

Prepared by:

Portland District
Corps of Engineers

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1.0 PROJECT DESCRIPTION, SITE HISTORY AND ASSESSMENT

1.1 Project Site Description and Location: Depoe Bay is a small inlet 100 miles south of the mouth of the Columbia River. Two small streams called North and South Depoe Bay Creek feed the bay. A check dam is located a few hundred feet upstream of the entry of South Depoe Creek into the bay. The check dam helps to collect sediment before it enters the bay. Water and sediment quality is more affected by tidal movement of water into and out of the bay than stream flows in the two creeks.

The authorized project includes two breakwaters that lie north and south of the rocky entrance. The entrance channel is 8 feet deep and 50 feet wide. A 390-by-750 foot boat basin is located within the bay. Both the boat basin and the channel are federally authorized for a depth of 8-foot, which is maintained by the US Army Corps of Engineers.

1.2 Site History: Between 1939 – 1950 a total of 56,143 cy of material was removed from the inner bay; between 1951 – 1970 a total of 39,336 cy; and between 1971 – 1988 a total of 46,707 cy. In 1989 a total of 10,000 cy of material was removed and in 1994 a total of 7,000 cy of material was removed. In 1996 2,000 cy were removed from the check dam catch basin. The majority of the material has been hydraulically removed with the discharge point located on the rocky intertidal shoreline of the outer bay, approximately 200 feet south of the entrance to the inner bay.

1.3 Previous Sediment Sampling: Sediment evaluations of Depoe Bay were conducted in 1980, 1989 and 1994. The sediments evaluated were found to be acceptable for in-water disposal. In 1994 the median grain size was 0.068 mm, with a composition of 47.1 % sand, 45.2 % silt and 12.7 % volatile solids. Two of 4 samples tested for Cadmium and 4 of 4 samples for Zinc were found in excess of the 1994 screening levels (SLs). Low levels of PCBs (3 of 4 samples) and Tributyltin (TBT) (4 of 4 samples) were detected, but none exceeded SLs. Some low molecular weight PAHs were detected in all samples, but none exceeded the SLs in effect. The high molecular weight PAHs screening levels were exceeded in 3 of the 4 samples tested for H-PAHs. These screening levels in effect in 1994 were exceeded as stated, however, none of these results are in excess of current 1998 SLs.

2.0 SAMPLING AND ANALYSIS OBJECTIVES

- To characterize sediments in accordance with the draft Dredged Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area.
- Collect, handle and analyze representative core sediment samples of the proposed dredging area in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of environmental impact.
- Only physical and chemical characterization will be conducted.

3.0 SAMPLING AND ANALYSIS REQUIREMENTS

3.1 Project Ranking: Although this area is not a part of the DMEF management area, it will be evaluated using the criteria adopted for this manual, based on the past and current sampling event results.

3.2 Sampling and Analysis Requirements: Depoe Bay will be sampled using a gravity core sampling device and a ponar sampler. A gravity coring system collects a continuous profile of sediments below

the mudline and a ponar sampler collects a surface grab sample. All samples more than 20 % fines and/or 5 % volatile solids will be subjected to both physical and chemical analyses. Ten percent (minimum 1 sample) will be Quality Control blind replicate sample(s), submitted for select chemical analysis only.

4.0 SAMPLE COLLECTION AND HANDLING PROCEDURES

4.1 Sampling Locations and Numbering: Figure 1 shows the project area and sample locations. Sampling sites are located for the best characterization of the material within the dredging area as possible. Potential sources of contamination (i.e. Port Facilities) and uniform coverage of the study area are factors in sample location. Proper QA/QC procedures as outlined in this section will be followed. Any deviation from these procedures shall be noted in the field log. Sample identification shall adhere to the following convention:

DB-XX-YY (Z)

Where, DB denotes samples collected from Depoe Bay, "XX" denotes the type of sampling device such as GC-gravity corer or P for ponar sampler; "YY" denotes the numeric sample number and will consist of two (or more) digits for all samples (i.e. 01, 05, 15, etc.). For cores an alpha character (i.e. A, B, C, etc.) will be used to denote vertical location as represented here by "Z" if such identification is determined to be necessary. Some samples will be composited; these samples will combined the individual site locations into one number (i.e. 01+02+03+04 = 1234).

4.2 Field Sampling Schedule: Sampling is planned for Aug 18th.

4.3 Field Notes: Field notes will be maintained during sampling and compositing operations. Included in the field notes will be the following:

- Names of the person(s) collecting and logging in the samples.
- Weather conditions.
- Depth of each station sampled as measured from the water surface. This will be accomplished using a leadline or corrected depth recorder.
- Date and time of collection of each sediment sample.
- The sample station number and individual designation numbers assigned for each individual sample.
- Descriptions of sediment or core sections.
- For cores the length of core and the penetration depth of the sampling device.
- Any deviation from the approved sampling plan.

4.4 Positioning: Sample locations are marked on Figure 1 (sample map, page 7).

4.5 Decontamination: All sampling devices and utensils will be thoroughly cleaned prior to use according to the following procedure:

- Wash with brush and Alconox soap
- Rinse with distilled water
- Rinse with 10% nitric acid solution

- Rinse with distilled water

Utensils used to collect physical samples only or sampling devices such as the box corer will be washed down before each sampling event. However, they will not require the cleaning procedure listed above as long as samples collected for chemical analyses are not in contact with the core walls. All utensils used to collect chemical samples will require decontamination prior to each use. All hand work for chemical analyses will be conducted with disposable latex gloves which will be rinsed with distilled water before and after handling each individual sample, as appropriate, to prevent sample contamination. Gloves will be disposed of between samples or composites to prevent cross contamination between samples.

4.6 Core Logging: Each discrete core section will be inspected and described. For each core sample, the following data will be recorded on the core log:

- Depth interval of each core section as measured from Columbia River Datum.
- Sample recovery
- Physical soil description in accordance with the Unified Soil Classification System (includes soil type, density/consistency of soil, color)
- Odor (e.g., hydrogen sulfide, petroleum products)
- Visual stratification and lenses
- Vegetation
- Debris
- Biological Activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

4.7 Field Replicates: Blind field replicates will be prepared and submitted along with the rest of the samples to the laboratory. This represents about 10% of the total samples collected. Sample numbers shall be labeled the same as the primary sample with the last letter duplicated i.e. DB- XX-YY (primary), DB-XX-YYA (replicate). Replicate sample locations shall be documented in the field log.

4.9 Sample Transport and Chain-of-Custody Procedures: After sample containers have been filled they will be packed on ice in coolers. Chain-of-custody procedures will commence in the field and will track delivery of the samples. Sample holding times and storage requirements are presented in Table 1. Specific procedures are as follows:

- Samples will be packaged and shipped in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24 or delivered directly to the testing laboratory.
- Individual sample containers will be packed to prevent breakage.
- The coolers will be clearly labeled with sufficient information (i.e. name of project, time and date container was sealed, person sealing the cooler and office name and address) to enable positive identification.
- A sealed envelope containing chain-of-custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- Custody seals shall be signed and dated, by the person relinquishing the chain of custody, and placed over cooler lid seal if cooler is out of their custody.

Upon transfer of sample possession to the laboratory, the persons transferring custody of the coolers will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the coolers will be inspected and the receiver will record the condition of the samples.

Table 1, Sample Volume and Storage

Sample Type	Holding Time	Sample Size (a)	Temperature(b)	Container
Particle Size	6 Months	200 g	4°C	1-1 Quart Plastic Bag
Total Solids	14 Days	125 g	4°C	1-16oz. Glass (combined)
Total Volatile Solids	14 Days	125 g	4°C	
Total Organic Carbon	14 Days	125 g	4°C	
Metals (except Mercury)	6 Months	50 g	4°C	
Polynuclear Aromatic Hydrocarbons, Phenols, Phthalates and Misc. Extractables	14 Days until extraction 40 Days after extraction	10 g	4°C	
Pesticides and PCBs	14 Days	10 g	4°C	
Mercury	28 Days	5 g	4°C	
Tributyltin (TBT)	14 Days		4°C	

a. Required sample sizes for one laboratory analysis. Actual volumes to be collected have been increased to provide a margin of error and allow for retest.

b. During transport to the lab, samples will be stored on blue ice.

5.0 LABORATORY PHYSICAL AND CHEMICAL SEDIMENT ANALYSIS

5.1 Laboratory Analyses Protocols. Laboratory testing procedures will be conducted in accordance with the DMEF. The samples will be analyzed for all the parameters listed in Appendix C and requested on the chain-of-custody record. Private contract analytical chemical laboratories will conduct all physical and chemical analyses.

5.1.1 Chain-of-Custody: A chain-of-custody record for each set of samples will be maintained throughout all sampling activities and will accompany samples and shipment to the laboratory. Information tracked by the chain-of-custody records in the laboratory include sample identification number, date and time of sample receipt, analytical parameters required, location and conditions of storage, date and time of removal from and return to storage, signature of person removing and returning the sample, reason for removing from storage, and final disposition of the sample.

5.1.2 Limits of Detection: Detection limits of all chemicals of concern must be below screening levels. All reasonable means, including additional cleanup steps and method modifications, will be used to bring all limits-of-detection below the screening levels. In addition, an aliquot of each sediment sample

for analysis will be archived and preserved at -18 C for additional analysis if necessary. Sediments or extracts will be kept under proper storage conditions until the chemistry data is deemed acceptable.

5.1.3 Sediment Chemistry: Private analytical laboratories will conduct all chemical analyses. Chemical analyses will include: metals (6010/7000 series), total organic carbon (TOC) method 9060, polynuclear aromatic hydrocarbons (PAHs), phenols, phthalates and misc. extractables by method 8270, pesticides/PCBs by method 8081 and tributyltin (TBT).

5.1.4 Sediment Conventionals: The private analytical laboratories will analyze physical parameters. Particle grain size distribution for each sample will be determined. Sieve analysis will use a geological sieve series, which will include the sieve sizes U.S. NO. 5, 10, 18, 35, 60, 120, and 230. Hydrogen peroxide will not be used in preparations for grain-size analysis. Hydrometer analysis will use for particle sizes finer than the 230 mesh. Water content will be determined using ASTM D 2216. Sediment classification designation will be made in accordance with U.S. Soil Classification System, ASTM D 2487.

5.1.5 Holding Times: To the maximum extent practicable all chemical results will be provided within 28 days of receipt. All samples for physical and chemical testing will be maintained at the testing laboratory at the temperatures specified in Table 1 and analyzed within the holding times shown in the table.

5.1.6 Quality Assurance/Quality Control: The chemistry QA/QC procedures found in Table 2 will be followed.

5.2 Laboratory Written Report: The analytical laboratory documenting all the activities associated with sample analyses will prepare a written report. As a minimum, the following will be included in the report:

- Results of the laboratory analyses and QA/QC results.
- All protocols used during analyses.
- Chain of custody procedures, including explanation of any deviation from those identified herein.
- Any protocol deviations from the approved sampling plan.
- Location and availability of data.

As appropriate, this sampling plan may be referenced in describing protocols.

Table 2, Minimum Laboratory QA/QC

Analytical Type	Method	Duplicate ²	RM ^{2,4}	Matrix	Surrogates ⁷
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	Blank ²			Spikes ²	
Semivolatiles ¹	X	X ³	X ⁵	X	X
Pesticides/PCBs ¹	X	X ³	X ⁵	X	X
Metals	X	X	X ⁶	X	
Total Organic Carbon	X	X	X ⁶		
Total Solids		X			
Total Volatile Solids		X			
Particle Size		X			

1. Initial calibration required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria. Ongoing calibration required at the beginning of each work shift, every 10-12 samples or every 12 hours (whichever is more frequent), and at the end of each shift.
2. Frequency of Analysis = one per batch
3. Matrix spike duplicate will be run
4. Reference Material
5. Canadian standard SRM-1
6. NIST certified reference material 2704
7. Surrogate spikes will be included with every sample, including matrix-spiked samples, blanks and reference materials

6.0 BIOLOGICAL TESTING

6.1 Biological Testing: No biological testing will be conducted under this study, however the need for biological testing will be assessed per the DMEF.

7.0 REPORTING

7.1 QA Report: The laboratory QA/QC reports will be incorporated by reference. This report will identify any laboratory activities that deviated from the approved protocols and will make a statement regarding the overall validity of the data collected.

7.2 Sediment Evaluation Report: A written discussion of findings shall be prepared documenting the physical and chemical character of potential material to be dredged. The physical and chemical reports will be included as reference; individual copies will be furnished as requested. As a minimum, the following will be included in the

- Previous sampling and analyses.
- Locations where the sediment samples were collected.
- A plan view of the project showing the actual sampling location.
- Description of sampling.
- Chemical testing data, with comparisons to screening levels guidelines.

APPENDIX A

PARAMETERS AND METHODS

1. Recommended Sample Preparation Methods, Cleanup Methods, Analytical Methods and Detection Limits for Sediment Management Standards, Chapter 173-204 WAC, Draft - July 1996.
2. Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, Puget Sound Estuary Program, March 1986.
3. Recommended Methods for Measuring TOC in Sediments, Kathryn Bragdon-Cook, Clarification Paper, Puget Sound Dredged Disposal Analysis Annual Review, May, 1993.
4. Units: ug = microgram, mg = milligram, kg = kilogram, dw = dry weight, oc = organic carbon.
5. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 3050, SW-846, 3rd ed., Vol 1A, Chapter 3, Sec 3.2, Rev 1. Office of Solid Waste and Emergency Response, Washington, DC.
6. Graphite Furnace Atomic Absorption (GFAA) Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
7. Inductively Coupled Plasma (ICP) Emission Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
8. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 7471, SW-846, 3rd ed., Vol. 1A, Chapter 3, Sec 3.3. Office of Solid Waste and Emergency Response, Washington, DC.
9. Sonication Extraction of Sample Solids - Method 3550 (Modified), SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986. Method is modified to add matrix spikes before the dehydration step rather than after the dehydration step.
10. GCMS Capillary Column - Method 8270, SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
11. Purge and Trap Extraction and GCMS Analysis - Method 8260, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
12. Soxhlet Extraction and Method 8081, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
13. Total PCBs BT value in mg/kg oc.

QA2 DATA REQUIREMENTS

CHEMICAL VARIABLES

ORGANIC COMPOUNDS

The following documentation is needed for organic compounds:

A cover letter referencing or describing the procedure used and discussing any analytical problems

Reconstructed ion chromatograms for GC/MS analyses for each sample

Mass spectra of detected target compounds (GC/MS) for each sample and associated library spectra

GC/ECD and/or GC/flame ionization detection chromatograms for each sample

Raw data quantification reports for each sample

A calibration data summary reporting calibration range used [and decafluorotriphenylphosphine (DFTPP) and bromofluorobenzene (BFB) spectra and quantification report for GC/MS analyses]

Final dilution volumes, sample size, wet-to-dry ratios, and instrument detection limit

Analyte concentrations with reporting units identified (to two significant figures unless otherwise justified)

Quantification of all analytes in method blanks (ng/sample)

Method blanks associated with each sample

Recovery assessments and a replicate sample summary (laboratories should report all surrogate spike recovery data for each sample; a statement of the range of recoveries should be included in reports using these data)

Data qualification codes and their definitions.

METALS

For metals, the data report package for analyses of each sample should include the following:

Tabulated results in units as specified for each matrix in the analytical protocols, validated and signed in original by the laboratory manager

Any data qualifications and explanation for any variance from the analytical protocols

Results for all of the QA/QC checks initiated by the laboratory

Tabulation of instrument and method detection limits.

All contract laboratories are required to submit metals results that are supported by sufficient backup data and quality assurance results to enable independent QA reviewers to conclusively determine the quality of the data. The laboratories should be able to supply legible photocopies of original data sheets with sufficient information to unequivocally identify:

Calibration results

Calibration and preparation blanks

Samples and dilutions

Duplicates and spikes

Any anomalies in instrument performance or unusual instrumental adjustments.