Appendix C

Sediment and Water Quality

February 2012

Appendix C
Sediment and Water Quality

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Appendix C
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GENERAL

The Marine Protection, Research and Sanctuaries Act (MPRSA) requires that four general criteria and eleven specific factors be addressed during the designation process (40 CFR 228.5 and 228.6). General criterion (b) and specific factors 4, 9, and 10 of 40 CFR 228.5 and 228.6 require sediment and water quality analyses indicative of both the dredging areas and disposal sites be reported. Dredged materials placed in ocean dredged material disposal sites (ODMDS) along the Oregon Coast usually consist of medium to fine sands taken from entrance bar shoals and deposited on slightly finer continental shelf sands. The bulk of the sediments dredged at the U.S. Army Corps of Engineers (USACE) Yaquina federal navigation project and placed in the ocean disposal sites are similar in grain size to those at the disposal sites. Because of their coarse nature, the presence of strong hydraulic regimes, similarity to ODMDS sediments, and isolation from known or historical contaminant sources, dredged sands from entrance bar shoals are often deemed acceptable for ocean disposal without further testing (40 CFR 227.13(b)). The use of Sediment Evaluation Framework (SEF) screening levels provides an additional safeguard for this material. Data for channel sands and fines for the navigation project and the proposed North and South ocean disposal sites (Figure C-1) are presented in this appendix.

The general criteria and specific factors of the MPRSA have been interpreted as 27 different "areas of consideration" that cover the proposed ocean disposal sites and the dredged material they receive. These areas of consideration are listed in a conflict matrix (see Evaluation Study/EA report) that is used to evaluate each disposal site on its compliance with the requirements for disposal site designation. The results of the matrix are compared and used to select the best ocean disposal site(s). The areas of consideration involving sediment quality include:

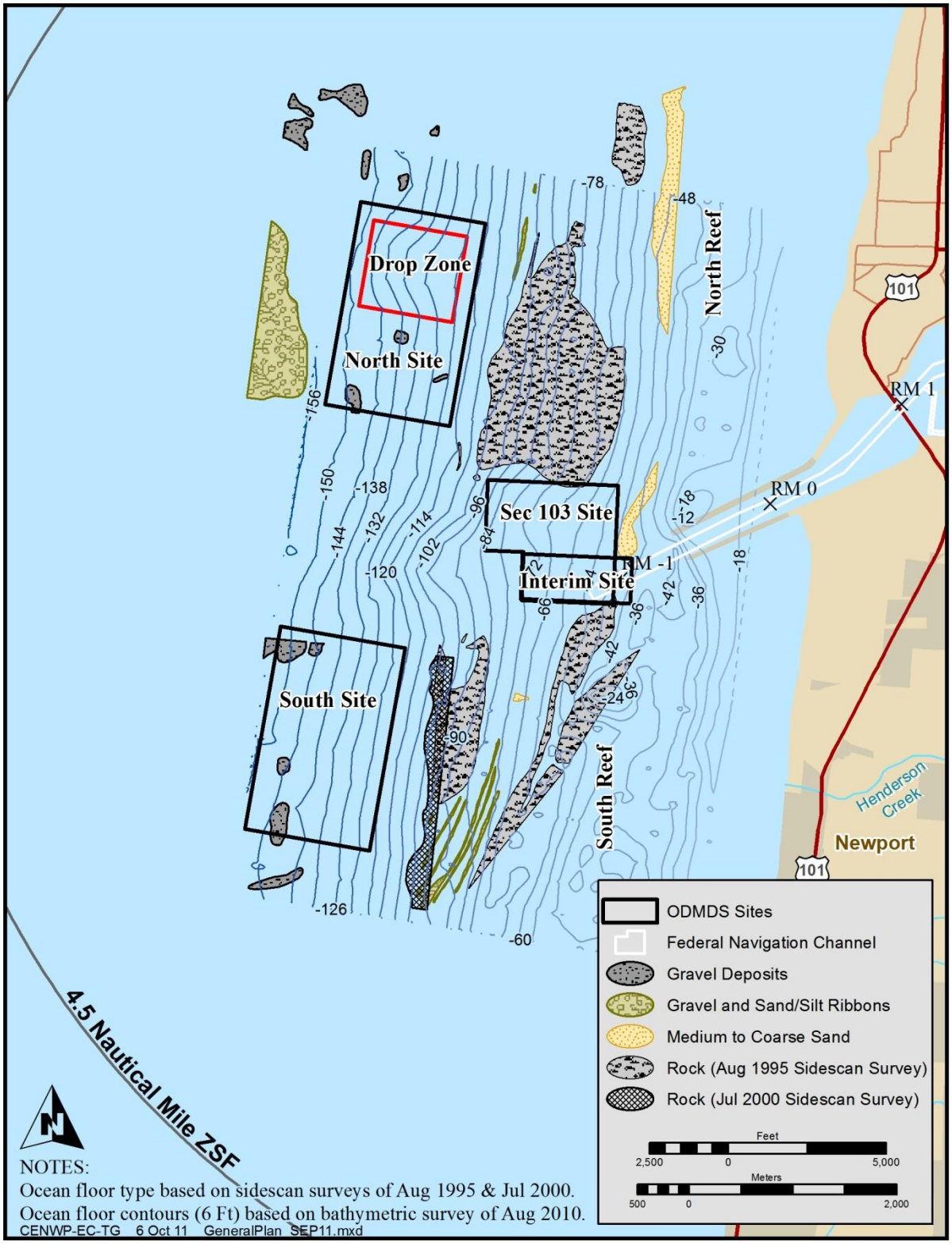
1. Physical and chemical sediment compatibility.
2. Water column chemistry and physical characteristics.
3. Influence of past disposal.
4. Size and shape of the disposal site.
5. Size of the buffer zone.
6. Degraded areas.
7. Potential for cumulative effects.

This information is provided in this appendix.

YAQUINA BAY AND RIVER FEDERAL NAVIGATION PROJECT

The federal navigation project at Yaquina includes an entrance channel that is 400-feet wide and 40-feet deep that runs from river mile (RM) -1.2 to RM 0.0. From RM 0.0, the authorized channel is 30-feet deep and 300-feet wide to the turning basin at McClean Point (RM 2.0). The turning basin is authorized at 30-feet deep, 900 to 1,200-feet wide, and 1,400-feet long. The authorized channel from the turning basin to RM 4.0 is 18-feet deep and 200-feet wide; this channel is currently not maintained.

Figure C-1. Proposed Yaquina North and South Ocean Disposal Sites



The federal project at Yaquina includes a small, 10-foot deep boat basin ("north basin") at Newport. East of the Highway 101 bridge is the South Beach marina with an authorized access channel that is 10-feet deep, 100-feet wide, and 2,035-feet long. The project in the Yaquina River consists of a channel that is generally 150-feet wide and 10-feet deep from about RM 4.0 to RM 14.0. At Toledo, the channel widens to 200 feet and extends into Depot Slough. A turning basin at RM 14.0 that is 350-feet wide and 500-feet long completes the authorized project.

Sediment testing in Yaquina Bay and river for the federal navigation projects has been done in 1980, 1986, 1990, 1991, 1995, 2000, 2005, and 2010 for the Yaquina Bay and River federal navigation project. The Sediment Evaluation Framework (SEF 2009) guidance manual used by federal and state permitting agencies in Oregon for evaluating the potential for unconfined in-water disposal of dredge material recommends physical and chemical testing of the sediments found in the federal navigation project area every 7 to 10 years, depending on location. However, the USACE has chosen to collect sediments and analyze their physical and chemical properties typically on a 5-year schedule or as specific sediment quality issues are raised. Information and specific data regarding these sediment quality evaluations are maintained and available at the USACE Portland District.[1] For the most recent sediment sampling effort in 2010, specific sample locations and physical/chemical data is provided in detail in this appendix.

Water Quality

Water quality in nearshore waters at Yaquina Bay is expected to be typical for seawater in the Pacific Ocean. A large data set regarding the impact of dredged material disposal on the water column was collected in the early 1980s. In June 1980, the U.S. Geological Survey collected samples from 14 stations offshore at Yaquina Bay and conducted elutriate tests (see Fuhrer and Rinella 1983). All parameters measured were well within normal ranges expected for nearshore ocean waters and met the state's water quality standards. Since then, focus has shifted away from the water column pathway to one having more direct contact with bulk or suspended sediment. Currently, water column tests are rarely performed unless there is a "reason to believe" a water column release may occur.

Baseline Sediment Quality

The Corps conducted physical and chemical analyses of sediment samples from Yaquina Bay and South Beach marina in 1980, 1986, 1990, 1991, 1995, 2000, 2005, and 2010). Potential sources of contaminants to the federal navigation channel are logging, wood processing, fish processing and urban runoff. From the USACE sediment sampling studies, the sediment is typically below screening levels (if they were identified at that time) for contaminants of concern. Consequently, sediment has been acceptable for in-water ocean disposal.

2010 Sediment Quality Results and Discussion

The latest sediment sampling effort at Yaquina Bay occurred on July 28, 2010 (USACE September 2010). The evaluation was conducted following procedures set forth in the SEF (2009), which is consistent with the federal guidance in the Ocean Testing Manual (USACE and EPA 1991) and Inland Testing Manual (EPA and USACE 1998). The 2009 SEF was developed jointly with regional federal and state agencies to address environmental issues associated with dredging and sediment management.

[1] All sediment analysis reports conducted by the USACE for the federal navigation project can be found at http://www.nwp.usace.army.mil/environment/sediment.asp.

Eight box core grab samples and one gravity core sample were collected in 2010: two from the entrance channel, four from the federal navigation channel, and three from South Beach marina (Figure C-2). Based upon grain size and sample location 5 out of the 9 samples were subjected to chemical analyses. Results are discussed below.

Figure C-2. Location of Sediment Samples Collected on July 28, 2010

Physical Grain Size (ASTM D422). Nine sediment samples were submitted for physical analyses with data presented in Table C-1. The overall mean grain size for the project is 72% sand, with a mean grain size of 94% sand for the federal navigation channel (entrance to turning basin) and 45% sand within South Beach marina.

Table C-1. Physical Grain Size, 2010

Location	Sample ID	Gravel	Sand	Fines
		%		
Entrance	072810YAQB-BC-01	0	99.1	1
	072810YAQB-BC-02	0	99	0.9
River (navigation channel)	072810YAQB-BC-03	0	98.7	1.3
	072810YAQB-BC-04	0	93.9	6
	072810YAQB-BC-05	0	89.3	10.6
	072810YAQB-GC-07	0	85.4	14.7
South Beach Marina	072810YAQB-BC-08	0.2	63.1	36.8
	072810YAQB-BC-09	0.4	20.4	79.3
	072810YAQB-BC-10	0.7	15.6	83.8

Metals (EPA method 6020/7471), Total Organic Carbon (EPA method 9060). Five sediment samples were submitted for metals and total organic carbon (TOC) testing, with data presented in Table C-2. Total organic carbon averaged 2.36% and had a range of 0.774% to 3.63%. Levels of metals were consistent with historical values and did not approach the SEF screening levels (SLs).

Table C-2. Metals and Total Organic Carbon, 2010

Sample I.D.	As	Sb	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	TOC
	mg/kg (ppm)										%
072810YAQB-BC-05	<7	<0.3	<0.3	28.2	6.3	4	<0.03	20	<0.4	40	0.774
072810YAQB-GC-07	<7	<0.3	<0.3	28.9	8.7	4	<0.03	22	<0.4	39	2.03
072810YAQB-BC-08	<8	<0.3	0.4	36.6	14.9	6	<0.04	28	<0.5	56	2.35
072810YAQB-BC-09	<10	<0.5	0.9	52	32.4	10	0.06	42	<0.7	97	3.02
072810YAQB-BC-10	<10	<0.5	1.2	57	39.8	11	0.05	43	<0.7	111	3.63
Marine Screening Level (SL)	57	150	5.1	260	390	450	0.41	--	6.1	410	--

-- = SL not established.
(<) = Non-detect (ND) at the value listed (MRL).

Pesticides/PCBs (EPA method 8081/8082). Five sediment samples were submitted for pesticides/ polychlorinated biphenyls (PCBs), with data presented in Tables C-3 and C-4. No pesticides or PCBs were detected in any of the samples above the laboratory method reporting limits. All method reporting limits (MRLs) were well below the SEF SLs.

Table C-3. Pesticides, 2010

Sample I.D.	4,4'-DDD	4,4'-DDE	4,4'-DDT	Aldrin	Chlordane		Dieldrin	Heptachlor	gamma-BHC
					Alpha	Gamma*			
	ug/kg (ppb)								
072810YAQB-BC-05	<1.9	<1.9	<1.9	11Y	<0.96	<0.96	<1.9	<0.96	<0.96
072810YAQB-GC-07	<2.0	<2.0	<2.0	<0.98	<0.98	<0.98	<2.0	<0.98	<0.98
072810YAQB-BC-08	<1.9	<1.9	<1.9	<0.97	<0.97	<0.97	<1.9	<0.97	<0.97
072810YAQB-BC-09	<2.0	<2.0	<2.0	<0.98	<0.98	<0.98	<2.0	<0.98	<0.98
072810YAQB-BC-10	<2.0	<2.0	<2.0	<0.98	<0.98	<0.98	<2.0	<0.98	<0.98
Marine SL	16	9.0	34	--	--		--	--	--

* Gamma-chlordane may also be called beta-chlordane or trans-chlordane
-- SL not established.
(<) = Non-detect (ND) at the value listed (MRL).
Y = The analyte was not detected at or above the reported concentration. The MRL was raised due to chromatographic interference.

Table C-4. Polychlorinated Biphenyls (PCBs), 2010

Sample I.D.	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total
	ug/kg (ppb)							
072810YAQB-BC-05	<9.5	<9.5	<9.5	<9.5	<9.5	<9.5	<9.5	<9.5
072810YAQB-GC-07	<9.9	<9.9	<9.9	<9.9	<12Y	26	<9.9	26Y
072810YAQB-BC-08	<9.7	<9.7	<9.7	<9.7	<9.7	<9.7	<9.7	<9.7
072810YAQB-BC-09	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9	<9.9
072810YAQB-BC-10	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8
Marine SL								130

Symbol (<) = Non-detect (ND) at the value listed (MRL).
Y = The analyte was not detected at or above the reported concentration. The MRL was raised due to chromatographic interference.

<u>Chlorinated Hydrocarbons, Phenols, Phthalates and Miscellaneous Extractables (EPA method 8270)</u>. Five sediment samples were submitted for chlorinated hydrocarbons, phenols, phthalates and miscellaneous extractables, with data presented in Tables C-5 to C-8. No chlorinated hydrocarbons or miscellaneous extractables were detected above MRLs in any of the samples. Bis(2-ethylhexyl) phthalate and phenol were detected in all samples, but below SEF marine SLs. Only one sample contained any other detected organic contaminant with an estimated concentration of 15 parts per billion (ppb) 4-methyl phenol, which is well below the SEF marine SL of 670 ppb. All MRLs were well below SEF SLs.

Table C-5. Chlorinated Hydrocarbons, 2010

Sample I.D.	Hexachlorobenzene	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,4-Dichlorobenzene
	ug/kg (ppb)			
072810YAQB-BC-05	<0.96	<19	<19	<19
072810YAQB-GC-07	<1.7Y	<20	<20	<20
072810YAQB-BC-08	<0.97	<20	<20	<20
072810YAQB-BC-09	<0.98	<20	<20	<20
072810YAQB-BC-10	<0.98	<20	<20	<20
Marine SL	22	31	35	110

Symbol (<) = Non-detect (ND) at the value listed (MRL).
Y = The analyte was not detected at or above the reported concentration. The MRL was raised due to chromatographic interference.

Table C-6. Phthalates, 2010

Sample I.D.	bis(2-Ethylhexyl) phthalate	Butyl-benzyl-phthalate	Di-n-butyl-phthalate	Di-n-octyl phthalate	Diethyl-phthalate	Dimethyl-phthalate
	ug/kg (ppb)					
072810YAQB-BC-05	16J	<19	<19	<19	<19	<19
072810YAQB-GC-07	1,300	<20	<20	<20	<20	<20
072810YAQB-BC-08	48	<20	<20	<20	<20	<20
072810YAQB-BC-09	80	<20	<20	<20	<20	<20
072810YAQB-BC-10	92	<20	<20	<20	<20	<20
Marine SL	1,300	63	1,400	6,200	200	71

Symbol (<) = Non-detect (ND) at the value listed (MRL).
J= The estimated concentration is less than the established MRL.

Table C-7. Phenols, 2010

Sample I.D.	Phenol	2-Methyl phenol	Pentachloro phenol	4-Methyl phenol	2,4-Dimethyl phenol
	ug/kg (ppb)				
072810YAQB-BC-05	36	<19	<97	15J	<19
072810YAQB-GC-07	29	<20	<99	<20	<20
072810YAQB-BC-08	33	<20	<99	<20	<20
072810YAQB-BC-09	36	<20	<98	<20	<20
072810YAQB-BC-10	39	<20	<99	<20	<20
Marine SL	420	63	400	670	29

Symbol (<) = Non-detect (ND) at the value listed (MRL).
J= The estimated concentration is less than the established MRL.

Table C-8. Miscellaneous Extractables, 2010

Sample I.D.	Hexachloro-butadiene	Benzoic Acid	Benzyl Alcohol	Dibenzofuran	N-Nitroso diphenylamine
	ug/kg (ppb)				
072810YAQB-BC-05	<0.96	<190	<19	<19	<19
072810YAQB-GC-07	<0.98	<200	<20	<20	<20
072810YAQB-BC-08	<0.97	<200	<20	<20	<20
072810YAQB-BC-09	<0.98	<200	<20	<20	<20
072810YAQB-BC-10	<0.98	<200	<20	<20	<20
Marine SL	11	650	57	540	28

Symbol (<) = Non-detect (ND) at the value listed (MRL).

Polynuclear Aromatic Hydrocarbons (EPA method 8270C). Five sediment samples were submitted for low and high molecular weight polynuclear aromatic hydrocarbons (PAHs), with data presented in Tables C-9 and C-10. Phenanthrene, a low molecular weight PAH, was detected in very low concentrations (21-46 pbb) in samples collected from the South Beach marina, well below the SEF marine SL of 1,500 ppb. Several high PAHs were detected in some of the samples. All detected values and MRLs were low and well below SEF SLs.

Table C-9. PAHs - Low Molecular Weight Analytes, 2010

Sample I.D.	Acenaph-thene	Acenaph-thylene	Anthracene	Fluorene	2-Methyl naphthalene	Naphthalene	Phen-anthrene	Total Low PAHs
	ug/kg (ppb)							
072810YAQB-BC-05	<19	<19	<19	<19	<19	<19	<19	<19
072810YAQB-GC-07	<20	<20	<20	<20	<20	<20	<20	<20
072810YAQB-BC-08	<20	<20	<20	<20	<20	<20	46	46
072810YAQB-BC-09	<20	<20	<20	<20	<20	<20	21	21
072810YAQB-BC-10	<20	<20	<20	<20	<20	<20	36	36
Marine SL	500	560	960	540	670	2,100	1,500	5,200
Symbol (<) = Non-detect (ND) at the value listed (MRL)								

Table C-10. PAHs - High Molecular Weight Analytes, 2010

Sample I.D.	Benzo(a)-anthracene	Benzo(b) fluor-anthene	Benzo(k) fluor-anthene	Benzo-(g,h,i)-perylene	Chry-sene	Pyrene	Benzo(a)-pyrene	Dibenz(a,h)-anthracene	Indeno-(1,2,3-cd)-pyrene	Fluor-anthene	Total High PAHs
	ug/kg (ppb)										
072810YAQB-BC-05	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
072810YAQB-GC-07	<20	<20	<20	<20	<20	22	<20	<20	<20	27	49
072810YAQB-BC-08	14J	20	20	<20	41	74	<20	<20	<20	110	279
072810YAQB-BC-09	15J	18J	18J	<20	42	65	10J	<20	<20	82	250
072810YAQB-BC-10	21	30	30	<20	69	82	18J	<20	<20	110	360
Marine SL	1,300	b + k = 3200		670	1,400	2,600	1,600	230	600	1,700	12,000
Symbol (<) = Non-detect (ND) at the value listed (MRL). J= The estimated concentration is less than the established MRL.											

Total Petroleum Hydrocarbons (NWTPH Method). Five sediment samples were submitted for hydrocarbon identification. Data is presented in Table C-11. No gasoline-, diesel-, or residual-range organics were detected in any of the samples.

Table C-11. Total Petroleum Hydrocarbons, 2010

Sample I.D.	Gasoline Range Organics	Diesel Range Organics	Residual Range Organics
	mg/kg (ppm)		
072810YAQB-BC-05	<20	<50	<100
072810YAQB-GC-07	<20	<50	<100
072810YAQB-BC-08	<20	<50	<100
072810YAQB-BC-09	<26	<66	<130
072810YAQB-BC-10	<28	<69	<140
Symbol (<) = Non-detect (ND) at the value listed (MRL).			

Butyltins (TBT) (Krone 1998 SIM Method). One sediment sample collected from the South Beach marina was submitted for TBT analysis and was found to be non-detect for butyltin ions. Data is presented in Table C-12.

Table C-12. Butyltins, 2010

Sample I.D.	Tributyltin	Dibutyltin	Monobutyltin
	ug/kg (ppb)		
072810YAQB-BC-09	<3.6	<5.4	<3.8
Symbol (<) = Non-detect (ND) at the value listed (MRL).			

In conclusion, the sediment represented by samples collected during the 2010 sampling event meets the guidelines established in the SEF (2009) for unconfined in-water placement without further characterization.

YAQUINA BAY OCEAN DISPOSAL SITES

Disposal Volumes

The USACE historically used the general area offshore of Yaquina Bay for dredged material disposal. The volume of dredged material placed at Yaquina Bay ocean disposal sites since 1928 is summarized in Table C-13. In 1977, an Interim ODMDS offshore of Yaquina (see Figure C-1) received EPA designation and was used by the USACE for dredged material disposal after 1977 and prior to 1986. However, because of increased mounding in the Interim Site and its potential adverse effect on navigation safety, the USACE selected an alternate ODMDS under the authority of Section 103 of the MPRSA. This nearshore Section 103 Site (see Figure C-1) was used for disposal from 1986 to 2000.

Dredged material continued to accumulate in the nearshore Section 103 Site. In 2001, an evaluation was conducted by the USACE and EPA to examine conditions at Yaquina and new locations for ocean disposal further offshore from the entrance (USACE and EPA 2001). The recommended areas from that study are the proposed North and South ocean disposal sites. These disposal sites are currently used under authorization of Section 103 of the MPRSA. Since October 2000, only the North ODMDS has been used by the USACE for dredged material disposal (see “drop site” in Figure C-1). The South ODMDS has never been utilized for disposal; due to prevailing northwest swell, the North ODMDS has been the preferred choice by dredge operators.

The annual dredging and disposal period for the Yaquina project typically occurs in April through October. The Yaquina project has two main shoaling areas. The sediment dredged from the entrance channel and associated bar crossing accounts for 95% of the annual dredging volume. The interior 30-foot channel (and turning basin) accounts for 5% of the total annual dredging. In its present configuration, the entrance channel up to the turning basin requires annual dredging of up to 370,000 cubic yards (cy) of shoaled sediment (fine-medium sand with some silt) to maintain the authorized depth. Up to an additional 25,000 cy of material may be removed from the South Beach Marina access channel, and up to 100,000 cy of material may be removed from Depot Slough every 5-8 years. Dredged material is expected to be disposed over a period of 32 days during the dredging period, which is April through October. Generally, disposal is expected to occur up to 6 days in April or May, then from June 15 to October 31.

Table C-13. Volume of Dredged Material Placed at Yaquina Bay Ocean Disposal Sites

ODMDS Location	Year	Year Total (cy)	Average at Site (cy)	Total Placed at Site (cy)
Interim Site	1928-1940*	1,040,000	252,379	14,638,036
	1941-1967*	5,400,000		
	1968-1981*	6,440,000		
	1982	331,180		
	1983	453,319		
	1984	670,773		
	1985	302,764		
Nearshore Section 103 Site	1986	242,468	310,240	4,653,596
	1987	537,843		
	1988	324,519		
	1989	333,807		
	1990	216,696		
	1991	316,956		
	1992	321,652		
	1993	358,407		
	1994	206,971		
	1995	393,641		
	1996	314,636		
	1997	370,000		
	1998	351,000		
	1999	260,000		
	2000	105,000		
North ODMDS	2001	198,284	217,379	2,173,790
	2002	179,427		
	2003	320,455		
	2004	241,293		
	2005	282,596		
	2006	223,150		
	2007	192,352		
	2008	175,031		
	2009	161,678		
	2010	199,524		
Total		**21,465,422**		

*Volumes are approximate

Sediment Baseline Analysis

The following baseline information for the Yaquina ocean disposal sites was taken from the 2001 *Yaquina Bay Ocean Dredged Material Disposal Site Evaluation Study and Environmental Assessment* (USACE and EPA 2001). This information as it pertains to sediment quality is considered baseline information because it was collected prior to use of the North ODMDS. The information is also relevant to the South ODMDS, however, information collected between 2001 and 2010 from the South site is considered baseline information given that the site has never been used by the USACE. Subsequent to the 2000 sampling at the North and South sites, EPA conducted sediment sampling at both sites in 2008. The results from the latter sampling are discussed as well.

2000 Baseline Sediment Analysis

The physical data analysis at the Yaquina ocean disposal sites conducted in 2001 showed that the sites had fine to medium marine sand with very little silts and clays (0 to 6%). The physical properties of sediments at the ocean disposal sites are similar to the majority of the dredged materials that will be placed there. The physical analyses from associated dredging locations in the federal navigation channel are similar to the physical analyses at the North site prior in baseline sampling in 2001 and more recent sampling at the South ocean disposal site for percent of sand, fines and TOC.

For all the chemistry analyses that were conducted in 2000, which included all chemicals of concern tested in 2010 (see Tables C-1 through C-12), all results were below screening levels. Total metal analyses were performed on samples collected in 2000 from the proposed Yaquina North and South ODMDS. Low concentrations were detected for most of the metals and these concentrations were far below the established screening levels. Analyses for phenols, pesticides and insecticides, low and high PAHs, chlorinated hydrocarbons, and miscellaneous extractables were performed on samples collected in 2000 from the proposed North and South ocean disposal sites. None of these compounds were detected. Analyses for phthalate compounds were performed on samples collected in 2000 the proposed Yaquina North and South ocean disposal sites. Dis(2-ethylhexyl) phthalate and diethyl phthalate were detected. Concentrations of dis(2-ethylhexyl) phthalate varied from 3.8 to 6.3 ppb, which was just above the detection limit of 4.3 ppb, but far below the established screening level of 8,300 ppb. A concentration of 3.8 ppb of diethyl phthalate was detected in one sample, which was just above the detection limit of 3.1 ppb, but far below the established screening level of 1,200 ppb. Given these results conducted in 2000 for baseline sampling of the North and South sites prior to disposal at these sites, neither of the sites had any elevated levels of chemicals that rise to a level of concern.

2008 Sediment Analysis

In June 2008, EPA collected sediment samples for physical and chemical analysis using a 0.1 m^2 Young modified Van Veen grab sampler at the North and South sites (USACE and EPA 2011). The 18 sample locations were selected based on 1999-2001 sampling efforts (Figure C-3) so that direct comparisons over time could be done. The 2008 survey area size was approximately 2.5 square nautical miles and the surveys occurred in water depths of 110 to 150 feet. Samples were analyzed for the following: grain size, total solids, TOC, metals, TBT, semivolatile organic compounds (SVOCs), PCBs, and PAHs. Between October 2000 and 2009, only the North ODMDS "drop zone" (see Figure C-1) has been used for disposal. In 2010 the entire site was used and in 2011 only the south half of the North Site was utilized for dredged material disposal. The South ODMDS has never been used for disposal to date. Some of the following data tables are divided to show results from the area where disposal of dredged material has occurred ("North ODMDS drop site") and from all areas where no disposal has occurred ("background stations").

Physical Analysis and TOC. For the North ODMDS drop site, the results of physical analysis (Table C-14) showed that the sediment collected was primarily medium sand with little variation, ranging from 97.8% to 99.7% sand-sized grains ("percent sand"),versus 96.6% to 99.5% sand at the background stations. There was higher percent coarse sand at the deepest location (YQ-22) and higher percent very fine sand at the shallowest location (YQ-01). The mean percent sand was essentially the same at the North drop site stations (98.6%) as that of the background stations (98.3%). The mean and median grain sizes were calculated using percentage of grain size. The mean grain sizes at the North drop site stations were more consistent than those at the background stations, ranging from 0.195 millimeters (mm) to 0.213 mm at the former and from 0.171 mm to 0.308 mm at the latter (Figure C-4). The largest grain size (0.308 mm) was collected at the deepest location (YQ-22).

Total solids were only slightly lower in the North drop site (mean 79.5%) than the background stations (mean of 81.1%). The TOC (Table C-14) was substantially lower at the North drop site versus the background [mean 349.2 milligrams per kilogram (mg/kg) versus 513.3 mg/kg], probably due to the relatively low TOC normally found in Oregon coast river sediments as opposed to the higher organic carbon normally found in deeper, more productive ocean waters. Baseline TOC samples collected at the proposed ocean disposal sites in 2000 averaged 500 mg/kg (USACE and EPA 2001).

Metals. Overall, metals concentrations were comparable between samples at the North ODMDS drop site stations versus those in the background stations (Table C-15). Exceptions included concentrations that were slightly lower at the North drop site stations for iron, magnesium, vanadium, and nickel, and higher for calcium and potassium. Metals concentrations detected in all samples were far below the SEF SLs (SEF 2009). The following metals were not detected at any of the sampling stations: antimony, cadmium, cobalt, copper, mercury, selenium, and thallium.

Organotins (including TBT). In marine sediments, pore-water analysis has been shown to improve the reliability of toxicity predictions over bulk-sediment, dry-weight analysis and consequently is required in marine environments (Michelsen et al. 1996). No organotin compounds were detected at any station (Table C-16); however, the laboratory method reporting limit was much greater than the SEF SL. For this analysis, none of the initial calibration and calibration verification, matrix spike/matrix spike duplicate, and laboratory duplicates met established laboratory/quality assurance criteria. While not noted in the laboratory results, it may also have occurred because of the small amount of pore water that can be extracted from sediment consisting primarily of sand. Significant concentrations of TBT or other organotins were not expected since dredged material is tested prior to disposal; prior testing of the dredge material in 2005 and 2010 showed non-detects of TBT and either non-detects or extremely low concentrations for other organotins.

Figure C-3. Sediment Sampling Sites, June and August 2008

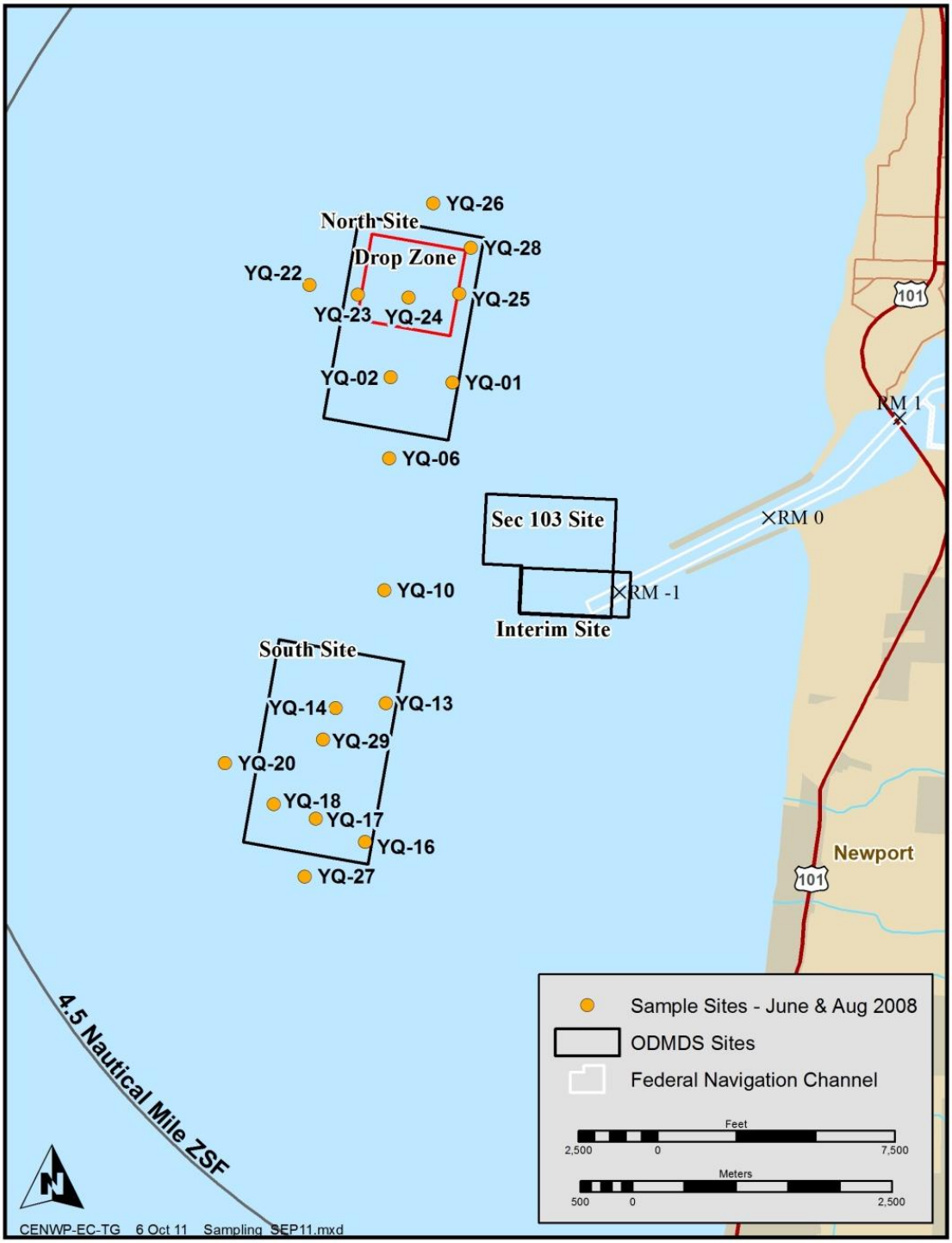
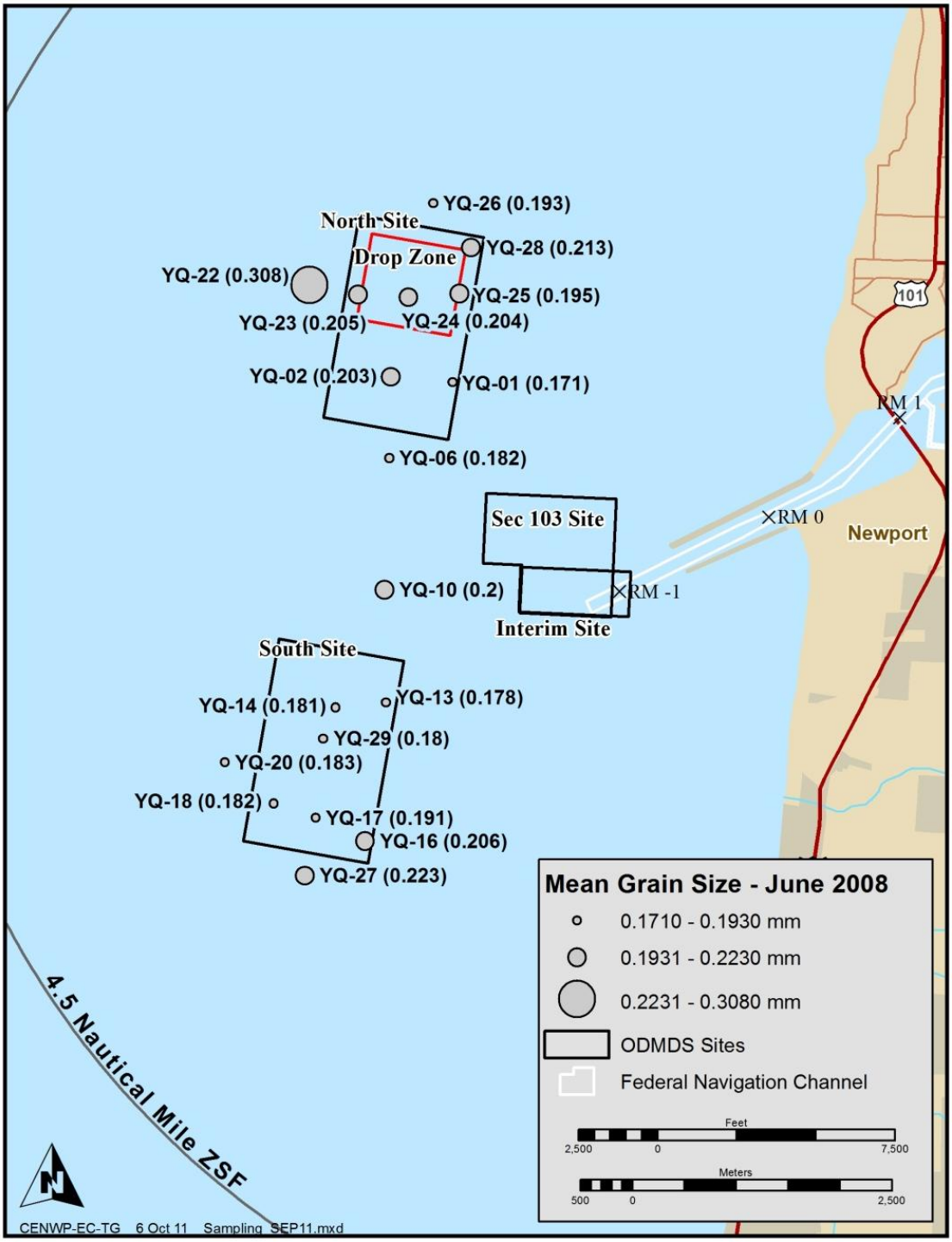


Figure C-4. Mean Grain Size, June 2008



Organic Compounds

Semivolatile Organic Compounds (SVOCs). Results of the analysis for SVOCs, including chlorinated hydrocarbons, miscellaneous extractables, phthalates, and phenols, are shown in Table C-17 along with SEF SLs (SEF 2009). All concentrations of SVOCs in the North drop zone and background stations were below SEF SLs. Benzoic acid was detected at three background stations at levels, but concentrations were well below SEF SLs. The only SVOCs detected above the method reporting level in the North drop zone were bis(2-ethylhexyl) phthalate and di-n-butylphthalate, both of which were found only in the sample duplicate collected at station YQ-024. The detected concentrations [73 and 170 micrograms per kilogram (µg/kg), respectively] were far below the SEF SLs of 1,300 µg/kg and 1,400 µg/kg. The compounds 2,4-dimethylphenol at station YQ-28 and pentachlorophenol at stations YQ-24D and YQ-25 also were identified, but each value is considered an estimate. These results above are expected because in a matrix made up of primarily sand-sized particles or larger, any organic contamination is expected to be minimal.

For several compounds, the laboratory method reporting limit exceeded the SEF SLs slightly; these included 2,4-dimethylphenol, dieldrin, heptachlor, hexachlorobenzene, hexachlorobutadiene, and n-nitrosodiphenylamine. However, the method reporting level was consistent for all compounds analyzed by the SVOC method. The reporting levels that were exceeded were for compounds with SLs very close to the reporting levels. Numerous other SVOCs had much higher screening levels and showed no detections. In addition to the statements above suggesting that concentrations of these compounds are not likely of concern, one of the compounds for which the SL was above the method reporting limit, were detected in either the 2005 or 2010 sediment characterization sampling of the dredge material thus, would not be expected at the ODMDS sites.

Polychlorinated Biphenyls. PCB aroclors were not detected at any of the Yaquina ODMDS sampling stations (Table C-18). The SEF SL is 130 µg/kg for the total of all detected PCBs.

Pesticides. Pesticides were not detected at any of the Yaquina ODMDS sampling sites (Table C-19).

Table C-14. Results for Grain Size, Total Solids, and TOC, 2008

* Sample from southern part of North ODMDS; disposal has not occurred.
** Sample from South ODMDS; disposal has not occurred.
D: Duplicate sample. LD: Lab Duplicate.

Station	Water Depth (feet)	% Gravel	% Coarse Sand (a)	% Medium Sand (b)	% Fine Sand (c)	% Total Sand (a+b+c)	% Total Fines	Mean Grain Size (mm)	TOC (mg/kg-dry)
North ODMDS Drop Site									
YQ-028	122	0.1	1.3	25	71	98	1.8	0.213	286
YQ-023	145	0.3	1.4	21	76	98	1.4	0.205	522
YQ-024	130	0	0.9	21	77	99	1.1	0.204	350
YQ-024D	133	0	0.6	21	78	100	0.2	0.204	276
YQ-025	121	0	0.7	18	80	99	1.3	0.195	312
Background Stations – Southern part of North ODMDS									
YQ-02*	137	0	0.4	22	76	98	1.8	0.203	495
YQ-02D*	140	0	0.3	20	79	99	1.2	--	617
YQ-01*	116	0	0.5	8	90	99	1.2	0.171	633
Background Stations – South ODMDS									
YQ-013**	120	0	0.2	11	86	97	3.5	0.178	577
YQ-014**	133	0	0.2	10	89	99	1.1	0.181	590
YQ-029**	137	0	0.2	9	90	98	1.6	0.180	551
YQ-016**	117	0	0.4	25	72	97	2.9	0.206	388
YQ-016 LD1	--	0.1	0.4	25	72	97	2.6	--	--
YQ-016 LD2	--	0.1	0.4	26	72	98	2.0	--	--
YQ-017**	128	0	0.3	17	80	98	2.2	0.191	468
YQ-018**	139	0	0.2	12	85	97	2.8	0.182	456
Background Stations – Outside of Proposed ODMDSs									
YQ-026	140	0	0.2	19	79	98	1.9	0.193	503
YQ-022	154	0	8.2	68	23	99	1.4	0.308	406
YQ-06	134	0.3	0.5	10	89	100	0	0.182	689
YQ-010	116	0	0.4	20	79	99	0.6	0.200	373
YQ-020	149	0	0.2	11	87	99	1.1	0.183	618
YQ-027	130	0	0.7	34	64	98	1.7	0.223	336

Table C-15. Results for Metals, 2008 (ppm)

* Sample from southern part of North ODMDS; disposal has not occurred in this area.
** Sample from South ODMDS; disposal has not occurred in this area.
D: Duplicate sample.
U: The analyte was not detected at or above the reported value.
J: The identification of the analyte is acceptable; however, the reported value is an estimate.
UJ: The analyte was not detected at or above the reported value; the reported value is an estimate.

Station	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
North ODMDS Drop Site												
YQ-028	2170	0.98 UJ	3.46	4.9	0.087	0.49 U	5000 J	6.35	2.5 U	2.5 U	4550	0.99
YQ-023	2790	0.96 UJ	3.5	4.77	0.11	0.48 U	3500 J	7.43	2.4 U	2.4 U	5900	1.1
YQ-024	2530	1 UJ	3.65	4.4	0.1	0.5 U	3600 J	7.41	2.5 U	2.5 U	5520	1.1
YQ-024D	2230	0.96 UJ	3.4	4.6	0.085	0.48 U	3100 J	6.67	2.4 U	2.4 U	4690	1
YQ-025	2460	0.94 UJ	3.49	4.27	0.091	0.47 U	2800 J	7.78	2.4 U	2.4 U	5190	1.1
Background Stations – Southern Part of North ODMDS												
YQ-02*	2710	1 UJ	2.59	4.31	0.09	0.5 U	760 J	12.3	2.5 U	2.5 U	6200	1.3
YQ-02D*	2650	1 UJ	2.56	4.65	0.093	0.5 U	750 J	11.8	2.5 U	2.5 U	6020	1.3
YQ-01*	2880	0.96 UJ	2.3	5.46	0.1	0.48 U	1190	14.8	2.4 U	2.4 U	6730	1.8
Background Stations – South ODMDS												
YQ-013**	2990	1 UJ	2.95	4.37	0.1	0.5 U	1100 J	12.9	2.5 U	2.5 U	6900	1.5
YQ-014**	3220	1 UJ	3.46	5.06	0.12	0.5 U	760 J	13	2.5 U	2.5 U	7700	1.5
YQ-029**	2850	1 UJ	3.35	5.17	0.11	0.5 U	790 J	12.1	2.5 U	2.5 U	7150	1.5
YQ-016**	2200	1 UJ	2.57	3.29	0.084	0.5 U	630 J	9.43	2.5 U	2.5 U	5460	1.1
YQ-017**	2850	1 UJ	3.26	4.97	0.11	0.5 U	1100 J	11.1	2.5 U	2.5 U	6940	1.3
YQ-018**	2810	1 UJ	3.02	4.34	0.1	0.5 U	620 J	10.9	2.5 U	2.5 U	6640	1.3
Background Stations – Outside Proposed ODMDS												
YQ-026	2500	1 UJ	2.78	4.04	0.097	0.5 U	850 J	11.5	2.5 U	2.5 U	6000	1.3
YQ-022	2210	0.98 UJ	3.68	4	0.095	0.49 U	390 J	8.75	2.5 U	2.5 U	6180	1.3
YQ-06	2960	1 UJ	3.05	5.54	0.11	0.5 U	780 J	14.1	2.5 U	2.5 U	6950	1.4
YQ-010	2130	1 UJ	3.17	3.45	0.082	0.5 U	760 J	7.89	2.5 U	2.5 U	4950	1.1
YQ-020	3040	1 UJ	3.25	5.24	0.1	0.5 U	700 J	14.3	2.5 U	2.5 U	7440	1.5
YQ-027	2330	1 UJ	2.81	5.35	0.095	0.5 U	540 J	9.49	2.5 U	2.5 U	5760	1.1
SEF SL	**--**	**150**	**57**	**--**	**--**	**5.1**	**--**	**260**	**--**	**390**	**--**	**450**

Table C-15 (continued). Results for Metals, 2008 (ppm)

* Sample from southern part of North ODMDS; disposal has not occurred in this area.
** Sample from South ODMDS; disposal has not occurred in this area.
D: Duplicate sample.
U: The analyte was not detected at or above the reported value.
J: The identification of the analyte is acceptable; however, the reported value is an estimate.
UJ: The analyte was not detected at or above the reported value; the reported value is an estimate.

Station	Mag-nesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
North ODMDS Drop Site												
YQ-028	1380	27.1	0.0099 U	2.5 U	3.4	491	0.49 U	0.049 U	2620	0.25 U	6.44	8.38
YQ-023	1730	43.6	0.0098 U	2.4 U	4.7	556	0.48 U	0.048 U	3250	0.24 U	8.65	11
YQ-024	1670	36.5	0.0096 U	2.5 U	4.3	552	0.5 U	0.05 U	3310	0.25 U	7.84	10.5
YQ-024D	1450	31.9	0.0099 U	2.4 U	3.8	502	0.48 U	0.048 U	3090	0.24 U	6.89	8.79
YQ-025	1620	32.7	0.01 U	2.4 U	4.76	524	0.47 U	0.047 U	2750	0.24 U	7.66	9.89
Background Stations – Southern Part of North ODMDS												
YQ-02*	1970	40.6	0.0099 U	2.5 U	6.38	637	0.5 U	0.05 U	2600	0.25 U	9.79	11.7
YQ-02D*	1950	41.4	0.0098 U	2.5 U	6.34	631	0.5 U	0.05 U	2890	0.25 U	9.68	11.6
YQ-01*	2280	54.4	0.0099 U	2.4 U	8.81	639	0.48 U	0.048 U	2700 J	0.24 U	14.1	13.9
Background Stations – South ODMDS												
YQ-013**	2150	46.1	0.0099 U	2.5 U	7.23	631	0.5 U	0.05 U	2880	0.25 U	12	11.9
YQ-014**	2300	44.3	0.0099 U	2.5 U	7.97	724	0.5 U	0.05 U	3170	0.25 U	11.8	13.8
YQ-029**	2230	38.5	0.0097 U	2.5 U	7.13	722	0.5 U	0.05 U	4450	0.25 U	10.9	12.9
YQ-016**	1630	31.3	0.0099 U	2.5 U	5.04	517	0.5 U	0.05 U	3140	0.25 U	8.77	9.66
YQ-017**	2070	37.5	0.0098 U	2.5 U	6.62	656	0.5 U	0.05 U	2970	0.25 U	10.1	12.3
YQ-018**	2030	37	0.0099 U	2.5 U	6.78	643	0.5 U	0.05 U	3070	0.25 U	10	11.8
Background Stations – Outside of Proposed ODMDS												
YQ-026	1910	38.9	0.0097 U	2.5 U	6.14	598	0.5 U	0.05 U	2890	0.25 U	9.54	11
YQ-022	1500	28.7	0.01 U	2.5 U	4.1	559	0.49 U	0.049 U	2750	0.25 U	9.19	10.4
YQ-06	2230	42.5	0.0098 U	2.5 U	7.56	708	0.5 U	0.05 U	3070	0.25 U	10.5	13.1
YQ-010	1510	29.3	0.0099 U	2.5 U	4.7	461	0.5 U	0.05 U	2730	0.25 U	7.28	8.96
YQ-020	2280	42.3	0.0099 U	2.5 U	7.88	692	0.5 U	0.05 U	2880	0.25 U	11.1	13.1
YQ-027	1600	29.2	0.01 U	2.5 U	5.09	548	0.5 U	0.05 U	2440	0.25 U	8.83	9.91
SEF SL	**--**	**--**	**0.41**	**--**	**--**	**--**	**--**	**6.1**	**--**	**--**	**--**	**410**

Table C-16. Results for Organotin, 2008 (µg/L)

* Sample from southern part of North ODMDS; disposal has not occurred.
** Sample from South ODMDS; disposal has not occurred.
D: Duplicate sample.
U: The analyte was not detected at or above the reported value.
J: The identification of the analyte is acceptable; however, the reported value is an estimate.
UJ: The analyte was not detected at or above the reported value; the reported value is an estimate.
R: The presence or absence of the analyte cannot be determined from the data due to severe quality control problems. The data are rejected and considered unusable. No value is reported with this qualification.

Station	Butyltin trichloride	Dibutyltin dichloride	Tetra-butyltin	Tributyltin chloride
North ODMDS Drop Site				
YQ-028	5 U	5 U	5 U	5 U
YQ-023	5 U	5 U	5 U	5 U
YQ-024	5.1 U	5.1 U	5.1 U	5.1 U
YQ-024D	5.1 UJ	5.1 UJ	5.1 U	5.1 U
YQ-025	5 U	5 U	5 U	5 U
Background Stations – Southern Part of North ODMDS				
YQ-02*	5.1 U	5.1 U	5.1 U	5.1 U
YQ-02D*	5.1 U	5.1 U	5.1 U	5.1 U
YQ-01*	5.2 U	5.2 U	5.2 U	5.2 U
Background Stations – South ODMDS				
YQ-013**	5.1 U	5.1 U	5.1 U	5.1 U
YQ-014**	5 U	5 U	5 U	5 U
YQ-029**	5.1 U	5.1 U	5.1 U	5.1 U
YQ-016**	5 U	5 U	5 U	5 U
YQ-017**	5.1 U	5.1 U	5.1 U	5.1 U
YQ-018**	5.1 U	5.1 U	5.1 U	5.1 U
Background Stations – Outside of Proposed ODMDS				
YQ-026	5.1 U	5.1 U	5.1 U	5.1 U
YQ-022	5.1 U	5.1 U	5.1 U	5.1 U
YQ-06	5.1 U	5.1 U	5.1 U	5.1 U
YQ-010	5 U	5 U	5 U	5 U
YQ-020	5.1 U	R	5.1 U	5.1 U
YQ-027	5 U	5 U	5 U	5 U
SEF SL	**--**	**--**	**--**	**0.15**

Table C-17. Results for SVOCs, 2008 (µg/kg)

* Sample from southern part of North ODMDS; disposal has not occurred.
** Sample from South ODMDS; disposal has not occurred.
D: Duplicate sample.
U: The analyte was not detected at or above the reported value.
J: The identification of the analyte is acceptable; however, the reported value is an estimate.
UJ: The analyte was not detected at or above the reported value; the reported value is an estimate.
NA: Not analyzed.

Station	1,2,4-trichloro-benzene	2,4-dimethyl phenol	4-methyl-phenol	9H-fluorene	Acena-phthene	Acena-phthylene	Anthra-cene	Benzene, 1,2-dichloro-	Benzene, 1,3-dichloro-	Benzene, 1,4-dichloro-	Benzene-methanol	Benzo(a)-anthra-cene	Benzo(a)-pyrene
North ODMDS Drop Site													
YQ-028	25 U	25 UJ	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	NA	25 U	25 U
YQ-023	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	NA	25 U	25 U
YQ-024	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	NA	30 U	30 U
YQ-024D	31 U	31 U	31 U	31 U	31 U	31 U	31 U	31 U	31 U	31 U	NA	31 U	31 U
YQ-025	31 U	31 U	31 U	31 U	31 U	31 U	31 U	31 U	31 U	31 U	NA	31 U	31 U
Background Stations – Southern Part of North ODMDS													
YQ-02*	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 UJ	29 UJ	29 UJ	NA	29 U	29 U
YQ-02D*	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	NA	29 U	29 U
YQ-01*	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	NA	28 U	28 U
Background Stations - South ODMDS													
YQ-013**	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	NA	28 U	28 U
YQ-014**	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	NA	28 U	28 U
YQ-029**	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	NA	29 U	29 U
YQ-016**	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	NA	28 U	28 U
YQ-017**	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	NA	29 U	29 U
YQ-018**	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	NA	28 U	28 U
Background Stations – Outside of Proposed ODMDS													
YQ-026	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	NA	29 U	29 U
YQ-022	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	NA	29 U	29 U
YQ-06	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	NA	29 U	29 U
YQ-010	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	NA	27 U	27 U
YQ-020	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	NA	29 U	29 U
YQ-027	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	NA	28 U	28 U
SEF SL	**31**	**29**	**670**	**540**	**500**	**560**	**960**	**35**	**--**	**110**	**--**	**1300**	**1600**

Table C-17 (continued). Results of SVOCs, 2008 (µg/kg)

* Sample from southern part of North ODMDS; disposal has not occurred.
** Sample from South ODMDS; disposal has not occurred.
D: Duplicate sample.
U: The analyte was not detected at or above the reported value.
J: The identification of the analyte is acceptable; however, the reported value is an estimate.
UJ: The analyte was not detected at or above the reported value; the reported value is an estimate.

Station	Benzo-(g,h,i)-perylene	Benzo[b]-fluor-anthene	Benzo[k]-fluor-anthene	Benzoic acid	Bis-(2-ethylhexyl)-phthalate	Butyl-benzyl-phthalate	Chry-sene	Dibenzo-[a,h]-anthracene	Dibenzo-furan	Diethyl-phthalate	Dimethyl-phthalate	Di-n-Butyl-phthalate	Di-n-Octyl-phthalate
North ODMDS Drop Zone													
YQ-028	25 U	25 U	25 U	140 UJ	25 U	25 U	25 U	50 U	25 U	25 U	25 U	25 U	50 U
YQ-023	25 U	25 U	25 U	130 UJ	25 U	25 U	25 U	50 U	25 U	25 U	25 U	25 U	25 U
YQ-024	30 U	30 U	30 U	162 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U
YQ-024D	31 U	31 U	31 U	300 UJ	73	31 U	31 U	62 U	31 U	31 U	31 U	170	31 U
YQ-025	31 U	31 U	31 U	290 UJ	31 U	31 U	31 U	62 U	31 U	31 U	31 U	31 U	31 U
Background Stations – Southern Part of North ODMDS													
YQ-02*	29 U	29 U	29 U	159 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-02D*	29 U	29 U	29 U	147 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-01*	28 U	28 U	28 U	155	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
Background Stations – South ODMDS													
YQ-013**	28 U	28 U	28 U	152 UJ	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
YQ-014**	28 U	28 U	28 U	162	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
YQ-029**	29 U	29 U	29 U	150 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-016**	28 U	28 U	28 U	149 U	28 U	28 U	28 U	28 U	28 U	35 UJ	28 U	28 U	28 U
YQ-017**	29 U	29 U	29 U	193 UJ	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-018**	28 U	28 U	28 U	183 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
Background Stations – Outside of Proposed ODMDS													
YQ-026	29 U	29 U	29 U	155 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-022	29 U	29 U	29 U	162 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-06	29 U	29 U	29 U	158	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-010	27 U	27 U	27 U	146 U	27 U	27 U	27 U	27 U	27 U	41 UJ	27 U	27 U	27 U
YQ-020	29 U	29 U	29 U	197 UJ	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-027	28 U	28 U	28 U	195 UJ	28 U	28 U	28 U	28 U	28 U	142 U	28 U	28 U	28 U
SEF SL	**670**	**3200**		**650**	**1300**	**63**	**1400**	**230**	**540**	**200**	**71**	**1400**	**6200**

Table C-17 (continued). Results of SVOCs, 2008 (µg/kg)

* Sample from southern part of North ODMDS; disposal has not occurred.
** Sample from South ODMDS; disposal has not occurred.
D: Duplicate sample.
U: The analyte was not detected at or above the reported value.
J: The identification of the analyte is acceptable; however, the reported value is an estimate.
UJ: The analyte was not detected at or above the reported value; the reported value is an estimate.

Station	Fluor-anthene	Hexachloro-benzene	Hexa-chloro-butadiene	Hexa-chloro-ethane	Indeno (1,2,3-cd)-pyrene	Naph-thalene	Naphthalene, 2-methyl-	n-nitroso-diphenyl-amine	Penta-chloro-phenol	Phen-anthrene	Phenol	Phenol, 2-methyl-	Pyrene
North ODMDS Drop Zone													
YQ-028	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	50 U	25 U	25 U	25 U	25 U
YQ-023	25 U	25 U	25 U	25 U	50 U	25 U	25 U	25 U	50 U	25 U	25 U	25 U	25 U
YQ-024	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U
YQ-024D	31 U	31 U	31 U	31 U	62 U	31 U	31 U	31 U	120 UJ	31 U	31 U	31 U	31 U
YQ-025	31 U	31 U	31 U	31 U	62 U	31 U	31 U	31 U	124 UJ	31 U	31 U	31 U	31 U
Background Stations – Southern part of North ODMDS													
YQ-02*	29 U	29 U	29 U	29 UJ	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-02D*	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-01*	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
Background Stations – South ODMDS													
YQ-013**	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
YQ-014**	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
YQ-029**	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-016**	28 U	28 U	28 U	28 UJ	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
YQ-017**	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-018**	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
Background Stations – Outside of Proposed ODMDS													
YQ-026	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-022	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-06	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-010	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U
YQ-020	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U	29 U
YQ-027	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U	28 U
SEF SL	**1700**	**22**	**11**	**--**	**600**	**2100**	**670**	**28**	**400**	**1500**	**420**	**63**	**2600**

Table C-18. Results for PCBs, 2008 (µg/kg)

* Sample from southern part of North ODMDS; disposal has not occurred.
** Sample from South ODMDS; disposal has not occurred.
D: Duplicate sample.
U: The analyte was not detected at or above the reported value.

Station	PCB-1016	PCB-1221	PCB-1232	PCB-1242	PCB-1248	PCB-1254	PCB-1260
North ODMDS Drop Zone							
YQ-028	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-023	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-024	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-024D	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-025	10 U	10 U	20 U	10 U	10 U	10 U	10 U
Background Stations – Southern part of North ODMDS							
YQ-02*	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-02D*	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-01*	10 U	10 U	21 U	10 U	10 U	10 U	10 U
Background Stations – South ODMDS							
YQ-013**	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-014**	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-029**	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-016**	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-017**	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-016**	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-017**	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-018**	10 U	10 U	20 U	10 U	10 U	10 U	10 U
Background Stations – Outside of Proposed ODMDS							
YQ-026	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-022	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-06	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-010	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-020	10 U	10 U	20 U	10 U	10 U	10 U	10 U
YQ-027	10 U	10 U	20 U	10 U	10 U	10 U	10 U

Table C-19. Results for Pesticides, 2008 (µg/kg)

* Sample from southern part of North ODMDS; disposal has not occurred.
** Sample from South ODMDS; disposal has not occurred.
D: Duplicate sample.
U: The analyte was not detected at or above the reported value.

Station	Aldrin	cis-Chlordane (alpha-Chlordane)	cis-Non-achlor	Gamma-chlor-dane	trans-Non-achlor	Dieldrin	Endrin	Hepta-chlor	Hepta-chlor Epoxide	Lindane	o,p'-DDD	o,p'-DDE	o,p'-DDT	P,P'-DDD	P,P'-DDE	P,P'-DDT
North ODMDS Drop Zone																
YQ-028	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U
YQ-023	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U
YQ-024	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U
YQ-024D	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
YQ-025	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U
Background Stations – Southern part of North ODMDS																
YQ-02*	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
YQ-02D*	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
YQ-01*	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Background Stations – South ODMDS																
YQ-013**	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
YQ-014**	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
YQ-029**	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
YQ-016**	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
YQ-017**	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
YQ-018**	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Background Stations – Outside of Proposed ODMDS																
YQ-026	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
YQ-022	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
YQ-06	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
YQ-010	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
YQ-020	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
YQ-027	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
SEF SL	**9.5**	**2.8**				**1.9**	**--**	**1.5**	**--**	**--**	**--**	**--**	**--**	**16**	**9**	**12**

DISCUSSION AND CONCLUSIONS

When evaluating the appropriateness and suitability of a location(s) to receive dredge material, the EPA and the USACE need to consider the following areas with regards to sediment quality:

1. Physical and chemical sediment compatibility.
2. Water column chemistry and physical characteristics.
3. Influence of past disposal.
4. Size and shape of the disposal site.
5. Size of the buffer zone.
6. Degraded areas.
7. Potential for cumulative effects.

The latest sediment sampling efforts for the Yaquina federal navigation project and proposed North and South ocean disposal sites occurred in 2010 and 2008, respectively. Sampling and analyses of sediments were conducted in accordance with the SEF (2009) and included testing for metals, TOC, pesticides, PCBs, phenols, phthalates, miscellaneous extractables, PAHs and TBT.

Eight box core grab samples and one gravity core sample were collected from the federal navigation project area on July 28, 2010. All nine sediment samples were submitted for physical analyses, with five samples collected from finer-grained areas further subjected to chemical analyses. The overall mean grain size for the project is 72% sand, with a mean grain size of 94% sand for the federal navigation channel (entrance to turning basin) and 45% sand within South Beach marina. All analyte concentrations were substantially below the SEF SLs. The data from samples collected during 2010 were consistent with historical sampling results. The material within the federal navigation channel and South Beach marina was found to be suitable for unconfined in-water placement without further characterization.

Sediment samples were collected in and near the Yaquina ocean disposal sites in 2008 to compare conditions of the North ODMDS drop site where dredged material from the Yaquina Bay and federal channel has been placed, with stations where dredged material disposal has not occurred ("background" stations). Physical analyses showed primarily medium sand with little variation. The percent sand was essentially the same at the North ODMDS drop site stations as that of the background stations, although the mean grain sizes were more consistent at the North ODMDS drop zone stations. Metals concentrations detected in all samples were far below SEF SLs. The following metals were not detected at any of the sampling stations: antimony, cadmium, cobalt, copper, mercury, selenium, and thallium. No organotin (TBT), PCBs or pesticides were detected at any station. All detected concentrations of SVOCs (including PAHs) in both the North ODMDS drop zone and background stations were below SEF SLs. Although the laboratory reporting limits for the following compounds exceeded the SEF SLs, none were detected above the reporting limits in any samples: 2,4-dimethylphenol, dieldrin, heptachlor, hexachlorobenzene, hexachlorobutadiene, and n-nitrosodiphenylamine. The sediments in the North ODMDS drop zone stations do not appear to have been negatively impacted by dredged material disposal.

REFERENCES

EPA and USACE (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 (referred to as the "Inland Testing Manual").

Fuhrer, G.J. and F.A. Rinella. 1983. Analyses of Elutriates, Native Water, and Bottom Material in Selected Rivers and Estuaries in Western Oregon and Washington. U.S. Geological Survey Open File Report 82-922.

Michelsen, T., T.C. Shaw, and S. Stirling. 1996. Testing, Reporting, and Evaluation of Tributyltin Data in PSDDA and SMS Programs. Puget Sound Dredged Disposal Analysis (PSDDA) Issue Paper and Sediment Management Standards (SMS) Technical Information Memorandum.

Nelson, P.O., C.K. Sollitt, K.J. Williamson and D.R. Hancock, 1983. Coos Bay Offshore Disposal Site Investigation Interim Report, Phase II-III, Coos Bay Offshore Disposal Site Investigation Interim Report, Phase II-III April 1980-June 1981. Report to U.S. Army Corps of Engineers, Portland District, Portland, OR, under contract no. DACW57-C-0040, Oregon State University, Corvallis, OR.

SEF (Sediment Evaluation Framework). May 2009. Sediment Evaluation Framework for the Pacific Northwest. Prepared by U.S. Army Corps of Engineers Seattle, Portland, and Walla Walla Districts and Northwestern Division; U.S. Environmental Protection Agency Region 10; Washington Departments of Ecology and Natural Resources; Oregon Department of Environmental Quality; Idaho Department of Environmental Quality; National Marine Fisheries Service; and U.S. Fish and Wildlife Service.

USACE. April 2009. Biological Assessment for Coastal Dredging Projects. Portland District.

USACE. January 2010. Study Status Information Report, Yaquina Bay. Portland District, Portland, OR. Located at http://www.nwp.usace.army.mil/docs/d_sediment/odmds/Yaquina_AMR.pdf (accessed August 2011).

USACE (U.S. Army Corps of Engineers). September 2010. Yaquina Bay Sediment Quality Evaluation Report. Portland District. Located at http://www.nwp.usace.army.mil/environment/sediment.asp (accessed August 2011).

USACE and EPA (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency). February 1991. Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual (referred to as the "Ocean Testing Manual" or "Green Book") located at http://www.epa.gov/owow/oceans/gbook/ (accessed August 2011).

USACE and EPA. 2001. Yaquina Bay Interim Ocean Dredged Material Disposal Site Evaluation Study and Environmental Assessment. Portland District and EPA Region 10. Located at http://www.nwp.usace.army.mil/environment/sediment.asp (accessed August 2011).

USACE and EPA. March 2011. 2008 Monitoring Studies at Yaquina Bay Ocean Dredged Material Disposal Sites (ODMDS). Final Data Report. Portland District and EPA Region 10.