CENWP-EC-HR October 2, 2012

Memorandum for: U.S. Army Corps of Engineers (Corps), Portland District, Operations Division, Regulatory Branch (Taylor), Regulatory File No. NWP-2000-984(2).

Subject: Portland Sediment Evaluation Team (PSET) Technical Memorandum Re: review of the Port of Portland's (Port's) July 11, 2012 Level 2 "Sediment Characterization Report Terminal 4 Berths 401 and 410, 11040 North Lombard Street, Portland, Oregon" (SCR); and the July 24, 2012 "Work Plan to Address NSM Sediments Terminal 4 Berths 410 – Mid and East Berth Areas 11040 Lombard Street Portland Oregon" (NSM Work Plan). Terminal 4 (T4) is located on the east bank of the Willamette River, between river miles (RMs) 4.0 and 5.5, in Portland, Multnomah County, Oregon.

Reviewers: The Portland Sediment Evaluation Team (PSET) includes the US Army Corps of Engineers (Corps), Environmental Protection Agency (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). The reviewers for this project included James McMillan (Corps), Pete Anderson (ODEQ), Laura Inouye (Ecology), Jeffrey Lockwood (NMFS), Jonathan Freedman (EPA), and Bridgette Lohrman (EPA). Sean Sheldrake (Remedial Project Manager for Terminal 4) with EPA Region 10's Environmental Cleanup Office also reviewed the Work Plan with assistance from contract personnel. USFWS did not review the document.

This memorandum documents the consensus of the reviewing agencies regarding the consistency of the SCR with the 2009 *Final Sediment Evaluation Framework for the Pacific Northwest* (2009 SEF).

Applicable Authorities Governing the Project: EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authority; Section 10 of the Rivers and Harbors Act; Section 401 of the Clean Water Act; Section 7 of the Endangered Species Act; Section 305 of the Magnuson-Stevens Act, et al.

Project Description: The project is located on the Willamette River (from RM 4.0 to RM 5.5) in Portland, Multnomah County, Oregon (Figure 1). Berth 401 is located at RM 4.5 on the T4 face, downstream of the Terminal's Slip 1. Berths 410 and 411 are located at approximately RM 4.8 on the north side of Slip 3. Dredging is only proposed in Berths 401 and 410; dredging at Berth 411 is unnecessary because depth is sufficient.

The design depth for Berths 401 and 410 is -41 feet Columbia River Datum (CRD). The new surface material, which is equivalent to the pay depth, is anticipated to average -42 feet CRD. The Port is proposing a maximum permitted depth of -44 feet CRD, to account for incursions below the -43 feet CRD over-dredge allowance (Figure 2).

Berth 401: Berth 401 was historically used as a grain handling facility and is currently used as a lay berth. The berthing area ranges from 1,127 to 1,427 feet long and is 150 feet wide. The river bottom within the berthing area varies from approximately -35 to -57 feet, relative to the CRD. The design depth of Berth 401 is -41 feet CRD, with 2 feet of over-dredge allowance (Figure 3). Approximately 20,000 cubic yards (cy) would be dredged to achieve -42 feet CRD across Berth 401.

Berth 410: Since 1998, Berth 410 (and Berth 411) is actively used to export soda ash. The berthing area for Berth 410 is generally the western portion of the north side of Slip 3 and extends 200 to 300 feet from the berthing wall. The length of the dredge area in Berth 410 is approximately 830 feet. Currently, the river bottom within the berthing area varies from -36 to -61 feet CRD based on the Port survey in 2011 (Figure 4). Approximately 15,000 cubic yards (cy) would be dredged to achieve -42 feet CRD across Berth 410.

Dredging Methods: A clamshell dredge will remove sediments using a close-lipped bucket operated either from the dock or from a floating crane. The depth and position of the bucket and dredge would be monitored by visual and positioning computer systems, including a global positioning system.

Dredged Material Transport and Placement: The dredged material will be placed in a barge and transported for placement at an upland placement facility. Dredged material will be placed at the Port's West Hayden Island Placement Facility, their Suttle Road Rehandling Facility, or another approved beneficial use site. If the dredged material is found to be unsuitable for these placement options, the material will be transported for disposal at a solid waste (RCRA Subtitle D) landfill. The Port does not anticipate that placement of this dredged material at the upland placement facilities will generate return water to the Columbia River.

Management Area Ranking/ Recency: Based on previous sediment sampling data, a high management area ranking was assigned to both berths. Historical sediment characterization data from Berths 401 and 410 are summarized in Section 2.3 and in Table 1 of the Port's sampling and analysis plan (SAP) for Terminal 4. A brief synopsis follows. Project sediments are also subject to sources of contamination in the Portland Harbor. Available data indicated high concentrations of contaminants of concern in sediments in a range known to cause adverse responses in biological tests.

Two consecutive rounds of sampling (including the proposed sampling), with a reduction in the numbers and concentrations of CoCs, would be necessary to down-rank either berth.

SEF recency guidelines require that the need to retest the dredge area be evaluated 2 years from the date of sample collection, unless site conditions change (e.g., if a chemical spill is documented in or upstream of the project area).

Sampling and Analysis Description: Sample positioning, handling, and chain of custody procedures appeared in Section 4 of the SAP. Final sample station locations for Berths 401 and 410 appear in Figures 2 and 3, respectively. Procedures described in the SAP were adhered to by the field sampling contractor during sampling, with the following minor modifications at sample station 401B:

- A ship was present at Berth 401 and will be for at least several more months; as such, core location 401B as presented in the SAP could not be performed. This condition was anticipated in the SAP and an alternative core location (401B-Alt) was proposed by the Port. This alternative location was cored and was called 401B in the SCR.
- The calculated mudline elevation for core location 401B was 1.5 feet higher than the estimated elevation based on the July 2011 bathymetry. To accommodate variability, the Port's contractor drove the vibracore deeper than stated in the SAP. Due to the thickness of the dredge prism material, only 1.5 feet of NSM sediment was recovered instead of the 2 feet proposed.

Samples were submitted to Analytical Resources, Inc. (ARI), of Tukwila, Washington, for analysis as described in Section 5 of the SAP. The sediment samples were analyzed for the following parameters as described below:

- Conventional parameters (grain size, total solids, total organic carbon, total sulfides, ammonia)
- Metals (Ag, As, Cd, Cr, Cu, Ni, Pb, Sb, Zn & Hg) by EPA method 200.8 //6020 & 7471 series
- Semi-volatile compounds by EPA method 8270D or 8270D SIM, including:
    - Phenols
    - Phthalates
    - Polynuclear aromatic hydrocarbons (PAHs)
    - Chlorinated organic compounds
    - Misc. extractables

- Pesticides by EPA method 8081A /polychlorinated biphenyls (PCBs) by EPA method 8082
- Tri-n-butyltin (dry weight) (Krone method)
- Total petroleum hydrocarbons (TPH) as diesel and oil (using the NWTPH method)

Quality Assurance procedures described in Section 5.3 and Appendix C of the SAP note that the applicant would request the MDL will be reported, especially for chemical compounds above SQLs.

Evaluation of Sediment Quality Data: The Port's sediment chemistry results were compared to the freshwater SLs found in the 2006 SEF (Table 7-1) which the PSET is utilizing until the revisions to the freshwater benthic toxicity screening levels (SLs) are accepted by the Northwestern Regional Sediment Evaluation Team (RSET). Marine pesticide SLs were used in the absence of freshwater SLs.

Biological Testing: Biological testing was not performed on the dredge prism material or NSM sediments. All dredged material will be placed at one of the Port's upland dredged material placement facilities. NSM sediments with contaminant concentrations over the SLs will be covered with clean sand.

Results:
Berth 401: Results for the dredge prism material and NSM appear in Table 1. Dredge prism samples 401A/DP and 401B/DP had exceedences of TBT and zinc, respectively. Sample station 401A is located in the downstream portion of the berth; sample station 401B is located shoreward in the upstream portion of the berth (Figure 2). Contaminant concentrations did not exceed the freshwater SLs in any of the NSM samples, or in sample 401C/DP.

Berth 410: Results for the dredge prism material and NSM appear in Table 2. Dredge prism sample 410C/DP exceeded freshwater SLs for zinc and total high molecular weight PAHs; individually, concentrations of benzo(b+k) fluoranthene and benzo(a)pyrene were exceeded. NSM sample 410C/NSM also exceeded SLs for cadmium, zinc, benzo(b+k) fluoranthene, and total PCBs. Sample station 410C is located in the interior portion of the berth. Concentrations of benzo(b+k) fluoranthene slightly exceeded the SL in NSM sample 410B/NSM. Sample station 410B is located mid-berth, in Berth 410. Concentrations of contaminants in the other samples (410A&B/DP; 410A/NSM) did not exceed the SEF SLs.

Suitability Determinations:
Berth 401 – Dredge Prism: Based on SL exceedences of zinc and TBT, the dredge prism material characterized by samples 401A/DP and 401B/DP is not suitable for unconfined, aquatic placement without additional biological testing. The dredge prism material characterized by sample 401C/DP is suitable for unconfined, aquatic placement without additional biological testing. However, per the project description provided by the Port, all dredged material will be placed at one of the Port's upland placement sites.

Berth 401 – NSM: The Berth 401 NSM is suitable for unconfined aquatic exposure. There were no exceedances of the SEF SLs in the NSM samples beneath the three DMMUs. Additionally, the PSET does not have issue with the 1.5 ft. sample interval of NSM collected at station 401B.

Berth 410 – Dredge Prism: the outer berth and mid-berth DMMUs (~5,000 cy, each) characterized by samples 410A/DP and 410B/DP did not exceed the SEF SLs, and this material is suitable for unconfined, aquatic placement. The inner berth DMMU represented by sample 410 C/DP is not suitable for unconfined, aquatic placement without additional biological characterization. However, per the project description provided by the Port, all dredged material will be placed at one of the Port's upland placement sites.

Berth 410 – NSM:

Outer (Western) Berth Area. The NSM material beneath the outermost DMMU, characterized by sample 410A/NSM, is suitable for unconfined aquatic exposure.

Mid Berth Area. The benzofluoranthenes concentration in the mid-berth NSM (characterized by sample 410B/NSM) slightly exceeded the SEF SL. The overlying dredge prism material is suitable for unconfined, aquatic placement and much lower in concentration than the NSM (130 µg/kg in the dredge prism; 640 µg/kg in the NSM). Since fallback and mixing of the dredge prism material is bound to occur during the dredging operation, concentrations of benzofluoranthenes in the post-dredge surface will likely be much lower than predicted.

Inner (Eastern) Berth Area. The inner-berth NSM characterized by sample 410C/NSM, with the exceedances of cadmium, zinc, benzofluoranthenes, and total PCBs, is not suitable for unconfined aquatic exposure. The Port's NSM management strategy for Berth 410 is described in the NSM Work Plan.

NSM Work Plan Review: Following completion of the SCR, and discussions with the PSET Lead (J. McMillan), the Port submitted the NSM Work Plan to address exposure of contaminants in the mid- and inner- (eastern) berth portions of Berth 410. In the NSM Work Plan, the Port proposes the following:

- Over-dredge the NSM below the inner-berth DMMU and a portion of the mid-berth DMMU to a depth of -44 feet CRD (i.e., to the maximum depth characterized) (Figure 4).
- After dredging, the Port would conduct post-dredge sampling in the over-dredged area.
- If SLs are still exceeded, the Port would place a layer of sand backfill in those areas to control and reduce the aquatic exposure of these sediments to the aquatic environment after dredging.

The western boundary of the over-dredge area extends approximately 500 to 520 feet west of the eastern boundary of the estimated limit of the dredge area, including a portion of the mid-berth DMMU represented by sample 410B/NSM (Figure 4). Extending the over-dredge area west into this DMMU was done in consideration of the benzo(b+k)fluoranthene exceedance.

Post-dredge Sampling: Immediately following dredging, within three days of final bathymetric surveys (verifying that dredging is complete) the Port would collect three surface grab samples from the post-dredge surface. A Ponar or Van Veen sampler would be used to collect the samples. One sample (NSM1) would be collected from the mid-berth area, and two samples (NSM2 and NSM3) from the east berth area. Post-dredge sample locations are shown are Figure 4. Samples would be analyzed only for chemicals which exceeded SEF SLs in the NSM characterization core samples, and not the entire suite of SEF chemicals of concern. The Port proposed the following analyses in the NSM Work Plan:

- Sample NSM1 analyzed for benzofluoranthenes only (EPA Method 8270D-SIM)
- Samples NSM 2 and 3 analyzed for:
    - Total metals (EPA Method 200.8)
    - PAHs (EPA Method 8270D-SIM)
    - Pesticides (EPA Method 8081)
    - PCBs (EPA Method 8082).

Results would be compared against the SEF SLs. For samples with one or more SL exeedances, that area would be broken into cells and backfilled with sand, to a depth of six inches using a clamshell bucket. Adequate sand layer thickness would be verified on a cell by cell basis before proceeding with filling in the next cell. Further details on sand cover placement would be provided at a later date. The plan states that "nominal exceedances would be discussed with appropriate regulatory agencies to determine if …sand backfilling or other management options are needed."

PSET Determination: The PSET approves of the general strategy described in the NSM Work Plan with the following requests/modifications:

1. The PSET requests that any sand cover placed in the over-dredge area be a *minimum* thickness of six inches.
2. In order to better understand the process by which the Port would place a sand cover, the PSET requests that the Port delineate the sand backfill cells described in Section 3.3 of the NSM Work Plan.
3. To create a record of compliance, the PSET requests that the Port prepare an after-action report that describes the following parameters:
    a. Dredge volumes (both berths)
    b. Dredging extent (horizontal and vertical, in both berths)
    c. Sample locations and analytical results (Berth 410)
    d. Figure delineating backfill cells and average backfill thickness in each cell (Berth 410)

Note: On page 1 of the NSM Work Plan, in the two bullets at the bottom of the page, sample locations in Berth 410 are referred to as cores 401A and 401B. We assume the Port was referring to cores 410A and 410B.

How much debris in Cut?

EPA Requirements: Staff from EPA's Superfund Program reviewed the SCR and NSM Work Plan and has imposed the following requirements:

1. All post-dredge grab samples need to be analyzed for total metals, PAHs, PCBs, and pesticides.
2. In addition to the three surface grab samples proposed in the NSM Work Plan, the Port must collect three additional surface grab samples in the western berth area (characterized by samples 410A/DP and 410A/NSM) (Figure 4):
    a. One sample must be collected from sample station 410A (sample NSM5).
    b. Two additional samples need to be located to the east and west of the sample NSM5 location (samples NSM6 and NSM4, respectively).

Questions regarding EPA requirements should be addressed to Sean Sheldrake (206) 553-1220 (email to: sheldrake.sean@epa.gov).

Contact: This memorandum was prepared by Jonathan Freedman and James McMillan reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum may be directed to Jonathan Freedman at (206) 553-0266, or email to: freedman.jonathan@epa.gov; or to James McMillan at (503) 808-4376, or e-mail to: james.m.mcmillan@usace.army.mil.

Jonathan Freedman
Portland Sediment Evaluation Team

References:

Hart Crowser. 2012. Sampling and Analysis Plan: Sediment Characterization, Terminal 4 Berths 401 and 410, 11040 North Lombard Street, Portland, Oregon. March 7, 2012.

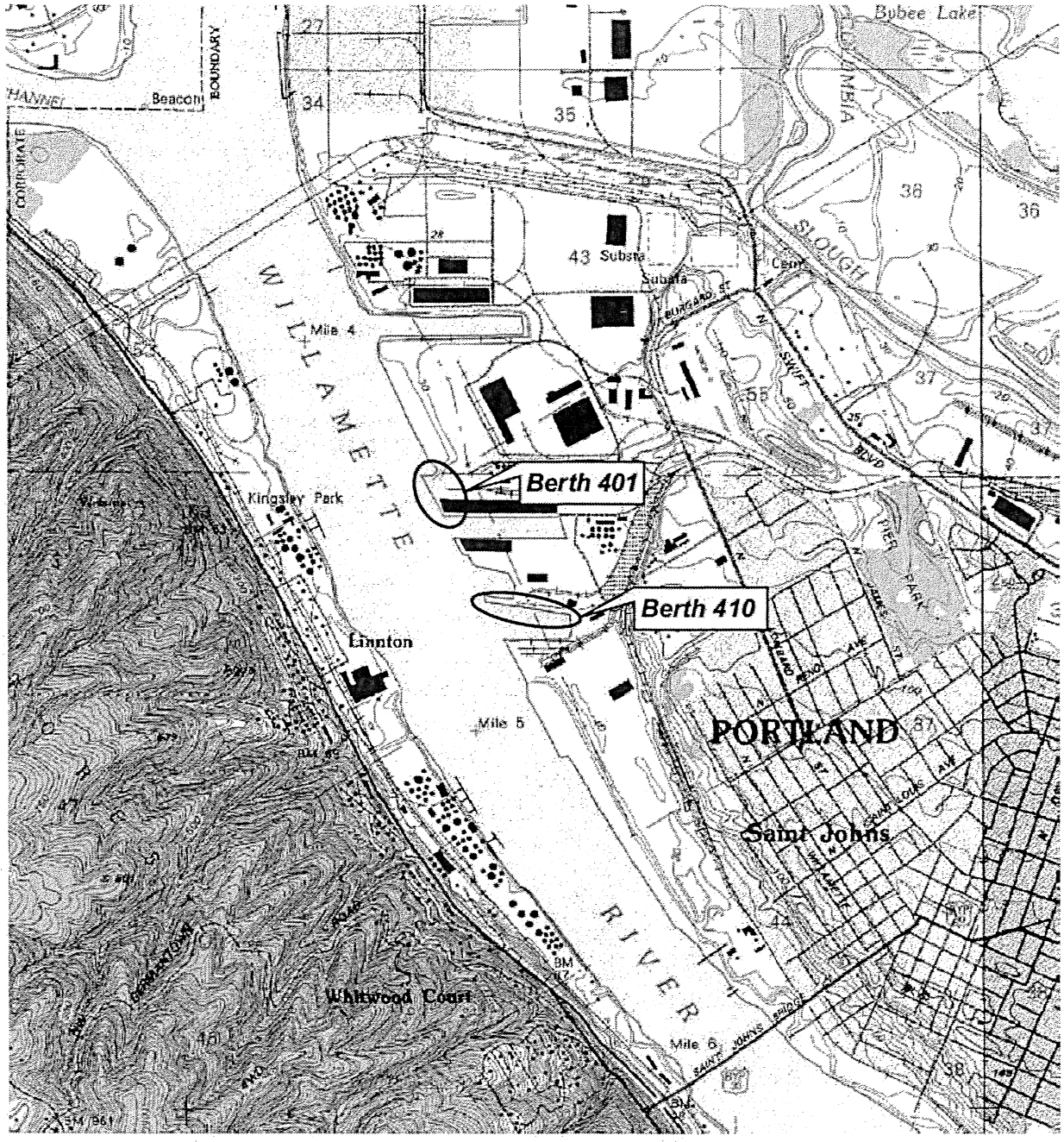
Hart Crowser. 2012. Sediment Charterization Report Terminal 4, Berths 401 and 410, 11040 Lombard Street Portland Oregon. July 11, 2012.

Hart Crowser. 2012. Work Plan To Address NSM Sediments Terminal 4 Barths 410 – Mid and East Berth Areas, 11040 Lombard Street, Portland, Oregon. July 24, 2012.

Integral Consulting Inc., Windward Environmental LLC, Kennedy/Jenks Consultants, Anchor QEA, LLC. 2011. Portland Harbor RI/FS Remedial Investigation Report, Draft Final. Prepared for the Lower Willamette Group. Appendix G – Baseline Ecological Risk Assessment, Section 6.1.1.1, Reference Envelope Approach. August 29, 2011.

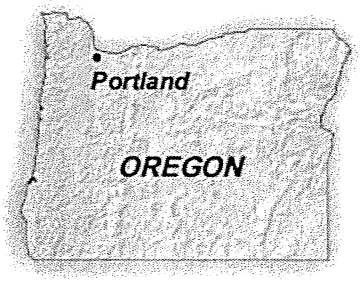
U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2006. *Interim Final Sediment Evaluation Framework for the Pacific Northwest.* Published September 30, 2006, by the U.S. Army Corps of Engineers, Northwestern Division, 194 pp + Appendices.

U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2009. *Sediment Evaluation Framework for the Pacific Northwest.* Published May 2009, by the U.S. Army Corps of Engineers, Northwestern Division, 128 pp + Appendices.



0 2,000 4,000

Scale in Feet



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Terminal 4 Sediment Characterization SAP
Portland, Oregon

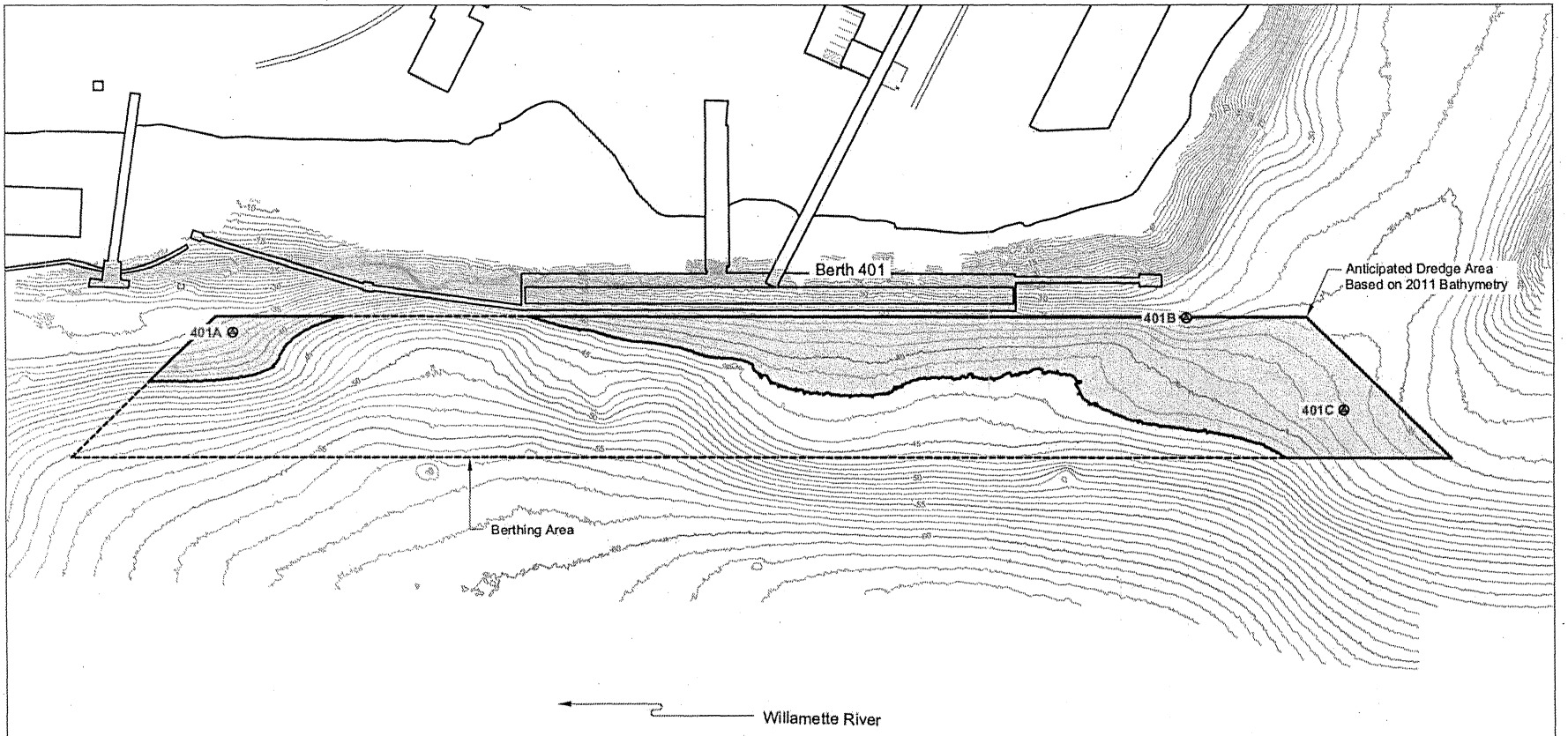
Site Location Map

15753-00 5/12

HARTCROWSER

Figure 1

Source: Base map prepared from the USGS 7.5-minute quadrangle of Linnton, Oregon, dated 1990.



401A Core Sampling Location and Number

Contours Based on a 2011 Bathymetric Survey in Feet (CRD)

Yellow Shading Represents Building

0 100 200

Scale in Feet

N

Terminal 4 Sediment Characterization SAP
Portland, Oregon

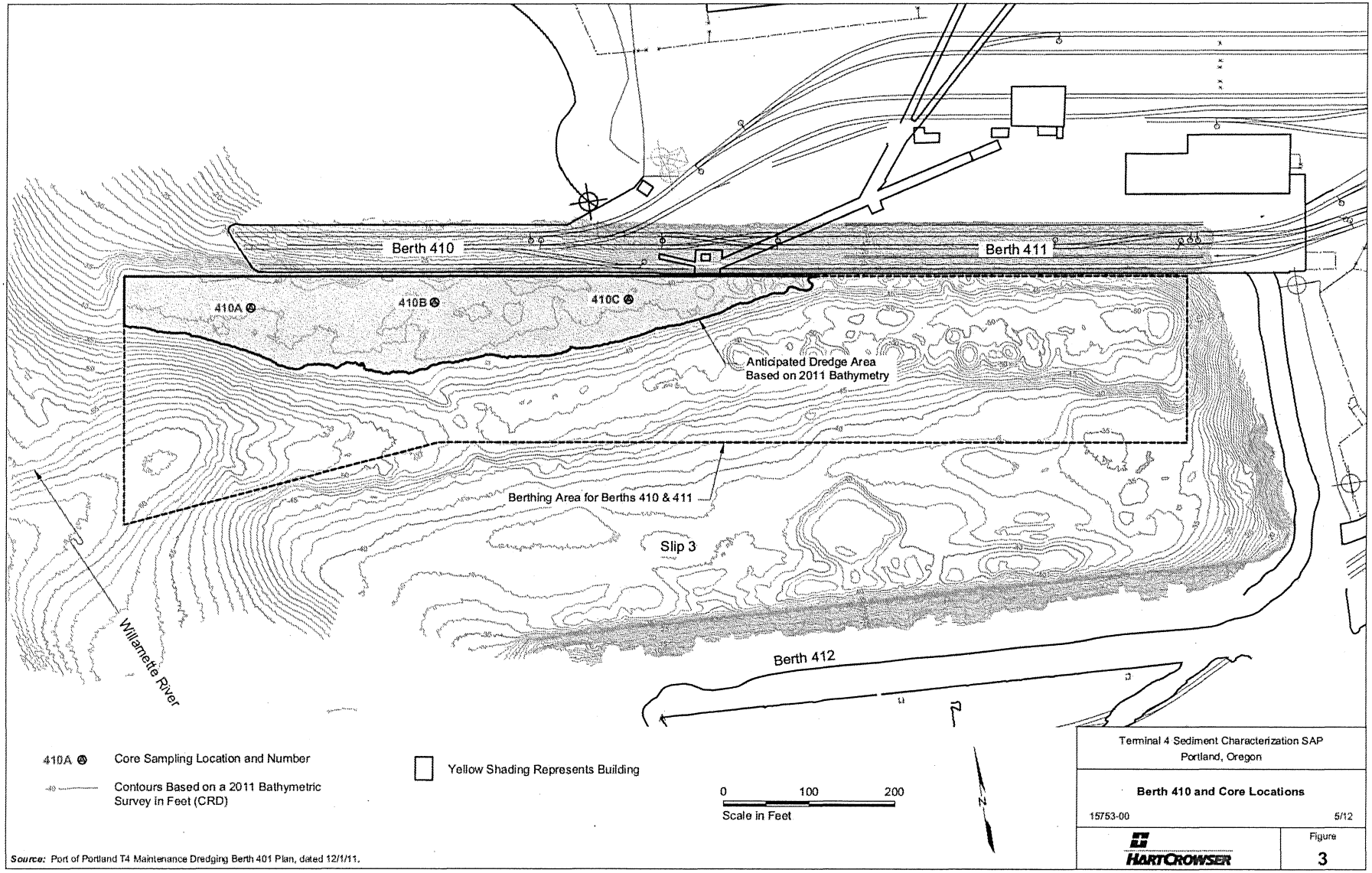
Berth 401 and Core Locations

15753-00 5/12

HARTCROWSER

Figure 2

Source: Port of Portland T4 Maintenance Dredging Berth 401 Plan, dated 12/1/11.



Source: Port of Portland T4 Maintenance Dredging Berth 401 Plan, dated 12/1/11.

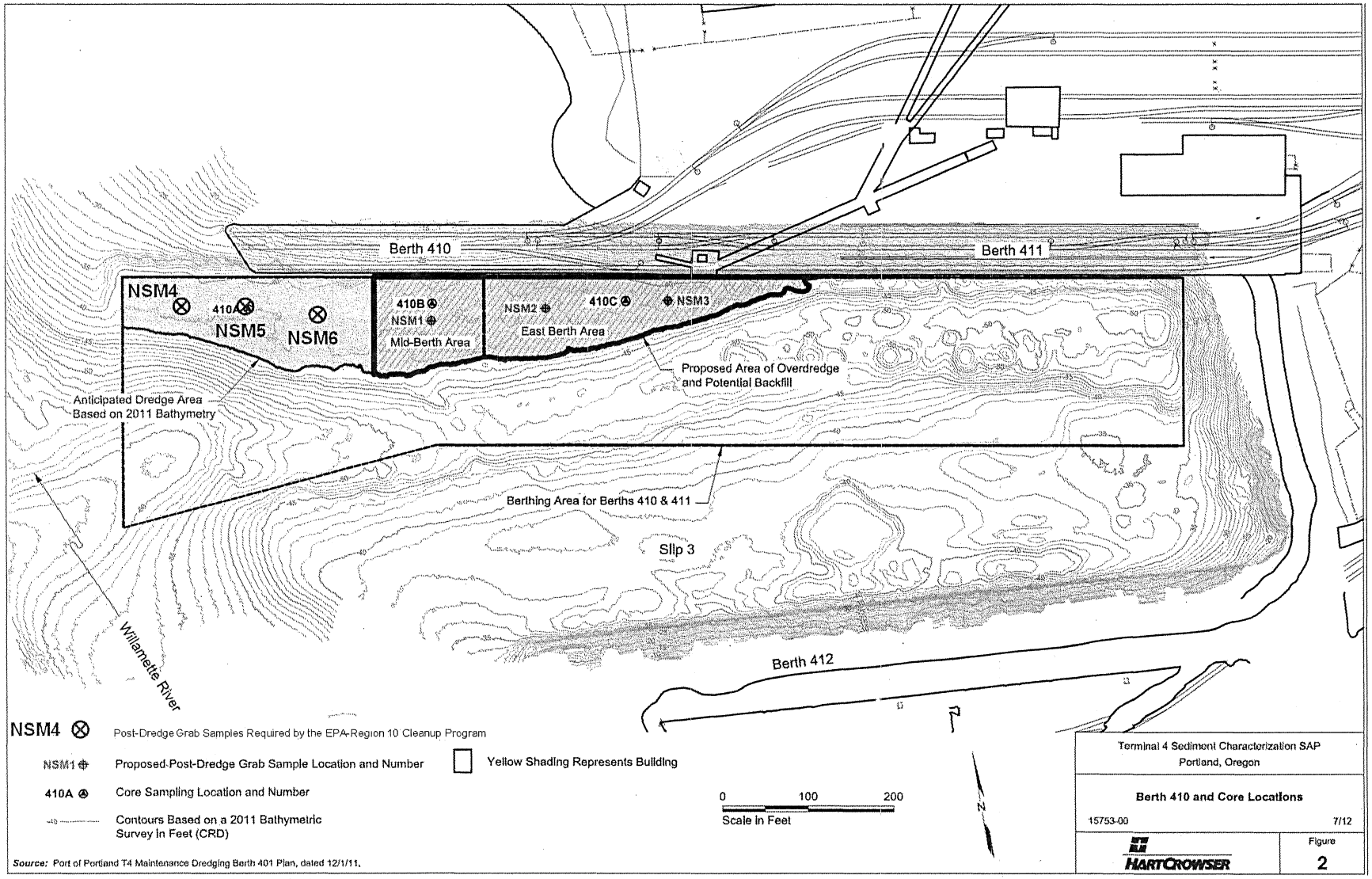


Figure 4. Post-dredge grab sample locations, Berth 410.

Table 1. Berth 401 laboratory analytical results.

Sediment Horizon	Prism			NSM			SEF Screening Levels
Sample	401A/DP	401B/DP	401C/DP	401A/NSM	401B/NSM	401C/NSM	
Lab ID	UU16A	UU16B	UU16C	UU16D	UU16E	UU16F	
Date	9-May-12	8-May-12	9-May-12	9-May-12	8-May-12	9-May-12	
Conventional Parameters							
Total Solids (%)	54.0	65.4	48.7	78.9	82.5	56.5	-
Total Organic Carbon (%)	1.70	1.49	1.80	1.36	0.116	1.68	-
Ammonia (mg/kg)	137	128	4.31	28.0	16.0	293	-
Total Sulfides (mg/kg)	10.9	9.36	1.76	33.8	1.20 U	5.35	-
TPH in mg/kg							
Diesel-Range	2.3 U	21	11	-	-	-	-
Oil-Range	2.8 U	32	32	-	-	-	-
Total TPH	2.8 U	53	43	-	-	-	-
Metals in mg/kg							
Antimony	0.024 R	0.019 R	0.027 R	0.016 UJ	0.015 UJ	0.021 UJ	-
Arsenic	4.1	3.7	4.6	3.3	2.4	3.7	20
Cadmium	0.3	0.4	0.025 U	0.2	0.014 U	0.2	1.1
Chromium	27	24	31	16	13	28	95
Copper	39.4	31.4	47	20.5	15.2	42.0	80
Lead	15.6	18.5	14.1	9.5	2.4	14.2	340
Mercury	0.07	0.09	0.07	0.08	0.03 U	0.06	0.28
Nickel	25.6	24.8	31	20.1	18.5	27.5	60
Silver	0.015 U	0.012 U	0.016 U	0.010 U	0.0091 U	0.013 U	2.0
Zinc	115	132	111	78	46	98	130
Tributyltin (TBT)							
TBT in Bulk Sediment (µg/kg)	140	2.4 J	5.2	17	0.9 U	32	75
PAHs in µg/kg							
LPAHs							
Naphthalene	130	460	36	190	2.6 U	170	500
Acenaphthylene	16	36	8.9	26	5.4 U	28	470
Acenaphthene	49	180	12	54	3.1 U	99	1,100
Fluorene	30	87	11	47	4.1 U	84	1,000
Phenanthrene	190	460	86	390	3.4 U	340	6,100
Anthracene	42	82	29	70	4.3 U	62	1,200
2-Methylnaphthalene	40	160	11	71	2.9 U	44	470
Total LPAHs	497	1,465	194	848	5.4 U	827	6,600
HPAHs							
Fluoranthene	320	480	230	400	2.8 U	310	11,000
Pyrene	280	490	210	510	1.8 U	300	8,800
Benz(a)anthracene	75	150	91	140	3.1 U	140	4,300
Chrysene	130	210	140	190	3.6 U	160	5,900
Benzo(b)fluoranthene	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-
Benzo(b+k)fluoranthenes	190	230	250	250	2.6 U	300	600
Benzo(a)pyrene	140	180	130	200	5.2 U	210	3,300
Indeno(1,2,3-cd)pyrene	80	100	67	110	4.4 U	100	4,100
Dibenz(a,h)anthracene	20	26	21	26	4.1 U	30	800
Benzo(g,h,i)perylene	110	140	78	150	4.1 U	120	4,000
Total HPAHs	1,345	2,006	1,217	1,976	5.2 U	1,670	31,000
SVOCs in µg/kg							
Chlorinated Hydrocarbons							
1,4-Dichlorobenzene	2.7 U	2.7 U	2.7 U	2.6 U	2.7 U	2.7 U	-
1,2-Dichlorobenzene	2.3 U	2.3 U	2.3 U	2.3 U	2.4 U	2.4 U	-
1,2,4-Trichlorobenzene	3.3 U	3.2 U	3.2 U	3.2 U	3.3 U	3.3 U	-
Hexachlorobenzene	4.0 U	4.0 U	4.0 U	3.9 U	4.1 U	4.1 U	-

Sediment Horizon	Prism			NSM			SEF Screening Levels
Sample	401A/DP	401B/DP	401C/DP	401A/NSM	401B/NSM	401C/NSM	
Lab ID	UU16	UU16	UU16	UU16	UU16	UU16	
Date	9-May-12	8-May-12	9-May-12	9-May-12	8-May-12	9-May-12	
SVOCs in µg/kg (Continued)							
Phthalates							
Dimethyl Phthalate	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.8 U	46
Diethyl Phthalate	34 U	34 U	34 U	33 U	35 U	35 U	-
Di-n-butyl Phthalate	7.7 U	7.6 U	7.6 U	7.5 U	7.7 U	7.7 U	-
Butyl Benzyl Phthalate	5.8 U	5.7 U	17 J	5.6 U	5.8 U	5.8 U	260
Bis (2-ethylhexyl) Phthalate	84 U	50 U	110	47 U	33 U	68 U	220
Di-n-octyl Phthalate	5.5 U	5.4 U	5.4 U	5.3 U	5.5 U	5.5 U	26
Phenols							
2,4-Dimethylphenol	3.2 U	3.2 U	3.2 U	3.2 U	3.3 U	3.3 U	-
2-Methylphenol	4.9 U	4.9 U	4.9 U	4.8 U	5.0 U	5.0 U	-
4-Methylphenol	39	130	37	67	6.3 U	110	-
Pentachlorophenol	46 UJ	45 UJ	45 UJ	44 UJ	46 UJ	46 UJ	-
Phenol	18 J	8.0 U	8.0 U	7.9 U	8.2 U	43	-
Miscellaneous Extractables							
Benzoic Acid	95 U	94 U	190 J	92 U	96 U	330 J	-
Benzyl Alcohol	39	25	98	5.6 U	5.8 U	190	-
Dibenzofuran	19	54	53	23	3.9 U	31	400
Hexachlorobutadiene	4.3 U	4.2 U	4.3 U	4.2 U	4.3 U	4.3 U	-
n-Nitrosodiphenylamine	5.1 U	5.0 U	5.0 U	4.9 U	5.1 U	5.1 U	-
Pesticides in µg/kg							
4,4'-DDD	2.2	3.3	1.1	1.4	0.13 U	2.5	16[a]
4,4'-DDE	3.6	4.1	2.2	2.1	0.12 U	5.5 JP	9[a]
4,4'-DDT	0.19 U	0.18 U	0.19 U	0.18 U	0.18 U	0.19 U	12[a]
Aldrin	0.054 U	0.053 U	0.053 U	0.053 U	0.053 U	0.054 U	9.5[a]
alpha-Chlordane	0.050 U	0.049 U	0.049 U	0.049 U	0.049 U	0.050 U	2.8[a]
Dieldrin	0.098 U	0.096 U	0.097 U	0.096 U	0.096 U	0.097 U	1.9[a]
Heptachlor	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	1.5[a]
gamma-BHC (Lindane)	0.047 U	0.046 U	0.046 U	0.046 U	0.046 U	0.047 U	10[b]
PCBs in µg/kg							
Aroclor 1016	1.0 U	0.97 U	0.99 U	0.99 U	0.97 U	1.0 U	-
Aroclor 1221	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	-
Aroclor 1232	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	-
Aroclor 1242	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	-
Aroclor 1248	12 JP	19 U	5.8 U	7.9	1.3 U	6.8 U	-
Aroclor 1254	12 U	19 U	5.8 U	9.7 U	1.3 U	9.8 U	-
Aroclor 1260	10	16	5.5	9.1	1.3 U	6.6	-
Aroclor 1262	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	-
Aroclor 1268	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	-
Total PCBs	22 J	16 J	5.5 J	17	1.3 U	6.6 J	60

Notes:

1. Screening levels (SLs) are Freshwater Screening Levels 1 (no adverse effects) from the Sediment Evaluation Framework (SEF) (Corps, et al., 2006; Table 7-1, revised 10/20/06). For pesticides, no freshwater SLs have been established and the Corp uses marine SLs from corrected Table 6-3 of the Final SEF (Corps, et al., 2009). These marine SLs are listed and flagged with an [a].
2. PAH and dibenzofuran concentrations are the higher of the lowest acceptable dilution of the EPA Method 8270D-SIM and EPA Method 8270D analyses.
3. Bolded values are detected concentrations.
4. For undetected compounds, method detections limits (MDLs) are shown.
5. - = Not analyzed or not available.
6. J = Estimated concentration. Result may be estimated due to value between MDL and method reporting limit (MRL), or due to QA exceedance.
7. U = Not detected at the indicated MDL.
8. P = The analyte was detected on both chromatographic columns but the RPD was greater than 40%.
9. Reference sample results: 51.7% solids, 29.9 mg/kg ammonia, and 2.51 mg/kg total sulfides.

Table 2. Berth 410 laboratory analytical results.

Sediment Horizon	Prism			NSM			SEF Screening Levels
Sample	410A/DP	410B/DP	410C/DP	410A/NSM	410B/NSM	410C/NSM	
Lab ID	UU16G	UU16H	UU16I	UU16J	UU16K	UU16L	
Date	8-May-12	8-May-12	8-May-12	8-May-12	8-May-12	8-May-12	
Conventional Parameters							
Total Solids (%)	55.3	71.1	65.5	60.6	72.7	69.4	-
Total Organic Carbon (%)	1.84	1.16	1.86	1.84	1.19	1.39	-
Ammonia (mg/kg)	105	81.9	85.8	152	96.2	140	-
Total Sulfides (mg/kg)	28.6	18.3	94.2	22.4	32.9	150	-
TPH in mg/kg							
Diesel-Range	10	1.3 U	20	-	-	-	-
Oil-Range	150	2.7 U	33	-	-	-	-
Total TPH	160	2.7 U	53	-	-	-	-
Metals in mg/kg							
Antimony	0.023 UJ	0.018 UJ	0.020 UJ	0.021 UJ	0.018 UJ	0.017 UJ	-
Arsenic	3.6	2.9	3.8	3.4	3.0	5.2	20
Cadmium	0.021 U	0.017 U	0.6	0.020 U	0.1	1.4	1.1
Chromium	22	16	18	22	18	21	95
Copper	31.7	24.5	35.9	31.4	26.8	43.5	80
Lead	9.5	8.3	53.7	13.7	19.1	201	340
Mercury	0.0018 U	0.03	0.05	0.07	0.0018 U	0.06	0.28
Nickel	23.7	19.8	22.7	24.5	20.0	23.2	60
Silver	0.014 U	0.011 U	0.012 U	0.013 U	0.011 U	0.5	2.0
Zinc	85	67	146	93	79	265	130
Tributyltin (TBT)							
TBT in Bulk Sediment (µg/kg)	1.0 U	1.9 J	10	2.9 J	14	18	75
PAHs in µg/kg							
LPAHs							
Naphthalene	34	37	140	510	47	150	500
Acenaphthylene	7.1	4.1 J	42	29	9.3 J	36	470
Acenaphthene	49	38	270	460	83	190	1,100
Fluorene	27	28	160	120	40	120	1,000
Phenanthrene	100	130	1,600	1,000	270	940	6,100
Anthracene	23	36	320	100	60	160	1,200
2-Methylnaphthalene	12	20	67	210	21	88	470
Total LPAHs	252	293	2,599	2,429	530	1,684	6,600
HPAHs							
Fluoranthene	160	170	5,900	600	500	1,400	11,000
Pyrene	160	170	5,000	580	450	1,200	8,800
Benz(a)anthracene	57	66	3,200	160	280	560	4,300
Chrysene	83	84	3,800	190	320	760	5,900
Benzo(b)fluoranthene	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-
Benzo(b+k)fluoranthenes	130	130	6,200	260	640	1,300	600
Benzo(a)pyrene	86	83	3,900	170	400	720	3,300
Indeno(1,2,3-cd)pyrene	50	41	1,500	65	160	260	4,100
Dibenz(a,h)anthracene	12	8.4	600	19	58	110	800
Benzo(g,h,i)perylene	62	44	1,400	74	160	250	4,000
Total HPAHs	800	796	31,500	2,118	2,968	6,560	31,000
SVOCs in µg/kg							
Chlorinated Hydrocarbons							
1,4-Dichlorobenzene	2.7 U	2.8 U	2.6 U	2.7 U	2.7 U	2.8 U	-
1,2-Dichlorobenzene	2.4 U	2.4 U	2.3 U	2.4 U	2.3 U	2.4 U	-
1,2,4-Trichlorobenzene	3.3 U	3.4 U	3.2 U	3.3 U	3.2 U	3.4 U	-
Hexachlorobenzene	4.0 U	4.4 U	3.9 U	4.1 U	4.2 U	4.1 U	-

Sediment Horizon	Prism			NSM			SEF Screening Levels
Sample	410A/DP	410B/DP	410C/DP	410A/NSM	410B/NSM	410C/NSM	
Lab ID	UU16	UU16	UU16	UU16	UU16	UU16	
Date	8-May-12	8-May-12	8-May-12	8-May-12	8-May-12	8-May-12	
SVOCs in µg/kg (Continued)							
Phthalates							
Dimethyl Phthalate	2.8 U	2.8 U	2.7 U	2.8 U	2.7 U	2.8 U	46
Diethyl Phthalate	35 U	36 U	34 U	35 U	34 U	35 U	-
Di-n-butyl Phthalate	7.7 U	7.9 U	7.5 U	7.8 U	7.6 U	7.9 U	-
Butyl Benzyl Phthalate	5.8 U	6.0 U	5.6 U	5.9 U	5.7 U	5.9 U	260
Bis (2-ethylhexyl) Phthalate	62 U	68 U	86 U	65 U	44 U	110	220
Di-n-octyl Phthalate	5.6 U	5.7 U	12 J	5.6 U	5.4 U	5.6 U	26
Phenols							
2,4-Dimethylphenol	3.3 U	3.4 U	3.2 U	3.3 U	3.2 U	3.3 U	-
2-Methylphenol	5 U	5.1 U	4.8 U	5.0 U	4.9 U	5.1 U	-
4-Methylphenol	14 J	6.5 U	26 J	110	9.3 J	34 J	-
Pentachlorophenol	46 UJ	47 UJ	44 UJ	46 UJ	45 UJ	47 UJ	-
Phenol	30 J	11 J	20 J	24 J	8.0 U	28 J	-
Miscellaneous Extractables							
Benzoic Acid	110 J	98 U	93 U	120 J	94 U	97 U	-
Benzyl Alcohol	73	20	25	68	5.6 U	12 J	-
Dibenzofuran	14	17	61	94	18 J	62	400
Hexachlorobutadiene	4.4 U	4.4 U	4.2 U	4.4 U	4.2 U	4.4 U	-
n-Nitrosodiphenylamine	5.1 U	5.2 U	4.9 U	5.2 U	5.0 U	30	-
Pesticides in µg/kg							
4,4'-DDD	0.92 J	1.1 JP	2.2	8.6	1.3	9.6* U	16[a]
4,4'-DDE	1.7	0.96 J	2.3	3.3	2.5 JP	12* U	9[a]
4,4'-DDT	0.19 U	0.18 U	0.19 U	0.19 U	0.19 U	18* U	12[a]
Aldrin	0.053 U	0.052 U	0.054 U	0.054 U	0.054 U	0.053 U	9.5[a]
alpha-Chlordane	0.049 U	0.048 U	0.050 U	0.050 U	0.050 U	0.049 U	2.8[a]
Dieldrin	0.097 U	0.095 U	0.098 U	0.099 U	0.098 U	0.096 U	1.9[a]
Heptachlor	0.13 U	0.12 U	0.13 U	0.13 U	0.13 U	0.13 U	1.5[a]
gamma-BHC (Lindane)	0.046 U	0.015 U	0.047 U	0.047 U	0.047 U	0.016 U	10[b]
PCBs in µg/kg							
Aroclor 1016	0.99 U	0.96 U	1.0 U	1.0 U	0.99 U	9.8 UJ	-
Aroclor 1221	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	13 UJ	-
Aroclor 1232	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	13 UJ	-
Aroclor 1242	9.7 U	5.6 U	1.3 U	1.3 U	1.3 U	13 UJ	-
Aroclor 1248	1.3 U	1.3 U	20 U	9.9 U	5.8 U	160 JP	-
Aroclor 1254	5.8 U	1.3 U	20 U	9.9 U	5.8 U	180 J	-
Aroclor 1260	5.7	3.8	16	9.3	4.9	95 J	-
Aroclor 1262	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	13 UJ	-
Aroclor 1268	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	13 UJ	-
Total PCBs	5.7 J	3.8 J	16 J	9.3 J	4.9 J	435 J	60

Notes:

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7. U = Not detected at the indicated MDL.
8. P = The analyte was detected on both chromatographic columns but the RPD was greater than 40%.
9. Reference sample results: 51.7% solids, 29.9 mg/kg ammonia, and 2.51 mg/kg total sulfides.
10. *Results on diluted sample that had acceptable quality control. The undiluted sample, which had a calibration sample failure on the run, had 5.2 µg/kg DDD, 8.2 µg/kg JP DDE, and undetected DDT at 0.18 µg/kg.