

SUBJECT: EVALUATION OF PROPOSED POST-DREDGE SEDIMENT SURFACE TO VERIFY COMPLIANCE WITH THE WASHINGTON STATE ANTIDegradation POLICY, FOR MAINTENANCE DREDGING OF THE PORT OF SEATTLE TERMINAL 18, SEATTLE, WA (NWS-2014-00413-WRD)

- 1. Introduction.** This memorandum reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington Department of Ecology, Washington State Department of Natural Resources, and the Environmental Protection Agency) regarding the suitability of the exposed sediment surface after removal of approximately 4,400 cubic yards (cy) of accumulated sediment from the Port of Seattle’s Terminal 18. All dredged material will be taken upland for disposal.

Table 1. Port of Seattle T18 project details

Regulatory reference #	NWS-2014-00413-WRD
SAP submitted	May 28, 2015
SAP approved	June 17, 2015
Sampling dates	June 23, 2015
Final Data characterization report submitted	September 10, 2015
Recency Determination: High Concern (3 years)	June 2018
DMMP reference #	PST18-1-A-O-368
EIM project #	PST1815

- 2. Project.** The Port of Seattle plans to dredge approximately 4,400 (cy) of accumulated material from Terminal 18, in the East Waterway at the mouth of the Duwamish River. The purpose of the project is to remove high spots adjacent to T-18 to accommodate safe berthing for container ships. Authorized maintenance dredge depth is -51 feet mean lower low water (MLLW). The conceptual dredge design will target -51 feet MLLW, with an allowable overdredge of 2 feet (to -53 feet MLLW). The newly exposed Z-layer is the first 2 feet of sediment beyond the overdredge elevation, from -53 to -55 feet MLLW for this project.

The area to be dredged is part of the EW Operable Unit (OU) of the Harbor Island Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site, and sediment is currently ranked High by the DMMP. The proposed dredged material was not characterized under DMMP for suitability for open-water disposal; all dredged material will be removed from the waterway and taken to an appropriate upland site for disposal. However, in order to determine compliance with the Sediment Management Standards (SMS) anti-degradation policy (Washington Administrative Code [WAC]-173-204-120), the Z-layer sediment was characterized.

- 3. Sampling and Analysis Plan.** A sampling and analysis plan (SAP) was submitted to the DMMP for review on May 28, 2015. DMMP review comments were adequately addressed and the SAP was approved on June 17, 2015. For this characterization, a tiered approach was taken to sample analysis: all Z-samples were analyzed to determine whether an antidegradation determination could be made on that data alone, or whether analysis of proposed dredged material would be needed for comparison purposes. Thus the portion of each core representing the dredged material prism (“A”) was archived while the portion representing the 2-foot Z-layer (“Z”) was initially submitted for analysis.

4. **Sampling.** Three cores were collected with a boat-mounted vibracore on June 23, 2015 (Figure 2). Sample locations and depths collected were consistent with the approved SAP (Table 2). Sample intervals were based on in situ depth and were corrected for length based on core recovery percentage, with assumed equal compaction throughout the core. After collection, cores were transported to the analytical laboratory where they were processed the same day.

Table 2. Port of Seattle T18 sample locations and intervals

Station	Samples	Location (NAD83 WASPS)		Mudline Elevation (feet MLLW)	Dredged Prism Sample (A) Elevation Interval (feet MLLW)	Z-layer Sample Elevation Interval (feet MLLW)
		X Coordinate	Y Coordinate			
C-1	C1-A	1267187	217858	-49.4	-49.4 to -53.0	
	C1-Z					
C-2	C2-A	1267148	215693	-51.1	-51.1 to -53.0	
	C2-Z					
C-3	C3-A	1267157	214771	-51.0	-51.0 to -53.0	
	C3-Z					

Notes:

Coordinates are in NAD83 WA State Plane South, U.S. Feet.
MLLW = mean lower low water

5. **Conventional and Chemical Analyses.** Analytical Resources Incorporated (ARI) of Tukwila, Washington analyzed all samples. The approved SAP was followed, and quality control guidelines specified by the DMMP were generally met. Samples were analyzed for SMS and DMMP marine chemicals of concern. The resulting analytical data were validated by Laboratory Data Consultants in Carlsbad, California. The data gathered were deemed sufficient and acceptable for regulatory decision-making under DMMP and SMS guidelines.

Z-samples were predominantly sand and silty sand, with relatively low total organic carbon content (Table 3). Analytes with benthic SMS criteria were screened against SMS benthic marine sediment chemical criteria (Ecology 2015), and TBT and dioxins and furans were screened against DMMP 2014 marine criteria to determine anti-degradation compliance. All standard chemicals of concern were either detected or undetected at levels below the regulatory guidelines in all three Z-samples (Table 4). Results of the dioxin/furan analysis showed that these compounds were largely undetected, with TEQs (calculated with $U = \frac{1}{2}$ detection limit) all less than 2 ppt TEQ, well below the 4 – 10 ppt TEQ range under DMMP guidelines (Table 5).

Data from the Z-samples were sufficient for the DMMP to make an antidegradation determination, and thus the archived dredge prism samples were not analyzed.

Table 3. Summary of Sediment Conventionals

	Sample	C1-Z	C2-Z	C3-Z
	Total organic carbon (%)	0.931	0.468	0.526
	Total solids (%)	73.86	72.76	72.57
	Total volatile solids (%)	2.3	2.21	2.04
Grain Size	Gravel (>2000 μm)	0.1	0.1 U	0.1
	Total Sand (2000 to 62.5 μm)	60.3	41.4	78.5
	Silt (62.5 to 3.9 μm)	33.3	49.9	18.1
	Clay (<3.9 μm)	6.3	8.6	3.3
	Total Fines (<62.5 μm)	39.6	58.5	21.4

6. **Sediment Exposed by Dredging.** The sediment to be exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) or the State's Antidegradation standard (Ecology 2013) as outlined by DMMP guidance (DMMP 2008). For this project, Z-samples representing the material underlying the proposed dredge prism had no detected or undetected exceedances of DMMP or SMS screening levels. Dioxin TEQs were also below the DMMP Puget Sound screening level of 4 ng/kg dry wt. for all samples. With this evidence, the DMMP agencies conclude that this project is in compliance with the State of Washington anti-degradation policy.

This determination does *not* constitute final agency approval of the project. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under section 404(b)(1) of the Clean Water Act.

7. **References.**

- Anchor QEA 2015a. *Sampling and Analysis Plan, Terminal 18 Maintenance Dredging Project Sediment Characterization*. Prepared for the Dredged Material Management Office, Seattle, Washington. June 2015.
- Anchor QEA 2015b. *Data Report, Terminal 18 Maintenance Dredging Project Sediment Characterization*. Prepared for the Dredged Material Management Office, Seattle, Washington. September 2015.
- DMMP 2008. *DMMP Clarification Paper: Quality of Post-Dredge Sediment Surfaces (Updated)*. Prepared by David Fox (USACE), Erika Hoffman (EPA) and Tom Gries (Ecology) for the Dredged Material Management Program, June 2008.
- DMMP 2014. *Dredged Material Evaluation and Disposal Procedures (User Manual)*. Dredged Material Management Program, updated December 2014.
- Ecology (Washington State Department of Ecology) 2013. *Sediment Management Standards – Chapter 173-204 WAC*. Washington State Department of Ecology, February 2013
- Ecology 2015. *Sediment Cleanup User's Manual II, Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards (Chapter 173-204 WAC)*. Ecology Publication No. 12-09-057. Washington State Department of Ecology. March 2015.

Table 4. Summary of Chemical Analysis Results Compared to DMMP and SMS Guidelines

	DMMP Criteria		SMS Marine Criteria		C1-Z		C2-Z		C3-Z	
	SL	BT	SCO	CSL	result	Q	result	Q	result	Q
Total organic carbon (%)					0.931		0.468		0.526	
Metals (mg/kg dry weight)										
Antimony	150				1.11	J	1.18	J	0.63	J
Arsenic	57	507.1	57	93	11		12		9	
Cadmium	5.1	11.3	5.1	6.7	0.3		0.3	U	0.3	U
Chromium	260	260	260	270	14.8		15.3		12.2	
Copper	390	1027	390	390	17.7		20.7		13.4	
Lead	450	975	450	530	3		3		1.95	J
Mercury	0.41	1.5	0.41	0.59	0.025	J	0.03		0.011	J
Nickel	--	--	--	--	10		10		8	
Selenium	--	3	--	--	0.26	J	0.18	J	0.12	J
Silver	6.1	6.1	6.1	6.1	0.4	U	0.4	U	0.4	U
Zinc	410	2783	410	960	26		28		21	
Organometallic Compounds (µg/kg dry weight)										
Tributyltin (ion)	--	73	--	--	3.6	U	3.6	U	3.6	U
PAHs (µg/kg dry weight)										
Naphthalene	2100	--	--	--	19	U	19	U	180	
Acenaphthylene	560	--	--	--	19	U	19	U	19	U
Acenaphthene	500	--	--	--	19	U	19	U	21	
Fluorene	540	--	--	--	19	U	19	U	19	U
Phenanthrene	1500	--	--	--	8.4	J	7.5	J	6.5	J
Anthracene	960	--	--	--	19	U	19	U	19	U
2-Methylnaphthalene	670	--	--	--	5.6		19	U	49	
Total LPAH ^a	5200	--	--	--	8.4	J	7.5	J	207.5	J
Fluoranthene	1700	4600	--	--	19	U	19	U	19	U
Pyrene	2600	11980	--	--	6.6	J	19	U	19	U
Benzo(a)anthracene	1300	--	--	--	19	U	19	U	19	U
Chrysene	1400	--	--	--	19	U	19	U	19	U
Total Benzofluoranthenes (b,j,k)	3200	--	--	--	38	U	38	U	37	U
Benzo(a)pyrene	1600	--	--	--	19	U	19	U	19	U
Indeno(1,2,3-c,d)pyrene	600	--	--	--	19	U	19	U	19	U
Dibenzo(a,h)anthracene	230	--	--	--	4.7	U	4.7	U	4.7	U
Benzo(g,h,i)perylene	670	--	--	--	7.5	J	19	U	19	U
Total HPAH ^b	12000	--	--	--	14.1	J	38	U	37	U
PAHs (mg/kg-OC)										
Naphthalene	--	--	99	170	2.04	U	4.06	U	34.22	
Acenaphthylene	--	--	66	66	2.04	U	4.06	U	3.61	U
Acenaphthene	--	--	16	57	2.04	U	4.06	U	3.99	
Fluorene	--	--	23	79	2.04	U	4.06	U	3.61	U
Phenanthrene	--	--	100	480	0.90	J	1.60	J	1.24	J
Anthracene	--	--	220	1200	2.04	U	4.06	U	3.61	U
2-Methylnaphthalene	--	--	38	64	0.60	J	4.06	U	9.32	
Total LPAH ^a	--	--	370	780	0.90	J	1.60	J	39.45	J

Table 4. Summary of Chemical Analysis Results Compared to DMMP and SMS Guidelines

	DMMP Criteria		SMS Marine Criteria		C1-Z		C2-Z		C3-Z	
	SL	BT	SCO	CSL	result	Q	result	Q	result	Q
Fluoranthene	--	--	160	1200	2.04	U	4.06	U	3.61	U
Pyrene	--	--	1000	1400	0.71	J	4.06	U	3.61	U
Benzo(a)anthracene	--	--	110	270	2.04	U	4.06	U	3.61	U
Chrysene	--	--	110	460	2.04	U	4.06	U	3.61	U
Total Benzofluoranthenes (b,j,k)	--	--	230	450	4.08	U	8.12	U	7.03	U
Benzo(a)pyrene	--	--	99	210	2.04	U	4.06	U	3.61	U
Indeno(1,2,3-c,d)pyrene	--	--	34	88	2.04	U	4.06	U	3.61	U
Dibenzo(a,h)anthracene	--	--	12	33	0.505	U	1.00	U	0.89	U
Benzo(g,h,i)perylene	--	--	31	78	0.81	J	4.06	U	3.61	U
Total HPAH ^b	--	--	960	5300	1.51	J	8.12	U	7.03	U
Chlorinated Hydrocarbons (µg/kg dry weight)										
1,2,4-Trichlorobenzene ^d	31	--	--	--	1.4	U	1.4	U	1.4	U
1,2-Dichlorobenzene	35	--	--	--	4.7	U	4.7	U	4.7	U
1,4-Dichlorobenzene	110	--	--	--	4.7	U	4.7	U	4.7	U
Hexachlorobenzene ^d	22	168	--	--	2.0	U	2.0	U	2.0	U
Chlorinated Hydrocarbons (mg/kg-OC)										
1,2,4-Trichlorobenzene ^d			0.81	1.8	0.15	U	0.30	U	0.27	U
1,2-Dichlorobenzene			2.3	2.3	0.50	U	1.00	U	0.89	U
1,4-Dichlorobenzene			3.1	9	0.50	U	1.00	U	0.89	U
Hexachlorobenzene ^d			0.38	2.3	0.21	U	0.43	U ^e	0.38	U
Phthalates (µg/kg dry weight)										
bis(2-Ethylhexyl)phthalate	1300	--	--	--	47	U	47	U	47	U
Butylbenzyl phthalate	63	--	--	--	4.7	U	4.7	U	4.7	U
Diethyl phthalate	200	--	--	--	19	U	19	U	19	U
Dimethyl phthalate	71	--	--	--	4.7	U	4.7	U	4.7	U
Di-n-butyl phthalate	1400	--	--	--	19	U	19	U	19	U
Di-n-octyl phthalate	6200	--	--	--	19	U	19	U	19	U
Phthalates (mg/kg-OC)										
bis(2-Ethylhexyl)phthalate	--	--	47	78	5.05	U	10.04	U	8.94	U
Butylbenzyl phthalate	--	--	4.9	64	0.50	U	1.00	U	0.89	U
Diethyl phthalate	--	--	61	110	2.04	U	4.06	U	3.61	U
Dimethyl phthalate	--	--	53	53	0.50	U	1.00	U	0.89	U
Di-n-butyl phthalate	--	--	220	1700	2.04	U	4.06	U	3.61	U
Di-n-octyl phthalate	--	--	58	4500	2.04	U	4.06	U	3.61	U
Phenols (µg/kg dry weight)										
2,4-Dimethylphenol	29	--	29	29	24	UJ	24	UJ	23	UJ
2-Methylphenol (o-Cresol)	63	--	63	63	4.7	U	4.7	U	4.7	U
4-Methylphenol (p-Cresol)	670	--	670	670	2.8	J	4.7	U	4.7	U
Pentachlorophenol	400	504	360	690	19	U	19	U	19	U
Phenol	420	--	420	1200	12	U	5.6	U	9.8	U
Miscellaneous Extractables (µg/kg dry weight)										
Benzyl alcohol	57	--	57	73	19	U	19	U	19	U
Benzoic acid	650	--	650	650	66	J	190	U	190	U

Table 4. Summary of Chemical Analysis Results Compared to DMMP and SMS Guidelines

	DMMP Criteria		SMS Marine Criteria		C1-Z		C2-Z		C3-Z	
	SL	BT	SCO	CSL	result	Q	result	Q	result	Q
Dibenzofuran	540	--	--	--	19	U	19	U	19	U
Hexachlorobutadiene	11	--	--	--	4.7	U	4.7	U	4.7	U
n-Nitrosodiphenylamine	28	--	--	--	19	U	19	U	19	U
Miscellaneous Extractables (mg/kg-OC)										
Dibenzofuran	--	--	15	58	2.04	U	4.06	U	3.61	U
Hexachlorobutadiene	--	--	3.9	6.2	0.50	U	1.00	U	0.89	U
n-Nitrosodiphenylamine	--	--	11	11	2.04	U	4.06	U	3.61	U
Pesticides (µg/kg)										
4,4'-DDD (p,p'-DDD)	16	--	--	--	0.96	U	0.95	U	0.96	U
4,4'-DDE (p,p'-DDE)	9	--	--	--	0.96	U	0.95	U	0.96	U
4,4'-DDT (p,p'-DDT)	12	--	--	--	0.96	U	0.95	UJ	0.96	U
Sum 4,4 DDT, DDE, DDD	--	50	--	--	0.96	U	0.95	UJ	0.96	U
Aldrin	9.5	--	--	--	0.48	U	0.48	U	0.48	U
Dieldrin	1.9	--	--	--	0.96	U	0.95	U	0.96	U
Heptachlor	1.5	--	--	--	0.48	U	0.48	UJ	0.48	U
Total Chlordane ^e	2.8	37	--	--	0.96	U	0.95	U	0.96	U
PCB Aroclors (µg/kg)										
Total PCB Aroclors	130	--	--	--	3.2	J	3.9	U	3.8	U
PCB Aroclors (mg/kg-OC)										
Total PCB Aroclors	--	38	12	65	0.34	J	0.83	U	0.72	U

^a Total LPAH are the total of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. 2-Methylnaphthalene is not included in the sum of LPAHs.

^b Total HPAH are the total of benzo(a)anthracene, benzo(a)pyrene, benzo(x)fluoranthenes, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, and pyrene.

^c Total Chlordane includes alpha-chlordane (cis-chlordane), beta-chlordane (trans-chlordane), cis-nonaclor, oxychlordane, and trans-nonaclor.

^d MDLs were used for non-detect values

^e Non-detect value exceeds OC normalized SCO screening level; however since TOC is below 0.5%, screening level is not applicable.

Table 5. Dioxin/furan Results compared to DMMP/SMS Guidelines

Dioxins/Furans	TEF*	ng/kg						U=1/2 RL TEQ					
		C1-Z		C2-Z		C3-Z		C1-Z		C2-Z		C3-Z	
2,3,7,8-TCDD	1	0.0772	U	0.0713	U	0.071	U	0.039	U	0.036	U	0.036	U
1,2,3,7,8-PeCDD	1	0.125	U	0.0851	U	0.101	U	0.063	U	0.043	U	0.051	U
1,2,3,4,7,8-HxCDD	0.1	0.143	U	0.113	U	0.101	U	0.007	U	0.006	U	0.005	U
1,2,3,6,7,8-HxCDD	0.1	0.182	U	0.117	U	0.107	U	0.009	U	0.006	U	0.005	U
1,2,3,7,8,9-HxCDD	0.1	0.21	U	0.156	U	0.183	U	0.011	U	0.008	U	0.009	U
1,2,3,4,6,7,8-HpCDD	0.01	3.37	U	2.32	U	1.68	U	0.017	U	0.012	U	0.008	U
OCDD	0.0003	29.1	U	17.4	UJ	12.4	U	0.004	U	0.003	U	0.002	U
2,3,7,8-TCDF	0.1	0.0693	U	0.0535	U	0.0611	U	0.003	U	0.003	U	0.003	U
1,2,3,7,8-PeCDF	0.03	0.0792	U	0.0792	U	0.0789	U	0.001	U	0.001	U	0.001	U
2,3,4,7,8-PeCDF	0.3	0.0832	U	0.0812	U	0.0848	U	0.012	U	0.012	U	0.013	U
1,2,3,4,7,8-HxCDF	0.1	0.0653	U	0.0792	U	0.0671	U	0.003	U	0.004	U	0.003	U
1,2,3,6,7,8-HxCDF	0.1	0.0614	U	0.0733	U	0.0651	U	0.003	U	0.004	U	0.003	U
1,2,3,7,8,9-HxCDF	0.1	0.0812	U	0.095	U	0.0828	U	0.004	U	0.005	U	0.004	U
2,3,4,6,7,8-HxCDF	0.1	0.0673	U	0.0792	U	0.069	U	0.003	U	0.004	U	0.003	U
1,2,3,4,6,7,8-HpCDF	0.01	0.19	J	0.226	J	0.0651	U	0.002	J	0.002	J	0.000	U
1,2,3,4,7,8,9-HpCDF	0.01	0.15	U	0.115	U	0.0394	U	0.001	U	0.001	U	0.000	U
OCDF	0.0003	0.356	U	0.855	U	0.394	U	0.000	U	0.000	U	0.000	U
Total TEQ								0.183	J	0.147	J	0.148	U

* WHO 2005, Mammal

SUBJECT: EVALUATION OF PROPOSED POST-DREDGE SEDIMENT SURFACE TO VERIFY COMPLIANCE WITH THE WASHINGTON STATE ANTIDegradation POLICY, FOR MAINTENANCE DREDGING OF THE PORT OF SEATTLE TERMINAL 18, SEATTLE, WA (NWS-2014-00413-WRD)

Concur:

Signed copy on file in the USACE Dredged Material Management Office

Date Luran Warner, Seattle District, Army Corps of Engineers

Date Erika Hoffman, Environmental Protection Agency, Region 10

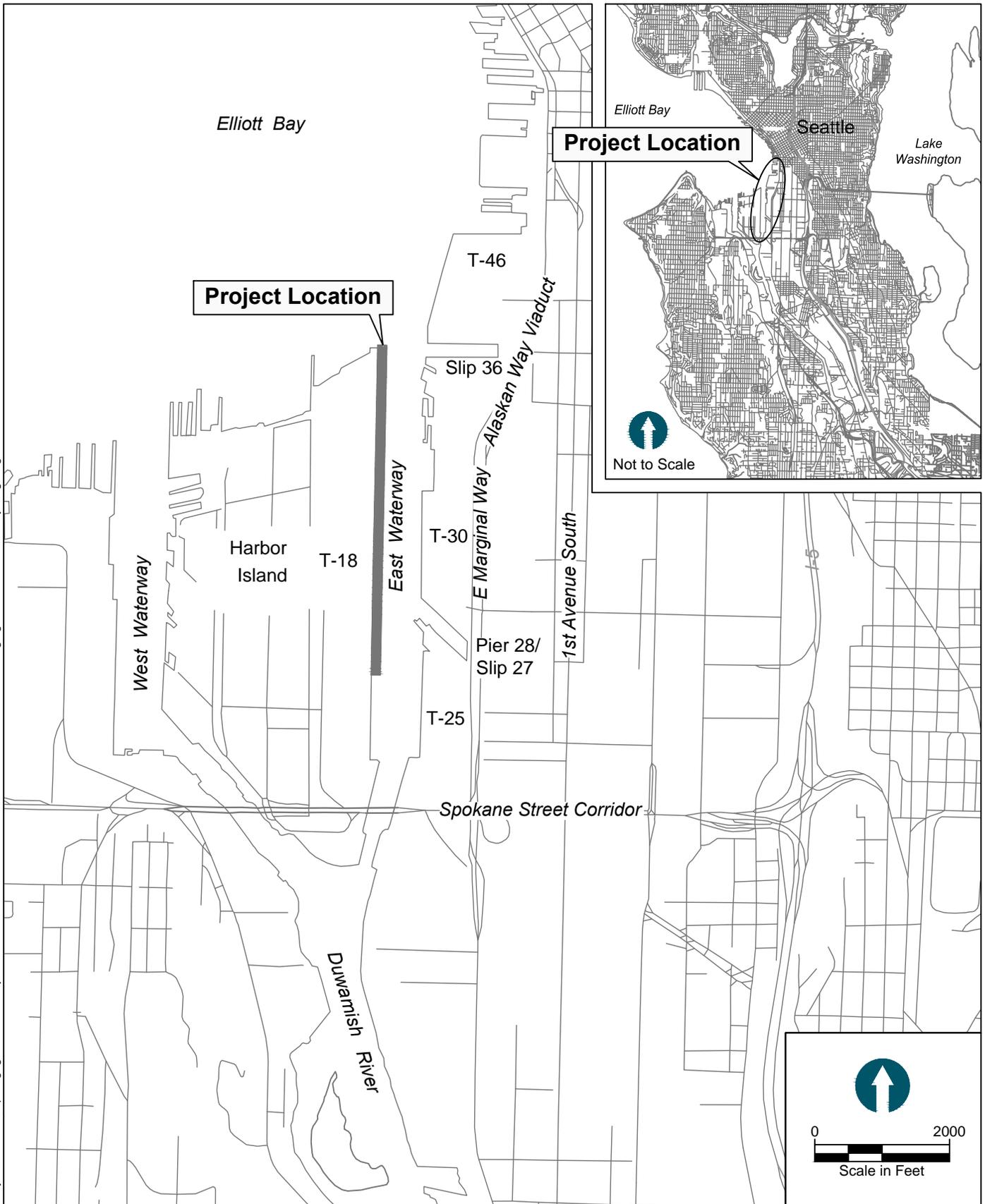
Date Laura Inouye, Ph.D., Washington Department of Ecology

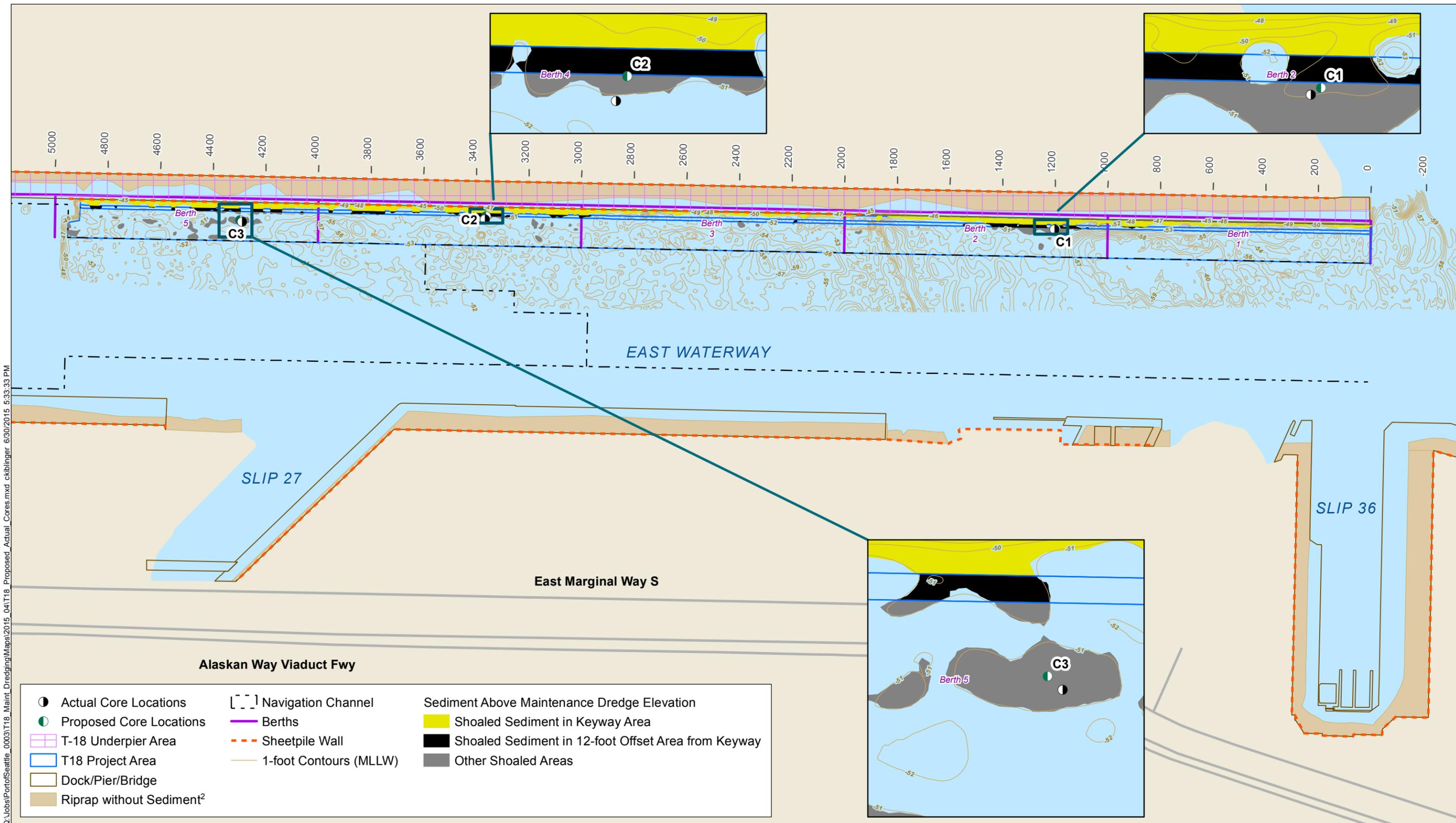
Date Celia Barton, Washington Department of Natural Resources

Copied furnished:

- DMMP signatories
- Olivia Romano, USACE Regulatory Project Manager
- Greg Brunkhorst and Joy Dunay, Anchor QEA
- Kym Anderson and Jon Sloan, Port of Seattle
- Glen St. Amant, Muckleshoot Indian Tribe

May 28, 2015 4:41pm tgriga K:\Projects\0003-Port of Seattle\POS Terminal 18 Maintenance Dredging\0003-RP-003 Vicinity.dwg Figure 1 SAP





C:\Jobs\PortofSeattle_0003\T18_Maint_Dredging\Maps\2015_04\T18_Proposed_Actual_Cores.mxd ckiblinger 6/30/2015 5:33:33 PM

NOTES:
 1. Bathymetry survey by eTrac, Inc., March 20, 2015.
 2. As mapped as part of the SRI/FS.
 3. Core locations were selected in larger shoaled areas that are most likely to be above maintenance elevation just prior to construction.

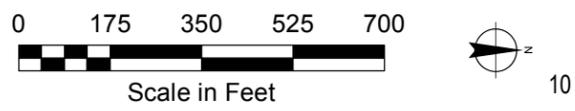


Figure 2
 Target and Actual Sample Locations
 Data Report
 Terminal 18 Maintenance Dredging Project Sediment Characterization