ANCHOR ENVIRONMENTAL, L.L.C.

Anchor Environmental, L.L.C.
1423 3rd Avenue, Suite 300
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131

Memorandum

To: Doug Hotchkiss, Jason Jordan, and Tim King; Port of Seattle

From: Dennis Hanzlick and Bryan Patterson; Anchor Environmental, L.L.C.

CC: Tom Wang; Anchor Environmental, L.L.C.

Date: May 30, 2008

Re: Sediment Characterization Chemical Results Summary and Recommendations for Construction at Port of Seattle Terminal 115

Background

In conjunction with sediment characterization prior to maintenance dredging, the Port of Seattle (Port) collected sediment samples from Terminal 115 (T-115) on March 14, 2008. The target depth was -19 feet mean lower low water (MLLW), which comprised a design depth of -15 feet MLLW, 1 foot of allowable overdepth, and 3 feet for the collection of three 1-foot-increment Z-layer samples. Figure 2 shows the proposed and actual coring locations.

Two Dredged Material Management Units (DMMUs) represented the dredge footprint, and sediment from two coring locations in each DMMU provided material for the respective composite samples. The two composite samples from the two DMMUs and the four upper Z-samples from the four cores were submitted for analysis for the 2007 Dredged Material Management Program (DMMP) analyte list plus dioxin/furan congeners.

Chemical analytical results for the composite samples yielded concentrations of total polychlorinated biphenyls (PCBs) that exceeded the DMMP screening criterion, concentrations of polycyclic aromatic hydrocarbons (PAHs) that exceeded one or more of their respective criteria, and dioxin/furan Toxic Equivalents Quotient (TEQ) values that exceeded those at the proposed open-water disposal site in Elliott Bay. Similarly, concentrations of these compounds were also elevated in the four Z-samples.

Because of these chemical analytical results, the Port, in accordance with the Sampling and Analysis Plan (SAP), and in coordination with the DMMP, submitted the remaining Z-samples for the same suite of analyses as the initial round. The purpose was to evaluate chemical concentrations in the 2 feet of sediment underlying the upper Z-layer samples.

These results are summarized further in the following section, and a proposal for a modified dredging approach is presented in the last section.

Summary of Chemical Analysis Results

Table 1 summarizes the results for both composite samples and all collected Z-samples. The upper, middle, and lower Z-samples were identified as "ZA", "ZB", and "ZC" samples, respectively. Only the ZA-sample could be collected at core location S1-01; ZA and ZB samples were obtained at core location S1-02, and all three Z-samples were collected at both locations S2-01 and S2-02.

Table 1 shows that high-molecular-weight polycyclic aromatic hydrocarbon (HPAH) concentrations remain elevated in some of the Z-samples from both DMMUs. While total PCB concentrations in the Z-samples from DMMU S1 are less that the concentration in the composite sample (141 micrograms per kilogram dry weight [μg/kg DW]), they are still elevated, showing the presence of PCBs in the subsurface material. PCB concentrations in the composite sample and all Z-samples from DMMU S2 all exceed the screening level criterion, and indicate no decrease with depth in the Z-samples. Dioxin/furan TEQ values range from 14.3 to 54.1, and similar to total PCB concentrations, are also elevated in the Z-samples. For comparison, the maximum of the three TEQ values measured in surface sediments at the Elliott Bay open-water disposal site is 17.0; one value is between 1 and 5, and the third is between 5 and 10.

Because of the apparent presence of PCBs and dioxin/furan congeners in the 3 feet of Z-material beneath the dredge prism, there is some concern for the sediment quality of the surface that would be exposed after dredging. The following section describes the Port's proposed dredging approach in light of the chemical analytical results.

Recommendations for Dredging at T-115

Based on the recent analysis of the Z-samples, a change to the proposed dredge design is recommended. Currently, the design calls for dredging to -15 feet MLLW with 1 foot of allowable overdepth. The recommended dredging approach would be to lower the required dredge elevation from -15 feet MLLW to -16 feet MLLW (Figure 1). This would allow for the removal of an additional 1 foot of contaminated material in the dredge prism. It is also recommended that the overdepth allowance be increased from 1 foot to 2 feet. The U.S. Army Corps of Engineers (USACE) allows up to 2 feet of allowable overdepth in coastal regions and in inland navigation channels (USACE 1996). The increased overdepth allowance could potentially result in more contaminated sediment being removed and also provide for the greatest flexibility for the contractor to reach the required dredge elevations.

Following dredging, a nominal clean sand layer would be placed over the dredged surface. Taking into account the 2-foot allowable overdepth, the newly exposed surface could vary between elevation -16 feet and -18 feet MLLW. However, the nominal sand layer would have a target thickness of 6 inches that would provide a clean substrate in the dredge prism without exceeding the original maintenance dredging elevation of -15 feet MLLW.

All other elements of the originally proposed design remain unchanged including the transloading and disposal of contaminated sediments. The contractor will likely transport the dredged material by barge to an offloading facility where it will be loaded onto trucks or rail cars. From the offloading facility, the material will be transported to an approved subtitle D disposal facility.

Reference

U.S. Army Corps of Engineers (USACE). 1996. Project operations: Navigation and dredging operations and maintenance policies. Engineering regulation 1130-2-520.

TABLES

Table 1
Summary of Chemical Analytical Results for DMMU Composite Samples and Z-Samples Collected at Port of Seattle Terminal 115

Location	Dredged Material Management Program Criteria			S1	S1	S1	S1	S2	S2	S2	S2	S2	S2	S2
Sample				T115-S1-CS-0803	T115-S1-01-ZA-0803	T115-S1-02-ZA-0803	T115-S1-02-ZB-0803	T115-S2-CS-0803	T115-S2-01-ZA-0803	T115-S2-01-ZB-0803	T115-S2-01-ZC-0803	T115-S2-02-ZA-0803	T115-S2-02-ZB-0803	T115-S2-02-ZC-0803
Sample Date	Screening Level	Bioaccumulation Trigger	Maximum Level	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08
Depth				Composite	-15.5 to -16.5 ft	-16 to -17 ft	-17 to -18 ft	Composite	-15.7 to -16.7 ft	-16.7 to -17.7 ft	-17.7 to -18.7 ft	-17.1 to -18.1 ft	-18.1 to -19.1 ft	-19.1 to -20.1 ft
Conventionals (mg/kg)														
Sulfide	–	–	–	3420	1220	196	–	1800	2390	–	–	2460	–	–
Conventionals (mg-N/kg)														
Ammonia	–	–	–	24	10.2	37.6	–	53.7	32.6	–	–	51.7	–	–
Conventionals (pct)														
Total organic carbon	–	–	–	2.59	2.08	1.98	1.92	1.84	2.23	1.89	5.25	1.6	5.02	3.53
Total Solids	–	–	–	53.9	69.4	55.1	66.5	53.5	69.1	78.5	78.4	61.4	60.1	68.9
Total solids (preserved)	–	–	–	48.6	75.3	53	–	62.9	61.3	–	–	57.5	–	–
Total volatile solids	–	–	–	6.87	3.32	7.34	–	7.63	4.6	–	–	6.36	–	–
Grain Size (pct)														
Gravel	–	–	–	28.6	66.6	4.3	0.8	10.6	63.2	41	45.1	3.7	22.7	25.4
Sand	–	–	–	22.7	19.8	13.9	11.2	25	21.8	38	43	31.6	43.9	51.2
Silt	–	–	–	36.6	10	61.8	62.9	48.6	9.7	15.6	8.1	50.7	24.3	16.3
Clay	–	–	–	12	3.7	19.8	25.3	15.8	5.4	5.3	3.8	14.1	9.1	7.1
Fines (Silt + Clay)	–	–	–	48.6	13.7	81.6	88.1	64.4	15.1	20.9	12	64.7	33.3	23.4
Metals (mg/kg)														
Antimony	150	–	200	10 UJ	7 UJ	9 UJ	7 U	9 UJ	20 U	20 U	20 U	8 UJ	8 U	7 U
Arsenic	57	507.1	700	10	7 U	9	8	14	20 U	20	20	13	12	12
Cadmium	5.1	11.3	14	0.6	0.4	0.5	0.3	0.7	0.8	0.9	0.6 U	0.7	0.6	0.5
Chromium	–	267	–	36	25.4	32.5	28.8	33.4	51	34	32	32.1	31.1	38.5
Copper	390	1027	1300	79.5	72.8	55.7	42.1	78.8	71.9	77.2	61.8	64.1	56.4	51.5
Lead	450	975	1200	60	46	27	18	53	133	71	71	58	68	76
Mercury	0.41	1.5	2.3	0.21	0.11	0.16	0.13	0.21	0.17	0.1	0.08	0.17	0.13	0.1
Nickel	140	370	370	30	29	29	23	26	36	27	31	35	29	32
Selenium	–	3	–	0.4	0.4	0.6	0.3 U	0.5	0.3 U	0.2 U	0.2 U	0.3 U	0.3 U	0.3 U
Silver	6.1	6.1	8.4	0.6 U	0.4 U	0.5 U	0.4 U	0.5 U	1 U	0.9 U	0.9 U	0.5 U	0.5 U	0.4 U
Zinc	410	2783	3800	155	96	115	88	188	266	213	212	172	179	195
Organometallic Compounds (µg/L)														
Tributyltin (ion)	0.15	0.15	–	0.019 U	0.03	0.019 U	–	0.024	0.19	–	–	0.019 U	–	–
LPAHs (µg/kg)														
Total LPAH [1]	5200	–	29000	2339	37	873	156	715	284	212	488	883 J	869	1049
Naphthalene	2100	–	2400	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	12 J	20 U	58
Acenaphthylene	560	–	1300	330	19 U	85 J	21 J	62 J	38	20 U	24	110 J	58	50
Acenaphthene	500	–	2000	79	19 U	28 J	20 UJ	28 J	20 U	20 U	35	36 J	35	81
Fluorene	540	–	3600	220	19 U	40 J	20 UJ	55 J	17 J	20 U	39	55 J	66	130
Phenanthrene	1500	–	21000	510	26	500 J	86 J	320 J	99	160	280	390 J	440	430
Anthracene	960	–	13000	1200	11 J	220 J	49 J	250 J	130	52	110	280 J	270	300
2-Methylnaphthalene	670	–	1900	20 U	19 U	9.9 J	20 UJ	20 U	20 U	20 U	20 U	11 J	20 U	20 U
HPAHs (µg/kg)														
Total HPAH	12000	–	69000	122960	588	19485 J	4138 J	10710	5278	2969	5478	11540 J	11830	15220
Fluoranthene	1700	4600	30000	47000	120	7400 J	1000 J	2400	650	330	730	2000 J	1200	1100
Pyrene	2600	11980	16000	34000	140 J	5500 J	1400 J	2900	1500	1100	1600	3300 J	4600	8500
Benzo(a)anthracene	1300	–	5100	6800	37	1200 J	360 J	800 J	400	140	370	570 J	680	740
Chrysene	1400	–	21000	16000	63	2600 J	350 J	1300	550	220	600	1600 J	1500	1300
Total Benzofluoranthenes (b, j, k) [2]	3200	–	9900	14200	134	1780 J	590 J	1890 J	1560	760	1390	2500 J	2400	2100
Benzo(a)pyrene	1600	–	3600	3400	49	560 J	240 J	720 J	420	260	520	820 J	940	1000
Indeno(1,2,3-cd)pyrene	600	–	4400	730	19 J	190 J	94 J	280 J	92	69	120	330 J	210	200
Dibenzo(a,h)anthracene	230	–	1900	300	19 U	85 J	21 J	130 J	47	28	48	150 J	110	110

Table 1
Summary of Chemical Analytical Results for DMMU Composite Samples and Z-Samples Collected at Port of Seattle Terminal 115

Location	Dredged Material Management Program Criteria			S1	S1	S1	S1	S2	S2	S2	S2	S2	S2	S2
Sample				T115-S1-CS-0803	T115-S1-01-ZA-0803	T115-S1-02-ZA-0803	T115-S1-02-ZB-0803	T115-S2-CS-0803	T115-S2-01-ZA-0803	T115-S2-01-ZB-0803	T115-S2-01-ZC-0803	T115-S2-02-ZA-0803	T115-S2-02-ZB-0803	T115-S2-02-ZC-0803
Sample Date	Screening Level	Bioaccumulation Trigger	Maximum Level	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08
Depth				Composite	-15.5 to -16.5 ft	-16 to -17 ft	-17 to -18 ft	Composite	-15.7 to -16.7 ft	-16.7 to -17.7 ft	-17.7 to -18.7 ft	-17.1 to -18.1 ft	-18.1 to -19.1 ft	-19.1 to -20.1 ft
Benzo(g,h,i)perylene	670	–	3200	530	26 J	170 J	83 J	290 J	59	62	100	270 J	190	170
Chlorinated Hydrocarbons (µg/kg)														
1,3-Dichlorobenzene	170	–	–	20 U	19 U	20 U	20 UJ	20 U	20 U	20 UJ	20 UJ	20 U	20 UJ	20 UJ
1,4-Dichlorobenzene	110	–	120	20 U	19 U	20 U	20 UJ	20 U	20 U	20 UJ	20 UJ	20 U	20 UJ	20 UJ
1,2-Dichlorobenzene	35	–	110	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U
1,2,4-Trichlorobenzene	31	–	64	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Hexachlorobenzene	22	168	230	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Phthalates (µg/kg)														
Dimethylphthalate	71	–	1400	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	**77 J**	**24**	20 U
Diethylphthalate	200	–	1200	20 U	19 U	**37 J**	20 UJ	**38 J**	20 U	20 U	20 U	20 U	20 U	20 U
Di-n-butylphthalate	1400	–	5100	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	**22**	20 U	**25**	20 U
Butylbenzylphthalate	63	–	970	**13 J**	**16 J**	**17 J**	20 UJ	**45 J**	20 U	**25**	20 U	**34 J**	**27**	20 U
Bis(2-Ethylhexyl)phthalate	1300	–	8300	**410**	**150**	**260 J**	**110 J**	**6700 J**	**1000**	**490**	**920**	**1000 J**	**1300**	**490**
Di-n-octylphthalate	6200	–	6200	**13 J**	19 U	20 U	20 UJ	**42 J**	**38**	**20**	20 U	**12 J**	20 U	20 U
Phenols (µg/kg)														
Phenol	420	–	1200	30 U	19 U	**22 J**	20 UJ	**68 J**	46 U	20 U	20 U	**37 J**	**22**	**20**
2-Methylphenol	63	–	77	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	**33**
4-Methylphenol	670	–	3600	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2,4-Dimethylphenol	29	–	210	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Pentachlorophenol	400	504	690	99 U	97 U	99 U	99 UJ	99 U	99 U	**160**	99 U	99 U	99 U	98 U
Miscellaneous Extractables (µg/kg)														
Benzyl alcohol	57	–	870	20 U	19 U	20 U	20 UJ	20 U	20 U	20 UJ	20 UJ	20 U	20 UJ	20 UJ
Benzoic acid	650	–	760	200 U	190 U	200 U	200 UJ	200 U	200 U	200 U	200 U	200 U	200 U	200 U
Dibenzofuran	540	–	1700	**41**	19 U	**20 J**	20 UJ	**22 J**	**10 J**	20 U	**25**	**27 J**	**35**	**62**
Hexachloroethane	1400	–	14000	20 U	19 U	20 U	20 UJ	20 U	20 U	20 UJ	20 UJ	20 U	20 UJ	20 UJ
Hexachlorobutadiene	29	–	270	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U
n-Nitroso-di-phenylamine	28	–	130	20 U	19 U	20 U	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Volatile Organics (µg/kg)														
Trichloroethene	160	–	1600	2 U	1.2 U	1.8 U	–	1.9 U	1.3 U	–	–	1.3 U	–	–
Tetrachloroethene	57	–	210	2 U	1.2 U	1.8 U	–	1.9 U	1.3 U	–	–	1.3 U	–	–
Ethylbenzene	10	–	50	2 U	1.2 U	1.8 U	–	1.9 U	1.3 U	–	–	1.3 U	–	–
m,p-Xylene	–	–	–	2 U	1.2 U	1.8 U	–	1.9 U	1.3 U	–	–	1.3 U	–	–
o-Xylene	–	–	–	2 U	1.2 U	1.8 U	–	1.9 U	1.3 U	–	–	1.3 U	–	–
Total Xylene [3]	40	–	160	2 U	1.2 U	1.8 U	–	1.9 U	1.3 U	–	–	1.3 U	–	–
Pesticides (µg/kg)														
Total DDT [4]	6.9	50	69	9.9 U	3.9 U	9.9 U	2 U	9.9 U	9.9 U	2 U	2 U	9.9 U	2 U	7 U
4,4'-DDD	–	–	–	9.9 U	3.9 U	9.9 U	2 U	9.9 U	9.9 U	2 U	2 U	9.9 U	2 U	2 U
4,4'-DDE	–	–	–	9.9 U	3.9 U	9.9 U	2 U	9.9 U	9.9 U	2 U	2 U	9.9 U	2 U	7 U
4,4'-DDT	–	–	–	9.9 U	3.9 U	9.9 U	2 U	9.9 U	9.9 U	2 U	2 U	9.9 U	2 U	2 U
Aldrin	10	–	–	4.9 U	1.9 U	5 U	–	5 U	4.9 U	–	–	5 U	–	–
Total Chlordane [5]	10	37		9.9 U	3.9 U	9.9 U	–	9.9 U	9.9 U	–	–	140 U	–	–
alpha-Chlordane (cis-Chlordane)	–	–	–	4.9 U	1.9 U	5 U	–	5 U	4.9 U	–	–	5 U	–	–
gamma-Chlordane (trans, beta-Chlordane)	–	–	–	4.9 U	1.9 U	5 U	–	5 U	4.9 U	–	–	5 U	–	–
cis-Nonachlor	–	–	–	9.9 U	3.9 U	9.9 U	–	9.9 U	9.9 U	–	–	9.9 U	–	–
Oxychlordane	–	–	–	9.9 U	3.9 U	9.9 U	–	9.9 U	9.9 U	–	–	140 U	–	–
trans-Nonachlor	–	–	–	9.9 U	3.9 U	9.9 U	–	9.9 U	9.9 U	–	–	130 U	–	–
Dieldrin	10	–	–	9.9 U	3.9 U	9.9 U	–	9.9 U	9.9 U	–	–	9.9 U	–	–
Heptachlor	10	–	–	4.9 U	1.9 U	5 U	–	5 U	4.9 U	–	–	5 U	–	–

Table 1
Summary of Chemical Analytical Results for DMMU Composite Samples and Z-Samples Collected at Port of Seattle Terminal 115

Location	Dredged Material Management Program Criteria			S1	S1	S1	S1	S2	S2	S2	S2	S2	S2	S2
Sample				T115-S1-CS-0803	T115-S1-01-ZA-0803	T115-S1-02-ZA-0803	T115-S1-02-ZB-0803	T115-S2-CS-0803	T115-S2-01-ZA-0803	T115-S2-01-ZB-0803	T115-S2-01-ZC-0803	T115-S2-02-ZA-0803	T115-S2-02-ZB-0803	T115-S2-02-ZC-0803
Sample Date	Screening Level	Bioaccumulation Trigger	Maximum Level	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08	3/14/08
Depth				Composite	-15.5 to -16.5 ft	-16 to -17 ft	-17 to -18 ft	Composite	-15.7 to -16.7 ft	-16.7 to -17.7 ft	-17.7 to -18.7 ft	-17.1 to -18.1 ft	-18.1 to -19.1 ft	-19.1 to -20.1 ft
gamma-BHC (Lindane)	10	–	–	4.9 U	1.9 U	5 U	–	5 U	4.9 U	–	–	5 U	–	–
PCBs (mg/kg OC)														
Total PCB	–	38	–	5.4	4.1	6.4	4.1	9.3	13.3	14	3.4	11.4	6.5	6.6
PCBs (µg/kg)														
Total PCB	130	–	3100	141	86	126	78	172	297	264	177	182	324	234
Aroclor 1016	–	–	–	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1221	–	–	–	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1232	–	–	–	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1242	–	–	–	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1248	–	–	–	35	20 U	33	20 U	41	53	34	20 U	42	74	54
Aroclor 1254	–	–	–	63	46	55	44	77	94	90	67	68	100	90
Aroclor 1260	–	–	–	43	40	38	34	54	150	140	110	72	150 J	90
Aroclor 1262	–	–	–	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1268	–	–	–	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Dioxin/Furans (TEQ)														
ITEF TEQ (ND = 0; EMPC = 0)	–	–	–	23.2	14.3	17.9	54.1	29.9	38.6	33.3	28.3	31.2	41.5	31.2
Dioxin/Furans (pg/g)														
1,2,3,4,6,7,8-HpCDD	–	–	–	615	349	532	2040	845 J	1110	1010	865	816	1130	938
1,2,3,4,6,7,8-HpCDF	–	–	–	73.9	46.3	44.9	60.3	91.4	99.4	82.6	74.1	85.7	90.8	66.4
1,2,3,4,7,8,9-HpCDF	–	–	–	6.23	3.77	3.62	3.96	7.46	7.52	5.73	6.12	7.18	8.34	6.07
1,2,3,4,7,8-HxCDD	–	–	–	4.53	2.88	3.08	5.02	5.07	7.47	5.72	5.1	5.37	4.91	4.29
1,2,3,4,7,8-HxCDF	–	–	–	9.72	5.87	5.57	8.2	10.3	10.4	7.74	7.78	9.95	8.96	6.67
1,2,3,6,7,8-HxCDD	–	–	–	20.6	13.9	13.4	46.8	22.1	35.9	33.7	22.3	22.1	22.3	18.4
1,2,3,6,7,8-HxCDF	–	–	–	3.59	2.4 J	2.06 J	3.1	3.71	5.06	4.38	4.39	4.04	3.66	2.78
1,2,3,7,8,9-HxCDD	–	–	–	10.6	8.51	6.46	8.27	10.9	17.8	14.1	10.9	11.9	10.8	8.59
1,2,3,7,8,9-HxCDF	–	–	–	2.05 J	1.37 J	1.36 J	4.16	2.23	2.75	2.57	2.2 J	2.38 J	2.11 J	1.59 J
1,2,3,7,8-PeCDD	–	–	–	2.51	2.11 J	1.47 J	1.22 J	2.53	4.14	3.24	2.61	2.69	2.44 J	1.95 J
1,2,3,7,8-PeCDF	–	–	–	1.54 J	0.944 J	0.977 J	2.3 J	1.57 J	2.16 J	1.95 J	1.49 J	1.6 J	1.52 J	1.25 J
2,3,4,6,7,8-HxCDF	–	–	–	5.08	3.43	3.09	5.31	5.48	7.39	7.08	6.59	5.73	5.81	4.13
2,3,4,7,8-PeCDF	–	–	–	4.57	2.91	3.13	5.32	5.14	5.91	5.29	4.54	5.1	4.54	3.58
2,3,7,8-TCDD	–	–	–	0.724	0.605	0.486 J	0.443 J	0.614	0.894	0.649	0.485	0.659	0.619	0.456 J
2,3,7,8-TCDF	–	–	–	1.61	1.03	1.16	1.25	1.9	2.01	1.77	1.35	1.92	1.71	1.46
OCDD	–	–	–	5850	3110	5470	20900 J	9430 J	11200 J	9340 J	8400	10800 J	18600 J	12700 J
OCDF	–	–	–	242	134	157	127	363	302	234	241	313	444	299

Notes:

Detected concentration is greater than the DMMP SL criterion

Detected concentration is greater than the DMMP BT criterion

Detected concentration is greater than the DMMP ML criterion

Non-detected concentration is greater than one or more of the DMMP criteria

- - - = No criteria

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

(1) 2-Methylnapthalene is not included in the sum of LPAHs

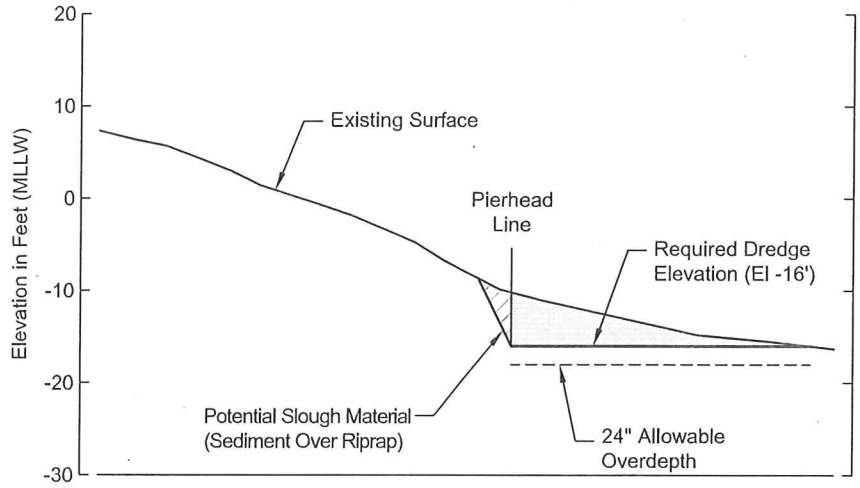
(2) Benzo(j)fluoranthene is included in the total of benzo(b&k)fluoranthenes

(3) Total xylene is the sum of o-, m-, p- isomers

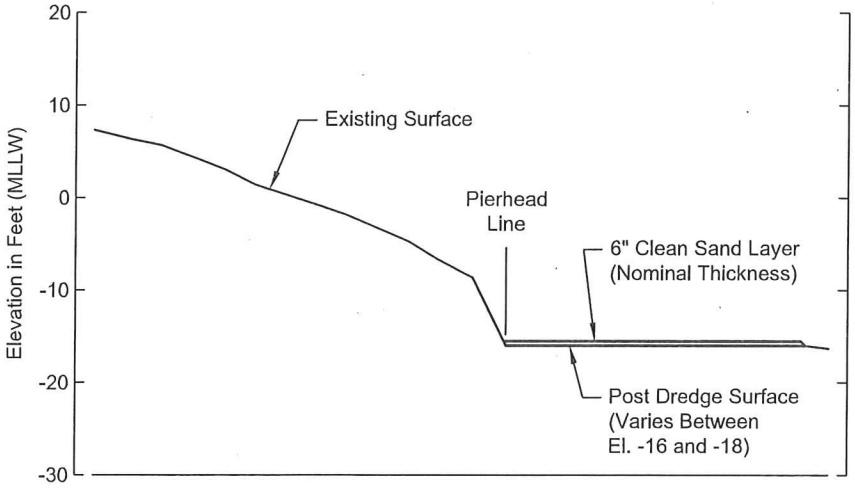
(4) Total DDT consists of the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT

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

FIGURES



TYPICAL DREDGE SECTION
SCALE: 1" = 20'



TYPICAL CAP SECTION
SCALE: 1" = 20'

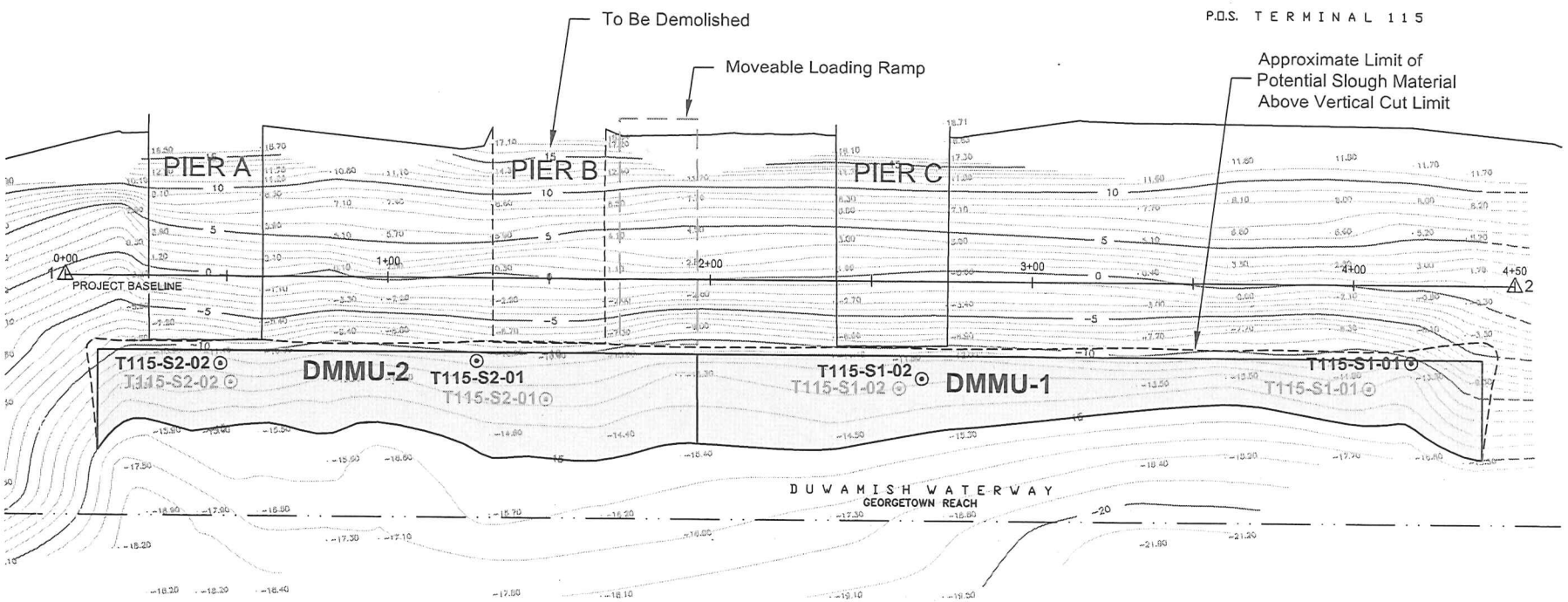
Horizontal Datum: Washington State Plane North, NAD83.
Vertical Datum: Mean Lower Low Water (MLLW).

0 20
Scale in Feet

May 30, 2008 9:52am dholmer K:\Jobs\080003-T115\080003-02\08000302-001 (MEMO).dwg FIGURE 1

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1
Typical Sections
Terminal 115 Maintenance Dredging



Horizontal Datum: Washington State Plane - North, NAD83.
Vertical Datum: Mean Lower Low Water (MLLW).

	Contour 2007
−2.15	Spot Elevation (October 28, 2007)
T115-S1-01 ⊙	Proposed Core Sample Location
T115-S1-01 ⊙	Actual Core Sample Location

0 50
Scale in Feet

May 30, 2008 10:16am dholmer K:\Jobs\080003-T115\080003-02\080003020-001 (MEMO).dwg FIGURE 2

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 2
Core Sample Locations
Port of Seattle
Terminal 115