

PORT OF SEATTLE TERMINAL 115 SLOPE AREA SURFACE SEDIMENT CHARACTERIZATION REPORT

Prepared for

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1 INTRODUCTION

The Port of Seattle (Port) proposes to conduct maintenance dredging to re-establish adequate depth to accommodate barge loading and unloading and to support new construction at the Berth 1 facilities at Terminal 115 (T115), which includes the removal of existing wooden Pier B and fabrication of a new loading ramp (Ramp 1). T115 is located at 6700 West Marginal Way Southwest in the City of Seattle, along the western shore of the Duwamish River (Figure 1). The proposed dredge depth is -15 feet mean lower low water (MLLW) with 1 foot of allowable overdredge. The site is located in the Joint Model Toxics Control Act (MTCA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Lower Duwamish Waterway Group (LDWG) Superfund Site.

As part of the U.S. Army Corps of Engineers (Corps) coordination with U.S. Environmental Protection Agency (EPA) and WA State Department of Ecology (Ecology), EPA directed the Port to collect four surface sediment samples from the intertidal slopes shoreward of the proposed dredge prism at the site. These slope areas will not be disturbed by dredging activities since the slope area adjacent to the berth will be stabilized with a sheetpile wall to prevent slope sloughing. These samples were analyzed for the contaminants of concern (COCs) from the 2007 Dredge Material Management Program (DMMP) analyte list including dioxin/furan congeners and excluding tributyltin (TBT) in porewater. The purpose of this data report is to summarize the results of these four samples.

T115 includes approximately 70 acres of upland yard space, a 1,200-linear-foot main pier at the northern extent, a 220-linear-foot finger pier at the south, and three small barge cargo piers, approximately 50 x 100 feet in the middle portion. T115 supports marine uses such as receipt and shipment of bulk cargo using medium-draft vessels; barge cargo operation; repair and maintenance of cargo shipping containers; cargo warehouse activities; warehouse and storage of metal and wood construction materials; and vessel outfitting, maintenance, and repair. Several stormwater outfalls are present near the site (shown in Figure 2). Outfall SWD1 on Figure 2 represents a King County combined sewer overflow (CSO) outfall 72 inches in diameter. Outfalls SWD2 and SWD3 are approximately 30-inch stormwater outfalls that primarily drain the Northlands and Northwest Container Services properties.

2 SAMPLE COLLECTION

This section summarizes the sediment sampling and processing activities conducted in connection with the characterization of the slope area sediments. Sampling and processing were carried out in accordance with the Sediment Evaluation Work Plan (Work Plan; Anchor 2009). Sampling locations are shown in Figure 2 and Appendix A provides copies of the field log forms. Table 1 presents the actual sample location coordinates for actual sampling locations.

Sediment grabs were collected on April 28, 2009 during a minus tide. The target sample collection elevation was -2 feet MLLW. Tidal elevations were estimated using predicted tide level software provided by Tides And Currents® software. The actual elevation at each sample location was verified using the difference in height above the water line at the time of sample collection. These elevations were corrected using NOAA's actual tidal observations for Seattle.

2.1 Sediment Processing and Handling

One grab sample was obtained from each sample location. Generally, the substrate along the slope area inshore of T115 consists of large rip rap stone and gravel. Sediment for each sample was obtained using a decontaminated stainless steel spoon to scoop sediment from small pockets between larger rocks. Ample sample material was generally available within a small area at each location.

Sediment for sulfides and volatile organic compounds were placed directly into sample jars prior to homogenization. Sediment from each sample location was placed into a clean stainless steel bowl and homogenized.

2.2 Deviations from Work Plan

There were no deviations from the work plan.

3 CHEMICAL TEST RESULTS

Sediment samples were analyzed for the 2007 DMMP analyte list (USACE 2007) including dioxin and furan congeners. Samples were analyzed for all parameters, with the exception of dioxin/furans, at Analytical Resources, Incorporated (ARI) in Tukwila, Washington according to procedures specified in the DMMP process for sampling and testing protocols for the chemical characterization of dredged material. Dioxin/furan analyses were performed at Analytical Perspectives in Wilmington, North Carolina. Results were compared to DMMP and SMS (Ecology 2008) screening criteria.

3.1 Chemistry Data Results

Table 2 presents the sediment chemistry analytical results and the corresponding DMMP evaluation criteria. Results are compared to the DMMP screening criteria, and those results that exceed DMMP criteria are highlighted in Table 2. Table 3 presents the sediment chemistry analytical results and the corresponding Sediment Management Standard (SMS) criteria and results that exceed SMS criteria are shaded in Table 3. Appendix B contains the laboratory reports and Appendix C contains the data validation reports for these data

3.1.1 Metals

None of the results exceeded DMMP or SMS criteria.

3.1.2 Polychlorinated Biphenyls

None of the polychlorinated biphenyl (PCB) results exceeded DMMP or SMS criteria.

3.1.3 Polycyclic Aromatic Hydrocarbons

None of the polycyclic aromatic hydrocarbons (PAH) results exceeded DMMP or SMS criteria.

3.1.4 Phthalates

The concentration of butylbenzylphthalate measured at station SS05 exceeded the DMMP SL and the SMS SQS, but was below the DMMP Maximum Level (ML) and the SMS Cleanup Screening Level (CSL). No other phthalates exceeded DMMP or SMS criteria.

3.1.5 Other Organic Chemicals

All other organic compound results were below DMMP and SMS screening criteria.

3.1.6 Dioxin/Furan Results

Dioxin/furan congeners were detected in all of the samples and TEQ values ranged from 3.99 nanograms per kilogram (ng/kg) to 23.4 ng/kg.

3.2 Data Validation Results

Data validation reports are provided in Appendix C. The data validation reports verified that the data quality of these results met the analytical accuracy and precision of the chemical analyses as outlined in the Quality Assurance Project Plan (QAPP, Anchor 2009). All data were deemed useable as qualified and no data were rejected for these samples.

4 REFERENCES

Anchor QEA, LLC. 2009. Sediment Analysis Work Plan, Port of Seattle Terminal 115.
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USACE. 2007. Dredged Material Evaluation and Disposal Procedures Users Manual. U.S.
Army Corps of Engineers, Seattle District Dredged Material Management Program;
USEPA Region 10; Washington Department of Natural Resources; and Washington
Department of Ecology. December.

Washington State Department of Ecology (Ecology). 2008. Sediment Sampling and Analysis
Plan Appendix. Ecology Publication No. 03-09-043. Sediment Source Control
Standards User Manual, Washington Department of Ecology Sediment Management
Unit. Revised February 2008.

TABLES

Table 2
Sample Station Locations and Mudline Elevations

Station ID	Northing	Easting	Latitude (°N)	Longitude (°W)	Mudline Elevation (feet MLLW)
T115-SS01	201960.650786	1268815.109780	47.54371195	-122.33801	-2.0
T115-SS02	202074.862312	1268760.924870	47.54402209	-122.3382384	-2.0
T115-SS03	202218.556778	1268714.696970	47.54441348	-122.3384369	-2.0
T115-SS04	202304.200561	1268673.249730	47.544646	-122.3386114	-2.0
T115-SS05	202456.688747	1268631.402980	47.54506172	-122.3387929	-2.0

Notes:

Washington North Zone, NAD 83 geographic and state plane coordinates - US Survey Feet

Table 2
T115 Shoreline Grab Sample Results Compared to DMMP Criteria

Location ID: Sample ID: Sample Date: Depth: Sample Type:	Unit	DMMP Screening Level	DMMP Bioaccumulation Trigger	DMMP Maximum Level Marine Guideline	T115-SS01 T115-01-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS02 T115-02-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS03 T115-03-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS04 T115-04-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-05-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-55-SS-090428 4/28/2009 0 - 10 cm Field Duplicate
Grain Size (pct)										
Total Gravel	pct	--	--	--	8.2	16.4	33.6	43.2	35.9	--
Total Sand	pct	--	--	--	85.3	58.1	35.3	40.5	59	--
Total Silt	pct	--	--	--	4.9	18.8	21.1	10.3	3.4	--
Total Clay	pct	--	--	--	1.5	6.7	10	6.1	1.8	--
Total Fines (silt + clay)	pct	--	--	--	6.4	25.5	31.1	16.4	5.2	--
Conventional Parameters (pct)										
Ash Content	pct	--	--	--	98.15	96.39	96.21	97.58	98.16	--
Total organic carbon	pct	--	--	--	3.5	3.53	2.57	1.78	1.84	--
Total organic matter	pct	--	--	--	1.85	3.61	3.79	2.42	1.84	--
Total solids	pct	--	--	--	71.9	62.2	55.2	63.5	78.3	--
Total Solids (preserved)	pct	--	--	--	78.7	55.7	56.6	70.2	76.9	78.1
Conventional Parameters (mg-N/kg)										
Ammonia	mg-N/kg	--	--	--	2.82	4.57	6.11	3.67	1.07	--
Conventional Parameters (mg/kg)										
Sulfide	mg/kg	--	--	--	50.5 J	15.5 J	48.4 J	1.45 UJ	11.9 J	9.04 J
Metals (mg/kg)										
Antimony	mg/kg	150		200	7 UJ	8 UJ	9 UJ	7 UJ	20 UJ	6 UJ
Arsenic	mg/kg	57	507.1	700	10	20	23	26	20	16
Cadmium	mg/kg	5.1	11.3	14	0.3 U	0.3 U	0.3 U	0.3 U	0.6 U	0.3 U
Chromium	mg/kg	--	267	--	25.5	39.7	35.5	31.4	42	44.7
Copper	mg/kg	390	1027	1300	34.8	56.7	60.2	87.1	114	65.7
Lead	mg/kg	450	975	1200	53 J	38 J	34 J	23 J	20 J	30 J
Mercury	mg/kg	0.41	1.5	2.3	0.03	0.1	0.13	0.07	0.03	0.03
Nickel	mg/kg	140	370	370	27	31	29	29	33	30
Selenium	mg/kg	--	3	--	0.6 U	0.8 U	0.8 U	0.7 U	0.6 U	0.6 U
Silver	mg/kg	6.1	6.1	8.4	0.4 U	0.5 U	0.5 U	0.4 U	1 U	0.4 U
Zinc	mg/kg	410	2783	3800	111	166	188	157	257	336
PCB Aroclors (ug/kg)										
Aroclor 1016	µg/kg	--	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1221	µg/kg	--	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1232	µg/kg	--	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1242	µg/kg	--	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1248	µg/kg	--	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1254	µg/kg	--	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1260	µg/kg	--	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Total PCB (U = 0)	µg/kg	130	--	3100	19 U	20 U	20 U	20 U	19 U	19 U
Aromatic Hydrocarbons (ug/kg)										
Total LPAH (U = 0)	µg/kg	5200	--	29000	96.5	78	81	83.5	203.5	196.5
Naphthalene	µg/kg	2100	--	2400	19 U	20 U	20 U	19 U	19 U	19 U
Acenaphthylene	µg/kg	560	--	1300	19 U	20 U	20 U	19 U	19 U	19 U
Acenaphthene	µg/kg	500	--	2000	19 U	20 U	20 UJ	19 U	19 U	19 U
Fluorene	µg/kg	540	--	3600	19 U	20 U	20 UJ	19 U	10 J	13 J

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Phenanthrene	µg/kg	1500	--	21000	49	28	29 J	36	140	120
Anthracene	µg/kg	960	--	13000	19 U	10 J	12 J	19 U	25	35
2-Methylnaphthalene	µg/kg	670	--	1900	19 U	20 U	20 U	19 U	19 U	19 U
Total HPAH (U = 0)	µg/kg	12000	--	69000	414.5	761	506	385.5	1407	1187.5
Fluoranthene	µg/kg	1700	4600	30000	81	96	72 J	100	360	290
Pyrene	µg/kg	2600	11980	16000	99	140	72 J	68	300	260
Benzo(a)anthracene	µg/kg	1300		5100	29	69	50 J	28	100	97
Chrysene	µg/kg	1400		21000	49	130	100 J	56	180	160
Benzo(b)fluoranthene	µg/kg	--	--	--	28	86	48 J	34	120	100
Benzo(k)fluoranthene	µg/kg	--	--	--	49	110	78 J	45	160	130
Total Benzofluoranthenes (b,j,k) (U = 0)	µg/kg	3200	--	9900	77	196	126 J	79	280	230
Benzo(a)pyrene	µg/kg	1600	--	3600	32	57	38 J	23	100	82
Indeno(1,2,3-c,d)pyrene	µg/kg	600	--	4400	16 J	30	19 J	11 J	36	28
Dibenzo(a,h)anthracene	µg/kg	230	--	1900	19 U	12 J	20 U	19 U	11 J	19 U
Benzo(g,h,i)perylene	µg/kg	670	--	3200	22	31	19 J	11 J	40	31
Total PAH (U = 0)	µg/kg	--	--	--	511	839	587	469	1610.5	1384
1-Methylnaphthalene	µg/kg	--	--	--	19 U	20 U	20 U	19 U	19 U	19 U
Chlorinated Hydrocarbons (ug/kg)										
1,3-Dichlorobenzene	µg/kg	170	--	--	1.0 UJ	1.3 UJ	1.3 UJ	1.2 U	1.0 U	0.9 U
1,4-Dichlorobenzene	µg/kg	110	--	120	1.0 UJ	1.3 UJ	1.3 UJ	1.2 U	1.0 U	0.9 U
1,2-Dichlorobenzene	µg/kg	35	--	110	1.0 UJ	1.3 UJ	1.3 UJ	1.2 U	1.0 U	0.9 U
1,2,4-Trichlorobenzene	µg/kg	31	--	64	5.2 UJ	6.3 UJ	6.4 UJ	5.8 U	5.1 U	4.6 U
Hexachlorobenzene	µg/kg	22	168	230	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
Phthalates (ug/kg)										
Dimethyl phthalate	µg/kg	71	--	1400	18 J	20 U	10 J	19 U	19 U	19 U
Diethyl phthalate	µg/kg	200	--	1200	19 U	20 U	20 U	19 U	19 U	19 U
Di-n-butyl phthalate	µg/kg	1400	--	5100	19 U	20 U	20 U	19 U	19 U	19 U
Butylbenzyl phthalate	µg/kg	63	--	970	19 U	20 U	20 U	19 U	93	160
Bis(2-ethylhexyl) phthalate	µg/kg	1300	--	8300	430	78	65	44	520	270
Di-n-octyl phthalate	µg/kg	6200	--	6200	31	20 U	20 U	19 U	19 U	19 U
Phenols (ug/kg)										
Phenol	µg/kg	420	--	1200	19 U	20 U	20 U	19 U	19 U	19 U
2-Methylphenol (o-Cresol)	µg/kg	63	--	77	19 U	20 U	20 U	19 U	19 U	19 U
4-Methylphenol (p-Cresol)	µg/kg	670	--	3600	19 U	20 U	20 U	19 U	19 U	19 U
2,4-Dimethylphenol	µg/kg	29	--	210	19 UJ	20 UJ	20 UJ	19 UJ	19 UJ	19 UJ
Pentachlorophenol	µg/kg	400	504	690	96 U	98 U	98 U	96 U	97 U	96 U
Miscellaneous Extractables (ug/kg)										
Benzyl alcohol	µg/kg	57	--	870	19 U	20 U	20 U	19 U	19 U	19 U
Benzoic acid	µg/kg	650	--	760	190 U	200 U	200 UJ	190 U	190 U	190 U
Dibenzofuran	µg/kg	540	--	1700	19 U	20 U	20 UJ	19 U	19 U	19 U
Hexachloroethane	µg/kg	1400	--	14000	19 U	20 U	20 U	19 U	19 U	19 U
Hexachlorobutadiene	µg/kg	29	--	270	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
N-Nitrosodiphenylamine	µg/kg	28	--	130	19 U	20 U	20 U	19 U	19 U	19 U

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Volatile Organics (ug/kg)										
Trichloroethene (TCE)	µg/kg	160	--	1600	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
Tetrachloroethene (PCE)	µg/kg	57	--	210	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
Ethylbenzene	µg/kg	10	--	50	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
o-Xylene	µg/kg	--	--	--	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
m,p-Xylene	µg/kg	--	--	--	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
Total Xylene (U = 0)	µg/kg	40	--	160	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
Pesticides & PCBs (ug/kg)										
4,4'-DDD (p,p'-DDD)	µg/kg	--	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
4,4'-DDE (p,p'-DDE)	µg/kg	--	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
4,4'-DDT (p,p'-DDT)	µg/kg	--	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Total DDT (U = 0)	µg/kg	6.9	50	69	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Aldrin	µg/kg	10	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
alpha-Chlordane (cis-Chlordane)	µg/kg	--	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
beta-Chlordane (trans-Chlordane)	µg/kg	--	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
Oxychlordane	µg/kg	--	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
cis-Nonachlor	µg/kg	--	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
trans-Nonachlor	µg/kg	--	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Total Chlordane (U = 0)	µg/kg	10	37	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Dieldrin	µg/kg	10	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Heptachlor	µg/kg	10	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
gamma-BHC (Lindane)	µg/kg	10	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
Dioxin Furans (ng/kg)										
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	--	--	--	0.151 J	0.601	0.526	0.399 J	0.171 J	0.222 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	--	--	--	0.781 J	1.77 J	2.18 J	2.69	0.797 J	0.829 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	--	--	--	1.6 J	4.51	5.08	8.19	1.99 J	1.94 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	--	--	--	4.37	14.7	19.1	32.3	6.22	7.01
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	--	--	--	2.94	8.99	10.6	16.1	3.35	3.62
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	--	--	--	88.8	571	745	913	148	157
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	--	--	--	690	6470	8120	7060	1290	1250
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	--	--	--	0.493 J	1.24	1.8	0.606	0.326 J	0.564
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	--	--	--	0.338 J	0.896 J	1.28 J	0.637 J	0.454 J	0.511 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	--	--	--	1.34 J	2.62	3.6	1.7 J	0.773 J	1.18 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	--	--	--	1.17 J	4.36	5.75	5.09	1.6 J	1.85 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	--	--	--	1.1 J	2.27 J	2.88	2.79	0.956 J	1.08 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	--	--	--	0.406 J	1.15 J	1.34 J	1.31 J	0.494 J	0.494 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	--	--	--	1.59 J	3.56	4.19	4.8	1.54 J	1.8 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	--	--	--	15.7	55.6	64.3	120	22	24.3
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	--	--	--	1.12 J	4.4	5.65	9.44	1.97 J	2.03 J
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	ng/kg	--	--	--	36.6	199	246	461	78.1	86
Total Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	--	--	--	3.45 J	6.7 J	14.2 J	3.97 J	1.98 J	2.32 J
Total Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	--	--	--	6.62 J	15.2 J	18.4 J	13.2 J	5.32 J	5.44 J
Total Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	--	--	--	31.5 J	201 J	245	188	48.9	47.2

Table 2
T115 Shoreline Grab Sample Results Compared to DMMP Criteria

Location ID: Sample ID: Sample Date: Depth: Sample Type:	Unit	DMMP Screening Level	DMMP Bioaccumulation Trigger	DMMP Maximum Level Marine Guideline	T115-SS01 T115-01-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS02 T115-02-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS03 T115-03-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS04 T115-04-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-05-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-55-SS-090428 4/28/2009 0 - 10 cm Field Duplicate
Total Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	--	--	--	180	2130	2950	1970	405	373
Total Tetrachlorodibenzofuran (TCDF)	ng/kg	--	--	--	11 J	22 J	24.1 J	12.1 J	7.02 J	7.36 J
Total Pentachlorodibenzofuran (PeCDF)	ng/kg	--	--	--	13.1 J	24.7 J	28.8 J	18.8 J	8.47 J	9.68 J
Total Hexachlorodibenzofuran (HxCDF)	ng/kg	--	--	--	25.4 J	75.3 J	89 J	122 J	29.3 J	35 J
Total Heptachlorodibenzofuran (HpCDF)	ng/kg	--	--	--	43.3	195	234	438	71.4	80.3
Total Dioxin/Furan TEQ (Mammal) (U = 0)	ng/kg	--	--	--	3.9852	15.5726	19.5577	23.4174	4.9913	5.4902
Total Dioxin/Furan TEQ (Mammal) (U = 1/2)	ng/kg	--	--	--	3.9852	15.5726	19.5577	23.4174	4.9913	5.4902

Notes:

- Detected concentration is greater than DMMP Screening Level
 - Detected concentration is greater than DMMP Bioaccumulation Trigger
 - Detected concentration is greater than DMMP Maximum Level Marine Guideline
 - Non-detected concentration is above one or more identified screening levels
- Results not reported or not applicable
 µg/kg = micrograms per kilogram
 mg/kg = milligrams per kilogram
 TEQ values as of 2005, World Health Organization. TEQ undetects are treated as zero and as half the MDL.

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

Total LPAH (Low PAH) are the total of Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene and Anthracene. 2-Methylnapthalene is not included in the sum of LPAHs

Total HPAH (High PAH) are the total of Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, Dibenzo(a,h)anthracene and Benzo(g,h,i)perylene

Total PAH are the total of Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, Dibenzo(a,h)anthracene and Benzo(g,h,i)perylene. 2-Methylnapthalene is not included.

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

Sum DDT consists of the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT

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

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

Totals are calculated as the sum of all detected results. If all are undetected results, the highest reporting limit value is reported as the sum.

Table 3
Terminal 115 Shoreline Grab Samples Compared to SMS Criteria

Location ID:			T115-SS01	T115-SS02	T115-SS03	T115-SS04	T115-SS05	T115-SS05
Sample ID:			T115-01-SS-090428	T115-02-SS-090428	T115-03-SS-090428	T115-04-SS-090428	T115-05-SS-090428	T115-55-SS-090428
Sample Date:			4/28/2009	4/28/2009	4/28/2009	4/28/2009	4/28/2009	4/28/2009
Depth:	SMS Sediment	SMS Cleanup	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Sample Type:	Quality Standards	Screening Level	Normal	Normal	Normal	Normal	Normal	Field Duplicate
Conventional Parameters (mg-N/kg)								
Ammonia	--	--	2.82	4.57	6.11	3.67	1.07	--
Conventional Parameters (mg/kg)								
Sulfide	--	--	50.5 J	15.5 J	48.4 J	1.45 UJ	11.9 J	9.04 J
Conventional Parameters (pct)								
Ash Content	--	--	98.15	96.39	96.21	97.58	98.16	--
Total organic carbon	--	--	3.5	3.53	2.57	1.78	1.84	--
Total organic matter	--	--	1.85	3.61	3.79	2.42	1.84	--
Total solids	--	--	71.9	62.2	55.2	63.5	78.3	--
Total Solids (preserved)	--	--	78.7	55.7	56.6	70.2	76.9	78.1
Grain Size (pct)								
Total Gravel	--	--	8.2	16.4	33.6	43.2	35.9	--
Total Sand	--	--	85.3	58.1	35.3	40.5	59	--
Total Clay	--	--	1.5	6.7	10	6.1	1.8	--
Total Silt	--	--	4.9	18.8	21.1	10.3	3.4	--
Total Fines (silt + clay)	--	--	6.4	25.5	31.1	16.4	5.2	--
Metals (mg/kg)								
Antimony			7 UJ	8 UJ	9 UJ	7 UJ	20 UJ	6 UJ
Arsenic	57	93	10	20	23	26	20	16
Cadmium	5.1	6.7	0.3 U	0.3 U	0.3 U	0.3 U	0.6 U	0.3 U
Chromium	260	270	25.5	39.7	35.5	31.4	42	44.7
Copper	390	390	34.8	56.7	60.2	87.1	114	65.7
Lead	450	530	53 J	38 J	34 J	23 J	20 J	30 J
Mercury	0.41	0.59	0.03	0.1	0.13	0.07	0.03	0.03
Nickel	--	--	27	31	29	29	33	30
Selenium	--	--	0.6 U	0.8 U	0.8 U	0.7 U	0.6 U	0.6 U
Silver	6.1	6.1	0.4 U	0.5 U	0.5 U	0.4 U	1 U	0.4 U
Zinc	410	960	111	166	188	157	257	336
PCB Aroclors (mg/kg-OC)								
Aroclor 1016	--	--	0.5429 U	0.5666 U	0.7782 U	1.1236 U	1.0326 U	--
Aroclor 1221	--	--	0.5429 U	0.5666 U	0.7782 U	1.1236 U	1.0326 U	--
Aroclor 1232	--	--	0.5429 U	0.5666 U	0.7782 U	1.1236 U	1.0326 U	--
Aroclor 1242	--	--	0.5429 U	0.5666 U	0.7782 U	1.1236 U	1.0326 U	--
Aroclor 1248	--	--	0.5429 U	0.5666 U	0.7782 U	1.1236 U	1.0326 U	--
Aroclor 1254	--	--	0.5429 U	0.5666 U	0.7782 U	1.1236 U	1.0326 U	--
Aroclor 1260	--	--	0.5429 U	0.5666 U	0.7782 U	1.1236 U	1.0326 U	--
Total PCB (U = 0)	12	65	0.5429 U	0.5666 U	0.7782 U	1.1236 U	1.0326 U	--
Aromatic Hydrocarbons (mg/kg-OC)								
Total LPAH (U = 0)	370	780	1.4	1.0765	1.5953	2.0225	9.5109	--
Naphthalene	99	170	0.5429 U	0.5666 U	0.7782 U	1.0674 U	1.0326 U	--
Acenaphthylene	66	66	0.5429 U	0.5666 U	0.7782 U	1.0674 U	1.0326 U	--
Acenaphthene	16	57	0.5429 U	0.5666 U	0.7782 UJ	1.0674 U	1.0326 U	--
Fluorene	23	79	0.5429 U	0.5666 U	0.7782 UJ	1.0674 U	0.5435 J	--
Phenanthrene	100	480	1.4	0.7932	1.1284 J	2.0225	7.6087	--
Anthracene	220	1200	0.5429 U	0.2833 J	0.4669 J	1.0674 U	1.3587	--

Table 3
Terminal 115 Shoreline Grab Samples Compared to SMS Criteria

Location ID: Sample ID: Sample Date: Depth: Sample Type:	SMS Sediment Quality Standards	SMS Cleanup Screening Level	T115-SS01 T115-01-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS02 T115-02-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS03 T115-03-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS04 T115-04-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-05-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-55-SS-090428 4/28/2009 0 - 10 cm Field Duplicate
2-Methylnaphthalene	38	64	0.5429 U	0.5666 U	0.7782 U	1.0674 U	1.0326 U	--
Total HPAH (U = 0)	960	5300	11.5715	21.558	19.2997	21.1236	76.4673	--
Fluoranthene	160	1200	2.3143	2.7195	2.8016 J	5.618	19.5652	--
Pyrene	1000	1400	2.8286	3.966	2.8016 J	3.8202	16.3043	--
Benzo(a)anthracene	110	270	0.8286	1.9547	1.9455 J	1.573	5.4348	--
Chrysene	110	460	1.4	3.6827	3.8911 J	3.1461	9.7826	--
Benzo(b)fluoranthene	--	--	0.8	2.4363	1.8677 J	1.9101	6.5217	--
Benzo(k)fluoranthene	--	--	1.4	3.1161	3.035 J	2.5281	8.6957	--
Total Benzofluoranthenes (U = 0)	230	450	2.2	5.5524	4.9027 J	4.4382	15.2174	--
Benzo(a)pyrene	99	210	0.9143	1.6147	1.4786 J	1.2921	5.4348	--
Indeno(1,2,3-c,d)pyrene	34	88	0.4571 J	0.8499	0.7393 J	0.618 J	1.9565	--
Dibenzo(a,h)anthracene	12	33	0.5429 U	0.3399 J	0.7782 U	1.0674 U	0.5978 J	--
Benzo(g,h,i)perylene	31	78	0.6286	0.8782	0.7393 J	0.618 J	2.1739	--
Total PAH (U = 0)	--	--	12.9715	22.6345	20.895	23.1461	85.9782	--
Chlorinated Benzenes (mg/kg-OC)								
1,2-Dichlorobenzene	2.3	2.3	0.0286 UJ	0.0368 UJ	0.0506 UJ	0.0674 U	0.0543 U	--
1,4-Dichlorobenzene	3.1	9	0.0286 UJ	0.0368 UJ	0.0506 UJ	0.0674 U	0.0543 U	--
1,2,4-Trichlorobenzene	0.81	1.8	0.1486 UJ	0.1785 UJ	0.2490 UJ	0.3258 U	0.2772 U	--
Hexachlorobenzene	0.38	2.3	0.0277 U	0.0275 U	0.0381 U	0.0539 U	0.0538 U	--
Phthalates (mg/kg-OC)								
Dimethyl phthalate	53	53	0.5143 J	0.5666 U	0.3891 J	1.0674 U	1.0326 U	--
Diethyl phthalate	61	110	0.5429 U	0.5666 U	0.7782 U	1.0674 U	1.0326 U	--
Di-n-butyl phthalate	220	1700	0.5429 U	0.5666 U	0.7782 U	1.0674 U	1.0326 U	--
Butylbenzyl phthalate	4.9	64	0.5429 U	0.5666 U	0.7782 U	1.0674 U	5.0543	--
Bis(2-ethylhexyl) phthalate	47	78	12.2857	2.2096	2.5292	2.4719	28.2609	--
Di-n-octyl phthalate	58	4500	0.8857	0.5666 U	0.7782 U	1.0674 U	1.0326 U	--
Miscellaneous (mg/kg-OC)								
Dibenzofuran	15	58	0.5429 U	0.5666 U	0.7782 UJ	1.0674 U	1.0326 U	--
Hexachlorobutadiene	3.9	6.2	0.0277 U	0.0275 U	0.0381 U	0.0539 U	0.0538 U	--
N-Nitrosodiphenylamine	11	11	0.5429 U	0.5666 U	0.7782 U	1.0674 U	1.0326 U	--
Ionizable Organic Compounds (µg/kg)								
Phenol	420	1200	19 U	20 U	20 U	19 U	19 U	19 U
2-Methylphenol (o-Cresol)	63	63	19 U	20 U	20 U	19 U	19 U	19 U
4-Methylphenol (p-Cresol)	670	670	19 U	20 U	20 U	19 U	19 U	19 U
2,4-Dimethylphenol	29	29	19 UJ	20 UJ	20 UJ	19 UJ	19 UJ	19 UJ
Pentachlorophenol	360	690	96 U	98 U	98 U	96 U	97 U	96 U
Benzyl alcohol	57	73	19 U	20 U	20 U	19 U	19 U	19 U
Benzoic acid	650	650	190 U	200 U	200 UJ	190 U	190 U	190 U
PCB Aroclors (µg/kg)								
Aroclor 1016	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1221	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1232	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1242	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1248	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aroclor 1254	--	--	19 U	20 U	20 U	20 U	19 U	19 U


Table 3
Terminal 115 Shoreline Grab Samples Compared to SMS Criteria


Location ID: Sample ID: Sample Date: Depth: Sample Type:	SMS Sediment Quality Standards	SMS Cleanup Screening Level	T115-SS01 T115-01-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS02 T115-02-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS03 T115-03-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS04 T115-04-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-05-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-55-SS-090428 4/28/2009 0 - 10 cm Field Duplicate
Aroclor 1260	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Total PCB (U = 0)	--	--	19 U	20 U	20 U	20 U	19 U	19 U
Aromatic Hydrocarbons (µg/kg)								
Total LPAH (U = 0)	--	--	49	38	41	36	175	168
Naphthalene	--	--	19 U	20 U	20 U	19 U	19 U	19 U
Acenaphthylene	--	--	19 U	20 U	20 U	19 U	19 U	19 U
Acenaphthene	--	--	19 U	20 U	20 UJ	19 U	19 U	19 U
Fluorene	--	--	19 U	20 U	20 UJ	19 U	10 J	13 J
Phenanthrene	--	--	49	28	29 J	36	140	120
Anthracene	--	--	19 U	10 J	12 J	19 U	25	35
2-Methylnaphthalene	--	--	19 U	20 U	20 U	19 U	19 U	19 U
Total HPAH (U = 0)	--	--	405	761	496	376	1407	1178
Fluoranthene	--	--	81	96	72 J	100	360	290
Pyrene	--	--	99	140	72 J	68	300	260
Benzo(a)anthracene	--	--	29	69	50 J	28	100	97
Chrysene	--	--	49	130	100 J	56	180	160
Benzo(b)fluoranthene	--	--	28	86	48 J	34	120	100
Benzo(k)fluoranthene	--	--	49	110	78 J	45	160	130
Total Benzofluoranthenes (U = 0)	--	--	77	196	126 J	79	280	230
Benzo(a)pyrene	--	--	32	57	38 J	23	100	82
Indeno(1,2,3-c,d)pyrene	--	--	16 J	30	19 J	11 J	36	28
Dibenzo(a,h)anthracene	--	--	19 U	12 J	20 U	19 U	11 J	19 U
Benzo(g,h,i)perylene	--	--	22	31	19 J	11 J	40	31
Total PAH (U = 0)	--	--	454	799	537	412	1582	1346
Chlorinated Benzenes (µg/kg)								
1,2-Dichlorobenzene	--	--	1.0 UJ	1.3 UJ	1.3 UJ	1.2 U	1.0 U	0.9 U
1,4-Dichlorobenzene	--	--	1.0 UJ	1.3 UJ	1.3 UJ	1.2 U	1.0 U	0.9 U
1,2,4-Trichlorobenzene	--	--	5.2 UJ	6.3 UJ	6.4 UJ	5.8 U	5.1 U	4.6 U
Hexachlorobenzene	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
Miscellaneous (µg/kg)								
Dibenzofuran	--	--	19 U	20 U	20 UJ	19 U	19 U	19 U
Hexachlorobutadiene	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
N-Nitrosodiphenylamine	--	--	19 U	20 U	20 U	19 U	19 U	19 U
Phthalates (µg/kg)								
Dimethyl phthalate	--	--	18 J	20 U	10 J	19 U	19 U	19 U
Diethyl phthalate	--	--	19 U	20 U	20 U	19 U	19 U	19 U
Di-n-butyl phthalate	--	--	19 U	20 U	20 U	19 U	19 U	19 U
Butylbenzyl phthalate	--	--	19 U	20 U	20 U	19 U	93	160
Bis(2-ethylhexyl) phthalate	--	--	430	78	65	44	520	270
Di-n-octyl phthalate	--	--	31	20 U	20 U	19 U	19 U	19 U
Other parameters (µg/kg)								
1,3-Dichlorobenzene	--	--	19 U	20 U	20 U	19 U	19 U	19 U
1-Methylnaphthalene	--	--	19 U	20 U	20 U	19 U	19 U	19 U
4,4'-DDD (p,p'-DDD)	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
4,4'-DDE (p,p'-DDE)	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U


Table 3
Terminal 115 Shoreline Grab Samples Compared to SMS Criteria

Location ID: Sample ID: Sample Date: Depth: Sample Type:	SMS Sediment Quality Standards	SMS Cleanup Screening Level	T115-SS01 T115-01-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS02 T115-02-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS03 T115-03-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS04 T115-04-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-05-SS-090428 4/28/2009 0 - 10 cm Normal	T115-SS05 T115-55-SS-090428 4/28/2009 0 - 10 cm Field Duplicate
4,4'-DDT (p,p'-DDT)	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Total DDT (U = 0)	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Aldrin	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
alpha-Chlordane (cis-Chlordane)	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
beta-Chlordane (trans-Chlordane)	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
cis-Nonachlor	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Dieldrin	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Ethylbenzene	--	--	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
gamma-BHC (Lindane)	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
Heptachlor	--	--	0.97 U	0.97 U	0.98 U	0.96 U	0.99 U	0.98 U
Hexachloroethane	--	--	19 U	20 U	20 U	19 U	19 U	19 U
o-Xylene	--	--	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
m,p-Xylene	--	--	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
Total Xylene (U = 0)	--	--	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
Oxychlordane	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Tetrachloroethene (PCE)	--	--	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U
trans-Nonachlor	--	--	1.9 U	1.9 U	2 U	1.9 U	2 U	2 U
Trichloroethene (TCE)	--	--	1 U	1.3 U	1.3 U	1.2 U	1 U	0.9 U

Notes:

 Detected concentration is greater than lowest SMS Sediment Quality Standards (SQS)

 Detected concentration is greater than lowest SMS Cleanup Screening Level (CSL)

 Non-detected concentration is above one or more identified screening levels

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

Total LPAH (Low PAH) are the total of Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene and Anthracene. 2-Methylnaphthalene is not included in the sum of LPAHs

Total HPAH (High PAH) are the total of Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, Dibenzo(a,h)anthracene and Benzo(g,h,i)perylene

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

Total PCB does not include Aroclor 1262 and 1268

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

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

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

Totals are calculated as the sum of all detected results. If all are undetected results, the highest reporting limit value is reported as the sum.

-- Results not reported or not applicable

µg/kg = micrograms per kilogram

mg/kg-OC = milligrams per kilogram organic carbon normalized

mg/kg = milligrams per kilogram

FIGURES

Oct 11, 2007 4:01pm cdavidson K:\Jobs\070003-Port of Seattle\07000302 T-115\07000302001.dwg Anc-A-Portrait WA VMAP

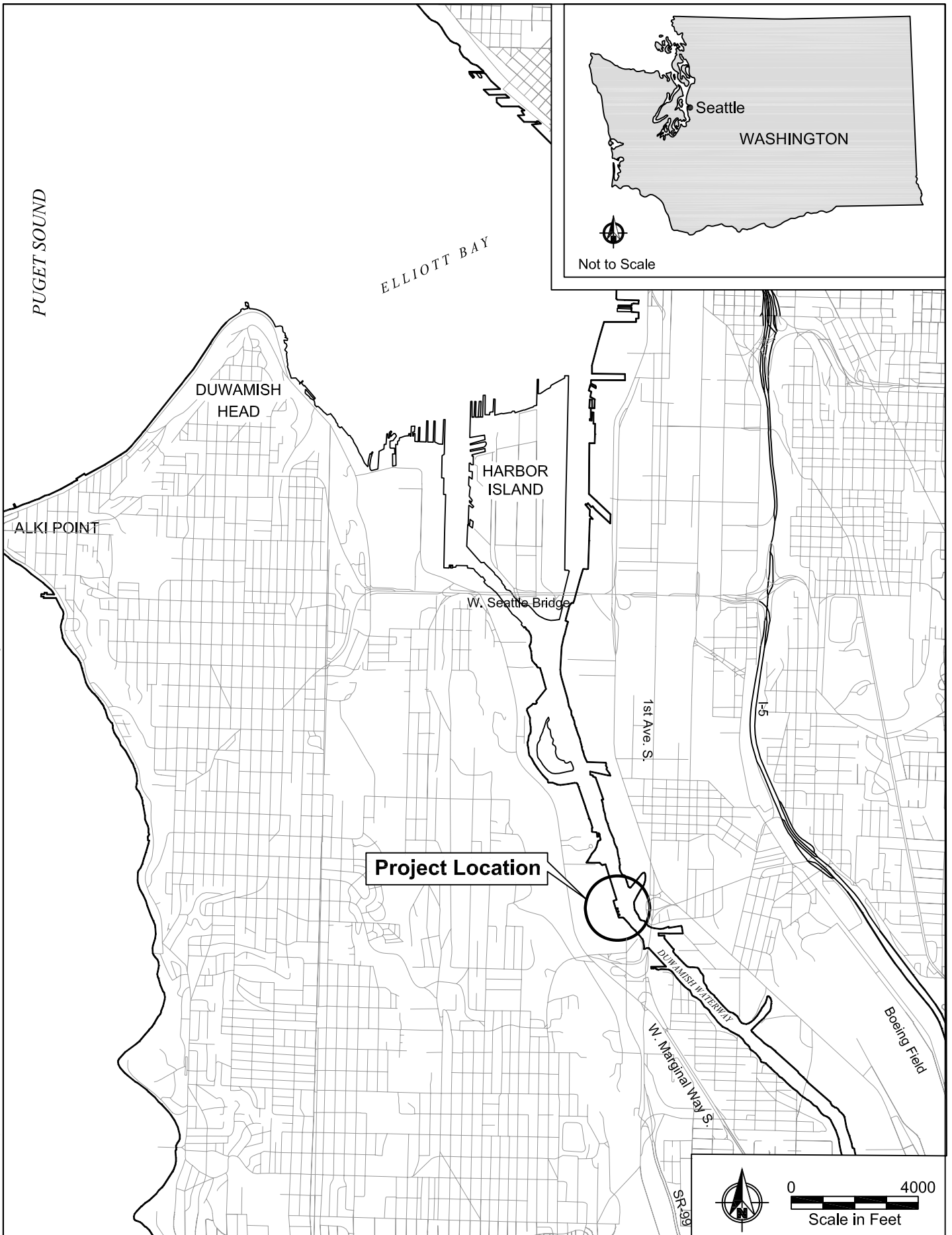


Figure 1
Vicinity Map
Terminal 115
Port of Seattle



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APPENDIX A

FIELD LOG FORMS

APPENDIX B

LABORATORY REPORTS

APPENDIX C

DATA VALIDATION REPORTS
