Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

August 27, 2010

Mr. Kelly Madalinski
Port of Portland
7200 NE Airport Way
Portland, Oregon 97218

Re: Final Proposed Surface Soil Sampling – Wheeler Bay Erosion
Terminal 4 Slip 1 Upland Facility
Portland, Oregon
1066-07

Dear Mr. Madalinski:

This letter presents the proposed surface soil sampling activities to support repair of erosion on the Wheeler Bay Bank at the Terminal 4 Slip 1 Upland Facility (the Facility) in Portland, Oregon (Figures 1 and 2). The Port of Portland (Port) is under a Voluntary Cleanup Program (VCP) Agreement with the Oregon Department of Environmental Quality (DEQ) for Remedial Investigation (RI), Source Control Measures (SCMs), and Feasibility Study (FS) at the Facility (dated December 4, 2003). The proposed activities presented in this letter include collection of surface soil samples for chemical analysis.

BACKGROUND

Wheeler Bay Source Control Action. In summer/fall 2008, a source control action was completed at Wheeler Bay as part of the Phase I Removal Action at Terminal 4. The source control action combined shoreline stabilization with capping of impacted soils. In summary, the Wheeler Bay shoreline stabilization activities included the following:

- Site Grading – Site grading was conducted to reduce the overall slope of most of the Wheeler Bay shoreline from 2H:1V to 3H:1V.
- Armor Stone/Habitat Cover – From elevation 10 feet to 15 feet, armor stone (rip rap) was placed to resist erosive forces of river currents, boat wakes, and waves. The armor stone was covered with sand/gravel habitat material, habitat logs, and large woody debris to enhance the habitat for fish.
- Topsoil and Planting – Above elevation 15 feet, the slope was covered with a topsoil cap and erosion control fabric. The lower portion (between elevation 15 feet and 20 feet) was planted with cottonwood and willow trees. The portion above elevation 20 feet was planted with a native grass seed mix.

Erosion Observed. During a site visit the week of June 21, 2010, erosion was observed in the landscaped shoreline on the Wheeler Bay bank. The areas of erosion extended above elevation 15 feet NGVD into the willow planting area and were focused largely between stations 0+00 and 2+25 (the portion nearest the main river channel). In approximately six locations between stations 0+00 and 2+05, the demarcation layer installed to identify the top of the

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impacted soil beneath the cap was exposed. Photographs of erosion in this area are included in Attachment A. Based on the observation of the exposed demarcation layer, in addition to erosion of the imported topsoil, it is possible that impacted soil from beneath the cap was eroded.

The Port has designed a repair for the erosion of the bank and is in the process of planning the construction to complete the repair work. In general, the proposed repair consists of removal and stockpiling of eroded topsoil/habitat material, placement of armor stone to buttress and protect the topsoil, and replacement of the stockpiled soil/habitat material at the toe of the new armor. The work is expected to begin in September 2010.

To support the planned construction and assess if impacted soil was eroded from beneath the cap, surface soil sampling will be completed in the areas where the demarcation layer was exposed, generally between stations 0+00 and 2+00.

Summary of Historical Sampling of Wheeler Bay Bank. Composite surface soil samples were collected along the bank of Wheeler Bay during the RI and source control action. The composite samples were analyzed for total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, metals, and phthalates. Some discrete samples were analyzed for selected chemicals. The results were summarized in the source control completion report and the corresponding tables and sample location plan are reproduced in Attachment B. TPH, PAHs, pesticides, metals, and phthalates were detected in one or more of the samples.

As part of the Wheeler Bay stabilization project, import materials were tested for lead. The concentration of lead in the topsoil and habitat material was 7.7 and 2.5 mg/kg, respectively.

PROPOSED SAMPLING ACTIVITIES

Sampling Purpose and Approach

The purpose of the surface soil sampling is to assess if impacted soil from beneath the demarcation layer has been eroded sufficiently to warrant further evaluation or action. It is anticipated that there has been little, if any, chemical impact from the erosion, so the Port has elected to use an indicator chemical to assess the potential impact. Table 1 summarizes the results for prior soil chemical analyses from the footprint of the observed bank erosion. Based on the screening in the table, lead has the highest relative exceedance of the screening levels. Furthermore, when comparing corresponding samples from 2005 and 2008 (S-26 to S-37 and S-27 to S-38), lead is the only chemical that is consistently replicated in the sampling. Therefore, lead was selected as the indicator chemical.

The following sampling and analysis logic will be used for this project.

- Soil samples will be collected from the areas most likely to have been impacted (areas with visible eroded material) and from areas immediately downgradient from those areas.
- Soil samples from the areas most likely to have been impacted will be analyzed for lead.
- The results will be screened against the presumed regional background concentration for lead (17 mg/kg as defined by the Portland Harbor Joint Source Control Strategy document). If concentrations are below the screening level, it will be deemed that no chemical impact from eroded material has occurred and no further sampling or analysis will be conducted.
- If concentrations are detected above the screening level, additional samples will be analyzed for lead to define the extent of impacts.
- In the event of a defined chemical impact, results will be incorporated into the erosion repair design and the Port will conduct further evaluation and/or actions.

Preparatory Activities

In preparation for the field work, Ash Creek will update the Health and Safety Plan for the Facility.

Surface Soil Sampling

Figure 3 shows the location of the proposed surface soil samples. The area of sampling is between elevation 10 feet and 15 feet and between station 0+00 and 2+00. This area corresponds to the armor/habitat material area in the bank stabilization project. The upper third of this area contains a layer of silt/sand (up to approximately 6 inches thick) eroded from the topsoil area immediately uphill. The lower portion primarily consists of re-worked habitat material, but in some areas the armor stone is exposed at the surface. Six composite soil samples will be collected as follows:

- S-42, station 0+00 to 1+00, approximately elevation 14 feet where visibly eroded material is present
- S-43, station 0+00 to 1+00, approximately 1 to 2 feet downhill from where visibly eroded material is present
- S-44, station 0+00 to 1+00, approximately elevation 11 feet, near the toe of the original stabilized slope
- S-45, station 1+00 to 2+00, approximately elevation 14 feet where visibly eroded material is present
- S-46, station 1+00 to 2+00, approximately 1 to 2 feet downhill from where visibly eroded material is present
- S-47, station 1+00 to 2+00, approximately elevation 11 feet, near the toe of the original stabilized slope

A four-point composite surface soil sample will be collected for each proposed sample. Discrete samples from each sub-sample location will also be collected and retained for potential future analysis. The locations of discrete sub-samples shown on Figure 3 are approximate. The actual locations will be adjusted in the field based on the locations of the erosion areas (i.e., to ensure collection of material in erosion areas) and presence of exposed armor stone.

Surface soil will be collected from a depth of 0 to 4 inches at the four discrete sub-sample locations within each of the six composite sample areas. This sample interval was selected based on the observed thickness of the eroded soil and the anticipated depth to underlying armor stone. The samples will be collected in accordance with Standard Operating Procedure (SOP) 2.2 (Attachment C) with the following modification: Prior to placement of samples into the sample container, soil will be passed through a No. 4 sieve to remove gravel-size particles. Samples will be passed through a No. 10 sieve in the laboratory prior to chemical analysis.

The sample locations will be recorded using a high-accuracy, handheld global positioning system (GPS) device (Trimble© GeoXH™).

CHEMICAL ANALYSES

Soil samples S-42 and S-45 (samples collected from the eroded material) will be submitted for analysis of total lead on a 2-day turnaround basis. In addition, the discrete sub-samples collected immediately downgradient of the two areas of greatest erosion (based on visual comparison of erosional features) will be analyzed for total lead on a 2-day turnaround. The target reporting limit will be 1 mg/kg or less. The remaining samples will be held pending these results. The held samples will be analyzed in the event that lead is detected above the screening level of 17 mg/kg in either of the initial samples.

If you have any questions regarding these proposed activities, please contact the undersigned at (503) 924-4704.

Sincerely,

REGISTERED PROFESSIONAL ENGINEER 15,147 PE OREGON OCT. 2, 1990 HERBERT F. CLOUGH

EXPIRES: DEC. 31, 2011

Herb Clough, P.E.
Principal Engineer

ATTACHMENTS

Table 1 – Historical Wheeler Bay Soil Exceedances within 2010 Observed Bank Erosion Footprint

Figure 1 – Facility Location Map
Figure 2 – Facility Vicinity Map
Figure 3 – Proposed Sampling Plan

Attachment A – Photograph Log
Attachment B – Wheeler Bay Bank Historical Sample Results
Attachment C – Standard Operating Procedure 2.2

Table 1
Historical Wheeler Bay Soil Exceedances within 2010 Observed Bank Erosion Footprint

	Screening levels			Results				Exceedance Factor			
								2005		2008	
	BG[7]	SLV[2]	PEC[1]	S-26	S-27	S-37	S-38	S-26	S-27	S-37	S-38
Metals (mg/kg)											
Cadmium	1	20	5.0	7.02	0.402	1.9	0.5	**1.4**	0.1	0.4	0.1
Chromium	42	2	-	16.4	16	-	-	0.4	0.4	-	-
Lead	17	80	128	479	30.4	427	32.8	**6.0**	0.4	**5.3**	0.4
Zinc	86	250	459	949	112	323	93.7	**3.8**	0.4	**1.3**	0.4
Pesticides (ug/kg)											
4,4-DDT	-	50	63	17	3.7	101	7.6	0.3	0.1	**2.0**	0.2

Notes:

Yellow highlighted cells indicate effective screening level for a given analyte

Orange highlighted cells incidate chemical with highest exceedance ratio for each composite sample

1) PEC = Probably Effects Concentrations for aquatic receptors (MacDonald et al. 2000)

2) SLV = Oregon DEQ Level II Screening Level Values (SLVs) for non-endangered terrestraial receptors (DEQ 2001)

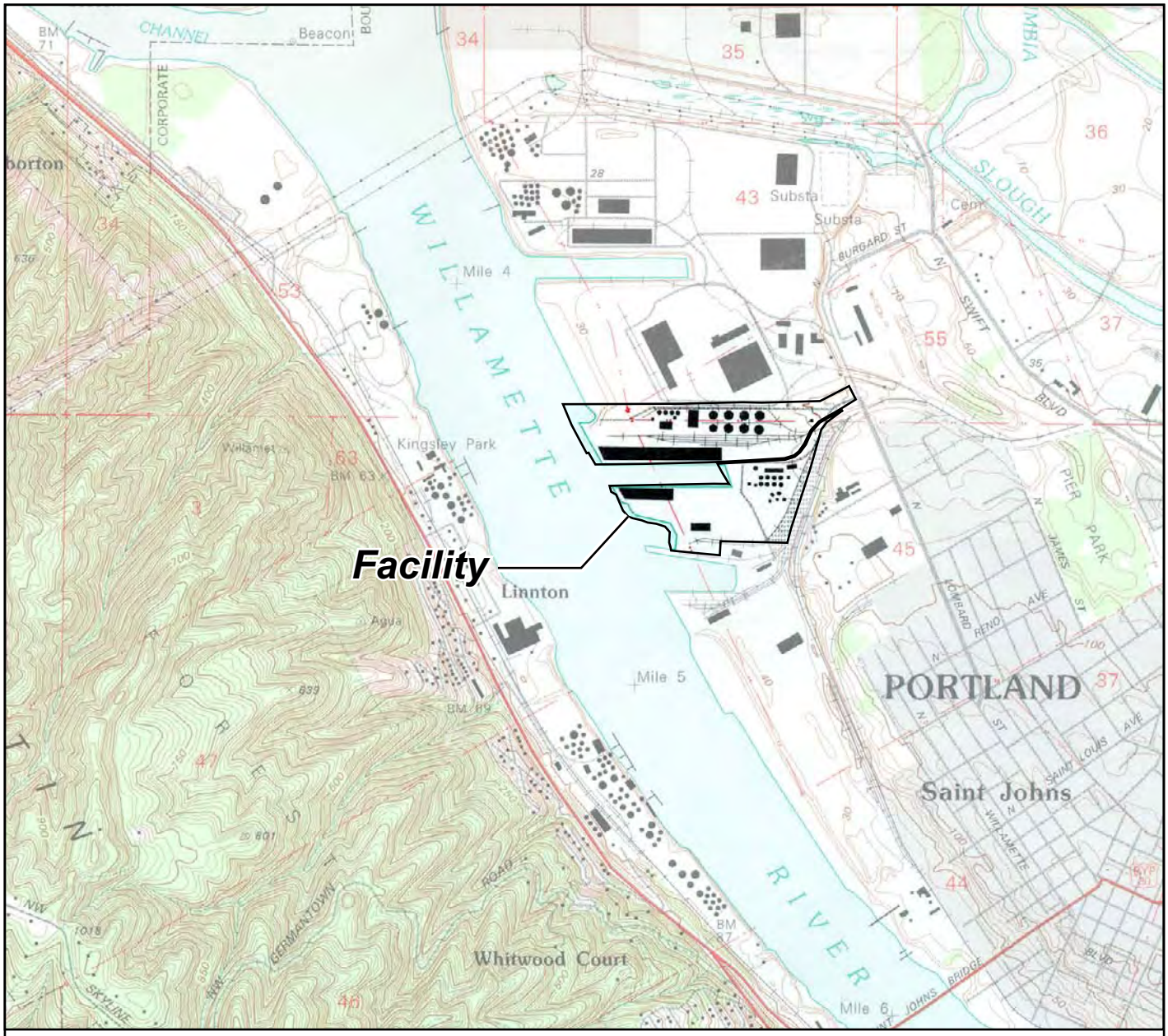
3) Analytes shown only if at least one sample exceeded the aquatic or terrestrial ecological screening level

4) No exceedance of the non-endangered SLV or PEC criteria for PAHs were observed in any samples.

5) " - " indicates no screening level available and/or sample not analyzed for a given analyte.

6) **Bold** values denote exceedances of the effective ecological screening level

7) WDOE 1994 Natural Background Soil Metals Concentrations in Washington State



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

0 2,000 4,000

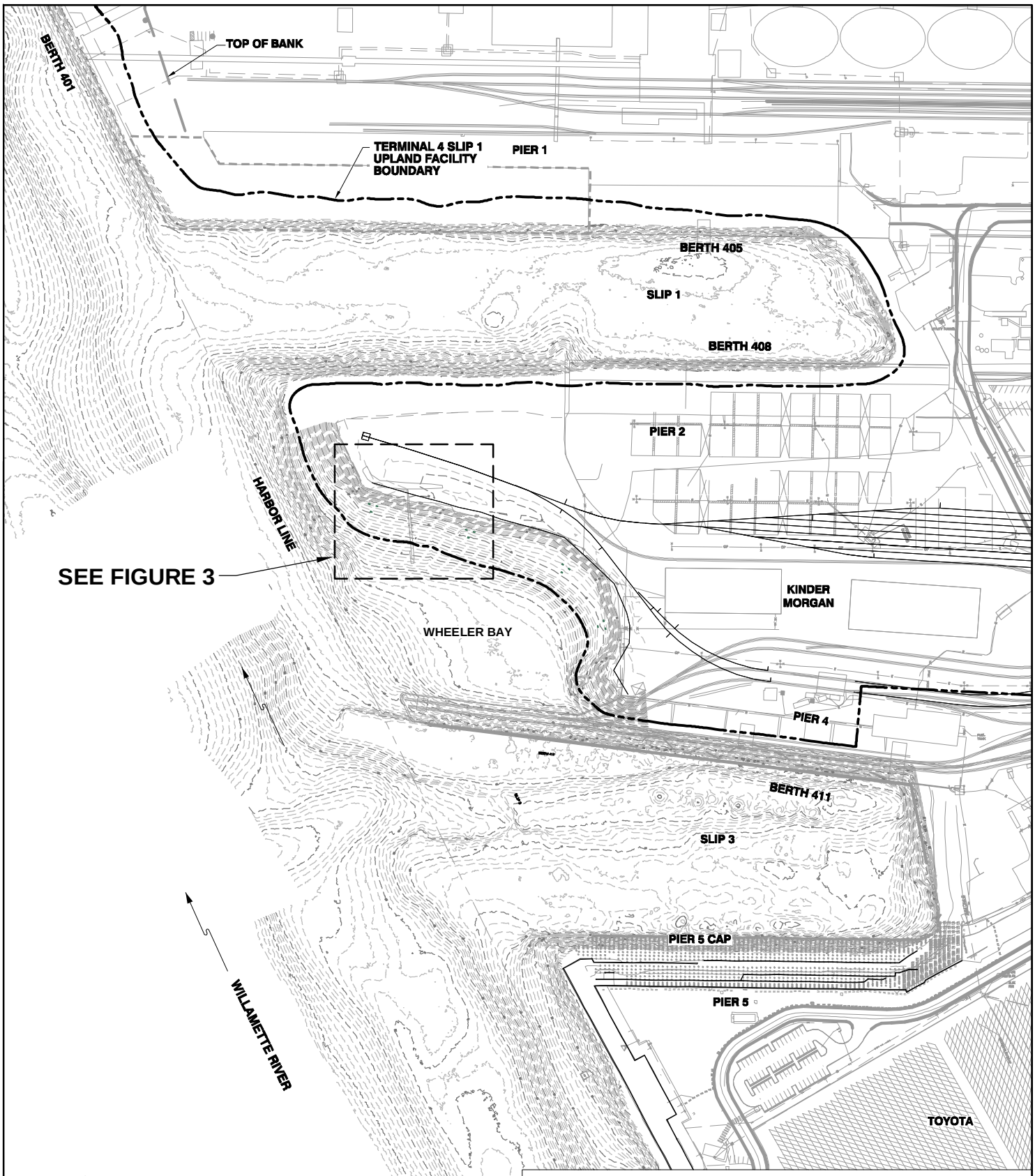
Approximate Scale in Feet

N

Facility Location Map

Proposed Surface Soil Sampling - Wheeler Bay Erosion
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number 1066-07	Figure 1
	August 2010	

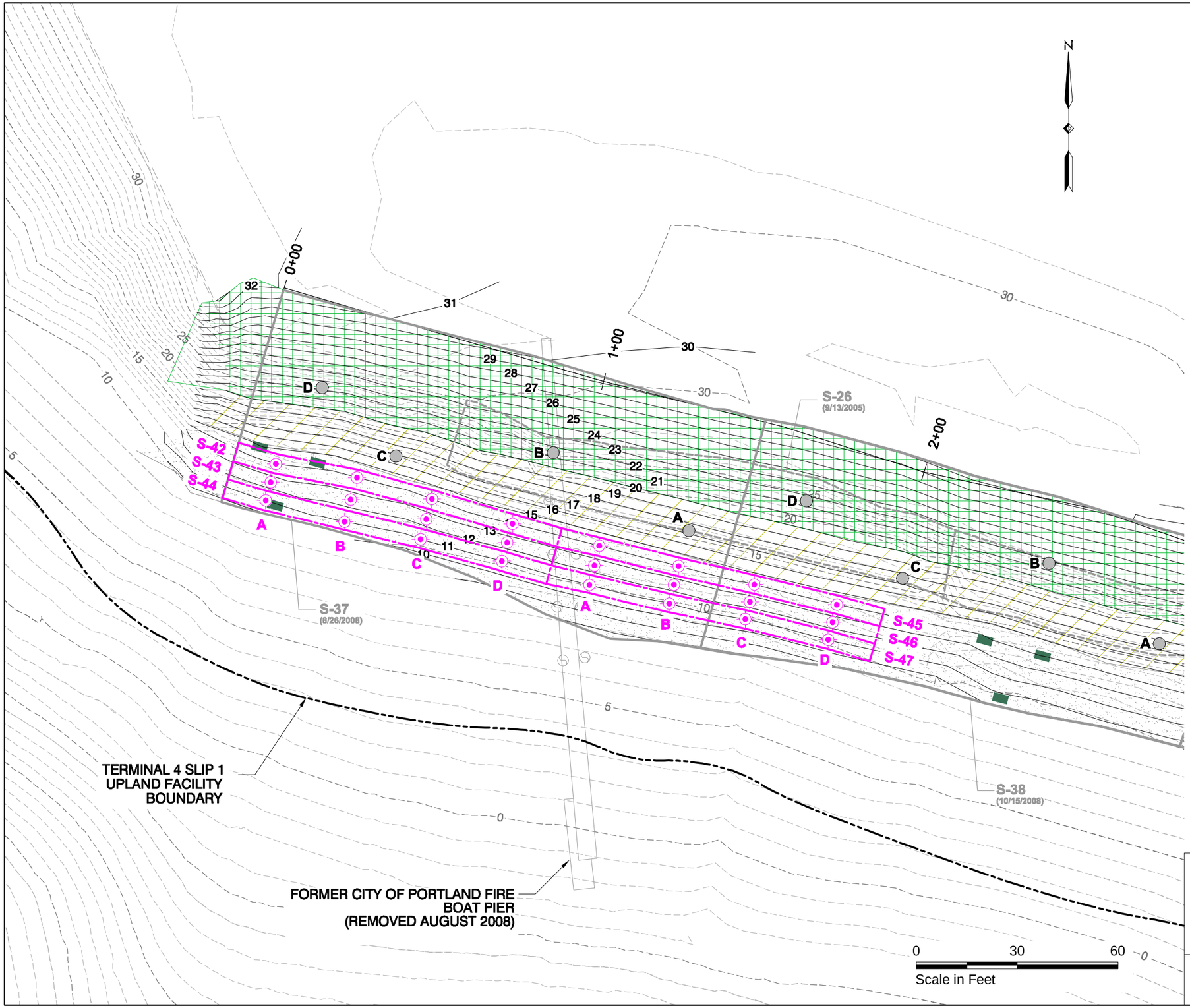


Facility Vicinity Plan

Proposed Surface Soil Sampling - Wheeler Bay Erosion
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1066-07	Figure
August 2010		2



LEGEND:

- S-37 (8/26/2008) — COMPOSITE SAMPLING BOUNDARY, IDENTIFICATION, AND (DATE SAMPLED)
- A — COMPOSITE SUB-SAMPLE LOCATION (2008)
- S-26 (9/13/2005) — RI RIVERBANK COMPOSITE SAMPLING BOUNDARY
- HYDROSEED AND JUTE MAT
- COIR FABRIC AND PLANTINGS WITH MULCH
- HABITAT ROCK AND LARGE WOODY DEBRIS
- ARMOR ROCK
- ECOLOGY BLOCK HABITAT LOG ANCHORS (BURIED MINIMUM 4 FEET BELOW FINISH GRADE)
- -25 — PRE-CONSTRUCTION CONTOURS
- 29 — AS-BUILT CONTOURS
- S-42 — PROPOSED COMPOSITE SAMPLING BOUNDARY AND IDENTIFICATION
- A — PROPOSED SUB-SAMPLE LOCATION

NOTE: SAMPLE LOCATIONS APPROXIMATE DEPENDING ON PRESENCE OF ERODED SOIL AND ARMOR STONE - SEE WORK PLAN TEXT.

NOTES:

1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)
   VERTICAL DATUM: NGVD 29-47
   CONTOUR INTERVAL = 1 FT
2. PRE-CONSTRUCTION BATHYMETRIC SURVEY BY PORT OF PORTLAND DATED NOVEMBER, 2007
3. PRE-CONSTRUCTION UPLAND SURVEY PROVIDED BY PORT OF PORTLAND DATED JANUARY 2008.
4. AS-BUILT UPLAND SURVEY BY MINISTER-GLASER DATED OCTOBER 13, 2008.

Proposed Sampling Plan

Proposed Surface Soil Sampling - Wheeler Bay Erosion
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number	1066-07	Figure
	August 2010		3

Attachment A

Photograph Log

ATTACHMENT A
PHOTOGRAPH LOG

Project Name: Wheeler Bay Erosion
Project Number: 1066-07

Client: Port of Portland
Location: Portland, Oregon

Photo No: 1	
Photo Date: August 17, 2010	
Orientation: Looking Northeast	
Description: Erosion of topsoil exposing demarcation layer. Approximately station 0+10.	
Photo No: 2	
Photo Date: August 17, 2010	
Orientation: Looking North	
Description: Erosion of topsoil exposing demarcation layer. Eroded topsoil layer visible in center of photograph. Approximately station 0+40.	

ATTACHMENT A
PHOTOGRAPH LOG

Project Name: Wheeler Bay Erosion
Project Number: 1066-07

Client: Port of Portland
Location: Portland, Oregon

Photo No: 3	
Photo Date: August 17, 2010	
Orientation: Looking Northwest	
Description: Erosion of topsoil. Demarcation layer not visible. Approximately station 1+25.	
Photo No: 4	
Photo Date: August 17, 2010	
Orientation: Looking North	
Description: Erosion of topsoil. Demarcation layer not visible. Approximately station 1+60.	

ATTACHMENT A
PHOTOGRAPH LOG

Project Name: Wheeler Bay Erosion
Project Number: 1066-07

Client: Port of Portland
Location: Portland, Oregon

Photo No: 5	
Photo Date: August 17, 2010	
Orientation: Looking North	
Description: Erosion of topsoil. Demarcation layer not visible. Approximately station 2+00.	

Attachment B

Wheeler Bay Bank Historical Sample Results

Table 4 - Subgrade Soil Samples: PAHs
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Sample Location:	Preliminary Screening Levels		T4S1S-26	T4S1S-26A	T4S1S-26B	T4S1S-26C	T4S1S-26D	T4S1S-27	T4S1S-27A
Sample ID:			T4S1S-26	T4S1S-26A	T4S1S-26B	T4S1S-26C	T4S1S-26D	T4S1S-27	T4S1S-27A
Sample Interval:	PRG	SLV	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Sampled:			9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005
PAHs (µg/kg)									
Naphthalene	190,000	10,000	30.3 J, D	13.6 U	5.55 J, D	13.9 U	83.2	69.2	269
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--
Acenaphthylene	--	--	35.7 J, D	13.6 U	48.8 D	13.9 U	108	18.7 J	114
Acenaphthene	29,000,000	20,000	70.1 U	13.6 U	27.1 D	13.9 U	77.3 U	97.4	375
Fluorene	26,000,000	30,000	70.1 U	13.6 U	28.7 D	13.9 U	77.3 U	48.0 J	207
Dibenzofuran	3,100,000	2	--	--	--	--	--	--	--
Phenanthrene	--	--	234 D	23.2 D	361 D	25.4 D	443	376	1,680
Anthracene	100,000,000	--	57.0 J, D	3.40 J, D	206 D	3.63 J, D	99.6	93.5	471
Fluoranthene	22,000,000	--	962 D	87.5 D	7,990 D	95.4 D	1,640	986	4,650
Pyrene	29,000,000	--	883 D	83.6 D	7,220 D	86.7 D	1,750	722	3,440
Benzo(b)fluoranthene	2,100	--	874 D	89.4 D	2,270 D	94.0 D	1,500	916	3,690
Benzo(k)fluoranthene	21,000	--	597 D	84.8 D	2,070 D	90.2 D	1,300	583	3,240
Benzo(a)anthracene	2,100	--	581 D	62.5 D	2,380 D	68.0 D	1,110	597	2,700
Chrysene	210,000	--	898 D	79.2 D	4,170 D	87.3 D	1,590	705	3,590
Benzo(a)pyrene	210	125,000	776 D	92.4 D	1,460 D	97.4 D	1,830	786	3,560
Indeno(1,2,3-cd)pyrene	2,100	--	514 D	55.4 D	433 D	54.8 D	790	581	2,280
Dibenz(a,h)anthracene	210	--	151 D	17.9 D	160 D	17.7 D	183	194	795
Benzo(g,h,i)perylene	--	--	611 D	61.4 D	358 D	60.1 D	926	655	2,560

Notes:

1. Only detected compounds are reported in the table. The complete analyte list is presented in the Sampling and Analysis Plan (Appendix A) of the RI Work Plan (Hart Cr
2. PAHs = Polynuclear Aromatic Hydrocarbons by EPA Method 8270C (SIM).
3. µg/kg = Micrograms per kilogram.
4. PRG = EPA Region 9 Preliminary Remediation Goal (PRG) for Industrial Soil (October 2004).
5. -- = No screening level available or not analyzed.
6. J = The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MI
7. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
8. Shaded values indicate that the detected concentration exceeds the PRG.
9. Sample ID nomenclature is per the following: type of sample-sample number-depth in feet-designation. For example, T4S1SB-46-1-1 = soil boring (SB) number 46, collected 1 foot below the ground surface, primary sample (1). T4S1S-6 = surface soil sample num
10. SLV = Oregon Department of Environmental Quality Level II Screening Level Values (SLVs) for Terrestrial Receptors (lowest available value
11. Boxed values indicate that the detected concentration exceeds the SLV (only samples from 0 to 3 feet were screened against the SLV).

Table 4 - Subgrade Soil Samples: PAHs
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Sample Location:	Preliminary Screening Levels		T4S1S-27B	T4S1S-27C	T4S1S-27D	T4S1S-28	T4S1S-28A	T4S1S-28B	T4S1S-28C	T4S1S-28D	T4S1S-29	T4S1S-30	T4S1S-30A	T4S1S-30C	T4S1S-30D
Sample ID:			T4S1S-27B	T4S1S-27C	T4S1S-27D	T4S1S-28	T4S1S-28A	T4S1S-28B	T4S1S-28C	T4S1S-28D	T4S1S-29	T4S1S-30	T4S1S-30A	T4S1S-30C	T4S1S-30D
Sample Interval:	PRG	SLV	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Sampled:			9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005
PAHs (µg/kg)															
Naphthalene	190,000	10,000	13.6 U	54.7 U	54.5 U	28.3 J	107 D	55.2 U	13.8 U	68.4 U	388	39.5 J	344 U	33.2 J	6,480
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	--	--	13.6 U	54.7 U	54.5 U	67.6 U	18.2 J	55.2 U	13.8 U	68.4 U	176	69.2 U	344 U	55.2 U	347 U
Acenaphthene	29,000,000	20,000	9.59 J	54.7 U	54.5 U	151	843	55.2 U	13.8 U	68.4 U	164 J	183	295 J	171	1,180
Fluorene	26,000,000	30,000	7.51 J	54.7 U	54.5 U	114	825	55.2 U	13.8 U	68.4 U	116 J	72.5	105 J	70.3	1,240
Dibenzofuran	3,100,000	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	141	28.5 J	35.0 J	1,040	6,300	29.8 J	22.4	137	1,710	972	1,630	873	1,830
Anthracene	100,000,000	--	19.7	54.7 U	54.5 U	166	717	55.2 U	13.8 U	24.8 J	314	173	251 J	162	520 U
Fluoranthene	22,000,000	--	511	88.1	113	2,390	11,300	93.5	80.1	400	5,780	2,650	4,340	2,110	139 J
Pyrene	29,000,000	--	402	94.2	105	1,640	8,280	85.7	63.1	379	5,490	1,870	3,610	1,770	147
Benzo(b)fluoranthene	2,100	--	485	91.0	107	2,020	8,010	87.7	85.4	378	4,440	2,300	3,560	1,690	7.49 J
Benzo(k)fluoranthene	21,000	--	409	88.6	101	1,230	7,260	80.7	64.0	331	3,660	1,270	3,240	1,620	5.34 J
Benzo(a)anthracene	2,100	--	320	62.9	74.4	1,390	6,580	61.6	48.4	263	3,610	1,590	2,810	1,500	16.4
Chrysene	210,000	--	393	83.2	98.7	1,650	8,190	83.4	64.0	357	4,510	1,850	3,600	1,720	24.3
Benzo(a)pyrene	210	125,000	445	104	110	1,660	7,790	85.1	74.5	376	4,920	1,880	3,610	1,840	8.08 J
Indeno(1,2,3-cd)pyrene	2,100	--	181	60.6	61.4	1,130	4,460	49.1 J	30.5	247	3,500	1,220	1,950	950	13.9 U
Dibenz(a,h)anthracene	210	--	64.2	18.2 J	20.4 J	394	1,530	16.7 J	10.9 J	73.3	1,060	427	662	322	13.9 U
Benzo(g,h,i)perylene	--	--	181	74.4	68.3	1,240	4,770	56.3	30.5	290	4,160	1,280	2,160	997	13.9 U

Sample Location:	Preliminary Screening Levels		S-37	S-38	S-39	S-40	S-41
Sample ID:			T4S1S-26	T4S1S-26A	T4S1S-26B	T4S1S-26C	T4S1S-26D
Sample Interval:	PRG	SLV	Note 12	Note 12	Note 12	Note 12	Note 12
Date Sampled:			8/26/2008	10/4/2008	9/12/2008	9/12/2008	9/4/2008
PAHs (µg/kg)							
Naphthalene	190,000	10,000	163 U	30.6 U	171 U	144 U	149
2-Methylnaphthalene	--	--	--	--	--	--	--
Acenaphthylene	--	--	163 U	30.6 U	171 U	144 U	149 U
Acenaphthene	29,000,000	20,000	163 U	30.6 U	171 U	866	761
Fluorene	26,000,000	30,000	163 U	30.6 U	171 U	973	662
Dibenzofuran	3,100,000	2	--	--	--	--	--
Phenanthrene	--	--	181	146	225	4,360	4,470
Anthracene	100,000,000	--	163 U	30.6 U	171 U	479	556
Fluoranthene	22,000,000	--	486	212	542	4,330	7,380
Pyrene	29,000,000	--	558	201	514	3,560	5,540
Benzo(b)fluoranthene	2,100	--	359	169	477	2,560	5,110
Benzo(k)fluoranthene	21,000	--	273	128	398	2,190	4,150
Benzo(a)anthracene	2,100	--	293	120	391	2,560	4,610
Chrysene	210,000	--	357	164	498	2,850	5,440
Benzo(a)pyrene	210	125,000	342	158	453	2,520	4,620
Indeno(1,2,3-cd)pyrene	2,100	--	231	114	318	1,710	2,770
Dibenz(a,h)anthracene	210	--	163 U	34.5	171 U	633	987
Benzo(g,h,i)perylene	--	--	278	141	372	1,780	2,860

Notes:

1. Only detected compounds are reported in the table. The complete analyte list is presented in the Sampling and Analysis Plan (Appendix A) of the RI Work Plan (Hart Crowser, 2004a).
2. PAHs = Polynuclear Aromatic Hydrocarbons by EPA Method 8270C (SIM).
3. µg/kg = Micrograms per kilogram.
4. PRG = EPA Region 9 Preliminary Remediation Goal (PRG) for Industrial Soil (October 2004).
5. -- = No screening level available or not analyzed.
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7. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
8. Shaded values indicate that the detected concentration exceeds the PRG.
9. Sample ID nomenclature is per the following: type of sample-sample number-depth in feet-designation. For example, T4S1SB-46-1-1 = soil boring (SB) number 46, collected 1 foot below the ground surface, primary sample (1). T4S1S-6 = surface soil sample number 6.
10. SLV = Oregon Department of Environmental Quality Level II Screening Level Values (SLVs) for Terrestrial Receptors (lowest available value).
11. Boxed values indicate that the detected concentration exceeds the SLV (only samples from 0 to 3 feet were screened against the SLV).
12. Sample is a 4-point composite collected at a depth of 0-1 foot below finish subgrade of the Wheeler Bay Stabilization project.

In general, the depth from finish grade to subgrade is 1 foot for two of the four composite subsamples and 2 feet for the other two composite subsamples.
The surface of the subgrade is delineated by a demarcation layer consisting of orange plastic mesh.

Table 5 - Subgrade Soil Samples: Pesticides
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Sample Location:	Preliminary Screening Levels		T4S1S-26	T4S1S-26A	T4S1S-26B	T4S1S-26C	T4S1S-26D	T4S1S-27	T4S1S-27A	T4S1S-27B	T4S1S-27C	T4S1S-27D
Sample ID:			T4S1S-26	T4S1S-26A	T4S1S-26B	T4S1S-26C	T4S1S-26D	T4S1S-27	T4S1S-27A	T4S1S-27B	T4S1S-27C	T4S1S-27D
Sample Interval:	PRG	SLV	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Sampled:			9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005
Pesticides (µg/kg)												
delta-BHC	--	--	1.04 U	1.37 U	6.87 U	1.39 U	7.70 U	1.02 U	6.78 U	1.35 U	1.37 U	1.37 U
Heptachlor	380	15,000	1.04 U	1.37 U	6.87 U	1.39 U	7.70 U	1.02 U	6.78 U	1.35 U	1.37 U	1.37 U
Heptachlor Epoxide	190	--	1.04 U	1.37 U	6.87 U	1.39 U	7.70 U	1.02 U	6.78 U	1.35 U	1.37 U	1.37 U
Aldrin	100	25,000	1.04 U	1.37 U	6.87 U	1.39 U	7.70 U	1.02 U	6.78 U	1.35 U	1.37 U	1.37 U
gamma-Chlordane	6,500	9,000	1.04 U	1.37 U	6.87 U	1.39 U	7.70 U	1.02 U	6.78 U	1.35 U	1.37 U	1.37 U
Endosulfan I	3,700,000	20,000	1.04 U	1.37 U	6.87 U	1.39 U	7.70 U	1.02 U	6.78 U	1.35 U	1.37 U	1.37 U
alpha-Chlordane	6,500	9,000	1.04 U	1.37 U	6.87 U	1.39 U	77.0 U	1.02 U	67.8 U	1.35 U	1.37 U	1.37 U
Dieldrin	110	300	0.761 J	1.37 U	68.7 U	1.39 U	77.0 U	2.04 U	67.8 U	1.35 U	1.37 U	1.37 U
4,4'-DDE	7,000	10	5.22	1.37 U	68.7 U	1.39 U	77.0 U	1.83 U	6.78 U	1.35 U	1.37 U	1.37 U
Endrin	180,000	40	2.09 U	1.37 U	6.87 U	1.39 U	7.70 U	2.04 U	67.8 U	1.35 U	1.37 U	1.37 U
4,4'-DDD	10,000	10	2.37	1.37 U	6.87 U	1.39 U	7.70 U	2.04 U	6.78 U	1.35 U	0.873 J	1.37 U
Endrin Aldehyde	--	--	2.09 U	1.37 U	6.87 U	1.39 U	77.0 U	2.04 U	67.8 U	1.35 U	1.37 U	1.37 U
4,4'-DDT	7,000	10	17.20	1.37 U	6.87 U	1.11 J	96.8	3.66	67.8 U	1.35 U	1.37 U	1.37 U
Endrin Ketone	--	--	2.09 U	1.37 U	6.87 U	1.39 U	77.0 U	2.04 U	67.8 U	1.35 U	1.37 U	1.37 U
Methoxychlor	3,100,000	500,000	2.09 U	1.37 U	68.7 U	1.39 U	77.0 U	2.04 U	67.8 U	1.35 U	1.37 U	1.37 U

Sample Location:	Preliminary Screening Levels		T4S1S-28	T4S1S-28A	T4S1S-28B	T4S1S-28C	T4S1S-28D	T4S1S-29	T4S1S-30	T4S1S-30A	T4S1S-30C	T4S1S-30D
Sample ID:			T4S1S-28	T4S1S-28A	T4S1S-28B	T4S1S-28C	T4S1S-28D	T4S1S-29	T4S1S-30	T4S1S-30A	T4S1S-30C	T4S1S-30D
Sample Interval:	PRG	SLV	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Sampled:			9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005
Pesticides (µg/kg)												
delta-BHC	--	--	1.01 U	1.03 U	1.02 U	1.02 U	1.01 U	1.03 U, D	1.03 U	1.03 U	1.01 U	1.04 U
Heptachlor	380	15,000	1.01 U	1.03 U	1.02 U	1.02 U	1.01 U	1.03 U, D	1.03 U	1.03 U	1.01 U	1.04 U
Heptachlor Epoxide	190	--	1.01 U	1.03 U	1.02 U	1.02 U	1.01 U	1.03 U, D	0.190 J	1.03 U	1.01 U	1.04 U
Aldrin	100	25,000	1.01 U	1.03 U	1.02 U	1.02 U	1.01 U	1.03 U, D	1.03 U	1.03 U	1.01 U	1.04 U
gamma-Chlordane	6,500	9,000	1.01 U	1.03 U	1.02 U	1.02 U	1.01 U	1.03 U, D	1.03 U	1.03 U	1.01 U	1.04 U
Endosulfan I	3,700,000	20,000	1.01 U	1.03 U	1.02 U	1.02 U	1.01 U	1.03 U, D	1.03 U	1.03 U	1.01 U	1.04 U
alpha-Chlordane	6,500	9,000	1.01 U	1.03 U	1.02 U	1.02 U	1.01 U	1.03 U, D	1.03 U	1.03 U	1.01 U	1.04 U
Dieldrin	110	300	2.03 U	2.06 U	0.274 J	2.05 U	0.808 J	2.06 U, D	0.397 J	0.896 J	2.02 U	0.381 J
4,4'-DDE	7,000	10	1.72 J	2.06 U	2.04 U	2.05 U	1.61 J	7.84 D	2.05 U	2.06 U	2.02 U	2.07 U
Endrin	180,000	40	2.03 U	2.06 U	2.04 U	2.05 U	2.01 U	2.06 U, D	2.05 U	2.06 U	2.02 U	2.07 U
4,4'-DDD	10,000	10	2.03 U	2.06 U	2.04 U	2.05 U	0.654 J	2.79 D	2.05 U	2.06 U	2.02 U	2.07 U
Endrin Aldehyde	--	--	2.03 U	2.06 U	2.04 U	2.05 U	2.01 U	2.06 U, D	2.05 U	2.06 U	2.02 U	2.07 U
4,4'-DDT	7,000	10	3.43	3.72	0.648 J	0.925 J	4.66	15.9 D	1.66 J	2.50	1.54 J	1.35 J
Endrin Ketone	--	--	2.03 U	2.06 U	2.04 U	2.05 U	2.01 U	2.06 U, D	2.05 U	2.06 U	2.02 U	2.07 U
Methoxychlor	3,100,000	500,000	2.03 U	2.06 U	2.04 U	2.05 U	2.01 U	2.06 U, D	2.05 U	2.06 U	2.02 U	2.07 U

Sample Location:	Preliminary Screening Levels		S-37	S-38	S-39	S-40	S-41
Lab ID:			K2406699-003	K2406699-003	K2406699-003	K2406699-003	K2406699-003
Sample Interval:			Note 12	Note 12	Note 12	Note 12	Note 12
Date Sampled:			8/26/2008	10/4/2008	9/12/2008	9/12/2008	9/4/2008
Pesticides (µg/kg)							
delta-BHC	--	--	--	--	--	--	--
Heptachlor	380	15,000	--	--	--	--	--
Heptachlor Epoxide	190	--	--	--	--	--	--
Aldrin	100	25,000	--	--	--	--	--
gamma-Chlordane	6,500	9,000	--	--	--	--	--
Endosulfan I	3,700,000	20,000	--	--	--	--	--
alpha-Chlordane	6,500	9,000	--	--	--	--	--
Dieldrin	110	300	--	--	--	--	--
4,4'-DDE	7,000	10	--	--	--	--	--
Endrin	180,000	40	--	--	--	--	--
4,4'-DDD	10,000	10	--	--	--	--	--
Endrin Aldehyde	--	--	--	--	--	--	--
4,4'-DDT	7,000	10	101	7.61 U	8.65 U	12.3	20.4
Endrin Ketone	--	--	--	--	--	--	--

Notes:

1. Only detected compounds are reported in the table. The complete analyte list is presented in the Sampling and Analysis Plan (Appendix A) of the RI Work Plan (Hart Crowser, 2004a).
2. Organochlorine Pesticides by EPA Method 8081A. Organophosphorus Pesticides by EPA Method 8141A.
3. µg/kg = Micrograms per kilogram.
4. PRG = EPA Region 9 Preliminary Remediation Goal (PRG) for Industrial Soil (October 2004).
5. -- = No screening level available or not analyzed.
6. J = The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
7. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
8. P = The GC or HPLC confirmation criterion was exceeded. The relative percent difference is greater than 40 percent between the two analytical results.
9. Sample ID nomenclature is per the following: type of sample-sample number-depth in feet-designation.
   For example T4S1SB-46-1-1 = soil boring (SB) number 46, collected 1 foot below the ground surface, primary sample (1). T4S1S-6 = surface soil sample number 6.
10. SLV = Oregon Department of Environmental Quality Level II Screening Level Values (SLVs) for Terrestrial Receptors (lowest available value).
11. Boxed values indicate that the detected concentration exceeds the SLV (only samples from 0 to 3 feet were screened against the SLV).
12. Sample is a 4-point composite collected at a depth of 0-1 foot below finish subgrade of the Wheeler Bay Stabilization project.

    In general, the depth from finish grade to subgrade is 1 foot for two of the four composite subsamples and 2 feet for the other two composite subsamples.
The surface of the subgrade is delineated by a demarcation layer consisting of orange plastic mesh.

Table 6 - Subgrade Soil Samples: Metals
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Sample Location:	Preliminary Screening Levels			T4S1S-26	T4S1S-26A	T4S1S-26B	T4S1S-26C	T4S1S-26D
Sample ID:				T4S1S-26	T4S1S-26A	T4S1S-26B	T4S1S-26C	T4S1S-26D
Sample Interval:	Background	PRG	SLV	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Sampled:				9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005
Metals (mg/kg)								
Antimony	5	410	5	0.0728 J	1.53 U	1.53 U	1.54 U	1.74 U
Arsenic	5.8	1.6	10	10.9	2.49	2.23	2.97	15.7
Beryllium	2.1	1,900	10	0.260 J	0.209 J	0.285 J	0.277 J	0.186 J
Cadmium	0.9	450	4	7.02	0.220 J	0.270 J	0.646	25.3
Chromium	26	450	0.4	16.4	12.3	14.5	15.2	23.6
Copper	34	41,000	50	78.1	12.0	14.0	16.9	219
Lead	17	800	16	479 D	7.78	12.6	43.6	868
Mercury	0.04	310	0.1	0.0947 J	0.126 U, D	0.131 U	0.130 U	0.325
Nickel	21	20,000	30	18.4	16.2	16.6	17.5	19.3
Selenium	0.8	5,100	1	0.286 J	0.184 J	0.163 J	0.159 J	0.407 J
Silver	0.6	5,100	2	1.16	0.511 U	0.509 U	0.123 J	2.10
Thallium	<5	67	1	0.0624 J	0.511 U	0.509 U	0.513 U	0.122 J
Zinc	95	100,000	50	949 D	55.7	64.0	127	3,320

Sample Location:	Preliminary Screening Levels			T4S1S-27	T4S1S-28	T4S1S-29D	T4S1S-30
Sample ID:				T4S1S-27	T4S1S-28	T4S1S-29	T4S1S-30
Sample Interval:	Background	PRG	SLV	0 - 1	0 - 1	0 - 1	0 - 1
Date Sampled:				9/13/2005	9/13/2005	9/13/2005	9/13/2005
Metals (mg/kg)							
Antimony	5	410	5	1.53 U	1.53 U	1.51 U	1.53 U
Arsenic	5.8	1.6	10	2.59	3.72	14.5	2.47
Beryllium	2.1	1,900	10	0.295 J	0.316 J	0.292 J	0.352 J
Cadmium	0.9	450	4	0.402 J	0.815	2.12	0.352 J
Chromium	26	450	0.4	16.0	16.6	23.8	16.8
Copper	34	41,000	50	16.7	19.5	38.5	17.0
Lead	17	800	16	30.4	88.8	276	41.8
Mercury	0.04	310	0.1	0.102 U	0.0261 J, D	0.0799 J	0.0340 J
Nickel	21	20,000	30	19.5	19.0	17.7	20.5
Selenium	0.8	5,100	1	0.229 J	0.295 J	0.347 J	0.250 J
Silver	0.6	5,100	2	0.509 U	0.0967 J	0.660	0.510 U
Thallium	<5	67	1	0.509 U	0.509 U	0.504 U	0.510 U
Zinc	95	100,000	50	112	181	328	91.4

See Notes on Last Page of Table

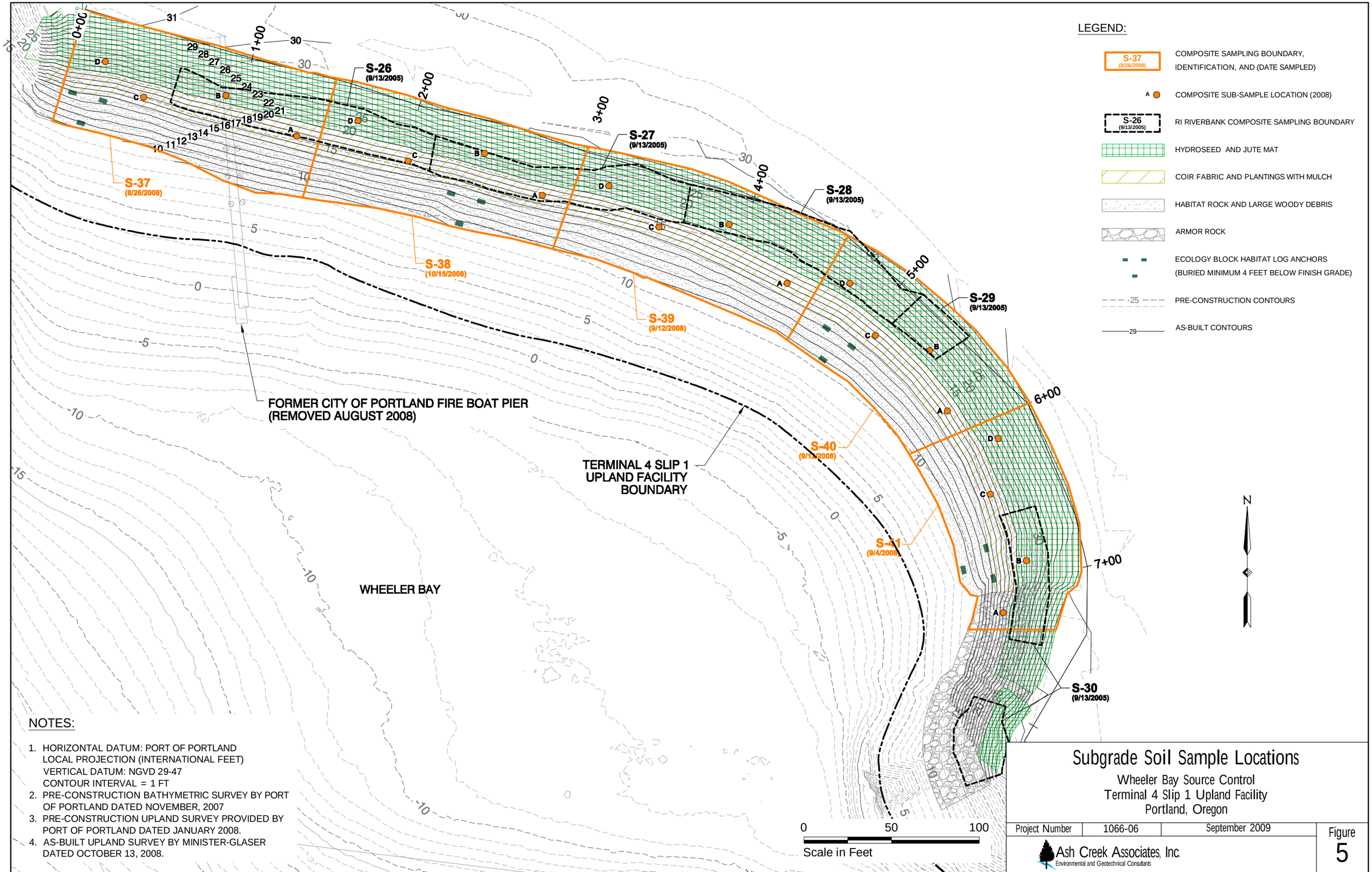
Table 6 - Subgrade Soil Samples: Metals
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Sample Location:	Preliminary Screening Levels			S-37	S-38	S-39	S-40	S-41
Sample Interval:		PRG	SLV	Note 13	Note 13	Note 13	Note 13	Note 13
Date Sampled:				8/26/2008	10/4/2008	9/12/2008	9/12/2008	9/4/2008
Metals (mg/kg)								
Antimony	5	410	5	--	--	--	--	--
Arsenic	5.8	1.6	10	8.83	4.44	3.95	5.02	4.78
Beryllium	2.1	1,900	10	--	--	--	--	--
Cadmium	0.9	450	4	1.86	0.545 U	0.637 U	0.742	0.998
Chromium	26	450	0.4	--	--	--	--	--
Copper	34	41,000	50	34.4	17.3	15.5	17.7	24.9
Lead	17	800	16	427	32.8	54.7	118	117
Mercury	0.04	310	0.1	--	--	--	--	--
Nickel	21	20,000	30	--	--	--	--	--
Selenium	0.8	5,100	1	--	--	--	--	--
Silver	0.6	5,100	2	--	--	--	--	--
Thallium	<5	67	1	--	--	--	--	--
Zinc	95	100,000	50	323	93.7	90.8	163	190

Notes:

1. All analytes are reported in the table.
2. Metals using EPA 6000-7000 Series Methods.
3. mg/kg = Milligrams per kilogram.
4. PRG = EPA Region 9 Preliminary Remediation Goal (PRG) for Industrial Soil (October 2004).
5. -- = No screening level available or not analyzed.
6. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
7. B = The result is an estimated concentration that is less than the MRL but greater than or equal to the method detection limit (MDL).
8. N = The matrix spike sample recovery is not within control limits. The case narrative suggests that soil samples digested with EPA
9. Method 3050 for antimony and lead was used which caused the laboratory to attribute the variability to the heterogeneous character of the sample.
10. Shaded values indicate that the detected concentration exceeds the background and PRG.
11. Background Levels are from the Washington Department of Ecology's publication Natural Background Soil Metals Concentrations in Washington State, dated October 1994. Values are the 90th percentile values for Clark County, except for antimony, selenium, silver and thallium where state-wide data were used due to a limited number of detections.
12. Boxed values indicate that the detected concentration exceeds background and the SLV (only samples from 0 to 3 feet were screened against the SLV).
13. Sample is a 4-point composite collected at a depth of 0-1 foot below finish subgrade of the Wheeler Bay Stabilization project.

In general, the depth from finish grade to subgrade is 1 foot for two of the four composite subsamples and 2 feet for the other two composite subsamples. The surface of the subgrade is delineated by a demarcation layer consisting of orange plastic mesh.



NOTES:

1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)
   VERTICAL DATUM: NGVD 29-47
   CONTOUR INTERVAL = 1 FT
2. PRE-CONSTRUCTION BATHYMETRIC SURVEY BY PORT OF PORTLAND DATED NOVEMBER, 2007
3. PRE-CONSTRUCTION UPLAND SURVEY PROVIDED BY PORT OF PORTLAND DATED JANUARY 2008.
4. AS-BUILT UPLAND SURVEY BY MINISTER-GLASER DATED OCTOBER 13, 2008.

Subgrade Soil Sample Locations

Wheeler Bay Source Control
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Project Number	1066-06	September 2009	Figure
Ash Creek Associates, Inc. Environmental and Geotechnical Consultants			5

Attachment C

Standard Operating Procedure 2.2

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods used for obtaining surface soil samples for physical and/or chemical analysis. For purposes of this SOP, surface soil (including shallow subsurface soil) is loosely defined as soil that is present within 3 feet of the ground surface at the time of sampling. Various types of sampling equipment are used to collect surface soil samples including spoons, scoops, trowels, shovels, and hand augers.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Spoons, scoops, trowels, shovels, and/or hand augers. Stainless steel is preferred.
- Stainless steel bowls
- Laboratory-supplied sample containers
- Field documentation materials
- Decontamination materials
- Personal protective equipment (as required by Health and Safety Plan)

3. METHODOLOGY

Project-specific requirements will generally dictate the preferred type of sampling equipment used at a particular site. The following parameters should be considered: sampling depth, soil density, soil moisture, use of analyses (e.g., chemical versus physical testing), type of analyses (e.g., volatile versus non-volatile). Analytical testing requirements will indicate sample volume requirements that also will influence the selection of the appropriate type of sampling tool. The project sampling plan should define the specific requirements for collection of surface soil samples at a particular site.

Collection of Samples

- Volatile Analyses. Surface soil sampling for volatile organics analysis (VOA) is different than other routine physical or chemical testing because of the potential loss of volatiles during sampling. To limit volatile loss, the soil sample must be obtained as quickly and as directly as possible. If a VOA sample is to collected as part of a multiple analyte sample, the VOA sample portion will be obtained first. The VOA sample should be obtained from a discrete portion of the entire collected sample and should not be composited or homogenized. Sample bottles should be filled to capacity, with no headspace. Specific procedures for collecting VOA samples using the EPA Method 5035 are discussed in SOP 2-7.

- Other Analyses. Once the targeted sample interval has been collected, the soil sample will be thoroughly homogenized in a stainless steel bowl prior to bottling. Sample homogenizing is accomplished by manually mixing the entire soil sample in the stainless steel bowl with the sampling tool or with a clean teaspoon or spatula until a uniform mixture is achieved. If packing of the samples into the bottles is necessary, a clean stainless steel teaspoon or spatula may be used.

General Sampling Procedure:

- Decontaminate sampling equipment in accordance with the Sampling and Analysis Plan (SAP) before and after each individual soil sample.
- Remove surface debris that blocks access to the actual soil surface or loosen dense surface soils, such as those encountered in heavy traffic areas. If sampling equipment is used to remove surface debris,

the equipment should be decontaminated prior to sampling to reduce the potential for sample interferences.

- When using a hand auger, push and rotate downward until the auger becomes filled with soil. Usually a 6- to 12-inch long core of soil is obtained each time the auger is inserted. Once filled, remove the auger from the ground and empty into a stainless steel bowl. If a VOA sample is required, the sample should be taken directly from the auger using a teaspoon or spatula and/or directly filling the sample container from the auger. Repeat the augering process until the desired sample interval has been augered and placed into the stainless steel bowl.

Backfilling Sample Locations:

Backfill in accordance with federal and state regulations including OAR 690-240 (e.g., bentonite requirements). The soils from the excavation will be used as backfill unless project-specific or state requirements include the use of clean backfill material.