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DATA REPORT
2019 FORMER TERMINAL 22T SEDIMENT INVESTIGATION PORTLAND, OREGON

by
Haley & Aldrich, Inc.
San Diego, California

for
Atlantic Richfield Company/BP Products North America Inc.
La Palma, California

File No. 129768-003
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10 February 2020
File No. 129768-003

Kyle Christie
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An Affiliate of Atlantic Richfield Company
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Subject: Data Report
2019 Former Terminal 22T Sediment Investigation
Portland, Oregon

Dear Mr. Christie:

Haley & Aldrich, Inc. (Haley & Aldrich) has prepared this Former Terminal 22T Sediment Investigation Data Report to describe activities completed and data collected in July 2019 adjacent to the Former Terminal 22T in Portland, Oregon (Terminal). These activities were conducted immediately prior to the 2019 maintenance dredging and capping project performed SeaPort Midstream Partners, LLC, the current owners of the Terminal. These data comply with the data quality objectives (DQOs) of the Portland Harbor Superfund Site and are suitable for use in any future remedial design activities at the Terminal.

This transmittal includes the final as-built construction drawings in Appendix H.

Sincerely yours,
HALEY & ALDRICH, INC.

Laura McWilliams, PhD
Senior Technical Specialist

Enclosures

c: Steve Goodman and Nicole McLaughlin, Miller Nash Graham & Dunn LLP

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1. Introduction

On behalf of Atlantic Richfield Company/BP Products North America Inc. (ARC/BP)[1], Haley & Aldrich, Inc. (Haley & Aldrich) has prepared this report, presenting the results of its July 2019 sediment investigation, which consisted of collecting and analyzing surface and subsurface sediment samples collected offshore from ARC/BP's former Terminal 22T (Terminal)[2]. The Terminal is located at approximately river mile (RM) 5 on the western bank of the Willamette River (Figure 1). The sediments are within the Portland Harbor Superfund Site, and therefore, all sampling and analyses were conducted is accordance with procedures (AECOM and Geosyntec, 2018a,b) previously approved by the United States Environmental Protection Agency (EPA).

The Portland Harbor Record of Decision (ROD) identifies the existence of a sediment management area (SMA) adjacent to the Terminal; however, defining the lateral extent of the SMA (as with all SMAs identified in the ROD) will require greater sample density (EPA, 2017). Limited additional sampling occurred during the 2018 Pre-Design Investigation (PDI; AECOM and Geosyntec, 2019a,b), but the sample density was still less than that which will be required for remedial design.

Prior to SeaPort Midstream Partners, LLC's (SMP's) 2019 maintenance dredge and cap project at the Terminal, ARC/BP collected higher density sediment samples prior to installation of the protective cap which now isolates a large portion of the sediment between the Terminal's dock and the navigation channel. The 1-foot thick cap was designed in accordance with the ROD's capping requirements (described in section 3.2.2) and includes an isolation layer, carbon amendment to prevent dissolved-phase contamination from migrating into the water column, and armor stone to prevent cap disturbance by prop wash or storm events. ARC/BP's collection of surface and subsurface data satisfies EPA's data quality objectives[3] (DQOs) for Portland Harbor.

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[1] Effective 31 December 2019, BP West Coast Products LLC was merged into BP Products North America Inc. which is the successor-by-merger to BP West Coast Products LLC.
[2] In 2017 SeaPort Midstream Partners, LLC purchased the Terminal and currently owns the Terminal.
[3] At the time when this work was executed, the EPA had not yet published its Remedial Design Guidelines for Portland Harbor (EPA, 2019a). The surface and subsurface sample spacing was designed to match EPA's approved pre-design sampling for the River Mile 11 E Project Area (GSI and DOF, 2018;2019). Analytical methods and DQOs were in accordance with the Program Data Management Plan for Portland Harbor (EPA, 2018).

2. Investigation Activities

All sampling and analysis activities were conducted in accordance with the work plan provided in Appendix A. All sampling procedures and methods were consistent with those employed during the Portland Harbor pre-design investigation (PDI) sampling (AECOM and Geosyntec, 2018a,b), with the exception that grab samples were a single point grab rather than a three-point composite.

2.1 SEDIMENT SAMPLING

2.1.1 Grab Sample Collection and Processing

A total of 23 surface grab samples were collected, consistent with the EPA-approved Portland Harbor PDI and RI/FS protocol. Locations are shown in Figure 2. Field collection forms can be found in Appendix B. The target sample interval for all samples was 0 to 30 centimeters (cm) below sediment surface (bss), with 25 cm penetration specified as the acceptance criterion. However, at several of the stations, penetration of 25 cm was not reached, even after multiple attempts. At these stations, the grab sample with the deepest penetration and for which the sampler jaws closed was retained for sampling.

To facilitate description of any layering within the surface sediment, a polyethylene cylinder was used to extract a mini-core from each grab sample, as shown in some of the photographs in Appendix B. After the sediment description was recorded, the top 30 cm of sediment (or the full depth of the grab sample in cases where penetration was less than 30 cm) was homogenized and placed in laboratory-supplied sampling containers. Station locations, penetration depths, and sampling intervals are listed in Table 1. The containers were packed on ice and delivered to the analytical laboratory following the sampling procedures and quality assurance/quality control procedures outlined in the Appendix A. A field duplicate sample was collected at station SG-11. An equipment rinsate blank was collected from a decontaminated mini-core cylinder after collecting the sample from Station SG-01.

2.1.2 Vibracore Collection and Processing

Vibracores were collected from three stations, as shown in Figure 2. Transparent 4-inch inner diameter core barrels were used so that recovery length could be measured at the time of collection to determine acceptability of the core (as outlined in Appendix A). For each vibracore attempt, station coordinates, mudline elevation, and barrel penetration depth was recorded on the core collection forms included in Appendix C. At stations VB-01 and VB-02, three vibracores were advanced in an effort to achieve the target penetration of 14 $\pm$ 2 feet. At these two stations, the core with the deepest penetration was retained for logging and sampling. At station VB-03, the target penetration was achieved on the first attempt.

After collection, sediment cores were transported to and processed on a stationary dock. Cores were removed from the core barrels and placed in a holding rack where recovery length and percentage were measured and documented prior to cutting open the core liners. Core sections were then opened, photographed, and logged. Recovered core depths were expanded vertically such that the recovered sediment column is assumed to represent the entire penetration interval with uniform dewatering/ compression.

Sediment cores were logged in accordance with ASTM Method D2488-06 (ASTM, 2007). Cores were logged by Lance Downs of Advanced Remediation Technologies, Inc., an Oregon-licensed Professional Geological Engineer with experience in logging Portland Harbor sediment cores. Core logs recorded, at the minimum: type, color, density/consistency, structure, particle size, odor, and any other notable characteristics. Additional characteristics included: shell fragments, wood chips, living organisms or abandoned organism shells, and the presence of any man-made debris. These characteristics and the depths at which they occurred were recorded on the sediment core logs included in Appendix C.

As described in the Work Plan (Appendix A) each core was segmented into approximately 2-foot intervals, adjusted based on field observations of lithologic changes or sheens and/or odors. Station locations, penetration depths, and sampling intervals are listed in Table 1. For each sample, a representative sediment volume from throughout the interval was collected, homogenized, and placed in laboratory-supplied containers. The containers were packed on ice and delivered to the analytical laboratory following the sampling procedures and quality assurance/quality control procedures outlined in Appendix A. A field duplicate sample was collected from 4 to 6 feet below sediment surface (ft bss) at station VB-03. An equipment rinsate blank was collected from a decontaminated core barrel and core catcher after collecting vibracore VB-01.

2.2 ANALYTICAL METHODS

All of the sediment samples were analyzed for the focused contaminants of concern for which remedial action levels (RALs) were established in the Portland Harbor Record of Decision (ROD; EPA, 2017). The compounds with RALs include: total polycyclic aromatic hydrocarbons (PAHs); total polychlorinated biphenyls (PCBs); total concentration of dichlorodiphenyltrichloroethane and its derivatives (DDx); 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD); 1,2,3,7,8-Pentachlorodibenzodioxin (1,2,3,7,8-PeCDD); and 2,3,4,7,8-Pentachlorodibenzofuran (2,3,4,7,8-PeCDF). All sediment samples were analyzed for these compounds, as well as total organic carbon (TOC), and percent solids so that results can be reported on a dry weight basis. Additionally, selected samples (see Table 1) with total PAH concentrations exceeding the revised total PAH RAL as established in the Explanation of Significant Differences (ESD; EPA, 2019b) were analyzed for an expanded list of PAHs including the alkylated PAH homologues. Analytical methods, target lists, supporting method detection limits, and nominal reporting limits were included in the work plan (Appendix A).

Laboratory analytical reports are included in Appendix D, and the data validation report can be found in Appendix E. Validated analytical results are presented in Tables 2 (surface samples) and 3 (subsurface samples).

2.3 DEVIATIONS FROM WORK PLAN

Deviations from the Sediment Investigation Work Plan (Appendix A) include:

- Two additional surface sediment grab samples were collected, for a total of 23.
- At surface sediment stations SG-01, SG-02, SG-03, and SG-08, a penetration of 25 cm was not reached, even after multiple attempts. At these stations, the grab sample with the deepest penetration and for which the sampler jaws closed was retained for sampling.

- After three vibracoring attempts each at stations VB-01 and VB-02, the target penetration of 14 ± 2 ft was not achieved. At each of these stations, the core with the deepest penetration was retained for logging and sampling.
- All sample intervals (rather than a subset) from each core were analyzed for TOC, priority pollutant PAHs, DDx, PCBs, and dioxin/furans.

- No samples were analyzed for metals.

2.4 INVESTIGATION DERIVED WASTE DISPOSAL

On August 2, 2019 one partially filled 55-gallon drum of river sediment/river water and one partially filled 55-gallon drum of decontamination water/soap, and river water were transported by Belshire Environmental Services, Inc. to the Chemical Waste Management of Northwest facility in Arlington, Oregon and disposed of as non-hazardous waste. Disposal documentation is included in Appendix

2.5 DATA QUALITY ASSESSMENT AND ASSURANCE

The quality assurance (QA) program includes quality control (QC) measures implemented for each critical project element:

- Field QC:
  - Accurate location of sampling stations;
  - Collection of representative sediment samples;
  - Prevention of sample misidentification; and
  - Collection of field QC for measures of sampling variability and potential cross-contamination.
- Laboratory QC:
  - Implementation of standard operating procedures and accepted protocols;
  - Laboratory controls and reference standards; and
  - Measures of accuracy, precision, and potential laboratory contamination.
- Data Validation:
  - Third-party review of analytical laboratory QC measures; and
  - Qualification of chemical data as warranted to document any additional uncertainty.

2.5.1 Field Quality Control

Target coordinates for the proposed sampling stations were chosen for the Work Plan. Field staff used these coordinates to get as close as possible to the proposed location during the field events, and then exact GPS coordinates were recorded upon sample collection. Along with the coordinates of each sampling attempt, water depth was also recorded to calculate mudline elevations.

Sediment samples were collected to achieve the most representative example of site conditions. Sample collection forms and vibracore logs were completed by the field staff and are provided in Appendices B and C. Samples were transported to the chemistry laboratory within specified hold times and under the proper preservation protocols.

Sample misidentification was mitigated by a strict sampling and field form process. All cores were examined to ensure acceptable core recovery prior to being processed. The cores were then split, logged, and transported to sample containers and immediately labeled. The labeled sample containers were inspected as part of the process of preparing chain-of-custody (COC) forms to avoid discrepancies between the two forms of identification. COC forms were reviewed before shipment. Upon delivery to the laboratory, the samples were logged into the laboratory information management system (LIMS) and a sample receipt form was sent to the Haley & Aldrich data manager. The data manager then completed a 100-percent review of the login form versus the COC to identify any discrepancies to be resolved.

Field quality control samples were collected to measure sampling variability and potential cross-contamination. Per the Work Plan, a field duplicate was collected at a rate of 5 percent of the sediment samples collected. The results were then compared to the primary sample data during validation to measure sample variability. These samples were identified by adding a "-D" to the end of the station ID (i.e., 22T-SG-11-D_20190716). Two equipment blanks were also collected to evaluate decontamination of sampling equipment. The results from these samples were then used during validation to qualify all data from that matrix if it was determined that the sampling process may have introduced contamination. Details can be found in the validation report in Appendix E prepared by Haley & Aldrich. The data validator was not involved in the sampling design or field investigation, thereby maintaining the requirement of review by an independent party.

2.5.2 Laboratory Quality Control

Sediment samples were sent to Eurofins TestAmerica of Tacoma Washington, which is a National Environmental Laboratory Accreditation Program certified laboratory. All appropriate laboratory standard operating procedures (SOPs) were followed for the requested methods. TestAmerica's sample analysis was supported by various forms of quality control, including method blanks, laboratory control samples, matrix spikes, and laboratory duplicates. Reference standards were used for spiking surrogates into each sample, laboratory control samples in each analysis batch, and matrix spikes when volumes allowed. Quality assurance procedures used were consistent with the methods described in the Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (EPA SW-846), Third Edition, Updated I – IV, 2007 and in the Standard Methods for the Examination of Water and Wastewater (APHA-AWWA-WEF).

- Method Blanks – Blank samples were prepared by the analytical laboratory and analyzed concurrently with the project samples to assess possible laboratory contamination.

- Laboratory Control Samples (LCS/LCSD) – Blank samples were spiked by the analytical laboratory with all analytes reported for the site samples to evaluate the performance of the entire analytical system, including preparation and analysis. Percent recovery of the compounds identifies analytical accuracy, while a comparison between an LCS and an LCSD (duplicate) will provide a review of the analytical precision.

- Matrix Spike Samples (MS/MSD) – A portion was taken of a submitted project-specific sample (provided there was enough additional volume) and spiked with all analytes reported for the project samples to determine the effect of the sample matrix on compound recovery. Percent recovery of the compounds identifies analytical accuracy with respect to matrix, while a comparison between an MS and an MSD (duplicate) provides a review of the analytical precision for the matrix.

- Laboratory Duplicate – A second aliquot of a homogenized sample was prepared in the laboratory and analyzed along with the first aliquot to measure precision associated with laboratory sample preparation and analysis.

- Surrogates – Compounds that reflect the chemistry of target analytes were added to samples for PAH analyses to monitor the effect of the sample matrix on compound recovery.

2.5.3 Data Validation

Analytical results were reviewed by Haley & Aldrich to determine the data usability. Each laboratory data package was reviewed under Level II guidelines, using the latest guidance provided by the USEPA, and also as referenced in the Work Plan. All data were reviewed at a minimum of a Level II review. The following QA/QC criteria from the analysis of the project samples were reviewed for all samples (Level II):

- Sample preservation and holding time compliance;
- Detection limits and reporting basis;
- Dioxin/Furan EMPC assessment;
- Field/method/equipment blank sample analysis;
- System monitoring compound recovery compliance;
- MS/MSD recovery and precision compliance;
- LCS recovery compliance;
- Duplicate sample analysis precision; and
- Proper use of laboratory data qualifiers.

Consistent with the PDI quality assurance project plan (QAPP; AECOM and Geosyntec, 2018 a,b), ten percent of data were reviewed at a higher Level IV review. The following additional QA/QC criteria from the analysis of the project samples were reviewed for a subset of the samples (Level IV):

- Initial calibration;
- Continuing calibration;
- Instrument performance and sample cleanup checks;
- Internal standards;
- Sample standards and calibration raw data; and
- Instrument run logs.

Maximum allowable holding times for each parameter were measured from the time of sample collection to the time of sample preparation or analysis for each project sample. Remaining volume was stored frozen to extend the hold time for potential additional analysis.

As described in Section 2.1, equipment blanks were prepared to identify contamination that may have been introduced during field activity. Two equipment blanks were called for in the Work Plan; one for the delineation sample collection equipment used on the sampling vessel (e.g, vibracore barrel and shoe) and another for the tools used for grab sample collection (mini-core tube). 22T-VB-01-RB-BRL_20190717 is associated with the vibracore sediment samples. 22T-SG-01-RB-CR_20190718 is associated with the grab sediment samples. Method blanks were prepared by the analytical laboratory and analyzed concurrently with the project samples to assess possible laboratory contamination. Sample results that were qualified with a "U" as a result of detections noted in blank samples indicate the detection was most likely due to laboratory or field contamination and was not indicative of field sample conditions as noted in the data validation report in Appendix E. These results are either reported to the laboratory reporting limit or to the reported value based on professional judgement by Haley & Aldrich.

System monitoring/surrogate compounds were added to each sample prior to the analysis of volatile methods. The efficiency of the sample preparation procedure was evaluated by ensuring the calculated recovery for each surrogate compound fell within the laboratory-specific quality control criteria.

Analytical precision and accuracy were evaluated based on the laboratory control and matrix spike sample analyses performed concurrently with the project samples or based on field duplicates.

Sample data were qualified by the laboratory in accordance with the laboratory SOP. Based on a check of the data qualifiers assigned to the project sample results, these were applied to the reported results in accordance with the laboratory-specific SOP. The results presented in each laboratory report were found to be compliant with the data quality objectives for the project and usable, with the few exceptions noted in Appendix E.

2.6 DATA REPORTING CONSISTENT WITH EPA GUIDANCE

Analytical methods and data management have been consistent with the Program Data Management Plan for the Portland Harbor Superfund Site (EPA, 2018). Appendix G includes electronic files suitable for upload to the Scribe.Net repository, after review by the EPA.

3. Investigation Results

3.1 SURFACE SEDIMENT

Surface sediment analytical results are presented in Table 2. Total DDx is calculated by summing all detected concentrations plus 1/2 the reporting limit for non-detects. Similarly, total PAHs were calculated based on the 17 compounds used for the Portland Harbor Remedial Investigation and Feasibility Study (RI/FS; EPA, 2016a,b) by summing all detected concentrations plus 1/2 the reporting limit for non-detects. The laboratory inadvertently reported an 18th PAH (1-methylnapthalene) which is reported on the table, but not included in the sum. Since the PCBs were analyzed as Aroclors, total PCB content was calculated by summing detected concentrations only.

Peach highlighting in Table 2 indicates exceedance of the associated RAL. During the initial analysis, six surface sediment samples had total PAH concentrations exceeding 30,000 μg/kg (EPA, 2019b). These samples were subsequently analyzed for the extended list of PAHs with the primary objective of producing data for use in PAH source fingerprinting. These results are included in Table 2, along with a second total PAH concentration calculated using the results for the 17 PAHs, as reported in the second analysis. In the second analysis, three of the six samples had total PAH concentrations exceeding 30,000 μg/kg.

3.2 SUBSURFACE SEDIMENT

Table 3 presents the analytical results from the subsurface samples. Summing conventions are identical to those used for the surface samples (Section 3.1). During the initial analysis, eight subsurface sediment samples had total PAH concentrations exceeding 30,000 μg/kg, six of which were analyzed for the extended list of PAHs for use in PAH source fingerprinting. In the second analysis, five of the six samples had total PAH concentrations exceeding 30,000 μg/kg.

3.3 SEDIMENT RESULTS RELATIVE TO 2008 AND 2019 CONSTRUCTION PROJECTS

3.3.1 2008 Source Control Measure Project

Between 2004 and 2008, three source control measures (SCMs) took place at the Terminal. These included improvements to the Terminal's hydraulic (groundwater) control system, the installation of a shoreline sheet pile seawall, and the excavation of impacted sediment riverward of the new seawall (URS, 2007;2009). After removal, the nearshore sediment elevations were reconstructed by placement of a minimum of three feet and up to nine feet of clean backfill (URS, 2009). The SCM dredge/backfill footprint is shown in Figure 3.

In 2011, three years after completion of the SCMs, ten surface samples were collected from within the sediment excavation SCM footprint, as well as two upstream and two downstream surface samples. All samples had very low contaminant concentrations, demonstrating that the sediment surface within the sediment excavation SCM footprint is unimpacted (URS, 2012).

3.3.2 2019 Dredging and Capping Project

Shortly after the 2019 sediment samples were collected, SMP completed a maintenance dredging project riverward of the dock, followed by the installation of an armored cap. Appendix H includes the final post-construction engineering drawings that document the dredge cut and cap construction.

Appendix I includes regulator comments during design development, the final construction permit application, and associated agency approvals. Because of the project's location within the Portland Harbor Superfund Site, the permit was reviewed and approved by the Portland Sediment Evaluation Team (PSET). Reviewing agencies included the EPA, the United States Army Corps of Engineers (USACE), the Oregon Department of Environmental Quality (DEQ), and the Oregon Department of State Lands (DSL).

The permit application contains a detailed discussion of the cap design, including the following components:

1. CapSim modeling to ensure sufficient reactive carbon content to avoid dissolved-phase contaminant breakthrough even under worst-case sediment contaminant concentrations;
2. Slope stability analysis, including earthquake analysis;
3. Propeller wash analysis of armoring stone; and
4. Incorporation of biologically-friendly substrate where possible without sacrificing cap performance.

Although the cap incorporates all ROD requirements, the as-built construction diagrams refer to the cap as "temporary" to reflect the fact that the Portland Harbor Remedial Design/Remedial Action process is ongoing and the cap has not been designated as a comprehensive final remedy. It is anticipated that the cap will become part of the final remedy when the process is concluded.

The cap covers the entire dredged area, plus the western sidewall of the dredge cut. As a result, the capped area is slightly larger than the dredge footprint. Figure 3 shows the as-built dredge and cap footprints.

3.3.3 Surface Sediment Samples Outside of Final Cap Footprint

Samples that represent surface sediment remaining in place following both the 2008 and 2019 construction projects are shown in Figure 3.

4. Conclusion

This investigation was successful in collecting surface and subsurface data adjacent to the Terminal from within the 2019 dredge/cap footprint prior to the 2019 construction project. The data complies with Portland Harbor DQOs and is of suitable density such that the 2019 cap does not need to be disturbed to collect additional samples. The data are suitable for use in remedial design activities at the Portland Harbor Superfund Site.

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14. URS, 2009. Interim Construction Report, Revetment Source Control Measure, BP Bulk Terminal 22T, Portland, Oregon. March.

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TABLES

TABLE 1
STATION LOCATIONS, SAMPLES, and ANALYSES
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

Station	Northing[a]	Easting[a]	Latitude (WGS84)	Longitude (WGS84)	Date	Water Depth (feet)	Mudline Elevation (ft MLLW)	Pentration (feet)	Sample Name	Sample Top Depth (feet)	Sample Bottom Depth (feet)	Sample Top Elevation (ft MLLW)	Sample Bottom Elevation (ft MLLW)	Analyses	Sample Represents Sediment Excavated in 2019	Sample Represents Sediment Capped in 2019
SG-01	710785.1	7619165.7	45.59374638 N	122.77758103 W	7/18/2019	33.9	-32.1	0.6	22T-SG-01	0.0	0.6	-32.1	-32.7	Focused COCs		
SG-02	710850.3	7619109.3	45.59392079 N	122.77780869 W	7/18/2019	19.0	-16.2	0.3	22T-SG-02	0.0	0.3	-16.2	-16.5	Focused COCs	Yes	NA
SG-03	710908.0	7619057.8	45.5940751 N	122.77801604 W	7/18/2019	12.0	-9.4	0.4	22T-SG-03	0.0	0.4	-9.4	-9.8	Focused COCs		
SG-04	711014.5	7618997.8	45.59436241 N	122.77826223 W	7/18/2019	10.0	-7.7	1.0	22T-SG-04	0.0	1.0	-7.7	-8.7	Focused COCs & Alk PAHs		
SG-05	711117.0	7618941.6	45.59463885 N	122.77849286 W	7/18/2019	11.5	-9.4	0.9	22T-SG-05	0.0	0.9	-9.4	-10.3	Focused COCs & Alk PAHs		
SG-06	711210.8	7618861.7	45.59488997 N	122.77881503 W	7/18/2019	6.7	-4.6	1.0	22T-SG-06	0.0	1.0	-4.6	-5.6	Focused COCs & Alk PAHs		
SG-07	711331.2	7618791.0	45.59521463 N	122.77910454 W	7/18/2019	7.9	-5.9	0.9	22T-SG-07	0.0	0.9	-5.9	-6.8	Focused COCs		
SG-08	711398.3	7618739.6	45.59539455 N	122.77931266 W	7/18/2019	4.5	-2.6	0.8	22T-SG-08	0.0	0.8	-2.6	-3.4	Focused COCs		
SG-09	711485.9	7618730.8	45.59563412 N	122.77935652 W	7/18/2019	11.3	-9.5	1.0	22T-SG-09	0.0	1.0	-9.5	-10.5	Focused COCs & Alk PAHs		
SG-10	710888.1	7619173.8	45.59402927 N	122.77756074 W	7/16/2019	30.0	-29.4	1.1	22T-SG-10	0.0	1.0	-29.4	-30.4	Focused COCs		
SG-11	711097.4	7619019.0	45.59459121 N	122.7781885 W	7/16/2019	33.7	-31.6	0.8	22T-SG-11 22T-SG-11-D	0.0	0.8	-31.6	-32.4	Focused COCs	Yes	NA
SG-12	711151.0	7618974.7	45.59473476 N	122.7783672 W	7/16/2019	32.7	-30.8	1.1	22T-SG-12	0.0	1.0	-30.8	-31.8	Focused COCs	Yes	NA
SG-13	711204.8	7618984.9	45.59488315 N	122.7783333 W	7/16/2019	37.2	-35.9	1.2	22T-SG-13	0.0	1.0	-35.9	-36.9	Focused COCs	Yes	NA
SG-14	711272.4	7618947.4	45.59506539 N	122.77848726 W	7/16/2019	39.8	-37.9	1.0	22T-SG-14	0.0	1.0	-37.9	-38.9	Focused COCs		
SG-15	711372.9	7618889.2	45.59533638 N	122.77872549 W	7/16/2019	42.8	-40.8	1.2	22T-SG-15	0.0	1.0	-40.8	-41.8	Focused COCs		
SG-16	711507.2	7618773.2	45.59569562 N	122.7791934 W	7/16/2019	27.7	-27.2	1.0	22T-SG-16	0.0	1.0	-27.2	-28.2	Focused COCs & Alk PAHs		
SG-17	710932.8	7619103.0	45.59414654 N	122.77784211 W	7/16/2019	29.8	-27.4	1.0	22T-SG-17	0.0	1.0	-27.4	-28.4	Focused COCs	Yes	NA
SG-18	711014.8	7619053.5	45.59436737 N	122.77804459 W	7/16/2019	31.6	-29.4	1.0	22T-SG-18	0.0	1.0	-29.4	-30.4	Focused COCs	Yes	NA
SG-19	711213.4	7618933.2	45.59490256 N	122.77853637 W	7/16/2019	32.9	-31.1	1.2	22T-SG-19	0.0	1.0	-31.1	-32.1	Focused COCs	Yes	NA
SG-20	711306.9	7618873.8	45.59515439 N	122.77877836 W	7/16/2019	31.1	-29	1.2	22T-SG-20	0.0	1.0	-29.00	-30.0	Focused COCs	Yes	NA
SG-21	711419.3	7618805.8	45.59545719 N	122.77905661 W	7/16/2019	27.4	-26.9	1.2	22T-SG-21	0.0	1.0	-26.9	-27.9	Focused COCs & Alk PAHs	Yes	NA
SG-22	711079.0	7619054.8	45.59454343 N	122.77804651 W	7/16/2019	34.7	-33.6	1.2	22T-SG-22	0.0	1.0	-33.6	-34.6	Focused COCs	Yes	NA
SG-23	710983.0	7619120.9	45.59428535 N	122.77777773 W	7/16/2019	33.7	-32.9	1.2	22T-SG-23	0.0	1.0	-32.9	-33.9	Focused COCs	Yes	NA
VB-01	710824.5	7619191.1	45.59385638 N	122.7774863 W	7/17/2019	43.9	-41.7	8.0	22T-VB-01-0.0-2.5	0.0	2.5	-41.7	-44.2	Focused COCs		
									22T-VB-01-2.5-4.0	2.5	4.0	-44.2	-45.7	Focused COCs		
									22T-VB-01-4.0-5.8	4.0	5.8	-45.7	-47.5	Focused COCs		
									22T-VB-01-5.8-8.0	5.8	8.0	-47.5	-49.7	Focused COCs		

TABLE 1
STATION LOCATIONS, SAMPLES, and ANALYSES
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

Station	Northing[a]	Easting[a]	Latitude (WGS84)	Longitude (WGS84)	Date	Water Depth (feet)	Mudline Elevation (ft MLLW)	Pentration (feet)	Sample Name	Sample Top Depth (feet)	Sample Bottom Depth (feet)	Sample Top Elevation (ft MLLW)	Sample Bottom Elevation (ft MLLW)	Analyses	Sample Represents Sediment Excavated in 2019	Sample Represents Sediment Capped in 2019
VB-02	711428.8	7618841.0	45.59548612 N	122.77892 W	7/17/2019	38.5	-39.9	10.5	22T-VB-02-0.0-1.5	0.0	1.5	-39.9	-41.4	Focused COCs		
									22T-VB-02-1.5-3.0	1.5	3.0	-41.4	-42.9	Focused COCs		
									22T-VB-02-3.0-5.0	3.0	5.0	-42.9	-44.9	Focused COCs		
									22T-VB-02-5.0-7.0	5.0	7.0	-44.9	-46.9	Focused COCs		
									22T-VB-02-7.0-8.8	7.0	8.8	-46.9	-48.7	Focused COCs & Alk PAHs		
									22T-VB-02-8.8-10.5	8.8	10.5	-48.7	-50.4	Focused COCs		
VB-03	711113.2	7618986.6	45.59463197 N	122.7783166 W	7/17/2019	29.0	-26.9	12.0	22T-VB-03-0.0-2.0	0.0	2.0	-26.9	-28.9	Focused COCs	Yes	NA
									22T-VB-03-2.0-4.0	2.0	4.0	-28.9	-30.9	Focused COCs & Alk PAHs	Yes	NA
									22T-VB-03-4.0-6.0 22T-VB-03-4.0-6.0-D	4.0	6.0	-30.9	-32.9	Focused COCs & Alk PAHs	Yes	NA
									22T-VB-03-6.0-8.0	6.0	8.0	-32.9	-34.9	Focused COCs	Yes	NA
									22T-VB-03-8.0-9.0	8.0	9.0	-34.9	-35.9	Focused COCs & Alk PAHs		Yes
									22T-VB-03-9.0-11.2	9.0	11.2	-35.9	-38.1	Focused COCs		Yes
									22T-VB-03-11.2-12.0	11.2	12.0	-38.1	-38.9	Focused COCs & Alk PAHs		Yes

Notes:

Yellow highlighting = Sample excavated during 2019 Construction Project
Peach highlighting = Sample capped during 2019 Construction Project
NA = not applicable (sediment excavated prior to capping)
[a]NAD 1983 HARN State Plane Oregon North Feet
ft MLLW = feet below mean lower low water, Columbia River Datum (CRD) as measured at the Morrison Street Bridge
WGS84 = Wold Geodetic System 1984 datum
Focused COCs = focused chemicals of concern identified in the Portland Harbor ROD (EPA, 2017)
Alk PAHs = parent and alkylated polycyclic aromatic hydrocarbons

TABLE 2
SURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

		Location	SG-01	SG-02	SG-03	SG-04	SG-05	SG-06	SG-07	SG-08	SG-09	SG-10	SG-11	
		Sample Date	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/16/2019	07/16/2019	07/16/2019
		Sample Depth	0.0-0.6	0.0-0.3	0.0-0.4	0.0-1.0	0.0-0.9	0.0-1.0	0.0-0.9	0.0-0.8	0.0-1.0	0.0-1.0	0.0-0.8	0.0-0.8
		Lab Sample ID	580-87761-27	580-87761-19	580-87761-20	580-87761-21	580-87761-22	580-87761-23	580-87761-24	580-87761-25	580-87761-26	580-87706-13	580-87706-3	580-87706-4
		Sample Type	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Duplicate
		Mudline (ft MLLW)	-32.1	-16.2	-9.4	-7.7	-9.4	-4.6	-5.9	-2.6	-9.5	-29.4	-31.6	-31.6
		Top of Elevation (ft MLLW)	-32.1	-16.2	-9.4	-7.7	-9.4	-4.6	-5.9	-2.6	-9.5	-29.4	-31.6	-31.6
		Bottom of Elevation (ft MLLW)	-32.7	-16.5	-9.8	-8.7	-10.3	-5.6	-6.8	-3.4	-10.5	-30.4	-32.4	-32.4
		Excavated or Capped during 2019 Construction?		Excavated										Excavated
Method	**Analyte**	**Unit**												
E160.3	Total Solids	%	68.6	65.6	59.8	49	39.7	49.7	55.6	58	51.8	55.8	40.1	38.3
SW9060	TOC Average Duplicates	%	0.37	1.1	1.4	2.4	3.4	2.9	1.9	1.5	2.9	2.3	3.3	3.2
Dioxins and Furans														
E1613B	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ug/kg	0.015 U	0.003 J	0.024	0.089	0.029	0.089	0.017 U	0.016	0.16	0.036 U	0.043 U	0.045 U
E1613B	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ug/kg	0.032	0.044	0.26	1.5	1.3	2.2	0.026	0.17	2.6	0.63	0.58	0.57
E1613B	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ug/kg	0.0073 U	0.0071 UJ	0.0068 J	0.034	0.031	0.15	0.0086 U	0.0039 UJ	0.062	0.01	0.013 J	0.014 J
E1613B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ug/kg	0.0045 J	0.0047 J	0.029	0.1	0.077	0.17	0.0034 J	0.018	0.21	0.048	0.064	0.064
E1613B	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ug/kg	0.0073 U	0.0071 U	0.00055 J	0.0033 UJ	0.0018 J	0.01 U	0.0086 U	0.0082 U	0.0062 J	0.0015 J	0.0013 J	0.0014 J
E1613B	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.0073 U	0.00041 J	0.0012 J	0.013	0.013 U	0.0053 UJ	0.0086 U	0.0082 U	0.024	0.0038 J	0.0024 J	0.0028 J
E1613B	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0073 U	0.0071 U	0.0084 UJ	0.01 U	0.013 U	0.01 U	0.0086 U	0.0082 U	0.0094 U	0.0089 U	0.012 U	0.013 U
E1613B	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.0073 U	0.0071 U	0.0084 UJ	0.0057 J	0.018	0.0087 J	0.0086 U	0.0082 U	0.0085 UJ	0.0017 J	0.012 U	0.013 U
E1613B	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0073 U	0.00033 UJ	0.0013 J	0.0036 UJ	0.0074 J	0.0091 J	0.0086 U	0.0014 J	0.0078 J	0.002 J	0.0027 J	0.0025 J
E1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.0073 U	0.00015 UJ	0.00016 J	0.00082 J	0.013 U	0.01 U	0.0086 U	0.0082 U	0.0094 U	0.0089 U	0.012 U	0.013 U
E1613B	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0073 U	0.00042 J	0.00098 UJ	0.0025 J	0.0037 J	0.0021 UJ	0.0086 U	0.0082 U	0.0037 UJ	0.0014 J	0.0021 J	0.002 J
E1613B	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ug/kg	0.0073 U	0.0071 U	0.0084 U	0.011	0.013 U	0.01 U	0.0086 U	0.0082 U	0.013	0.004 J	0.012 U	0.013 U
E1613B	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ug/kg	0.0073 U	0.00017 J	0.00037 J	0.01 U	0.0039 J	0.01 U	0.0086 U	0.0082 U	0.0094 U	0.0089 U	0.012 U	0.013 U
E1613B	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.0073 U	0.00012 UJ	0.00028 UJ	0.0015 J	0.0047 J	0.0027 J	0.0086 U	0.0082 U	0.0021 J	0.00054 J	0.00057 J	0.013 U
E1613B	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ug/kg	0.0073 U	0.00017 UJ	0.00035 J	0.0049 J	0.013 U	0.01 U	0.0086 U	0.0082 U	0.006 J	0.0016 J	0.00089 J	0.013 U
E1613B	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ug/kg	0.0015 U	0.00037 UJ	0.00071 J	0.008	0.0063 U	0.0022 U	0.0017 U	0.0011 J	0.0092	0.0033	0.0019 J	0.0014 J
E1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ug/kg	0.0015 U	0.0002 UJ	0.00034 UJ	0.00072 UJ	0.001 J	0.0021 U	0.0017 U	0.0016 U	0.00065 UJ	0.0004 UJ	0.00061 J	0.00066 J
Dichorodiphenyltrichloroethane (DDT) and its derivatives														
SW8081B	4,4'-DDD	ug/kg	0.56 U	0.6 U	0.34 J	20 J+	1 U	0.79 U	0.64 U	0.89	79 J	0.62 J	0.7 J	0.78 J
SW8081B	4,4'-DDE	ug/kg	0.16 J	0.6 U	0.41 J	6.9 J+	1 U	0.79 U	0.28 J	1.2	0.69 UJ	0.82 J	1.4	1.5
SW8081B	4,4'-DDT	ug/kg	0.56 U	0.6 U	0.6 U	5.7 J+	1 U	0.79 U	0.64 U	0.67 U	7.6	1 U	1.4 U	1.5 U
SW8081B	o,p'-DDD	ug/kg	1.4 U	1.5 U	1.5 U	5.1 J+	2.5 U	2 U	1.6 U	0.52 J	34 J	2.6 U	3.5 U	3.8 U
SW8081B	o,p'-DDE	ug/kg	1.4 U	1.5 U	1.5 U	4.8 J+	2.5 U	2 U	1.6 U	1.7 U	17 J	2.6 U	3.5 U	3.8 U
SW8081B	o,p'-DDT	ug/kg	1.4 U	1.5 U	1.5 U	1.8 U	2.5 U	2 U	1.6 U	1.7 U	2 J	2.6 U	3.5 U	3.8 U
	Total DDx (NDx = 1/2 RL)	ug/kg	2.8 J	3.2 U	3.3 J	43.4 J	5.3 U	4.2 U	3.3 J	4.6 J	140 J	5.8 J	8.1 J	8.7 J
Polychlorinated biphenyls (PCBs)														
SW8082A	Aroclor-1016	ug/kg	2.8 U	3 U	3 U	3.6 U	5 U	3.9 U	3.2 U	3.4 U	3.4 U	3.5 UJ	4.6 UJ	5.1 UJ
SW8082A	Aroclor-1221	ug/kg	2.8 U	3 U	3 U	3.6 U	5 U	3.9 U	3.2 U	3.4 U	3.4 U	3.5 UJ	4.6 UJ	5.1 UJ
SW8082A	Aroclor-1232	ug/kg	2.8 U	3 U	3 U	3.6 U	5 U	3.9 U	3.2 U	3.4 U	3.4 U	3.5 U	4.6 U	5.1 U
SW8082A	Aroclor-1242	ug/kg	2.8 U	3 U	3 U	3.6 U	5 U	3.9 U	3.2 U	3.4 U	3.4 U	3.5 UJ	4.6 UJ	5.1 UJ
SW8082A	Aroclor-1248	ug/kg	2.8 U	3 U	3 U	3.6 U	5 U	3.9 U	3.2 U	3.4 U	3.4 U	3.5 U	4.6 U	5.1 U
SW8082A	Aroclor-1254	ug/kg	2.8 U	3 U	3 U	3.6 U	5 U	3.9 U	3.2 U	3.4 U	3.4 U	3.5 U	4.6 U	5.1 U
SW8082A	Aroclor-1260	ug/kg	2.8 U	3 U	3 U	16	5 U	2.3 J	3.2 U	2.1 J	36 J	2.5 J	1.8 J	3.7 J
	Total PCBs (NDs = zero)	ug/kg	2.8 U	3 U	3 U	16	5 U	2.3 J	3.2 U	2.1 J	36 J	2.5 J	1.8 J	3.7 J
Polycyclic aromatic hydrocarbons (PAHs)														
SW8270DSIM	1-Methylnaphthalene	ug/kg	9.3	160	18	370	1,200	550	68	27	570	22	27	31
SW8270DSIM	2-Methylnaphthalene	ug/kg	17	340	34	660	1,500	1,100	130	50	1,500	51	69 J	53 J
SW8270DSIM	Acenaphthene	ug/kg	34	490	46	2,400	3,700	2,900	250	120	2,000	52	56 J	38 J
SW8270DSIM	Acenaphthylene	ug/kg	13	73	12	170	750	530	120	50	280	12	21	20
SW8270DSIM	Anthracene	ug/kg	58	150	42	740	2,200	2,000	270	77	1,100	48	65 J	45 J
SW8270DSIM	Benzo(a)anthracene	ug/kg	76	330	50	1,400	3,200	5,800	360	200	2,500	97	240 J	110 J

TABLE 2
SURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

			SG-01	SG-02	SG-03	SG-04	SG-05	SG-06	SG-07	SG-08	SG-09	SG-10	SG-11	
	Sample Date		07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/16/2019	07/16/2019	07/16/2019
	Sample Depth		0.0-0.6	0.0-0.3	0.0-0.4	0.0-1.0	0.0-0.9	0.0-1.0	0.0-0.9	0.0-0.8	0.0-1.0	0.0-1.0	0.0-0.8	0.0-0.8
	Lab Sample ID		580-87761-27	580-87761-19	580-87761-20	580-87761-21	580-87761-22	580-87761-23	580-87761-24	580-87761-25	580-87761-26	580-87706-13	580-87706-3	580-87706-4
	Sample Type		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Duplicate
	Mudline (ft MLLW)		-32.1	-16.2	-9.4	-7.7	-9.4	-4.6	-5.9	-2.6	-9.5	-29.4	-31.6	-31.6
	Top of Elevation (ft MLLW)		-32.1	-16.2	-9.4	-7.7	-9.4	-4.6	-5.9	-2.6	-9.5	-29.4	-31.6	-31.6
	Bottom of Elevation (ft MLLW)		-32.7	-16.5	-9.8	-8.7	-10.3	-5.6	-6.8	-3.4	-10.5	-30.4	-32.4	-32.4
	Excavated or Capped during 2019 Construction?			Excavated										Excavated
SW8270DSIM	Benzo(a)pyrene	ug/kg	81	450	66	1,300 J	3,600	7,000	510	300	2,600	75	300 J	120 J
SW8270DSIM	Benzo(b)fluoranthene	ug/kg	100	390	67	1,400	4,100	7,200	490	310	2,900	82	320 J	140 J
SW8270DSIM	Benzo(g,h,i)perylene	ug/kg	70	450	56	1,100	3,300	6,000	570	230	2,000	50	260 J	110 J
SW8270DSIM	Benzo(k)fluoranthene	ug/kg	31	130	23	450	930	1,700	160	84	690	22	92 J	40 J
SW8270DSIM	Chrysene	ug/kg	97	350	53	1,700	3,900	6,600	410	250	3,000	95	250 J	110 J
SW8270DSIM	Dibenz(a,h)anthracene	ug/kg	7.3	26	7 J	130	340	660	43	25	240	8.7 J+	28 J	13 UJ
SW8270DSIM	Fluoranthene	ug/kg	310	1,000	130	4,800 J	15,000	21,000	1,500	520	7,500	260	460	280
SW8270DSIM	Fluorene	ug/kg	33	200	36	1,600 J	2,400	2,300	130	58	1,300	52	55 J	40 J
SW8270DSIM	Indeno(1,2,3-cd)pyrene	ug/kg	69	470	69	1,000	3,100	6,100	480	250	2,000	63	310 J	140 J
SW8270DSIM	Naphthalene	ug/kg	43	840	87	1,600 J	7,500	4,900	780	160	4,000	130	170 J	96 J
SW8270DSIM	Phenanthrene	ug/kg	240	640	160	6,600 J	18,000	22,000	1,300	560	8,900	270	330	260
SW8270DSIM	Pyrene	ug/kg	340	1,400	140	5,400	17,000	26,000	1,900	590	9,500	280	500 J	300 J
	Total 17 PAHs (NDs = 1/2 RL) - excluding 1-methylnapthalene	ug/kg	1,619	7,729	1,078 J	32,450 J	90,520	123,790	9,403	3,834	52,010	1,648 J	3,526 J	1,909 J
Extended list of polycyclic aromatic hydrocarbons (PAHs)														
SW8270DSIM	Naphthalene*	ug/kg	--	--	--	670	1,100	1,600	--	--	1,700	--	--	--
SW8270DSIM	1-Methylnaphthalene	ug/kg	--	--	--	200	170 J	270	--	--	340	--	--	--
SW8270DSIM	2-Methylnaphthalene*	ug/kg	--	--	--	380	270 J	450	--	--	770	--	--	--
SW8270DSIM	C1-Naphthalenes	ug/kg	--	--	--	380	280 J	460	--	--	710	--	--	--
SW8270DSIM	C2-Naphthalenes	ug/kg	--	--	--	910	420	1,000	--	--	1,100	--	--	--
SW8270DSIM	C3-Naphthalenes	ug/kg	--	--	--	1,600	550	1,300	--	--	1,700	--	--	--
SW8270DSIM	C4-Naphthalenes	ug/kg	--	--	--	1,400	490	830	--	--	1,300	--	--	--
SW8270DSIM	Acenaphthylene*	ug/kg	--	--	--	120	230	300	--	--	230	--	--	--
SW8270DSIM	Acenaphthene*	ug/kg	--	--	--	1,800	700	1,900	--	--	1,500	--	--	--
SW8270DSIM	Fluorene*	ug/kg	--	--	--	1,200	440	1,500	--	--	980	--	--	--
SW8270DSIM	C1-Fluorenes	ug/kg	--	--	--	490	190	530	--	--	500	--	--	--
SW8270DSIM	C2-Fluorenes	ug/kg	--	--	--	800	300	600	--	--	780	--	--	--
SW8270DSIM	C3-Fluorenes	ug/kg	--	--	--	610	220	470	--	--	700	--	--	--
SW8270DSIM	Dibenzothiophene	ug/kg	--	--	--	670	500	1,500	--	--	830	--	--	--
SW8270DSIM	C1-Dibenzothiophenes	ug/kg	--	--	--	400	210	530	--	--	530	--	--	--
SW8270DSIM	C2-Dibenzothiophenes	ug/kg	--	--	--	530	250	480	--	--	710	--	--	--
SW8270DSIM	C3-Dibenzothiophenes	ug/kg	--	--	--	420	220	330	--	--	570	--	--	--
SW8270DSIM	C4-Dibenzothiophenes	ug/kg	--	--	--	230	150	190	--	--	320	--	--	--
SW8270DSIM	Anthracene*	ug/kg	--	--	--	590	690	1,200	--	--	850	--	--	--
SW8270DSIM	Phenanthrene*	ug/kg	--	--	--	4,800	4,000	13,000	--	--	5,900	--	--	--
SW8270DSIM	C1-Phenanthrenes/Anthracenes	ug/kg	--	--	--	1,700	970	2,600	--	--	2,400	--	--	--
SW8270DSIM	C2-Phenanthrenes/Anthracenes	ug/kg	--	--	--	1,500	700	1,300	--	--	2,100	--	--	--
SW8270DSIM	C3-Phenanthrenes/Anthracenes	ug/kg	--	--	--	890	440	700	--	--	1,200	--	--	--
SW8270DSIM	C4-Phenanthrenes/Anthracenes	ug/kg	--	--	--	500 J	320 J	530 J	--	--	720 J	--	--	--
SW8270DSIM	Fluoranthene*	ug/kg	--	--	--	4,300	5,000	13,000	--	--	6,100	--	--	--
SW8270DSIM	Pyrene*	ug/kg	--	--	--	4,500	5,500	15,000	--	--	6,900	--	--	--
SW8270DSIM	C1-Fluoranthenes/Pyrenes	ug/kg	--	--	--	1,400	1,200	2,800	--	--	2,100	--	--	--
SW8270DSIM	C2-Fluoranthenes/Pyrenes	ug/kg	--	--	--	570	390	730	--	--	920	--	--	--
SW8270DSIM	C3-Fluoranthenes/Pyrenes	ug/kg	--	--	--	350	240	360	--	--	570	--	--	--
SW8270DSIM	C4-Fluoranthenes/Pyrenes	ug/kg	--	--	--	200	160	200	--	--	340	--	--	--
SW8270DSIM	Benzo(a)anthracene*	ug/kg	--	--	--	1,300	1,500	3,700	--	--	2,200	--	--	--

TABLE 2
SURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

Location			SG-01	SG-02	SG-03	SG-04	SG-05	SG-06	SG-07	SG-08	SG-09	SG-10	SG-11	
Sample Date			07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/18/2019	07/16/2019	07/16/2019	07/16/2019
Sample Depth			0.0-0.6	0.0-0.3	0.0-0.4	0.0-1.0	0.0-0.9	0.0-1.0	0.0-0.9	0.0-0.8	0.0-1.0	0.0-1.0	0.0-0.8	0.0-0.8
Lab Sample ID			580-87761-27	580-87761-19	580-87761-20	580-87761-21	580-87761-22	580-87761-23	580-87761-24	580-87761-25	580-87761-26	580-87706-13	580-87706-3	580-87706-4
Sample Type			Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Duplicate
Mudline (ft MLLW)			-32.1	-16.2	-9.4	-7.7	-9.4	-4.6	-5.9	-2.6	-9.5	-29.4	-31.6	-31.6
Top of Elevation (ft MLLW)			-32.1	-16.2	-9.4	-7.7	-9.4	-4.6	-5.9	-2.6	-9.5	-29.4	-31.6	-31.6
Bottom of Elevation (ft MLLW)			-32.7	-16.5	-9.8	-8.7	-10.3	-5.6	-6.8	-3.4	-10.5	-30.4	-32.4	-32.4
Excavated or Capped during 2019 Construction?				Excavated										Excavated
SW8270DSIM	Chrysene*	ug/kg	--	--	--	1,400	1,700	3,900	--	--	2,300	--	--	--
SW8270DSIM	C1-Chrysenes	ug/kg	--	--	--	560	460	970	--	--	950	--	--	--
SW8270DSIM	C2-Chrysenes	ug/kg	--	--	--	300	230	380	--	--	490	--	--	--
SW8270DSIM	C3-Chrysenes	ug/kg	--	--	--	200	170	200	--	--	350	--	--	--
SW8270DSIM	C4-Chrysenes	ug/kg	--	--	--	120	120	150	--	--	220	--	--	--
SW8270DSIM	Benzo(b)fluoranthene*	ug/kg	--	--	--	1,300	2,000	4,100	--	--	2,200	--	--	--
SW8270DSIM	Benzo(k)fluoranthene*	ug/kg	--	--	--	470	650	1,700	--	--	790	--	--	--
SW8270DSIM	Benzo(e)pyrene	ug/kg	--	--	--	830	1,300	2,800	--	--	1,500	--	--	--
SW8270DSIM	Benzo(a)pyrene*	ug/kg	--	--	--	1,400	2,100	4,900	--	--	2,500	--	--	--
SW8270DSIM	Perylene	ug/kg	--	--	--	380	690	1,300	--	--	670	--	--	--
SW8270DSIM	Indeno(1,2,3-cd)pyrene*	ug/kg	--	--	--	740	1,300	2,800	--	--	1,400	--	--	--
SW8270DSIM	Dibenz(a,h)anthracene*	ug/kg	--	--	--	150	210	460	--	--	250	--	--	--
SW8270DSIM	Benzo(g,h,i)perylene*	ug/kg	--	--	--	1,000	1,800	3,800	--	--	1,900	--	--	--
Total 17 PAHs (NDs = 1/2 RL) using results of second analysis		ug/kg	--	--	--	26,120	29,190	73,310	--	--	38,470	--	--	--

Notes:

Yellow highlighting = Sample excavated during 2019 Construction Project
Pink highlighting indicates exceedance of remedial action level (RAL)
-- = not analyzed
ft MLLW = feet below mean lower low water
NDs are reported to the laboratory reporting limit (RL U).
ug/kg = micrograms per kilogram
Data is reported on a dry weight basis except for total organic carbon (TOC).
J flags indicate estimated data found between the method detection limit (MDL) and RL, or estimated based on validation.
J+ flags indicates estimated biased high, J- flags indicates estimated biased low.
R flags indicate data is rejected as unusable.
See the Data Usability Summary Report (DUSR) for details on validation qualifier reasonings.
Total DDx was calculated by summing all detected concentrations plus 1/2 the reporting limit for non-detects.
Total PCBs was calculated by summing detected concentrations. Non-detects were considered 'zero'.
Total PAHs was calculated by summing all detected concentrations plus 1/2 the reporting limit for non-detects. 1-Methylnaphthalene was not included in this summation.
1-Methylnaphthalene was reported by the laboratory in the initial PAH runs in error. The data was included in this table, but was not included in the Total PAH summation.
* Total PAH 17 compounds used for summation from the Alkylated PAH runs.

TABLE 2
SURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

		Location	SG-12	SG-13	SG-14	SG-15	SG-16	SG-17	SG-18	SG-19	SG-20	SG-21	SG-22	SG-23
		Sample Date	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019
		Sample Depth	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
		Lab Sample ID	580-87706-5	580-87706-10	580-87706-9	580-87706-8	580-87706-15	580-87706-1	580-87706-2	580-87706-6	580-87706-7	580-87706-14	580-87706-11	580-87706-12
		Sample Type	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
		Mudline (ft MLLW)	-30.8	-35.9	-37.9	-40.8	-27.2	-27.4	-29.4	-31.1	-29	-26.9	-33.6	-32.9
		Top of Elevation (ft MLLW)	-30.8	-35.9	-37.9	-40.8	-27.2	-27.4	-29.4	-31.1	-29.0	-26.9	-33.6	-32.9
		Bottom of Elevation (ft MLLW)	-31.8	-36.9	-38.9	-41.8	-28.2	-28.4	-30.4	-32.1	-30.0	-27.9	-34.6	-33.9
		Excavated or Capped during 2019 Construction?	Excavated	Excavated				Excavated	Excavated	Excavated	Excavated	Excavated	Excavated	Excavated
Method	**Analyte**	**Unit**												
E160.3	Total Solids	%	38.9	40	38.7	35.7	43.8	54.6	30	50.8	44.7	43.1	39.3	46
SW9060	TOC Average Duplicates	%	3.5	3.5	3.5	4.1	2.9	1.3	3.2	2.3	4	3.3	3.3	2.6
Dioxins and Furans														
E1613B	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ug/kg	0.037 U	0.041 U	0.05 U	0.043 U	0.067 U	0.019 U	0.048 U	0.029 U	0.046 U	0.099	0.042 U	0.031 U
E1613B	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ug/kg	0.55	0.53	0.79	0.56	1.2	0.25	0.83	0.49	0.59	2.1	0.61	0.52
E1613B	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ug/kg	0.012 UJ	0.014	0.016 J	0.013 UJ	0.024	0.0065 UJ	0.015 UJ	0.011	0.015 J	0.039	0.012 UJ	0.0091 UJ
E1613B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ug/kg	0.058	0.061	0.088	0.061	0.12	0.027	0.092	0.052	0.063	0.21	0.069	0.059
E1613B	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ug/kg	0.0016 J	0.0014 J	0.0016 UJ	0.0014 J	0.0036 UJ	0.0011 UJ	0.0018 J	0.0011 UJ	0.0013 J	0.0051 J	0.0012 J	0.0011 J
E1613B	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.004 J	0.0037 J	0.0038 J	0.0046 J	0.029	0.002 J	0.0044 J	0.0078 J	0.0028 J	0.021	0.0031 J	0.002 J
E1613B	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.013 UJ	0.012 U	0.013 U	0.014 U	0.011 UJ	0.009 UJ	0.017 U	0.0098 U	0.011 U	0.012 UJ	0.013 U	0.011 U
E1613B	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.013 U	0.012 U	0.013 U	0.014 UJ	0.0078 J	0.009 U	0.017 U	0.0023 J	0.011 U	0.0077 J	0.013 U	0.011 UJ
E1613B	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0027 J	0.0028 J	0.0045 J	0.0031 J	0.0058 J	0.0013 UJ	0.0031 UJ	0.0029 J	0.0027 J	0.0045 J	0.0023 UJ	0.0023 J
E1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.013 U	0.012 U	0.013 U	0.014 U	0.011 U	0.009 U	0.017 U	0.0098 U	0.011 U	0.012 U	0.013 U	0.011 U
E1613B	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0021 J	0.0019 J	0.003 UJ	0.0024 J	0.0032 J	0.0012 J	0.0026 J	0.002 J	0.0021 UJ	0.003 J	0.0021 J	0.002 J
E1613B	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ug/kg	0.0025 J	0.012 UJ	0.0029 J	0.0028 J	0.025	0.009 U	0.004 J	0.012	0.011 U	0.019	0.003 J	0.011 U
E1613B	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ug/kg	0.013 U	0.012 U	0.013 U	0.00074 J	0.011 U	0.009 U	0.017 U	0.00068 UJ	0.011 U	0.012 U	0.013 U	0.011 U
E1613B	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.00057 UJ	0.012 U	0.00055 UJ	0.00069 J	0.0017 J	0.00042 UJ	0.00079 UJ	0.00099 J	0.00051 UJ	0.0015 UJ	0.00063 J	0.00052 J
E1613B	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ug/kg	0.00098 J	0.001 J	0.0013 J	0.00099 J	0.0067 J	0.009 U	0.003 J	0.0058 J	0.011 U	0.0076 J	0.001 J	0.011 U
E1613B	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ug/kg	0.0017 J	0.0019 J	0.0042	0.0021 J	0.0085	0.00066 UJ	0.01	0.015	0.0019 J	0.014	0.0043	0.0014 J
E1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ug/kg	0.00052 UJ	0.0008 J	0.00091 J	0.0028 U	0.0023 U	0.00054 UJ	0.0013 J	0.0014 J	0.0022 U	0.0023 U	0.00091 UJ	0.00073 J
Dichorodiphenyltrichloroethane (DDT) and its derivatives														
SW8081B	4,4'-DDD	ug/kg	0.97 J	1 J	1.3 J	0.81 J	2.7 J	0.61 J	1.4 J	1.9 J-	1.5	15 J-	0.96 J	1.3
SW8081B	4,4'-DDE	ug/kg	1.2 J	1.5	1.7	1.4 J	3.7	0.76 J	1.4 J	1.7 J-	1.5	7.6 J-	1.1 J	1.3
SW8081B	4,4'-DDT	ug/kg	1.5 R	1.5 U	1.5 U	1.6 U	1.2 U	0.47 J	1.9 U	1.1 UJ	1.2 U	1.3 UJ	1.3 U	1.2 U
SW8081B	o,p'-DDD	ug/kg	1.3 J	3.7 U	3.8 U	3.9 U	1 J	2.4 U	4.8 U	0.83 J-	0.76 J	5.9 J-	3.4 U	0.77 J
SW8081B	o,p'-DDE	ug/kg	3.8 U	3.7 U	3.8 U	3.9 U	3 U	2.4 U	4.8 U	2.8 UJ	3.1 U	6.3 J-	3.4 U	3 U
SW8081B	o,p'-DDT	ug/kg	3.8 U	3.7 U	3.8 U	3.9 U	3 U	2.4 U	4.8 U	2.8 UJ	3.1 U	3.2 UJ	3.4 U	3 U
		Total DDx (NDx = 1/2 RL) ug/kg	8.0 J	8.8 J	9.5 J	8.9 J	11.0 J	5.4 J	11.0 J	7.8 J	7.5 J	37.1 J	7.8 J	7.0 J
Polychlorinated biphenyls (PCBs)														
SW8082A	Aroclor-1016	ug/kg	5.1 UJ	5 UJ	5.1 UJ	5.3 UJ	4 UJ	3.2 UJ	6.3 UJ	3.8 UJ	4.1 UJ	4.3 UJ	4.5 UJ	4 UJ
SW8082A	Aroclor-1221	ug/kg	5.1 UJ	5 UJ	5.1 UJ	5.3 UJ	4 UJ	3.2 UJ	6.3 UJ	3.8 UJ	4.1 UJ	4.3 UJ	4.5 UJ	4 UJ
SW8082A	Aroclor-1232	ug/kg	5.1 UJ	5 U	5.1 U	5.3 U	4 U	3.2 U	6.3 U	3.8 U	4.1 U	4.3 U	4.5 U	4 U
SW8082A	Aroclor-1242	ug/kg	5.1 UJ	5 UJ	5.1 UJ	5.3 UJ	4 UJ	3.2 UJ	6.3 UJ	3.8 UJ	4.1 UJ	4.3 UJ	4.5 UJ	4 UJ
SW8082A	Aroclor-1248	ug/kg	5.1 UJ	5 U	5.1 U	5.3 U	4 U	3.2 U	6.3 U	3.8 U	4.1 U	4.3 U	4.5 U	4 U
SW8082A	Aroclor-1254	ug/kg	5.1 UJ	5 U	5.1 U	5.3 U	22	3.2 U	6.3 U	3.8 U	4.1 U	4.3 U	4.5 U	4 U
SW8082A	Aroclor-1260	ug/kg	5.1 UJ	2.1 J	2.3 J	2.9 J	4 UJ	2.8 J	4.3 J	3.6 J	2.5 J	25 J	3.8 J	2.3 J
		Total PCBs (NDs = zero) ug/kg	5.1 U	2.1 J	2.3 J	2.9 J	22	2.8 J	4.3 J	3.6 J	2.5 J	25 J	3.8 J	2.3 J
Polycyclic aromatic hydrocarbons (PAHs)														
SW8270DSIM	1-Methylnaphthalene	ug/kg	67	37	110	6 J	130	4.7 J	12 J	33	84	520	46	15
SW8270DSIM	2-Methylnaphthalene	ug/kg	130 J	51	75	10 J	290	10	19	70	110	1,600	110	23
SW8270DSIM	Acenaphthene	ug/kg	120	61	210	11 J	340	7.7 J	24	370	100	3,600	65	31
SW8270DSIM	Acenaphthylene	ug/kg	53	21	37	9.4 J	880	4.5 J	19	41	42	260	22	14
SW8270DSIM	Anthracene	ug/kg	160	59	56	18	390	14	36	200	120	1,800	79	39
SW8270DSIM	Benzo(a)anthracene	ug/kg	280	110	110	50	3,700	38	110	610	240	3,000	110	91

TABLE 2
SURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

			SG-12	SG-13	SG-14	SG-15	SG-16	SG-17	SG-18	SG-19	SG-20	SG-21	SG-22	SG-23
	Location		SG-12	SG-13	SG-14	SG-15	SG-16	SG-17	SG-18	SG-19	SG-20	SG-21	SG-22	SG-23
	Sample Date		07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019
	Sample Depth		0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
	Lab Sample ID		580-87706-5	580-87706-10	580-87706-9	580-87706-8	580-87706-15	580-87706-1	580-87706-2	580-87706-6	580-87706-7	580-87706-14	580-87706-11	580-87706-12
	Sample Type		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
	Mudline (ft MLLW)		-30.8	-35.9	-37.9	-40.8	-27.2	-27.4	-29.4	-31.1	-29	-26.9	-33.6	-32.9
	Top of Elevation (ft MLLW)		-30.8	-35.9	-37.9	-40.8	-27.2	-27.4	-29.4	-31.1	-29.0	-26.9	-33.6	-32.9
	Bottom of Elevation (ft MLLW)		-31.8	-36.9	-38.9	-41.8	-28.2	-28.4	-30.4	-32.1	-30.0	-27.9	-34.6	-33.9
	Excavated or Capped during 2019 Construction?		Excavated	Excavated				Excavated	Excavated	Excavated	Excavated	Excavated	Excavated	Excavated
SW8270DSIM	Benzo(a)pyrene	ug/kg	280	120	120	53	4,700	35	130	470	250	2,800	110	85
SW8270DSIM	Benzo(b)fluoranthene	ug/kg	320	130	140	62	4,000	43	140	520	270	2,900	130	97
SW8270DSIM	Benzo(g,h,i)perylene	ug/kg	250	100	110	45	3,900	33	130	340	230	2,200	86	75
SW8270DSIM	Benzo(k)fluoranthene	ug/kg	83	39	41	17	1,500	12	38	150	70	890	36	25
SW8270DSIM	Chrysene	ug/kg	280	120	120	55	3,300	44	120	600	240	3,000	120	95
SW8270DSIM	Dibenz(a,h)anthracene	ug/kg	27	12 J+	12 J+	14 U	410	8.4 U	16 U	33	26	220	11 U	10 U
SW8270DSIM	Fluoranthene	ug/kg	720 J	290	370	110	3,300	91	260	2,600	650	9,800	310	230
SW8270DSIM	Fluorene	ug/kg	130	60	150	12 J	320	9.5	26	410	120	2,600	70	33
SW8270DSIM	Indeno(1,2,3-cd)pyrene	ug/kg	290	120	130	58	4,900	38	160	410	260	2,500	110	90
SW8270DSIM	Naphthalene	ug/kg	670 J	140	240	26	780	24	55	230	280	2,600	250	42
SW8270DSIM	Phenanthrene	ug/kg	810 J	290	500	69	1,400	54	180	2,200	670	16,000	420	160
SW8270DSIM	Pyrene	ug/kg	780	320	380	120	4,900	100	310	3,300	740	11,000	340	250
	Total 17 PAHs (NDs = 1/2 RL) - excluding 1-methylnapthalene	ug/kg	5,383 J	2,043 J	2,801 J	732 J	39,010	562 J	1,765 J	12,554	4,418	66,770	2,374 J	1,385 J
Extended list of polycyclic aromatic hydrocarbons (PAHs)														
SW8270DSIM	Naphthalene*	ug/kg	--	--	--	--	100 J	--	--	--	--	1200	--	--
SW8270DSIM	1-Methylnaphthalene	ug/kg	--	--	--	--	23 J	--	--	--	--	270	--	--
SW8270DSIM	2-Methylnaphthalene*	ug/kg	--	--	--	--	46 J	--	--	--	--	740	--	--
SW8270DSIM	C1-Naphthalenes	ug/kg	--	--	--	--	45 J	--	--	--	--	640	--	--
SW8270DSIM	C2-Naphthalenes	ug/kg	--	--	--	--	71	--	--	--	--	2100	--	--
SW8270DSIM	C3-Naphthalenes	ug/kg	--	--	--	--	99	--	--	--	--	2300	--	--
SW8270DSIM	C4-Naphthalenes	ug/kg	--	--	--	--	91	--	--	--	--	1200	--	--
SW8270DSIM	Acenaphthylene*	ug/kg	--	--	--	--	44	--	--	--	--	170	--	--
SW8270DSIM	Acenaphthene*	ug/kg	--	--	--	--	120	--	--	--	--	3600	--	--
SW8270DSIM	Fluorene*	ug/kg	--	--	--	--	93	--	--	--	--	2300	--	--
SW8270DSIM	C1-Fluorenes	ug/kg	--	--	--	--	38	--	--	--	--	820	--	--
SW8270DSIM	C2-Fluorenes	ug/kg	--	--	--	--	59	--	--	--	--	870	--	--
SW8270DSIM	C3-Fluorenes	ug/kg	--	--	--	--	74	--	--	--	--	630	--	--
SW8270DSIM	Dibenzothiophene	ug/kg	--	--	--	--	58	--	--	--	--	2000	--	--
SW8270DSIM	C1-Dibenzothiophenes	ug/kg	--	--	--	--	42	--	--	--	--	780	--	--
SW8270DSIM	C2-Dibenzothiophenes	ug/kg	--	--	--	--	66	--	--	--	--	690	--	--
SW8270DSIM	C3-Dibenzothiophenes	ug/kg	--	--	--	--	63	--	--	--	--	410	--	--
SW8270DSIM	C4-Dibenzothiophenes	ug/kg	--	--	--	--	39	--	--	--	--	190	--	--
SW8270DSIM	Anthracene*	ug/kg	--	--	--	--	110	--	--	--	--	1500	--	--
SW8270DSIM	Phenanthrene*	ug/kg	--	--	--	--	550	--	--	--	--	16000	--	--
SW8270DSIM	C1-Phenanthrenes/Anthracenes	ug/kg	--	--	--	--	200	--	--	--	--	3400	--	--
SW8270DSIM	C2-Phenanthrenes/Anthracenes	ug/kg	--	--	--	--	180	--	--	--	--	1800	--	--
SW8270DSIM	C3-Phenanthrenes/Anthracenes	ug/kg	--	--	--	--	130	--	--	--	--	910 J	--	--
SW8270DSIM	C4-Phenanthrenes/Anthracenes	ug/kg	--	--	--	--	89 J	--	--	--	--	650 J	--	--
SW8270DSIM	Fluoranthene*	ug/kg	--	--	--	--	780	--	--	--	--	10000	--	--
SW8270DSIM	Pyrene*	ug/kg	--	--	--	--	800	--	--	--	--	12000	--	--
SW8270DSIM	C1-Fluoranthenes/Pyrenes	ug/kg	--	--	--	--	280	--	--	--	--	2100	--	--
SW8270DSIM	C2-Fluoranthenes/Pyrenes	ug/kg	--	--	--	--	120	--	--	--	--	620	--	--
SW8270DSIM	C3-Fluoranthenes/Pyrenes	ug/kg	--	--	--	--	76	--	--	--	--	320	--	--
SW8270DSIM	C4-Fluoranthenes/Pyrenes	ug/kg	--	--	--	--	40	--	--	--	--	170	--	--
SW8270DSIM	Benzo(a)anthracene*	ug/kg	--	--	--	--	350	--	--	--	--	2300	--	--

TABLE 2
SURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

			SG-12	SG-13	SG-14	SG-15	SG-16	SG-17	SG-18	SG-19	SG-20	SG-21	SG-22	SG-23
		Location	SG-12	SG-13	SG-14	SG-15	SG-16	SG-17	SG-18	SG-19	SG-20	SG-21	SG-22	SG-23
		Sample Date	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019	07/16/2019
		Sample Depth	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
		Lab Sample ID	580-87706-5	580-87706-10	580-87706-9	580-87706-8	580-87706-15	580-87706-1	580-87706-2	580-87706-6	580-87706-7	580-87706-14	580-87706-11	580-87706-12
		Sample Type	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
		Mudline (ft MLLW)	-30.8	-35.9	-37.9	-40.8	-27.2	-27.4	-29.4	-31.1	-29	-26.9	-33.6	-32.9
		Top of Elevation (ft MLLW)	-30.8	-35.9	-37.9	-40.8	-27.2	-27.4	-29.4	-31.1	-29.0	-26.9	-33.6	-32.9
		Bottom of Elevation (ft MLLW)	-31.8	-36.9	-38.9	-41.8	-28.2	-28.4	-30.4	-32.1	-30.0	-27.9	-34.6	-33.9
		Excavated or Capped during 2019 Construction?	Excavated	Excavated				Excavated	Excavated	Excavated	Excavated	Excavated	Excavated	Excavated
SW8270DSIM	Chrysene*	ug/kg	--	--	--	--	350	--	--	--	--	2500	--	--
SW8270DSIM	C1-Chrysenes	ug/kg	--	--	--	--	150	--	--	--	--	720	--	--
SW8270DSIM	C2-Chrysenes	ug/kg	--	--	--	--	76	--	--	--	--	280	--	--
SW8270DSIM	C3-Chrysenes	ug/kg	--	--	--	--	48	--	--	--	--	160	--	--
SW8270DSIM	C4-Chrysenes	ug/kg	--	--	--	--	28	--	--	--	--	100	--	--
SW8270DSIM	Benzo(b)fluoranthene*	ug/kg	--	--	--	--	450	--	--	--	--	2200	--	--
SW8270DSIM	Benzo(k)fluoranthene*	ug/kg	--	--	--	--	160	--	--	--	--	800	--	--
SW8270DSIM	Benzo(e)pyrene	ug/kg	--	--	--	--	280	--	--	--	--	1400	--	--
SW8270DSIM	Benzo(a)pyrene*	ug/kg	--	--	--	--	470	--	--	--	--	2500	--	--
SW8270DSIM	Perylene	ug/kg	--	--	--	--	190	--	--	--	--	630	--	--
SW8270DSIM	Indeno(1,2,3-cd)pyrene*	ug/kg	--	--	--	--	270	--	--	--	--	1300	--	--
SW8270DSIM	Dibenz(a,h)anthracene*	ug/kg	--	--	--	--	57	--	--	--	--	230	--	--
SW8270DSIM	Benzo(g,h,i)perylene*	ug/kg	--	--	--	--	370	--	--	--	--	1700	--	--
	Total 17 PAHs (NDs = 1/2 RL) using results of second analysis	ug/kg	--	--	--	--	5,120	--	--	--	--	61,040	--	--

Notes:
Yellow highlighting = Sample excavated during 2019 Construction Project
Pink highlighting indicates exceedance of remedial action level (RAL)
-- = not analyzed
ft MLLW = feet below mean lower low water
NDs are reported to the laboratory reporting limit (RL U).
ug/kg = micrograms per kilogram
Data is reported on a dry weight basis except for total organic carbon (TOC).
J flags indicate estimated data found between the method detection limit (MD
J+ flags indicates estimated biased high, J- flags indicates estimated biased low
R flags indicate data is rejected as unusable.
See the Data Usability Summary Report (DUSR) for details on validation qualifi
Total DDx was calculated by summing all detected concentrations plus 1/2 the
Total PCBs was calculated by summing detected concentrations. Non-detects v
Total PAHs was calculated by summing all detected concentrations plus 1/2 th
1-Methylnaphthalene was reported by the laboratory in the initial PAH runs in
* Total PAH 17 compounds used for summation from the Alkylated PAH runs.

TABLE 3
SUBSURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

		Location	VB-01				VB-02					
		Sample Date	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019
		Sample Depth (feet)	0.0-2.5	2.5-4.0	4.0-5.8	5.8-8.0	0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.0	7.0-8.8	8.8-10.5
		Lab Sample ID	580-87761-7	580-87761-8	580-87761-9	580-87761-10	580-87761-1	580-87761-2	580-87761-3	580-87761-4	580-87761-5	580-87761-6
		Sample Type	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
		Mudline (ft MLLW)	-41.7	-41.7	-41.7	-41.7	-39.9	-39.9	-39.9	-39.9	-39.9	-39.9
		Top of Elevation (ft MLLW)	-41.7	-44.2	-45.7	-47.5	-39.9	-41.4	-42.9	-44.9	-46.9	-48.7
		Bottom of Elevation (ft MLLW)	-44.2	-45.7	-47.5	-49.7	-41.4	-42.9	-44.9	-46.9	-48.7	-50.4
		Excavated or Capped during 2019 Construction?										
Method	**Analyte**	**Unit**										
E160.3	Total Solids	%	53	70.5	72.9	73.2	53.2	54.6	55.7	56.8	58	71.1
SW9060	TOC Average Duplicates	%	1.5	0.11	0.059	0.05	2.7	2.6	2.9	2.7	2.5	0.34
Dioxins and Furans												
E1613B	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ug/kg	0.021	0.013 UJ	0.0063 J	0.013 U	0.071	0.086	0.11	0.084	0.13	0.017
E1613B	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ug/kg	0.27	0.013 U	0.054	0.013 U	2.1	2.4	2.4	1.9	2.1	0.23
E1613B	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ug/kg	0.0066 UJ	0.0067 U	0.0065 UJ	0.0067 UJ	0.027	0.049	0.049	0.033	0.064	0.011
E1613B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ug/kg	0.031	0.0043 J	0.0038 J	0.0023 J	0.2	0.23	0.23	0.18	0.19	0.019
E1613B	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ug/kg	0.00098 J	0.00018 UJ	0.0065 U	0.0067 U	0.0089 U	0.0079 J	0.013	0.007 J	0.012	0.0012 J
E1613B	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.0024 J	0.0067 U	0.0065 U	0.0067 UJ	0.01	0.059	0.088	0.042	0.052	0.0041 J
E1613B	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.00077 J	0.00037 J	0.00026 UJ	0.00025 UJ	0.0017 J	0.0018 UJ	0.0018 J	0.009 U	0.0018 J	0.00047 J
E1613B	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.00091 UJ	0.0067 U	0.0065 U	0.00009 UJ	0.0089 U	0.02	0.013	0.014	0.018	0.0018 J
E1613B	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0019 J	0.00025 J	0.000095 J	0.00026 J	0.015	0.014	0.015	0.011	0.0095	0.00093 J
E1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.00015 UJ	0.00018 J	0.000083 UJ	0.00014 J	0.0089 U	0.0089 U	0.0084 U	0.009 U	0.0011 J	0.00019 UJ
E1613B	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0096 U	0.0067 U	0.0065 UJ	0.0067 U	0.0067 J	0.0064 UJ	0.0077 J	0.005 UJ	0.0051 J	0.0067 U
E1613B	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ug/kg	0.0013 J	0.0067 U	0.0065 U	0.00011 J	0.0057 J	0.023	0.036	0.033	0.034	0.0025 J
E1613B	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ug/kg	0.0096 U	0.0067 U	0.000088 UJ	0.00016 J	0.0089 U	0.0089 U	0.0084 U	0.009 U	0.0014 J	0.00018 UJ
E1613B	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.0096 U	0.0067 U	0.0065 UJ	0.0067 U	0.0089 U	0.0034 UJ	0.0084 U	0.009 U	0.0032 UJ	0.0067 U
E1613B	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ug/kg	0.00065 J	0.0067 U	0.0065 U	0.00012 J	0.0024 J	0.0087 J	0.013	0.013	0.013	0.00076 UJ
E1613B	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ug/kg	0.0019 U	0.0013 U	0.0013 U	0.0013 U	0.0064	0.012	0.016	0.02	0.018	0.0014
E1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ug/kg	0.0019 U	0.0013 U	0.0013 U	0.0013 U	0.0012 J	0.0018 U	0.0017 U	0.0032 J	0.0007 UJ	0.0013 U
Dichorodiphenyltrichloroethane (DDT) and its derivatives												
SW8081B	4,4'-DDD	ug/kg	0.41 J	0.26 U	0.23 U	0.23 U	2.8 J	6.9	4.2 J	6.2 J+	22 J+	2.6
SW8081B	4,4'-DDE	ug/kg	0.42 J	0.26 U	0.23 U	0.23 U	4.6 J	6.3	4.6	7 J+	8.5 J+	1.9 J
SW8081B	4,4'-DDT	ug/kg	0.96 U	0.26 U	0.23 U	0.23 U	0.66 J	3.9	1.7 J	3.7 J+	3.9 J+	0.78 U
SW8081B	o,p'-DDD	ug/kg	2.4 U	0.64 U	0.57 U	0.58 U	2.7 U	0.9 J	1.3 J	1.8 J+	9.6 J+	1.5 J
SW8081B	o,p'-DDE	ug/kg	2.4 U	0.64 U	0.57 U	0.58 U	2.7 U	0.91 J	2.6 U	0.56 J+	3.5 J+	0.63 J
SW8081B	o,p'-DDT	ug/kg	2.4 U	0.64 U	0.57 U	0.58 U	2.7 U	2.1 J	3.8 J	9.4 J+	2.4 U	1.9 U
	Total DDx (NDs = 1/2 RL)	ug/kg	4.9 J	1.4 U	1.2 U	1.2 U	12.1 J	21.0 J	16.9 J	28.7 J	48.7 J	8.0 J
Polychlorinated biphenols (PCBs)												
SW8082A	Aroclor-1016	ug/kg	3.2 U	2.6 U	2.3 U	2.3 U	3.6 U	3.4 U	3.5 U	3.2 U	3.2 U	2.6 U
SW8082A	Aroclor-1221	ug/kg	3.2 U	2.6 U	2.3 U	2.3 U	3.6 U	3.4 U	3.5 U	3.2 U	3.2 U	2.6 U
SW8082A	Aroclor-1232	ug/kg	3.2 U	2.6 U	2.3 U	2.3 U	3.6 U	3.4 U	3.5 U	3.2 U	3.2 U	2.6 U
SW8082A	Aroclor-1242	ug/kg	3.2 U	2.6 U	2.3 U	2.3 U	3.6 U	3.4 U	3.5 U	3.2 U	3.2 U	2.6 U
SW8082A	Aroclor-1248	ug/kg	3.2 U	2.6 U	2.3 U	2.3 U	3.6 U	3.4 U	3.5 U	3.2 U	3.2 U	2.6 U
SW8082A	Aroclor-1254	ug/kg	3.2 U	2.6 U	2.3 U	2.3 U	3.6 U	3.4 U	3.5 U	3.2 U	3.2 U	2.6 U
SW8082A	Aroclor-1260	ug/kg	3.2 U	2.6 U	2.3 U	2.3 U	7.2 J	5.3 J	15 J	17 J	31	2.1 J
	Total PCBs (NDs = zero)	ug/kg	3.2 U	2.6 U	2.3 U	2.3 U	7.2 J	5.3 J	15 J	17 J	31	2.1 J
Polycyclic aromatic hydrocarbons (PAHs)												
SW8270DSIM	1-Methylnaphthalene	ug/kg	4.6 J	6 U	6.2 U	6.3 U	28	32	87	290	310	37
SW8270DSIM	2-Methylnaphthalene	ug/kg	8.9 J	6 U	6.2 U	6.3 U	63	81	200	480	810	100
SW8270DSIM	Acenaphthene	ug/kg	11	6 U	6.2 U	6.3 U	78	110	250	2,100	2,100	240
SW8270DSIM	Acenaphthylene	ug/kg	4.9 J	6 U	6.2 U	6.3 U	39	44	110	99	250	42
SW8270DSIM	Anthracene	ug/kg	19	1 J	6.2 U	6.3 U	100	130	300	520	910	150
SW8270DSIM	Benzo(a)anthracene	ug/kg	33	2.2 J	6.2 U	6.3 U	270	330	890	770	2,800	560

TABLE 3
SUBSURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

	Location		VB-01				VB-02					
	Sample Date		07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019
	Sample Depth (feet)		0.0-2.5	2.5-4.0	4.0-5.8	5.8-8.0	0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.0	7.0-8.8	8.8-10.5
	Lab Sample ID		580-87761-7	580-87761-8	580-87761-9	580-87761-10	580-87761-1	580-87761-2	580-87761-3	580-87761-4	580-87761-5	580-87761-6
	Sample Type		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
	Mudline (ft MLLW)		-41.7	-41.7	-41.7	-41.7	-39.9	-39.9	-39.9	-39.9	-39.9	-39.9
	Top of Elevation (ft MLLW)		-41.7	-44.2	-45.7	-47.5	-39.9	-41.4	-42.9	-44.9	-46.9	-48.7
	Bottom of Elevation (ft MLLW)		-44.2	-45.7	-47.5	-49.7	-41.4	-42.9	-44.9	-46.9	-48.7	-50.4
	Excavated or Capped during 2019 Construction?											
SW8270DSIM	Benzo(a)pyrene	ug/kg	28	2 J	6.2 U	6.3 U	300	330	970	670	2,800	640
SW8270DSIM	Benzo(b)fluoranthene	ug/kg	37	6 U	6.2 U	6.3 U	310	360	890	660	2,700	560
SW8270DSIM	Benzo(g,h,i)perylene	ug/kg	28	2.3 J	0.88 J	6.3 U	250	300	880	560	2,300	560
SW8270DSIM	Benzo(k)fluoranthene	ug/kg	12	6 U	6.2 U	6.3 U	110	120	320	240	710	170
SW8270DSIM	Chrysene	ug/kg	37	2.9 J	6.2 U	6.3 U	300	360	900	780	2,500	540
SW8270DSIM	Dibenz(a,h)anthracene	ug/kg	4.4 J	6 U	6.2 U	6.3 U	29	29	70	50	110	39
SW8270DSIM	Fluoranthene	ug/kg	87	5.9 J	6.2 U	6.3 U	560	700	1,700	2,100	8,200	1,400
SW8270DSIM	Fluorene	ug/kg	12	6 U	6.2 U	6.3 U	73	110	240	1,500	1,500	170
SW8270DSIM	Indeno(1,2,3-cd)pyrene	ug/kg	31	2.3 J	6.2 U	6.3 U	280	380	990	640	2,400	610
SW8270DSIM	Naphthalene	ug/kg	16	6 U	6.2 U	6.3 U	160	210	540	760	1,700	270
SW8270DSIM	Phenanthrene	ug/kg	73	3.6 J	6.2 U	6.3 U	450	570	1,400	3,200	10,000	1,200
SW8270DSIM	Pyrene	ug/kg	90	5.5 J	1.2 J	6.3 U	620	820	2,100	2,200	9,600	2,000
	Total 17 PAHs (NDs = 1/2 RL) - excluding 1-methylnapthalene	ug/kg	532 J	51.7 J	48.6 J	53.6 U	3,992	4,984	12,750	17,329	51,390	9,251
Extended list of polycyclic aromatic hydrocarbons (PAHs)												
SW8270DSIM	Naphthalene*	ug/kg	--	--	--	--	--	--	--	--	720	--
SW8270DSIM	1-Methylnaphthalene	ug/kg	--	--	--	--	--	--	--	--	130 J	--
SW8270DSIM	2-Methylnaphthalene*	ug/kg	--	--	--	--	--	--	--	--	340	--
SW8270DSIM	C1-Naphthalenes	ug/kg	--	--	--	--	--	--	--	--	310	--
SW8270DSIM	C2-Naphthalenes	ug/kg	--	--	--	--	--	--	--	--	580	--
SW8270DSIM	C3-Naphthalenes	ug/kg	--	--	--	--	--	--	--	--	920	--
SW8270DSIM	C4-Naphthalenes	ug/kg	--	--	--	--	--	--	--	--	660	--
SW8270DSIM	Acenaphthylene*	ug/kg	--	--	--	--	--	--	--	--	150	--
SW8270DSIM	Acenaphthene*	ug/kg	--	--	--	--	--	--	--	--	1,700	--
SW8270DSIM	Fluorene*	ug/kg	--	--	--	--	--	--	--	--	1,000	--
SW8270DSIM	C1-Fluorenes	ug/kg	--	--	--	--	--	--	--	--	390	--
SW8270DSIM	C2-Fluorenes	ug/kg	--	--	--	--	--	--	--	--	470	--
SW8270DSIM	C3-Fluorenes	ug/kg	--	--	--	--	--	--	--	--	400	--
SW8270DSIM	Dibenzothiophene	ug/kg	--	--	--	--	--	--	--	--	870	--
SW8270DSIM	C1-Dibenzothiophenes	ug/kg	--	--	--	--	--	--	--	--	420	--
SW8270DSIM	C2-Dibenzothiophenes	ug/kg	--	--	--	--	--	--	--	--	440	--
SW8270DSIM	C3-Dibenzothiophenes	ug/kg	--	--	--	--	--	--	--	--	310	--
SW8270DSIM	C4-Dibenzothiophenes	ug/kg	--	--	--	--	--	--	--	--	150	--
SW8270DSIM	Anthracene*	ug/kg	--	--	--	--	--	--	--	--	550	--
SW8270DSIM	Phenanthrene*	ug/kg	--	--	--	--	--	--	--	--	6,900	--
SW8270DSIM	C1-Phenanthrenes/Anthracenes	ug/kg	--	--	--	--	--	--	--	--	1,900	--
SW8270DSIM	C2-Phenanthrenes/Anthracenes	ug/kg	--	--	--	--	--	--	--	--	1,200	--
SW8270DSIM	C3-Phenanthrenes/Anthracenes	ug/kg	--	--	--	--	--	--	--	--	620	--
SW8270DSIM	C4-Phenanthrenes/Anthracenes	ug/kg	--	--	--	--	--	--	--	--	350 J	--
SW8270DSIM	Fluoranthene*	ug/kg	--	--	--	--	--	--	--	--	6,900	--
SW8270DSIM	Pyrene*	ug/kg	--	--	--	--	--	--	--	--	8,700	--
SW8270DSIM	C1-Fluoranthenes/Pyrenes	ug/kg	--	--	--	--	--	--	--	--	1,800	--
SW8270DSIM	C2-Fluoranthenes/Pyrenes	ug/kg	--	--	--	--	--	--	--	--	540	--
SW8270DSIM	C3-Fluoranthenes/Pyrenes	ug/kg	--	--	--	--	--	--	--	--	290	--
SW8270DSIM	C4-Fluoranthenes/Pyrenes	ug/kg	--	--	--	--	--	--	--	--	150	--
SW8270DSIM	Benzo(a)anthracene*	ug/kg	--	--	--	--	--	--	--	--	2,000	--

TABLE 3
SUBSURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

			Location	VB-01				VB-02					
			Sample Date	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019
			Sample Depth (feet)	0.0-2.5	2.5-4.0	4.0-5.8	5.8-8.0	0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.0	7.0-8.8	8.8-10.5
			Lab Sample ID	580-87761-7	580-87761-8	580-87761-9	580-87761-10	580-87761-1	580-87761-2	580-87761-3	580-87761-4	580-87761-5	580-87761-6
			Sample Type	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
			Mudline (ft MLLW)	-41.7	-41.7	-41.7	-41.7	-39.9	-39.9	-39.9	-39.9	-39.9	-39.9
			Top of Elevation (ft MLLW)	-41.7	-44.2	-45.7	-47.5	-39.9	-41.4	-42.9	-44.9	-46.9	-48.7
			Bottom of Elevation (ft MLLW)	-44.2	-45.7	-47.5	-49.7	-41.4	-42.9	-44.9	-46.9	-48.7	-50.4
			Excavated or Capped during 2019 Construction?										
SW8270DSIM	Chrysene*	ug/kg		--	--	--	--	--	--	--	--	2,200	--
SW8270DSIM	C1-Chrysenes	ug/kg		--	--	--	--	--	--	--	--	660	--
SW8270DSIM	C2-Chrysenes	ug/kg		--	--	--	--	--	--	--	--	290	--
SW8270DSIM	C3-Chrysenes	ug/kg		--	--	--	--	--	--	--	--	170	--
SW8270DSIM	C4-Chrysenes	ug/kg		--	--	--	--	--	--	--	--	100	--
SW8270DSIM	Benzo(b)fluoranthene*	ug/kg		--	--	--	--	--	--	--	--	2,100	--
SW8270DSIM	Benzo(k)fluoranthene*	ug/kg		--	--	--	--	--	--	--	--	810	--
SW8270DSIM	Benzo(e)pyrene	ug/kg		--	--	--	--	--	--	--	--	1,400	--
SW8270DSIM	Benzo(a)pyrene*	ug/kg		--	--	--	--	--	--	--	--	2,400	--
SW8270DSIM	Perylene	ug/kg		--	--	--	--	--	--	--	--	670	--
SW8270DSIM	Indeno(1,2,3-cd)pyrene*	ug/kg		--	--	--	--	--	--	--	--	1,300	--
SW8270DSIM	Dibenz(a,h)anthracene*	ug/kg		--	--	--	--	--	--	--	--	230	--
SW8270DSIM	Benzo(g,h,i)perylene*	ug/kg		--	--	--	--	--	--	--	--	1,800	--
	Total 17 PAHs (NDs = 1/2 RL) using results of second analysis	ug/kg		--	--	--	--	--	--	--	--	39,800	--

Notes:
Yellow highlighting = Sample excavated during 2019 Construction Project
Peach highlighting = Sample capped during 2019 Construction Project
Pink highlighting indicates exceedance of remedial action level (RAL)
-- = not analyzed
ft MLLW = feet below mean lower low water
NDs are reported to the laboratory reporting limit (RL U).
ug/kg = micrograms per kilogram
Data is reported on a dry weight basis except for total organic carbon (TOC).
J flags indicate estimated data found between the method detection limit (MDL) and RL, or estimated based on validation.
J+ flags indicates estimated biased high, J- flags indicates estimated biased low.
R flags indicate data is rejected as unusable.
See the Data Usability Summary Report (DUSR) for details on validation qualifier reasonings.
Total DDx was calculated by summing all detected concentrations plus 1/2 the reporting limit for non-detects.
Total PCBs was calculated by summing detected concentrations. Non-detects were considered 'zero'.
Total PAHs was calculated by summing all detected concentrations plus 1/2 the reporting limit for non-detects. 1-Methylnaphthalene was not included in this summation.
1-Methylnaphthalene was reported by the laboratory in the initial PAH runs in error. The data was included in this table, but was not included in the Total PAH summation.
* Total PAH 17 compounds used for summation from the Alkylated PAH runs.

TABLE 3
SUBSURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

		Location	VB-03							
		Sample Date	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019
		Sample Depth (feet)	0.0-2.0	2.0-4.0	4.0-6.0	4.0-6.0	6.0-8.0	8.0-9.0	9.0-11.2	11.2-12.0
		Lab Sample ID	580-87761-11	580-87761-12	580-87761-13	580-87761-18	580-87761-14	580-87761-15	580-87761-16	580-87761-17
		Sample Type	Primary	Primary	Primary	Duplicate	Primary	Primary	Primary	Primary
		Mudline (ft MLLW)	-26.9	-26.9	-26.9	-26.9	-26.9	-26.9	-26.9	-26.9
		Top of Elevation (ft MLLW)	-26.9	-28.9	-30.9	-30.9	-32.9	-34.9	-35.9	-38.1
		Bottom of Elevation (ft MLLW)	-28.9	-30.9	-32.9	-32.9	-34.9	-35.9	-38.1	-38.9
		Excavated or Capped during 2019 Construction?	Excavated	Excavated	Excavated	Excavated	Excavated	Capped	Capped	Capped
Method	**Analyte**	**Unit**								
E160.3	Total Solids	%	55.9	54.3	59.2	58.8	60.3	61.1	62	68.4
SW9060	TOC Average Duplicates	%	2.1	3.3	3.3	3.3	3.2	3.1	3.1	2.4
Dioxins and Furans										
E1613B	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ug/kg	0.11	0.2	0.088 J	0.065 J	0.15	0.075	0.2	0.026
E1613B	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ug/kg	0.83	3.8	1.9	1.5	3	1.4	3.1	0.61
E1613B	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ug/kg	0.021	0.17	0.036	0.029	0.072	0.034	0.057	0.026
E1613B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ug/kg	0.089	0.36	0.17	0.17	0.25	0.11	0.21	0.036
E1613B	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ug/kg	0.0028 J	0.019	0.0049 J	0.0042 J	0.0077 J	0.0043 J	0.0081 J	0.0011 J
E1613B	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.0049 J	0.083	0.018	0.015	0.048	0.017	0.031	0.0056 J
E1613B	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0016 J	0.0033 J	0.008 U	0.0013 J	0.0018 J	0.0011 J	0.0025 J	0.00072 J
E1613B	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.0027 J	0.051	0.006 J	0.006 J	0.019	0.0073 J	0.0098	0.0024 J
E1613B	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0039 J	0.014	0.0056 J	0.0057 J	0.0086	0.0046 J	0.0086	0.0019 J
E1613B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.00039 UJ	0.0018 J	0.00039 UJ	0.0009 J	0.001 J	0.00046 J	0.001 J	0.00039 UJ
E1613B	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ug/kg	0.0089 U	0.0059 J	0.008 U	0.0084 U	0.0045 J	0.0077 U	0.0049 J	0.0074 U
E1613B	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ug/kg	0.0033 J	0.023	0.012	0.013	0.036	0.013	0.024	0.0021 J
E1613B	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ug/kg	0.00086 J	0.0017 J	0.00089 J	0.0084 U	0.001 UJ	0.00089 J	0.0012 UJ	0.00021 UJ
E1613B	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ug/kg	0.0089 UJ	0.0063 J	0.008 U	0.0084 UJ	0.0032 J	0.0077 U	0.0082 U	0.0074 U
E1613B	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ug/kg	0.0018 J	0.0074 J	0.0051 J	0.0053 J	0.013	0.0058 J	0.0099	0.001 UJ
E1613B	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ug/kg	0.0018 U	0.019	0.012	0.012	0.018	0.014	0.016	0.0015 U
E1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ug/kg	0.00041 UJ	0.00093 J	0.0005 UJ	0.00088 J	0.00092 UJ	0.00081 UJ	0.0014 J	0.0015 U
Dichorodiphenyltrichloroethane (DDT) and its derivatives										
SW8081B	4,4'-DDD	ug/kg	3.3	17	28 J+	34 J+	29 J+	53 J+	30 J+	3.4 J+
SW8081B	4,4'-DDE	ug/kg	3.8 J	6.9 J	21 J+	10 J+	16 J+	12 J+	14 J+	1.2 J+
SW8081B	4,4'-DDT	ug/kg	0.96 U	0.49 J	2 J+	8.7 J+	0.95 U	0.85 U	11 J+	0.55 U
SW8081B	o,p'-DDD	ug/kg	0.92 J	5.5 J	13 J+	13 J+	19 J+	21 J+	12 J+	1.1 J+
SW8081B	o,p'-DDE	ug/kg	0.68 J	1.2 J	5.5 J+	5 J+	12 J+	7 J+	6.1 J+	0.29 J+
SW8081B	o,p'-DDT	ug/kg	2.4 U	2.6 U	2.2 U	1.6 U	2.4 U	0.85 J+	1.4 U	1.4 U
	Total DDx (NDs = 1/2 RL)	ug/kg	10.4 J	32.4 J	70.6 J	71.5 J	77.7 J	94.3 J	73.8 J	7.0 J
Polychlorinated biphenols (PCBs)										
SW8082A	Aroclor-1016	ug/kg	3.2 U	3.5 U	2.9 U	3.1 U	3.2 U	2.8 U	2.8 U	2.7 U
SW8082A	Aroclor-1221	ug/kg	3.2 U	3.5 U	2.9 U	3.1 U	3.2 U	2.8 U	2.8 U	2.7 U
SW8082A	Aroclor-1232	ug/kg	3.2 U	3.5 U	2.9 U	3.1 U	3.2 U	2.8 U	2.8 U	2.7 U
SW8082A	Aroclor-1242	ug/kg	3.2 U	3.5 U	2.9 U	3.1 U	3.2 U	2.8 U	2.8 U	2.7 U
SW8082A	Aroclor-1248	ug/kg	3.2 U	3.5 U	2.9 U	3.1 U	3.2 U	2.8 U	2.8 U	2.7 U
SW8082A	Aroclor-1254	ug/kg	3.2 U	3.5 U	2.9 U	3.1 U	3.2 U	2.8 U	2.8 U	2.7 U
SW8082A	Aroclor-1260	ug/kg	4.3	6.7	14	17	27	39 J	63 J	2.5 J
	Total PCBs (NDs = zero)	ug/kg	4.3	6.7	14	17	27	39 J	63 J	2.5 J
Polycyclic aromatic hydrocarbons (PAHs)										
SW8270DSIM	1-Methylnaphthalene	ug/kg	62	210	480	530	760	560	1,100	350
SW8270DSIM	2-Methylnaphthalene	ug/kg	110	500	1,200	1,300	1,600	1,200	1,200	590
SW8270DSIM	Acenaphthene	ug/kg	130	690	6,200	6,100	6,100	5,100	3,600	1,700
SW8270DSIM	Acenaphthylene	ug/kg	39	160	420	440	480	420	350	430
SW8270DSIM	Anthracene	ug/kg	140	460	7 UJ	3,500 J	3,600	1,800	1,800	1,100
SW8270DSIM	Benzo(a)anthracene	ug/kg	290	1,200	5,400	4,900	5,600	4,700	2,900	2,700

TABLE 3
SUBSURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

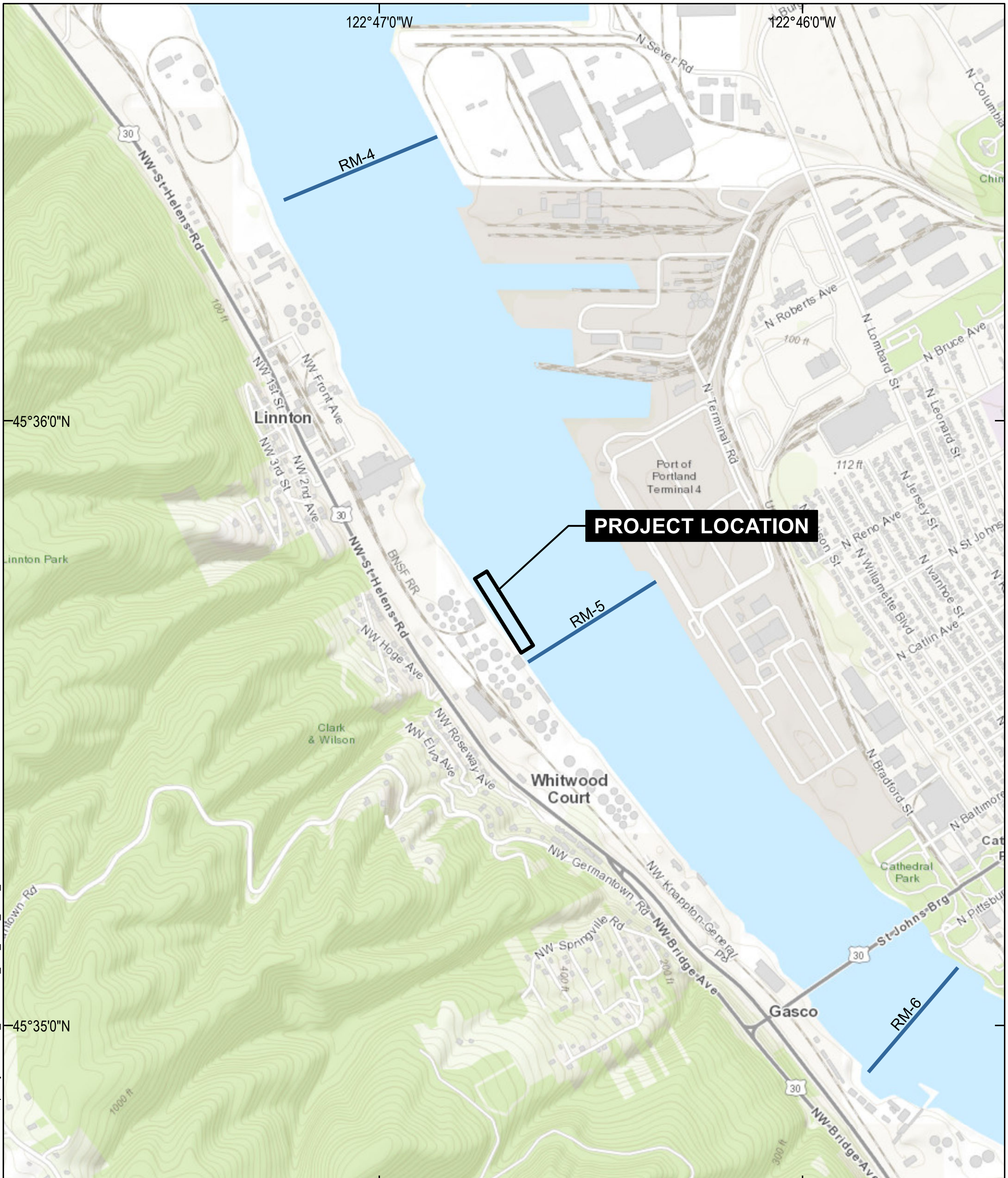
Location			VB-03							
Sample Date			07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019
Sample Depth (feet)			0.0-2.0	2.0-4.0	4.0-6.0	4.0-6.0	6.0-8.0	8.0-9.0	9.0-11.2	11.2-12.0
Lab Sample ID			580-87761-11	580-87761-12	580-87761-13	580-87761-18	580-87761-14	580-87761-15	580-87761-16	580-87761-17
Sample Type			Primary	Primary	Primary	Duplicate	Primary	Primary	Primary	Primary
Mudline (ft MLLW)			-26.9	-26.9	-26.9	-26.9	-26.9	-26.9	-26.9	-26.9
Top of Elevation (ft MLLW)			-26.9	-28.9	-30.9	-30.9	-32.9	-34.9	-35.9	-38.1
Bottom of Elevation (ft MLLW)			-28.9	-30.9	-32.9	-32.9	-34.9	-35.9	-38.1	-38.9
Excavated or Capped during 2019 Construction?			Excavated	Excavated	Excavated	Excavated	Excavated	Capped	Capped	Capped
SW8270DSIM	Benzo(a)pyrene	ug/kg	290	1,200	5,400	4,900	6,000	4,900	3,000	3,300
SW8270DSIM	Benzo(b)fluoranthene	ug/kg	430	1,100	4,800	5,300	5,500	4,400	2,400	2,700
SW8270DSIM	Benzo(g,h,i)perylene	ug/kg	230	860	4,400	4,200	5,100	4,100	2,200	3,200
SW8270DSIM	Benzo(k)fluoranthene	ug/kg	97	420	1,400	1,600	1,900	1,200	840	890
SW8270DSIM	Chrysene	ug/kg	290	1,200	5,600	5,400	5,700	4,900	3,000	2,400
SW8270DSIM	Dibenz(a,h)anthracene	ug/kg	25	83	190 J	530 J	650	530	310	240
SW8270DSIM	Fluoranthene	ug/kg	730	2,500	17,000	16,000	18,000	15,000	9,200	8,500
SW8270DSIM	Fluorene	ug/kg	150	660	4,100	4,100	4,100	2,800	2,200	1,200
SW8270DSIM	Indeno(1,2,3-cd)pyrene	ug/kg	300	1,100	5,000	4,700	5,700	4,600	2,300	3,300
SW8270DSIM	Naphthalene	ug/kg	250	1,500	2,700	3,700	4,400	2,700	2,300	2,000
SW8270DSIM	Phenanthrene	ug/kg	690	2,500	26,000	24,000	26,000	21,000	14,000	8,300
SW8270DSIM	Pyrene	ug/kg	760	21,000	20,000	19,000	22,000	18,000	11,000	11,000
	Total 17 PAHs (NDs = 1/2 RL) - excluding 1-methylnapthalene	ug/kg	4,951	37,133	109,814 J	109,670 J	122,430	97,350	62,600	53,550
Extended list of polycyclic aromatic hydrocarbons (PAHs)										
SW8270DSIM	Naphthalene*	ug/kg	--	440 J	1,800	1,600	--	2,200	--	1,300
SW8270DSIM	1-Methylnaphthalene	ug/kg	--	94 J	310	290	--	400	--	260
SW8270DSIM	2-Methylnaphthalene*	ug/kg	--	210 J	800	720	--	970	--	430
SW8270DSIM	C1-Naphthalenes	ug/kg	--	190 J	710	650	--	880	--	440
SW8270DSIM	C2-Naphthalenes	ug/kg	--	300	3,300	2,600	--	2,300	--	900
SW8270DSIM	C3-Naphthalenes	ug/kg	--	360	3,500	2,600	--	3,000	--	1,200
SW8270DSIM	C4-Naphthalenes	ug/kg	--	290	2,000	1,400	--	1,800	--	850
SW8270DSIM	Acenaphthylene*	ug/kg	--	110	320	290	--	300	--	340
SW8270DSIM	Acenaphthene*	ug/kg	--	620	5,500	4,300	--	4,000	--	1,700
SW8270DSIM	Fluorene*	ug/kg	--	560	3,800	3,000	--	2,600	--	1,000
SW8270DSIM	C1-Fluorenes	ug/kg	--	180	1,300	980	--	1,000	--	480
SW8270DSIM	C2-Fluorenes	ug/kg	--	270	1,300	970	--	1,100	--	620
SW8270DSIM	C3-Fluorenes	ug/kg	--	230	910	660	--	800	--	560
SW8270DSIM	Dibenzothiophene	ug/kg	--	300	3,300	2,600	--	2,300	--	1,100
SW8270DSIM	C1-Dibenzothiophenes	ug/kg	--	180	1,200	980	--	980	--	550
SW8270DSIM	C2-Dibenzothiophenes	ug/kg	--	230	1,000	760	--	900	--	560
SW8270DSIM	C3-Dibenzothiophenes	ug/kg	--	180	640	480	--	580	--	410
SW8270DSIM	C4-Dibenzothiophenes	ug/kg	--	110	300	230	--	280	--	250
SW8270DSIM	Anthracene*	ug/kg	--	350	3,900	3,100	--	1,700	--	1,200
SW8270DSIM	Phenanthrene*	ug/kg	--	2,800	29,000	22,000	--	19,000	--	9,400
SW8270DSIM	C1-Phenanthrenes/Anthracenes	ug/kg	--	960	5,600	4,200	--	4,400	--	2,400
SW8270DSIM	C2-Phenanthrenes/Anthracenes	ug/kg	--	660	2,900	2,200	--	2,600	--	1,500
SW8270DSIM	C3-Phenanthrenes/Anthracenes	ug/kg	--	410	1,500 J	1,000	--	1,900 J	--	840
SW8270DSIM	C4-Phenanthrenes/Anthracenes	ug/kg	--	270 J	1,200 J	650 J	--	3,100 J	--	560 J
SW8270DSIM	Fluoranthene*	ug/kg	--	4,100	22,000	16,000	--	14,000	--	11,000
SW8270DSIM	Pyrene*	ug/kg	--	3,500	24,000	18,000	--	17,000	--	13,000
SW8270DSIM	C1-Fluoranthenes/Pyrenes	ug/kg	--	1,100	4,500	3,400	--	3,500	--	2,400
SW8270DSIM	C2-Fluoranthenes/Pyrenes	ug/kg	--	370	1,200	930	--	1,000	--	700
SW8270DSIM	C3-Fluoranthenes/Pyrenes	ug/kg	--	200	590	470	--	550	--	410
SW8270DSIM	C4-Fluoranthenes/Pyrenes	ug/kg	--	120	300	240	--	290	--	260
SW8270DSIM	Benzo(a)anthracene*	ug/kg	--	1,100	5,500	3,800	--	3,700	--	2,800

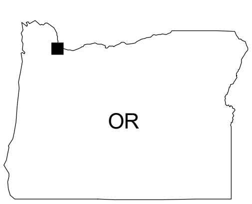
TABLE 3
SUBSURFACE SAMPLE RESULTS
2019 SEDIMENT INVESTIGATION DATA REPORT
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

	Location		VB-03							
	Sample Date		07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019	07/17/2019
	Sample Depth (feet)		0.0-2.0	2.0-4.0	4.0-6.0	4.0-6.0	6.0-8.0	8.0-9.0	9.0-11.2	11.2-12.0
	Lab Sample ID		580-87761-11	580-87761-12	580-87761-13	580-87761-18	580-87761-14	580-87761-15	580-87761-16	580-87761-17
	Sample Type		Primary	Primary	Primary	Duplicate	Primary	Primary	Primary	Primary
	Mudline (ft MLLW)		-26.9	-26.9	-26.9	-26.9	-26.9	-26.9	-26.9	-26.9
	Top of Elevation (ft MLLW)		-26.9	-28.9	-30.9	-30.9	-32.9	-34.9	-35.9	-38.1
	Bottom of Elevation (ft MLLW)		-28.9	-30.9	-32.9	-32.9	-34.9	-35.9	-38.1	-38.9
	Excavated or Capped during 2019 Construction?		Excavated	Excavated	Excavated	Excavated	Excavated	Capped	Capped	Capped
SW8270DSIM	Chrysene*	ug/kg	--	1,200	5,300	4,100	--	4,000	--	3,100
SW8270DSIM	C1-Chrysenes	ug/kg	--	430	1,500	1,100	--	1,300	--	840
SW8270DSIM	C2-Chrysenes	ug/kg	--	220	570	470	--	510	--	380
SW8270DSIM	C3-Chrysenes	ug/kg	--	130	300	260	--	290	--	250
SW8270DSIM	C4-Chrysenes	ug/kg	--	77	210	150	--	170	--	180
SW8270DSIM	Benzo(b)fluoranthene*	ug/kg	--	1,200	4,900	3,700	--	3,500	--	3,200
SW8270DSIM	Benzo(k)fluoranthene*	ug/kg	--	430	2,300	1,600	--	1,500	--	1,300
SW8270DSIM	Benzo(e)pyrene	ug/kg	--	730	3,300	2,400	--	2,400	--	2,200
SW8270DSIM	Benzo(a)pyrene*	ug/kg	--	1,200	6,000	4,400	--	4,300	--	3,800
SW8270DSIM	Perylene	ug/kg	--	440	1,500	1,100	--	1,100	--	1,100
SW8270DSIM	Indeno(1,2,3-cd)pyrene*	ug/kg	--	640	3,200	2,300	--	2,300	--	2,200
SW8270DSIM	Dibenz(a,h)anthracene*	ug/kg	--	130	570	430	--	420	--	340
SW8270DSIM	Benzo(g,h,i)perylene*	ug/kg	--	830	4,100	3,000	--	3,000	--	3,000
	Total 17 PAHs (NDs = 1/2 RL) using results of second analysis	ug/kg	--	19,420	122,990	92,340	--	84,490	--	59,110

Notes:
Yellow highlighting = Sample excavated during 2019 Construction Project
Peach highlighting = Sample capped during 2019 Construction Project
Pink highlighting indicates exceedance of remedial action level (RAL)
-- = not analyzed
ft MLLW = feet below mean lower low water
NDs are reported to the laboratory reporting limit (RL U).
ug/kg = micrograms per kilogram
Data is reported on a dry weight basis except for total organic carbon (TOC).
J flags indicate estimated data found between the method detection limit (MDL) a
J+ flags indicates estimated biased high, J- flags indicates estimated biased low.
R flags indicate data is rejected as unusable.
See the Data Usability Summary Report (DUSR) for details on validation qualifier re
Total DDx was calculated by summing all detected concentrations plus 1/2 the rep
Total PCBs was calculated by summing detected concentrations. Non-detects were
Total PAHs was calculated by summing all detected concentrations plus 1/2 the re
1-Methylnaphthalene was reported by the laboratory in the initial PAH runs in erro
* Total PAH 17 compounds used for summation from the Alkylated PAH runs.

FIGURES





MAP SOURCE: ESRI
SITE COORDINATES: 45°35'42.8" N 122°46'42.3" W

HALEY ALDRICH

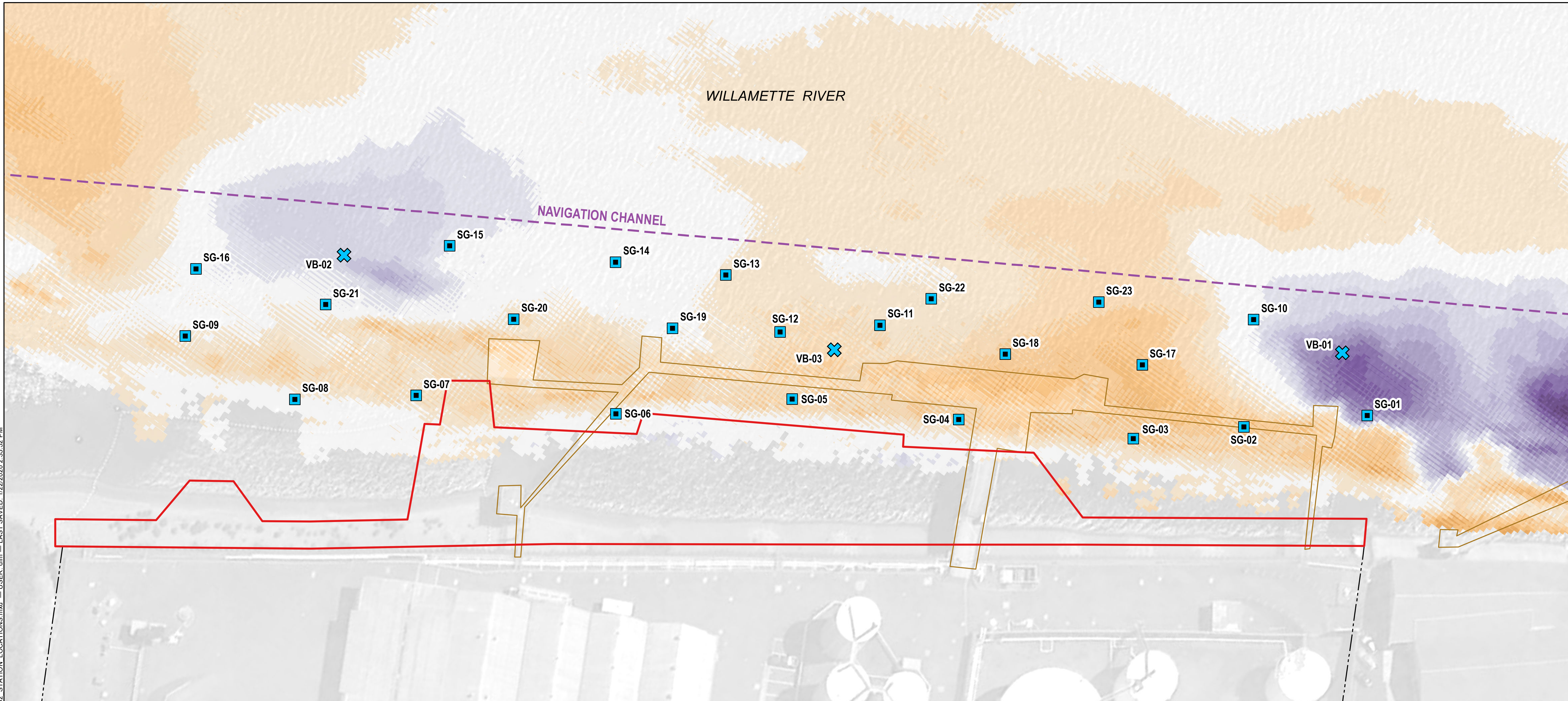
FORMER BP TERMINAL 22T
SEDIMENT SAMPLING DATA REPORT
PORTLAND, OREGON

SITE VICINITY

APPROXIMATE SCALE: 1 IN = 2000 FT
JANUARY 2020

FIGURE 1

GIS FILE PATH: G:\34655_BP Portland Harbor\Global\GIS\MapProjects\2020_01\129768_004_0001_SITE_VICINITY.mxd — USER: DFM — LAST SAVED: 1/22/2020 1:04:46 PM



LEGEND

2019 SURFACE SEDIMENT STATION

2019 SEDIMENT CORE

PROPERTY BOUNDARY

2008 SCM DREDGE/BACKFILL

DOCK/WALKWAY

BATHYMETRY DIFFERENCE BETWEEN 2004 AND 2018
EROSION (-) AND DEPOSITION (+), IN FEET

EROSIONAL

DEPOSITIONAL

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: GOOGLE, 16 JULY 2018

0 70 140
SCALE IN FEET

HALEY ALDRICH

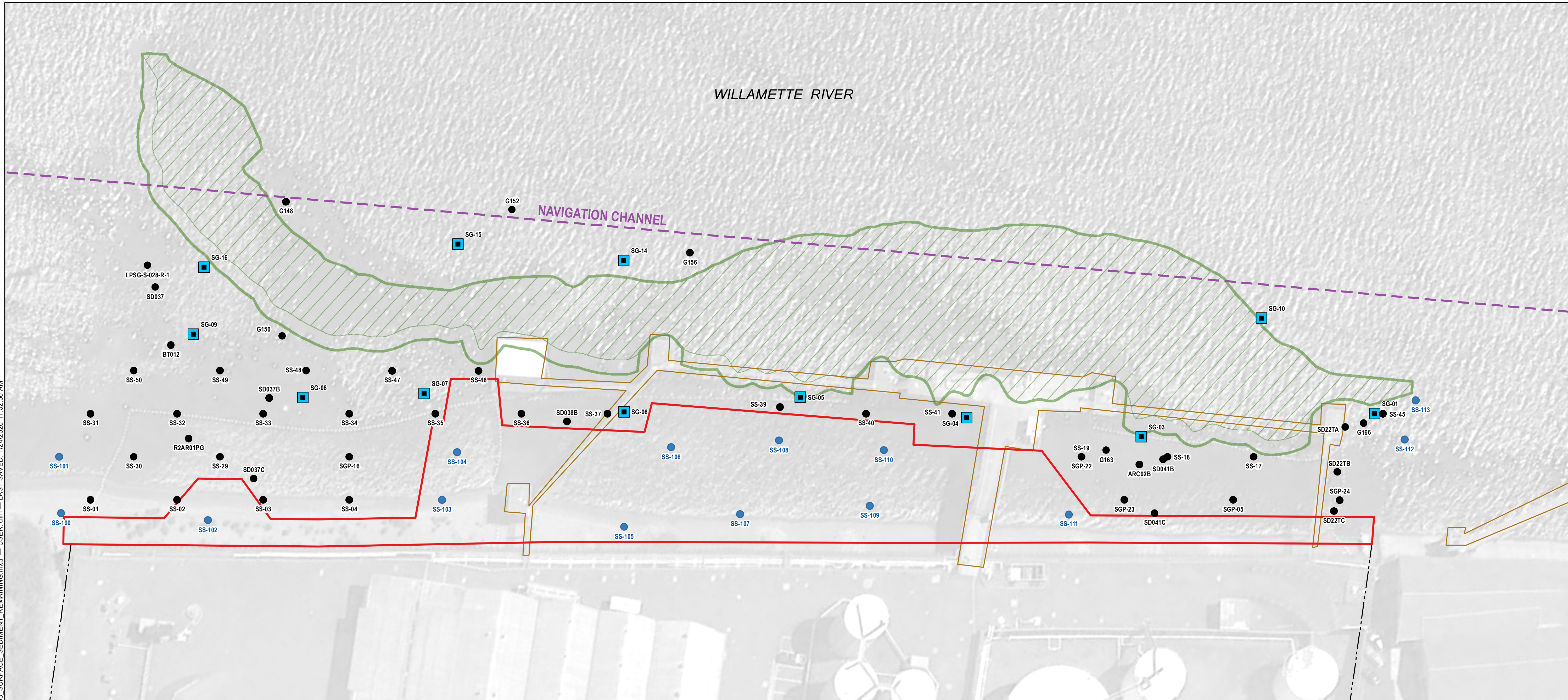
FORMER BP TERMINAL 22T
SEDIMENT SAMPLING DATA REPORT
PORTLAND, OREGON

STATION LOCATIONS

JANUARY 2020

FIGURE 2

GIS FILE PATH: G:\34655_BP Portland Harbor\Global\GIS\MapProjects\2020_01\129768_004_0002_STATION_LOCATIONS.mxd — USER: dfm — LAST SAVED: 1/22/2020 2:35:52 PM



GIS FILE PATH: G:\34655_BP Portland Harbor\Global\GIS\MapProjects\2020_01\129768_004_0003_SURFACE_SEDIMENT_REMAINING.mxd — USER: dfm — LAST SAVED: 1/24/2020 11:52:50 AM

LEGEND

- 2019 SURFACE SEDIMENT SAMPLE
- POST SCM SURFACE SEDIMENT SAMPLE (2011)
- OTHER SURFACE SEDIMENT SAMPLE
- 2008 SCM DREDGE/BACKFILL
- 2019 CAP AREA
- 2019 DREDGE AREA
- DOCK/WALKWAY
- NAVIGATION CHANNEL
- PROPERTY BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. SCM = SOURCE CONTROL MEASURE
3. AERIAL IMAGERY SOURCE: GOOGLE, 16 JULY 2018

0 70 140
SCALE IN FEET

HALEY ALDRICH

FORMER BP TERMINAL 22T
SEDIMENT SAMPLING DATA REPORT
PORTLAND, OREGON

SURFACE SEDIMENT SAMPLES REMAINING AFTER 2008 AND 2019 CONSTRUCTION PROJECTS

JANUARY 2020

FIGURE 3

APPENDIX A

Sediment Investigation Work Plan

HALEY & ALDRICH, INC.
1956 Webster Street
Suite 300
Oakland, CA 94612
510.879.4544

16 May 2019
File No. 129768-004

Kyle Christie
Remediation Management Services Company
An Affiliate of Atlantic Richfield Company
4 Centerpoint Drive, Suite 200
La Palma, CA 90623

Subject: Sediment Investigation Work Plan
Former Terminal 22T
Portland Harbor Superfund Site

Dear Mr. Christie:

Haley & Aldrich, Inc. (Haley & Aldrich) has prepared this Sediment Investigation Work Plan (Work Plan) on behalf of Atlantic Richfield Company and BP West Coast Products LLC (ARC/BP) describing the proposed sediment investigation adjacent to ARC/BP's former Terminal 22T in Portland Oregon. The investigation area vicinity is shown in Figure 1, at approximately River Mile 4.9 in the Portland Harbor Superfund Site.

Objectives

The primary objective is to characterize chemical concentrations in surface and subsurface sediment samples for comparison to remedial action levels (RALs) and cleanup levels (CLs), as outlined in the Portland Harbor Record of Decision (ROD). RALs have been established for six focused contaminants of concern (COCs), including total polycyclic aromatic hydrocarbons (PAHs), total polychlorinated biphenols (PCBs), total concentration of dichorodiphenyltrichloroethane and its derivatives (DDx), 2,3,7,8 TCDD, 1,2,3,7,8-PeCDD, and 2,3,4,7,8-PeCDF (EPA, 2017). All sediment samples will be analyzed for these compounds, as well as total organic carbon (TOC), and percent solids so that results can be reported on a dry weight basis. A subset of the samples will also be analyzed for selected metals, for which CLs have been established (As, Cd, Cu, Hg, Pb, and Zn).

A secondary objective is to collect forensic PAH data for use in determining PAH sources. Therefore, selected samples with total PAH concentrations exceeding the RAL will be analyzed for an expanded list of PAHs including the alkylated PAH homologues.

Figure 2 shows target station locations for up to 21 sediment grab samples and up to three vibracore stations. Coordinates are provided on Table 1. The anticipated number of samples and analyses for each media are summarized in Table 2.

Proposed Field Activities

The sections below describe the scope of the proposed investigation, including field and analytical methods. Additional information is included as Appendix A - sediment and general sampling procedures and Appendix B - quality assurance/quality control [QA/QC] procedures. All sampling procedures and methods will be consistent with those employed during the Portland Harbor pre-design investigation (PDI) sampling (AECOM and Geosyntec, 2018a,b), with the exception that grab samples will be a single point grab rather than a three-point composite.

FIELD PREPARATION

Prior to the field activities, a project-specific Health and Safety Plan will be prepared, and all necessary permits will be obtained.

SEDIMENT GRAB SAMPLES

Approximately 21 surface grab samples will be collected, consistent with the EPA approved Portland Harbor PDI and RI/FS protocol. The target sample interval is 0 to 30 centimeters (cm) below sediment surface (bss). A minimum penetration of 25 cm will be used for acceptance criteria of individual grabs. Proposed surface sediment sample stations are shown in Figure 2; target coordinates are provided in Table 1. Sample naming and sampling procedures are outlined in Appendix A.

VIBRACORE SAMPLING

Up to three vibracores will be collected, consistent with the Portland Harbor PDI and RI/FS protocol, to characterize subsurface sediment conditions adjacent to the dock, where maintenance dredging activities may reasonably be anticipated to occur. Hard acetate core barrel liners will be used. Target vibracore depth is 14 feet bss. Proposed vibracore sample stations are shown in Figure 2 and target coordinates are listed in Table 1. Sample naming and sampling procedures are outlined in Appendix A.

The vibracores will be processed on board the sampling vessel and segmented into approximately 2-ft sections for potential chemical analysis. Sample containers will be identical to those used for the surface samples. A subset of the sample intervals will be analyzed for the same set of constituents as the surface sediment samples; the remainder will be archived.

SAMPLE ANALYSIS

As summarized in Table 2, surface sediment samples will be analyzed for TOC, priority pollutant PAHs, DDx, PCBs, and dioxin/furans. Analytical methods, sampling requirements, and holding times can be found on Table 3. Approximately three sample intervals from each of the vibracores will be selected for analysis based on observed sample elevation, lithology, and any field observations of potential impacts. The samples will be selected by the Project Manager in consultation with the project team, including yourself. These subsurface sediment samples will likewise be analyzed for TOC, priority pollutant PAHs, DDx, PCBs, and dioxin/furans (Table 2). The remaining subsurface intervals, and all remaining sample volume will be archived for potential future analysis.

All samples will be packed on ice and transfer under chain-of-custody protocol by courier to TestAmerica in Seattle, WA. Analyte lists for each analysis, as well as method detection and reporting limits are listed on Table 4. QA/QC requirements are described in Appendix B. Based on the results of the first round of analysis, up to 12 samples will be analyzed for selected metals and/or the extended list of PAHs (see Table 4). Additional subsurface intervals may also be analyzed for one or more of the analyte groups listed on Table 4.

DECONTAMINATION AND WASTE MANAGEMENT

All reusable sampling equipment (such as the grab sampler) will be decontaminated between each location with an initial rinse with vessel river water to dislodge particles, scrubbing with Alconox® (or similar detergent), and distilled water rinse. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site. Additional information in contained in Appendix A.

Tyvek, gloves, paper towels, plastic sheeting, and other waste material generated during sampling will be placed in heavyweight garbage bags or other appropriate containers and placed in normal refuse containers for disposal at a solid waste landfill. All excess sediment from core processing or other investigation-derived waste will be placed in a Department of Transportation (DOT) rated container, labeled appropriately and removed off-site by a licensed waste hauler. The waste will be profiled and disposed of at an appropriate facility.

SPILL PREVENTION, CONTROL AND RESPONSE

Spill prevention and control measures will be implemented during any work activity during which impacted sediments could spill into surface water, such as retrieving cores, handling of waste materials, and decontamination of equipment. A spill response kit will be available in the work area at all times when work is being completed.

Please let us know if you have any comments or questions.

Sincerely yours,
HALEY & ALDRICH, INC.

Laura S McWilliams

Laura McWilliams, PhD

Enclosures:

References
Table 1 – Proposed Sediment Station Coordinates
Table 2 – Investigation Samples and Analyses
Table 3 – Analytical Methods, Sampling Requirements, and Holding Times
Table 4 – Method Detection and Reporting Limits for Sediment and Pore Water
Figure 1 – Sediment Investigation Vicinity Map
Figure 2 – Proposed Sediment Station Locations
Appendix A – Sediment and General Sampling Procedures
Appendix B – Quality Assurance/Quality Control Procedures

c: Miller Nash Graham & Dunn LLP, Steve Goodman and Nicole McLaughlin
Antea Group, Bryan Taylor

References:

AECOM and Geosyntec, 2018a. Surface Sediment Field Sampling Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 18 January.

AECOM and Geosyntec, 2018b. Subsurface Sediment Coring Field Sampling Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 18 January.

EPA, 2017. Record of Decision, Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.

TABLES

Table 1
Proposed Sediment Station Coordinates
Sediment Investigation Work Plan
Former Terminal 22T
Portland Harbor Superfund Site

Station	Sample Type	Latitude (decimal degrees)	Longitude (decimal degress)	Northing[a]	Easting[a]
SG-01	Surface grab	45.59371521	-122.7776384	710773	7619135
SG-02	Surface grab	45.59384705	-122.7778714	710822	7619077
SG-03	Surface grab	45.59406059	-122.7780517	710902	7619033
SG-04	Surface grab	45.59433824	-122.7782936	711005	7618974
SG-05	Surface grab	45.59463115	-122.7785397	711113	7618914
SG-06	Surface grab	45.59487665	-122.7788214	711205	7618845
SG-07	Surface grab	45.59520546	-122.7791453	711327	7618765
SG-08	Surface grab	45.59540479	-122.7793194	711401	7618723
SG-09	Surface grab	45.59562948	-122.779389	711483	7618707
SG-10	Surface grab	45.59399556	-122.7775119	710874	7619171
SG-11	Surface grab	45.59458667	-122.7781962	711094	7619002
SG-12	Surface grab	45.59472428	-122.7783532	711146	7618963
SG-13	Surface grab	45.59497059	-122.7784027	711236	7618953
SG-14	Surface grab	45.59516952	-122.7785531	711309	7618916
SG-15	Surface grab	45.59532945	-122.7787234	711369	7618874
SG-16	Surface grab	45.59570422	-122.7791981	711509	7618757
SG-17	Surface grab	45.59414213	-122.7778378	710930	7619089
SG-18	Surface grab	45.59438257	-122.7780363	711019	7619041
SG-19	Surface grab	45.59489671	-122.7785549	711210	7618913
SG-20	Surface grab	45.59515957	-122.7787855	711307	7618857
SG-21	Surface grab	45.59543589	-122.7790598	711410	7618789
VB-01	Vibracore	45.59385858	-122.7774721	710824	7619179
VB-02	Vibracore	45.59553706	-122.7788858	711446	7618835
VB-03	Vibracore	45.59465335	-122.7783338	711120	7618967

Note:

[a]NAD 1983 HARN State Plane Oregon North Feet

Table 2
Investigation Samples and Analyses
Sediment Investigation Work Plan
Former Terminal 22T
Portland Harbor Superfund Site

Sample Type	Number of Stations	Number of Samples					
		Total Organic Carbon (TOC) and percent solids	Polycyclic Aromatic Hydrocarbons (PAHs)	Organochlorine Pesticides (DDx only)	Polychlorinated Biphenyls (PCBs)	Polychlorinated dibenz-o-Dioxins and Furans (PCDD/Fs)	Archive
Surface Sediment	21	21	21	21	21	21	all remaining volume
Sediment Vibracore	3	3 x 3 intervals = 9	3 x 3 intervals = 9	3 x 3 intervals = 9	3 x 3 intervals = 9	3 x 3 intervals = 9	3 x 4 intervals = 12 and all remaining volume

Notes:

Archived samples may be analyzed for the extended list of PAHs and/or selected metals.

Sediment intervals not analyzed initially may be analyzed at a later time.

Table 3
Analytical Methods, Sampling Requirements, and Holding Times
Sediment Investigation Work Plan
Former Terminal 22T
Portland Harbor Superfund Site

Analytical Parameter	Method	Acceptable Containers	Sample Volume	Perservative	Holding Time
Total Organic Carbon (TOC) and percent solids	9060_PSEP and ASTM D2216	Wide-mouth glass jar with Teflon-lined lid	50 g	Cool to 4ºC	14 days; 6 months for frozen storage
Priority Pullutant Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270D SIM	Wide-mouth glass jar with Teflon-lined lid	100 g	Cool to 4ºC	14 days for extraction and 40 days for analysis; 1 year for frozen storage
Organochlorine Pesticides (DDx only)	EPA 8081B	Wide-mouth glass jar with Teflon-lined lid	100 g	Cool to 4ºC	14 days for extraction and 40 days for analysis; 1 year for frozen storage
Polychlorinated Biphenyls (PCBs)	EPA 8082A	Wide-mouth glass jar with Teflon-lined lid	20 g	Cool to 4ºC	1 year
Metals (As, Cd, Cu, Hg, Pb, Zn)	EPA 6020A and 7471A	Wide-mouth glass jar with Teflon-lined lid	30 g	Cool to 4ºC	28 days (Hg), 6 months (others)
Polychlorinated dibenz-o-Dioxins and Furans (PCDD/Fs)	EPA 1613B	Wide-mouth glass jar with Teflon-lined lid	25 g	Cool to 4ºC	1 year
Extended List of Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270D SIM MODIFIED	Wide-mouth glass jar with Teflon-lined lid	100 g	Cool to 4ºC	14 days for extraction and 40 days for analysis; 1 year for frozen storage

Notes:

ASTM = American Society for Testing and Materials
EPA = U.S. Environmental Protection Agency
PSEP = Puget Sound Estuary Program
SIM = selected ion mode
g = grams
ºC = degrees Celsius

Table 4
Method Detection and Reporting Limits
Sediment Investigation Work Plan
Former Terminal 22T
Portland Harbor Superfund Site

Analyte	CAS Number	Method Reporting Limit	Method Detection Limit
Total Organic Carbon (9060_PSEP)	7440-44-0	0.02%	0.0044%
Pesticides (8081B) - ug/kg			
2,4'-DDD	53-19-0	0.5	0.11
2,4'-DDE	3424-82-6	0.5	0.091
2,4'-DDT	789-02-6	0.5	0.19
4,4'-DDD	72-54-8	0.2	0.039
4,4'-DDE	72-55-9	0.2	0.053
4,4'-DDT	50-29-3	0.2	0.039
Priority Pollutant Polycyclic Aromatic Hydrocarbons (8270D SIM) - ug/kg			
Naphthalene	91-20-3	5.00	0.800
2-Methylnaphthalene	91-57-6	5.00	0.450
Acenaphthylene	208-96-8	5.00	0.500
Acenaphthene	83-32-9	5.00	0.600
Fluorene	86-73-7	5.00	0.500
Phenanthrene	85-01-8	5.00	0.690
Anthracene	120-12-7	5.00	0.600
Fluoranthene	206-44-0	5.00	1.40
Pyrene	129-00-0	5.00	0.970
Benzo[a]anthracene	56-55-3	5.00	0.760
Chrysene	218-01-9	5.00	1.50
Benzo[b]fluoranthene	205-99-2	5.00	0.590
Benzo[k]fluoranthene	207-08-9	5.00	0.600
Benzo[a]pyrene	50-32-8	5.00	0.400
Indeno[1,2,3-cd]pyrene	193-39-5	5.00	0.600
Dibenz(a,h)anthracene	53-70-3	5.00	0.720
Benzo[g,h,i]perylene	191-24-2	5.00	0.500
Metals (6020A or 7471A) - mg/kg			
Arsenic	7440-38-2	0.500	0.100
Cadmium	7440-43-9	0.400	0.0770
Copper	7440-50-8	1.00	0.220
Lead	7439-92-1	0.500	0.0480
Zinc	7440-66-6	5.00	1.61
Mercury	7439-97-6	0.0300	0.00900
Polychlorinated Biphenyls (8082A) - ug/kg			
Aroclor 1016	12674-11-2	2	0.34
Aroclor 1221	11104-28-2	2	0.95
Aroclor 1232	11141-16-5	2	0.47
Aroclor 1242	53469-21-9	2	0.49
Aroclor 1248	12672-29-6	2	0.16
Aroclor 1254	11097-69-1	2	0.79
Aroclor 1260	11096-82-5	2	0.34

Table 4
Method Detection and Reporting Limits
Sediment Investigation Work Plan
Former Terminal 22T
Portland Harbor Superfund Site

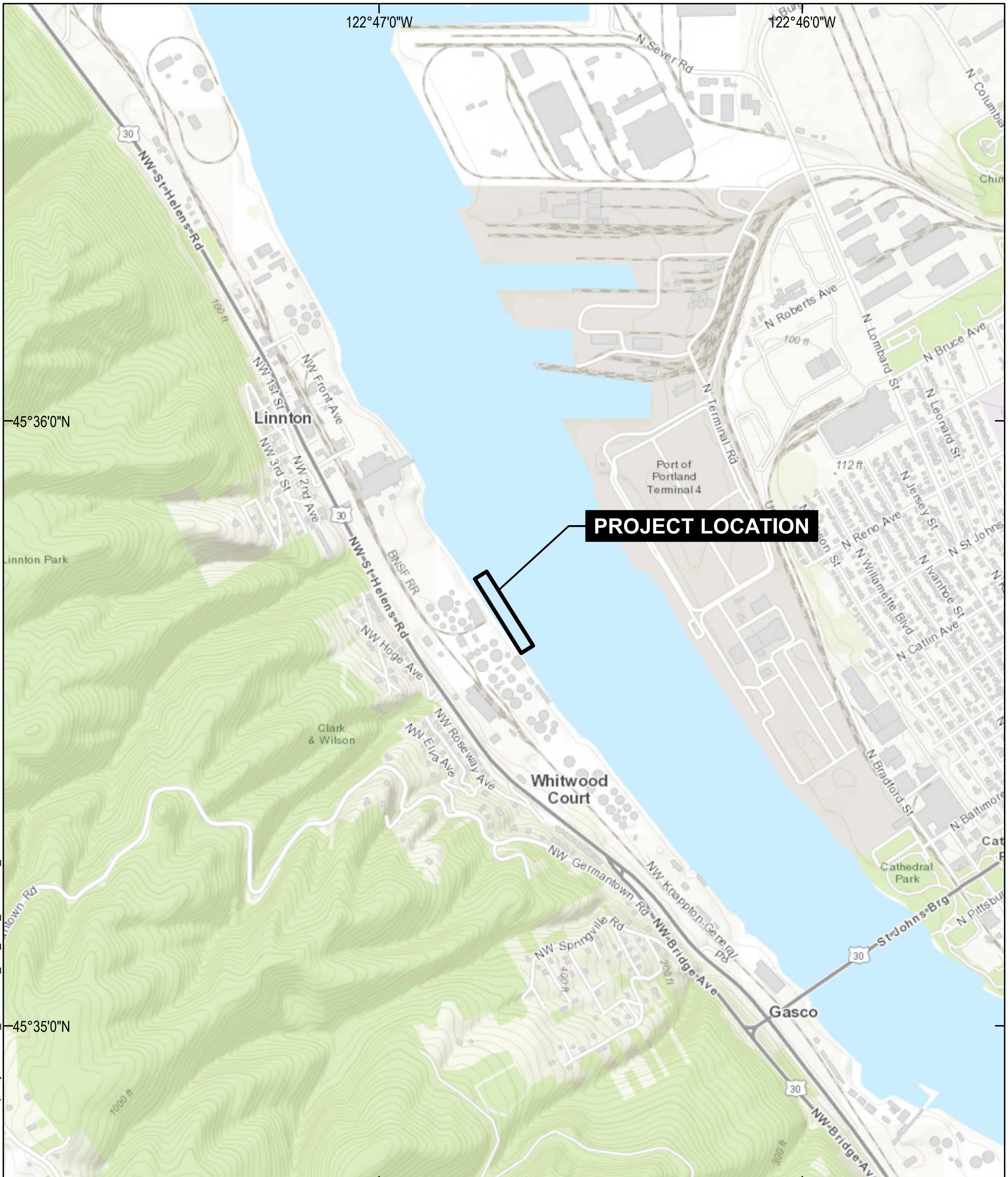
Analyte	CAS Number	Method Reporting Limit	Method Detection Limit
Polychlorinated dibenz-o-Dioxins and Furans (1613B) - ng/kg			
2,3,7,8-TCDD	1746-01-6	1.00	0.230
1,2,3,7,8-PeCDD	40321-76-4	5.00	0.480
1,2,3,4,7,8-HxCDD	39227-28-6	5.00	0.380
1,2,3,6,7,8-HxCDD	57653-85-7	5.00	0.470
1,2,3,7,8,9-HxCDD	19408-74-3	5.00	0.450
1,2,3,4,6,7,8-HpCDD	35822-46-9	5.00	0.800
OCDD	3268-87-9	10.0	0.970
2,3,7,8-TCDF	51207-31-9	1.00	0.270
1,2,3,7,8-PeCDF	57117-41-6	5.00	0.370
2,3,4,7,8-PeCDF	57117-31-4	5.00	0.530
1,2,3,4,7,8-HxCDF	70648-26-9	5.00	0.520
1,2,3,6,7,8-HxCDF	57117-44-9	5.00	0.360
2,3,4,6,7,8-HxCDF	60851-34-5	5.00	0.590
1,2,3,7,8,9-HxCDF	72918-21-9	5.00	0.310
1,2,3,4,6,7,8-HpCDF	67562-39-4	5.00	0.380
1,2,3,4,7,8,9-HpCDF	55673-89-7	5.00	0.440
OCDF	39001-02-0	10.0	0.500
Extended list of Polycyclic Aromatic Hydrocarbons (8270D SIM) - ug/kg			
Naphthalene	91-20-3	20.0	1.83
C1-Naphthalenes	STL00916	10.0	0.790
C2-Naphthalenes	STL00917	2.00	0.760
C3-Naphthalenes	STL00918	2.00	0.980
C4-Naphthalenes	STL00919	4.00	2.07
1-Methylnaphthalene	90-12-0	5.00	0.700
2-Methylnaphthalene	91-57-6	10.0	1.01
Acenaphthene	83-32-9	1.00	0.460
Acenaphthylene	208-96-8	1.00	0.250
Fluorene	86-73-7	1.00	0.480
C1-Fluorenes	STL00913	1.00	0.560
C2-Fluorenes	STL00914	2.00	1.20
C3-Fluorenes	STL00915	2.00	1.07
Dibenzothiophene	132-65-0	1.00	0.340
C1-Dibenzothiophenes	STL00909	1.00	0.650
C2-Dibenzothiophenes	STL00910	1.00	0.930
C3-Dibenzothiophenes	STL00911	2.00	1.12
C4-Dibenzothiophenes	STL00967	1.00	0.950
Phenanthrene	85-01-8	2.00	1.76
Anthracene	120-12-7	1.00	0.810
C1-Phenanthrenes/Anthracenes	STL00901	2.00	1.12
C2-Phenanthrenes/Anthracenes	STL00902	4	2.45
C3-Phenanthrenes/Anthracenes	STL00903	2.00	1.58

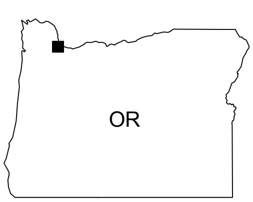
Table 4
Method Detection and Reporting Limits
Sediment Investigation Work Plan
Former Terminal 22T
Portland Harbor Superfund Site

Analyte	CAS Number	Method Reporting Limit	Method Detection Limit
C4-Phenanthrenes/Anthracenes	STL00904	2.00	1.88
Fluoranthene	206-44-0	1.00	0.910
Pyrene	129-00-0	2.00	0.600
C1-Fluoranthenes/pyrene	STL00912	1.00	0.520
C2-Fluoranthenes/Pyrene	STL00968	1.00	0.450
C3-Fluoranthenes/Pyrene	STL00969	1.00	0.550
C4-Fluoranthenes/Pyrene	STL01791	1.00	0.380
Benzo[a]anthracene	56-55-3	1.00	0.400
Chrysene	218-01-9	1.00	0.380
C1-Chrysenes	STL00905	1.00	0.260
C2-Chrysenes	STL00906	1.00	0.310
C3-Chrysenes	STL00907	1.00	0.300
C4-Chrysenes	STL00908	1.00	0.340
Benzo[b]fluoranthene	205-99-2	1.00	0.510
Benzo[k]fluoranthene	207-08-9	1.00	0.460
Benzo[a]pyrene	50-32-8	1.00	0.360
Benzo[e]pyrene	192-97-2	1.00	0.340
Perylene	198-55-0	1.00	0.200
Indeno[1,2,3-cd]pyrene	193-39-5	1.00	0.700
Dibenz(a,h)anthracene	53-70-3	1.00	0.570
Benzo[g,h,i]perylene	191-24-2	1.00	0.590

Notes:
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
ng/kg = nanograms per kilogram

FIGURES





MAP SOURCE: ESRI
SITE COORDINATES: 45°35'42.8" N 122°46'42.3" W

HALEY ALDRICH

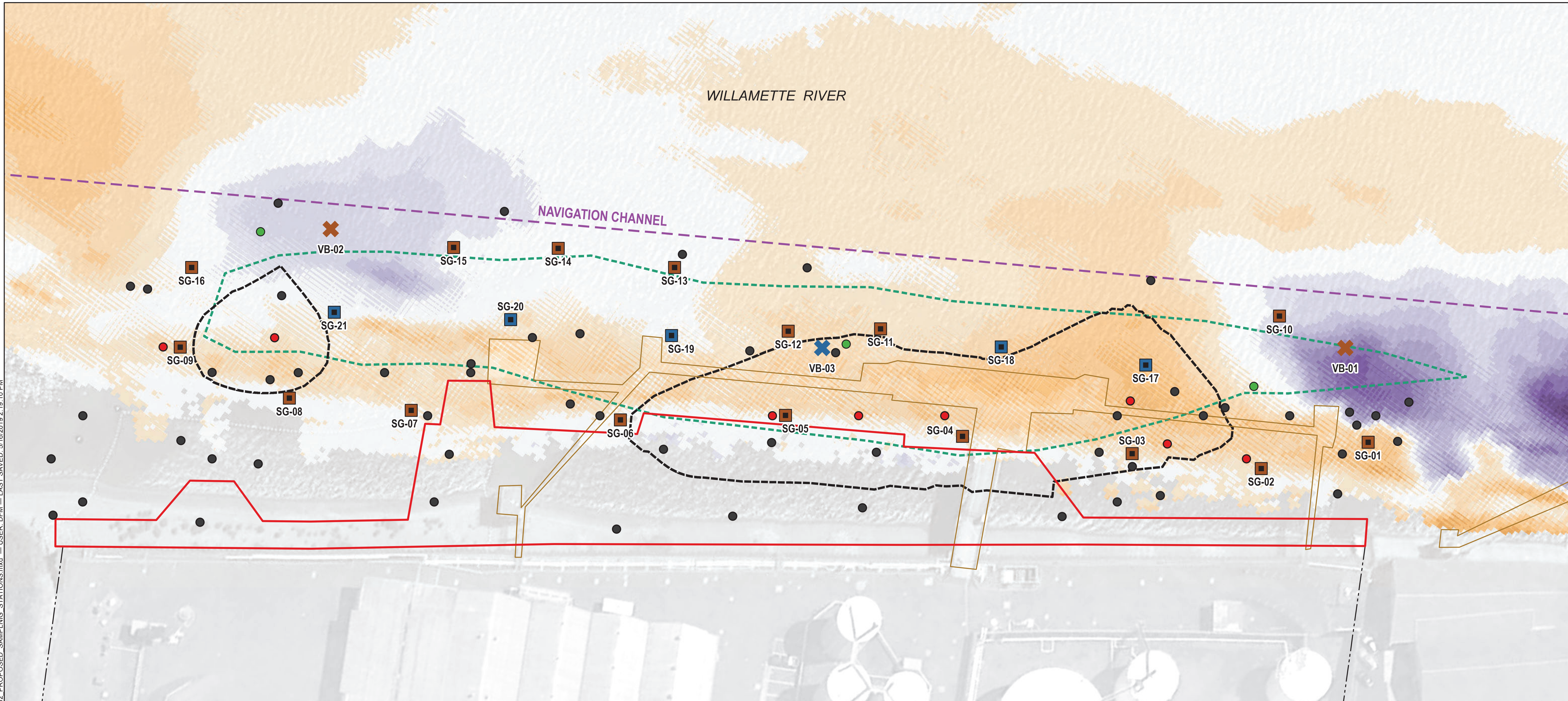
FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

PROJECT LOCATION

APPROXIMATE SCALE: 1 IN = 2000 FT
APRIL 2019

FIGURE 1

GIS FILE PATH: G:\34655_BP Portland Harbor\Global\GIS\MapProjects\2019_04\129768_004_0001_PROJECT_LOCATION.mxd — USER: dfm — LAST SAVED: 1/18/2019 2:22:08 PM



LEGEND

- HISTORICAL SURFACE SEDIMENT SAMPLE WITH TPAH < 13,000 µg/kg
- HISTORICAL SURFACE SEDIMENT SAMPLE WITH TPAH > 13,000 µg/kg
- PRE-REMEDIAL DESIGN SURFACE SEDIMENT SAMPLE (2018)
- PROPERTY BOUNDARY
- NAVIGATION CHANNEL
- 2008 SOURCE CONTROL DREDGE BOUNDARY
- DOCK, WALKWAY
- ROD SMA FOOTPRINT (RECORD OF DECISION, JAN 2017)
- PRELIMINARY REFINED SMA FOOTPRINT (PRE-REMEDIATION DESIGN FOOTPRINT REPORT, JAN 2019)

PROPOSED LOCATIONS

- PRIMARY SURFACE SEDIMENT SAMPLE
- PRIMARY VIBRACORE
- SECONDARY SURFACE SEDIMENT SAMPLE
- SECONDARY VIBRACORE

BATHYMETRY DIFFERENCE BETWEEN 2004 AND 2018
EROSION (-) AND DEPOSITION (+), IN FEET

- EROSIONAL
- DEPOSITIONAL

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. SMA = SEDIMENT MANAGEMENT AREA
3. ROD = RECORD OF DECISION
4. µg/kg = MICROGRAMS PER KILOGRAM
5. TPAH = TOTAL CONCENTRATION OF 17 POLYCYCLIC AROMATIC HYDROCARBONS
6. AERIAL IMAGERY SOURCE: GOOGLE, 16 JULY 2018

0 70 140
SCALE IN FEET

HALEY ALDRICH

FORMER BP TERMINAL 22T
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

PROPOSED SAMPLING STATIONS

MAY 2019

FIGURE 2

GIS FILE PATH: G:\34655_BP Portland Harbor\Global\GIS\MapProjects\2019_04\129768_004_0002_PROPOSED_SAMPLNIG_STATIONS.mxd — USER: DFM — LAST SAVED: 5/16/2019 2:19:10 PM

APPENDIX A

Sediment and General Sampling Procedures

Sediment Sampling and General Sample Handling Procedures

Sediment Sampling Procedures

Surface and subsurface sediment samples will be collected. Consistent sampling procedures will be used to collect representative sediment samples for various objectives. The following sections describe the Haley & Aldrich's sediment collection and sampling procedures to be used to collect sediment surface grab and discrete core samples. These procedures are in accordance with the guidance set forth in "Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual" (United States Environmental Protection Agency [EPA], 2001) and Haley and Aldrich "Interim Operating Procedure (OP) 3004 – Stream Sediment and Wetlands Soil Sampling."

LICENSE, ACCESS COORDINATION, AND AGENCY NOTIFICATION

All necessary permits will be obtained from the Oregon Department of State Lands (DSL) and the Oregon Department of Fish and Wildlife (ODFW). In addition, although a permit is not required, the United States Army Corps of Engineers (USACE) will be notified.

STATION AND SAMPLE IDENTIFICATION

Each station location and individual sample will be assigned a unique alphanumeric identifier using the format described below.

- The first three characters of the station ID will identify the investigation area from which the sample was collected (22T);
- Followed by a two-digit code indicating sample type (SG = surface grab; VB = vibracore);
- This will be followed by a sequential two-digit number (e.g., 01, 02, etc.); and
- For subsurface samples only, the sample depth interval in ft bss.

For example:

- 22T-SG-01 = surface sediment sample from station SG-01.
- 22T-VB-01-2.0-4.0 = subsurface sediment sample from the interval 2-4 ft bss from vibracore station VB-01.

Field duplicate samples are indicated by adding a "D". Extra volume collected for laboratory matrix spike and matrix spike duplicates are indicated by adding a "MSD". Equipment rinsate blanks should be named as the station ID of the last sample collected, followed by RB (Rinsate Blank), and a one or two-digit descriptor of the field equipment being examined.

For example:

- 22T-SG-01-D = field duplicate surface sediment sample from station SG-01.
- 22T-VB-01-2.0-4.0-MSD = additional volume collected from the interval 2-4 ft bss from vibracore station VB-01 for laboratory matrix spike and matrix spike duplicates.

- 22T-VB-02-RB-SH = rinsate blank collected from the decontaminated shoe of the vibracore barrel after collecting a core from station VB-02.

SAMPLE COLLECTION EQUIPMENT AND PROCEDURES

The following subsections describe the sampling procedures to be used in this investigation. The procedures address the various types of sampling proposed.

Sampling Platform

Sediment collection will be conducted from a vessel or platform supplied by a qualified subcontractor and operated by a licensed captain and under the direction of a Haley & Aldrich Project Manager.

Horizontal and Vertical Positioning

Station positioning will be determined using a differential global positioning system (GPS) on board the vessel. Station positions will be recorded in latitude and longitude to the nearest 0.01 second using the World Geodetic System 84 coordinate system.

The sediment surface elevation of each sampling station will be determined relative to the NAVD 1988 vertical datum by measuring the water depth with lead line or a calibrated fathometer and subtracting the river stage. River stage will be determined Willamette River station 14211720, operated by the United States Geological Survey (USGS) at the Morrison Bridge.

Surface Sediment Grab Sample Collection

Surface grab samples will be collected with a hydraulic power grab sampler. The target sample interval is 0 to 30 centimeters (cm) below sediment surface (bss). A minimum penetration of 25 cm will be used for acceptance criteria of individual grabs.

Sampling procedures will be consistent with the Portland Harbor pre-design investigation (PDI) and remedial investigation/feasibility study (RI/FS) protocol (Geosyntec , 2017; EPA, 2016a,b). The following text from AECOM and Geosyntec (2018a) outlines the grab sample sampling and processing procedures:

> ***[Surface] Sample Collection and Processing***
> *The hydraulic power grab samplers (similar to a van Veen grab sampler but with power-assist) will target collection of sediment from the upper 0 to 30 centimeters of sediment…*
>
> *In general, the volume of sediment from the* [*surface grab*] *will be homogenized until uniform in color and texture, as described in more detail in Section 5.6 of RI Round 1 FSP (Integral 2002), Section 4.6 of RI Round 2 FSP (Integral 2004), and Section 5.6 of RI Round 3 FSP (Integral 2006). Sediments will be collected from the hydraulic power grab using a stainless-steel spoon, avoiding sediments in contact with the sides. Large organisms and pieces of debris will be removed and noted in the sample log sheet. Acceptance criteria include the following (PSEP 1996; Integral 2004):*
>
> 1. *No or minimal excess water leaking from the jaws of the sampler.*
> 2. *No excessive turbidity in the overlaying water of the sampler.*
> 3. *Sampler did not over-penetrate.*
> 4. *Sediment surface appears to be intact with minimal disturbance.*

5. Program-specific penetration … has been achieved.

After sample acceptance, the sediment will be placed in a large, stainless-steel bowl for homogenization. Once the volume of sediment from each grab has been homogenized to a uniform consistency and color, composited sediments will be visually described following American Society for Testing and Materials visual-soil classification procedure in the field log book. Sediments will be placed in the appropriate laboratory-provided sampling containers and stored in a cooler at 4 degrees Celsius (°C) until transport to the laboratory.

Subsurface Sediment Core Collection

Vibracoring technology will be used for the deep sediment cores. Dedicated, single use Lexan® polycarbonate liner will be inserted into a 4-inch inside diameter aluminum or stainless steel core barrel for each core decontaminated stainless steel cutter-head coupled to an aluminum tyned catcher will be attached to the bottom of the core barrel. The core barrel will then be lower to the sediment surface and advanced into the sediment using the vibracore head.

If the core barrel does not penetrate to the target depth before meeting refusal, second or third attempts will be made within a close distance (approximately 10-foot) of the target location. If refusal is encountered after three attempts, the core retrieved after the deepest of the three penetrations will be retained. Once the retrieved core is on the vessel deck, the core will be examined to determine compliance with acceptance criteria described below for sediment core recovery. If core acceptance criteria are not achieved after three attempts, the station may be relocated at the discretion of the Project Manager.

Sampling procedures will be consistent with the Portland Harbor PDI and RI/FS protocol (Geosyntec , 2017; EPA, 2016a,b). The following text from AECOM and Geosyntec (2018b) outlines the vibracore sampling and processing procedures:

Core Collection

Subsurface core sample collection will be performed as described in the RI Round 2 FSP, Section 4.0 (Integral 2004). In general, coring will follow these steps:

1. Subsurface sediment core collection:

- *a. Core tube caps will be removed immediately prior to placement into coring device, in order to minimize potential core contamination.*
- *b. Position will be recorded when the vibracore first rests on the sediment surface.*
- *c. The vibracore will be advanced without power (under its own weight), then vibration will be applied until the core tube is advanced to the target depth or refusal.*
- *d. After a brief pause, the core tube will be extracted from the sediment using only the minimum vibratory power needed for extraction.*
- *e. As soon as the core tube daylights to the surface water/air interface, a bottom cap will be placed over the tube to prevent material loss out of the core catcher.*
- *f. Inspect the exterior side-walls of core tube for signs of potential NAPL and scrapes/scoring of the aluminum walls from contact with dense gravel.*
- *g. The following core collection data will be recorded on the vessel (in the core collection log [attached]):*
  - *i. Date/Time. Local date and time when the vibracoring began at each station.*
  - *ii. Depth to Mudline. Water depth at the sampling station at the time of core collection.*
  - *iii. Total Drive Length. Core tube length and depth of the core tube penetration into the subsurface.*

iv. Recovered Length. Thickness of the sediment column retained in the core tube prior to sectioning and removal of the core catcher.

v. Sediment Observation. Average grain size, color, notable odors, debris, etc. observed at each of the cut ends of the core section. Visual description will follow American Society for Testing and Materials (ASTM) visual soil classification procedure.

h. Core will be accepted, rejected, or stored on the vessel pending another drive attempt.

i. After core acceptance, water will be carefully decanted from the top of the core tube to minimize sediment disturbance. Cores will be cut into segments approximately 4 ft long for handling, storage, and transport. Core tubes will be capped with aluminum foil and plastic caps, scribed on the sidewalls with core and segment ID (A, B, C, etc.) and "up" arrow, stored upright … until processed.

2. Core Acceptance Criteria: each subsurface sediment core retrieved on deck will be compared to these acceptance criteria:

a. Overlying water is present and the surface is intact.

b. Core has at least 80% recovery versus penetration.

c. Core tube is in good condition (not excessively bent).

d. Core appears representative of surrounding area.

e. Target penetration depth has been achieved (within +/- 2 ft of target).

Core and Sample Processing [non-applicable steps are not reproduced]

Subsurface sediment core processing at the field lab will follow these steps:

…

2. Cores will be opened using a table saw, when possible, according to methods described in RI Round 2 FSP (Integral 2004).

3. If a core exhibits evidence of an oily product present, another method for core extraction may be utilized.

4. Sediment cores will be visually described following ASTM visual soil classification procedures.

…

7. Subsurface sample intervals will be 2 ft intervals unless lithology indicates otherwise. Minimum interval thickness will be 1 ft. Maximum thickness will be about 3 ft in general accordance with thickness criteria in RI Round 2 FSP (Integral 2004).

8. Cores will be photographed and archived per the RI Round 2 FSP (Integral 2004).

9. After the cores have been described and the sample intervals have been determined, sediment will be collected and homogenized within the determined sample interval until uniform in color and texture and placed into appropriate sample containers for laboratory analysis.

10. Headspace screening using a photoionization detector (PID) will be conducted over the core sediment.

11. Core lithology, geotechnical indexes, PID readings, sample IDs, and sample depth intervals will be recorded in the core processing log.

FIELD DATA RECORDING

Field notes of all samples and data collected will be maintained throughout the sampling program.

For each sampling station, a grab sample collection form or a core collection form will be created. Each form will, at least, include the following information:

- The sample station number, date, target coordinates in latitude/longitude or State Plane;
- Depth of water measured using a lead line or vessel's sounder;
- Actual coordinates of sample location, time, height of tide and calculated mudline elevation in ft MLLW;
- Observations made during sample collection including: weather conditions; complications; and other details associated with the sampling effort;
- Qualitative notation of apparent resistance of sediment column to penetration, including notes on debris;
- For pore water: screen interval, purge volume, pore water pumping rate, water quality parameters;
- For cores: target core barrel penetration, measured penetration, total core length recovered and recovery percentage;
- Any deviation from the Work Plan; and
- Names of Field Survey Task Leader.

EQUIPMENT DECONTAMINATION

Between stations any gatherable excess sediment remaining on the deck or sampling equipment will be placed in a discard bucket to transport to the core processing area for proper disposal. The core barrel or grab sampler and the deck of the vessel will be rinsed with Site water.

For sediment coring, any equipment, sampling tools or part which will become into contact with the sample or core should be new or pre-cleaned. It includes the reusable stainless steel sample catcher and caps.

The core cutter blades, and any spatulas, paddles, or additional field equipment on the sampling vessel will be decontaminated prior to the collection or processing of each sample using by the following procedure:

- Rinse with potable water and wash with scrub brush until free of sediment;
- Wash with phosphate-free detergent (e.g., Alconox®);
- Visually inspect the sampling apparatus and repeat the scrub and rinse step, if necessary. If scrubbing and rinsing with Alconox® is insufficient to remove visually observable tar/oil-related contamination on the core barrel or cutter head assembly, the equipment will be scrubbed and rinsed using acetone until all visual signs of contamination are absent; and
- Rinse with de-ionized water three times.

Sediment discard and rinsate collection buckets will be capped for transfer to the processing area To be transported by a licensed waste hauler to a transfer facility. All investigation derived waste (IDW) will be properly labeled and securely stored, pending waste characterization profiling, and disposed in accordance with the waste management plan, detailed in the Site-Specific Health and Safety Plan (HASP).

Sample Processing and Handling Procedures

Sediment grab samples and cores collected from a barge, will be transported the processing area for processing and handling. The following sections describe grab and core processing and handling procedures.

GRAB SAMPLE PROCESSING PROCEDURES

The grab sample bag will be carefully transferred from the sampling vessel to a designated location for processing. Sample bag will be opened and homogenized at the processing area. Using a clean stainless steel spoon or dedicated (disposable) sampling tool, sufficient volume of sediment will be placed into the pre-labeled, pre-cleaned sample containers. Each container will be clearly labeled with the name of the project, sample ID, type of analysis, preservation, date, time, and initials of the person preparing the sample. This information will be recorded on the field log and on the chain of custody forms. Sample containers will be carefully wrapped using bubble wrap or similar material to prevent breakage and place inside of a cooler on ice for storage at approximately 4°C during transport to the analytical laboratories by courier or commercial shipping company.

CORE PROCESSING PROCEDURES

All cores will be carefully transferred to a designated location for processing. Cores will be opened at the processing area and logged by a licensed geologist or geotechnical engineer and subsampled by qualified scientists. The entire core length at each sampling station will be opened simultaneously to facilitate an accurate identification of sample stratification. During logging, the recovered core depths will be expanded vertically such that the recovered sediment column is assumed to represent the entire penetration interval with uniform dewatering/compression.

Subsamples will be composed of a proportionate volume of sediment from each prescribed sampling interval or each stratigraphic interval of interest throughout the full penetration depth to ensure the samples are representative of their respective strata or depth interval. In cases where distinct stratigraphy is identified, depth intervals may be adjusted accordingly and discrete samples from the different strata from within the interval may be subsampled. Strata with distinctly different geology should not be combined within a depth interval.

The following description provides a detailed account of the core processing procedures:

- **Core data validation:** Measure the core length and validate the calculated core recovery percentage conducted on the sampling vessel.
- **Open Core:** Lay out on the core liner sections for the entire penetration depth on the sampling processing table. Cut the disposable core tube liners longitudinally using electric cutters, taking care to minimize blade penetration and disturbance of the sediment during cutting.
- **Stratigraphy/Zone Identification:** examine the stratigraphy of the captured sediment core to identify the impacted sections and separate lithologic zones of the core.
- **Determine sampling intervals:** Based on the visual observations and work plan criteria, mark the core sampling intervals.
- **Photograph Core:** Take digital photographs of the entire core and each core interval with a label indicating the station number, date and depth of the core interval.

- **Core Logging:** Record the description of the full length of the core sample on the core log form, including, but not limited to, the following observations as appropriate:
  - core recovery (recovered sediment depth relative to penetration depth and percent compaction);
  - Sample number and depth;
  - Sample interval PID reading, if required;
  - physical soil description in accordance with the Unified Soil Classification System - ASTM Method D2488-06 (ASTM, 2007), including soil type, color, consistency, cementation, structure, maximum particle size, etc.;
  - odor (e.g., hydrogen sulfide, petroleum, etc.);
  - vegetation;
  - man-made debris;
  - biological activity (e.g., shells, tubes, bioturbation, organisms, etc.);
  - presence and depth of a redox layer, if observed;
  - presence of tar and/or other visible oil and/or presence of oil sheen;
  - locations, depths, and distinctness of interfaces between zones; and
  - any other distinguishing characteristics or features

- **Collect samples for analysis of Volatile Constituents:** Prior to homogenizing, aliquots of sediment for analysis of volatile organic compounds (VOCs) will be collected directly into laboratory-supplied containers.
- **Homogenize Core Intervals for Analysis:** Using a clean stainless-steel spoon, or dedicated (disposable) sampling tool, scoop the center of the core of the full vertical extent of each interval to homogenize each selected stratum/interval until uniform color and texture is achieved. Collect sample from the center of the core to preclude, to the extent possible, any contact with the inside wall of the core liner.
- **Record Sample's Total Volatile Organic Compounds:** measure total volatile organics using a photoionization detector (PID) placed within a sealed container (e.g., Ziploc® bag or covered jar). The headspace measurement, in parts per billion, will be documented.
- **Fill Sample Containers:** Using a clean, stainless steel spoon fill pre-labeled, pre-cleaned sample containers. Each container will be clearly labeled with the name of the project, sample ID, type of analysis, preservation, date, time, and initials of the person preparing the sample. This information will be recorded in the field log and on the chain of custody forms.
- **Pack on Ice:** Pack each sample container carefully using bubble wrap or similar material to prevent breakage and place inside of a cooler on ice for storage at approximately 4°C during transport to the analytical laboratories by courier or commercial shipping company. When shipping samples, enclose completed chain of custody forms in a plastic bag and tape to the inside of the cooler. Coolers for shipment will be clearly labeled, addressed, and affixed with signed and dated custody seals.
- **Deliver/Ship the Samples:** Coolers containing iced sample containers will be shipped to the appropriate laboratory, via courier or commercial shipping company.

SAMPLE PROCESSING AREA DECONTAMINATION PROCEDURES

To prevent sample cross-contamination, sampling and processing tools and equipment in contact with the sediment samples will undergo the following decontamination procedures prior to and between collection activities using the following procedures:

- Rinse with potable water and wash with scrub brush until free of sediment;
- Wash with Alconox®;
- Visually inspect the sampling utensils and repeat the scrub and rinse step, if necessary;
- Rinse with potable water;
- Rinse three times with de-ionized water.

Decontaminated sampling tools and equipment will be allowed to air dry and then wrapped in aluminum foil for storage.

Sediment discard and rinsate collection buckets will be capped and transported by a licensed waste hauler to a transfer facility. All IDW will be properly labeled and securely stored, pending waste characterization profiling, and disposed in accordance with the waste management plan, detailed in the Site-Specific HASP.

GENERAL SAMPLE HANDLING AND STORAGE

All sample containers received from the laboratory will be pre-cleaned, certified, and EPA-approved.

Sample containers, tools, working surfaces, scientist protective gear, and other items that may come into contact with sediment sample material must meet high standards of cleanliness. All tools and cutting equipment used to collect sediment from the core will be made of glass, aluminum, stainless steel, or Teflon®, and will be cleaned prior to each day's use and between sampling, homogenization or compositing events.

All working surfaces and tools will be thoroughly cleaned, decontaminated, and covered with aluminum foil to minimize outside contamination between sampling events. Disposable gloves will be discarded after processing samples from each station and replaced prior to handling decontaminated tools and equipment or work surfaces.

Prior to shipping, glass sample containers will be placed in sealable plastic bags, wrapped in bubble wrap, and securely packed inside a cooler with ice to keep the samples at 4° ± 2°C. A temperature blank will be placed in each cooler prior to shipping. Chain of custody forms will be filled out and the originally signed chain of custody forms will be placed in a sealable plastic bag and taped to the inside of the lid of the cooler. Tape will be wrapped completely around the cooler. Samples will be shipped via overnight express to the appropriate laboratory. Samples will be held no more than 2 days before shipping. If samples are held on site over night, they will be packed on ice in a locked and secured storage unit.

SAMPLE CHAIN OF CUSTODY PROCEDURES

The possession of the samples must be traceable from the time they are collected through transport, processing, and analysis or archiving. Sample custody will be established through documentation during all stages of this study.

Samples are considered in custody if they are: (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a container and secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). The principal documents used to identify samples and to document possession are records, field logs, and field tracking forms. Chain of custody procedures will be used for all samples throughout the collection, transport, and analytical processes, and for all data and data documentation whether in hard copy or electronic format.

A completed chain of custody form will be placed in a sealable plastic bag and taped to the inside lid of the ice chest containing the listed samples. The ice chest will be sealed with tape. Upon transfer and receipt of samples at the laboratory, the tape around the shipping container be broken. The chain of custody form will be signed by the persons transferring custody of the samples. The condition of the samples will be recorded by the receiver. Chain of custody records will be included in the analytical report prepared by the laboratory and will be considered an integral part of that report.

SAMPLE SHIPPING

All containers of sediment samples will be transported to the analytical laboratories after preparation is completed. Specific sample shipping procedures will be as follows:

- The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container, and contractor's office name and address) to enable positive identification.

- Individual glass sample containers will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.

- Glass jars will be separated in the shipping container by shock adsorbent material (e.g., bubble wrap) to prevent breakage.

- Ice will be placed in doubled plastic bags and sealed to prevent leakage while maintaining a temperature of approximately 4°C during transport to the analytical laboratory.

- A sealed envelope containing chain of custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.

- The cooler lids will be secured by wrapping the coolers in packing tape.

- Each cooler or container containing the sediment samples for analysis will be shipped to the appropriate laboratory.

DISPOSAL OF EXCESS SEDIMENT AND OTHER INVESTIGATION-DERIVED WASTES

All remaining sediment, fluids used for decontamination of sampling equipment, and core collection disposable wastes (e.g., gloves, paper towels, foil, etc.) will be placed into appropriate Department of Transportation (DOT) containers and transported by a licensed waste hauler to a secured transfer facility to be stored for disposal.. These containers will be appropriately tested and disposed at a suitable disposal facility. When the containers are not being used, they will be sealed to prevent spills. Each container will be clearly labeled with the date, contents (e.g., sediment or rinse water), generator (e.g., PG&E), and source (e.g., offshore sediment).

References

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APPENDIX B

Quality Assurance/Quality Control Procedures

Quality Assurance/Quality Control Procedures

PROJECT TEAM AND RESPONSIBILITIES

This section discusses the project team and responsibilities as a part of Quality Assurance and Quality Control (QA/QC) requirements.

Project Planning and Oversight

Dr. Laura McWilliams of Haley & Aldrich is the Sediment Project Manager responsible for planning and directing all aspects of the sediment investigation. Dr. McWilliams will report on all technical and administrative project matters to Mr. Kyle Christie and Mr. Doug Reinhart of ARC/BP.

Project Health and Safety

Mr. Ray Voss of ARC/BP will serve as the Project Health and Safety Coordinator. He will coordinate the safety tasks under the authority of the Haley & Aldrich Project Manager (Laura McWilliams) and the ARC/BP Health and Safety Compliance Officer (Kevin Murphy, CSP)

All work will be performed under the project Site-specific Health and Safety Plan (HASP) prepared by Antea Group.

Subcontractors

The field survey will be performed under the direction of Haley & Aldrich and Antea Group, and will include staff and subcontractors. The following summarizes the roles performed by participating subcontractors.

Field Survey Support:

- Gravity Marine, subcontractor - Providing sample vessels and sample collection services; and
- Advanced Remediation Technologies, subcontractor – Providing a geotechnical engineer licensed in the state of Oregon (Mr. Lance Downs)

Laboratory Analyses and Testing

All analytical work will be performed by Test America, in their Seattle, WA and Knoxville, TN laboratories. Test America is a qualified environmental testing laboratory experienced with sediment characterization analyses, and has performed analysis of samples collected throughout the Portland Harbor Superfund Site. Mr. will serve as laboratory project manager to direct the analyses of the sediment samples in accordance with the Haley & Aldrich Quality Assurance/Quality Control (QA/QC) requirements outlined herein.

A report of analytical results and QA/QC compliance will be prepared by the laboratory and submitted with each data package submitted for data validation. Ms. Vanessa Boucher of Haley & Aldrich will serve as the Data Manager/Validator for this project.

FIELD QUALITY CONTROL MEASURES

Field QA/QC samples will be collected and used to evaluate the variability resulting from sampling handling and the efficiency of field decontamination procedures. Field QA/QC samples only will be collected for additional sediment quality delineation samples. All field QC samples will be documented in the project log book.

Field Duplicates

The field duplicate will be generated by subsampling a homogenized sediment or water sample (to be analyzed, not an archival sample) and splitting it into two unique samples (the original sample and a duplicate) for chemical characterization. Field duplicates are not required for physical analyses such as grain size distribution. The field duplicate samples will be processed in exactly the same way as the original sample and will be submitted to the laboratory as a blind sample. The field duplicate will be analyzed for the same analytes as the original sample. Duplicates will be collected and analyzed at a rate of 5 percent, assuming that sufficient volume can be collected to create a field duplicate. Field duplicates may not be collected if there is only sufficient sample for the primary samples. The field duplicates will be numbered as discussed in Appendix A.

Equipment Rinse Blanks

Equipment rinse blank samples will be collected to evaluate the efficiency of field decontamination procedures. One rinsate blank will be collected for the delineation sample collection equipment (e.g, vibracore shoe) used on the sampling vessel, and a separate rinse blank will be collected for the tools used for sample processing (mixing bowls, spoons, etc.). After sample collection and decontamination, the equipment blanks will consist of rinsing the sampling equipment (only surface that come in contact with sediment samples) device and homogenization equipment with distilled water and collecting the rinsates. Rinsate blanks will be named as discussed in Appendix A.

Trip Blanks

Trip blanks are not necessary for this fieldwork since there will be no analysis of volatile organic compounds (VOCs).

Temperature Blanks

A temperature blank will be placed in each sample cooler prior to shipping. Upon receipt of samples at the Alpha analytical laboratory; the receiver will record and document the temperature and sample conditions.

CHEMICAL ANALYSES

Specific analytical method procedures are detailed in the cited EPA Solid Waste 846 Methods and/or laboratory QA/QC Plan and standard operating procedures (SOPs) of the analytical laboratory. These documents may be reviewed by Haley & Aldrich and/or the project QA/QC specialist during laboratory audits to ensure that project specifications are met.

Chemistry Results Data Validation

Data validation will be performed following National Functional Guidelines (EPA, 2016). Data validation includes signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets, respectively; review for completeness and accuracy; review for outliers and omissions; and the use of QC criteria to accept or reject specific data. All laboratory data for delineation and/or risk screening/assessment will undergo validation to determine compliance with QA/QC requirements.

Data packages will be checked for EPA Level II completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. Data quality will be assessed by considering the following:

- Holding times, preservation, and storage;
- Chain of custody forms and sample receipt forms;
- Initial calibration;
- Continuing calibrations;
- Method blanks;
- Surrogate recoveries;
- Internal standards;
- Detection limits;
- Laboratory Control Samples;
- Matrix Spike/Matrix Spike Duplicate samples;
- Certified reference material results;
- Sample standards and calibration raw data;
- Instrumentation run logs; and
- All communications between the laboratory and the Project QA/QC Representative.

Any necessary corrective actions will be communicated to the laboratory and the Haley & Aldrich Project Manager. Data validation reports will be maintained by Haley & Aldrich in the project files.

DATA MANAGEMENT

Database

The project database will allow efficient management of chemical and analytical data received from the laboratory and will provide electronic data submittals in accordance with stakeholder and lead agency requirements. Laboratory conducting analyses for this program will be supplied with specific electronic data deliverable formats to ensure compatibility with the project database. Qualified personnel will be assigned to conduct QA/QC reviews for each dataset generated. The database will be integrated with a geographical information system to allow for presentation of spatial information and data. These graphical displays will present the Site features, ownership boundaries, and sample locations.

Data Deliverables

The analytical laboratory will submit data in a package suitable for third-party validation and will include the following elements:

- **Project Narrative:** A detailed report that describes the samples received, analyses performed, and corrective actions undertaken.
- **Chain of Custody Documentation:** Laboratory policy requires that chain of custody documentation be available for all samples received. The chain of custody will document basic sample information such as client and project names, sample identification, analyses requested, and special instruction.
- **Data Summary Form:** A tabular listing of concentrations and/or detection limits for all target analytes. The evaluation report will also list other pertinent information such as the number of samples analyzed, dilution factors, sample processing dates, extract cleanups, and surrogate recoveries.
- **QC Summary:** Includes results of all QC analyses, specifically recovery information. Laboratory control samples will be reported with each batch. Additional QA analysis may include laboratory replicates, matrix spikes, and standard reference materials. Reference toxicant results compared to the laboratory reference toxicant database will be included.
- **Instrument Calibration Forms and Raw Data:** Includes initial and continuing calibration summaries and instrument tuning data, laboratory bench sheets, and log book pages as necessary to facilitate third-party data validation by the project QA specialist.

The laboratory will also provide electronic deliverables in Microsoft Excel format. Close contact with the laboratory will be maintained to resolve any QA/QC problems in a timely manner.

Reference

United States Environmental Protection Agency (EPA). 2016. National Functional Guidelines for Superfund Organic Methods Data Review. EPA. September, 2016.

APPENDIX B

Grab Sample Field Collection Forms and Photographs

Photo 1: SG-01

Photo 2: SG-02 (No photo taken)

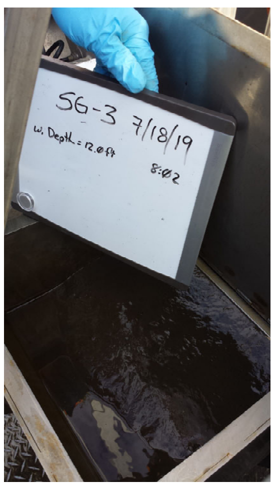

Photo 3: SG-03

Photo 4: SG-04

Photo 5: SG-05

Photo 6: SG-06

Photo 7: SG-07

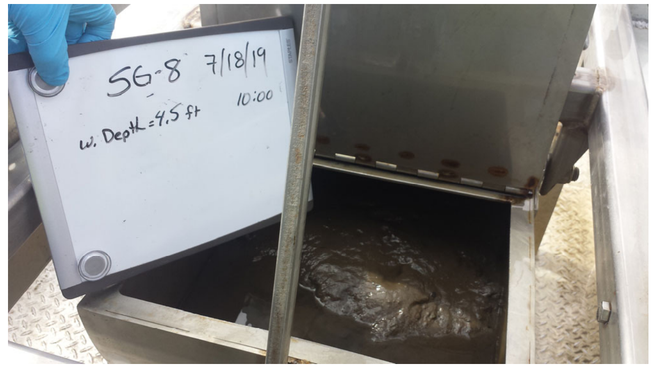

Photo 8: SG-08

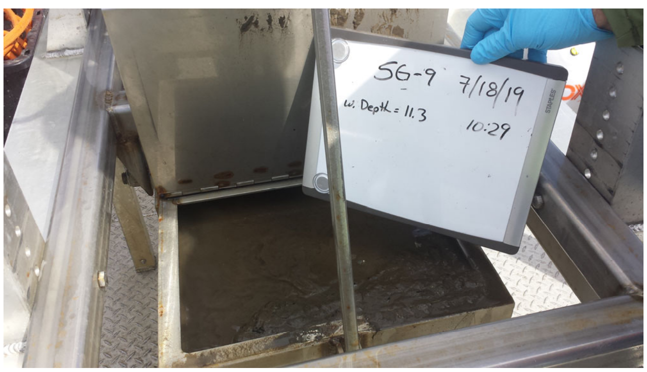

Photo 9: SG-09

Photo 10: SG-10

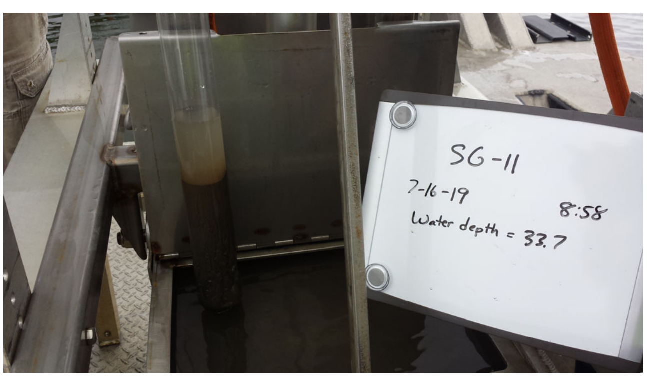

Photo 11: SG-11

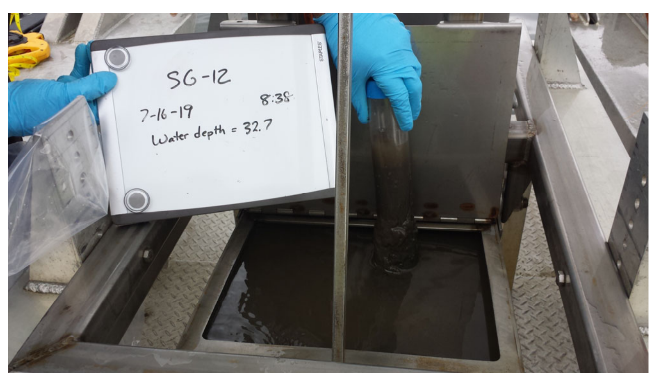

Photo 12: SG-12

Photo 13: SG-13

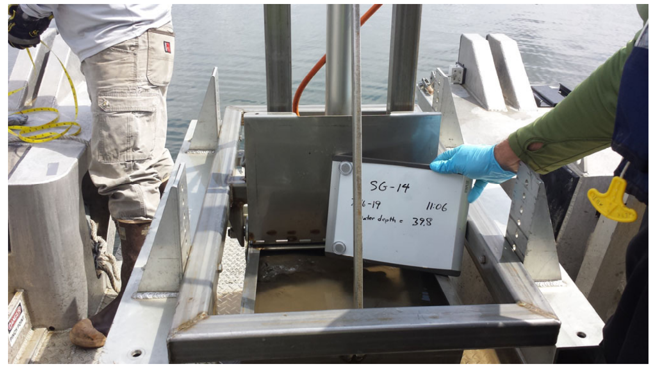

Photo 14: SG-14

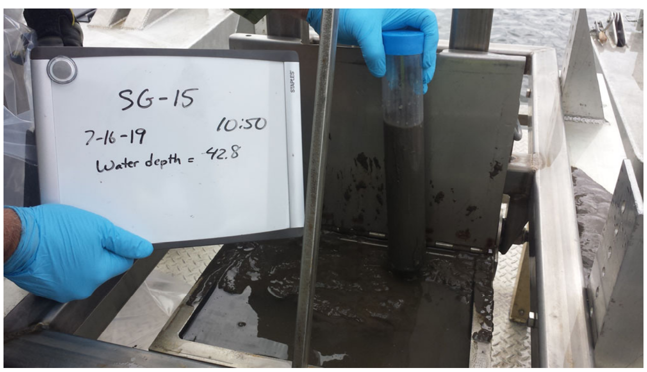

Photo 15: SG-15

Photo 16: SG-16

Photo 17: SG-17

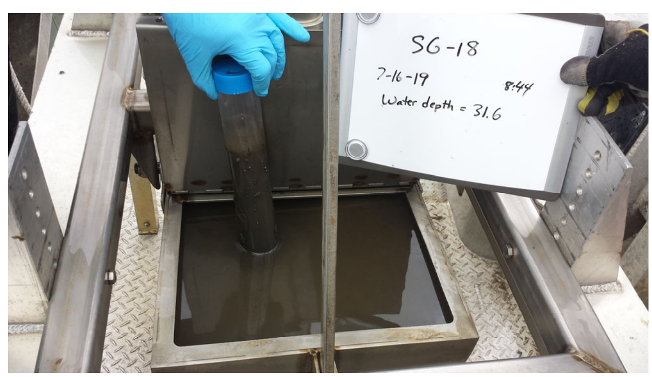

Photo 18: SG-18

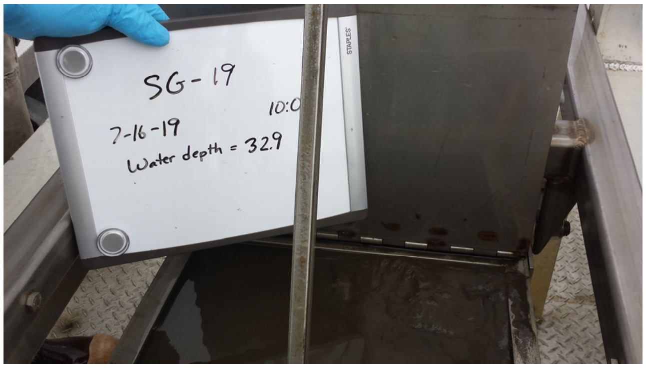

Photo 199: SG-19

Photo 20: SG-20

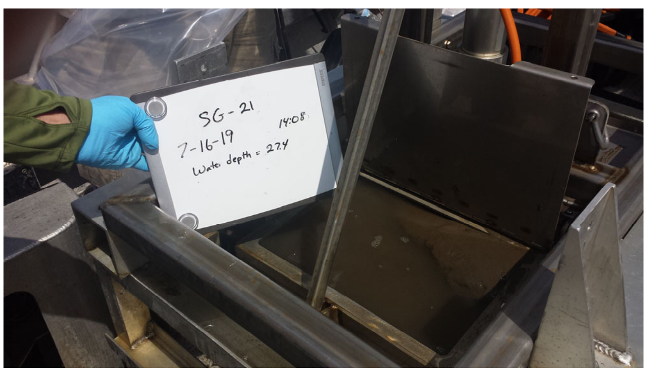

Photo 21: SG-21

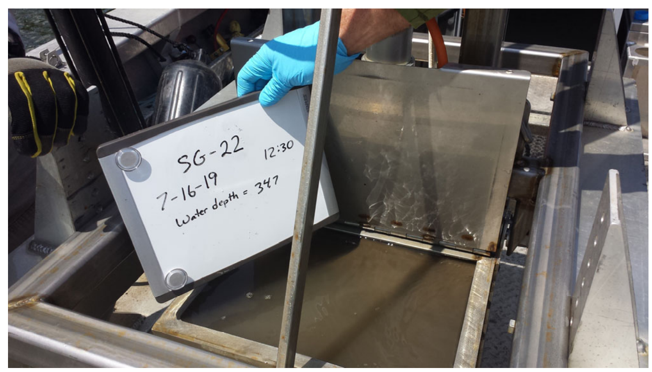

Photo 22: SG-22

Photo 23: SG-23

SEDIMENT GRAB COLLECTION FORM

power grab → target of 30cm bss

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-01	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~: Northing	710773
Overdepth (OD):	---	~~Longitude~~: Easting	7619135
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	~~MLLW~~ ~~MLW~~ ~~Other~~:
Total Target Core Depth:	---		tide from Morrison Bridge
Weather:	Sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a) & 2	Attempt ~~2 (b)~~ 3	Attempt ~~3 (c)~~ 4	Attempt 5
~~Latitude~~ northing	710778.6	710796.7	710786.9	710791.1
~~Longitude~~: easting	7619151.0	7619157.5	7619140.6	7619140.7
Time:	13:40 and 13:42	13:47	13:53	13:56
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]				
(A) Measured Water Depth	12.1	31.8	14.7	29.2
(B) Tide Height (MLLW)	0.48	0.46	0.45	0.45
(C) Mudline Elevation (MLLW)	-11.6	-31.3	-14.3	-28.8
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |				
Target ~~Core Barrel~~ Penetration	30cm	30cm	30cm	30cm
Measured Penetration	??	≈ 20cm	??	none
~~Total Core Length Recovered~~				
~~% Recovery~~				
Description ~~of Core Drive~~	Rocks in jaw No recovery	wood in jaw; likely winnowing	fist sized cobble in jaw	empty bucket
Refusal Encountered?	No / Yes (Yes)	No (No) / Yes	No / Yes (Yes)	yes
Description of Refusal	on rip-rap (to close to shore)			
Sample ~~Core~~ Collection Comments:	no sample	no sample	no sample	no sample

SAMPLE CHARACTERISTICS

Sediment Odor			
Sediment Color			
Sediment Type			
Layering / Homogeneous			

Characteristic Comments:

Recorded By: Laura McWilliams

Page: 1 of 2

SEDIMENT GRAB COLLECTION FORM

continuation of SG-01

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 18, 2019
Station ID:	SG-01	Project Number:	
Harbor Area:	Willamette River	Survey Vessel:	Gravity marine
Project Depth (PD):	---	~~Latitude:~~	710773
Overdepth (OD):	---	~~Longitude:~~	7619135
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Bridge
Weather:	Sunny		

GRAB SAMPLE COLLECTION

	Attempt ~~1 (a)~~ 6	Attempt ~~2 (b)~~ 7	Attempt 3 (c)
~~Latitude~~	710770.95	710785.1	
Longitude:	7619173.4	7619166.0	
Time:	10:47	10:52	
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [Include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	35.8	33.9	
(B) Tide Height (MLLW)	1.81	1.80	
(C) Mudline Elevation (MLLW)	-34.0	-32.1	
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) (incl. Z)) - (Mudline Elevation) |			
Target ~~Core Barrel~~ Penetration	30cm	30cm	
Measured Penetration	??	18cm	
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of Core Drive		jaws closed will accept sample	
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal	Rocks in jaw	took photos	
~~Core~~ Collection Comments: sample	no sample	Sample included both layers 22T-SG-01	

SAMPLE CHARACTERISTICS

Sediment Odor		none	
Sediment Color		See below	
Sediment Type		silt and sand and mudstone	
Layering / Homogeneous		2 layers	

Characteristic Comments:
layer 1: 0-13cm bss - silty sand; fine-medium grained with gravel and cobble brown; loose

2: 13-18 cm bss - mudstone; grey silt with clay

Recorded By: Laura McWilliams

Page: 2 of 2

Description By: Lance Downs

SEDIMENT GRAB COLLECTION FORM

HALEY ALDRICH

power grab → target of 30cm bss

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 18, 2019
Station ID:	SG-Ø2	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~: Northing	710822
Overdepth (OD):	---	~~Longitude~~: Easting	7619077
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW / ~~MLW~~ ~~Other~~:
Total Target Core Depth:	---		tide at Morrison Bridge
Weather:	Sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)	Attempt 4
~~Latitude~~ Northing	710829.1	710844.8	710855.2	710850.3
~~Longitude~~: Easting	7619094.2	7619113.6	7619104.1	7619109.3
Time:	7:35	7:37	7:41	7:44
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]				
(A) Measured Water Depth	6.5	16.6	18.3	19.0
(B) Tide Height (MLLW)	2.86	2.84	2.79	2.76
(C) Mudline Elevation (MLLW)	-3.6	-13.8	-15.5	-16.2
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |				
Target Core Barrel Penetration	30cm	30cm	30cm	30cm
Measured Penetration	?.?	≈ 20cm	?.?	8cm
~~Total Core Length Recovered~~				
~~% Recovery~~				
Description ~~of Core Drive~~	Rock in jaw No recovery	Rock in jaw Sediment streaming out	caught large piece of rope	jars closed so will collect sample
Refusal Encountered?	No / Yes	No / Yes	No / Yes	
Description of Refusal	on rip rap slope too close to shore			No picture.
~~Core~~ Sample Collection Comments:	no sample	no sample	no sample	Sample collected: 22T-SG-Ø2 obtained with stainless steel spoon rather than mini-core

SAMPLE CHARACTERISTICS

Sediment Odor			none
Sediment Color			various shades of grey
Sediment Type			silt and sand
Layering / Homogeneous			2 layers

Characteristic Comments:
layer 1 = Ø to 4 cm bss : silty sand with cobbles; loose
layer 2 = 4 to 8 cm bss : silt; soft

Recorded By: Laura McWilliams

Page: ____ of 1

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

HALEY ALDRICH

Power Grab -> target 30cm bss

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 18, 2019
Station ID:	SG-03	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~: Northing	710902
Overdepth (OD):	---	~~Longitude~~: Easting	7619033
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW ~~MLW Other~~:
Total Target Core Depth:	---		tide at Morrison Bridge
Weather:	Sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: Northing	710908.0	710908.4	710906.6
~~Longitude~~: Easting	7619057.8	7619078.4	7619043.3
Time:	8:02	8:15	8:23
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	12.0	18.0	7.8
(B) Tide Height (MLLW)	2.6	2.5	2.4
(C) Mudline Elevation (MLLW)	-9.4	-15.5	-5.4
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm	30cm	30cm
Measured Penetration	12cm	?.?	0
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description ~~of Core Drive~~	collected sample in case later attempts were worse	Brick in jaw	No recovery
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal	tipped on slope, but jaws closed wood in sample		
~~Core~~ Collection Comments: Sample	22T-SG-03	no sample	no sample

SAMPLE CHARACTERISTICS

Sediment Odor	none		
Sediment Color	brownish grey		
Sediment Type	0-6cm = very soft silt; little sand 6-12cm = loose sand		
Layering / Homogeneous	see above; debris		

Characteristic Comments: photos taken
Subsequent grabs were not sucessful to kept Attempt 1
obtained sample with stainless steel spoon rather than mini-core

Recorded By: Laura McWilliams

Page: ____ of __1__

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab → target 30cm bss

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 18, 2019
Station ID:	SG-04	Project Number:	
Harbor Area:	Willamette River	~~Survey Vessel:~~	Gravity Marine
Project Depth (PD):	—	~~Latitude:~~ Northing	711005
Overdepth (OD):	---	~~Longitude:~~ Easting	7618974
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Bridge
Weather:	Sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude:~~ Northing	711014.53		
Longitude: Easting	7618997.75		
Time:	8:36		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	10.0		
(B) Tide Height (MLLW)	2.30		
(C) Mudline Elevation (MLLW)	-7.7		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	30cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of Core Drive	bucket closed		
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Sample Collection Comments:	22T_SG-04 and 22T_SG_04_MSD (extra volume for lab QC)		

SAMPLE CHARACTERISTICS

Sediment Odor	petroleum odor slight sheen		
Sediment Color	brownish grey		
Sediment Type	Silt with some fine sand and gravel		
~~Layering / Homogeneous~~	very soft; Debris		

Characteristic Comments: Debris included a 9" long rusty spike/nail
photos taken

Recorded By: Laura McWilliams

Page: ____ of __1__

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

Power Grab → target 30cm bss

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 18, 2019
Station ID:	SG-05	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel:~~	Gravity Marine
Project Depth (PD):	—	~~Latitude:~~ Northing	711113
Overdepth (OD):	—	~~Longitude:~~ Easting	7618914
Z - Layer (Z):	—	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	—	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	—		tide at Morrison Bridge
Weather:	Sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude:~~ Northing	711116.95		
~~Longitude:~~ Easting	7618941.6		
Time:	855		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	11.5		
(B) Tide Height (MLLW)	2.15		
(C) Mudline Elevation (MLLW)	-9.4		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	26cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of Core Drive	bucket closed		
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
Core Collection Comments:	22T-SG-05		

SAMPLE CHARACTERISTICS

Sediment ~~Odor~~ color	various shades of grey		
Sediment ~~Color~~	slight sheen; no odor		
Sediment Type	medium stiff silt with little fine-grained sand		
Layering / Homogeneous	non-homogeneous		

Characteristic Comments: wood debris in grab (excluded from sample)
pictures taken

Recorded By: Laura McWilliams

Page: ____ of 1

Description by: Lance Downs

SEDIMENT GRAP COLLECTION FORM

power grab → target 30cm bss

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 18, 2019
Station ID:	SG-06	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel:~~	Gravity Marine
Project Depth (PD):	---	~~Latitude:~~ Northing	711205
Overdepth (OD):	---	~~Longitude:~~ Easting	7618845
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW ~~Other:~~
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	Partly Sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude:~~ Northing	711210.8		
~~Longitude:~~ Easting	7618861.7		
Time:	9:11		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	6.7		
(B) Tide Height (MLLW)	2.06		
(C) Mudline Elevation (MLLW)	-4.6		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	30cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of Core Drive	bucket closed		
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
Core Collection Comments:	22T-SG-06		

SAMPLE CHARACTERISTICS

Sediment Odor	sheen; tiny oil droplets Petroleum odor		
Sediment Color	greyish brown to brown		
Sediment Type	silty sand, fine to coarse grained; loose		
Layering / Homogeneous	debris		

Characteristic Comments:
Debris include rocks; wood; piece of a clay pipe
Pictures Taken

Recorded By: Laura McWilliams
Description by: Lance Downs

Page: ____ of 1

SEDIMENT GRAP COLLECTION FORM

HALEY ALDRICH

Power grab → target 30cm bss

SITE INFORMATION

Project Name:	Terminal 22T	**Date:**	July 18, 2019
Station ID:	SG-07	**Project Number:**	
Harbor Area:	Willamette River	**Survey Vessel:**	Gravity Marine
Project Depth (PD):	---	~~**Latitude:**~~ northing	711327
Overdepth (OD):	---	~~**Longitude:**~~ easting	7618765
Z - Layer (Z):	---	**Water Depth Measurement:**	Sounder / Leadline
Cap Contingency Layer (CCL):	---	**Vertical Datum:**	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Bridge
Weather:	partly sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~**Latitude:**~~ northing	711333.2	711331.2	
~~**Longitude:**~~ easting	7618775.3	7618791.0	
Time:	9:40	9:43	
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	4.9	7.9	
(B) Tide Height (MLLW)	1.96	1.95	
(C) Mudline Elevation (MLLW)	-2.9	-5.9	
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) (incl Z)) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm	30cm	
Measured Penetration	≈12cm	27cm	
~~**Total Core Length Recovered**~~			
% ~~**Recovery**~~			
Description of ~~**Core Drive**~~	Debris in jaw	jaws closed	
Refusal Encountered?	No / Yes	No / Yes	No / Yes
Description of Refusal			
~~**Core**~~ **Collection Comments:** Sample	no sample; jaws not closed	22T-SG-07	

SAMPLE CHARACTERISTICS

Sediment Odor		slight sheen	
Sediment Color		see below	
Sediment Type		see below	
Layering / Homogeneous		2 layers	

Characteristic Comments:

layer 1: 0-15cm bss : fine to medium sand, occassional gravel; grey; loose
15-27cm bss : silt w/some fine sand; brownish grey; medium stiff

Recorded By: Laura McWilliams

Page: ____ **of** __1__

Description By: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab → target 30cm bss

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 18, 2019
Station ID:	SG-08	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~: Northing	711401
Overdepth (OD):	---	~~Longitude~~: Easting	7618723
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Bridge
Weather:	partly sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: northing	711402.5	711398.3	711406.0
~~Longitude~~: easting	7618734.0	7618739.6	7618741.2
Time:	1000	1008	1020
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	4.0	4.5	4.1
(B) Tide Height (MLLW)	1.90	1.89	1.86
(C) Mudline Elevation (MLLW)	-2.1	-2.6	-2.2
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm	30cm	30cm
Measured Penetration	≈ 6cm	23cm	7.7
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description ~~of Core Drive~~	Did not close at bottom; more likely in water column	rope in jaws, but closed and holding water	Large rock in jaws
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: Sample		22T-SG-08	

SAMPLE CHARACTERISTICS

Sediment Odor		None	
Sediment Color		Brownish grey	
Sediment Type		silt w/ fine sand; very soft	
Layering / Homogeneous		homogeneous	

Characteristic Comments: pictures taken

Recorded By: Laura McWilliams

Page: ____ of 1

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab → target 30cm bss

HALEY ALDRICH

SITE INFORMATION			
Project Name:	Terminal 22T	Date:	July 18, 2019
Station ID:	SG-07	Project Number:	
Harbor Area:	Willamette River	Survey Vessel:	Gravity Marine
Project Depth (PD):	---	Latitude: Northing	711483
Overdepth (OD):	---	Longitude: Easting	7618702
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide=Morrison Bridge
Weather:	partly sunny		

GRAB SAMPLE COLLECTION	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
Latitude: Northing	711485.9		
Longitude: Easting	7618730.8		
Time:	10:29		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [Include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	11.3		
(B) Tide Height (MLLW)	1.85		
(C) Mudline Elevation (MLLW)	-9.5		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	30cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description ~~of Core Drive~~	Nicely closed		
Refusal Encountered?	No / Yes	No / Yes	No / Yes
Description of Refusal			
~~Core~~ Collection Comments: Sample	22T-SG-09		

SAMPLE CHARACTERISTICS			
Sediment Odor	sheen when disturbed tiny oil droplets		
Sediment Color	brownish grey		
Sediment Type	stiff silt; trace fine sand; low plasticity		
Layering / Homogeneous	small slivers of wood debris		

Characteristic Comments:

pictures taken

Recorded By: Laura McWilliams

Page: ____ of 1

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

HALEY ALDRICH

Power Grab

SITE INFORMATION			
Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-10	Project Number:	
Harbor Area:	Willamette River	Survey Vessel:	Gravity Marine
Project Depth (PD):	---	~~Latitude:~~ Northing	710874
Overdepth (OD):	---	~~Longitude:~~ Easting	7619174
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	Sunny		

GRAB SAMPLE COLLECTION	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude:~~ Northing	710884.9	710888.1	
~~Longitude:~~ Easting	7619178.1	7619173.8	
Time:	1309	1315	
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	39.5	30.0	
(B) Tide Height (MLLW)	0.67	0.62	
(C) Mudline Elevation (MLLW)	-38.8	-29.4	
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm	30cm	
Measured Penetration	18cm	33cm	
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description ~~of Core Drive~~	closed, but insufficient penetration	bucket closed	
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: Sample	no sample	sample top 30cm 22T-SG-10 wood debris	

SAMPLE CHARACTERISTICS			
Sediment Odor	none		
Sediment Color	brownish grey;	one grey gravel	1x3 inches
Sediment Type	silt and sand-	see below	
Layering / Homogeneous	2 layers - see	below	

Characteristic Comments:
picture taken
Station was shifted slightly north to create even spacing

Recorded By: Laura McWilliams

Page: ____ of __1__

Description By: Lance Downs

layer 1: 0-20 cm bss → soft silt
layer 2: 20-30 cm bss → fine-medium grained sand (loose)

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-11	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~: Northing	711094
Overdepth (OD):	---	~~Longitude~~: Easting	7619002
Z - Layer (Z):	---	Water Depth Measurement:	Sounder Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	overcast		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: Northing	711097.4		
~~Longitude~~: Easting	7619019.0		
Time:	858		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	33.7		
(B) Tide Height (MLLW)	2.14		
(C) Mudline Elevation (MLLW)	-31.6		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	25cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of Core Drive	bucket closed - overlying water 25cm = within project requirements		
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: Sample	22T-SG-11 = primary sample @ 858 22T-SG-11-D = field dup @ 900		

SAMPLE CHARACTERISTICS

Sediment Odor	minor organic odor		
Sediment Color	Brownish grey		
Sediment Type	0-15cm = very soft silt 15-25cm = soft silt		
Layering / Homogeneous	2 layers		

Characteristic Comments: pictures taken

Recorded By: Laura McWilliams

Page: ____ of __1__

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July, 16, 2019
Station ID:	SG-12	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	—	~~Latitude~~: Northing	711146
Overdepth (OD):	---	~~Longitude~~: Easting	7618963
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide @ Morrison Bridge
Weather:	overcast		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: Northing	711148.8	711147.7	711151.0
~~Longitude~~: Easting	7618978.0	7618981.8	7618974.7
Time:	925	932	938
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	32.3	33.3	32.7
(B) Tide Height (MLLW)	2.00	1.97	1.94
(C) Mudline Elevation (MLLW)	-30.3	-31.3	-30.8
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm	30cm	30cm
Measured Penetration	23cm	~~73~~35cm	33cm
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of Core Drive	closed but insufficient penetration	over penetration	bucket closed
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			collect sample from top 30cm
~~Core~~ Collection Comments: sample	No sample	No sample	22T-SG-12 22T-SG-12-MSD = extra volume for Lab QC

SAMPLE CHARACTERISTICS

Sediment Odor			biogenic bubbles and slight sheen
Sediment Color			Brownish Grey
Sediment Type			0-15cm: very soft silt 15-30cm: soft silt
Layering / Homogeneous			low plasticity

Characteristic Comments: picture taken

Recorded By: Laura McWilliams

Description by: Lance Downs

Page: ____ of __1__

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-13	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~: Northing	711236
Overdepth (OD):	---	~~Longitude~~: Easting	7618953
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW ~~MLW~~ ~~Other~~:
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	Sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: Northing	711204.8		
Longitude: Easting	7618984.9		
Time:	1212		

Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
(A) Measured Water Depth	37.2		
(B) Tide Height (MLLW)	1.25		
(C) Mudline Elevation (MLLW)	-35.9		

Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
Target Core Barrel Penetration	30cm		
Measured Penetration	35cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
~~Description of Core Drive~~	Bucket closed completely full		
Refusal Encountered?	No / Yes	No / Yes	No / Yes
Description of Refusal			
~~Core~~ Collection Comments: Sample	Sampled top 30cm 22T-SG-13		

SAMPLE CHARACTERISTICS

Sediment Odor	none		
Sediment Color	brownish grey		
Sediment Type	soft silt; trace sand		
Layering / Homogeneous			

Characteristic Comments: picture taken

Note, station was moved slightly south to create more equal spacing

Recorded By: Laura McWilliams

Description By: Lance Downs

Page: ____ of __1__

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-14	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~: Northing	711309
Overdepth (OD):	---	~~Longitude~~: Easting	7618946
Z - Layer (Z):	—	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW ~~MLW~~ ~~Other~~
Total Target Core Depth:	—		tide at Morrison Br.
Weather:	partly sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: Northing	711272.4		
~~Longitude~~: Easting	7618947.4		
Time:	1106		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	39.8		
(B) Tide Height (MLLW)	1.87		
(C) Mudline Elevation (MLLW)	-37.9		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	30cm		
~~Total Core Length~~ Recovered			
~~% Recovery~~			
Description ~~of Core Drive~~	RR spike caught in jaws, but still closed with standing water		
Refusal Encountered?	No Yes (No)	No Yes	No Yes
Description of Refusal			
Core Collection Comments:	22T-SG-14		

SAMPLE CHARACTERISTICS

Sediment Odor	none		
Sediment Color	olive grey to brownish grey		
Sediment Type	soft silt; trace sand		
~~Layering / Homogeneous~~	one rounded gravel ≈1 inch piece of wood excluded from sample		

Characteristic Comments:
picture taken
Note station was moved slightly south to create more equal spacing

Recorded By: Laura McWilliams

Page: ____ of 1

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 16 2019
Station ID:	SG-15	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~ Northing	711369
Overdepth (OD):	---	~~Longitude~~: Easting	7618874
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	overcast		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
Latitude:	711372.9		
Longitude:	7618889.2		
Time:	1050		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	42.8		
(B) Tide Height (MLLW)	1.97		
(C) Mudline Elevation (MLLW)	-40.8		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	35cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description ~~of Core Drive.~~	jaws closed		
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: Sample	sampled top 30cm 22T-SG-15		

SAMPLE CHARACTERISTICS

Sediment Odor	none		
Sediment Color	Brownish grey		
Sediment Type	soft silt; trace sand		
Layering / Homogeneous			

Characteristic Comments: picture taken

Recorded By: Laura McWilliams

Page: ____ of 1

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power Grab

HALEY ALDRICH

SITE INFORMATION			
Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-16	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~:	Northing 711509
Overdepth (OD):	---	~~Longitude~~:	Easting 7618757
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW ~~MLW~~ ~~Other~~
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	partly sunny		

GRAB SAMPLE COLLECTION	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
Latitude:	711507.2		
Longitude:	7618773.2		
Time:	1424		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [Include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	27.7		
(B) Tide Height (MLLW)	0.5		
(C) Mudline Elevation (MLLW)	-27.2		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	30cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description ~~of Core Drive~~	bucket closed rusted metal debris		
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: Sample	22T-SG-16		

SAMPLE CHARACTERISTICS			
Sediment Odor	none		
Sediment Color	Brownish Grey		
Sediment Type	soft silt; trace sand		
Layering / Homogeneous			

Characteristic Comments:
picture taken

Recorded By: Laura McWilliams

Page: ____ of 1

Description By: Lance Downs

SEDIMENT GRAB COLLECTION FORM

HALEY ALDRICH

power grab

SITE INFORMATION			
Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-17	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~: Northing	710930
Overdepth (OD):	---	~~Longitude~~:	Easting 7619089
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	overcast		

GRAB SAMPLE COLLECTION	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: Northing	710932.8		
~~Longitude~~: Easting	7619103.0		
Time:	813		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	29.8		
(B) Tide Height (MLLW)	2.38		
(C) Mudline Elevation (MLLW)	-27.4		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	30cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of ~~Core Drive~~	jaws closed Overlying water		
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: Sample	22T-SG-17		

SAMPLE CHARACTERISTICS			
Sediment Odor	none		
Sediment Color	Brownish Grey		
Sediment Type	0-15cm: very soft silt 15-30cm: Loose fine grained silty sand		
Layering / Homogeneous			

Characteristic Comments: picture taken

Recorded By: Laura McWilliams

Page: ____ of 1

Description By: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION			
Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-18	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel:~~	Gravity Marine
Project Depth (PD):	---	~~Latitude:~~ Northing	711019
Overdepth (OD):	---	Longitude: Easting	7619041
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW ~~MLW~~ ~~Other:~~
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	overcast		

GRAB SAMPLE COLLECTION	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude:~~ Northing	711021.2	711014.8	
~~Longitude:~~ Easting	7619054.2	7619053.4	
Time:	838	844	
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	31.8	31.6	
(B) Tide Height (MLLW)	2.27	2.23	
(C) Mudline Elevation (MLLW)	-29.5	-29.4	
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) (incl Z)) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm	30cm	
Measured Penetration	>35cm	30cm	
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of ~~Core Drive~~	overpenetrated	jaws closed	
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Sample Collection Comments:	no sample	22T-SG-18	

SAMPLE CHARACTERISTICS			
Sediment Odor		Biological odor	
Sediment Color		Brownish Grey	
Sediment Type		0-15cm = very soft silt 15-30cm = soft silt	
Layering / Homogeneous			

Characteristic Comments: picture taken

Recorded By: Laura McWilliams Page: ____ of 1

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-19	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude:~~ Northing	711210
Overdepth (OD):	—	Longitude: Easting	7618985
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	—	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Br
Weather:	overcast		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: Northing	711211.84	711213.4	
~~Longitude~~: Easting	7618935.9	7618933.6	
Time:	1000	1009	
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	33.5	32.9	
(B) Tide Height (MLLW)	1.85	1.82	
(C) Mudline Elevation (MLLW)	-31.2	-31.1	
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm	30cm	
Measured Penetration	>35cm	35cm	
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description ~~of Core Drive~~	overpenetrated	jaws closed completely full	
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: Sample	no sample	sampled top 30cm 22T-SG-19	

SAMPLE CHARACTERISTICS

Sediment Odor		minor biological sheen	
Sediment Color		Brownish grey	
Sediment Type		0-25cm = soft silt 25-30cm = loose very fine sand	
Layering / Homogeneous			

Characteristic Comments:
picture taken
wood debris

Recorded By: Laura McWilliams

Page: ____ of __1__

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION			
Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-20	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	—	~~Latitude~~: Northing	711307
Overdepth (OD):	---	~~Longitude~~: Easting	7618857
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	overcast		

GRAB SAMPLE COLLECTION	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: northing	711306.9		
~~Longitude~~: easting	7618873.8		
Time:	1031		

Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
(A) Measured Water Depth	31.1		
(B) Tide Height (MLLW)	2.06		
(C) Mudline Elevation (MLLW)	-29.0		

Target Core Length = \| ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) \|

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
Target Core Barrel Penetration	30cm		
Measured Penetration	35cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description ~~of Core Drive~~	bucket closed		
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: sample	sampled top 30cm 22T-SG-20		

SAMPLE CHARACTERISTICS			
Sediment Odor	slight biological sheen		
Sediment Color	brownish grey		
Sediment Type	0-15cm = very soft silt 15-30cm = soft silt		
Layering / Homogeneous			

Characteristic Comments: picture taken

Recorded By: Laura McWilliams

Page: ____ of 1

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-21	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~ Northing	711410
Overdepth (OD):	---	~~Longitude~~: Easting	7618784
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / ~~Leadline~~
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	partly sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
Latitude:		711419.3	
Longitude:		7618805.8	
Time:	1406	1408	
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	30.2	27.4	
(B) Tide Height (MLLW)	.46	.46	
(C) Mudline Elevation (MLLW)	-29.7	-26.9	
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm	30cm	
Measured Penetration	?.?	35cm	
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of ~~Core Drive~~	Big chunk of wood in jaws	Jaws closed completely full	
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: sample		Sample top 30cm 22T-SG-21	

SAMPLE CHARACTERISTICS

Sediment Odor		none	
Sediment Color		brownish grey	
Sediment Type		0-10cm = soft silt 10-30cm = medium stiff silt; trace sand	
Layering / Homogeneous			

Characteristic Comments: picture taken

Recorded By: Laura McWilliams

Page: ____ of __1__

Description By: Lance Downs

SEDIMENT GRAB COLLECTION FORM

power grab

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 16, 2019
Station ID:	SG-22	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	---	~~Latitude~~: Northing	N/A
Overdepth (OD):	—	~~Longitude~~: Easting	N/A
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		tide at Morrison Br.
Weather:	Sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: Northing	7110789.0		
~~Longitude~~: easting	7619054.8		
Time:	1230		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	34.7		
(B) Tide Height (MLLW)	1.06		
(C) Mudline Elevation (MLLW)	-33.6		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm		
Measured Penetration	35cm		
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description of ~~Core Drive~~	jaws closed		
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
~~Core~~ Collection Comments: sample	sampled top 30cm 22T-SG-22		

SAMPLE CHARACTERISTICS

Sediment Odor	none		
Sediment Color	Brownish Grey		
Sediment Type	Soft silt; trace sand		
Layering / Homogeneous			

Characteristic Comments:
picture taken
Added station to complete second row of samples outside of dock

Recorded By: Laura McWilliams

Page: ____ of __1__

Description by: Lance Downs

SEDIMENT GRAB COLLECTION FORM

Power grab

HALEY ALDRICH

SITE INFORMATION

Project Name:	Terminal 22T	Date:	July 16 2019
Station ID:	SG-23	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity
Project Depth (PD):	---	~~Latitude~~:	N/A
Overdepth (OD):	—	~~Longitude~~:	N/A
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core Depth:	---		
Weather:	Sunny		

GRAB SAMPLE COLLECTION

	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: northing	710986.3	710983.0	
~~Longitude~~: easting	769117.5	769120.9	
Time:	1250	1258	
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	33.5	33.7	
(B) Tide Height (MLLW)	.84	.77	
(C) Mudline Elevation (MLLW)	-32.7	-32.9	
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	30cm	30cm	
Measured Penetration	?.?	35cm	
~~Total Core Length Recovered~~			
~~% Recovery~~			
Description ~~of Core Drive~~	jaws did not close	bucket closed	
Refusal Encountered?	No / Yes (No circled)	No / Yes (No circled)	No / Yes
Description of Refusal			
Core Collection Comments:		sampled top 30cm 22T-SG-23	

SAMPLE CHARACTERISTICS

Sediment Odor		none	
Sediment Color		Brownish grey	
Sediment Type		soft silt; trace sand	
Layering / Homogeneous			

Characteristic Comments: picture taken
Added station to complete second row of samples outside of dock

Recorded By: Laura McWilliams

Page: ____ of 1

Description By: Lance Downs

APPENDIX C

Vibracore Photographs, Field Collection Forms, and Boring Logs

Vibracore VB-01

SEDIMENT CORE COLLECTION FORM

HALEY ALDRICH

SITE INFORMATION			
Project Name:	Terminal 22T	Date:	July 17, 2019
Station ID:	VB-01	Project Number:	
Harbor Area:	Willamette River	Survey ~~Vessel~~:	Gravity Marine
Project Depth (PD):	—	Northing:	710824
Overdepth (OD):	---	Easting:	7619179
Z - Layer (Z):	---	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW ~~MLW Other~~:
Total Target Core ~~Depth~~: length: 14 ft			tide from Morrison Br
Weather:	overcast		

CORE COLLECTION	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude~~: Northing	710824.5	710846.5	710818.1
~~Longitude~~: Easting	7619191.1	7619183.8	7619204.6
Time:	8:51	9:22	12:35
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	43.9	42.6	42.5
(B) Tide Height (MLLW)	2.22	2.16	1.27
(C) Mudline Elevation (MLLW)	-41.7	-40.4	-41.2
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	14 ft	14 ft	14 ft
Measured Penetration	8 ft (96")	unknown	5 ft
Total Core Length Recovered	91"	no core	approx 4'10"
% Recovery	95%	Ø	≈ 97%
Description of Core Drive		Vibracore tipped and got stuck in sediments	
Refusal Encountered?	No / Yes (Yes circled)	No / Yes (Yes circled)	No / Yes (Yes circled)
Description of Refusal	Hard sand	lost core barrel	Hard Sand
Core Collection Comments:	good recovery used for sampling		Not used because Attempt 1 was deeper

CORE CHARACTERISTICS			
Sediment Odor	No odor		
Sediment Color	See core log		
Sediment Type			
Layering / Homogeneous			

Core Characteristic Comments:

Samples: 22T-VB-01-0.0-2.5 at 15:20
22T-VB-01-2.5-4.0 at 15:25
22T-VB-01-4.0-5.8 at 15:30
22T-VB-01-5.8-8.0 at 15:35

Core Collection Recorded By: Laura McWilliams

Page: ____ of ____

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(503)-266-2122

CORING LOG

Borehole ID: VB-01
Sheet 1 of 1

Project Name: BP Terminal 22, Portland Harbors		Project No.: BPT22		Client: ANTEA Group
Drilling Co.: Gravity Environmental		Driller: Ed & Mark	Mudline Elev. -41.68 (MLLW)	Targeted Depth 14.0 ft
Drilling Equipment: A-Frame Vibracore	Drilling Method vibratory; Borehole Dia. 4"	Date/Time Drilling Started: July 17, 2019/08:51		Total Depth Reached/Recovery 8.0 ft/7.58 ft (95%)
Type of Sampling Device Lexan line tube		Depth of Water: 43.9 ft; Tide Level: 2.22 ft		Time of Tide: 08:51
Sample Location: Northing: 710824.5	Easting: 7619191.09	Logger: Lance Downs, PE, GE		Checked by/Date
Location Description upstream of ship dock near dolphine				

Depth	Interval	Recovery	Blow Counts	Description	USCS Symbol	OVA Reading	Remarks
0				very soft, wet, brown (10YR 4/3), sandy Silt sand fraction fine to medium grain, slight plasticity	ML		
1						0.0	0-2.5' sample no odor
2							
2.5				loose, wet, brown (10YR 4/2), slightl silty Sand color change to grey (10YR 6/1) 2" thin lense color change to pale brown (10YR 6/3)	SM		
3				fine to medium grain sand		0.0	2.5-4.0' sample no odor
4							
5						0.0	4.0 -5.8' sample no odor
6				color change to brown (10YR 4/3)			small wood fragments
7						0.0	5.8 - 8.0' sample no odor
7.5				change to dense			
8				TD 8.0'			

Vibracore VB-02

SEDIMENT CORE COLLECTION FORM

HALEY ALDRICH

SITE INFORMATION			
Project Name:	Terminal 22T	Date:	July 17, 2019
Station ID:	VB-02	Project Number:	
Harbor Area:	Willamette River	Survey Vessel:	Gravity Marine
Project Depth (PD):	—	Northing:	711446
Overdepth (OD):	---	Easting:	7618835
Z - Layer (Z):	—	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	---	Vertical Datum:	MLLW MLW Other:
Total Target Core ~~Depth~~: length = 14 ft		tide from morrison Br.	
Weather:	overcast		

CORE COLLECTION	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
~~Latitude:~~ Northing	711444.9	711439.4	711428.8
~~Longitude:~~ Easting	7618855.3	7618839.4	7618841.0
Time:	11:23	11:52	12:06
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	41.2	38.7	38.5
(B) Tide Height (MLLW)	1.62	1.60	1.58
(C) Mudline Elevation (MLLW)	-39.6	-37.1	-36.9
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	14 ft	14 ft	14 ft
Measured Penetration	7 ft	8 ft	10 1/2 ft = 126"
Total Core Length Recovered	approx 7 ft	approx 7'10"	108"
% Recovery	≈ 100%	≈ 98%	86%
Description of Core Drive			
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal			
Core Collection Comments:	Short	Short	used for sampling because of deepest penetration

CORE CHARACTERISTICS			
Sediment Odor			No odor
Sediment Color			See core log
Sediment Type			
Layering / Homogeneous			

Core Characteristic Comments:
Samples: 22T-VB-02-0.0-1.5 at 1400
22T-VB-02-1.5-3.0 at 1405
22T-VB-02-3.0-5.0 at 1410
22T-VB-02-5.0-7.0 at 14:15
22T-VB-02-7.0-8.8 at 14:20
22T-VB-02-8.8-10.5 at 1425

Core Collection Recorded By: Laura McWilliams

Page: ____ of ____

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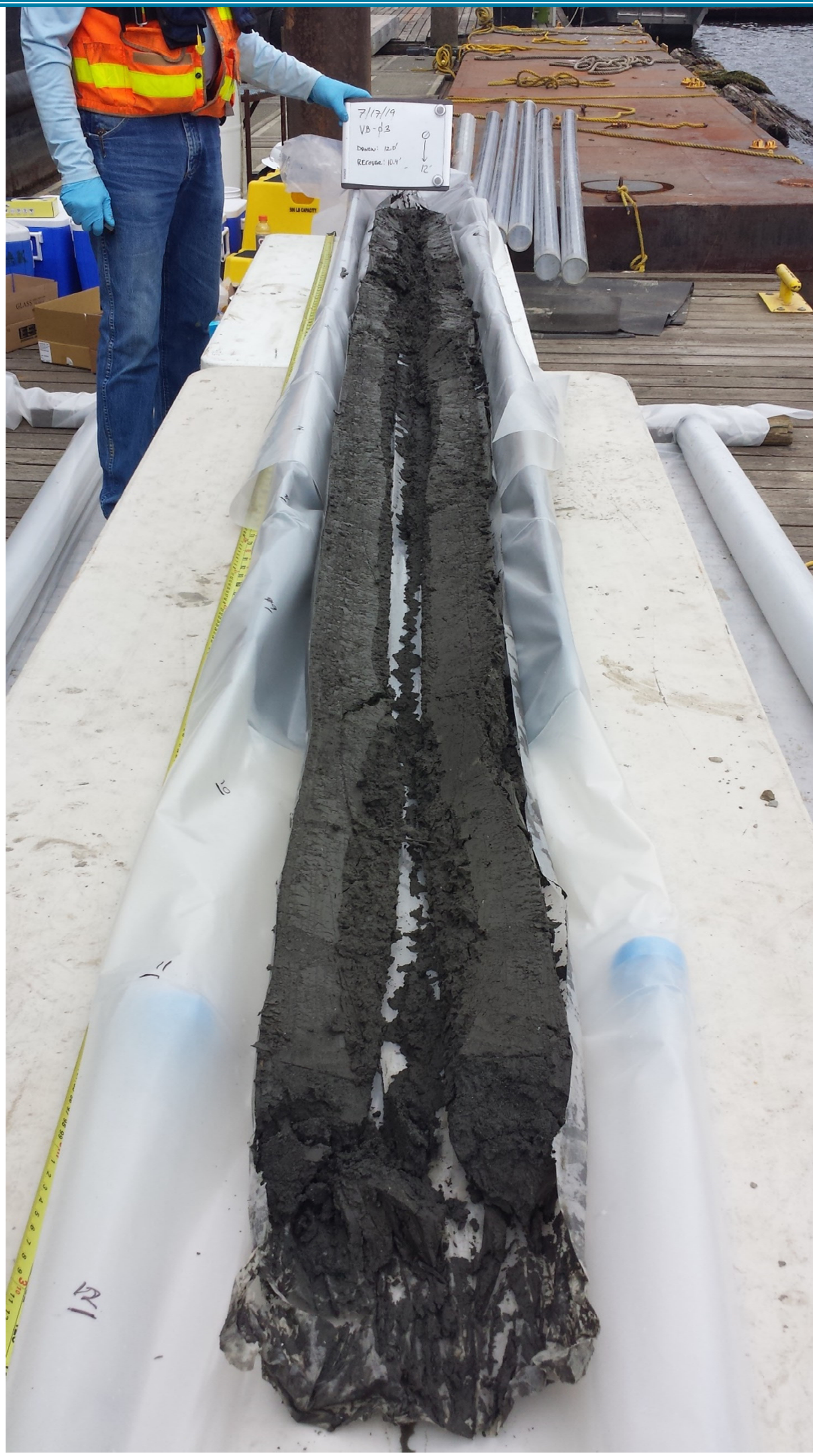
CORING LOG

Borehole ID: VB-02
Sheet 1 of 1

Project Name: BP Terminal 22, Portland Harbors			Project No.: BPT22		Client: ANTEA Group
Drilling Co.: Gravity Environmental			Driller: Ed & Mark	Mudline Elev. -36.9 (MLLW)	Targeted Depth 14.0 ft
Drilling Equipment: A-Frame Vibracore	Drilling Method vibratory	Borehole Dia. 4"	Date/Time Drilling Started: July 17, 2019/12:06		Total Depth Reached/Recovery 10.5 ft/9.0 ft (85%)
Type of Sampling Device Lexan line tube			Depth of Water: 38.5 ft Tide Level: 1.58 ft		Time of Tide: 12:06
Sample Location: Northing: 711428.84	Easting: 7618841.00		Logger: Lance Downs, PE, GE		Checked by/Date
Location Description downstream of ship dock					

Depth	Interval	Recovery	Blow Counts	Description	USCS Symbol	OVA Reading	Remarks
				very soft, wet, brown (10YR 4/3), sandy Silt sand fraction fine to medium grain, slight plasticity	ML	0.0	0-1.5' sample
1							
2						0.0	1.5-3.0' sample
3				wood debris present			
4						1.5	3.0-5.0' sample no odor
5							
6						0.0	5.0-7.0' sample
7				loose, wet, grey (10YR 6/1), silty Sand, thin lense	SM		
				soft, wet, brown (10YR 4/3), sandy Silt, fine to medium grain, slight plasticity	ML		
8						2.9	7.0-8.8' sample no odor, slight sheen
9				med dense, wet, grey (10YR 6/2), silty Sand	SM	3.1	8.8-10.5' sample no odor
10							
				TD 10.5'			



Vibracore VB-03

SEDIMENT CORE COLLECTION FORM

HALEY ALDRICH

SITE INFORMATION			
Project Name:	terminal 22T	Date:	July 17, 2019
Station ID:	VB-03	Project Number:	
Harbor Area:	Willamette River	Survey Vessel:	Gravity Marine
Project Depth (PD):	—	Northing:	711120
Overdepth (OD):	—	Easting:	7618967
Z - Layer (Z):	—	Water Depth Measurement:	Sounder / Leadline
Cap Contingency Layer (CCL):	—	Vertical Datum:	MLLW MLW Other:
Total Target Core ~~Depth~~: length = 14ft			tide from Morrison Br.
Weather:	partly cloudy		

CORE COLLECTION	Attempt 1 (a)	Attempt 2 (b)	Attempt 3 (c)
Latitude:	711113.17		
Longitude:	7618986.61		
Time:	9:35		
Mudline Elevation (C) = (Measured Depth (A) + Tide Height (B)) - [include sign (+/-) of tide height as reported]			
(A) Measured Water Depth	29.0		
(B) Tide Height (MLLW)	2.08		
(C) Mudline Elevation (MLLW)	-26.9		
Target Core Length = | ((Project Depth (PD) + Overdepth (OD) + Cap Contingency Layer (CCL) [incl. Z]) - (Mudline Elevation) |			
Target Core Barrel Penetration	14 ft		
Measured Penetration	12ft = 144"		
Total Core Length Recovered	125"		
% Recovery	87%		
Description of Core Drive			
Refusal Encountered?	No Yes	No Yes	No Yes
Description of Refusal	Hard Sand		
Core Collection Comments:	Achived project objective of 14±2 ft penetration		

CORE CHARACTERISTICS			
Sediment Odor	Odor approx 6-9 ft bss		
Sediment Color	See core log		
Sediment Type			
Layering / Homogeneous	Distinct Sand layer below 11.2 ft bss (this deepest sample contains metal rivits - no metals analysis		

Core Characteristic Comments:

Samples: 22T-VB-03-0.0-2.0 at 1630
22T-VB-03-2.0-4.0 at 1635
22T-VB-03-4.0-6.0 at 1640
22T-VB-03-6.0-8.0 at 1645
22T-VB-03-8.0-9.0 at 1650
22T-VB-03-9.0-11.2 at 1655
22T-VB-03-11.2-12 at 1700
22T-VB-03-4.0-6.0-D at 1705 field dup of 4-6ft bss interval

Core Collection Recorded By: Laura McWilliams

Page: _____ of _____

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CORING LOG

Borehole ID: VB-03
Sheet 1 of 2

Project Name: BP Terminal 22, Portland Harbors		Project No.: BPT22		Client: ANTEA Group
Drilling Co.: Gravity Environmental		Driller: Ed & Mark	Mudline Elev. -26.9 (MLLW)	Targeted Depth 14.0 ft
Drilling Equipment: A-Frame Vibracore	Drilling Method vibratory / Borehole Dia. 4"	Date/Time Drilling Started: July 17, 2019/09:35		Total Depth Reached/Recovery 12.0 ft/10.4 ft (87%)
Type of Sampling Device Lexan line tube		Depth of Water: 29.0 ft		
Sample Location:		Tide Level: 2.08 ft		Time of Tide: 09:35
Northing: 711113.17	Easting: 7618986.61	Logger: Lance Downs, PE, GE		Checked by/Date
Location Description middle of ship dock				

Depth	Interval	Recovery	Blow Counts	Description	USCS Symbol	OVA Reading	Remarks
0				soft, wet, brown (10YR 4/3), sandy Silt sand fraction fine to medium grain, slight plasticity	ML	0.0	0-2' sample no odor
1							
2						0.0	2-4.0' sample no odor
3				wood debris present			
4							
5						13.1	4.0-6.0' sample slight odor
6							
7				color change, light brownish grey (10YR 6/2)		19.5	6.0-8.0' sample slight odor, sheen present
8						20.7	8.0-9.0' sample odor, sheen present
9							
10						17.7	9.0-11.0' sample slight odor, no sheen
11							

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CORING LOG

Borehole ID: VB-03

Project Name: BP Terminal 22, Portland Harbors			Project No.: BPT22	Client: ANTEA Group
Drilling Co.: Gravity Environmental			Driller: Ed & Mark / Mudline Elev. -26.9 (MLLW)	Targeted Depth 14.0 ft
Drilling Equipment: A-Frame Vibracore	Drilling Method vibratory	Borehole Dia. 4"	Date/Time Drilling Started: July 17, 2019/09:35	Total Depth Reached/Recovery 12.0 ft/10.4 ft (87%)
Type of Sampling Device Lexan line tube			Depth of Water: 29.0 ft	
Sample Location:			Tide Level: 2.08 ft	Time of Tide: 09:35
Northing: 711113.17	Easting: 7618986.61		Logger: Lance Downs, PE, GE	Checked by/Date
Location Description middle of ship dock				

Depth	Interval	Recovery	Blow Counts	Description	USCS Symbol	OVA Reading	Remarks
11				soft, wet, brown (10YR 4/3), sandy Silt sand fraction fine to medium grain, slight plasticity	ML		
12				dense, wet, brown (10YR 4/3), silty Sand	SM	23.6	11.2-12.0' sample slight odor, no sheen
				TD 12.0'			
13							
14							

APPENDIX D

Laboratory Reports (Electronic Files Only)

APPENDIX E

Data Validation Report

Haley & Aldrich, Inc.
600 South Meyer Ave
Suite 100
Tucson, AZ 85701
520.289.8621

Data Usability Summary Report

Project Name: Portland Harbor

Analytical Laboratory: Eurofins TestAmerica Laboratories, Inc. – Tacoma, WA

Validation Performed by: Vanessa Godard

Validation Reviewed by: Katherine Miller

Validation Date: July 2019

Haley & Aldrich, Inc., prepared this Data Usability Summary Report (DUSR) to summarize the review and validation of the Portland Harbor sediment samples collected from 16 to 18 July 2019. The analytical results for Sample Delivery Group(s) (SDG) listed below were reviewed to determine the data usability. This data validation and usability assessment was performed per the guidance and requirements established by the U.S. Environmental Protection Agency's (EPA) "National Functional Guidelines for Inorganic Data Review", "National Functional Guidelines for Organic Data Review", "National Functional Guidelines for High Resolution Superfund Methods Data Review", "R10 Data Validation and Review Guidelines for Polychlorinated Dibenzo-p-Dioxin and Polychlorinated Dibenzofuran Data (PCDD/PCDF) Using Method 1613B, and SW846 Method 8290A", and the Project-specific Quality Assurance Project Plan (QAPP), herein referred to as the specified limits. The HA Work Plan referenced outdated NFG. Data in this report has been reviewed against the most recent NFG in accordance with the AECOM QAPP. The following quality assurance/quality control criteria were reviewed as applicable for analytes reported in the project sample(s):

1. Sample Delivery Group Number 580-87706-1 (Stage 4)
2. Sample Delivery Group Number 580-87706-2 (Stage 4)
3. Sample Delivery Group Number 580-87761-1 (Stage 2A)
4. Sample Delivery Group Number 580-87761-2 (Stage 2A)
5. Sample Delivery Group Number 580-87761-3 (Stage 2A)

- Holding Times/Preservation
- Reporting Limits & Sample Dilutions
- Reporting Basis (Wet/Dry)
- Surrogate Recovery Compliance
- Confirmation Review
- Dioxin/Furan EMPCs
- Pesticide Gas Chromatograph Performance Check
- Pesticide/PCB Cleanup Procedure Check
- Blank Sample Analysis
- Laboratory Control Samples
- Matrix Spike Samples
- Laboratory and Field Duplicate Sample Analysis
- Gas Chromatograph/Mass Spectrometer Instrument Performance Checks
- Initial Calibration
- Initial and Continuing Calibration Verification
- Internal Standards
- Target Analyte Identification
- System Performance and Overall Assessment

Overall Quality Control Summary

Analytical precision and accuracy were evaluated based on the laboratory control, matrix spike, or laboratory duplicate analyses performed concurrently with the project samples or based on field duplicates collected at the site.

Data reported in this sampling event were reported to the laboratory method detection limit (MDL). Results found between the MDL and RL are flagged “J” estimated.

Sample data were qualified in accordance with laboratory’s standard operating procedures (SOPs). The results presented in each laboratory report were found to be compliant with the data quality objectives for the project and usable; any exceptions are noted in the following pages.

1. Sample Delivery Group Number 580-87706-1 (Stage 4)

1.1 SUMMARY

This DUSR summarizes the review of SDG number 580-87706-1. Samples were collected, preserved, and shipped following standard chain of custody protocol. Samples were also received appropriately, identified correctly, and analyzed according to the monitoring schedule. Chains of custody were appropriately signed and dated by the field and/or laboratory personnel.

Analyses were performed on the following samples:

Sample ID	Sample Type	Lab ID	Sample Collection Date	Matrix	Methods
22T-SG-17_20190716	N	580-87706-1	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-18_20190716	N	580-87706-2	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-11_20190716	N	580-87706-3	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-11-D_20190716	FD	580-87706-4	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-12_20190716	N	580-87706-5	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-19_20190716	N	580-87706-6	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-20_20190716	N	580-87706-7	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-15_20190716	N	580-87706-8	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-14_20190716	N	580-87706-9	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-13_20190716	N	580-87706-10	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-22_20190716	N	580-87706-11	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-23_20190716	N	580-87706-12	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-10_20190716	N	580-87706-13	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-21_20190716	N	580-87706-14	7/16/2019	Sediment	A, B, C, D, E, F
22T-SG-16_20190716	N	580-87706-15	7/16/2019	Sediment	A, B, C, D, E, F

Holding Times:

A. Total Solids by EPA 160.3 -- 7 days
B. Dioxins & Furans by EPA 1613B (Mixed Phase) -- 7 days
C. Organochlorine Pesticides (DDx) by EPA 8081B -- 14 days extraction/40 days analysis
D. Polychlorinated Biphenyls (PCBs) by EPA 8082A --- 14 days extraction/40 days analysis
E. Polycyclic Aromatic Hydrocarbons (PAHs) by EPA 8270D SIM --------------------------------- 14 days extraction/40 days analysis
F. Total Organic Carbon (TOC) by EPA 9060A --- 28 days

1.2 HOLDING TIMES/PRESERVATION

The samples arrived at the laboratory at the proper temperature and were prepared and analyzed within the holding time and preservation criteria specified per method protocol.

Cooler temperature on arrival to the laboratory was: 3.0, 3.3, 4.5; 5.4 Degrees C.

1.3 REPORTING LIMITS AND SAMPLE DILUTIONS

The reporting limits for the samples within this SDG met or were below the minimum reporting limit requirements specified by the Project-specific QAPP within reason. Soil reporting limits vary based on the amount of sample used.

All dilutions were reviewed and found to be justified. Any non-detects with elevated reported limits are noted and explained below.

Sample ID	Lab ID	Analyte/Method	Dilution Factor	Issue/Explanation
All Samples	All Samples	DDx by EPA 8081B	3x	Dilution required due to matrix interference and/or high target analyte concentrations.

1.4 REPORTING BASIS (WET/DRY)

Soil samples can be reported on either a wet (as received) or dry weight basis. Dry weight data indicate calculations have been made to compensate for the moisture content of the soil sample. Per the QAPP requirements, data in this SDG were reported on a dry weight basis except for TOC, which is not correctable per the method.

Percent (%) solids should be appropriately considered when evaluating analytical results for non-aqueous samples. Sediments with high moisture content may or may not be successfully analyzed by routine analytical methods. Samples should have ≥ 30% solids to be appropriately quantified. Percent solid results have been reviewed and found to within limits.

1.5 SURROGATE RECOVERY COMPLIANCE

Surrogates, also known as deuterated monitoring compounds, are compounds added to each sample prior to sample preparation to evaluate the percent recovery (%R) to ensure that the organic analytical method is efficient. The %R were within the specified limits with the following exceptions:

Method	Sample ID	Lab ID	Surrogate	Recovery	Qualification
EPA 8081B	22T-SG-11	580-87706-3	Decachlorobiphenyl	34%	NA, within NFG limits.
	22T-SG-12	580-87706-5	Decachlorobiphenyl	32%	NA, within NFG limits.
	22T-SG-19	580-87706-6	Decachlorobiphenyl	22%	**J-/UJ Pesticides**
	22T-SG-20	580-87706-7	Tetrachloro-m-xylene	49%	NA, within NFG limits.
	22T-SG-23	580-87706-12	Decachlorobiphenyl	34%	NA, within NFG limits.
	22T-SG-21	580-87706-14	Tetrachloro-m-xylene	44%	NA, within NFG limits.
			Decachlorobiphenyl	21%	**J-/UJ Pesticides**

1.6 CONFIRMATION COLUMN REVIEW

When analyzing for pesticides and PCBs, compound identification based on single-column analysis should be confirmed on a second column or should be supported by at least one other qualitative technique. When being confirmed on a second column, the relative percent difference (RPD) should not exceed 40%. All RPDs were within control limits, with the following exceptions:

Method	Analyte	Sample*	RPD	Action
EPA 8081B	4,4-DDD	580-87706-15	> 40%	**Qualify data estimated "J/UJ".**
	2,4-DDD	580-87706-5, 6, 7, 12, 14, 15	> 40%	**Qualify data estimated "J/UJ".**
	2,4-DDE	580-87706-14	> 40%	**Qualify data estimated "J/UJ".**
EPA 8082A	PCB-1260	580-87706-3, 6, 7, 9, 10, 12, 14	> 40%	**Qualify data estimated "J/UJ".**

* The lower value between the two columns was reported per the lab SOP.

1.7 PESTICIDE GAS CHROMATOGRAPH PERFORMANCE CHECK

Analyzing for pesticides on a Gas Chromatograph/Electron Capture Detector (GC/ECD) instrument requires performance checks to ensure adequate resolution and instrument sensitivity. Two performance checks are required: the resolution check mixture and the performance evaluation mixture.

The performance evaluation mixture (PEM) is analyzed at the beginning and at the end of the ICAL sequence. The resolution between any two adjacent peaks must be:

- ≥ 90% on each GC column when using INDA/INDB
- ≥ 80% for the primary and ≥ 50% for the secondary column when using INDC

The percent breakdown is the amount of decomposition that 4,4-DDT and Endrin undergo when analyzed on the GC column and cannot exceed 20% individually or 30% combined. Resolutions and breakdown were reviewed and found to be within limits.

1.8 PESTICIDE/PCB CLEANUP PROCEDURE CHECKS

Gel Permeation Chromatography (GPC) cleanup is used for the cleanup of all non-aqueous sample extracts and for all aqueous sample extracts that contain high molecular weight components that interfere with the analysis of the target analytes. The retention time (RT) shift for bis(2-ethylhexyl) phthalate and perylene must be < 5% and the %R for each target analytes in the GPC calibration verification must be within 80-120%. GPC cleanup was not performed on site samples for pesticide or PCB analysis.

Pesticide/Aroclor sulfur cleanup procedures remove elemental sulfur from sample extracts prior to analysis. If not removed, sulfur may cause a rise in the chromatographic baseline, preventing accurate analyte identification and quantitation. Field sample GC chromatograms were reviewed to determine whether there is a flat baseline. Copper TBA sulfite cleanups were performed on all site samples the lab determined were influenced by sulfur and chromatograms do not show any additional indication of sulfur interference.

1.9 DIOXIN/FURAN EMPCS

An Estimated Maximum Possible Concentration (EMPC) is a worst-case estimate of the concentration for a dioxin/furan due to all identification criteria being met except the ion abundance ratio criteria, or if a peak representing a chlorinated diphenyl ether was detected. The lab reported many EMPC flags:

- **Sample results flagged "q" that were detected below the reporting limit should be qualified estimated ND "UJ" at the reported concentration.**
- **Sample results flagged "q" that were detected above the reporting limit should be qualified estimated "J".**

1.10 BLANK SAMPLE ANALYSIS

Method blanks are prepared by the analytical laboratory and analyzed concurrently with the project samples to assess possible laboratory contamination. Method blank samples had no detections, indicating that no contamination from laboratory activities occurred with the following exceptions:

Blank Type	Batch ID	Analyte Detected in Blank	Concentration	Qualifier	Affected Samples
Method Blank	309103	1,2,3,4,6,7,8-HpCDD	0.218 Jq pg/g	NA	None, samples > 5x MB & blank EMPC.
		1,2,3,4,7,8-HxCDD	0.140 Jq pg/g	**RL U**	**All Samples**
		1,2,3,7,8,9-HxCDF	0.681 J pg/g	**RL U**	**All Samples**
		OCDD	1.95 J pg/g	NA	None, samples >10x MB.
		OCDF	0.415 J pg/g	**Result U**	**All Samples omitting 580-87706-14**
Method Blank	306243	Benzo(g,h.i)perylene	0.668 J ug/kg	NA	None, samples >10x blank.
		Dibenz(a,h)anthracene	1.47 J ug/kg	**RL U**	**580-87706-1, 2, 8, 12**
				Result U	**580-87706-4, 11**
				J+	**580-87706-9, 10, 13**

Field blanks are prepared to identify contamination that may have been introduced during field activity. Equipment blanks are prepared to identify contamination that may have been introduced while decontaminating sampling equipment. Per the Work Plan, equipment rinse blanks were to be collected as follows:

- One rinse blank will be collected for the delineation sample collection equipment (e.g. vibracore shoe) used on the sampling vessel (collected on 7/17/2019): 22T-VB-01-RB-BRL_20190717 (580-87761-28).
- A separate rinse blank will be collected for the tools used for the sample processing (mixing bowls, spoons, etc.) collected on 7/18/2019: 22T-SG-01-RB-CR_20190718 (580-87761-29).

Blank samples for field quality control had no detections, indicating that no contamination from field activities occurred with the following exceptions. All detections in field blanks were compared to the site samples following a unit conversion to the base milligram concentration found.

- Various detections were qualified ND due to method blank contamination or EMPC flags (Section 2).

Blank Type	Date	Analyte Detected in Blank	Concentration	Qualifier	Affected Samples
Equipment Blank (Associated with Vibracore samples)	7/17/2019	OCDF	4.2 J pg/L	**RL U**	**580-87761-8, 10**
		1,2,3,4,6,7,8-HpCDF	1.7 J pg/L	**RL U**	**580-87761-8, 9, 10**
		1,2,3,4,7,8-HxCDF	1.2 J pg/L	**RL U**	**580-87761-9, 10**
		1,2,3,7,8,9-HxCDD	2.0 J pg/L	**RL U**	**580-87761-6,7,8,9,10,11,13,15,17,18**
		2,3,4,6,7,8-HxCDF	1.4 J pg/L	**RL U**	**580-87761-6,9,10,11,13,15,16,17,18**
		2,3,7,8-TCDF	1.0 J pg/L	**RL U**	**580-87761-7, 17**
		TOC	1.7 mg/L	NA	None, samples >10x blank.
Equipment Blank (Associated with Grab samples)	7/18/2019	1,2,3,4,6,7,8-HpCDF	1.1 J pg/L	**RL U**	**580-87761-19**
		1,2,3,4,7,8-HxCDD	2.3 J pg/L	**RL U**	**580-87761-19, 20, 21, 22, 26**
		1,2,3,6,7,8-HxCDF	0.94 J pg/L	**RL U**	**580-87706-1, 2, 3, 5, 8, 10, 11, 12; 580-87761-19, 20**
		1,2,3,7,8-PeCDF	0.86 J pg/L	**RL U**	**580-87706-1, 3, 7, 10, 12; 580-87761-19, 20**
		TOC	1.8 mg/L	NA	None, samples >10x blank.

1.11 CALIBRATION BLANKS

Calibration blanks help determine the validity of the analytical results by determining the existence and magnitude of contamination resulting from laboratory activities or baseline drift during analysis. Initial Calibration Blanks (ICBs) are analyzed after the standards and prior to the Initial Calibration Verification (ICV) sample. Continuing Calibration Blanks (CCBs) are analyzed immediately after every Continuing Calibration Verification (CCV) sample. Calibration blanks had no detections.

1.12 LABORATORY CONTROL SAMPLES

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. Compounds associated with the LCS/LCSD analyses exhibited recoveries and relative percent difference (RPDs) within the specified limits.

1.13 MATRIX SPIKE SAMPLES

Matrix spike/matrix spike duplicate (MS/MSD) data are used to assess the precision and accuracy of the analytical method and evaluate the effect of the sample matrix on the sample preparation procedures and measurement methodologies. The sample(s) below were used for MS/MSD:

Lab Sample Number	Matrix Spike/ Matrix Spike Duplicate Sample Client ID	Method(s)
580-87706-5	22T-SG-12_20190716	PAHs by EPA 8270D SIM; 4,4-DDx by EPA 8081B; PCBs by EPA 8082A; TOC by EPA 9060

The MS/MSD recoveries and the RPD between the MS and MSD results were within the specified limits with the following exceptions:

Sample Type	Method	Parent Sample Number	Analyte	%R/RPD	Qualifier	Affected Samples
MS/MSD	EPA 8270D SIM	22T-SG-12	Naphthalene	63%/56%	**J**	**22T-SG-12**
MSD			2-Methylnaphthalene	RPD = 13%	**J**	**22T-SG-12**
MS/MSD			Phenanthrene	65%/57%, RPD = 12%	**J**	**22T-SG-12**
MSD			Fluoranthene	73%	**J**	**22T-SG-12**
MSD	EPA 8081B		4,4-DDD	46%, RPD = 46%	**J**	**22T-SG-12**
MS/MSD			4,4-DDE	51%/42%	**J**	**22T-SG-12**
MSD			4,4-DDT	9%, RPD = 129%	**Reject**	**22T-SG-12**
MSD	EPA 8082A		PCB-1016	RPD = 16%	NA	None, sample ND.

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1.14 LABORATORY AND FIELD DUPLICATE SAMPLE ANALYSIS

The laboratory duplicate sample analysis is used by the laboratory at the time of the analysis to demonstrate acceptable method precision. The following sample(s) were used for laboratory duplicate analysis and the RPDs were all below 20% (or the absolute difference rule was satisfied if detects were less than 5x the RL):

Lab Sample Number	Laboratory Duplicate Sample Client ID	Method(s)
580-87706-5	22T-SG-12_20190716	TOC by EPA 9060 (duplicate and triplicate)
580-87706-15	22T-SG-16_20190716	Total Solids by EPA 2540G

The field duplicate sample analysis is used to assess the precision of the field sampling procedures and analytical method. Per the Work Plan, field duplicates were to be collected at a rate of 5%, assuming there was sufficient volume. The RPD comparison for any field duplicates in this SDG is shown below. RPDs were all below 50% for soil (or the absolute difference rule was satisfied if detects were less than 5x the RL). Any exceptions are noted below and qualified.

Field Duplicate RPD Calculations:

Method(s): Inorganics				
Analyte	**Primary Sample ID**	**Duplicate Sample ID**	**% RPD**	**Qualification**
	22T-SG-11	**22T-SG-11-D**		
TOC (mg/kg)	**33000**	**32000**	3.1	None, RPD < 50%
Total Solids (%)	**40.1**	**38.3**	4.6	None, RPD < 50%
Method(s): EPA 1613B				
Analyte (pg/g)	**Primary Sample ID**	**Duplicate Sample ID**	**% RPD**	**Qualification**
	22T-SG-11	**22T-SG-11-D**		
OCDF	43 *	45 *	NA	None, Both ND.
OCDD	**580**	**570**	1.7	None, RPD < 50%
HpCDF	**13**	**14**	NA	None, Abs. Diff. < RL
HpCDD	**64**	**64**	NA	None, Abs. Diff. < RL
HpCDF	**1.3 J**	**1.4 J**	NA	None, Abs. Diff. < RL
HxCDF	**2.4 J**	**2.8 J**	NA	None, Abs. Diff. < RL
HxCDD	1.1 J*	1.1 J*	NA	None, Both ND.
HxCDF	1.2 J*	13 U	NA	None, Abs. Diff. < RL
HxCDD	**2.7 J**	**2.5 J**	NA	None, Abs. Diff. < RL
HxCDF	2.5 J*	3.2 J*	NA	None, Both ND.
HxCDD	**2.1 J**	**2.0 J**	NA	None, Abs. Diff. < RL
PeCDF	1.8 J*	13 U	NA	None, Abs. Diff. < RL
PeCDD	12 U	13 U	NA	None, Both ND.
HxCDF	**0.57 J**	13 U	NA	None, Abs. Diff. < RL
PeCDF	**0.89 J**	13 U	NA	None, Abs. Diff. < RL
TCDF	**1.9 J**	**1.4 J**	NA	None, Abs. Diff. < RL
TCDD	**0.61 J**	**0.66 J**	NA	None, Abs. Diff. < RL

* Qualified ND by method or equipment blank contamination.

Field Duplicate RPD Calculations (continued):

Method(s): EPA 8081B & 8082A				
Analyte (mg/kg, unless noted)	**Primary Sample ID 22T-SG-11**	**Duplicate Sample ID 22T-SG-11-D**	**% RPD**	**Qualification**
4,4'-DDD (ug/kg)	**0.70 J**	**0.78 J**	NA	None, Abs. Diff. < RL
4,4'-DDE (ug/kg)	**1.4**	**1.5**	NA	None, Abs. Diff. < RL
4,4'-DDT (ug/kg)	1.4 U	1.5 U	NA	None, Both ND.
o,p'-DDD (ug/kg)	3.5 U	3.8 U	NA	None, Both ND.
o,p'-DDE (ug/kg)	3.5 U	3.8 U	NA	None, Both ND.
o,p'-DDT (ug/kg)	3.5 U	3.8 U	NA	None, Both ND.
Aroclor-1016 (PCB-1016)	0.0046 U	0.0051 U	NA	None, Both ND.
Aroclor-1221 (PCB-1221)	0.0046 U	0.0051 U	NA	None, Both ND.
Aroclor-1232 (PCB-1232)	0.0046 U	0.0051 U	NA	None, Both ND.
Aroclor-1242 (PCB-1242)	0.0046 U	0.0051 U	NA	None, Both ND.
Aroclor-1248 (PCB-1248)	0.0046 U	0.0051 U	NA	None, Both ND.
Aroclor-1254 (PCB-1254)	0.0046 U	0.0051 U	NA	None, Both ND.
Aroclor-1260 (PCB-1260)	**0.0018 J**	**0.0037 J**	NA	None, Abs. Diff. < RL
Method(s): EPA 8270D SIM				
Analyte (ug/kg, unless noted)	**Primary Sample ID 22T-SG-11**	**Duplicate Sample ID 22T-SG-11-D**	**% RPD**	**Qualification**
1-Methylnaphthalene	**27**	**31**	NA	None, Abs. Diff. < RL
2-Methylnaphthalene	**69**	**53**	NA	**J Flag, Abs. Diff. > RL**
Acenaphthene	**56**	**38**	NA	**J Flag, Abs. Diff. > RL**
Acenaphthylene	**21**	**20**	NA	None, Abs. Diff. < RL
Anthracene	**65**	**45**	NA	**J Flag, Abs. Diff. > RL**
Benzo(a)anthracene	**240**	**110**	**74.3**	**J Flag, RPD ≥ 50%**
Benzo(a)pyrene	**300**	**120**	**85.7**	**J Flag, RPD ≥ 50%**
Benzo(b)fluoranthene	**320**	**140**	**78.3**	**J Flag, RPD ≥ 50%**
Benzo(g,h,i)perylene	**260**	**110**	**81.1**	**J Flag, RPD ≥ 50%**
Benzo(k)fluoranthene	**92**	**40**	NA	**J Flag, Abs. Diff. > RL**
Chrysene	**250**	**110**	**77.8**	**J Flag, RPD ≥ 50%**
Dibenz(a,h)anthracene	**28**	13 *	NA	**J Flag, Abs. Diff. > RL**
Fluoranthene	**460**	**280**	48.6	None, RPD < 50%
Fluorene	**55**	**40**	NA	**J Flag, Abs. Diff. > RL**
Indeno(1,2,3-cd)pyrene	**310**	**140**	**75.6**	**J Flag, RPD ≥ 50%**
Naphthalene	**170**	**96**	**55.6**	**J Flag, RPD ≥ 50%**
Phenanthrene	**330**	**260**	23.7	None, RPD < 50%
Pyrene	**500**	**300**	**50.0**	**J Flag, RPD ≥ 50%**

* Qualified ND by method blank contamination.

1.15 GAS CHROMATOGRAPH/MASS SPECTROMETER INSTRUMENT PERFORMANCE CHECKS

When analyzing organic compounds, the instrument performance check solution known as Decafluorotriphenylphosphine (DFTPP) for semi-volatiles is run every 12 hours to ensure adequate mass resolution, identification, and sensitivity, and to document this level of performance prior to analyzing any sequence of standards or samples. Ion abundance criteria were within the specified limits.

1.16 INTERNAL STANDARDS

Internal standards are compounds added to each sample by the laboratory prior to volatile sample analysis to ensure that instrument sensitivity and response are stable during each analysis. Area response and retention time were reviewed and found to be within the specified limits.

1.17 TARGET ANALYTE IDENTIFICATION

A review of the sample chromatographs and retention times for all organic compounds indicated no problems with target compound identification with the following exceptions:

- Sample 22T-SG-12_20190716 (580-87706-5) appears to have aroclors, however, due to multiple overlapping aroclors, weathering or other environmental processes, the PCBs in the sample do not closely match any of the laboratory's aroclor standards used for instrument calibration. The sample has been quantified and reported with the predominant Aroclor or mixture of aroclors. Due to the poor match with the Aroclor standard(s), there is increased qualitative and quantitative uncertainty associated with this result. **Qualify results estimated "UJ".**

1.18 INITIAL CALIBRATION

Organic methods require an initial calibration to ensure the instrument is capable of producing acceptable qualitative and quantitative data. Standards of varying concentrations are run to create a calibration curve, which is then used to ensure the validity of compound quantitation. Percent Relative Standard Deviation (%RSD) and Relative Response Factors (RRF) are reported and must be within the specified limits. R^2 values are sometimes reported to support linear fit for certain EPA methods/compounds also. The following instruments were calibrated:

Analyses	Instrument	Analysis Date
Dioxins by EPA 1613B	3D5; 4D2	5/21/2019; 5/13/2019
DDx by EPA 8081B	TAC034; TAC045	7/14/2019; 2/27/2019
PCBs by EPA 8082A	TAC057	12/22-23/2018
PAHs by EPA 8270D SIM	TAC023	1/30/2019

Proper concentrations for standards were used for the instruments and Relative Response Factors (RRFs) and %RSDs or the R^2 values were within the specified limits.

Inorganic methods require an Initial Calibration to ensure the instrument is capable of producing acceptable qualitative and quantitative data. Instruments should be calibrated each time the instrument is set up and after CCV failure. A blank and at least five standards of varying concentrations should be run to create a calibration curve. At least one of these must be at or below the reporting limit (RL) but above the method detection limit (MDL). The following instruments were calibrated:

Analyses	Instrument	Analysis Date
TOC by EPA 9060	TAC105	7/8/2019

The curve must have a correlation coefficient of ≥0.995 and the calculated percent differences (%Ds) for all non-zero standards must be within ±30% of the true value. The initial calibration curves have been reviewed for all reported parameters and were found to be within limits.

1.19 INITIAL AND CONTINUING CALIBRATION VERIFICATION

Organic methods require an additional Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) to ensure that the instrument continues to meet the sensitivity and linearity criteria to produce acceptable qualitative and quantitative data throughout each analytical sequence. CCVs must be run at the beginning and end of every 12-hour period of operation. Relative Response Factors (RRFs) and the Percent Difference (%D) were within the specified limits with the following exceptions:

Type	Instrument	Date	Time	Analyte	%D/RRF	Action
CCV	TAC045	7/23/2019	11:21	4,4-DDD	33.0	Results were confirmed on both columns and reported from the passing column.
				4,4-DDE	39.7	
CCV	TAC034		13:27	2,4-DDE	29.6%	
CCVL			14:06	4,4-DDE	36.5	Second column not run. %Ds a bit high as this was a low level CCV. No action.
				4,4-DDT	-26.5	
CCV	TAC057		08:00	PCB-1232 Peak 1	20.5	NA, within NFG opening limit of 25%.
				PCB-1232 Peak 2	21.4	NA, within NFG opening limit of 25%.
				PCB-1262 Peak 2	21.9	NA, within NFG opening limit of 25%.
				PCB-1262 Peak 3	23.8	NA, within NFG opening limit of 25%.
				PCB-1262 Peak 4	29.3	NA, Aroclor not reported.
				PCB-1262 Peak 5	28.2/23.8	NA, Aroclor not reported.
CCV			08:18	PCB-1248 Peak 1 C2	-35.0	NA, all 1248 reported from Column 1.
				PCB-1248 Peak 2 C2	-37.4	NA, all 1248 reported from Column 1.
CCV			08:36	PCB-1242 Peak 3 C1	38.1	**"UJ" All PCB-1248 in Samples**
				PCB-1248 Peak 5	-21.0	NA, within NFG opening limit of 25%.
CCV			08:54	PCB-1221 Peak 2 C1	-29.9	**"UJ" All PCB-1221 in Samples**
CCV			09:12	PCB-1016 Peak 2 C1	25.7	**"UJ" All PCB-1016 in Samples**
				PCB-1016 Peak 5 C1	-36.7	
				PCB-1260 Peak 1 C1	-25.2	**"J/UJ" All PCB-1260 in Column1 Samples**

Dioxin analysis requires a retention time difference of less than 15 seconds between the Initial Calibration and Continuing Calibration samples for the internal standards, otherwise the descriptor switching times may not be optimum for detecting all homologues. The laboratory called attention to the below internal standards that exceeded this requirement:

Instrument	Analyte	ICAL RT (min)	CCV RT (min)	RT Diff (sec)	Action
3D5	13C-1,2,3,4-TCDD	18.429	17.188, 17.158	> 15	This retention time shift is due to normal and reasonable column maintenance and does not affect the instrument chromatography resolution, sensitivity or identification of target analytes. No action.
	13C-1,2,3,7,8,9-HxCDD	32.496	31.485, 31.472	> 15	
4D2	13C-1,2,3,4-TCDD	14.386	14.360, 14.915	> 15	

Inorganic methods require an Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) to ensure that the instrument continues to meet the sensitivity and linearity criteria to produce acceptable qualitative and quantitative data throughout each analytical sequence. Initial calibrations must be run each time the instrument is set up and after each CCV failure. ICVs are analyzed immediately after initial calibration to verify ICAL accuracy, and CCVs are analyzed every two hours during an analytical sequence. Percent Recovery (%R) are reported and must be within the specified limits (90 to 110%). Percent Recovery (%R) have been reviewed and were found to be within limits.

1.20 SAMPLE RESULT VERIFICATION

The below sample result(s) were tracked through the relevant sample preparation steps, raw data outputs, transcriptions, conversions and/or calculations and have been confirmed to be accurate and representative of the site. Methods 8081B and 8082A do not provide raw responses for non-detects, therefore the potential for false negatives could not be evaluated.

Sample ID	Method	Analyte	Reported Result	Recalculated Result	Result Status
22T-SG-17	EPA 160.3	Percent Solids	54.6 %	54.65	Confirmed
	EPA 8270D SIM	1-Methylnaphthalene	4.7 ug/kg	4.7	Confirmed
		2-Methylnaphthalene	10 ug/kg	10	Confirmed
		Acenaphthene	7.7 ug/kg	7.7	Confirmed
		Acenaphthylene	4.5 ug/kg	4.5	Confirmed
		Anthracene	14 ug/kg	14	Confirmed
		Benzo(a)anthracene	38 ug/kg	38	Confirmed
		Benzo(a)pyrene	35 ug/kg	35	Confirmed
		Benzo(b)fluoranthene	43 ug/kg	43	Confirmed
		Benzo(g,h,i)perylene	33 ug/kg	33	Confirmed
		Benzo(k)fluoranthene	12 ug/kg	12	Confirmed
		Chrysene	44 ug/kg	44	Confirmed
		Dibenz(a,h)anthracene	4.4 ug/kg	4.4	Confirmed
		Fluoranthene	91 ug/kg	91	Confirmed
		Fluorene	9.5 ug/kg	9.5	Confirmed
		Indeno(1,2,3-cd)pyrene	38 ug/kg	38	Confirmed
		Naphthalene	24 ug/kg	24	Confirmed
		Phenanthrene	54 ug/kg	54	Confirmed
		Pyrene	100 ug/kg	101	Confirmed (Sig Figs)
	EPA 8081B	4,4'-DDD	0.61 ug/kg	0.62	Confirmed (Rounding)
		4,4'-DDE	0.76 ug/kg	0.76	Confirmed
		4,4'-DDT	0.47 ug/kg	0.47	Confirmed
22T-SG-21	EPA 8082A	Aroclor-1260	0.025 p mg/kg	0.025 p	Confirmed
22T-SG-17	EPA 1613B	1,2,3,4,6,7,8,9-OCDF	19 pg/g	19.4	Confirmed
		1,2,3,4,6,7,8,9-OCDD	250 pg/g	254	Confirmed (Sig Figs)
		1,2,3,4,6,7,8-HpCDF	6.5 Jq pg/g	6.5	Confirmed
		1,2,3,4,6,7,8-HpCDD	27 pg/g	27.1	Confirmed
		1,2,3,4,7,8,9-HpCDF	1.1 Jq pg/g	1.1	Confirmed
		1,2,3,4,7,8-HxCDF	2.0 J pg/g	2.0	Confirmed
		1,2,3,4,7,8-HxCDD	0.74 Jq pg/g	0.74	Confirmed
		1,2,3,6,7,8-HxCDF	0.95 J pg/g	0.95	Confirmed
		1,2,3,6,7,8-HxCDD	1.3 Jq pg/g	1.3	Confirmed
		1,2,3,7,8,9-HxCDF	1.7 J pg/g	1.7	Confirmed
		1,2,3,7,8,9-HxCDD	1.2 J pg/g	1.2	Confirmed
		1,2,3,7,8-PeCDF	0.98 J pg/g	0.99	Confirmed (Rounding)
		1,2,3,7,8-PeCDD	9.0 U pg/g	0.0	Confirmed (Below EDL)
		2,3,4,6,7,8-HxCDF	0.42 Jq pg/g	0.42	Confirmed
		2,3,4,7,8-PeCDF	9.0 U pg/g	0.0	Confirmed (Below EDL)
		2,3,7,8-TCDF	0.66 Jq pg/g	0.66	Confirmed
		2,3,7,8-TCDD	0.54 Jq pg/g	0.54	Confirmed
	EPA 9060A	TOC	13,000 mg/kg	12637.1	Confirmed (Sig Figs)

1.21 SYSTEM PERFORMANCE AND OVERALL ASSESSMENT

The results presented in this report were found to comply with the data quality objects for the project and the guidelines specified by analytical method. Based on the review of this report, the data are 100% useable except for rejected data noted below. A summary of qualifiers applied to this SDG are shown below.

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-SG-19_20190716	Pesticides	Detect/ND U	Detect J-/ND UJ	Low Surrogate Recovery
22T-SG-21_20190716		Detect/ND U	Detect J-/ND UJ	
22T-SG-16_20190716	4,4-DDD	Detect p	Detect J	RPD between confirmation columns >40%
580-87706-5, 6, 7, 12, 14, 15	2,4-DDD			
22T-SG-21_20190716	2,4-DDE			
580-87706-3, 6, 7, 9, 10, 12, 14	PCB-1260			
580-87706-1, 2, 5, 8, 11, 12	1,2,3,4,6,7,8-HpCDF	Result Jq	Result UJ	Estimated Maximum Possible Concentrations
580-87706-3, 4, 7, 9		Result q	Result J	
580-87706-1, 6, 9, 15	1,2,3,4,7,8,9-HpCDF	Result Jq	Result UJ	
580-87706-1, 5, 14, 15	1,2,3,4,7,8-HxCDD	Result Jq	Result UJ	
580-87706-8, 12	1,2,3,6,7,8-HxCDF	Result Jq	Result UJ	
580-87706-1, 2, 11	1,2,3,6,7,8-HxCDD	Result Jq	Result UJ	
580-87706-7, 9	1,2,3,7,8,9-HxCDD	Result Jq	Result UJ	
580-87706-10	1,2,3,7,8-PeCDF	Result Jq	Result UJ	
580-87706-6	1,2,3,7,8-PeCDD	Result Jq	Result UJ	
580-87706-1, 2, 5, 7, 9, 14	2,3,4,6,7,8-HxCDF	Result Jq	Result UJ	
580-87706-1	2,3,7,8-TCDF	Result Jq	Result UJ	
580-87706-1, 5, 11, 13	2,3,7,8-TCDD	Result Jq	Result UJ	
22T-SG-17_20190716	OCDF	19 B	19 U	Method Blank Contamination
22T-SG-18_20190716		48 B	48 U	
22T-SG-11_20190716		43 B	43 U	
22T-SG-11-D_20190716		45 B	45 U	
22T-SG-12_20190716		37 B	37 U	
22T-SG-19_20190716		29 B	29 U	
22T-SG-20_20190716		46 B	46 U	
22T-SG-15_20190716		43 B	43 U	
22T-SG-14_20190716		50 B	50 U	
22T-SG-13_20190716		41 B	41 U	
22T-SG-22_20190716		42 B	42 U	
22T-SG-23_20190716		31 B	31 U	
22T-SG-10_20190716		36 B	36 U	
22T-SG-16_20190716		67 B	67 U	

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-SG-17_20190716	1,2,3,4,7,8-HxCDD	0.74 JB	9.0 U	Method Blank Contamination
22T-SG-13_20190716		1.1 JB	12 U	
22T-SG-22_20190716		1.1 JB	13 U	
22T-SG-23_20190716		0.98 JB	11 U	
22T-SG-10_20190716		0.73 JB	8.9 U	
22T-SG-21_20190716		1.0 JB	12 U	
22T-SG-16_20190716		1.4 JB	11 U	
22T-SG-18_20190716		1.4 JB	17 U	
22T-SG-11_20190716		1.1 JB	12 U	
22T-SG-11-D_20190716		1.1 JB	13 U	
22T-SG-12_20190716		0.97 JB	13 U	
22T-SG-19_20190716		1.0 JB	9.8 U	
22T-SG-20_20190716		0.76 JB	11 U	
22T-SG-15_20190716		1.2 JB	14 U	
22T-SG-14_20190716		1.4 JB	13 U	
22T-SG-17_20190716	1,2,3,7,8,9-HxCDF	1.7 JB	9.0 U	
22T-SG-13_20190716		2.4 JB	12 U	
22T-SG-22_20190716		2.5 JB	13 U	
22T-SG-23_20190716		1.8 JB	11 U	
22T-SG-10_20190716		2.2 JB	8.9 U	
22T-SG-21_20190716		1.9 JB	12 U	
22T-SG-16_20190716		1.9 JB	11 U	
22T-SG-18_20190716		2.5 JB	17 U	
22T-SG-11_20190716		2.5 JB	12 U	
22T-SG-11-D_20190716		3.2 JB	13 U	
22T-SG-12_20190716		2.7 JB	13 U	
22T-SG-19_20190716		1.5 JB	9.8 U	
22T-SG-20_20190716		1.4 JB	11 U	
22T-SG-15_20190716		2.8 JB	14 U	
22T-SG-14_20190716		2.5 JB	13 U	
22T-SG-10_20190716	Dibenz(a,h)anthracene	8.7 B	8.7 J+	
22T-SG-22_20190716		11 B	11 U	
22T-SG-13_20190716		12 B	12 J+	
22T-SG-14_20190716		12 B	12 J+	
22T-SG-11-D_20190716		13 B	13 U	
22T-SG-17_20190716		4.4 JB	8.4 U	
22T-SG-15_20190716		7.1 JB	14 U	
22T-SG-23_20190716		8.5 JB	10 U	
22T-SG-18_20190716		15 JB	16 U	

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-SG-17_20190716	1,2,3,6,7,8-HxCDF	0.95 J	9.0 U	Equipment Blank Contamination
22T-SG-13_20190716		1.4 J	12 U	
22T-SG-22_20190716		1.1 J	13 U	
22T-SG-23_20190716		0.82 J	11 U	
22T-SG-18_20190716		1.8 J	17 U	
22T-SG-11_20190716		1.2 J	12 U	
22T-SG-12_20190716		1.4 J	13 U	
22T-SG-15_20190716		1.3 J	14 U	
22T-SG-17_20190716	1,2,3,7,8-PeCDF	0.98 J	9.0 U	
22T-SG-13_20190716		1.7 J	12 U	
22T-SG-23_20190716		1.3 J	11 U	
22T-SG-11_20190716		1.8 J	12 U	
22T-SG-20_20190716		1.8 J	11 U	
22T-SG-12_20190716	2-Methylnaphthalene	130	130 J	Matrix Spike Recovery Out of Limits
	4,4'-DDD	0.97	0.97 J	
	4,4'-DDE	1.2	1.2 J	
	4,4'-DDT	1.5 U	Reject	
	Fluoranthene	720	720 J	
	Naphthalene	670	670 J	
	Phenanthrene	810	810 J	
22T-SG-11_20190716 & 22T-SG-11-D_20190716	2-Methylnaphthalene	Detect	Detect J	Field Duplicate Pair Outside Limits
	Acenaphthene	Detect	Detect J	
	Anthracene	Detect	Detect J	
	Benzo(a)anthracene	Detect	Detect J	
	Benzo(a)pyrene	Detect	Detect J	
	Benzo(b)fluoranthene	Detect	Detect J	
	Benzo(g,h,i)perylene	Detect	Detect J	
	Benzo(k)fluoranthene	Detect	Detect J	
	Chrysene	Detect	Detect J	
	Dibenz(a,h)anthracene	Detect/ND U	Detect J/ND UJ	
	Fluorene	Detect	Detect J	
	Indeno(1,2,3-cd)pyrene	Detect	Detect J	
	Naphthalene	Detect	Detect J	
	Pyrene	Detect	Detect J	
22T-SG-12_20190716	All Aroclors	ND U	ND UJ	Aroclors appear to be present but do not match lab standards.
All Samples	Aroclor-1016	ND U	ND UJ	Continuing Calibration Exceedance
All Samples	Aroclor-1221	ND U	ND UJ	
All Samples	Aroclor-1242	ND U	ND UJ	
580-87706-1,2,4,5,8,11,13,15	Aroclor-1260	Detect/ND U	Detect J/ND UJ	

2. Sample Delivery Group Number 580-87706-2 (Stage 4)

2.1 SAMPLE MANAGEMENT

This DUSR summarizes the review of SDG number 580-87706-2. Samples were collected, preserved, and shipped following standard chain of custody protocol. Samples were also received appropriately, identified correctly, and analyzed according to the monitoring schedule. Chains of custody were appropriately signed and dated by the field and/or laboratory personnel.

Analyses were performed on the following samples:

Sample ID	Sample Type	Lab ID	Sample Date	Matrix	Methods	Holding Time
22T-SG-21_20190716	N	580-87706-14	7/16/2019	Sediment	Alkylated PAHs by EPA 8270D SIM	14 days extraction/ 40 days analysis
22T-SG-16_20190716	N	580-87706-15	7/16/2019	Sediment		

2.2 HOLDING TIMES/PRESERVATION

The samples arrived at the laboratory at the proper temperature and were prepared and analyzed within the holding time and preservation criteria specified per method protocol.

- These sediment samples were frozen by the laboratory to arrest hold time. Alkylated PAHs were requested on 8/4/2019 for these samples after initial results were received/reviewed. The frozen samples were sent to the TestAmerica Knoxville, TN laboratory and were received frozen on 8/16/2019. Samples were extracted on 8/26/2019, within the accepted EPA hold time. No action is required.

Cooler temperature on arrival to the laboratory was: 3.0, 3.3, 4.5 Degrees C.

2.3 REPORTING LIMITS AND SAMPLE DILUTIONS

The reporting limits for the samples within this SDG met or were below the minimum reporting limit requirements specified by the Project-specific QAPP within reason. Soil reporting limits vary based on the amount of sample used.

All dilutions were reviewed and found to be justified. Only detected analytes were reported from a dilution.

2.4 REPORTING BASIS (WET/DRY)

Soil samples can be reported on either a wet (as received) or dry weight basis. Dry weight data indicate calculations have been made to compensate for the moisture content of the soil sample. Per the QAPP requirements, data in this SDG were reported on a dry weight basis.

Percent (%) solids should be appropriately considered when evaluating analytical results for non-aqueous samples. Sediments with high moisture content may or may not be successfully analyzed by routine analytical methods. Samples should have ≥ 30% solids to be appropriately quantified. Percent solid results have been reviewed and found to within limits.

2.5 SURROGATE RECOVERY COMPLIANCE

Surrogates, also known as deuterated monitoring compounds, are compounds added to each sample prior to sample preparation to evaluate the percent recovery (%R) to ensure that the organic analytical method is efficient. The %R were within the specified limits with the following exceptions:

Method	Sample ID	Lab ID	Surrogate	Recovery	Qualification
EPA 8270D SIM	22T-SG-21	580-87706-14	2-Fluorobiphenyl Nitrobenzene-d5 Terphenyl-d14	0%	None, sample diluted 30x/100x

2.6 BLANK SAMPLE ANALYSIS

Method blanks are prepared by the analytical laboratory and analyzed concurrently with the project samples to assess possible laboratory contamination. Method blank samples had no detections, indicating that no contamination from laboratory activities occurred.

Field blanks are prepared to identify contamination that may have been introduced during field activity. Equipment blanks are prepared to identify contamination that may have been introduced while decontaminating sampling equipment. Blank samples for field quality control had no detections, indicating that no contamination from field activities occurred with the following exceptions:

Blank Type	Date of Blank	Analyte Detected in Blank	Concentration	Qualifier	Affected Samples
Equipment Blank (Grab)	7/18/2019	Acenaphthene	19 ng/L	NA	None, both samples had detections greater than 10x the blank concentrations once units were converted using the prep information for comparability.
		Acenaphthylene	1.5 J ng/L		
		C1-Naphthalenes	7.8 J ng/L		
		C2-Naphthalenes	6.8 J ng/L		
		C3-Naphthalenes	10 J ng/L		
		Fluorene	7.9 J ng/L		
		1-Methylnaphthalene	4.7 J ng/L		
		2-Methylnaphthalene	7.5 J ng/L		
		Naphthalene	19 J ng/L		
		Arsenic	0.0047 J mg/L	NA	None, marked ND by MB.

2.7 LABORATORY CONTROL SAMPLES

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. Compounds associated with the LCS analyses exhibited recoveries within the specified limits.

- The full alkylated PAH list was not spiked in the LCS sample; therefore, all parameters could not be assessed for precision and accuracy.
- A LCSD was not reported for this analysis batch. As a site-specific field duplicate was analyzed in SDG 580-87761-3, this data set is supported by precision quality control.

2.8 MATRIX SPIKE SAMPLES

Matrix spike/matrix spike duplicate (MS/MSD) data are used to assess the precision and accuracy of the analytical method and evaluate the effect of the sample matrix on the sample preparation procedures and measurement methodologies. No client samples were used for MS/MSD analysis in this SDG.

2.9 LABORATORY AND FIELD DUPLICATE SAMPLE ANALYSIS

The laboratory duplicate sample analysis is used by the laboratory at the time of the analysis to demonstrate acceptable method precision. The laboratory did not analyze any laboratory duplicates in this SDG.

The field duplicate sample analysis is used to assess the precision of the field sampling procedures and analytical method. No field duplicates were collected in this data set.

2.10 GAS CHROMATOGRAPH/MASS SPECTROMETER INSTRUMENT PERFORMANCE CHECKS

When analyzing organic compounds, the instrument performance check solution known as Decafluorotriphenylphosphine (DFTPP) for semi-volatiles is run every 12 hours to ensure adequate mass resolution, identification, and sensitivity, and to document this level of performance prior to analyzing any sequence of standards or samples. Mass tuning is not necessary for SIM mode, therefore this was not reviewed.

2.11 INITIAL CALIBRATION

Organic methods require an initial calibration to ensure the instrument is capable of producing acceptable qualitative and quantitative data. Standards of varying concentrations are run to create a calibration curve, which is then used to ensure the validity of compound quantitation. Percent Relative Standard Deviation (%RSD) and Relative Response Factors (RRF) are reported and must be within the specified limits. The following instruments were calibrated:

Analyses	Instrument	Analysis Date
Alkylated PAHs by EPA 8270D SIM	MP	7/21/2019

Proper concentrations for standards were used for the instruments and Relative Response Factors (RRFs) and %RSDs/R^2 values were within the specified limits.

2.12 INITIAL AND CONTINUING CALIBRATION VERIFICATION

Organic methods require an additional Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) to ensure that the instrument continues to meet the sensitivity and linearity criteria to produce acceptable qualitative and quantitative data throughout each analytical sequence. CCVs must be run at the beginning and end of every 12-hour period of operation. Relative Response Factors (RRFs) and the Percent Difference (%D) were within the specified limits.

2.13 INTERNAL STANDARDS

Internal standards are compounds added to each sample by the laboratory prior to volatile sample analysis to ensure that instrument sensitivity and response are stable during each analysis. Area response and retention time were reviewed and found to be within the specified limits.

2.14 TARGET ANALYTE IDENTIFICATION

A review of the sample chromatographs and retention times for all organic compounds indicated no problems with target compound identification with the following exceptions:

- The below data points were flagged "AP" by the laboratory, indicating the compounds had an altered pattern compared to the reference pattern within the expected retention time window. This may be due to interferences from non-target compounds and/or different relative concentrations of the compounds. **Qualify results estimated "J".**
  - C3-Phenanthrenes/Anthracenes for sample 580-87706-14
  - C4-Phenanthrenes/Anthracenes for samples 580-87706-14 and -15
- Total alkyl homologue results are considered estimated. These compounds are identified as eluting within a retention time window established by examining NIST SRM 2779 (Gulf of Mexico Crude Oil). Quantitation is estimated using a parent PAH response factor. The following compounds are reported individually and are also included in their associated "total" homologue:
  - 1-methylnaphthalene and 2-methylnaphthalene: total C1-naphthalene homologue
  - 2,6-dimethylnaphthalene: total C2-alkylnaphthalene homologue
  - 2,3,5-trimethylnaphthalene: total C3-alkylnaphthalene homologue
  - 1-methylphenanthrene: total C1-phenanthrene/anthracenes homologue

2.15 SAMPLE RESULT VERIFICATION

The below sample result(s) were tracked through the relevant sample preparation steps, raw data outputs, transcriptions, conversions and/or calculations and have been confirmed to be accurate and representative of the site. Recalculated results are shown as exact values. The lab reports these results based on two significant figures.

Sample ID	Method	Analyte (ug/kg)	Reported Result	Recalculated Result	Result Status
22T-SG-21_20190716	EPA 8270D SIM	1-Methylnaphthalene	270	268	Confirmed
		2-Methylnaphthalene	740	736	Confirmed
		Acenaphthene	3600	3553	Confirmed
		Acenaphthylene	170	170	Confirmed
		Anthracene	1500	1487	Confirmed
		Benzo(a)anthracene	2300	2322	Confirmed
		Benzo(a)pyrene	2500	2478	Confirmed
		Benzo(b)fluoranthene	2200	2201	Confirmed
		Benzo(e)pyrene	1400	1415	Confirmed
		Benzo(g,h,i)perylene	1700	1696	Confirmed
		Benzo(k)fluoranthene	800	804	Confirmed
		C1-Chrysenes	720	718	Confirmed
		C1-Dibenzothiophenes	780	784	Confirmed
		C1-Fluoranthenes/Pyrenes	2100	2132	Confirmed
		C1-Fluorenes	820	819	Confirmed
		C1-Naphthalenes	640	645	Confirmed
		C1-Phenanthrenes/Anthracenes	3400	3345	Confirmed (Rounding)
		C2-Chrysenes	280	281	Confirmed
		C2-Dibenzothiophenes	690	690	Confirmed
		C2-Fluoranthenes/Pyrenes	620	618	Confirmed
		C2-Fluorenes	870	866	Confirmed

Sample Result Verification (continued):

22T-SG-21_20190716	EPA 8270D SIM	C2-Naphthalenes	2100	2132	Confirmed
		C2-Phenanthrenes/Anthracenes	1800	1837	Confirmed
		C3-Chrysenes	160	157	Confirmed
		C3-Dibenzothiophenes	410	408	Confirmed
		C3-Fluoranthenes/Pyrenes	320	316	Confirmed
		C3-Fluorenes	630	631	Confirmed
		C3-Naphthalenes	2300	2288	Confirmed
		C3-Phenanthrenes/Anthracenes	910	910	Confirmed
		C4-Chrysenes	100	102	Confirmed
		C4-Dibenzothiophenes	190	191	Confirmed
		C4-Fluoranthenes/Pyrenes	170	166	Confirmed
		C4-Naphthalenes	1200	1239	Confirmed
		C4-Phenanthrenes/Anthracenes	650	648	Confirmed
		Chrysene	2500	2530	Confirmed
		Dibenz(a,h)anthracene	230	228	Confirmed
		Dibenzothiophene	2000	2028	Confirmed
		Fluoranthene	10000	10399	Confirmed
		Fluorene	2300	2288	Confirmed
		Indeno(1,2,3-cd)pyrene	1300	1257	Confirmed
		Naphthalene	1200	1243	Confirmed
		Perylene	630	630	Confirmed
		Phenanthrene	16000	16408	Confirmed
		Pyrene	12000	11844	Confirmed

2.16 SYSTEM PERFORMANCE AND OVERALL ASSESSMENT

The results presented in this report were found to comply with the data quality objects for the project and the guidelines specified by analytical method. Based on the review of this report, the data are 100% useable. A summary of qualifiers applied to this SDG are shown below.

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-SG-21_20190716	C3-Phenanthrenes/Anthracenes	910 AP	910 J	Altered pattern compared to the reference pattern.
22T-SG-21_20190716	C4-Phenanthrenes/Anthracenes	650 AP	650 J	
22T-SG-16_20190716		89 AP	89 J	

3. Sample Delivery Group Number 580-87761-1 (Stage 2A)

3.1 SUMMARY

This DUSR summarizes the review of SDG number 580-87761-1. Samples were collected, preserved, and shipped following standard chain of custody protocol. Samples were also received appropriately, identified correctly, and analyzed according to the monitoring schedule. Chains of custody were appropriately signed and dated by the field and/or laboratory personnel.

- The chain of custody was edited by Haley & Aldrich to update sample IDs for samples -1, and -10 to -14.

Analyses were performed on the following samples:

Sample ID	Sample Type	Lab ID	Sample Collection Date	Matrix	Methods
22T-VB-02-0.0-1.5_20190717	N	580-87761-1	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-02-1.5-3.0_20190717	N	580-87761-2	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-02-3.0-5.0_20190717	N	580-87761-3	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-02-5.0-7.0_20190717	N	580-87761-4	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-02-7.0-8.8_20190717	N	580-87761-5	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-02-8.8-10.5_20190717	N	580-87761-6	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-01-0.0-2.5_20190717	N	580-87761-7	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-01-2.5-4.0_20190717	N	580-87761-8	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-01-4.0-5.8_20190717	N	580-87761-9	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-01-5.8-8.0_20190717	N	580-87761-10	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-03-0.0-2.0_20190717	N	580-87761-11	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-03-2.0-4.0_20190717	N	580-87761-12	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-03-4.0-6.0_20190717	N	580-87761-13	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-03-6.0-8.0_20190717	N	580-87761-14	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-03-8.0-9.0_20190717	N	580-87761-15	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-03-9.0-11.2_20190717	N	580-87761-16	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-03-11.2-12_20190717	N	580-87761-17	7/17/2019	Sediment	A, B, C, D, E, F
22T-VB-03-4.0-6.0-D_20190717	FD	580-87761-18	7/17/2019	Sediment	A, B, C, D, E, F
22T-SG-02_20190718	N	580-87761-19	7/18/2019	Sediment	A, B, C, D, E, F
22T-SG-03_20190718	N	580-87761-20	7/18/2019	Sediment	A, B, C, D, E, F
22T-SG-04_20190718	N	580-87761-21	7/18/2019	Sediment	A, B, C, D, E, F
22T-SG-05_20190718	N	580-87761-22	7/18/2019	Sediment	A, B, C, D, E, F
22T-SG-06_20190718	N	580-87761-23	7/18/2019	Sediment	A, B, C, D, E, F
22T-SG-07_20190718	N	580-87761-24	7/18/2019	Sediment	A, B, C, D, E, F
22T-SG-08_20190718	N	580-87761-25	7/18/2019	Sediment	A, B, C, D, E, F
22T-SG-09_20190718	N	580-87761-26	7/18/2019	Sediment	A, B, C, D, E, F
22T-SG-01_20190718	N	580-87761-27	7/18/2019	Sediment	A, B, C, D, E, F
22T-VB-01-RB-BRL_20190717	EB	580-87761-28	7/17/2019	Blank	B, C, D, E, F
22T-SG-01-RB-CR_20190718	EB	580-87761-29	7/18/2019	Blank	B, C, D, E, F

Holding Times:

G. Total Solids by EPA 160.3 -- 7 days
H. Dioxins & Furans by EPA 1613B (Mixed Phase) -- 7 days
I. Organochlorine Pesticides (DDx) by EPA 8081B --- 14 days extraction/40 days analysis
J. Polychlorinated Biphenyls (PCBs) by EPA 8082A -- 14 days extraction/40 days analysis
K. Polycyclic Aromatic Hydrocarbons (PAHs) by EPA 8270D SIM --------------------------------- 14 days extraction/40 days analysis
L. Total Organic Carbon (TOC) by EPA 9060A --- 28 days

3.2 HOLDING TIMES/PRESERVATION

The samples arrived at the laboratory at the proper temperature and were prepared and analyzed within the holding time and preservation criteria specified per method protocol.

Cooler temperature on arrival to the laboratory was: 1.2, 1.7, 2.1, 4.1, 4.6, 4.9, 5.3; 5.8 Degrees C.

3.3 CASE NARRATIVE

The TestAmerica laboratory report case narrative lists various quality control exceedances not covered in a standard Level II review. Since a full Level IV validation was not requested, these quality control exceedances were not reviewed, and no qualifiers were therefore applied.

- Various samples required a TBA clean-up to reduce matrix interferences caused by sulfur prior to pesticide and PCB analysis.
- Pesticides and PCBs had various CCV samples outside control limits.
- Multiple samples contained more than one Aroclor with weathering and insufficient separation to quantify individually.
- The delta retention time between the ICAL and CCV was exceeded for various Dioxin samples. This retention time shift is due to normal and reasonable column maintenance and does not affect the instrument chromatography resolution, sensitivity or identification of target analytes.

3.4 REPORTING LIMITS AND SAMPLE DILUTION

The reporting limits for the samples within this SDG met or were below the minimum reporting limit requirements specified by the Project-specific QAPP within reason. Soil reporting limits vary based on the amount of sample used. All dilutions were reviewed and found to be justified. Any non-detects with elevated reported limits are noted and explained below.

Sample ID	Lab ID	Analyte/ Method	Dilution Factor	Issue/Explanation
Various Samples	580-87761-1 to -7	DDx by EPA 8081B	3x	Dilution required due to matrix interference and/or high target analyte concentrations.
Various Samples	580-87761-11 to -15			
Various Samples	580-87761-16 to -27		2x	

3.5 REPORTING BASIS (WET/DRY)

Soil samples can be reported on either a wet or dry weight basis. Dry weight data indicate calculations have been made to compensate for the moisture content of the soil sample. Per the QAPP requirements, data in this SDG were reported on a dry weight basis except for TOC, which is not correctable per the method.

Percent (%) solids should be appropriately considered when evaluating analytical results for non-aqueous samples. Sediments with high moisture content may or may not be successfully analyzed by routine analytical methods. Samples should have ≥ 30% solids to be appropriately quantified. Percent solid results have been reviewed and found to be within limits.

3.6 BLANK SAMPLE ANALYSIS

Method blanks are prepared by the analytical laboratory and analyzed concurrently with the project samples to assess possible laboratory contamination. Method blank samples had no detections, indicating that no contamination from laboratory activities occurred with the following exceptions:

Blank Type	Batch ID	Analyte Detected in Blank	Concentration	Qualifier	Affected Samples
Method Blank	309455	OCDD	0.662 J pg/g	**RL U**	**580-87761-8, -10**
Method Blank	310069	1,2,3,4,6,7,8-HpCDD	13.4 Jq pg/L	**MBK U**	**580-87761-29**
		OCDD	74.1 J pg/L	**RL U**	**580-87761-28, -29**
Method Blank	306838	TOC	0.631 J mg/L	**J+**	**580-87761-28, -29**
Method Blank	306847	TOC	107 J mg/kg	NA	None, samples >10x blank.

Field blanks are prepared to identify contamination that may have been introduced during field activity. Equipment blanks are prepared to identify contamination that may have been introduced while decontaminating sampling equipment. Per the Work Plan, equipment rinse blanks were to be collected as follows:

- One rinse blank will be collected for the delineation sample collection equipment (e.g. vibracore shoe) used on the sampling vessel (collected on 7/17/2019): 22T-VB-01-RB-BRL_20190717 (580-87761-28).
- A separate rinse blank will be collected for the tools used for the sample processing (mixing bowls, spoons, etc.) collected on 7/18/2019: 22T-SG-01-RB-CR_20190718 (580-87761-29).

Blank samples for field quality control had no detections, indicating that no contamination from field activities occurred with the following exceptions. All detections in field blanks were compared to the site samples following a unit conversion to the base milligram concentration found.

- Various detections were qualified ND due to method blank contamination or EMPC flags (Section 2.7).

Blank Type	Date	Analyte Detected in Blank	Concentration	Qualifier	Affected Samples
Equipment Blank (Associated with Vibracore samples)	7/17/2019	OCDF	4.2 J pg/L	**RL U**	**580-87761-8, 10**
		1,2,3,4,6,7,8-HpCDF	1.7 J pg/L	**RL U**	**580-87761-8, 9, 10**
		1,2,3,4,7,8-HxCDF	1.2 J pg/L	**RL U**	**580-87761-9, 10**
		1,2,3,7,8,9-HxCDD	2.0 J pg/L	**RL U**	**580-87761-6,7,8,9,10,11,13,15,17,18**
		2,3,4,6,7,8-HxCDF	1.4 J pg/L	**RL U**	**580-87761-6,9,10,11,13,15,16,17,18**
		2,3,7,8-TCDF	1.0 J pg/L	**RL U**	**580-87761-7, 17**
		TOC	1.7 mg/L	NA	None, samples >10x blank.
Equipment Blank (Associated with Grab samples)	7/18/2019	1,2,3,4,6,7,8-HpCDF	1.1 J pg/L	**RL U**	**580-87761-19**
		1,2,3,4,7,8-HxCDD	2.3 J pg/L	**RL U**	**580-87761-19, 20, 21, 22, 26**
		1,2,3,6,7,8-HxCDF	0.94 J pg/L	**RL U**	**580-87706-1, 2, 3, 5, 8, 10, 11, 12; 580-87761-19, 20**
		1,2,3,7,8-PeCDF	0.86 J pg/L	**RL U**	**580-87706-1, 3, 7, 10, 12; 580-87761-19, 20**
		TOC	1.8 mg/L	NA	None, samples >10x blank.

3.7 DIOXIN/FURAN EMPCS

An Estimated Maximum Possible Concentration (EMPC) is a worst-case estimate of the concentration for a dioxin/furan due to all identification criteria being met except the ion abundance ratio criteria, or if a peak representing a chlorinated diphenyl ether was detected. The lab reported many EMPC flags:

- **Sample results flagged "q" that were detected below the reporting limit should be qualified estimated ND "UJ" at the reported concentration.**
- **Sample results flagged "q" that were detected above the reporting limit should be qualified estimated "J".**

3.8 SURROGATE RECOVERY COMPLIANCE

Surrogates, also known as deuterated monitoring compounds, are compounds added to each sample prior to sample preparation to evaluate the percent recovery (%R) to ensure that the organic analytical method is efficient. The %R were within the specified limits with the following exceptions:

Method	Sample ID	Lab ID	Surrogate	Recovery	Qualification
EPA 8270D SIM	22T-VB-03-2.0-4.0	580-87761-12	Terphenyl-d14	560%	None, sample diluted 20x.
EPA 8081B	22T-VB-02-5.0-7.0	580-87761-4	Tetrachloro-m-xylene	198%	**J+ Detected Pesticides**
	22T-VB-02-7.0-8.8	580-87761-5	Tetrachloro-m-xylene	242%	**J+ Detected Pesticides**
	22T-VB-03-4.0-6.0	580-87761-13	Tetrachloro-m-xylene	605%	**J+ Detected Pesticides**
	22T-VB-03-6.0-8.0	580-87761-14	Decachlorobiphenyl	286%	**J+ Detected Pesticides**
			Tetrachloro-m-xylene	944%	
	22T-VB-03-8.0-9.0	580-87761-15	Decachlorobiphenyl	154%	**J+ Detected Pesticides**
			Tetrachloro-m-xylene	565%	
	22T-VB-03-9.0-11.2	580-87761-16	Tetrachloro-m-xylene	364%	**J+ Detected Pesticides**
	22T-VB-03-11.2-12	580-87761-17	Decachlorobiphenyl	237%	**J+ Detected Pesticides**
			Tetrachloro-m-xylene	198%	
	22T-VB-03-4.0-6.0-D	580-87761-18	Decachlorobiphenyl	275%	**J+ Detected Pesticides**
			Tetrachloro-m-xylene	425%	
	22T-SG-02	580-87761-19	Decachlorobiphenyl	33%	None, within NFG limits.
	22T-SG-04	580-87761-21	Tetrachloro-m-xylene	177%	**J+ Detected Pesticides**
	22T-SG-06	580-87761-23	Decachlorobiphenyl	186%	**J+ Detected Pesticides**
			Tetrachloro-m-xylene	238%	
	22T-SG-07	580-87761-24	Tetrachloro-m-xylene	48%	None, within NFG limits.
	22T-SG-09	580-87761-26	Tetrachloro-m-xylene	139%	None, within NFG limits.
	22T-SG-01	580-87761-27	Tetrachloro-m-xylene	43%	None, within NFG limits.
EPA 8082A	22T-VB-02-8.8-10.5	580-87761-6	Decachlorobiphenyl	38%	None, within NFG limits.

3.9 LABORATORY CONTROL SAMPLES

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. Compounds associated with the LCS/LCSD analyses exhibited recoveries and relative percent difference (RPDs) within the specified limits with the following exceptions:

Sample Type	Method	Batch ID	Analyte	%R	Qualifier	Affected Samples
LCS	EPA 8081B	306581	4,4-DDT	153%	NA	None, retest was within limits.

3.10 MATRIX SPIKE SAMPLES

Matrix spike/matrix spike duplicate (MS/MSD) data are used to assess the precision and accuracy of the analytical method and evaluate the effect of the sample matrix on the sample preparation procedures and measurement methodologies. The sample(s) below were used for MS/MSD:

Lab Sample Number	Matrix Spike/ Matrix Spike Duplicate Sample Client ID	Method(s)
580-87761-1	22T-VB-02-0.0-1.5_20190717	4,4-DDx by EPA 8081B; PCBs by EPA 8082A
580-87761-21	22T-SG-04_20190718	PAHs by EPA 8270D SIM; 4,4-DDx by EPA 8081B; PCBs by EPA 8082A; TOC by EPA 9060

The MS/MSD recoveries and the RPD between the MS and MSD results were within the specified limits with the following exceptions:

Sample Type	Method	Parent Sample Number	Analyte	%R/RPD	Qualifier	Affected Samples
MS/MSD	EPA 8270D SIM	22T-SG-04	Naphthalene	65%, RPD = 17%	**J**	**22T-SG-04**
MSD			Acenaphthene	54%	NA	None, within NFG limits.
MSD			Fluorene	70%	**J**	**22T-SG-04**
MS			Phenanthrene	49%	**J**	**22T-SG-04**
MS/MSD			Fluoranthene	61%/55%	**J**	**22T-SG-04**
MS/MSD			Pyrene	58%/58%	NA	None, within NFG limits.
MS/MSD			Benzo(a)pyrene	70%/61%	**J**	**22T-SG-04**
MS/MSD	EPA 8081B	22T-VB-02 -0.0-1.5	4,4-DDD	33%/31%	**J**	**22T-VB-02-0.0-1.5**
MS/MSD			4,4-DDE	32%/27%	**J**	**22T-VB-02-0.0-1.5**
MS/MSD			4,4-DDT	13%/19%, RPD = 22%	**J**	**22T-VB-02-0.0-1.5**
MS/MSD		22T-SG-04	4,4-DDD	54%/-218%, RPD = 53%	NA	None, sample >4x spike.
MS/MSD			4,4-DDE	45%/-85%, RPD =66%	**J**	**22T-SG-04**
MS/MSD			4,4-DDT	-53%/43%, RPD =87%	**J**	**22T-SG-04**
MS/MSD	EPA 8082A	22T-VB-02 -0.0-1.5	PCB-1016	38%, RPD = 41%	NA	None, sample ND.
MS/MSD			PCB-1260	11%/37%, RPD = 43%	**J**	**22T-VB-02-0.0-1.5**
MS/MSD		22T-SG-04	PCB-1260	45%/42%	NA	None, within NFG limits.

3.11 CONFIRMATION COLUMN REVIEW

When analyzing for pesticides and PCBs, compound identification based on single-column analysis should be confirmed on a second column or should be supported by at least one other qualitative technique. When being confirmed on a second column, the relative percent difference (RPD) should not exceed 40%. All RPDs were within control limits, with the following exceptions:

Method	Analyte	Sample	RPD	Action
8081	DDx	580-87761-2 to -7	> 40%	**Qualify data estimated "J/UJ".**
	DDx	580-87761-11 to -18	> 40%	**Qualify data estimated "J/UJ".**
	DDx	580-87761-21	> 40%	**Qualify data estimated "J/UJ".**
	DDx	580-87761-24 to -27	> 40%	**Qualify data estimated "J/UJ".**
8082	PCB-1260	-1, 2, 3, 4, 15, 16, 23, 26	> 40%	**Qualify data estimated "J/UJ".**

3.12 LABORATORY AND FIELD DUPLICATE SAMPLES

The laboratory duplicate sample analysis is used by the laboratory at the time of analysis to demonstrate acceptable method precision. The following sample(s) were used for laboratory duplicate analysis and the RPDs were all below 20% (or the absolute difference rule was satisfied if detects were less than 5x the RL):

Lab Sample Number	Laboratory Duplicate Sample Client ID	Method(s)
580-87761-2	22T-VB-02-1.5-3.0_20190717	Total Solids by EPA 160.3
580-87761-21	22T-SG-04_20190718	TOC by EPA 9060 (duplicate and triplicate)

The field duplicate sample analysis is used to assess the precision of the field sampling procedures and analytical method. Per the Work Plan, field duplicates were to be collected at a rate of 5%, assuming there was sufficient volume. The RPD comparison for any field duplicates in this SDG is shown below. RPDs were all below 50% for soil (or the absolute difference rule was satisfied if detects were less than 5x the RL). Any exceptions are noted below and qualified.

Field Duplicate RPD Calculations:

Method(s): Inorganics				
Analyte	Primary Sample ID	Duplicate Sample ID	% RPD	Qualification
	22T-VB-03-4.0-6.0	22T-VB-03-4.0-6.0-D		
TOC (mg/kg)	**33,000**	**33,000**	0.0	None, RPD < 50%
Total Solids (%)	**59.2**	**58.8**	0.7	None, RPD < 50%

Field Duplicate RPD Calculations (continued):

Method(s): EPA 1613B				
Analyte (pg/g)	**Primary Sample ID**	**Duplicate Sample ID**	**% RPD**	**Qualification**
	22T-VB-03-4.0-6.0	**22T-VB-03-4.0-6.0-D**		
OCDF	**88**	**65**	NA	**J-Flag, Abs. Diff. > RL**
OCDD	**1900**	**1500**	23.5	None, RPD < 50%
HpCDF	**36**	**29**	NA	None, Abs. Diff. < RL
HpCDD	**170**	**170**	0.0	None, RPD < 50%
HpCDF	**4.9 J**	**4.2 J**	NA	None, Abs. Diff. < RL
HxCDF	**18**	**15**	NA	None, Abs. Diff. < RL
HxCDD	8.0 U	**1.3 J**	NA	None, Abs. Diff. < RL
HxCDF	**6.0 J**	**6.0 J**	NA	None, Abs. Diff. < RL
HxCDD	**5.6 J**	**5.7 J**	NA	None, Abs. Diff. < RL
HxCDF	0.39 UJ	**0.90 J**	NA	None, Abs. Diff. < RL
HxCDD	**3.0 J**	**3.2 J**	NA	None, Abs. Diff. < RL
PeCDF	**12**	**13**	NA	None, Abs. Diff. < RL
PeCDD	**0.89 J**	8.4 U	NA	None, Abs. Diff. < RL
HxCDF	**1.5 J**	1.3 UJ	NA	None, Abs. Diff. < RL
PeCDF	**5.1 J**	**5.3 J**	NA	None, Abs. Diff. < RL
TCDF	**12**	**12**	0.0	None, RPD < 50%
TCDD	0.50 UJ	**0.88 J**	NA	None, Abs. Diff. < RL
Method(s): EPA 8081B & 8082A				
Analyte (mg/kg, unless noted)	**Primary Sample ID**	**Duplicate Sample ID**	**% RPD**	**Qualification**
	22T-VB-03-4.0-6.0	**22T-VB-03-4.0-6.0-D**		
4,4'-DDD (ug/kg)	**28**	**34**	19.4	None, RPD < 50%
4,4'-DDE (ug/kg)	**21**	**10**	**71.0**	**J-Flag, RPD > 50%**
4,4'-DDT (ug/kg)	**2.0**	**8.7**	NA	**J-Flag, Abs. Diff. > RL**
o,p'-DDD (ug/kg)	**13**	**13**	0.0	None, RPD < 50%
o,p'-DDE (ug/kg)	**5.5**	**5.0**	NA	None, Abs. Diff. < RL
o,p'-DDT (ug/kg)	2.2 U	1.6 U	NA	None, Both ND.
Aroclor-1016 (PCB-1016)	0.0029 U	0.0031 U	NA	None, Both ND.
Aroclor-1221 (PCB-1221)	0.0029 U	0.0031 U	NA	None, Both ND.
Aroclor-1232 (PCB-1232)	0.0029 U	0.0031 U	NA	None, Both ND.
Aroclor-1242 (PCB-1242)	0.0029 U	0.0031 U	NA	None, Both ND.
Aroclor-1248 (PCB-1248)	0.0029 U	0.0031 U	NA	None, Both ND.
Aroclor-1254 (PCB-1254)	0.0029 U	0.0031 U	NA	None, Both ND.
Aroclor-1260 (PCB-1260)	**0.014**	**0.017**	NA	None, Abs. Diff. < RL

Field Duplicate RPD Calculations (continued):

Method(s): EPA 8270D SIM				
Analyte (ug/kg, unless noted)	Primary Sample ID	Duplicate Sample ID	% RPD	Qualification
	22T-VB-03-4.0-6.0	22T-VB-03-4.0-6.0-D		
1-Methylnaphthalene	**480**	**530**	9.9	None, RPD < 50%
2-Methylnaphthalene	**1200**	**1300**	8.0	None, RPD < 50%
Acenaphthene	**6200**	**6100**	1.6	None, RPD < 50%
Acenaphthylene	**420**	**440**	4.7	None, RPD < 50%
Anthracene	7.3 U	**3500**	NA	**J-Flag, Abs. Diff. > RL**
Benzo(a)anthracene	**5400**	**4900**	9.7	None, RPD < 50%
Benzo(a)pyrene	**5400**	**4900**	9.7	None, RPD < 50%
Benzo(b)fluoranthene	**4800**	**5300**	9.9	None, RPD < 50%
Benzo(g,h,i)perylene	**4400**	**4200**	4.7	None, RPD < 50%
Benzo(k)fluoranthene	**1400**	**1600**	13.3	None, RPD < 50%
Chrysene	**5600**	**5400**	3.6	None, RPD < 50%
Dibenz(a,h)anthracene	**190**	**530**	**94.4**	**J-Flag, RPD > 50%**
Fluoranthene	**17000**	**16000**	6.1	None, RPD < 50%
Fluorene	**4100**	**4100**	0.0	None, RPD < 50%
Indeno(1,2,3-cd)pyrene	**5000**	**4700**	6.2	None, RPD < 50%
Naphthalene	**2700**	**3700**	31.3	None, RPD < 50%
Phenanthrene	**26000**	**24000**	8.0	None, RPD < 50%
Pyrene	**20000**	**19000**	5.1	None, RPD < 50%

3.13 SYSTEM PERFORMANCE AND OVERALL ASSESSMENT

The results presented in this report were found to comply with the data quality objectives for the project and the guidelines specified by analytical method. Based on the review of this report, the data are 100% useable. A summary of qualifiers applied to this SDG are shown below.

Sediment Qualifiers:

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-VB-01-5.8-8.0_20190717	OCDD	18 B	13 U	Method Blank Contamination
22T-VB-01-2.5-4.0_20190717		33 B	13 U	
22T-VB-03-4.0-6.0_20190717	Detected Pesticides	Detect	Detect J+	High Surrogate Recovery
22T-VB-03-6.0-8.0_20190717		Detect	Detect J+	
22T-VB-03-8.0-9.0_20190717		Detect	Detect J+	
22T-VB-03-9.0-11.2_20190717		Detect	Detect J+	
22T-VB-03-11.2-12_20190717		Detect	Detect J+	
22T-VB-03-4.0-6.0-D_20190717		Detect	Detect J+	
22T-SG-04_20190718		Detect	Detect J+	
22T-VB-02-5.0-7.0_20190717		Detect	Detect J+	
22T-VB-02-7.0-8.8_20190717		Detect	Detect J+	

Sediment Qualifiers (continued):

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-SG-04_20190718	4,4'-DDE	6.9	6.9 J	Matrix Spike Exceedance
	4,4'-DDT	5.7	5.7 J	
	Benzo(a)pyrene	1300	1300 J	
	Fluoranthene	4800	4800 J	
	Fluorene	1600	1600 J	
	Naphthalene	1600	1600 J	
	Phenanthrene	6600	6600 J	
22T-VB-02-0.0-1.5_20190717	4,4'-DDD	2.8	2.8 J	
	4,4'-DDE	4.6	4.6 J	
	4,4'-DDT	0.66 J	0.66 J	
	Aroclor-1260 (PCB-1260)	0.0072 J	0.0072 J	
580-87761-3, 4, 14, 15, 17, 21, 26	4,4'-DDD	Detect p	Detect J	RPD between confirmation columns >40%
580-87761-6, 7, 11, 12, 13, 15, 21, 24, 26, 27	4,4'-DDE			
580-87761-3, 4, 12, 18, 21	4,4'-DDT			
580-87761-2 to 6, 11 to 18, 21, 25, 26	2,4'-DDD			
580-87761-2, 4, 5, 6, 11 to 18, 21, 26	2,4'-DDE			
580-87761-3, 4, 15, 26	2,4'-DDT			
22T-VB-03-4.0-6.0_20190717 & 22T-VB-03-4.0-6.0-D_20190717	OCDF	Detect	Detect J	Field Duplicate Pair Outside Limits
	4,4'-DDE	Detect	Detect J	
	4,4'-DDT	Detect	Detect J	
	Anthracene	Detect/ND U	Detect J/ND UJ	
	Dibenz(a,h)anthracene	Detect	Detect J	
580-87761-8	OCDF	Result Jq	Result UJ	Estimated Maximum Possible Concentrations
580-87761-7, 9, 10, 19, 25	1,2,3,4,6,7,8-HpCDF	Result Jq	Result UJ	
580-87761-8, 21	1,2,3,4,7,8,9-HpCDF	Result Jq	Result UJ	
580-87761-10, 23	1,2,3,4,7,8-HxCDF	Result Jq	Result UJ	
580-87761-2, 9,10, 20	1,2,3,4,7,8-HxCDD	Result Jq	Result UJ	
580-87761-7, 10, 20, 26	1,2,3,6,7,8-HxCDF	Result Jq	Result UJ	
580-87761-19, 21	1,2,3,6,7,8-HxCDD	Result Jq	Result UJ	
580-87761-6, 7, 9, 11, 13, 17, 19	1,2,3,7,8,9-HxCDF	Result Jq	Result UJ	
580-87761-2, 4, 9, 20, 23, 26	1,2,3,7,8,9-HxCDD	Result Jq	Result UJ	
580-87761-6, 9, 14, 16, 17	1,2,3,7,8-PeCDD	Result Jq	Result UJ	
580-87761-2, 5, 9, 11, 18, 19, 20	2,3,4,6,7,8-HxCDF	Result Jq	Result UJ	
580-87761-6, 17, 19	2,3,4,7,8-PeCDF	Result Jq	Result UJ	
580-87761-19	2,3,7,8-TCDF	Result Jq	Result UJ	
580-87761-4	2,3,7,8-TCDD	Result q	Result J	
580-87761-5, 11, 13, 14, 15, 19, 20, 21, 26		Result Jq	Result UJ	

Sediment Qualifiers (continued):

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-VB-01-5.8-8.0_20190717	OCDF	0.69 J	13 U	Equipment Blank Contamination
22T-VB-01-2.5-4.0_20190717		1.7 J	13 U	
22T-SG-02_20190718	1,2,3,4,6,7,8-HpCDF	1.1 J	7.1 U	
22T-VB-01-5.8-8.0_20190717		0.23 J	6.7 U	
22T-VB-01-2.5-4.0_20190717		0.61 J	6.7 U	
22T-VB-01-4.0-5.8_20190717		0.40 J	6.5 U	
22T-VB-01-5.8-8.0_20190717	1,2,3,4,7,8-HxCDF	0.078 J	6.7 U	
22T-VB-01-4.0-5.8_20190717		0.10 J	6.5 U	
22T-SG-02_20190718	1,2,3,4,7,8-HxCDD	0.38 J	7.1 U	
22T-SG-03_20190718		0.59 J	8.4 U	
22T-SG-04_20190718		0.75 J	10 U	
22T-SG-05_20190718		1.7 J	13 U	
22T-SG-09_20190718		1.8 J	9.4 U	
22T-SG-02_20190718	1,2,3,6,7,8-HxCDF	0.20 J	7.1 U	
22T-SG-03_20190718		0.44 J	8.4 U	
22T-VB-01-5.8-8.0_20190717	1,2,3,7,8,9-HxCDD	0.55 J	6.7 U	
22T-VB-03-0.0-2.0_20190717		3.1 J	8.9 U	
22T-VB-03-4.0-6.0_20190717		3.0 J	8.0 U	
22T-VB-03-8.0-9.0_20190717		2.8 J	7.7 U	
22T-VB-03-11.2-12_20190717		1.0 J	7.4 U	
22T-VB-03-4.0-6.0-D_20190717		3.2 J	8.4 U	
22T-VB-02-8.8-10.5_20190717		0.67 J	6.7 U	
22T-VB-01-0.0-2.5_20190717		1.4 J	9.6 U	
22T-VB-01-2.5-4.0_20190717		0.56 J	6.7 U	
22T-VB-01-4.0-5.8_20190717		0.30 J	6.5 U	
22T-SG-02_20190718	1,2,3,7,8-PeCDF	0.29 J	7.1 U	
22T-SG-03_20190718		0.71 J	8.4 U	
22T-VB-01-5.8-8.0_20190717	2,3,4,6,7,8-HxCDF	0.10 J	6.7 U	
22T-VB-03-0.0-2.0_20190717		0.88 J	8.9 U	
22T-VB-03-4.0-6.0_20190717		1.5 J	8.0 U	
22T-VB-03-8.0-9.0_20190717		1.6 J	7.7 U	
22T-VB-03-9.0-11.2_20190717		2.2 J	8.2 U	
22T-VB-03-11.2-12_20190717		0.56 J	7.4 U	
22T-VB-03-4.0-6.0-D_20190717		1.3 J	8.4 U	
22T-VB-02-8.8-10.5_20190717		0.43 J	6.7 U	
22T-VB-01-4.0-5.8_20190717		0.067 J	6.5 U	
22T-VB-03-11.2-12_20190717	2,3,7,8-TCDF	1.4 J	1.5 U	
22T-VB-01-0.0-2.5_20190717		1.4 J	1.9 U	

Aqueous Qualifiers:

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-SG-01-RB-CR_20190718	OCDD	10 JB	96.0 U	Method Blank Contamination
	1,2,3,4,6,7,8-HpCDD	2.1 JB	13.4 U	
	Total Organic Carbon (TOC)	1.8 B	1.8 J+	
	OCDF	2.5 Jq	2.5 UJ	Estimated Maximum Possible Concentrations
	1,2,3,4,7,8,9-HpCDF	0.75 Jq	0.75 UJ	
	1,2,3,6,7,8-HxCDD	0.78 Jq	0.78 UJ	
	1,2,3,7,8,9-HxCDF	0.76 Jq	0.76 UJ	
	1,2,3,7,8,9-HxCDD	0.90 Jq	0.90 UJ	
	2,3,4,6,7,8-HxCDF	0.52 Jq	0.52 UJ	
22T-VB-01-RB-BRL_20190717	OCDD	13 JB	98.0 U	Method Blank Contamination
	Total Organic Carbon (TOC)	1.7 B	1.7 J+	
	1,2,3,4,6,7,8-HpCDD	3.2 Jq	3.2 UJ	Estimated Maximum Possible Concentrations
	1,2,3,4,7,8,9-HpCDF	1.2 Jq	1.2 UJ	
	1,2,3,4,7,8-HxCDD	2.3 Jq	2.3 UJ	
	1,2,3,6,7,8-HxCDD	1.5 Jq	1.5 UJ	
	1,2,3,7,8,9-HxCDF	1.2 Jq	1.2 UJ	
	1,2,3,7,8-PeCDF	1.1 Jq	1.1 UJ	
	2,3,4,7,8-PeCDF	1.1 Jq	1.1 UJ	

4. Sample Delivery Group Number 580-87761-2 (Stage 2A)

4.1 SAMPLE MANAGEMENT

This DUSR summarizes the review of SDG number 580-87761-2. Samples were collected, preserved, and shipped following standard chain of custody protocol. Samples were also received appropriately, identified correctly, and analyzed according to the monitoring schedule. Chains of custody were appropriately signed and dated by the field and/or laboratory personnel with the following exceptions:

- The lab mis-labeled the sample date for sample -28 as 7/18/2019 on the sub chain sent to Knoxville, TN.

Analyses were performed on the following samples:

Sample ID	Sample Type	Lab ID	Sample Collection Date	Matrix	Methods
22T-VB-01-RB-BRL_20190717	EB	580-87761-28	7/17/2019	Blank	A, B, C
22T-SG-01-RB-CR_20190718	EB	580-87761-29	7/18/2019	Blank	A, B, C

Holding Times:

A. Alkylated PAHs by EPA 8270D SIM -- 7 days extraction/40 days analysis
B. Total Metals (As, Cd, Cu, Pb, Zn) by EPA 6020A -- 180 days
C. Total Mercury by EPA 7470A --- 28 days

4.2 HOLDING TIMES/PRESERVATION

The samples arrived at the laboratory at the proper temperature and were prepared and analyzed within the holding time and preservation criteria specified per method protocol with the following exceptions:

Method	Matrix	Holding Time	Preservation	Sample ID, Violation, Qualification
EPA 8270D SIM	Water	7 days extraction/ 40 days analysis	Cool to ≤ 6 °C	Sample 580-87761-28 was extracted on the 8th day following collection due to the lab listing the incorrect sample date on the sub-COC. **Estimate data "J/UJ".**

Cooler temperature on arrival to the laboratory was: 1.2, 1.7, 2.1, 4.1, 4.6, 4.9, 5.3; 1.5 Degrees C.

4.3 REPORTING LIMITS AND SAMPLE DILUTION

All dilutions were reviewed and found to be justified. Any non-detects with elevated reported limits are noted and explained below.

Sample ID	Lab ID	Analyte/ Method	Dilution Factor	Issue/Explanation
22T-VB-01-RB-BRL_20190717	580-87761-28	Metals by EPA 6020A	5x	Laboratory dilutes all samples by a standard 5x for this method.
22T-SG-01-RB-CR_20190718	580-87761-29			

4.4 BLANK SAMPLE ANALYSIS

Method blanks are prepared by the analytical laboratory and analyzed concurrently with the project samples to assess possible laboratory contamination. Method blank samples had no detections, indicating that no contamination from laboratory activities occurred with the following exceptions:

Blank Type	Batch ID	Analyte Detected in Blank	Concentration	Qualifier	Affected Samples
Method Blank	32296	C2-Fluorenes	10.8 ng/L	NA	None, samples ND.
Method Blank	306788	Arsenic	0.000853 J mg/L	**RL U**	**Both Samples**

Field blanks are prepared to identify contamination that may have been introduced during field activity. Equipment blanks are prepared to identify contamination that may have been introduced while decontaminating sampling equipment. Blank samples for field quality control had no detections, indicating that no contamination from field activities occurred with the following exceptions:

<table>
<tr><th>Blank Type</th><th>Date of Blank</th><th>Analyte Detected in Blank</th><th>Concentration</th><th>Qualifier</th><th>Affected Samples</th></tr>
<tr><td rowspan="5">Equipment Blank (Vibracore)</td><td rowspan="5">7/17/2019</td><td>Acenaphthene</td><td>22 ng/L</td><td colspan="2" rowspan="4">See Section 5 for Vibracore qualifiers.</td></tr>
<tr><td>Acenaphthylene</td><td>1.3 J ng/L</td></tr>
<tr><td>Fluorene</td><td>5.0 J ng/L</td></tr>
<tr><td>Naphthalene</td><td>14 J ng/L</td></tr>
<tr><td>Arsenic</td><td>0.0042 J mg/L</td><td>NA</td><td>None, marked ND by MB.</td></tr>
<tr><td rowspan="10">Equipment Blank (Grab)</td><td rowspan="10">7/18/2019</td><td>Acenaphthene</td><td>19 ng/L</td><td colspan="2" rowspan="9">See Section 2 & 5 for Grab Sample qualifiers.</td></tr>
<tr><td>Acenaphthylene</td><td>1.5 J ng/L</td></tr>
<tr><td>C1-Naphthalenes</td><td>7.8 J ng/L</td></tr>
<tr><td>C2-Naphthalenes</td><td>6.8 J ng/L</td></tr>
<tr><td>C3-Naphthalenes</td><td>10 J ng/L</td></tr>
<tr><td>Fluorene</td><td>7.9 J ng/L</td></tr>
<tr><td>1-Methylnaphthalene</td><td>4.7 J ng/L</td></tr>
<tr><td>2-Methylnaphthalene</td><td>7.5 J ng/L</td></tr>
<tr><td>Naphthalene</td><td>19 J ng/L</td></tr>
<tr><td>Arsenic</td><td>0.0047 J mg/L</td><td>NA</td><td>None, marked ND by MB.</td></tr>
</table>

4.5 SURROGATE RECOVERY COMPLIANCE

Surrogates, also known as deuterated monitoring compounds, are compounds added to each sample prior to sample preparation to evaluate the percent recovery (%R) to ensure that the organic analytical method is efficient. The %R were within the specified limits.

4.6 LABORATORY CONTROL SAMPLES

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. Compounds associated with the LCS/LCSD analyses exhibited recoveries and relative percent difference (RPDs) within the specified limits.

- The full alkylated PAH list was not spiked in the LCS/LCSD samples; therefore, all parameters could not be assessed for precision and accuracy.

4.7 MATRIX SPIKE SAMPLES

Matrix spike/matrix spike duplicate (MS/MSD) data are used to assess the precision and accuracy of the analytical method and evaluate the effect of the sample matrix on the sample preparation procedures and measurement methodologies. The sample(s) below were used for MS/MSD:

Lab Sample Number	Matrix Spike/ Matrix Spike Duplicate Sample Client ID	Method(s)
580-87761-29	22T-SG-01-RB-CR_20190718*	Mercury by EPA 7470A

* Equipment blanks should not be spiked for lab QC.

The MS/MSD recoveries and the RPD between the MS and MSD results were within the specified limits.

4.8 LABORATORY AND FIELD DUPLICATE SAMPLES

The laboratory duplicate sample analysis is used by the laboratory at the time of analysis to demonstrate acceptable method precision. The following sample(s) were used for laboratory duplicate analysis and the RPDs were all below 20% (or the absolute difference rule was satisfied if detects were less than 5x the RL):

Lab Sample Number	Laboratory Duplicate Sample Client ID	Method(s)
580-87761-29	22T-SG-01-RB-CR_20190718*	Mercury by EPA 7470A

* Equipment blanks should not be used for lab QC.

The field duplicate sample analysis is used to assess the precision of the field sampling procedures and analytical method. No field duplicates were collected in this data set.

4.9 SYSTEM PERFORMANCE AND OVERALL ASSESSMENT

The results presented in this report were found to comply with the data quality objectives for the project and the guidelines specified by analytical method. Based on the review of this report, the data are 100% useable. A summary of qualifiers applied to this SDG are shown below.

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-VB-01-RB-BRL_20190717	All Alkylated PAHs	Detect/ND U	Detect J/ND UJ	Extraction Holding Time Exceedance
22T-SG-01-RB-CR_20190718	Arsenic	0.0047 J	0.0050 U	Method Blank Contamination
22T-VB-01-RB-BRL_20190717		0.0042 J	0.0050 U	

5. Sample Delivery Group Number 580-87761-3 (Stage 2A)

5.1 SAMPLE MANAGEMENT

This DUSR summarizes the review of SDG number 580-87761-3. Samples were collected, preserved, and shipped following standard chain of custody protocol. Samples were also received appropriately, identified correctly, and analyzed according to the monitoring schedule. Chains of custody were appropriately signed and dated by the field and/or laboratory personnel.

Analyses were performed on the following samples:

Sample ID	Sample Type	Lab ID	Sample Date	Matrix	Methods	Holding Time
22T-VB-02-7.0-8.8_20190717	N	580-87761-5	7/17/2019	Sediment	Alkylated PAHs by EPA 8270D SIM	14 days extraction/ 40 days analysis
22T-VB-03-2.0-4.0_20190717	N	580-87761-12	7/17/2019	Sediment		
22T-VB-03-4.0-6.0_20190717	N	580-87761-13	7/17/2019	Sediment		
22T-VB-03-8.0-9.0_20190717	N	580-87761-15	7/17/2019	Sediment		
22T-VB-03-11.2-12_20190717	N	580-87761-17	7/17/2019	Sediment		
22T-VB-03-4.0-6.0-D_20190717	FD	580-87761-18	7/17/2019	Sediment		
22T-SG-04_20190718	N	580-87761-21	7/18/2019	Sediment		
22T-SG-05_20190718	N	580-87761-22	7/18/2019	Sediment		
22T-SG-06_20190718	N	580-87761-23	7/18/2019	Sediment		
22T-SG-09_20190718	N	580-87761-26	7/18/2019	Sediment		

5.2 HOLDING TIMES/PRESERVATION

The samples arrived at the laboratory at the proper temperature and were prepared and analyzed within the holding time and preservation criteria specified per method protocol.

- These sediment samples were frozen by the laboratory to arrest hold time. Alkylated PAHs were requested on 8/4/2019 for these samples after initial results were received/reviewed. The frozen samples were sent to the TestAmerica Knoxville, TN laboratory and were received frozen on 8/16/2019. Samples were extracted on 8/26/2019, within the accepted EPA hold time. No action is required.

Cooler temperature on arrival to the laboratory was: 1.2, 1.7, 2.1, 4.1, 4.6, 4.9, 5.3 Degrees C.

5.3 REPORTING LIMITS AND SAMPLE DILUTION

The reporting limits for the samples within this SDG met or were below the minimum reporting limit requirements specified by the Project-specific QAPP within reason. Soil reporting limits vary based on the amount of sample used.

All dilutions were reviewed and found to be justified. Only detected analytes were reported from a dilution.

5.4 CASE NARRATIVE

The TestAmerica laboratory report case narrative lists various quality control exceedances not covered in a standard Level II review. Since a full Level IV validation was not requested, these quality control exceedances were not reviewed, and no qualifiers were therefore applied.

- Total alkyl homologue results are considered estimated. These compounds are identified as eluting within a retention time window established by examining NIST SRM 2779 (Gulf of Mexico Crude Oil). Quantitation is estimated using a parent PAH response factor. The following compounds are reported individually and are also included in their associated "total" homologue:
  - 1-methylnaphthalene and 2-methylnaphthalene: total C1-naphthalene homologue
  - 2,6-dimethylnaphthalene: total C2-alkylnaphthalene homologue
  - 2,3,5-trimethylnaphthalene: total C3-alkylnaphthalene homologue
  - 1-methylphenanthrene: total C1-phenanthrene/anthracenes homologue
- The below data points were flagged "AP" by the laboratory, indicating the compounds had an altered pattern compared to the reference pattern within the expected retention time window. This may be due to interferences from non-target compounds and/or different relative concentrations of the compounds. **Qualify results estimated "J".**
  - C3-Phenanthrenes/Anthracenes for samples 580-87761-13 and -15
  - C4-Phenanthrenes/Anthracenes for samples 580-87761-5, 12, 13, 15, 17, 18, 21, 22, 23 and 26

5.5 BLANK SAMPLE ANALYSIS

Method blanks are prepared by the analytical laboratory and analyzed concurrently with the project samples to assess possible laboratory contamination. Method blank samples had no detections, indicating that no contamination from laboratory activities occurred.

Field blanks are prepared to identify contamination that may have been introduced during field activity. Equipment blanks are prepared to identify contamination that may have been introduced while decontaminating sampling equipment. Blank samples for field quality control had no detections, indicating that no contamination from field activities occurred with the following exceptions:

Blank Type	Date of Blank	Analyte Detected in Blank	Concentration	Qualifier	Affected Samples
Equipment Blank (Vibracore)	7/17/2019	Acenaphthene	22 ng/L	NA	None, all Vibracores had detections greater than 10x the blank concentrations once units were converted using the prep information for comparability.
		Acenaphthylene	1.3 J ng/L		
		Fluorene	5.0 J ng/L		
		Naphthalene	14 J ng/L		
		Arsenic	0.0042 J mg/L	NA	None, marked ND by MB.
Equipment Blank (Grab)	7/18/2019	Acenaphthene	19 ng/L	NA	None, all grab samples had detections greater than 10x the blank concentrations once units were converted using the prep information for comparability.
		Acenaphthylene	1.5 J ng/L		
		C1-Naphthalenes	7.8 J ng/L		
		C2-Naphthalenes	6.8 J ng/L		
		C3-Naphthalenes	10 J ng/L		
		Fluorene	7.9 J ng/L		
		1-Methylnaphthalene	4.7 J ng/L		
		2-Methylnaphthalene	7.5 J ng/L		
		Naphthalene	19 J ng/L		
		Arsenic	0.0047 J mg/L	NA	None, marked ND by MB.

5.6 SURROGATE RECOVERY COMPLIANCE

Surrogates, also known as deuterated monitoring compounds, are compounds added to each sample prior to sample preparation to evaluate the percent recovery (%R) to ensure that the organic analytical method is efficient. The %R were within the specified limits with the following exceptions:

Method	Sample ID	Lab ID	Surrogate	Recovery	Qualification
EPA 8270D SIM	22T-VB-02-7.0-8.8	580-87761-5	2-Fluorobiphenyl Nitrobenzene-d5 Terphenyl-d14	0%	None, sample diluted 30x/50x
	22T-VB-03-2.0-4.0	580-87761-12		0%	None, sample diluted 30x
	22T-VB-03-4.0-6.0	580-87761-13		0%	None, sample diluted 30x/200x
	22T-VB-03-8.0-9.0	580-87761-15		0%	None, sample diluted 30x/100x
	22T-VB-03-11.2-12	580-87761-17		0%	None, sample diluted 30x/100x
	22T-VB-03-4.0-6.0-D	580-87761-18		0%	None, sample diluted 30x/100x
	22T-SG-04	580-87761-21		0%	None, sample diluted 30x
	22T-SG-05	580-87761-22		0%	None, sample diluted 30x
	22T-SG-06	580-87761-23		0%	None, sample diluted 30x/100x
	22T-SG-09	580-87761-26		0%	None, sample diluted 30x

5.7 MATRIX SPIKE SAMPLES

Matrix spike/matrix spike duplicate (MS/MSD) data are used to assess the precision and accuracy of the analytical method and evaluate the effect of the sample matrix on the sample preparation procedures and measurement methodologies. The sample(s) below were used for MS/MSD:

Lab Sample Number	Matrix Spike/ Matrix Spike Duplicate Sample Client ID	Method(s)
580-87761-21	22T-SG-04_20190718	Alkylated PAHs by EPA 8270D SIM

- The full alkylated PAH list was not spiked in the MS/MSD samples; therefore, all parameters could not be assessed for precision and accuracy.

The MS/MSD recoveries and the RPD between the MS and MSD results were within the specified limits with the following exceptions:

Sample Type	Method	Parent Sample Number	Analyte	%R/RPD	Qualifier	Affected Samples
MS/MSD	EPA 8270D SIM	22T-SG-04	Various PAHs	Low	NA	None, sample >4x spike.
MS/MSD			1-Methylnaphthalene	-60%/-60%	NA	None, sample diluted 30x and MS surrogates did not recover either.
MSD			Acenaphthylene	27%		
MS/MSD			Dibenz(a,h)anthracene	-24%/-45%		

5.8 LABORATORY CONTROL SAMPLES

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. Compounds associated with the LCS analyses exhibited recoveries within the specified limits.

- The full alkylated PAH list was not spiked in the LCS/LCSD samples; therefore, all parameters could not be assessed for precision and accuracy.

5.9 REPORTING BASIS (WET/DRY)

Soil samples can be reported on either a wet (as received) or dry weight basis. Dry weight data indicate calculations have been made to compensate for the moisture content of the soil sample. Per the QAPP requirements, data in this SDG were reported on a dry weight basis.

Percent (%) solids should be appropriately considered when evaluating analytical results for non-aqueous samples. Sediments with high moisture content may or may not be successfully analyzed by routine analytical methods. Samples should have ≥ 30% solids to be appropriately quantified. Percent solid results have been reviewed and found to be within limits.

5.10 LABORATORY AND FIELD DUPLICATE SAMPLES

The laboratory duplicate sample analysis is used by the laboratory at the time of analysis to demonstrate acceptable method precision. No client samples were used for laboratory duplicate analysis in this SDG.

The field duplicate sample analysis is used to assess the precision of the field sampling procedures and analytical method. The RPD comparison for any field duplicates in this SDG is shown below. RPDs were all below 50% for soil (or the absolute difference rule was satisfied if detects were less than 5x the RL). Any exceptions are noted below and qualified.

Field Duplicate RPD Calculations:

Method(s): EPA 8270D SIM				
Analyte (ng/g)	Primary Sample ID 22T-VB-03-4.0-6.0_20190717	Duplicate Sample ID 22T-VB-03-4.0-6.0-D_20190717	% RPD	Qualification
1-Methylnaphthalene	310	290	NA	None, Abs. Diff. < RL
2-Methylnaphthalene	800	720	NA	None, Abs. Diff. < RL
Acenaphthene	5500	4300	24	None, RPD < 50%
Acenaphthylene	320	290	10	None, RPD < 50%
Anthracene	3900	3100	23	None, RPD < 50%
Benzo(a)anthracene	5500	3800	37	None, RPD < 50%
Benzo(a)pyrene	6000	4400	31	None, RPD < 50%
Benzo(b)fluoranthene	4900	3700	28	None, RPD < 50%
Benzo(e)pyrene	3300	2400	32	None, RPD < 50%
Benzo(g,h,i)perylene	4100	3000	31	None, RPD < 50%
Benzo(k)fluoranthene	2300	1600	36	None, RPD < 50%
C1-Chrysenes	1500	1100	31	None, RPD < 50%
C1-Dibenzothiophenes	1200	980	20	None, RPD < 50%
C1-Fluoranthenes/Pyrenes	4500	3400	28	None, RPD < 50%
C1-Fluorenes	1300	980	28	None, RPD < 50%

Field Duplicate RPD Calculations (continued):

Method(s): EPA 8270D SIM				
Analyte (ng/g)	**Primary Sample ID**	**Duplicate Sample ID**	**% RPD**	**Qualification**
	22T-VB-03-4.0-6.0_20190717	**22T-VB-03-4.0-6.0-D_20190717**		
C1-Naphthalenes	710	650	NA	None, Abs. Diff. < RL
C1-Phenanthrenes/Anthracenes	5600	4200	29	None, RPD < 50%
C2-Chrysenes	570	470	19	None, RPD < 50%
C2-Dibenzothiophenes	1000	760	27	None, RPD < 50%
C2-Fluoranthenes/Pyrenes	1200	930	25	None, RPD < 50%
C2-Fluorenes	1300	970	29	None, RPD < 50%
C2-Naphthalenes	3300	2600	24	None, RPD < 50%
C2-Phenanthrenes/Anthracenes	2900	2200	27	None, RPD < 50%
C3-Chrysenes	300	260	14	None, RPD < 50%
C3-Dibenzothiophenes	640	480	29	None, RPD < 50%
C3-Fluoranthenes/Pyrenes	590	470	23	None, RPD < 50%
C3-Fluorenes	910	660	32	None, RPD < 50%
C3-Naphthalenes	3500	2600	30	None, RPD < 50%
C3-Phenanthrenes/Anthracenes	1500	1000	40	None, RPD < 50%
C4-Chrysenes	210	150	33	None, RPD < 50%
C4-Dibenzothiophenes	300	230	26	None, RPD < 50%
C4-Fluoranthenes/Pyrenes	300	240	22	None, RPD < 50%
C4-Naphthalenes	2000	1400	35	None, RPD < 50%
C4-Phenanthrenes/Anthracenes	1200	650	**59**	**J Flag, RPD > 50%**
Chrysene	5300	4100	26	None, RPD < 50%
Dibenz(a,h)anthracene	570	430	28	None, RPD < 50%
Dibenzothiophene	3300	2600	24	None, RPD < 50%
Fluoranthene	22000	16000	32	None, RPD < 50%
Fluorene	3800	3000	24	None, RPD < 50%
Indeno(1,2,3-cd)pyrene	3200	2300	33	None, RPD < 50%
Naphthalene	1800	1600	NA	None, Abs. Diff. < RL
Perylene	1500	1100	31	None, RPD < 50%
Phenanthrene	29000	22000	27	None, RPD < 50%
Pyrene	24000	18000	29	None, RPD < 50%

5.11 SYSTEM PERFORMANCE AND OVERALL ASSESSMENT

The results presented in this report were found to comply with the data quality objectives for the project and the guidelines specified by analytical method. Based on the review of this report, the data are 100% useable. A summary of qualifiers applied to this SDG are shown below.

Sample ID	Analyte	Reported Result	Validated Result	Reason for Qualifier
22T-VB-03-4.0-6.0_20190717	C3-Phenanthrenes/ Anthracenes	1500 AP	1500 J	Altered pattern compared to the reference pattern.
22T-VB-03-8.0-9.0_20190717		1900 AP	1900 J	
22T-VB-02-7.0-8.8_20190717	C4-Phenanthrenes/ Anthracenes	350 AP	350 J	
22T-VB-03-2.0-4.0_20190717		270 AP	270 J	
22T-VB-03-8.0-9.0_20190717		3100 AP	3100 J	
22T-VB-03-11.2-12_20190717		560 AP	560 J	
22T-SG-04_20190718		500 AP	500 J	
22T-SG-05_20190718		320 AP	320 J	
22T-SG-06_20190718		530 AP	530 J	
22T-SG-09_20190718		720 AP	720 J	
22T-VB-03-4.0-6.0_20190717		1200 AP	1200 J	Altered pattern compared to the reference pattern and Field Duplicate RPD
22T-VB-03-4.0-6.0-D_20190717		650 AP	650 J	

References

1. United States Environmental Protection Agency, 2016. National Functional Guidelines for High Resolution Superfund Methods Data Review. EPA-542-B-16-001. April.

2. United States Environmental Protection Agency, 2014. R10 Data Validation and Review Guidelines for Polychlorinated Dibenzo-p-Dioxin and Polychlorinated Dibenzofuran Data (PCDD/PCDF) Using Method 1613B, and SW846 Method 8290A. EPA-910-R-14-003. May.

3. United States Environmental Protection Agency ,2017a. National Functional Guidelines for Inorganic Superfund Methods Data Review. EPA-540-R-2017-001. January.

4. United States Environmental Protection Agency, 2017b. National Functional Guidelines for Organic Superfund Methods Data Review. EPA-540-R-2017-002. January.

5. AECOM, 2018. Quality Assurance Project Plan, Portland Harbor Pre-Remedial Design, Investigation and Baseline Sampling, Portland Harbor Superfund Site. CERCLA 10-2018-0236. January.

6. Haley & Aldrich, Inc. 2019. Sediment Investigation Work Plan, Former Terminal 22T, Portland Harbor Superfund Site. Appendix B. File No. 129768-004. May.

Glossary

- Sample Types:
  - N Primary Sample
  - FD Field Duplicate Sample
  - FB Field Blank Sample
  - EB Equipment Blank Sample
  - TB Trip Blank Sample
- Units:
  - µg/kg or ug/kg microgram per kilogram
  - µg/L or ug/L microgram per liter
  - mg/kg milligram per kilogram
  - mg/L milligram per liter
  - % percent
  - pg/g picogram per gram
  - pg/L picogram per liter
  - ng/g nanogram per gram
  - ng/L nanogram per liter
- Table Footnotes
  - NA Not applicable
  - ND Non-detect

Results are qualified with the following codes in accordance with EPA National Functional Guidelines:

- Concentration (C) Qualifiers:
  - U The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
  - B The compound was found in the sample and its associated blank. Its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers:
  - E The compound was quantitated above the calibration range.
  - D The concentration is based on a diluted sample analysis.
- Validation Qualifiers:
  - J The compound was positively identified; however, the associated numerical value is an estimated concentration only.
  - J+ The result is an estimated quantity, but the result may be biased high.
  - J- The result is an estimated quantity, but the result may be biased low.
  - UJ The compound was not detected above the reported sample quantitation limit; however, the reported limit is approximate and may or may not represent the actual limit of quantitation.
  - NJ The analysis indicated the presence of a compound for which there is presumptive evidence to make a tentative identification; the associated numerical value is an estimated concentration only.
  - R The sample results were rejected as unusable; the compound may or may not be present in the sample.

APPENDIX F

Investigation Derived Waste Disposal Documentation

belshire
environmental services, inc.
25971 Towne Centre Drive, Foothill Ranch, CA 92610
Tel. (949) 460-5200 Fax (949) 460-5210

Invoice No. 508047
BESI No. 309246

Submit To:

BP Products North America Inc.
6 Centerpointe Drive #6-174
La Palma, CA 90623--1066
Attn: Accounts Payable

Bill To:

BP Products North America Inc.
6 Centerpointe Drive #6-174
La Palma, CA 90623--1066
Attn: Accounts Payable

Invoice Date:	August 19, 2019
Invoice Terms:	Due and payable upon receipt
Tax ID:	33-0466005
Engineer:	
Job Site:	BP West Coast Products - Former Portland 45.595848,-122.779097 Portland, OR 97213
Job Date:	8/2/2019
Job Scope:	BESI to profile and manage the disposal of 2 drums containing sediment from the sampling of the river bottom.

Proposal #:	00BX4-0016
Work Release #:	WR332167
Contract:	EPSCM-2016/BP01490860

Summary of Charges

Dale Raymond NRC Project # 140962

NO. 749493

NON-HAZARDOUS WASTE DATA FORM

BESI # 309246

GENERATOR

Generator's Name and Mailing Address
BP WEST COAST PRODUCTS, LLC
P.O. BOX 80249
RANCHO SANTA MARGARITA, CA 92688

Generator's Site Address (if different than mailing address)
BP WEST COAST PRODUCTS - FORMER PORTLAND TERMINAL
45.595818,-122.779007
PORTLAND , OR 97218

Generator's Phone: 949-460-5200

Container type removed from site:
☐ Drums ☐ Vacuum Truck ☐ Roll-off Truck ☐ Dump Truck
☐ Other ______
Quantity ______

Container type transported to receiving facility:
☐ Drums ☐ Vacuum Truck ☐ Roll-off Truck ☐ Dump Truck
☐ Other ______
Quantity ______ Volume ______

WASTE DESCRIPTION NON-HAZARDOUS SOLID

GENERATING PROCESS Investigation Derived

COMPONENTS OF WASTE	PPM	%	COMPONENTS OF WASTE	PPM	%
1. Soil/River Sediment		90-100%	3.		
2. River water		0-10%	4.		

Waste Profile OR342526 PROPERTIES: pH ____ ☐ SOLID ☐ LIQUID ☐ SLUDGE ☐ SLURRY ☐ OTHER ____

HANDLING INSTRUCTIONS: ______

Generator Printed/Typed Name	Signature	Month	Day	Year
KYLE CHRISTIE	Kyle Christie	7	22	19

The Generator certifies that the waste as described is 100% non-hazardous

TRANSPORTER

Transporter 1 Company Name: NRC
Phone#: 503-978-7293

Transporter 1 Printed/Typed Name	Signature	Month	Day	Year
Perry L. Stayton	Perry L. Stayton	08	02	19

Transporter Acknowledgment of Receipt of Materials

Transporter 2 Company Name
Phone#

Transporter 2 Printed/Typed Name	Signature	Month	Day	Year
[illegible]	[illegible]	8	2	19

Transporter Acknowledgment of Receipt of Materials

RECEIVING FACILITY

Designated Facility Name and Site Address
CHEMICAL WASTE MANAGEMENT OF NORTHWEST
17629 CEDAR SPRINGS LANE
ARLINGTON, OR 97812

Phone#: 541-454-2030

Printed/Typed Name	Signature	Month	Day	Year

Designated Facility Owner or Operator: Certification of receipt of materials covered by this data form.

Dale Raymond NRC Project # 140962

NO. 749494

NON-HAZARDOUS WASTE DATA FORM

BESI # 309246

GENERATOR

Generator's Name and Mailing Address
BP WEST COAST PRODUCTS, LLC
P.O. BOX 80249
RANCHO SANTA MARGARITA, CA 92688

Generator's Site Address (if different than mailing address)
BP WEST COAST PRODUCTS - FORMER PORTLAND TERMINAL
45.595848,-122.779097
PORTLAND , OR 97213

Generator's Phone: 949-460-5200

Container type removed from site:
☐ Drums ☐ Vacuum Truck ☐ Roll-off Truck ☐ Dump Truck
☐ Other ______
Quantity ______

Container type transported to receiving facility:
☐ Drums ☐ Vacuum Truck ☐ Roll-off Truck ☐ Dump Truck
☐ Other ______
Quantity ______ Volume ______

WASTE DESCRIPTION NON-HAZARDOUS WATER

GENERATING PROCESS WATER/DECON WATER

	COMPONENTS OF WASTE	PPM	%
1.	River/Decon Water		99.9-100%
2.	Decon Soap		<0.1%
3.	Soil		0-85%
4.			

Waste Profile OR342529 PROPERTIES: pH 5-9 ☐ SOLID ☒ LIQUID ☐ SLUDGE ☐ SLURRY ☐ OTHER ______

HANDLING INSTRUCTIONS: ______

Generator Printed/Typed Name	Signature	Month	Day	Year
KYLE CHRISTIE	Kyle Christie	7	22	19

The Generator certifies that the waste as described is 100% non-hazardous

TRANSPORTER

Transporter 1 Company Name: NRC
Phone#: 503-978-7293

Transporter 1 Printed/Typed Name	Signature	Month	Day	Year
Perry L Stayton	Perry L Stayton	08	07	19

Transporter Acknowledgment of Receipt of Materials

Transporter 2 Company Name
Phone#

Transporter 2 Printed/Typed Name	Signature	Month	Day	Year

Transporter Acknowledgment of Receipt of Materials

RECEIVING FACILITY

Designated Facility Name and Site Address
CHEMICAL WASTE MANAGEMENT OF NORTHWEST
17629 CEDAR SPRINGS LANE
ARLINGTON, OR 97812

Phone#: 541-454-2030

Printed/Typed Name	Signature	Month	Day	Year

Designated Facility Owner or Operator: Certification of receipt of materials covered by this data form.

APPENDIX G

Electronic Data Deliverable (EDD)

APPENDIX H

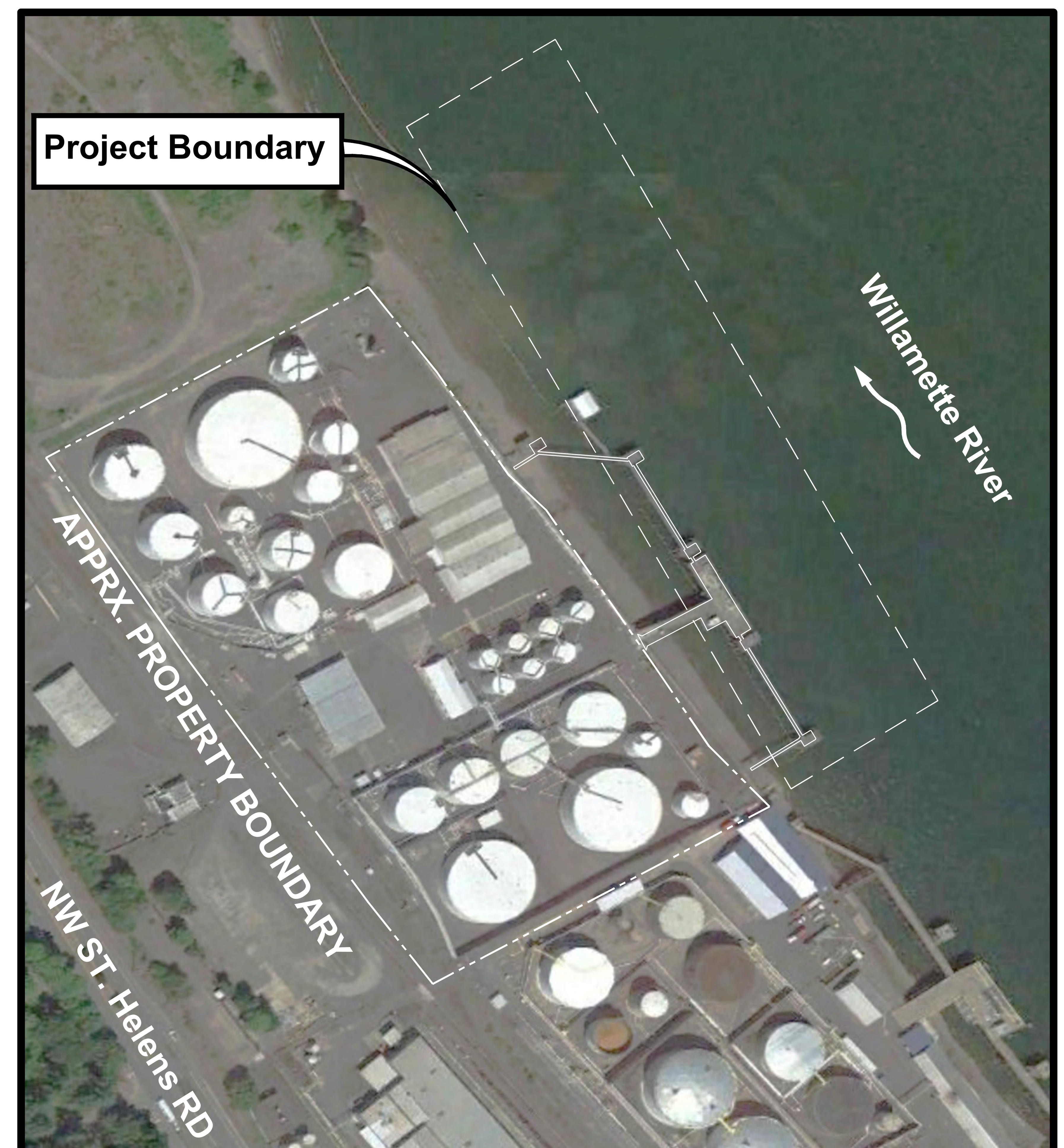
2019 Dredge/Cap As-Built Drawings

PORTLAND TERMINAL MAINTENANCE DREDGING

DRAWING INDEX

SHEET #	FIGURE #	SHEET TITLE
1	G-01	TITLE SHEET, VICINITY MAP, AND LOCATION
2	G-02	GENERAL NOTES
3	C-01	PRE-DREDGE CONDITIONS AND TURBIDITY MONITORING
4	C-02	DREDGE AS-BUILT CONDITIONS
5	C-03	TEMPORARY COVER FOR BERTH AS-BUILT CONDITIONS
6	C-04	TEMPORARY COVER FOR SLOPE AS-BUILT CONDITIONS
7	C-05	AS-BUILT CROSS SECTIONS

VICINITY MAP
NTS



SITE MAP
NTS

AECOM

PROJECT
PORTLAND TERMINAL MAINTENANCE DREDGE

CLIENT
SEAPORT MIDSTREAM PARTNERS, LLC
PORTLAND TERMINAL
9930 NW ST. Helens Road
Portland, Oregon

CONSULTANT
AECOM
111 SW Columbia St, Suite 1500
Portland Oregon 97201
503.222.7200 tel 503.222.4292 fax
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
5		
4		
3		
2		
1		
0	2019-12-18	AS BUILT

PROJECT NUMBER
60558028

SHEET TITLE
TITLE SHEET, VICINITY MAP, AND LOCATION

SHEET NUMBER
G-01

ANSI D 22" x 34" Approved: KB Checked: KC Designer: AC Project Management Initials:

Last saved by: CHINA2(2019-12-16) Last Plotted: 2019-12-16
Filename: \\1571SR-P8PWCS1\PROJECTS\60558028 SEAPORT SEDIMENT DREDGING\900-CAD_GIS\910-CAD\20-SHEETS\CONSTRUCTION DRAWINGS\AS-BUILT\G-01.DWG

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ABBREVIATIONS:

CL	CENTER LINE
CONC.	CONCRETE
CPD	CITY OF PORTLAND DATUM
CRD	COLUMBIA RIVER DATUM
CY	CUBIC YARD
DWG	DRAWING(S)
EA	EACH
EL.	ELEVATION
EXIST.	EXISTING
FT(')	FOOT(FEET)
IN(")	INCH(ES)
MAX	MAXIMUM
MIN	MINIMUM
OHWL	ORDINARY HIGH WATER
OLW	ORDINARY LOW WATER
MHHW	MEAN HIGHER HIGH WATER
MHW	MEAN HIGH WATER
MLW	MEAN LOW WATER
MLLW	MEAN LOWER LOW WATER
REF	REFERENCE
SF	SQUARE FEET
TYP	TYPICAL
USGS	U.S. GEOLOGICAL SURVEY

SURVEY CONTROL:

HORIZONTAL DATUM: NAD83, STATE PLANE OREGON NORTH, INTERNATIONAL FEET

VERTICAL DATUM: CRD

CONTROL BENCHMARKS: SITE HORIZONTAL AND VERTICAL CONTROL

BENCHMARK: 1	BENCHMARK: 2
NORTHING: 710732.573'	NORTHING: 711425.518'
EASTING: 7619065.482'	EASTING: 7618556.522'
ELEVATION: 29.55'	ELEVATION: 28.43'
DESCRIPTION: 1" DIAMETER NAIL STAMPED "MAG SPIKE SURVEY MARK" SET IN NE CORNER OF CONCRETE MOORING BLOCK	DESCRIPTION: 1" DIAMETER NAIL STAMPED "MAG SPIKE SURVEY MARK" SET IN NE CORNER OF CONCRETE MOORING BLOCK

TIDAL INFORMATION:

TIDES ARE ACCORDING TO THE MORRISON BRIDGE NOAA TIDE PREDICTION STATION (#9439221). USGS MAINTAINS A RIVER LEVEL GAGE (#14211720) AT THIS LOCATION.

OHWL	14.9 FT CRD
MHHW	5.3 FT CRD
MHW	4.8 FT CRD
MLW	1.9 FT CRD
MLLW	1.6 FT CRD

GENERAL NOTES:

1. SURVEY INFORMATION PROVIDED IN NAD83 OREGON STATE PLANE NORTH COORDINATE SYSTEM.
2. PRE-CONSTRUCTION SURVEY PROVIDED BY ETRAC DATED JULY 25, 2019.
3. POST-DREDGE SURVEY PROVIDED BY ETRAC DATED AUGUST 29, 2019.
4. FINAL CONDITION SURVEY PROVIDED BY ETRAC DATED NOVEMBER 2, 2019.
5. LOCATIONS OF ALL EXISTING FACILITIES AS SHOWN ON THE DRAWINGS ARE BASED ON FIELD SURVEY, AS-BUILT DRAWINGS AND GIS INFORMATION. LOCATIONS ARE APPROXIMATE AND NOT GUARANTEED TO BE COMPLETE OR ACCURATE.

SITE INFORMATION:

FOR PROPERTY LINES SEE SHEET 03

* CITY = PORTLAND
* COUNTY = MULTNOMAH
* TAX MAP #SECTION 02 1N 1W
* TAX LOT #400

LEGEND:

EXISTING OIL BOOM PILE

CONCRETE

TURBIDITY MONITORING STATIONS

BENCHMARK

2017 CHEMISTRY CORE LOCATIONS

2018 SEDIMENT CORE LOCATIONS

2018 CPT LOCATIONS

2019 DIVER VERIFICATION LOCATIONS

DOCK

BASE OF DREDGE

COVER PLACEMENT

ARMOR STONE STEEPENED SLOPE COVER PLACEMENT

ELEVATION -2' CRD CONTOUR

APPROXIMATE TOP OF AMENDED SLOPE

NAVIGATION CHANNEL

EXISTING SHEET PILE

BERTH BOUNDARY

TAXLOTS

8 10 PRE-CONSTRUCTION ELEVATION CONTOURS 2' INTERVAL 10' INDEX

-8- -10- POST-DREDGE ELEVATION CONTOURS 2' INTERVAL 10' INDEX

-8- -10- FINAL CONDITION ELEVATION CONTOURS 2' INTERVAL 10' INDEX

PROJECT BOUNDARY

AECOM

PROJECT

PORTLAND TERMINAL MAINTENANCE DREDGE

CLIENT

SEAPORT MIDSTREAM PARTNERS, LLC

Portland Terminal
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Portland, Oregon

CONSULTANT

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
5		
4		
3		
2		
1		
0	2019-12-18	AS BUILT

PROJECT NUMBER

60558028

SHEET TITLE

GENERAL NOTES

SHEET NUMBER

G-02

ANSI D 22" x 34"
Approved:KB
Checked: KC
Designer: AC
Project Management Initials:
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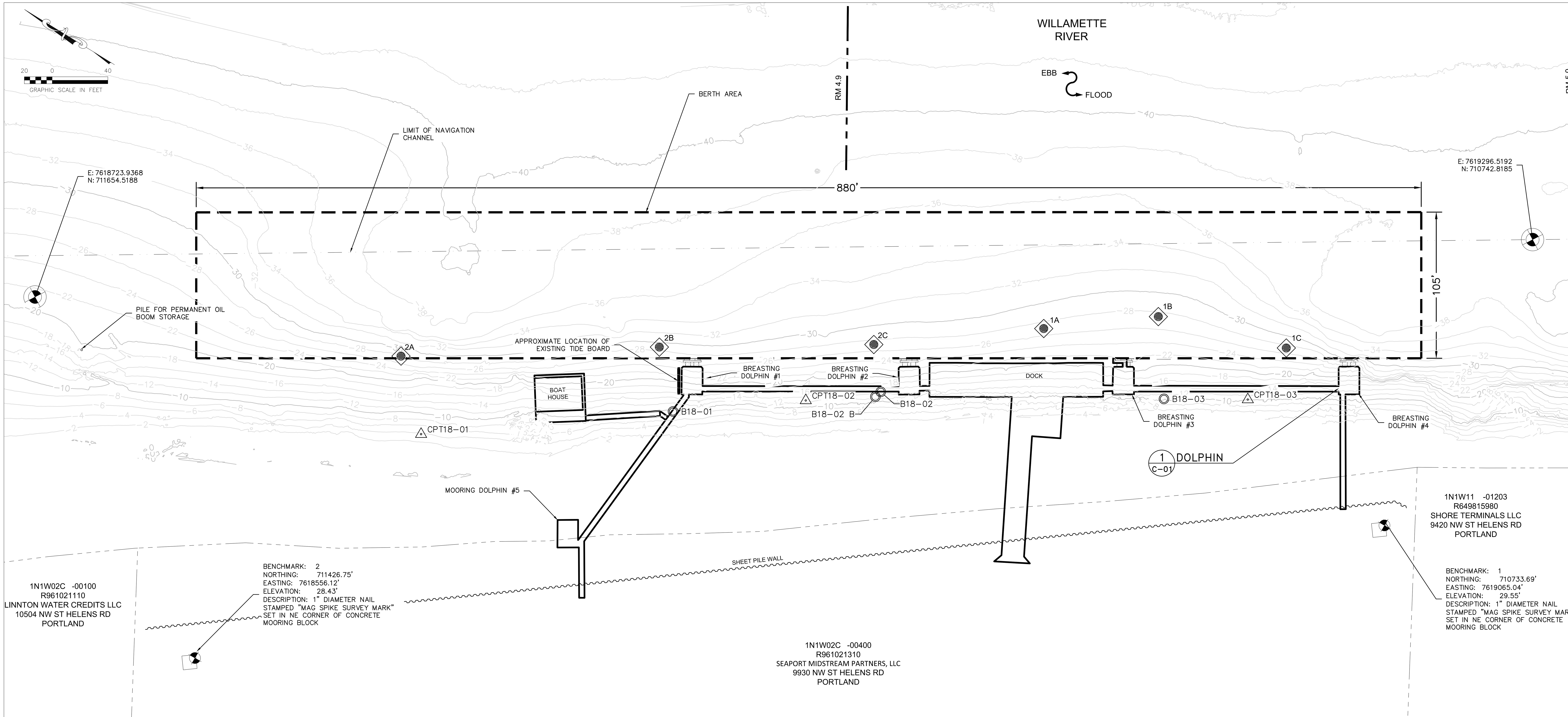
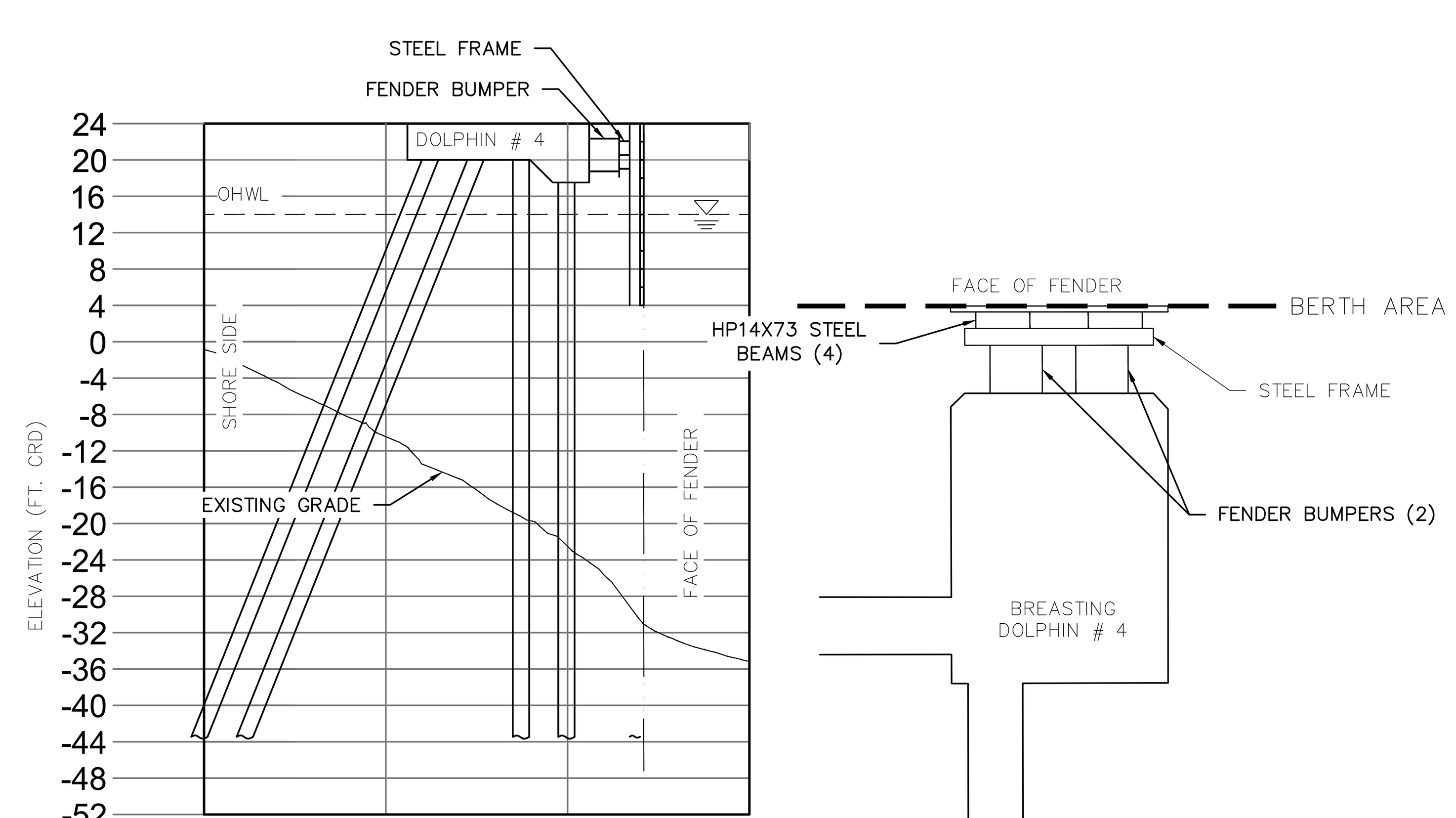
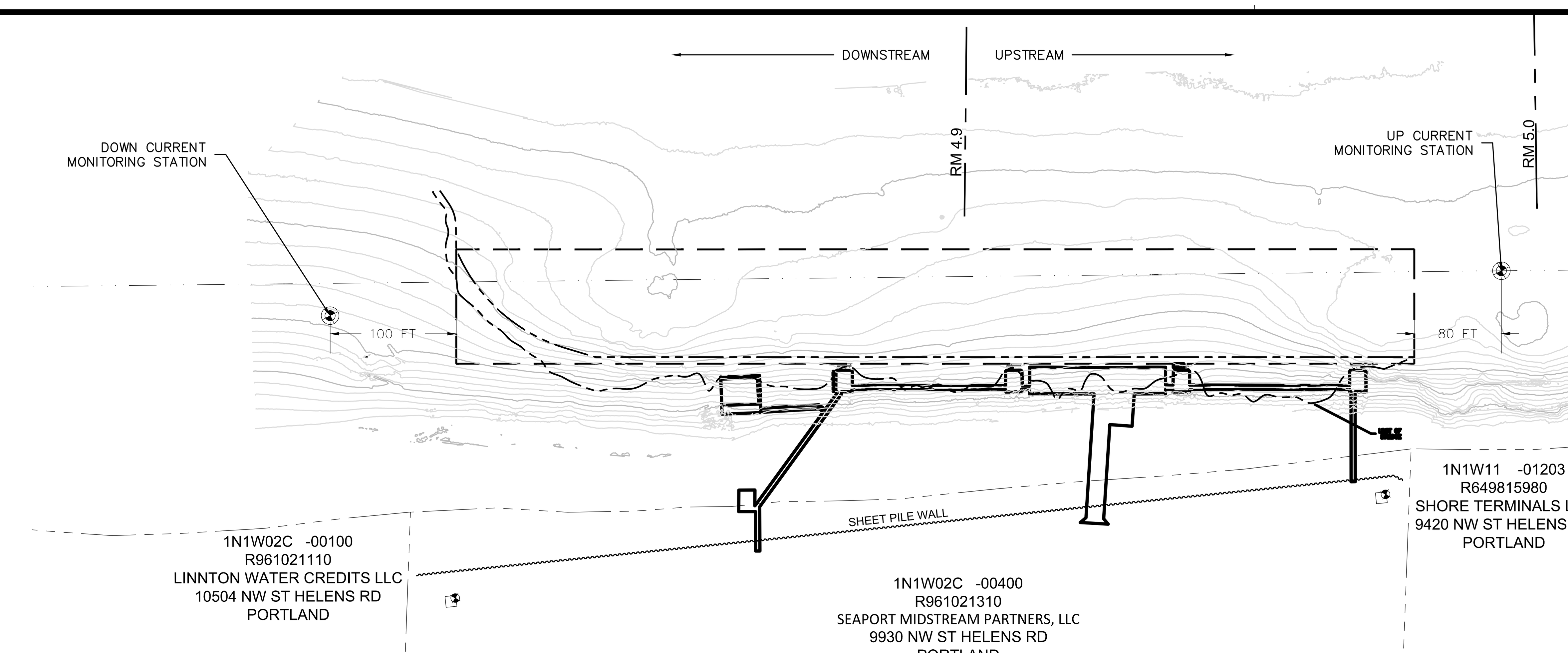




1 DOLPHIN, PROFILE AND PLAN (TYP.) C-01



2 TURBIDITY MONITORING LOCATIONS C-01

AECOM

PROJECT

PORTLAND TERMINAL MAINTENANCE

CLIENT

SEAPORT MIDSTREAM PARTNERS, LLC

Portland Terminal
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PROJECT INFORMATION, GENERAL NOTES, AND DRAWING LEGEND CAN BE FOUND ON G-02.

ISSUE/REVISION

I/R	DATE	DESCRIPTION
5		
4		
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1		
0	2019-12-18	AS-BUILT

PROJECT NUMBER

60558028

SHEET TITLE

PRE-CONSTRUCTION CONDITIONS AND TURBIDITY MONITORING

SHEET NUMBER

C-01

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Approved: KB
Checked: KC
Designer: AC
Project Management Initials:
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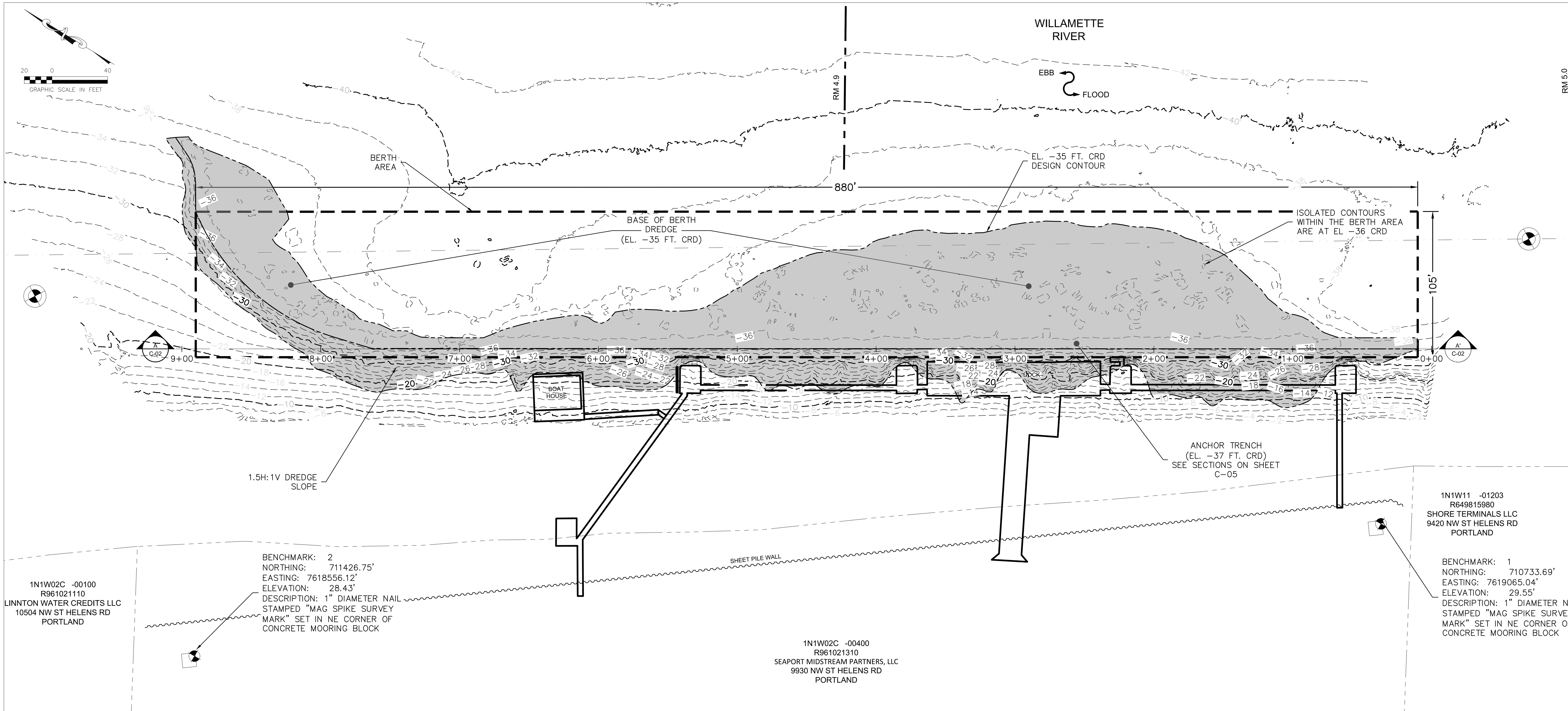
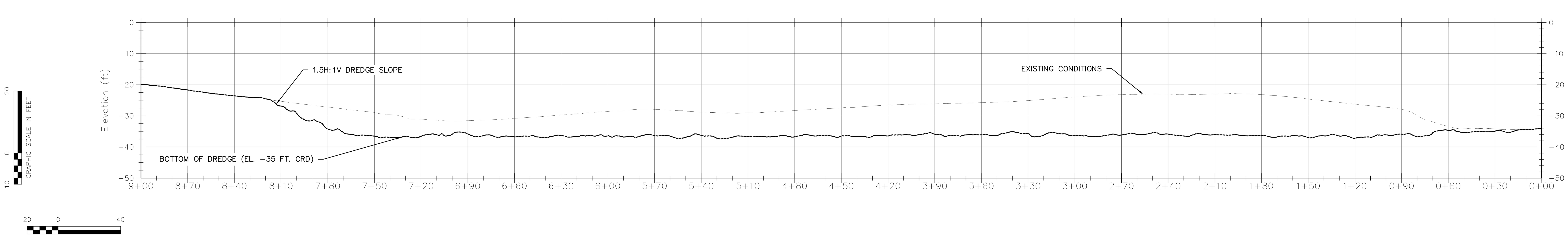


NOTE:

THE DESIGN FINAL BERTH ELEVATION OF −34 CRD RESTORES THE ORIGINAL DESIGN CONTOURS AND CONDITIONS AS PER DOCK MODIFICATION DRAWINGS, ARCO PRODUCTS COMPANY, LINNTON PLAN, PORTLAND OREGON, 1993.

PROFILE A–A'



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PORTLAND TERMINAL MAINTENANCE

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
5		
4		
3		
2		
1		
0	2019-12-18	AS-BUILT

PROJECT NUMBER

60558028

SHEET TITLE

DREDGE AS-BUILT CONDITIONS

SHEET NUMBER

C-02

ANSI D 22" x 34"
Approved: KB
Checked: KC
Designer: AC
Project Management Initials:

Last saved by: CHINA2(2019-12-21) Last Plotted: 2019-12-21
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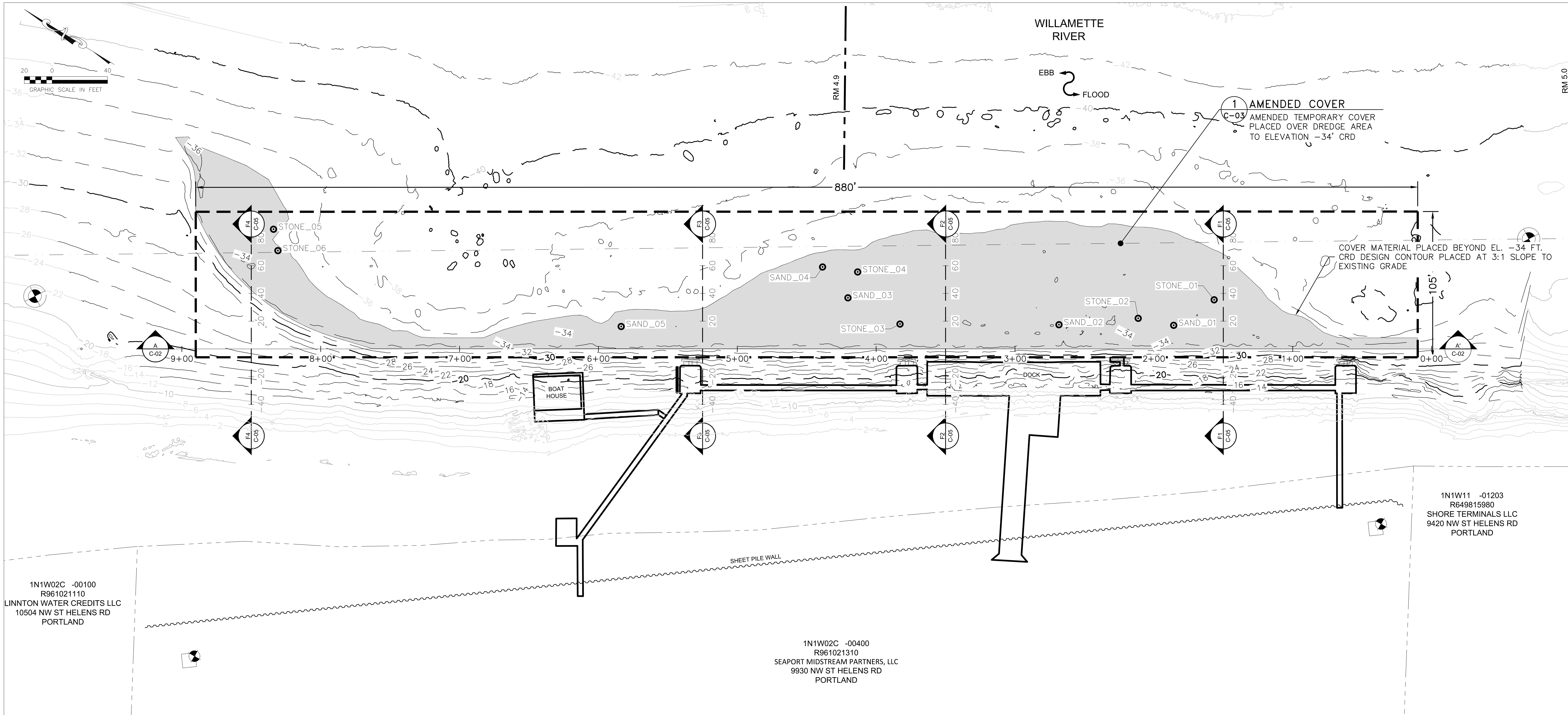

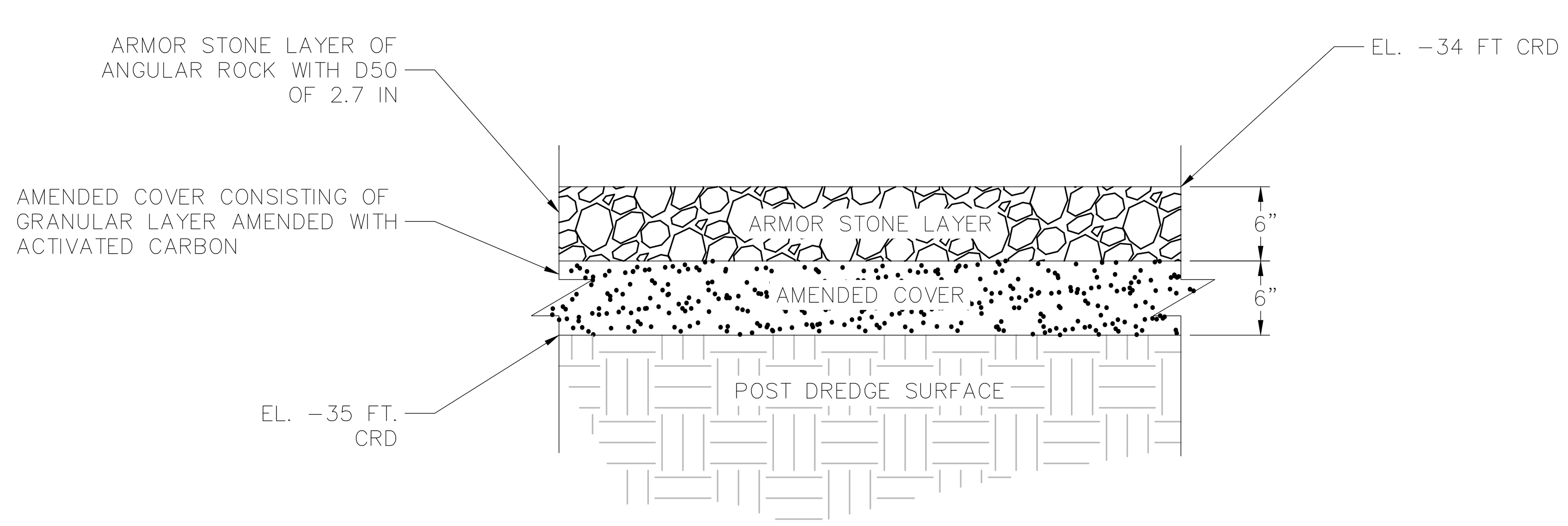

1 CARBON AMENDED COVER
C-03

Diver Verification Measurements		
Location	**Cover Material**	**Measured Thickness (inches)**
Sand_01	Carbon Amended Sand	6.25
Sand_02	Carbon Amended Sand	6.5
Sand_03	Carbon Amended Sand	5.9
Sand_04	Carbon Amended Sand	5.9
Sand_05	Carbon Amended Sand	6.0
Stone_01	Armor Stone	6.0
Stone_02	Armor Stone	5.75
Stone_03	Armor Stone	5.5
Stone_04	Armor Stone	6.0
Stone_05	Armor Stone	6.0
Stone_06	Armor Stone	6.5

AECOM

PROJECT

PORTLAND TERMINAL MAINTENANCE

CLIENT

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Portland, Oregon

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NOTE:

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
5		
4		
3		
2		
1		
0	2019-12-18	AS-BUILT

PROJECT NUMBER

60558028

SHEET TITLE

TEMPORARY COVER FOR BERTH AS-BUILT CONDITIONS

SHEET NUMBER

C-03

ANSI D 22" x 34"
Approved: KB
Checked: KC
Designer: AC
Project Management Initials:

Last saved by: CHINA2(2019-12-21) Last Plotted: 2019-12-21
Filename: C:\USERS\CHINA2\DESKTOP\AS BUILT REV 0.DWG

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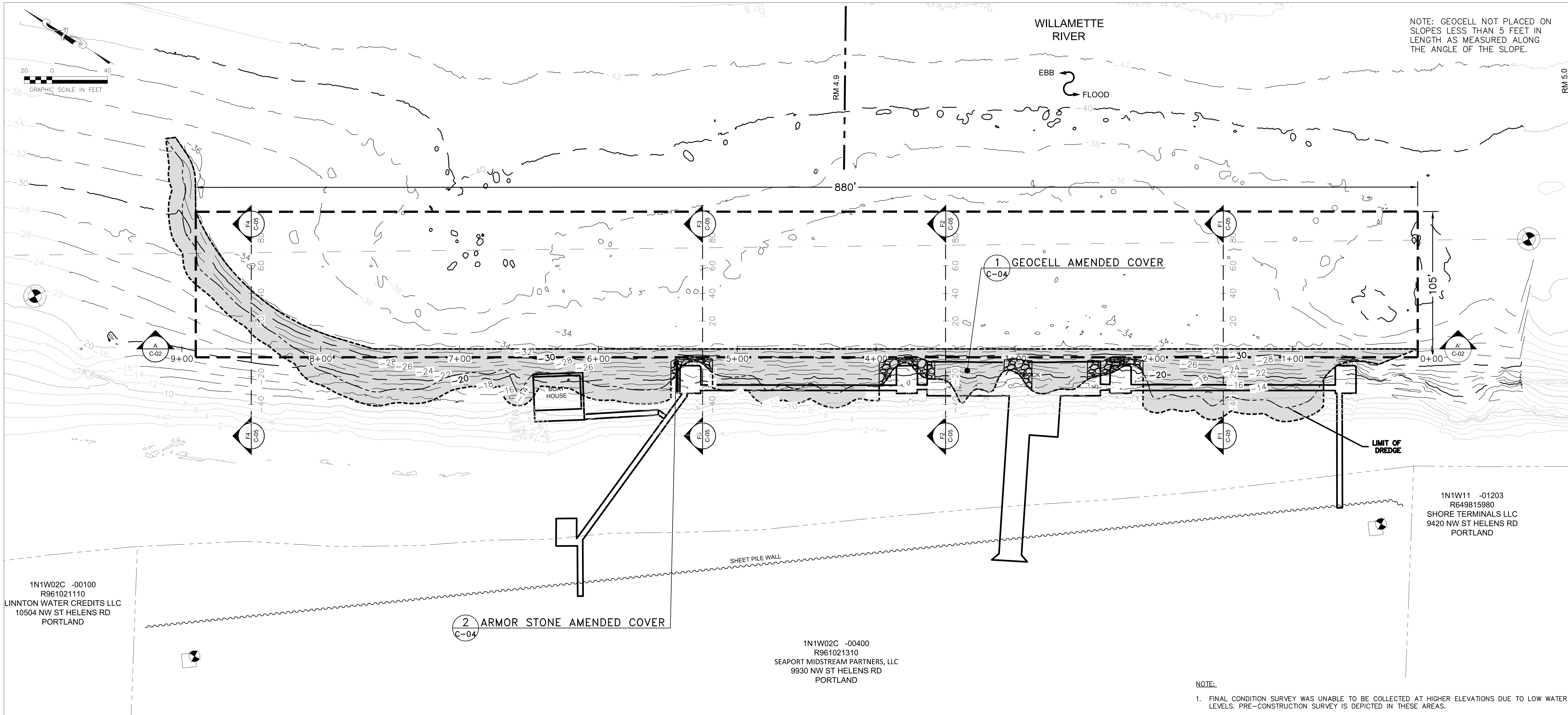
ANSI D 22" x 34"

Project Management Initials: Designer: AC Checked: KC Approved: KB



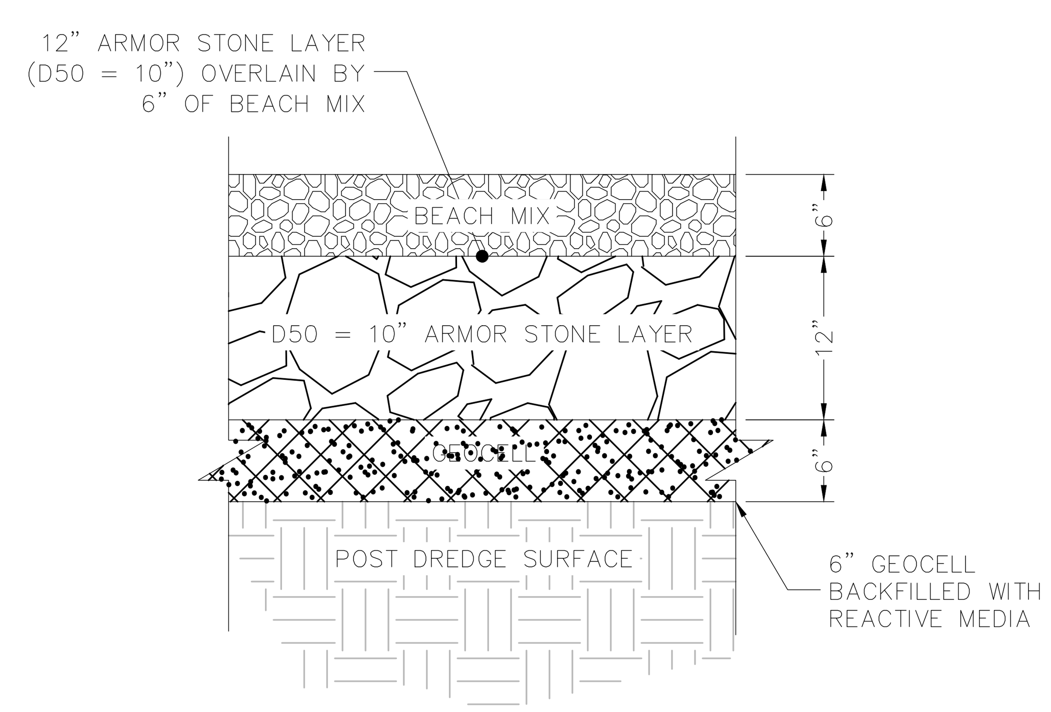
NOTE: GEOCELL NOT PLACED ON SLOPES LESS THAN 5 FEET IN LENGTH AS MEASURED ALONG THE ANGLE OF THE SLOPE.

NOTE:

1. FINAL CONDITION SURVEY WAS UNABLE TO BE COLLECTED AT HIGHER ELEVATIONS DUE TO LOW WATER LEVELS. PRE-CONSTRUCTION SURVEY IS DEPICTED IN THESE AREAS.

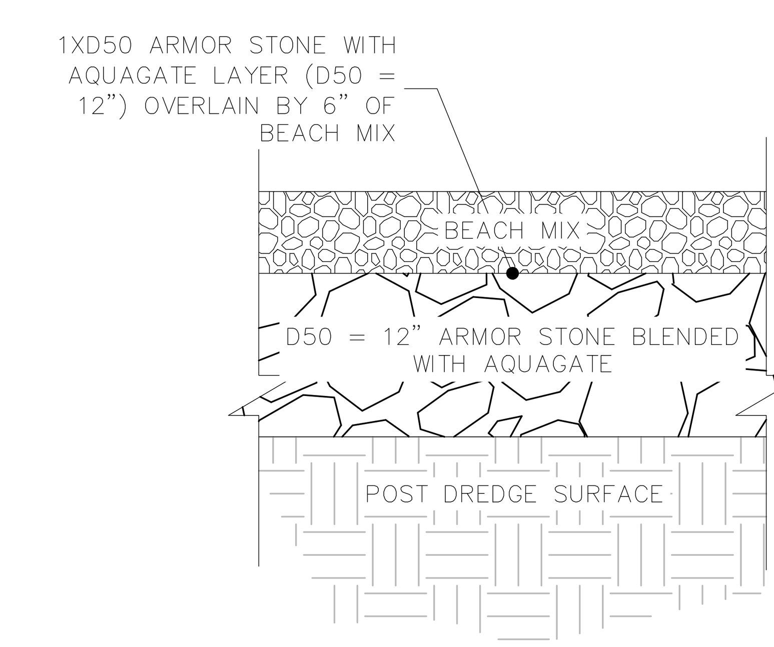
NOTE:

1. TYPICAL DESIGN USES AN ARMOR LAYER THICKNESS OF TWO TIMES THE MEDIAN DIAMETER ARMOR ROCK TO FORM THE PROTECTION. THIS INSTALLMENT IS TO BE TEMPORARY AND THEREFORE, THE LAYER THICKNESS IS SPECIFIED AS ONE TIMES THE MEDIAN DIAMETER ARMOR ROCK.
2. DIVERS INSPECTED THE CARBON AMENDED SAND PLACED WITHIN THE GEOCELL TO CONFIRM THE DESIGN THICKNESS WAS ACHIEVED. A TOTAL OF 9 LOCATIONS WERE INSPECTED AND DOCUMENTED WITH PHOTOS. ARMOR STONE WAS PLACED IN AREAS FOLLOWING CONFIRMATION OF THE CARBON AMENDED SAND PLACEMENT FROM THE DIVERS.



NOTE:
CARBON AMENDED MATERIAL PLACED TO A DISTANCE OF 10 FT BEYOND THE TOP OF THE DREDGE SLOPE.

1 GEOCELL COVER WITH CARBON REACTIVE MEDIA
C-04



2 ARMOR STONE WITH CARBON REACTIVE MEDIA
C-04

AECOM

PROJECT
PORTLAND TERMINAL MAINTENANCE

CLIENT
SEAPORT MIDSTREAM PARTNERS, LLC
Portland Terminal
9930 NW St, Helens Road
Portland, Oregon

CONSULTANT

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111 SW Columbia St, Suite 1500
Portland, Oregon 97201
503.222.7200 tel 503.222.4292 fax
www.aecom.com

REGISTRATION

NOTE:
PROJECT INFORMATION, GENERAL NOTES, AND DRAWING LEGEND CAN BE FOUND ON G-02.

ISSUE/REVISION

I/R	DATE	DESCRIPTION
5		
4		
3		
2		
1		
0	2019-12-18	AS-BUILT

PROJECT NUMBER
60558028

SHEET TITLE
TEMPORARY COVER FOR SLOPE AS-BUILT CONDITIONS

SHEET NUMBER
C-04

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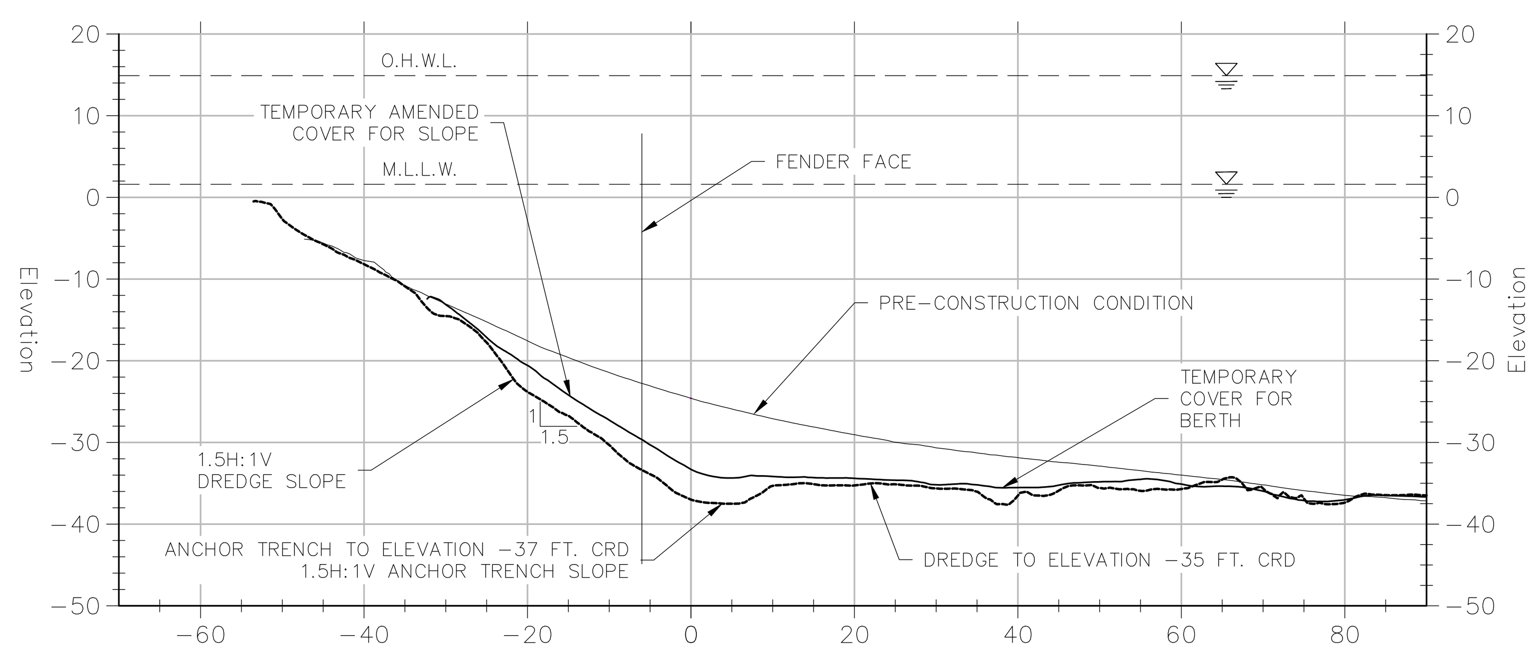
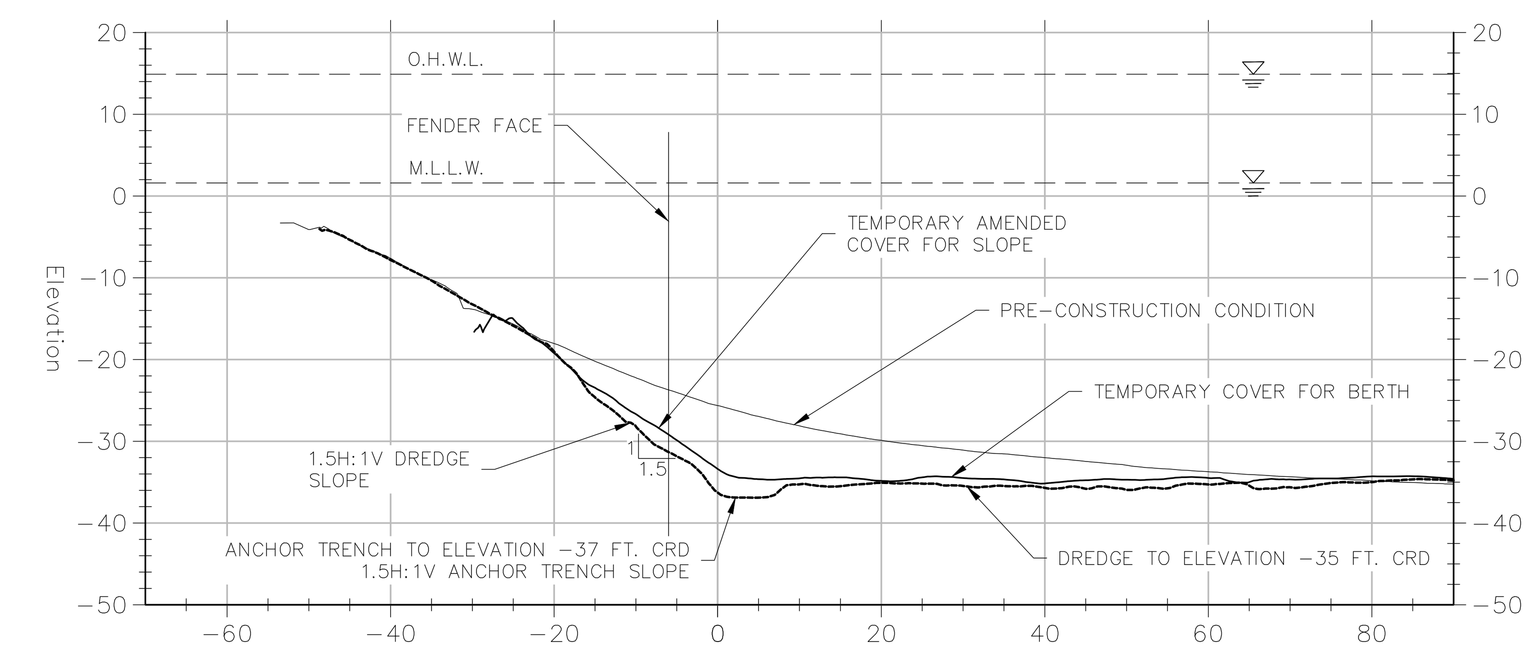
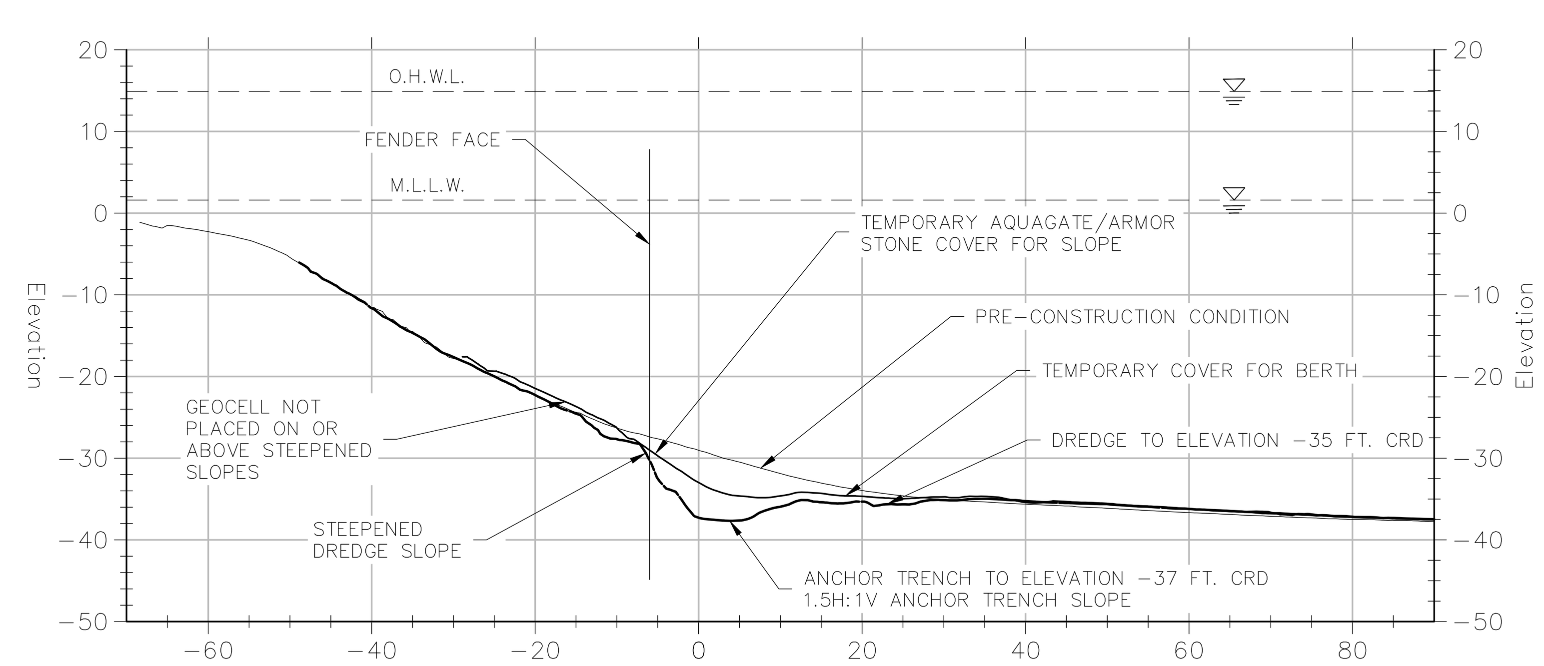
SECTION F1



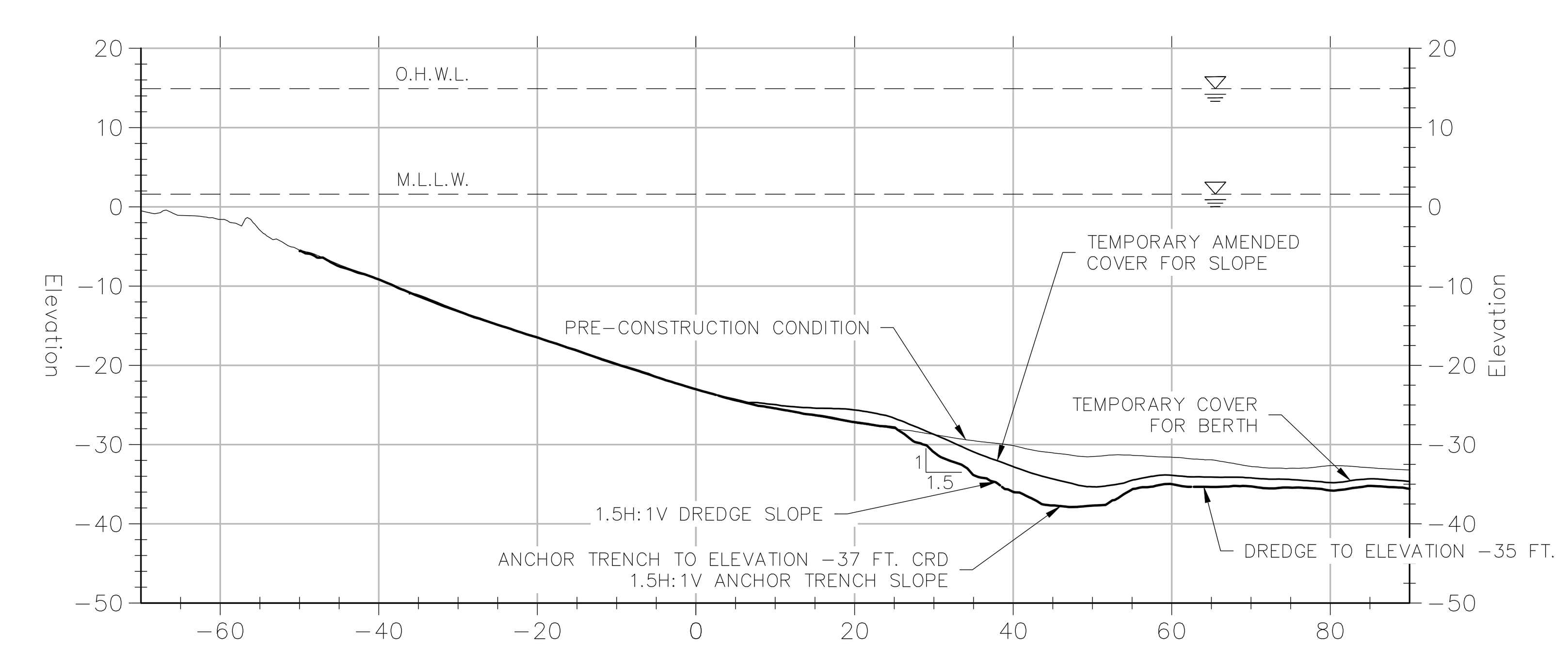
SECTION F2



SECTION F3



SECTION F4



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GRAPHIC SCALE IN FEET

NOTE:

1. TOTAL COVER THICKNESS IN THE BERTH CONFIRMED TO BE 1 FOOT IN ACCORDANCE WITH DETAIL 1 ON C-03. SEE SHEET C-03 FOR CORE THICKNESS MEASUREMENTS.

AECOM

PROJECT

PORTLAND TERMINAL MAINTENANCE

CLIENT

SEAPORT MIDSTREAM PARTNERS, LLC
Portland Terminal
9930 NW St, Helens Road
Portland, Oregon

CONSULTANT

AECOM
111 SW Columbia St, Suite 1500
Portland, Oregon 97201
503.222.7200 tel 503.222.4292 fax
www.aecom.com

REGISTRATION

NOTE:

PROJECT INFORMATION, GENERAL NOTES, AND DRAWING LEGEND CAN BE FOUND ON G-02.

ISSUE/REVISION

I/R	DATE	DESCRIPTION
5		
4		
3		
2		
1		
0	2019-12-18	AS-BUILT

PROJECT NUMBER

60558028

SHEET TITLE

AS-BUILT CROSS SECTIONS

SHEET NUMBER

C-05

ANSI D 22" x 34"
Approved: KB
Checked: KC
Designer: AC
Project Management Initials:

Last saved by: CHINA2(2019-12-21) Last Plotted: 2019-12-21
Filename: C:\USERS\CHINA2\DESKTOP\AS BUILT REV 0.DWG

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GRAPHIC SCALE IN FEET

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APPENDIX I

2019 Dredge/Cap Permit Application and Agency Approvals

EPA and USACE Comments on Revised SAP

2017-08-23

(Relevant Passage Outlined in Red)

From:	Holm, James A CIV USARMY CENWP (US)
To:	Moody, Nicky; White, Melody J CIV USARMY CENWP (US)
Cc:	Sheldrake, Sean; petersonle@cdmsmith.com; Greenfield, Sarah (ORDEQ); Lohrman, Bridgette; ANDERSON Peter; Yballe, Dominic P CIV USARMY CENWP (US); "Tom Hausmann - NOAA Federal"; Jeremy_Buck@fws.gov; Kranz, Scott; Clodfelter, Andy; Herlocker, Noah
Subject:	PSET REVIEW: NWP-2006-946 BP Portland Revised SAP Approval (Willamette River, RM 5.1)
Date:	Wednesday, August 23, 2017 11:13:58 AM

Dear Nicky and Melody:

The U.S. Environmental Protection Agency's Region 10 Cleanup Program (EPA-CU) and the interagency Portland Sediment Evaluation Team (PSET) have reviewed AECOM's revised 7 August 2017 "Sampling and Analysis Plan: BP Portland Terminal" (SAP, version 4). BP's Portland Terminal is located on the west bank of the Willamette River at River Mile 5.1, in Portland, Multnomah County, Oregon.

CONSISTENCY DETERMINATION: BP may proceed with sediment sampling at their Portland Terminal. EPA-CU reviewed BP's revised SAP in accordance with their January 2017 Record of Decision (ROD) for the Portland Harbor Superfund Site. Correct implementation of the SAP will provide EPA-CU with sufficient information to determine consistency of the proposed maintenance dredging action with the ROD. The PSET reviewed the revised SAP and determined it to be consistent with the 2016 Sediment Evaluation Framework for the Pacific Northwest (SEF) with clarifications listed below.

PROJECT DESCRIPTION: Dredging is needed to maintain adequate depths for docking current vessels and future vessels. BP's Portland Terminal berth is approximately 105 feet wide by 825 feet long (2 acres). BP would dredge their Portland Terminal berth to a maximum depth of -35 ft Columbia River Datum (CRD), including +1 ft to accommodate a 1 ft sand cover for a final berth depth of -34 ft CRD. Current mudline elevations in the dredge area range from -21 ft to -38 ft CRD. To achieve the maximum proposed depth of -35 ft CRD, approximately 6,500 cy would be dredged.

According to the revised SAP, sediments will be dredged either hydraulically or mechanically. Dredged material would be placed on a sealed barge for transport (i.e., no water would leak from the barge). Any exposed barge weep holes should be sealed prior to placing sediment within the barge. Any excess water created during dredging would be pumped into on-site storage containers (e.g., storage barge), then treated, tested, and discharged via an appropriate legal, NPDES approved disposal method. Dredged material would be transported to the Wasco County Landfill near The Dalles, Oregon, or to the Roosevelt Regional Landfill near Roosevelt, Washington. A clean sand cover (approximately 1 ft thick) will be placed over the dredge area. The SAP states the sand cover will be tested sections 6.1 and 7 of the revised SAP.

SEDIMENT SAMPLING AND ANALYSIS: BP's contractor (AECOM) has divided the dredge area into two (2) dredged material management units (DMMUs) (see revised SAP Figure 5). AECOM, coring contractor, Gravity Consulting, will collect three cores from each DMMU to a depth of -37 ft CRD as shown in revised SAP Figure 6 (plus a little extra to account for the core catcher and ensure that the entire 2-ft Z-layer interval is sampled). AECOM will achieve a minimum core recovery of 75%. The PSET will be contacted after 3 unsuccessful attempts. Horizontal and vertical positioning procedures are described in section 5.2 of the revised SAP; a tide board (in ft CRD) is affixed to BPs Portland Terminal dock (SAP, Photos 1 and 2). Analytical and geotechnical core processing procedures are described in sections 5.3.2 and 5.3.3, respectively.

AECOM's sampling and compositing scheme are summarized in Table 4 of the revised SAP. Within each DMMU, three equal volume subsamples of dredge prism material (mudline to -35 ft CRD) will be mixed to form one dredge prism composite sample; a total of two dredge prism composite samples will be submitted to the contract laboratory. Within each DMMU, three (3) discrete Z-layer samples from the 2 ft below the selected dredge depth (-35 to -37 ft CRD) will be analyzed separately for a total of six (6) Z-layer samples. One field duplicate sample will also be submitted for laboratory analysis. Sample handling and chain of custody procedures appear in Section 5.3.4 and Appendix B of the SAP.

ALS-Environmental (ALS) will conduct the chemical analyses for BP. Dredge prism composite samples from each

DMMU will be archived. Chemical analytical and quality assurance/ quality control procedures appear in section 6 of the SAP. All samples will be analyzed for the SEF standard list of chemicals of concern (CoCs) and EPA-CU's list of CoCs (Table 17 sediment cleanup levels) published in the January 2017 ROD. ALS should strive to achieve detection limits below these thresholds.

Northwest Geotech, Inc. will perform all geotechnical testing. Planned geotechnical analyses appear in section 7 of the SAP.

Handling procedures for all investigation-derived waste is described in section 9 of the SAP. Data management and reporting requirements appear in section 9 and Appendix B of the SAP.

PSET/EPA-CU CLARIFICATIONS:

1) SAP Sections 5.3.2.1 and 5.3.2.2 identify eight (8) initial DP composites and 8 discrete Z-samples, respectively. However, based on the revised number of DMMUs (2) with three (3) cores per DMMU, only 2 initial DP composites (1 at each DMMU) will be analyzed initially and 2 extra DP composites for lab archive are anticipated. Secondly, only six (6) discrete Z-samples (3 at each DMMU) are expected to be collected and analyzed.

2) Move 4 sampling stations (DMMU 1A and 1C, DMMU 2A and 2C) closer to shore in a thicker portion of the dredge cut to be more representative of the dredge prism in each DMMU. Each sampling station shall be at least on the -30 ft CRD contour or shallower.

INTERPRETATION OF ANALYTICAL RESULTS: BP's analytical results for the Portland Terminal will be compared to EPA-CU's sediment cleanup levels (ROD Table 17) and the SEF freshwater benthic toxicity screening levels. These results will inform the need for dredging operational controls and/or post-dredge sediment management. EPA-CU requires the following clarification:

1) The results of analytical testing on sediment and sand cover samples should be compared with the River Bank Soil/Sediment Cleanup Levels listed in Table 17 of the 2017 Portland Harbor ROD. For a detailed discussion of data quality for COCs and media of concern, refer to information provided in the Joint Source Control Strategy (JSCS). EPA and DEQ recognize that some values represent concentrations that are less than some laboratory standard method practical quantification limits (PQLs). In these cases, responsible parties should evaluate whether alternative sampling approaches (e.g., cumulative sampling techniques or high volume) or alternative laboratory methods can be used to achieve the desired PQLs. The responsible parties are expected to conduct laboratory analyses using the best commercially available analytical techniques after consideration of alternative sampling or analytical techniques. See JSCS Section 3.3 for more information.

PRE-SAMPLING CONFERENCE CALL: AECOM and Gravity field staff must arrange a conference call with the Corps and EPA-CU prior to sampling on 5 September. In this 15-30 minute call we will review the revised SAP and this PSET SAP approval to ensure that we have a mutual understanding of the sampling procedures, revised sampling stations, tide-correction procedures for coring and subsampling, and analytical methods/detection limits that will be employed.

CONTACTS: If you or BP's sampling contractors have questions regarding this determination, please contact me or Mr. Sean Sheldrake (Remedial Project Manager, EPA-CU). Our information is provided below.

Sincerely,
James H.

James A. Holm
Sediment Quality Team: Biologist & PSET Lead
Waterways Maintenance, Channels and Harbors
USACE - Portland District
503-808-4963 (desk), 503-758-5571 (cell)
james.a.holm@usace.army.mil

PSET Suitability Determination

2018-02-08

(Relevant Passage Outlined in Red)

CENWP-OD-NW (Sediment Quality) 5 February 2018
EPA-Region 10 Cleanup Program

Memorandum for: Portland District, Regulatory Branch (CENWP-OD-G, White), Regulatory File No. NWP-2006-946 (TLP Portland Terminal)

Subject: Portland Sediment Evaluation Team (PSET) Level 2 dredged material suitability determination for maintenance dredging of TLP's (formerly BP US Pipelines and Logistics) Portland Terminal on the Lower Willamette River (RM 5.1W), 9930 NW Saint Helens Road, Portland, Multnomah County, Oregon.

Introduction: Per the 2016 *Sediment Evaluation Framework for the Pacific Northwest* (SEF), this suitability determination memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of sediments in the project area, for unconfined, aquatic placement. The PSET reviewed TLP's 31 October 2017 "Sediment Characterization Report, Portland Terminal" (SCR) prepared by AECOM. Sediment chemistry testing results are summarized in the SCR; TLP's chemical analytical results were compared to the freshwater benthic toxicity screening levels (SEF SLs) published in the 2016 SEF. The PSET used Oregon Department of Environmental Quality's (ODEQ's) sediment screening level values (SLVs) for freshwater fish to evaluate bioaccumulative compounds in the dredge prism material.

The Environmental Protection Agency – Region 10's Cleanup Program (EPA Cleanup) has also evaluated project sediments under the January 2017 Portland Harbor Superfund Site – Record of Decision (ROD). This memorandum also documents EPA Cleanup's determination regarding the suitability of sediments in the project area. EPA Cleanup compared TLP's chemical analytical results to the Cleanup Levels (CL) for river bank soil/sediment (ROD Appendix II, Table 17) and with remedial action levels (RALs) (ROD Appendix II Table 21).

<u>PSET Suitability Summary:</u>

Surface Sediments:	☐ Suitable	☑ Unsuitable
Post-dredge Surface (PDS):	☐ Suitable	☑ Unsuitable

<u>EPA Cleanup Suitability Summary:</u>

Surface Sediments:	☐ Suitable	☑ Unsuitable
Post-dredge Surface (PDS):	☐ Suitable	☑ Unsuitable

Reviewers: The PSET agencies include the U.S. Army Corps of Engineers (Corps), Environmental Protection Agency – Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and ODEQ. EPA Cleanup staff and contractors also reviewed the SCR. The sediment evaluation review timeline appears in Table 1, below. The reviewers for this project included:

☑ James Holm (Corps, PSET Lead) ☑ Bridgette Lohrman (EPA, PSET Co-Lead)
☑ Dominic Yballe (Corps) ☑ Pete Anderson (ODEQ) ☑ Madi Novak (DEQ Cleanup)
☑ Tom Hausmann (NMFS) ☐ Jeremy Buck (USFWS) ☐ Laura Inouye (Ecology)
☑ Sean Sheldrake (EPA Cleanup)

SEF/EPA Cleanup Special Condition Categories:

☑ Data Recency Expiration - If additional work is necessary, coordinate with the EPA Cleanup and PSET at least 9 months prior to September 2020 to determine the need to re-characterize the dredged materials and PDS.
☑ Pre-dredge hydrography survey and post-dredge hydrographic survey of the dredge area.
☑ Submit dredge plan consistent with the ROD to EPA Cleanup, Regulatory PM and PSET at two months prior to dredging.

☑ Cover materials sampling and post-cover placement testing conforming to the ROD and with an EPA Cleanup-approved sampling and analysis plan).
☑ Pre-dredge meeting with EPA Cleanup, Regulatory PM, PSET, and Oregon DEQ required at least two months prior to dredging. A dredging and disposal quality control plan must be developed and submitted to the EPA Cleanup Regulatory PM at least two months prior to the pre-dredge meeting. Dredging, positioning, post-dredge cover sampling and cover material sampling, and disposal will all need to be addressed with enough detail to provide assurance to the agencies that the dredge and sampling plans will be properly implemented.
☑ Management of the PDS in conformance with the ROD per EPA Cleanup.
☑ Submit post-dredge and disposal report with figures to EPA Cleanup, Regulatory PM and PSET within 60 days of dredging/placement (dredging dates, locations, volumes, acreages, dredge depths, photographs, debris and biological observations, sampling results, and hydrosurveys).
☑ Coordination with EPA Cleanup for work in Portland Harbor Superfund site (CERCLA). Plans must be approved by EPA Cleanup prior to beginning work.

*** The PSET requests the Regulatory PM provide electronic copies of the Corps permit (NWP-2006-946) and the 401 water quality certifications for our files ***

Table 1. Review Timeline

Sampling and Analysis Plan (SAP) received	24 February 2017
SAP revisions	7 March 2017
SAP put on hold by AECOM	13 March 2017
Revised SAP received	28 March 2017
SAP approval by PSET	27 April 2017
Dredge depth revised by BP	4 August 2017
Revised SAP received	7 August 2017
Revised SAP approved by PSET with clarifications	23 August 2017
Final SAP received	25 August 2017
Pre-sampling conference call (PSET only)	30 August 2017
Sampling dates	6-8 September 2017
SCR received	1 November 2017
SDM submitted to Regulatory PM	5 February 2018
Project management area ranking	High
Data recency determination*	3 years (resample by September 2020)

* If site conditions or the proposed project change, or if new information related contaminants of concerns is discovered, additional coordination with PSET and EPA Cleanup is required to re-verify SDM.

Federal Regulatory Authorities:

☑ Section 10, Rivers and Harbors Act
☑ Section 404, Clean Water Act (CWA)
☑ Section 401, CWA
☑ Section 7, Endangered Species Act
☑ Section 305 of the Magnuson-Stevens Act
☑ Fish and Wildlife Coordination Act
☐ Section 103, Marine Protection, Research and Sanctuaries Act
☑ Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 summarizes TLP's maintenance dredging project details. Dredging in the terminal is currently needed to accommodate current and future vessels. TLP's existing bathymetry and proposed dredge area appear in SCR Figure 2 (SDM Figure 1, below).

Table 2. Project Details

Project address	9930 NW Saint Helens Road, Portland, Oregon
Waterbody/river mile (RM)	Willamette River / 5 (west bank)
Total proposed dredging volume (cy)	6,500 (approx.)
Dredge area	1.98 ac (~825 ft. by 105 ft.)
Max. proposed dredging depth	-35 ft. Columbia River datum (CRD) including a 1 ft. overdepth to accommodate a cover
Dredging method	Close-lipped clamshell
Dredged material transport	Barge
Proposed disposal location	Upland landfill – no in-water placement proposed
Proposed dredging date(s)	In-water work window (July 1 to October 31)
Dredged material mgmt. units (DMMUs)	2

Sampling and Analysis Description: TLP's sampling and analytical program for the terminal dredging project is summarized in Table 3 per the 2016 SEF and EPA's 2017 ROD. Specifically, three subsamples were collected in each DMMU with a vibracore. Equal volumes were mixed to form composite samples for the dredge prism (mudline to -35' CRD) in each DMMU. Six discrete Z-layer (-35' to -37' CRD) samples were collected for the PDS.

Table 3. Project Sampling and Analysis Description

Sampling Description			
Sample collection method		Vibracore	
DMMU ID / Sample ID		1-DP / OP1-DMMU-1	2-DP / OP1-DMMU-2
Z-layer ID / Sample ID		1-Z / OP1-ZL-1A, 1B, 1C	2-Z / OP1-ZL-2A, 2B, 2C
Proposed DMMU volume (cy)		6,800	
Dredge Prism	Depth range (ft CRD)	-27.1 to -35	-27.7 to -35
	Composite (Y/N)	Y	Y
	Subsamples (SS)/DMMU	3	3
	Archive (Y/N)	Y	Y
Post-Dredge Surface	Depth range (ft CRD)	-35 to -37	-35 to -37
	Composite (Y/N)	N	N
	SS/Z-layer	3	3
	SS Archive (Y/N)	Y	Y
Sediment Physical and Chemical Analysis (No. DP/ No. Z-layer)			
Grain size		1/3	1/3
Total solids		1/3	1/3
Total volatile solids		1/3	1/3
Total organic carbon		1/3	1/3
Total sulfides		1/3	1/3
Ammonia		1/3	1/3
Metals		1/3	1/3
Semi volatile organic compounds (polynuclear aromatic hydrocarbons, chlorinated hydrocarbons, phthalates, phenols, misc. extractables, cPAHs*)		1/3	1/3
Pesticides		1/3	1/3
Polychlorinated Biphenyls (Aroclors)		1/3	1/3
Butyltins		1/3	1/3
Total petroleum hydrocarbons (dx, rx)		1/3	1/3
Dioxins/furans*		1/3	1/3
Biological Testing Description			
Bioassays (Y/N)		N	N

* Analyses required by EPA Cleanup under CERCLA for Portland Harbor (see ROD Table 17).

Deviations from the SAP: Two deviations were reported in the SCR.

- The compositing of the initial composite samples used to create the final composite for each DMMU was completed at the AECOM warehouse instead of the analytical laboratory. This change simplified lab processing.

- Separate geotechnical cores were not conducted as listed in the SAP. They were collected for engineering and design purposes not sediment characterizations.

Results: Tables 4a and 4b summarize TLP's physical and chemical testing results for the dredge prisms and PDS. Chemical analytical results were compared to the 2016 SEF freshwater SLs and EPA Cleanup's Cleanup Levels (CL) for river bank soil/sediment (ROD Table 17).

Table 4a. Sediment Analytical Summary – Dredge Prism

Underlined: exceeds EPA Cleanup CLs; **bolded**: exceeds SEF freshwater SL
U = not detected at or above the method reporting limit (MRL) or method detection limit (MDL), MDL reported;
UJ = not detected, MDL is an estimate; J = estimated concentration; Ui = elevated MDL/MRL due to matrix interference
† = ODEQ (2007) fish-based screening level value; K = ion abundance ratio between primary and secondary ions were outside acceptance limits and concentration is an estimate

Sediment Physical and Chemical Results				
Decision unit (Sample ID): Parameter	DMMU 1 DP (OP1-DMMU-1)	DMMU 2 DP (OP1-DMMU-2)	SEF Freshwater SLs	Portland Harbor CLs
Grain size (%) gravel, sand, fines	1.8, 29.0, 67.2	0.1, 24.7, 75.4	--	--
Total Solids (%)	56.4	56.9	--	--
Total Volatile Solids (%)	7.40	7.90	--	--
Total Organic Carbon (%)	1.9	2.3	--	--
Total Sulfides (mg/kg)	3.1	8.0	39	--
Ammonia (mg/kg)	151	173	230	--
Metals (mg/kg)	Detected, J, As >CL	Detected, J, As + Hg >CLs	varies	varies
Total PAHs (ug/kg)	7,247	**96,710**	17,000	23,000
* cPAHs (ug/kg)	586	7,353	--	12
SVOCs (ug/kg)	Detected J, U	Detected, J, U	varies	varies
Dibenzofuran	34 J	**300**	200	--
BEHP	450 U	89 U	500	135
Di-n-octyl phthalate	**45 U**	**88 U**	39	--
Pesticides (ug/kg)	Detected J, U / <SLs, > CLs	Detected J, U / <SLs, >CLs	varies	varies
* cis-Nonachlor	0.64 Ui	2.5 U J	--	1.4
* Oxychlordane	1.2 J	1.9 U J	--	1.4
* Total Chlordane	1.2 J	2.5 U J	--	1.4
PCBs – Total Aroclors (ug/kg)	20 J	**145 J**	110 (22†)	9
Butyltins (ug/kg)	Detected J, U, <SLs, CL	Detected J, U, <SLs, CL	varies	3,080
TPH – dx / rx (ug/kg)	230 U / 470 J	**750 J** / 1,200 J	340 / 3,600	91 /--
* Dioxins / Furans (ng/kg)				
1,2,3,4,7,8-HxCDF	5.46	19.8	--	0.4
1,2,3,7,8-PeCDD	0.483 JK	1.05 JK	--	0.2
2,3,4,7,8-PeCDF	3.04	3.71	--	0.3
2,3,7,8-TCDD	1.84 K	2.73	--	0.40658
2,3,7,8-TCDF	2.88	9.94 J	--	0.2

* Analyses required by EPA Cleanup under CERCLA for Portland Harbor (see ROD Table 17).

Table 4b. Sediment Analytical Summary – Post-Dredge Surface

Underlined: exceeds EPA Cleanup CLs; **bolded**: exceeds SEF freshwater SL;
U = not detected at or above the method reporting limit (MRL) or method detection limit (MDL), MDL reported; UJ = not detected, MDL is an estimate; J = estimated concentration;
† = ODEQ (2007) fish-based screening level value; K = ion abundance ratio between primary and secondary ions were outside acceptance limits and concentration is an estimate

Sediment Physical and Chemical Results								
Decision unit (Sample ID): Parameter	DMMU 1 PDS (OP1-ZL-1A)	DMMU 1 PDS (OP1-ZL-1B)	DMMU 1 PDS (OP1-ZL-1C)	DMMU 2 PDS (OP1-ZL-2A)	DMMU 2 PDS (OP1-ZL-2B)	DMMU 2 PDS (OP1-ZL-2C)	SEF Freshwater SLs	Portland Harbor CLs
Grain size (%) gravel, sand, fines	4.0, 22.6, 74.8	0.1, 21.9, 78.2	0.2, 24.9, 69.2	0.1, 23.6, 64.2	0.0, 14.4, 88.5	0.0, 15.3, 84.5	--	--
Total Solids (%)	58.9	59.2	64.2	59.7	59.1	59.3	--	--
Total Volatile Solids (%)	7.30	7.00	8.30	9.10	8.60	8.50	--	--
Total Organic Carbon (%)	1.9	2.0	2.3	2.6	2.2	2.2	--	--
Total Sulfides (mg/kg)	9.1	1.8	10.2	13.8	11.5	12.9	39	--
Ammonia (mg/kg)	68	167	186	230	**260**	**275**	230	--
Metals (mg/kg)	Detected J, most <SLs, CLs	Detected J, most <SLs, CLs	Detected J, most <SLs, CLs	Detected J, most <SLs, CLs	Detected J, most <SLs, CLs	Detected J, most <SLs, CLs	varies	varies
Arsenic	5.90	5.27	5.57	5.86	5.59	6.09	14	3
Mercury	0.131	0.054	0.221	0.231	0.216	0.311	0.66	0.085
Nickel	**27.4**	25.2	**26.2**	**28.8**	**26.2**	**28.3**	26	--
Total PAHs (ug/kg)	15,310	2,134	**124,780**	**109,250**	**25,940**	**22,740**	17,000	23,000
* cPAHs (ug/kg)	1,401	289	7,764	10,292	1,956	1,219	--	12
SVOCs (ug/kg)	Detected J, U, most <SLs, CLs	Detected J, U, most <SLs, CLs	Detected J, U, most <SLs, CLs	Detected J, U, most <SLs, CLs	Detected J, U, most <SLs, CLs	Detected J, U, most <SLs, CLs	varies	varies
Dibenzofuran	78	9.4	**430**	170	150	130	200	--
BEHP	430 U	85 U	89 U	89 U	430 U	45 U	500	135
Di-n-octyl phthalate	16 U	9.1 J	**78 U**	32 U	**45 J**	**42 U**	39	--
Pesticides (ug/kg)	Detected U, J, <SLs, >CLs	Detected U, J, <SLs, >CLs	Detected U, J, few >SLs, >CLs	U, <SLs, >CLs	Detected U, J, <SLs, >CLs	Detected U, J, <SLs, >CLs	varies	varies
*cis-Chlordane	1.3 U	0.79 U	0.72 U	0.66 U	1.6 U	1.3 U	--	1.4
*cis-Nonachlor	4.2 J	0.74 U	3.6 U	0.47 U	4.1 U	5.6 J	--	1.4
*Oxychlordane	1.5 J	1.4 J	1.7 UJ	0.40 UJ	2.4 U J	1.5 UJ	--	1.4
*Total Chlordane	5.7 J	1.4 J	3.6 UJ	1.10 U	4.1 UJ	5.6 J	--	1.4
DDE	9.7	3.5	**39 J**	0.75	13 J	10 J	21	226
*Total DDx	9.7	11 J	119 J	0.98 U	32 J	10 J	--	6.1
*Dieldrin	1.3 U	0.33 U	1.8 U	0.35 U	2.6 U	1.5 U	4.9	0.07
PCBs – Total Aroclors (ug/kg)	**263 J**	34 J	**165**	11 J	**343**	**299**	110 (22†)	9
Butyltins (ug/kg)	U, J, <SLs, <CLs	U, J, <SLs, <CLs	U, <SLs, <CLs	U, <SLs, <CLs	U, <SLs, <CLs	U, <SLs, <CLs	varies	3,080
TPH – dx / rx (ug/kg)	**550** / 820 J	210 U / 320 J	**400 J** / 540 J	**660 J** / 1,300 J	**480** / 650 J	**410 J** / 510 J	340 / 3,600	91 /--
* Dioxins / Furans (ng/kg)								
1,2,3,4,7,8-HxCDF	39.7	2.35 J	12.9	2.31	56.8	191	--	0.4
1,2,3,7,8-PeCDD	1.51 JK	0.356 U	0.553 U	0.844 JK	0.985 J	1.06 JK	--	0.2
2,3,4,7,8-PeCDF	13.2	0.874 J	8.71	4.93	17.2 J	118	--	0.3
2,3,7,8-TCDF	23.2	1.26	7.75	0.726 K	14.4	95.5	--	0.40658
2,3,7,8-TCDD	2.99	2.32	2.16	2.16	2.47 K	2.65	--	0.2

* Analyses required by EPA Cleanup under CERCLA for Portland Harbor (see ROD Table 17).

Discussion:
There are several exceedances (detections or elevated MDL/MRL) of SEF freshwater SLs and EPA Cleanup CLs for the ROD in both dredge prism composite samples and across the six (6) discrete PDS samples (see Tables 4a and 4b). Only butyltins did not have a SL or CL exceedance in the dredge prism or PDS.

PSET Suitability Determination:
Dredge Prism – There were detections and non-detection (U) exceedances of analytes with freshwater screening levels under the SEF (Table 4a) in the dredge prism composite samples. As such, the TLP **dredge prism material is not suitable** for unconfined, aquatic placement per the SEF guidance. TLP is proposing upland placement (landfill) of the dredged materials.

Post-Dredge Surface – There were detections and non-detection (U) exceedances of analytes with freshwater screening levels under the SEF (Table 4b) in the discrete post-dredge samples. As such, the TLP **post-dredge surface is not suitable** for unconfined, aquatic exposure per the SEF guidance. Management of the post-dredge surface in both DMMUs is required. Management of the PDS will be determined by EPA Cleanup per the 2017 ROD.

EPA Cleanup Suitability Determination:
Dredge Prism – TLP's Portland Terminal is within the Portland Harbor Superfund Site, therefore EPA Cleanup's ROD CLs apply to the suitability determination. There were detections and non-detection (U) exceedances of analytes with ROD CLs (Table 4a, ROD Appendix II Table 17) in the dredge prism composite samples. TLP's **dredge prism is not suitable** for unconfined, aquatic placement per EPA's 2017 ROD. TLP is proposing upland placement (landfill) of the dredged materials.

Post-Dredge Surface – There were detection and non-detection (U) exceedances of analytes with ROD CLs (Table 4b, ROD Appendix II Table 17) and detection exceedances of analytes with ROD RALs (ROD Appendix II Table 21) in the discrete post-dredge surface samples. As such, the TLP **post-dredge surface is not suitable** for unconfined, aquatic exposure per EPA's 2017 ROD. Management of the PDS in both DMMUs is required. ROD Figure 28 and Section 14.2.9 should be referred to for general capping requirements. Activated carbon and/or other reactive materials may need to be incorporated into the design due to the presence of principal threat waste (PTW) concentrations in the Z-layer sample results. The cap design must be provided to EPA for review and approval prior to installation.

ROD/Remedy Considerations:
If TLP elects to proceed with its maintenance dredging project under the Section 404 permit program, then TLP must recognize that the project will not be considered a final cleanup action under the Portland Harbor ROD. If TLP desires the sediment cleanup in the footprint of the its maintenance dredging to be a final action, then a Consent Decree (and the legal protections it affords under the Superfund law), will need to be negotiated with EPA Cleanup. EPA Cleanup is available to discuss the implications of these two options with TLP.

Contact:
This memorandum was prepared by James Holm (PSET Lead, Corps) and Sean Sheldrake (Project Manager, EPA Cleanup) and reviewed by the participating PSET agency staff identified above.

Questions regarding the PSET suitability determination should be directed to James Holm at (503) 808-4963 or e-mail to: james.a.holm@usace.army.mil.

Questions regarding the EPA Cleanup suitability determination should be directed to Sean Sheldrake at (206) 553-1220 or email to: sheldrake.sean@epa.gov.

References:

AECOM . 2017. *Sediment Characterization Report – Portland Terminal, BP US Pipelines and Logistics*. Issued 31 October 2017. 17 pp + appendices.

Northwestern Regional Sediment Evaluation Team. 2016. *Sediment Evaluation Framework for the Pacific Northwest*. Published July 2016, by the REST Agencies, 172 pp + appendices.

Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*. Prepared by ODEQ Cleanup Program, 3 April 2007, 18 pp + appendices.

Portland Sediment Evaluation Team (PSET). 2017. P*SET Review: NWP-2006-946 BP Portland Revised SAP Approval*. Prepared by PSET and EPA Region 10. 23 August 2017 email from J. Holm (USACE).

U.S. Environmental Protection Agency, Region 10. 2017. Record Of Decision – Portland Harbor Superfund Site, Portland, Oregon. Issued by EPA Region 10, January 2017, 146 pp + appendices.

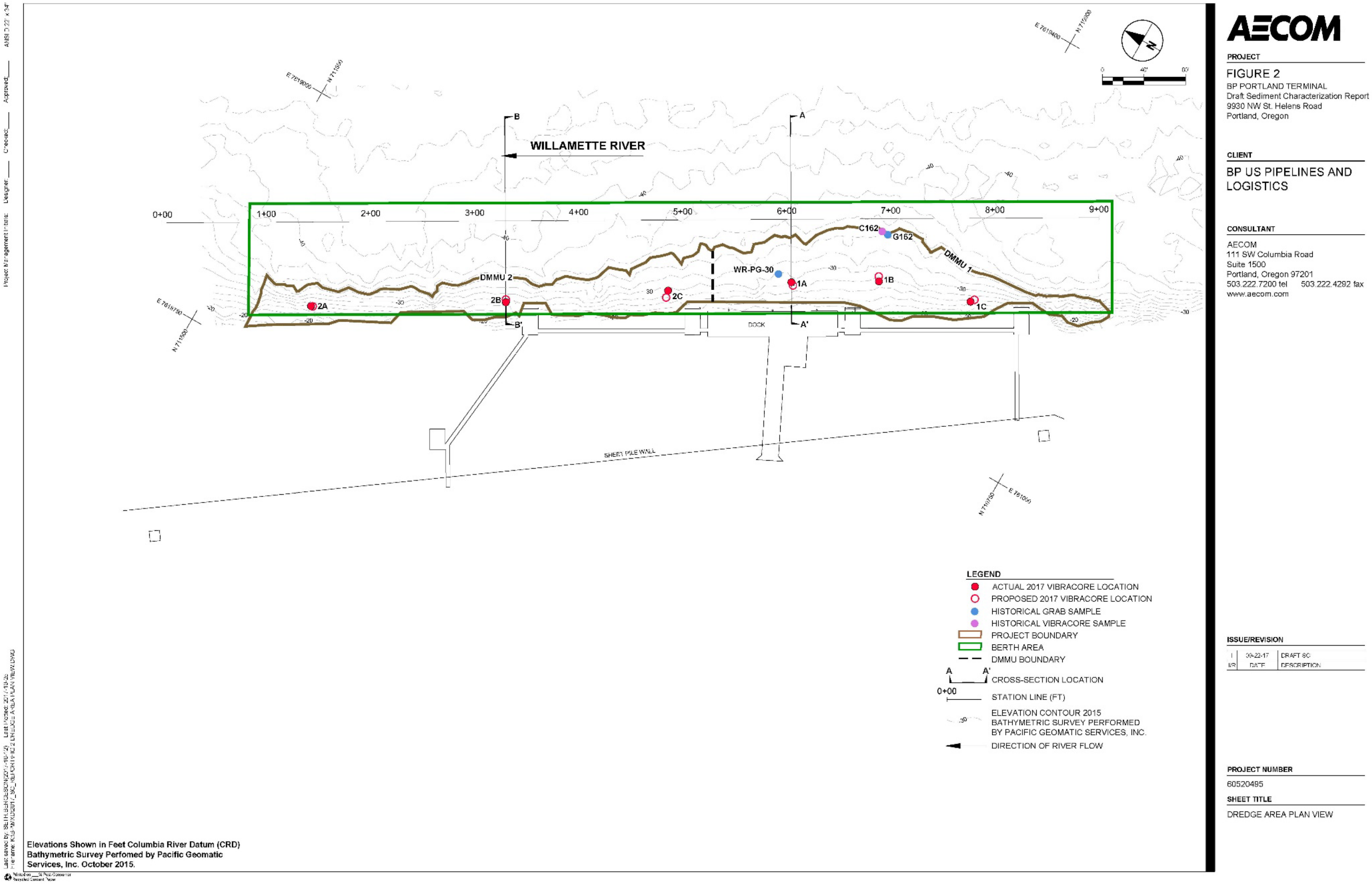

Figure 1. TLP (BP) Portland Terminal dredging project DMMUs and planned/actual sediment sampling locations (sampled 6-8 September 2017).

EPA and USACE Comments on 90% Design

2018-05-09

(Relevant Passages Outlined in Red)

From:	Holm, James A CIV USARMY CENWP (US)
To:	Sheldrake, Sean; Kranz, Scott; Doug Hall; Juan Medina; White, Melody J CIV USARMY CENWP (US)
Cc:	Sarah Greenfield (Greenfield.Sarah@deq.state.or.us); Peterson, Lance; Scott Coffey
Subject:	RE: Seaport Portland Terminal SCR Special Conditions Response sf6
Date:	Friday, May 11, 2018 10:23:45 AM
Attachments:	NWP-2006-946 TLP Portland final SDM 20180205.pdf

Hi Sean,

I will be sampling Detroit Reservoir on May 24/25. But I am not the key Corps person for this ongoing conversation.

Melody White is the Corps Regulatory permit project manager that will condition the 404/10 permit to comply with Portland Harbor ROD under CERCLA. My PSET role was to evaluate the dredged materials and post-dredge surface for suitability under the SEF and to concurrently facilitate EPA's review the sediment characterization effort so it meets the ROD and supports the selected Harbor remedy needed in the dredge area.

Melody can speak to the 404 permit condition specific to CERCLA on BP/TLP/Seaport project (NWP-2006-946). In general, permittees dredging in and upstream of the Harbor have to conduct the sediment characterization and permitted work in accordance with CERCLA (EPA's ROD) to ensure all permitted work meets the Harbor remedy.

If dredging will expose an unsuitable surface layer, that post-dredge surface (PDS) must be managed. As stated in our joint SDM, the EPA Cleanup will evaluate if the proposed PDS management is sufficient and supports the Harbor remedy.

Thanks,
James

James A. Holm
Sediment Quality Team: Biologist & PSET Lead
Waterways Maintenance, Channels and Harbors
USACE - Portland District
503-808-4963 (desk), 503-758-5571 (cell)
james.a.holm@usace.army.mil

-----Original Message-----
From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Friday, May 11, 2018 9:58 AM
To: Kranz, Scott <scott.kranz@aecom.com>; Doug Hall <dhall@transmontaigne.com>; Juan Medina <jmedina@transmontaigne.com>
Cc: Holm, James A CIV USARMY CENWP (US) <James.A.Holm@usace.army.mil>; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) <Greenfield.Sarah@deq.state.or.us>; Peterson, Lance <petersonle@cdmsmith.com>; Scott Coffey <coffeyse@cdmsmith.com>
Subject: [Non-DoD Source] RE: Seaport Portland Terminal SCR Special Conditions Response sf6

Scott, Regardless, unless USACE objects, you will find these aspects necessary under CWA 404 in the permit requirements, which we will be checking on with field oversight provided in real time to USACE per the EPA/USACE agreement.

James, can you participate on 5/24 (any particular time better)? As the regulator, I think it would be valuable for you to participate.

Thank you.

S

Sean Sheldrake RPM, Unit Diver Officer

U.S. Environmental Protection Agency

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Blockedhttps://www.epa.gov/superfund/portland-harbor <Blockedhttps://www.epa.gov/superfund/portland-harbor>

From: Kranz, Scott [mailto:scott.kranz@aecom.com]
Sent: Friday, May 11, 2018 9:21 AM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>; Doug Hall <dhall@transmontaigne.com>; Juan Medina <jmedina@transmontaigne.com>
Cc: James A NWP Holm (James.A.Holm@usace.army.mil) <James.A.Holm@usace.army.mil>; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) <Greenfield.Sarah@deq.state.or.us>; Peterson, Lance <petersonle@cdmsmith.com>; Scott Coffey <coffeyse@cdmsmith.com>
Subject: RE: Seaport Portland Terminal SCR Special Conditions Response sf5.

Sean

Thanks again for the quick response. Yesterday we conducted a site walk with the contractors proposing to conduct the maintenance dredge. May 24 appears to be the best day for our team.

The comments appear to require Seaport to conduct a remedial action. Seaport is not a responsible party in the Portland Harbor Superfund Site.

Scott Kranz, RG

Senior Project Manager

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scott.kranz@aecom.com <mailto:scott.kranz@aecom.com>

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From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Thursday, May 10, 2018 11:34 AM
To: Kranz, Scott; Doug Hall; Juan Medina
Cc: James A NWP Holm (James.A.Holm@usace.army.mil <mailto:James.A.Holm@usace.army.mil>); Sarah Greenfield (Greenfield.Sarah@deq.state.or.us <mailto:Greenfield.Sarah@deq.state.or.us>); Peterson, Lance; Scott Coffey
Subject: RE: Seaport Portland Terminal SCR Special Conditions Response sf5.

Scott, Understood that you don't intend to perform any final remedial action for any particular site under the 404 permit. However, the comments stand as is regardless of degree of implementation of the ROD. That said, I'd be happy to go over our comments on call with you.

Please propose times you'd be available on 5/21, 5/24, 5/25 (am) and I'll work with our team so we can hear how you will address these issues under the permit.

Thank you.

S

Sean Sheldrake RPM, Unit Diver Officer

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Blockedhttps://www.epa.gov/superfund/portland-harbor <Blockedhttps://www.epa.gov/superfund/portland-harbor>

From: Kranz, Scott [mailto:scott.kranz@aecom.com]
Sent: Thursday, May 10, 2018 10:41 AM
To: Sheldrake, Sean <sheldrake.sean@epa.gov <mailto:sheldrake.sean@epa.gov> >; Doug Hall <dhall@transmontaigne.com <mailto:dhall@transmontaigne.com> >; Juan Medina <jmedina@transmontaigne.com <mailto:jmedina@transmontaigne.com> >
Cc: James A NWP Holm (James.A.Holm@usace.army.mil <mailto:James.A.Holm@usace.army.mil>) <James.A.Holm@usace.army.mil <mailto:James.A.Holm@usace.army.mil> >; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us <mailto:Greenfield.Sarah@deq.state.or.us>) <Greenfield.Sarah@deq.state.or.us <mailto:Greenfield.Sarah@deq.state.or.us> >; Peterson, Lance <petersonle@cdmsmith.com <mailto:petersonle@cdmsmith.com> >; Scott Coffey <coffeyse@cdmsmith.com <mailto:coffeyse@cdmsmith.com> >
Subject: RE: Seaport Portland Terminal SCR Special Conditions Response sf4

Sean

Thanks for providing some early responses quickly.   The maintenance dredging and temporary cover are not intended to be the final remedial action for AOPC-8 and Seaport Midstream Partners LLC is not the responsible party. The comment questions appear to be directly related to conditions necessary for final remedial action necessary to comply with the ROD, which is not the intent of the maintenance dredging and temporary cover.   Can you please provide information describing how the comments relate to maintenance dredging and temporary cover installation conducted by a terminal operator and not a responsible party? An important element is that the Portland Harbor Superfund Site cleanup has not started.

I suggest a conference call to discuss the comments and how to best resolve the comments to allow maintenance dredging.

Scott Kranz, RG

Senior Project Manager

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From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Wednesday, May 09, 2018 1:44 PM
To: Kranz, Scott
Cc: James A NWP Holm (James.A.Holm@usace.army.mil <mailto:James.A.Holm@usace.army.mil>); Sarah Greenfield (Greenfield.Sarah@deq.state.or.us <mailto:Greenfield.Sarah@deq.state.or.us>); Peterson, Lance; Scott Coffey
Subject: FW: Seaport Portland Terminal SCR Special Conditions Response sf4

Scott, EPA took a cursory look at your submittal. In the interest of keeping things moving we are passing on a couple preliminary comments for you to start working on (see below). We will continue our review and provide our remaining comments as soon as possible.

Let me know if you have any questions.

Thank you.

S

1. The ROD requires all caps to have sufficient armor material to protect against erosive forces resulting from wind and vessel generated waves, current, or propeller wash. The armor layer in the 90% Design Package is designed to withstand propwash effects and 100-year flood river current, but effects from wave-induced current have not been evaluated. It is possible that the current design of armor layer sizing will be sufficient, but erosion due to wind and vessel generated waves needs to be evaluated to confirm that appropriate armor layer sizing and thickness is being implemented. Additionally, the evaluation of the 100-year flood river currents is lacking details such as the armor layer thickness required, which need to be provided in design documents.
2. The physical stability and chemical concentration of the slope is unclear. A slope stability evaluation is needed in the design submittal. Additionally, a better explanation of the expected chemical concentrations in sediments in the sloughed slope is also needed. Regarding the slope stability evaluation, Attachment C of the 90% Design Package states that: "The slope behind the dock is expected to slough during dredging and will reach equilibrium naturally during dredging." The slough slope is estimated to be 1.5H:1V and this material will be removed during dredging. No evaluations have been included to support the estimated slope and its stability. There needs to be a fair level of confidence that the slope will remain stable and will not slough over the cap after it is placed. Regarding chemical concentrations, this information is needed to demonstrate that unacceptable concentrations of COCs in the subsurface sediments will not be exposed at project completion. Given the project schedule, evaluation of data in the October 2017 Sediment Characterization Report as well as the Portland Harbor FS database should be performed. Attachment C states that sediment cores were inspected but the findings are not presented or discussed quantitatively. If the COCs in the sloughed slope are shown to likely exceed ROD RALs, then the sediment cannot be left in place without being removed or covered with a stable sand/amended layer.

Sean Sheldrake RPM, Unit Diver Officer

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From: "Kranz, Scott" <scott.kranz@aecom.com <mailto:scott.kranz@aecom.com> >
To: "Karl Bernard (kbernard@transmontaigne.com <mailto:kbernard@transmontaigne.com>)" <kbernard@transmontaigne.com <mailto:kbernard@transmontaigne.com> >, "Jim Dugan" <jdugan@transmontaigne.com <mailto:jdugan@transmontaigne.com> >, "Juan Medina" <jmedina@transmontaigne.com <mailto:jmedina@transmontaigne.com> >, "Doug Hall" <dhall@transmontaigne.com <mailto:dhall@transmontaigne.com> >, "Holm, James A CIV USARMY CENWP (US)" <James.A.Holm@usace.army.mil <mailto:James.A.Holm@usace.army.mil> >, "Sheldrake, Sean" <sheldrake.sean@epa.gov <mailto:sheldrake.sean@epa.gov> >
Cc: "Carbonneau, Kristine" <Kris.Carbonneau@aecom.com <mailto:Kris.Carbonneau@aecom.com> >, "Bridges, Kerri" <Kerri.Bridges@aecom.com <mailto:Kerri.Bridges@aecom.com> >, "Clodfelter, Andy" <Andy.Clodfelter@aecom.com <mailto:Andy.Clodfelter@aecom.com> >
Subject: RE: Seaport Portland Terminal SCR Special Conditions Response

Please use this copy. Two sheets were incorrectly located in the first.

Sorry for multiple emails.

Scott Kranz, RG

Senior Project Manager

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From: Kranz, Scott
Sent: Tuesday, May 01, 2018 4:45 PM
To: Karl Bernard (kbernard@transmontaigne.com <mailto:kbernard@transmontaigne.com>); Jim Dugan; Juan Medina; Doug Hall; 'Holm, James A CIV USARMY CENWP (US)'; Sheldrake, Sean
Cc: Carbonneau, Kristine; Bridges, Kerri (Kerri.Bridges@aecom.com <mailto:Kerri.Bridges@aecom.com>); Clodfelter, Andy (Andy.Clodfelter@aecom.com <mailto:Andy.Clodfelter@aecom.com>)

EPA Comments on 90% Design

2018-06-04

(Relevant Passage Outlined in Red)

EPA Comments on the 90% Design Package and Temporary Cover Modeling Memorandum Seaport Portland Terminal Memorandum Dated May 1, 2018

Comments dated June 4, 2018

The following are EPA comments on the *Seaport Portland Terminal 90% Design Package* (Appendix B) *and Temporary Cover Modeling Memorandum* (Appendix C), dated May 21, 2018 and prepared by AECOM on behalf of SeaPort Midstream Partners, LLC (Seaport). These two appendices were provided to EPA by AECOM as part of a response letter titled *Additional Information Requested to Address SEF/EPA Cleanup Special Condition Categories in the PSET Suitability Determination Memorandum (USACE Permit No.: NWP-2006-946) for Maintenance Dredging at the SeaPort Midstream Partners, LLC Portland Terminal in the Lower Willamette River, Portland, Oregon.* EPA has the following comments related to the two appendices.

Appendix B – 90% Design Package

General Comments

1. EPA requests the turbidity monitoring process include the following elements to ensure that effective management of sediment remobilization during the in-water construction. If any of these elements are inconsistent with the forthcoming Section 401 Water Quality Certification (WQC) issued by DEQ then the 401 WQC should be followed.

    a. At the downstream monitoring station, turbidity shall not exceed 5 nephelometric turbidity units (NTU) over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU. At no time should turbidity exceed 50 NTU over background. Should this occur, then all in-water activities shall cease immediately.

    b. Background turbidity will be established prior to the start of any active in-water work. A minimum of seven independent measurements at all applicable water depths will be made at the upstream monitoring station over the course of a two-day period just prior to construction initiation. For NTU measurements, the 90th percentile upper confidence limit on the mean will be used to represent initial background conditions.

    c. As the Lower Willamette River is tidally influenced, if flow reversal is observed to occur during monitoring, then the sampling stations will be reversed to continue the down-current and up-current (for background conditions) pattern as appropriate. Measurements of current velocities and/or turbidity plumes will be required to confirm field observations and decisions on monitoring locations relative to tidal influence.

d. Turbidity exceedances will be reported as soon as possible on the day of measurement verbally or by email to EPA so that response decisions can be coordinated. As noted above, all in-water activities shall cease immediately if there is a turbidity exceedance. Work shall not resume until turbidity levels have returned to compliant levels and approval has been given by EPA.

e. In addition to turbidity curtains a debris boom will be used to contain any debris displacement resulting from dredging operations.

f. The cause of any observed silt plume generated by construction activities will be assessed and appropriate measures (e.g., change production rates, modify work schedule, perform work on a slower flow, etc.) will be taken in consultation with EPA to correct an identified problem if project operations are determined to be the source.

g. Sampling depths for turbidity should be located at the approximate top, middle, and bottom of the water column if the water depth permits collecting samples from three intervals separated by at least 5 feet from each other. Top and bottom samples will be taken 1 foot below the surface of the water and above the mud line, respectively. Thus, for water depths less than 7 feet, two samples will be collected and for water depths less than 2 feet, one sample will be collected.

2. The results of analytical testing on temporary cover material samples, including armor layer, should be compared with the January 2017 Portland Harbor Cleanup Levels provided in Table 17 of the ROD. Appropriate analytical methods should be used to ensure that laboratory detection limits are below each of the contaminant cleanup levels in the table. If the source of temporary cover materials is an upland quarry with no suspected anthropogenic impacts, then the analytical suite can be limited to only the metals listed on Table 17.

Specific Comments

1. **Section 01561. Spill Prevention and Emergency Response. 3.2 Spill Response Measures.** The text states that: “The Contractor shall default to the measures of their SPCC plan for the Work Site and immediately notify Terminal Personnel if any spill or sheen passes the secondary absorbent/hard booms that encompass the work area.” Revise to include text that EPA will be notified if sheens are observed outside the work area.

2. **Section 02080. Sediment Handling and Dewatering. 1.8 Waste Disposal, bullet B.** The composite sediment sample waste characterization results summarized in the table should include PAHs which are a site COC and were measured in the composite sediment samples.

3. **Section 02325. Dredge and Marine Work. 2.2 Backfill Material.** This section states that the largest size of armor stone will be 2.5 inches. That is less than the largest armor stone size determined in the propeller wash evaluations which was 2.7 inches. The largest size of the armor stone should be at least 2.7 inches and the armor layer

should consist of material designed to minimize adverse impacts on biological resources.

4. **Section 02325. Dredge and Marine Work. 3.2 Amended Backfill Placement, item D., Item 2.** The text states that: "For the combined sand/active materials (i.e., amended cover), the average thickness shall be 6 inches with a minimum thickness of 4 inches and a maximum thickness of 8 inches." The minimum thickness of the amended cover should be 6 inches which was used in the amended layer modeling. The maximum thickness would be established by navigation requirements.

Attachment C – Temporary Cover Modeling Memo

General Comments

Note: The first two general comments were previously transmitted by EPA to AECOM via email on May 9, 2018 and are being included with this comprehensive comment set for completeness.

1. The ROD requires all caps to have sufficient armor material to protect against erosive forces resulting from wind and vessel generated waves, current, or propeller wash. The armor layer in the 90% Design Package is designed to withstand propwash effects and 100-year flood river current, but effects from wave-induced current have not been evaluated. It is possible that the current design of armor layer sizing will be sufficient, but erosion due to wind and vessel generated waves needs to be evaluated to confirm that appropriate armor layer sizing and thickness is being implemented. Additionally, the evaluation of the 100-year flood river currents is lacking details such as the armor layer thickness required, which need to be provided in design documents.

2. The physical stability and chemical concentration of the slope is unclear. A slope stability evaluation is needed in the design submittal. Additionally, a better explanation of the expected chemical concentrations in sediments in the sloughed slope is also needed. Regarding the slope stability evaluation, Attachment C of the 90% Design Package states that: "The slope behind the dock is expected to slough during dredging and will reach equilibrium naturally during dredging." The slough slope is estimated to be 1.5H:1V and this material will be removed during dredging. No evaluations have been included to support the estimated slope and its stability. There needs to be a fair level of confidence that the slope will remain stable and will not slough over the cover after it is placed. Regarding chemical concentrations, this information is needed to demonstrate that unacceptable concentrations of COCs in the subsurface sediments will not be exposed at project completion. Given the project schedule, evaluation of data in the October 2017 Sediment Characterization Report as well as the Portland Harbor FS database should be performed. Attachment C states that sediment cores were inspected but the findings are not presented or discussed quantitatively. If the COCs in the sloughed slope are shown to likely exceed ROD RALs, then the sediment cannot be left in place without being removed or covered with a stable sand/amended layer.

3. Per EPA's *Guidance for In-Situ Subaqueous Capping of Contaminated Sediment* (USEPA, 1998), proper assessment of the ability of the underlying sediments to support a cap is a critical geotechnical component in a cover design. Bearing capacity

and slope stability need to be analyzed to demonstrate the stability of the cover and underlying sediments. Data collected during the September 2017 sampling could potentially be used to aid in such calculations. This would also provide confidence in the modeling assumption that there is no consolidation in the underlying sediments.

4. The armor layer is currently being modeled as a six-inch sand layer above the amended layer. The sand layer is not a reasonable surrogate for the armor layer for modeling chemical isolation. A better approach would be to model concentrations at the amended cover/armor layer interface which provides a more realistic estimate of chemical isolation. This would also be protective of the organisms that move into the voids of the armor layer.

5. Cover performance is being evaluated at a depth of 10cm below the top of the cover, under the bioturbation layer, which would be within the armor layer. As discussed in the comment above, this is not representative of the actual design of the cover and bioturbation will likely not take place on the surface of the armor layer but at the interface of the amended cover and armor layer.

   EPA's contractor, CDM Smith, conducted an independent evaluation by modeling the amended layer for the four cover options without including the 6-inch armor layer. The results indicate that the amended layer is protective for at least 40 years and there is no exceedance of ROD cleanup levels in the top 10 cm for that period. Based on this conservative evaluation, EPA does not require any changes to the temporary cover design because implementation of the ROD remedy will occur at this location much sooner than 40 years. However, Seaport should be cognizant that their modeling is not considered representative of actual conditions and a better approach would be to model concentrations at or below the amended cover/armor layer interface.

6. Four cover design options are modeled but there is no indication of a preferred option. EPA understands that the ultimate decision of material is to be made by the contractor, but the document should identify and discuss which cover design is more protective in relation to the others based on the modeling results.

7. Elevated dioxin concentrations were also measured in the 2017 sediment sampling and have been identified as a site COC. Discuss the rationale for excluding dioxin in the modeling evaluation.

Specific Comments

1. **Page 1, Introduction.** The last sentence ends abruptly with "and", and it seems that a bullet point may have omitted. Revise as appropriate.

2. **Page 2, Temporary Cover Breakthrough Modeling, last bullet point.** Discuss the rationale for using AASHTO #8 for mixing with the AquaGate+PAC5% instead of just using sand, as was done for the GAC bulk mixture.

3. **Page 2, Model Input, 3rd paragraph.** A citation for the groundwater modeling report being discussed should be added to the references.

4. **Page 2, Model Input, last paragraph.** The text states that: “For Total PCBs, Freundlich coefficients for activated carbon were based on Gomez-Eyles et al., 2013. The average of the reported values for the congeners was used (log Kf of 8.48).” Was the Freundlich 1/n value also averaged? Provide clarification.

5. **Page 3, Temporary Cover Propwash Modeling and Material Gradation, 1st paragraph.** The text should discuss how the Mean Low Low Water (MLLW) was used in the armor calculations presented in this section.

6. **Page 3, Propeller Wash Stone Calculation, 2nd paragraph.** The text states that: “The Tidewater Crown Point tug was evaluated at a 70% engine use after speaking with site personnel about how the tug operates at the terminal.” Clarify what personnel from which organization were consulted and/or provide a formal citation for this information.

7. **Page 3, Propeller Wash Stone Calculation, 3rd paragraph.** The mean velocity near River Mile 5 provided in the cited FEMA, 2010 source is 3.6 ft/sec for a 100-year flood. Provide an explanation why was a velocity of 2.5 ft/sec used. Additionally, the table in Appendix A is an assumed value. Provide clarification/justification of using 2.5 ft/sec.

8. **Page 4, Filter Layer Sizing.** It seems the design equation provided in EPA’s *Guidance for In-Situ Subaqueous Capping of Contaminated Sediment* was not used for the filter design. The source for the filter layer design criteria for retention, permeability, and internal stability should be provided.

9. **Appendix A.** This appendix should present the equations that are being referenced in the table. Additionally, all the data used for calculating the armor stone size for river current, and the armor layer thickness for river current should also be presented. Also see general comment 1 above. Sources for constants, coefficients, and safety factors should be cited if different from the Blaauw and Kaa, 1978 study.

10. **Appendix B.** The title for Appendix B is missing so EPA assumes that the sheets with the title “Soil Filter Calculations” are all meant to be part of Appendix B. All gradation information sheets are titled “Sand for GAC Cover” and should provide more information so the material being presented can be easily identified. Additional information should include which material the gradation curve is for, and whether it is the measured gradation of the material or literature derived.

11. **Table 1, note at bottom of table.** Provide the rationale for using the Koc values for pyrene and fluoranthene to represent total PAHs in the model.

12. **Table 3.** The notes for the partition coefficient, Freundlich coefficients, and molecular diffusivity should indicate exactly which PAH was used for the respective value being used in the model. The value of dry bulk density of AquaGate+PAC and 2% activated carbon provided by the vendor, and a source for the equation used to estimate dispersivity should also be provided in the notes. Additionally, the bulk density being used for the sand and underlying sediment layer is identical (1.56 g/cm^3). While this

will not significantly affect the model results, it should be noted that it is likely not a true representation of the system.

EPA Comments Regarding Methodology for Chemical Breakthrough Modeling

2018-10-04

(Relevant Passage Outlined in Red)

From: Sheldrake, Sean
To: Kranz, Scott
Cc: Holm, James A CIV USARMY CENWP (US); White, Melody J CIV USARMY CENWP (US); GREENFIELD Sarah; n cky.moody@aecom.com
Subject: [Non-DoD Source] FW: Portland Terminal SAP Amendment (NWP-2006-946) 404 sf 3
Date: Thursday, October 04, 2018 1:44:30 PM
Attachments: Portland Terminal SCR to SEF no appendices.pdf Duplicate Withheld

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Scott,

The proposed approach of using the highest concentrations from the dredge prism and Z-layer results for temporary cover modeling is acceptable to EPA EPA assumes that this will be the highest concentration for each COC selected from both data sets combined (please respond if this assumption is not correct) EPA understands that this approach will be used instead of conducting chemical characterization of the slope, therefore a cover design should have conservative assumptions for chemical isolation as discussed below

Because there is no quantitative way to confirm that Z-layer concentrations in the slope will not be greater than concentrations measured in the dredge prism and Z-layer, the cover needs to be conservatively designed with a factor of safety or for a longer design life As stated in the June 2018 EPA comments on the Temporary Cover Modeling Memorandum, a "sand layer is not a reasonable surrogate for the armor layer for modeling chemical isolation A better approach would be to model concentrations at the amended cover/armor layer interface which provides a more realistic estimate of chemical isolation " This expected approach would also provide a more conservative estimate for the chemical isolation capabilities of the cover

Let me know if you have any questions

Thank you

S

Sean Sheldrake RPM, Unit Diver Officer
U S Environmental Protection Agency
1200 Sixth Avenue, Suite 155, M/S DOC-01
Seattle, WA 98101
206 553 1220 desk
206 225 6528 cell
Blockedhttps://www epa gov/scientific-diving
Blockedhttps://www facebook com/EPADivers
Blockedhttps://www epa gov/superfund/portland-harbor

-----Original Message-----
From: Kranz, Scott [mailto scott kranz@aecom com]
Sent: Monday, October 1, 2018 3:53 PM
To: Sheldrake, Sean <sheldrake sean@epa gov>
Cc: Scott Coffey <coffeyse@cdmsmith com>; Peterson, Lance <petersonle@cdmsmith com>; James A NWP Holm (James A Holm@usace army mil) <James A Holm@usace army mil>; White, Melody J NWP <Melody J White@usace army mil>; GREENFIELD Sarah <Sarah GREENFIELD@state or us>
Subject: RE: Portland Terminal SAP Amendment (NWP-2006-946) 404 sf

Sean

We can't quantitatively substantiate COC concentrations of the side slope Z-layer won't be greater than the concentrations already detected in sediment samples collected from the main dredge prism or bottom z-layer However, based on our understanding of the site, the sediment under the dock and immediately up slope of the dock was deposited at the same time as the sediment immediately in front of the dock We expect sediment sample COC concentrations from a z-layer sample collected adjacent to the upslope side of the dock to be similar to the dredge prism and z-layers samples collected on the downslope side of the dock We thought this could allow the temporary cover on the slope to be designed using greatest COC concentration from the combined data set from the dredge prism and z-layer sediment sample results

The dredge prism and z-layer sediment sample results were provided in the Sediment Characterization Report, attached, which was completed when BP was the property owner We are proposing to use the highest COC detection from both dredge prism and z-layer samples from the previous sampling conducted immediately in front of the dock to represent the conditions immediately behind the dock Please let me know if the proposed use of the highest COC concentration from dredge prism and Z-layer samples presented in the Sediment Characterization Report is acceptable for design of the temporary cover on the slope

Thanks

Scott Kranz, RG
Senior Project Manager
D 503-478-2764 C 503-816-6643
scott kranz@aecom com

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111 SW Columbia St , Suite 1500, Portland, Oregon 97201-5850 T 503 222 7200 F 503 222 4292 Blockedhttps://urldefense proofpoint com/v2/url?u=http-3A www aecom com&d=DwIFAw&c=NpiPIT1KNSO0vXgGk6ogJQ&r=bXD tP7AI24WWnaLcT69ppOlLynPKkgCXN0HEH8pq8M&m=F2rN0o4-JI6vbDqYars2PFU8J- 33FEZQ-lDEirOTmU&s=kX65s04jkn8wGNUd51 gHvnqyJ3s-TYEfgSl6UVRP9M&e=

-----Original Message-----
From: Sheldrake, Sean [mailto:sheldrake sean@epa gov]
Sent: Monday, October 01, 2018 12:23 PM
To: Kranz, Scott
Cc: Scott Coffey; Peterson, Lance; James A NWP Holm (James A Holm@usace army mil); White, Melody J NWP; GREENFIELD Sarah
Subject: FW: Portland Terminal SAP Amendment (NWP-2006-946) 404 sf

Scott and Nicky,

Thanks for asking EPA about use of the existing sediment chemistry data for the temporary cover breakthrough modeling Can you confirm that this is the Z-layer data presented in the 90% Design and Cover Modeling Tech Memo (dated 5/1/18)? If this is not the data that you are referencing, can you provide a summary table of the data?

Additionally, can you substantiate through the CSM or other data that the proposed side slope Z-layer sampling will not have COC concentrations higher than the existing data? If the side slope had higher COC concentrations EPA would request that these data be used in the temporary cover modeling Feel free to reach out with any questions

Thank you

S

Sean Sheldrake RPM, Unit Diver Officer
U S Environmental Protection Agency
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206 553 1220 desk
206 225 6528 cell
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Blockedhttps://urldefense proofpoint com/v2/url?u=https-3A   www epa gov superfund portland-2Dharbor&d=DwIFAw&c=NpiPIT1KNSO0vXgGk6ogJQ&r=bXD tP7AI24WWnaLcT69ppOlLynPKkgCXN0HEH8pq8M&m=F2rN0o4-JI6vbDqYars2PFU8J- 33FEZQ-lDEirOTmU&s=SAAA03xi-xO2h2PagVjhK3pcUO1BPDTqU9ssJWXfEjE&e=

-----Original Message-----
From: Kranz, Scott [mailto scott kranz@aecom com]
Sent: Tuesday, September 25, 2018 1:05 PM
To: Holm, James A CIV USARMY CENWP (US) <James A Holm@usace army mil>; Sheldrake, Sean <sheldrake sean@epa gov>; Moody, Nicky <nicky moody@aecom com>
Cc: White, Melody J CIV USARMY CENWP (US) <Melody J White@usace army mil>; Peterson, Lance <petersonle@cdmsmith com>; Scott Coffey <coffeyse@cdmsmith com>; GREENFIELD Sarah <Sarah GREENFIELD@state or us>
Subject: RE: Portland Terminal SAP Amendment (NWP-2006-946) 404 sf

James and Sean

We appreciate the comments and feedback   Our goal is to provide the USACE and EPA the necessary technical information to support the project   The geotechnical field work is scheduled the week of October 8   Our team had a meeting this morning to finalize plans for the geotechnical field work and plan for the geotechnical data analysis, slope stability analysis, and temporary cover design   We would like to use the existing sediment chemistry results to conduct the temporary cover chemical break through modeling   We would use the highest concentrations from the sediment samples collected under the previously approved SAP to conduct the modeling   Is this an acceptable approach for the USACE and EPA?

Thanks

Scott Kranz, RG
Senior Project Manager
D 503-478-2764   C 503-816-6643
scott kranz@aecom com

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111 SW Columbia St , Suite 1500, Portland, Oregon 97201-5850 T 503 222 7200 F 503 222 4292 Blockedhttps://urldefense proofpoint com/v2/url?u=http-3A   www aecom com&d=DwIFAw&c=NpiPIT1KNSO0vXgGk6ogJQ&r=0BnpZqAWXWSayq3J9N8bmYdKDREStDyIwtwPDEpGPXw&m=om3fqiOORExg29zQxe7rqsOB2FCB0N-ovkub49Of8Ds&s=FVm1Vs57oFLpQdT4XfYZ1M2n qV1YcsLC7P7jYVM4dc&e=

Updated JPA Package Cover Letter and Application

2019-04-08

AECOM
111 SW Columbia St., Suite 1500
Portland, OR 97201
aecom.com

April 8, 2019

Melody White
Project Manager, Regulatory Branch
U.S. Army Corps of Engineers
Portland District
333 S.W. First Avenue
Portland, OR 97208

RE: Updated Joint Permit Application Package, Sediment Evaluation Framework Documentation, and Response to Public Notice Comments for Maintenance Dredging at the SeaPort Midstream Partners, LLC Portland Terminal in the Lower Willamette River, Portland, Oregon (Corps # NWP-2009-946-3)

Dear Ms. White:

AECOM Technical Services (AECOM) is submitting the enclosed updated Joint Permit Application (JPA), Sediment Evaluation Framework Documentation, and Responses to Public Notice Comments received by the US Army Corps of Engineers (Corps) on behalf of SeaPort Midstream Partners, LLC (SeaPort) for the Portland Terminal Maintenance Dredging Project. The Portland Terminal is owned by SeaPort and operated by TransMontaigne Management Services LLC (TMS LLC).

The original JPA was submitted on December 15, 2017 (Corps No.: NWP-2006-946) with the following clarifying documents submitted to support the Corps and Portland Sediment Evaluation Team (PSET) review process:

- February 2, 2018 letter to clarify property ownership and clearly demonstrate SeaPort is not a Portland Harbor Superfund Site (PHSS) potentially responsible party (PRP);
- May 1, 2018 memo providing additional information requested by the PSET and United States Environmental Protection Agency (EPA) including:
    - Pre-Dredge Hydrographic Study
    - 90% Design Package (including plans and specifications); and
    - Temporary Cover Modeling Memo
- May 22, 2018 memo addressing preliminary comments from the EPA on the 90% Design Package (submitted on May 1, 2018).

A revised JPA was submitted to the Corps on January 7, 2019. The revised JPA addressed EPA comments provided on June 4, 2018.

AECOM received formal comments from the Corps on the January 7, 2019 submittal on March 11, 2019. The attached JPA permit package and Response to Comments document demonstrate where agency and tribal comments have been addressed. The proposed maintenance dredging and temporary cover action applies means and methods previously approved by the Oregon Department of Environmental Quality (DEQ) and EPA at other remediation sites on the Willamette River while meeting the Sediment Evaluation Framework (SEF) requirements for a maintenance dredging permit. The project is projected to require the full in-water work period from July 1 through October 31, 2019. The applicant appreciates an expedited permit package review and approval to allow SeaPort the necessary time to secure bids for construction, pre-construction submittal processing, and mobilization prior to the July 1, 2019 in-water work start-up date.

As requested by the Corps, the following documents are provided:

- Updated Joint Permit Application (This JPA is the same version that was sent by carbon copy to the Corps when addressing Oregon Department of State Lands comments on March 15, 2019. We have resubmitted this version with this submittal for your convenience).
- Updated 100% Design Package (including plans and specifications)
- Attachments:
    - Attachment A – Revised Temporary Cover Modeling Memorandum for the SeaPort Terminal Maintenance Dredging Project (March 15, 2019)
    - Attachment B – Revised Dredge Slope Stability Analysis at SeaPort Midstream Portland Terminal (April 3, 2019)
    - Attachment C - Responses to Public Notice comments on the revised Joint Permit Application package submitted on January 7, 2019

There are have been no changes to the Biological Assessment, Biological Assessment Amendment Letter, or Cultural Resources Assessment from the previous January 2019 submittal so these documents have not been enclosed. We look forward to the Corps authorization and coordinating with the Corps, EPA, and other regulatory agencies during the maintenance dredging project. Please contact me at 503-478-2764 if you have any questions.

Yours sincerely,

Scott Kranz

Scott Kranz
Senior Project Manager
AECOM
T: 503-478-2764
M: 503-816-6643
E: scott.kranz@aecom.com

cc: Juan Medina, agent for SeaPort Midstream Partners, LLC
Jim Dugan, TransMontaigne Management Services, LLC
Karl Bernard, TransMontaigne Management Services, LLC
Doug Hall, TransMontaigne Management Services, LLC
Michael Hammell, TransMontaigne Management Services, LLC

Joint Permit Application

This is a joint application, and must be sent to both agencies, who administer separate permit programs. Alternative forms of permit applications may be acceptable; contact the Corps and DSL for more information.

Date Stamp

U.S. Army Corps of Engineers Portland District	Oregon Department of State Lands
Corps Action ID Number: NWP-2006-946-1 (former)	DSL Number: 60800-RF

(1) TYPE OF PERMIT(S) IF KNOWN (check all that apply)

Corps: ☒ Individual ☐ Nationwide No.: _______ ☐ Regional General _______ ☐ Other _____________

DSL: ☒ Individual ☐ General Permit ☐ No State Permit Required ☐ Waiver

(2) APPLICANT AND LANDOWNER CONTACT INFORMATION

	Applicant	Property Owner (if different)	Authorized Agent (if applicable) ☑ Consultant ☐ Contractor
Name (Required)	Michael Hammell		Andy Clodfelter
Business Name	TLP Management Services LLC		AECOM
Mailing Address 1	PO Box 5660		111 SW Columbia St.
Mailing Address 2			Suite 1500
City, State, Zip	Denver, CO 80217		Portland, OR 97201
Business Phone	303-626-8200		503-948-7234
Cell Phone			
Fax	303-626-8228		503-222-4292
Email	mhammell@transmontaigne.com		andy.clodfelter@aecom.com

(3) PROJECT INFORMATION

A. Provide the project location.

Project Name	Latitude & Longitude*
Portland Terminal Maintenance Dredging	45.5948°, -122.7782°

Project Address / Location	City (nearest)	County
9930 NW St. Helens Road (Highway 30)	Portland, OR (Linnton)	Multnomah

Township	Range	Section	Quarter / Quarter	Tax Lot
1N	1W	2C	NE/SW	N/A (in-water, adjacent to 400)

Brief Directions to the Site:
From Portland, take US Highway 30 north for 7.5 miles. The site is approximately 1 mile north of the St. Johns Bridge. Approximately 0.5 mile before Linnton, turn right into the Portland Terminal facility (opposite NW Hoge Ave.).

B. What types of waterbodies or wetlands are present in your project area? (Check all that apply.)

☑ River / Stream ☐ Non-Tidal Wetland ☐ Lake / Reservoir / Pond

☐ Estuary or Tidal Wetland ☐ Other ☐ Pacific Ocean

Waterbody or Wetland Name**	River Mile	6th Field HUC Name	6th Field HUC (12 digits)
Willamette River	4.9	Willamette River	170900120202

* In decimal format (e.g., 44.9399, -123.0283)
** If there is no official name for the wetland or waterbody, create a unique name (such as “Wetland 1” or “Tributary A”).

C. Indicate the project category. (Check all that apply.)		
☐ Commercial Development	☐ Industrial Development	☐ Residential Development
☐ Institutional Development	☐ Agricultural	☐ Recreational
☐ Transportation	☐ Restoration	☐ Bridge
☑ Dredging	☐ Utility lines	☐ Survey or Sampling
☐ In- or Over-Water Structure	☑ Maintenance	☑ Other: Temporary cover layer placement

(4) PROJECT DESCRIPTION

A. Summarize the overall project including work in areas both in and outside of waters or wetlands.

Dredging Dimensions and Volumes:

The proposed project includes maintenance dredging at the facility dock to reestablish original berth elevations (depths) for docking current and future vessels. The facility dock has a 2.1-acre berth area—approximately 880 feet long (measured parallel to the navigation channel) and 105 feet wide (from the dock face to just beyond the navigation channel). Approximately 1.1 acres of the 2.1-acre berthing area is proposed to be dredged.

The project objective is to lower the substrate elevation within the berthing area to a final elevation of -34 feet Columbia River Datum (CRD). This will require dredging to -35 feet CRD so that a 1-foot temporary cover layer (up to 1,850 cubic yards [cy] of material) can be placed over the post-dredge sediment surface to achieve a final elevation of -34 feet CRD. The dredge prism includes the berthing area as well as side slopes that need to be dredged to facilitate slope stability and material placement. Side slopes of the dredge prism will be dredged to achieve a final slope of 1.5H:1V, which has been modeled to be stable[1]. Most of the side slope dredging will occur along deeper portions of the slope (<-20 feet CRD). Where dredging occurs on the side slopes to reduce slope angles to 1.5H:1V, a minimum 18-inch thick temporary cover will also be placed as described below.

Dredging of the berthing area and side slopes will remove approximately 9,400 cy of material. Incorporating additional allowance for an over-dredge depth of one foot, the maximum removal volume for the dredge prism is 12,100 cy of sediment. It is possible that dredging activities could inadvertently dredge as much as 2 feet beyond the target depth (to -37 feet CRD) in certain locations. If some areas are unintentionally dredged deeper than -35 feet CRD, the contractor would still just place a one-foot cover layer over those areas. Since the contractor will not be compensated for any costs associated with dredging over 6 inches beyond the dredge design depth or for dredging outside of the prescribed dredge prism limits, we anticipate that the final post-dredging surface will be very close to meeting the design depths described above.

Based on a 2017 bathymetric survey, elevations within the berthing area range from -20 feet CRD at the far northwest boundary and descend to -40 feet CRD near the southern boundary. The potential future navigation channel elevation (outside of the berthing area) is -48 feet CRD. River sediment elevations are variable at this site; the target dredge depth will require dredging between 1 and 15 feet of sediment within the dredge prism.

The applicant is required to maintain suitable berthing depths to meet contractual obligations. Thus, the requested permit durations (10 years for the Corps and 5 years for DSL) will allow the applicant the option to perform additional maintenance dredging if sediment in-fill occurs within the berthing area more quickly than anticipated during this time period. Although additional dredging is unlikely within the permit duration based on the dredging history at this site and the design vessel draft, portions of the berthing area are depositional and the applicant requests flexibility to be able to maintain sediment depths at their terminal. This additional dredge event would involve mechanical dredging down to an elevation of -34 feet (to the elevation of the proposed cover layer) and a total removal volume of up to 5,000 cy of sediment (based on historical sediment accretion rates). If necessary, the additional dredging would also adhere to SEF and EPA requirements and be performed in a similar manner as the initial dredging event described herein. If future dredging is needed in areas where the temporary cover is not present, then a permit modification would be prepared to request authorization to place additional temporary cover material.

Temporary Cover Layer:

Based on the sediment sampling results within the dredge prism and leave surface, the PSET suitability determination, and subsequent discussions with EPA, a 1-foot thick cover layer will be placed over the post-dredge surface in the berthing area after the initial dredging event, consistent with the EPA's ROD recommendations for the cleanup of the

[1] AECOM 2018. Dredge Slope Stability Analysis at Seaport Midstream Portland Terminal. Prepared for TransMontaigne Management Services, LLC. December 18, 2018.

Portland Harbor Superfund Site. The cover material will consist of a carbon-amended layer of up to 6 inches thick with a minimum 6-inch thick angular gravel overlay (D_{50}=2.7 inches) to reduce potential scour from propeller wash. Modeling results indicated that this gravel size would better resist displacement of the underlying sand layer from propeller wash than a 2.5" D_{50} gravel overlay.[2]

The EPA is requiring sediment contaminant sequestering and armoring of the dredge side slopes to prevent any sediment contaminants from migrating onto the cover layer in the berthing area. AECOM has performed modeling to design a slope cover that would meet ROD requirements. As such, in the side slope area, the carbon-amended layer will consist of 6 inches of granular material (similar to the berthing area) but will be placed into either a stabilizing geosynthetic structure or an activated carbon filled reinforced core mat (RCM/AC). The carbon-amended layer would only be placed on the side-slopes where dredging is required to achieve a 1.5H:1V stable slope. Unamended sand material would be placed on other portions of the side slopes. The sand layer will be covered by a 12.2-inch D_{50} rock layer with 6 inches of 2.5-inch D_{50} rounded gravels overlaying and filling the interstitial spaces between the larger rock to maintain fish habitat. This gravel rock size was selected to approximately meet NMFS's recommended sediment size requirements for optimal habitat[3,4,5] and is the minimum size necessary to ensure that most of the underlying granular material stays in place. It is anticipated that some of the rounded gravels may be washed away by strong currents, waves at low water levels, or from strong propeller wash. However, it is likely that if smaller rock material (<2.5-inch) were placed over the riprap layer, it would be washed away completely and would not protect the underlying material or meet EPA ROD requirements. The carbon amendment is required to sequester dissolved PCB and PAH concentrations (contaminants of concern) from water upwelling through the post-dredge surface. Modeling results suggest the cover layer will prevent the chemical breakthrough and migration of PCBs from the leave surface for over 30 years. The cover layer is intended to function until the final remedy is performed at the site.

Cover materials will be delivered to the site via barge. Materials will be placed using a barge-mounted crane or excavator with a clam-shell bucket, or other similar specialized equipment as determined by the contractor. All cover placement activities for the berthing area will be staged from the water, with no proposed heavy equipment use on the shoreline. For the side slope cover operations, some shoreline equipment may be needed as access to the area is limited.

Different placement methods would be evaluated to determine the best approach for accurately placing material while reducing disturbance of the sediment surface or underlying cover layer. The carbon-amended sand layer will be placed first. It is anticipated that this material would be placed by a mechanical bucket or Telebelt® system but other methods could also be used, depending on feasibility, effectiveness, or to reduce aquatic impacts. For bucket-deployment operations, the bucket would be suspended above the water surface, then opened, and the material would be released through a slow sweeping motion over a pre-determined placement grid. If a Telebelt® system is used, the boom conveyor would be fixed at an appropriate angle established by the operator for deployment, and the conveyor belt speed would be adjusted for accurate placement thickness as established on barge or land. Grid size will be selected in advance to deposit the material in desired lifts. Due to the need to anchor the engineered geosynthetic materials, the deployment of cover material may extend as shallow as -2 feet CRD.

An erosion protection layer will then be installed above the amendment layer to protect it from propeller wash. Effort will be taken to accurately place the cover material. However, some cover materials (particularly finer sand particles in the amendment layer) may drift a short distance (up to 20 feet) outside of the placement area. Further, the cover layer may exceed design depths in certain areas due to the challenges of placing sediment at exact depths in a dynamic river system. Thus, the estimated fill volumes and dimensions provided in Sections 4H and 4I have been calculated to account for potential inaccuracies associated with the placement of cover material in the river. Bathymetric surveys will be completed to ensure that the cover materials are placed across the intended area and at the intended thickness.

In summary, it is projected that the berthing area will require removal of up to 7,550 cy of sediment to achieve an elevation of -35' CRD while the under-dock slope area will require removal of up to 4,250 cy of sediment to achieve a minimum 1.5H:1V slope angle under the dock. In addition, approximately 300 cy of material will be removed near the toe of the slope to form an anchor trench for the geosynthetic material used in the side slope cover construction. In the berthing area, 805 cy of carbon-amended backfill will be placed and overlain with 1,045 cy of protective armor stone. On top of the slope area, 960 cy of carbon-amended backfill or 6,690 square yards (sy) of RCM/AC overlain by 2,950

[2] AECOM 2019. Temporary Cover Modeling for the Proposed SeaPort Terminal Maintenance Dredging Project. Technical Memo to TransMontaigne Management Services LLC. January 7, 2019.

[3] NMFS 2011. Endangered Species Act Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Conservation Recommendations for the ZRZ Realty Company Contaminant Cleanup, Multnomah County, Oregon (6th Field HUC: 170900120302) (COE No. NWP-2007-962).

[4] AECOM 2017. Appendix B to Biological Assessment for PGE RM 13.1 Remedy Implementation Project. RM 13.1 Sediment Capping Project – Existing Site Habitat Conditions and Evaluation of Improvements/Impacts from Remedy Implementation. March 2017.

[5] NMFS 2017. Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for Portland General Electric's River Mile 13.1 Remedy Implementation on the Willamette River (HUC 170900120202), Multnomah County, Oregon (Corps No.: NWP-2015-454/1).

cy of protective armor would be placed. Removal/fill volumes are summarized in Section 4 (F to I). The removal of sediment and placement of backfill will be performed inside of a protective turbidity curtain. Water quality monitoring will be conducted during construction operations, pursuant to federal and state permit conditions.

Sediment materials will not be compacted, as consolidation will be allowed to occur through natural settlement. The top cover layer (2.7” D_{50} angular gravel) would be close to meeting NMFS’ recommended sediment size gradation for optimal habitat; however, the berthing area is located in deep water habitat that does not support optimal foraging habitat for salmonids. The shallow water portions of the side slopes may provide some seasonal rearing and foraging opportunities for juvenile salmonids (particularly Chinook), although most juvenile salmonids are known to obtain most of their prey items from pelagic sources. The 2.5” D_{50} rounded gravel placed over the riprap material would reduce impacts to fish habitat. Further, a previous study conducted at the site found that the side slope adjacent to the dock is generally accretional[6] which suggests that sediment deposition will deposit over the rounded gravel over time, which would help facilitate recolonization of benthic organisms.

As recommended by the EPA for other Portland Harbor sites, one 10-point composite sample of the cover material will be collected (one sample for every 500 cubic yards of fill) prior to delivery to the project site. The sample will be submitted for geotechnical and chemical/analytical tests to characterize the properties of the cover material. The analytical test results will be compared with the Portland Harbor ROD cleanup levels to ensure that the project does not introduce additional contaminants into the system.

The EPA-required temporary cover material cannot be removed without EPA approval and it has been designed to remain effective for up to 100 years, or well after the final remedial action is implemented by the responsible party. The final action is expected to be completed within the next 10-20 years, by the responsible party, but the exact timing of this action is unknown. It is anticipated that removal of the temporary cover material would occur during the recommended ODFW in-water work window. However, the responsible party is responsible for defining remedial action timing, methods, and sediment disposal methods.

B. Describe work within waters and wetlands.

Work within wetlands:

N/A – All work will be performed from floating barges within the Willamette River channel to the extent feasible. Low water levels may require some of the work to be conducted from the shoreline or above the steel sheet pile for access purposes. There are no designated wetlands along the shoreline. Dredged sediments will be placed on a barge and shipped to a permitted transload facility, where the sediment will be transferred to a truck for transport to a RCRA Subtitle D permitted facility for disposal as a non-hazardous contaminated dredged material.

Work within waters:

Dredging of the sediment will be accomplished with a mechanical dredge. A mechanical dredge consists of a crane that is mounted on the deck of a barge. Mechanical dredging uses a bucket to scoop the submerged sediment.

An “environmental” dredge bucket will be used to the extent practicable. These buckets are equipped with rubber seals and special ports that reduce resuspension of residual sediment. Sediment will be dredged from the river and placed on a transfer barge for transport to a transload facility for disposal. Decant water generated during dredging may be dewatered from the barge, pumped to an upland holding tank for treatment and disposal with a permit, or transported with the dredged material to a disposal facility. It may be feasible that the decant water be released back into the river in the vicinity of dredging since sediment concentrations are below their respective elutriate testing trigger levels per SEF guidelines[7]. Decant water on the barge, if discharged, would be filtered through hay bales and geotextile fabric prior to release into the river. Any release of decant water to the river will comply with state and federal water quality criteria. The contractor will ultimately determine how decant water will be managed to ensure compliance with federal, state, and local permit conditions. Prior to transporting the barge, the scuppers will be raised and sealed to prevent water from leaking from the barge during transfer. The initial dredging event is currently planned for 2019 using the mechanical dredging method and standard dredged material transport barges.

C. Construction Methods. Describe how the removal and/or fill activities will be accomplished to minimize impacts to waters and wetlands.

As described above, an environmental dredge bucket is proposed to be used. This type of bucket creates a seal when scooping that encloses the potentially contaminated sediments and minimizes resuspension and spillage back into the water column. If sediment removal is difficult to achieve using an environmental bucket, a clamshell dredge with a

[6] AECOM 2016. Preliminary Engineering Cost Estimate for BP Bulk Terminal 22T Maintenance Dredging and Capping. Technical Memorandum. Prepared for Alana Scoon, BP. December 20, 2016.

[7] https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll11/id/2548

digging bucket or other suitable bucket may be used.

Sediment will be dredged from the river and placed on a sealed barge for transport but it will remain in the area of dredging for up to 24 hours to allow free water to drain from the sediment. When ready for transport, the scuppers will be raised and sealed (i.e., no water will leak from the barge, as any exposed barge weep holes should be sealed prior to placing sediment within the barge). Engineering controls will be implemented such as a containment boom around the area of discharge and any observable sheen would be remediated with an absorbent boom during dewatering activities. Any release of decant water to surface waters will comply with state and federal water quality criteria.

The dredging operation is anticipated to use a 12 hour per day and 5-6 day per week work shift. This reduces the possibility of errors during night hours (e.g., low visibility) and allows one day per week for any repairs to equipment. It is estimated that it will take approximately 60-70 days to perform maintenance dredging and place the cover material for this project. The exposure of aquatic organisms to suspended sediment in the water column would be limited to the duration of mechanical dredging and cover placement. Dredging will occur within the Willamette River in-water work period (July 1 to October 31) to minimize impacts to ESA-listed fish species.

(4) PROJECT DESCRIPTION (continued)

D. Describe source of fill material and disposal locations if known

Disposal Locations: Based on the analysis of contaminant concentrations, sediment will be disposed as a RCRA Subtitle D waste. After sediment is placed on a barge and allowed to dewater for a set period of time (typically 24 hours), it will be transported from the Willamette River to a transload facility selected by the contractor. Sediment will be stabilized on the barge or at the transload facility using Portland cement, lime, etc., as required by the landfill. It will be loaded onto trucks for transport and disposal at the landfill. The transportation operation will take approximately 1 to 2 days to complete for each barge. The dredged sediment will be disposed at a permitted t RCRA Subtitle D landfill.

Backfill Material: The cover material will consist of clean material sourced from a local supplier or manufacturer. As appropriate, cover material will be tested prior to placement in the river.

E. Construction timeline.

What is the estimated project start date? July 1, 2019 (initial event)

What is the estimated project completion date? October 31, 2019 (initial event)

Is any of the work underway or already complete?
If yes, please describe.
Sediment core sampling was completed within the proposed dredge footprint in the summer of 2017 to examine the sediments within the proposed dredged area and leave surface. Sediment samples were tested for contaminants and to determine the grain sizes/texture of material for the proposed cover layer. Geotechnical investigations were performed in October 2018 to gather data used in the modeling of slope stability. No other work has been completed to date. The estimated total time to dredge and place the cover layer over the dredge prism and side slope is expected to take the entire 4-month in-water work window and may extend beyond this time particularly in consideration of the limited access to the under-dock areas. An in-water work extension would be requested from the Corps and DSL if additional time is needed to complete project activities outside of the in-water work window. An effort will be made to limit those activities to placement of clean cover material.

F. Removal Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

Wetland / Waterbody Name *	Removal Dimensions					Duration of Impact**	Material***
	Length (ft.)	Width (ft.)	Depth (ft.)	Area (sq.ft. or ac.)	Volume (c.y.)		
Willamette River (berthing area)	880	Varies	1-15	1.1 ac.	7,850	Permanent	River sediment (silt, sand, clay)
Willamette River (dredge side slope)	880	Varies	1-12	0.6 ac.	4,250	Permanent	River sediment (silt, sand, clay)
Willamette River (berthing area)- Future maintenance event (if needed)	880	Varies	1-5	2.1 ac. (maximum)	5,000	Permanent	River sediment (silt, sand, clay)

G. Total Removal Volumes and Dimensions			
Total Removal to Wetlands and Other Waters	**Length (ft.)**	**Area (sq. ft or ac.)**	**Volume (c.y.)**
Total Removal to Wetlands			
Total Removal Below Ordinary High Water	880	2.7 ac. (maximum)	17,100
Total Removal Below Highest Measured Tide			
Total Removal Below High Tide Line			
Total Removal Below Mean High Water Tidal Elevation			

H. Fill Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

Wetland / Waterbody Name*	Fill Dimensions					Duration of Impact**	Material***
	Length (ft.)	Width (ft.)	Depth (ft.)	Area (sq. ft. or ac.)	Volume (c.y.)		
Willamette River (berthing area)	880	Varies	0.5	1.1 ac.	805	Permanent	Clean sand, gravel, and activated carbon
Willamette River (berthing area)	880	Varies	0.5	1.1 ac.	1,045	Permanent	Small, angular rock (D_{50}=2.7”)
Willamette River (dredge side slope)	880	Varies	1	1.4 ac.	1,970	Permanent	Large, angular rock (D_{50}=12.2”)
Willamette River (dredge side slope)	880	Varies	0.5	1.4 ac.	980	Permanent	Small, rounded gravel (D_{50}=2.5”)
Willamette River (dredge side slope)	880	Varies	0.5	1.4 ac.	960	Permanent	Clean sand, gravel, and activated carbon

(4) PROJECT DESCRIPTION (CONTINUED)

I. Total Fill Volumes and Dimensions			
Total Fill to Wetlands and Other Waters	**Length (ft.)**	**Area (sq. ft or ac.)**	**Volume (c.y.)**
Total Fill to Wetlands			
Total Fill Below Ordinary High Water	880	2.5 ac.	5,760
Total Fill Below Highest Measured Tide			
Total Fill Below High Tide Line			
Total Fill Below Mean High Water Tidal Elevation			

*If there is no official name for the wetland or waterbody, create a unique name (such as “Wetland 1” or “Tributary A”).
**Indicate the days, months or years the fill or removal will remain. Enter “permanent” if applicable. For DSL, permanent removal or fill is defined as being in place for 24 months or longer.
*** Example: soil, gravel, wood, concrete, pilings, rock etc.

(5) PROJECT PURPOSE AND NEED

Provide a statement of the purpose and need for the overall project.

The purpose of the proposed project is to reestablish original ship berth elevations (depths) for current and future vessels that dock at the Portland Terminal. Dredging to -34 feet CRD will reestablish the berth to its original design depth; an additional foot of sediment will be removed (i.e., to -35 feet CRD) to accommodate placement of a 1-foot temporary cover layer that is consistent with the 2017 Portland Harbor Superfund Site Record of Decision (ROD) requirements for certain surface sediment contaminants that exceed ROD cleanup levels.

Maintenance dredging is necessary to bring the mudline elevations down to a berth elevation consistent with the original design and permit, which will allow current and future vessels to safely access the terminal. The applicant is required to maintain these navigable depths within the Portland Terminal berthing area to meet contractual requirements. The proposed maintenance dredging activities are not associated with any potential future remedial action activities that may be performed by British Petroleum (BP) at this site. However, since the proposed activities are located within an area identified for future remediation in the ROD, the EPA has requested that dredging and cover placement activities meet the intent of the ROD requirements to help ensure protection of human health and aquatic receptors until the final remedial action is completed.

Removal of sediment within the berthing area will result in a bank cut that increases the slope angle beneath the adjacent dock. Consequently, additional material will be removed from the slope to reach a stable angle of 1.5H:1V.. The dredged slope area will receive a cover layer similar to the berthing area; however, because of the angle, additional stabilization geosynthetics (e.g., geocell or RCM/AC) will be needed. These reactive media covers will prevent dissolved chemicals of concern from the underlying sediment to upwell into the surface water. To protect the cover materials, riprap armor will be placed over it. In order to construct the cover and key in the armor, a 1-foot deep trench will be constructed along the dock at the point of intersection between the slope and the berthing area. The anchor trench will provide a key for the temporary cover on the slope and will be constructed with a clamshell bucket. A cross-section of the trench is shown on the attached figures.

(6) DESCRIPTION OF RESOURCES IN PROJECT AREA

A. Describe the existing physical and biological characteristics of each wetland or waterbody. Reference the wetland and waters delineation report if one is available. Include the list of items provided in the instructions.

Wetlands: N/A. Proposed maintenance activities would not impact any wetlands.

Waterway: The Willamette River is the waterbody in which the site dredging will occur. Its Cowardin classification is Riverine Tidal, Unconsolidated Bottom, Permanently flooded. At the proposed dredge site, the Willamette River is tidally influenced and substrate elevations vary. Substrate within the berthing area is primarily composed of fine-grained material (i.e., sand, silt, and clay), and substrate within the dredge prism includes material that has accumulated since the last dredging event in 1993. Based on a 2017 bathymetric survey, the substrate elevations within the Portland Terminal dredge prism ranges from -20 feet CRD at the far northwest boundary and descend to -40 feet CRD near the southern boundary. Substrate elevations shallower than -35 CRD will be dredged within the berthing area. At the project site (RM 4.9), the ordinary high water elevation for the Willamette River is +14.9 feet CRD (+16.6 feet NGVD/+18 feet City of Portland Datum).[8] The dredge prism does not provide salmonid spawning habitat but is suitable for providing food for rearing and migrating juvenile salmonids. However, since most of the dredge prism is deeper than -20 feet CRD, most food production is likely derived from pelagic sources (rather than from the benthic environment). Cover material would be placed over the post-dredge side slope at elevations ranging from -2 to -34 feet CRD. However, a top layer of 2.5-inch D_{50} rounded rock would be placed on top of the cover material to reduce the potential for piscivorous predation of salmonids and allow for benthic recolonization once sediments redeposit on this layer over time.

Within the Portland Harbor, the lower Willamette River (LWR) is located in the predominantly urban setting of the greater Portland metropolitan region. Ecological functions and services historically provided by the river have been highly degraded by development. The lower reach of the river (from RM 0 to 11.6) has been dredged to maintain the 40-foot-deep navigation channel for commercial shipping, while docks, piers, bulkheads (seawalls), placement of fill, and rock revetment (riprap) have replaced much of the natural bank habitat. Riparian habitat is discontinuous and limited by industrial development. The river has been channelized and off-channel areas developed; many tributaries have been piped; and the river has been disconnected from its floodplain as the lower valley was urbanized. Silt loading to the LWR has increased over historical levels due to logging, agriculture, road building, and urban and suburban development within the watershed. Historical development has also contributed to changes in water quality. The proposed project does not represent a significant disturbance over existing conditions.

The Willamette River, from RM 0 to 24.5, is currently listed on the Oregon Department of Environmental Quality (DEQ) 303(d) list as water quality limited for several parameters, including heavy metals, pesticides, bacteria, and temperature.[9] Contaminated sediments are present at discrete locations within Portland Harbor due to historical and ongoing releases of contamination from industrial sources in the Harbor, as well as from urban runoff and upstream sources. For these reasons, the Portland Harbor is currently designated as a Superfund Site by the Environmental Protection Agency (EPA). The Willamette River at the project site flows northwest and is approximately 1,500 feet wide.

From 1973 through 2007, average annual mean flow in the Willamette River was approximately 33,000 cubic feet per second at the Morrison Bridge (near RM 12.8) in Portland. Low flow typically occurs between September and early November, prior to the onset of winter rains. Flows generally increase in response to regional storms due to the highly developed, urban matrix surrounding the river. The large amount of impervious area in the Portland Metro region results in rapid runoff to the river during storm events. During periods of low and medium flows, tidal effects are evident up to Willamette Falls (RM 26.5). Additionally, reverse flow has been measured as far upstream as Ross Island (RM 15) during low flow periods.

[8] http://www.nwd-wc.usace.army.mil/nwp/Reports/Portland_Harbor.pdf
[9] https://www.oregon.gov/deq/wq/Pages/WQ-Assessment.aspx

The project site has been highly developed for industrial use and currently provides limited habitat for wildlife. The project site is located in Zone 5 (Site 5.4) of the Lower Willamette River Wildlife Habitat Inventory.[10] According to the inventory, wildlife habitat in this area has a rank of IV (lowest rank). The inventory states "although there is some vegetative cover, the vegetation is scattered and the area highly disturbed. The remainder of the bank tends to be riprapped, with minimal vegetative cover."[11]

Physical/Chemical Tests: Historical sediment sampling occurred within the proposed dredge area in 2004 and 2005, and two surface grab samples (up to 1 foot deep) and two vibracore samples (up to 4 feet deep) were collected.[12] Both surface grab samples had one or more analyte detections above the Sediment Evaluation Framework (SEF) screening levels and ROD cleanup levels. These analytes included arsenic, mercury, nickel, total carcinogenic polycyclic aromatic hydrocarbons (PAHs), and total polychlorinated biphenyls (PCBs). Both vibracore samples had one or more analytes detected at concentrations above these levels as well, including arsenic, mercury, total carcinogenic PAHs, total chlordane, dieldrin, total PCBs, and diesel range hydrocarbons.

Sediment sampling was recently conducted from September 6 to 9, 2017 in support of the proposed maintenance dredging. The sediment sample results are summarized in the Sediment Characterization Report (SCR). The sediment sampling consisted of six cores that were advanced between 5 and 9 feet below sediment surface and analyzed for conventional chemical and physical parameters. The results were generally consistent with past sediment results that identified chemicals of concern at levels that exceeded SEF screening levels and ROD cleanup levels within the dredge prism and leave surface (post-dredge surface that would remain after the dredged material is removed). The dredge prism analytical results included specific analytes that exceeded both the SEF screening level and ROD cleanup levels, which indicate the sediment dredge material would not be suitable for unconfined, aquatic disposal.[13] The results confirmed that future dredged sediment will be acceptable for disposal at a Resource Conservation and Recovery Act (RCRA) Subtitle D Landfill. None of the analytes detected in the dredge prism samples exceeded elutriate triggers, indicating dredged material is not expected to cause adverse water quality effects at the point of dredging.

A geotechnical investigation was conducted on October 18-19, 2018[14]. The investigation at the terminal consisted of three Cone Penetration Tests (CPTs) to a depth of 22-26 feet below sediment surface (bss), and four sediment cores to a depth of 5 feet bss. A total of six samples were collected and analyzed for grain size and hydrometer, moisture content, and organic content. A subset of four samples was analyzed for Atterberg limits and specific gravity due to insufficient recovery. The data were used to conduct a slope stability analysis which was performed using the computer program Slope/W by Geo-Slope International (2012). The model predicts the Factor of Safety associated with varying slope conditions including short and long term but drained and undrained under normal and seismic conditions. The side slope of 1.5H:1V was found to be stable for the sediment characteristics under all conditions except for long term drained seismic conditions which are not consistent with the intent of the cover material.

Engineering controls and conservation measures will be followed to manage and control any sheening that occurs in the water column during dredging or dewatering activities. The SCR results were reviewed by the Portland Sediment Evaluation Team (PSET) through the SEF process to inform potential sediment management planning efforts and evaluate project sediments under the Portland Harbor Superfund Site ROD. The PSET concurred with AECOM's SCR findings. The dredge prism was found to be "not suitable for unconfined, aquatic placement" per the SEF guidance.[15] Further, the post-dredge surface was also found to be "not suitable for unconfined, aquatic exposure" per EPA's ROD. Thus, at the request of the EPA, a temporary cover layer will be placed over the post-dredge surface to help prevent resuspension and disturbance of sediment contaminants at this location until the final remedy is completed at the site. A cover layer will also be placed over the dredged slope surface for the same purposes.

100-year Floodplain: The dredging project is located within the 100-year floodplain (Zone AE) and will be conducted completely below the mean lower low water line; it will not adversely affect flood storage capacity.

Endangered Species Act (ESA)-Listed and Sensitive Fish: Based on review of the National Marine Fisheries Service (NMFS) web site (http://www.nwr.noaa.gov) and Oregon Biodiversity Information Center (ORBIC) data acquired for the project in 2017, five federally listed salmonids are known to occur in the LWR (Table 1). Federally threatened bull trout (*Salvelinus confluentus*), Southern DPS green sturgeon (*Acipenser medirostris*), and eulachon (*Thaleichthys pacificus*) are not expected to occur in the LWR. Pacific lamprey (*Entosphenus tridentatus*) is a federal species of concern that occurs in the LWR.

[10] City of Portland 1986. Lower Willamette River Wildlife Habitat Inventory, Bureau of Planning. March 1986.
[11] *Ibid*.
[12] AECOM 2017. Sampling and Analysis Plan. Portland Terminal, Portland, OR. August 25, 2017.
[13] AECOM 2017. Sediment Characterization Report. Portland Terminal, Portland, OR. October 31, 2017.
[14] AECOM 2018. Dredge Slope Stability Analysis at Seaport Midstream Portland Terminal. Technical Memo to TransMontaigne Management Services LLC. December 18, 2018.
[15] PSET 2018. Level 2 Dredged Material Suitability Determination for Maintenance Dredging of TLP's (formerly BP US Pipelines and Logistics) Portland Terminal on the Lower Willamette River (RM 5.1W). February 5, 2018.

Table 1. Federally Listed Salmonids that Occur within the Lower Willamette River

Salmonids	Federal Status
Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River ESU, spring & fall runs	Threatened
Chinook salmon (*O. tshawytscha*) Upper Willamette River ESU, spring run	Threatened
Coho salmon (*O. kisutch*) Lower Columbia River ESU	Threatened
Steelhead (*O. mykiss*), Lower Columbia River DPS, winter run	Threatened
Steelhead (*O. mykiss*) Upper Willamette River DPS	Threatened

ESU= Evolutionary Significant Unit; DPS= Distinct Population Segment

Salmonids that were spawned in the Willamette River or its tributaries may utilize the project area for rearing and/or migration. Adult salmonids tend to move upstream in a directed migration pattern, utilizing deeper water habitats more frequently than juvenile salmonids. Some adult salmonids (e.g., spring Chinook and winter steelhead) may hold in shallow or deep-water areas of the LWR for several weeks prior to spawning in upstream tributaries. Use of the project area by most juvenile salmonids would be limited to the peak outmigration period, which generally runs from March through June. Juvenile salmonids, particularly sub-yearling Chinook salmon that were spawned in the Willamette River or its tributaries, may utilize shoreline or off-channel rearing areas during their migration. Fall and spring Chinook salmon that out-migrate during their first year of life are expected to use the action area for longer periods than yearling spring Chinook salmon and steelhead trout, which tend to migrate further offshore and swim more rapidly through the LWR. Lower abundances of juvenile Chinook salmon may be present during fall and winter, but higher water temperatures likely preclude juvenile rearing during summer and early fall.

ESA-Listed and Sensitive Wildlife and Plants: Steller sea lion (*Eumetopias jubatus*) and California sea lions (*Zalophus californianus*) also are found in the LWR and some migrate to Willamette Falls to feed on salmon, steelhead, and sturgeon. Although not listed, these species are protected under the Marine Mammal Protection Act (MMPA) of 1972.

The bald eagle (*Haliaeetus leucocephalus*) was removed from the ESA list by the US Fish and Wildlife Service (USFWS), and ESA consultation is no longer required (72 FR 37373). However, bald eagles will continue to be protected under the Bald and Golden Eagle Protection Act (16 United States Code [U.S.C.] 668a-d), Migratory Bird Treaty Act (16 U.S.C 703-712), and the National Bald Eagle Management Guidelines. In the Willamette River, the closest bald eagle nest sites (Forest Park, Smith Lake, and near the Sauvie Island Bridge) are located within 2 miles of the project, and bald eagles are occasionally observed roosting along the shoreline of the LWR. However, based on the proposed nature of dredging work, no effects to bald eagles are anticipated.

Tricolored blackbird (*Agelaius tricolor*) is a federal species of concern that has been observed in the vicinity of the site. State-listed wildlife species may also occur in the vicinity of the project site, including the bald eagle, American peregrine falcon (*Falco peregrinus*), great blue heron (*Ardea herodias*), double-crested cormorant (*Phalacrocorax auritus*), great egret (*Ardea alba*), osprey (*Pandion haliaetus*), and red-tailed hawk (*Buteo jamaicensis*), and painted turtle (*Chrysemys picta*). No habitat exists in the project area for any state or federally listed plant species.

Cultural Resources: The proposed dredging would occur on submerged sediment that was dredged to the same depth in 1993 when the dock facility was constructed; therefore, the possibility of encountering cultural resources is considered very low, and no further site investigations or archaeological monitoring is recommended. Dredged sediments would be disposed at an authorized upland disposal site (Wasco County Landfill). The landfill is currently constructed and is not subject to new development with the potential to uncover cultural resources. If any cultural artifacts are discovered during the course of the project, dredging activities will cease immediately, and a qualified (staff) archaeologist and the State Historic Preservation Office will both be notified before dredging is allowed to continue.

B. Describe the existing navigation, fishing and recreational use of the waterbody or wetland.

The LWR is primarily used for navigation and industrial uses. Berth dredging would maintain access for deep and shallow-draft vessels that navigate to and call at the terminal. Being within a Superfund Site, limited fishing and recreation occur in the Portland Harbor, but these are not the primary uses. Although the berthing area could provide some deep-water fishing or recreational opportunities when it is not in use, no public access is allowed at the terminal facility or dock. The Willamette River is approximately 0.25-mile wide at the project location; therefore, it is wide enough such that the proposed project would not prohibit navigation, fishing, and recreational uses.

(7) PROJECT SPECIFIC CRITERIA AND ALTERNATIVES ANALYSIS

Describe project-specific criteria necessary to achieve the project purpose. Describe alternative sites and project designs that were considered to avoid or minimize impacts to the waterbody or wetland.[*]

The proposed project is a maintenance activity specific to the project location. Dredging depth must be able to accommodate ship berth elevations for current and expected future vessels that dock at the facility. The -34 foot CRD dredge design depth is the original design depth, and was the depth of the most recent authorized dredging activity at the project site in 1993. This depth has been determined to be sufficient for expected future vessels under current ownership. Dredging to a depth of -35 feet CRD is necessary to allow for placement of a one-foot cover layer to meet EPA and SEF requirements. A No Action Alternative would not meet the purpose of restoring the berth to its original design depth and would not accommodate ongoing authorized maritime activities. Removal of sediment within the berthing area will result in a bank cut that increases the slope angle beneath the adjacent dock. Consequently, additional material will be removed from the slope to reach a stable angle of 1.5H:1V which will reduce the potential for sediment fallback that could occur from steepened slopes. The dredge slope area will receive a cover layer similar to the berthing area and riprap armor to prevent propeller wash and current from displacing it. In addition to the armor, 6 inches of 2.5-inch rounded stone will be placed within the interstitial spaces of the riprap on the slope to minimize impacts on fish habitat. This smaller stone will be placed in lieu of larger stone that would be more protective against propeller wash but less fish-friendly.

(8) ADDITIONAL INFORMATION

Question	Yes	No	Unknown
Are there state or federally listed species on the project site?	☑ Yes	☐ No	☐ Unknown
Is the project site within designated or proposed critical habitat?	☑ Yes	☐ No	☐ Unknown
Is the project site within a national Wild and Scenic River ?	☐ Yes	☑ No	☐ Unknown
Is the project site within a State Scenic Waterway?	☐ Yes	☑ No	☐ Unknown
Is the project site within the 100-year floodplain?	☑ Yes	☐ No	☐ Unknown

If yes to any of the above, explain in Block 6 and describe measures to minimize adverse effects to these resources in Block 7.

Question	Yes	No	Unknown
Is the project site within the Territorial Sea Plan (TSP) Area?	☐ Yes	☑ No	☐ Unknown

If yes, attach TSP review as a separate document for DSL.

Question	Yes	No	Unknown
Is the project site within a designated Marine Reserve?	☐ Yes	☑ No	☐ Unknown

If yes, certain additional DSL restrictions will apply.

Question	Yes	No	Unknown
Will the overall project involve ground disturbance of one acre or more?	☐ Yes	☑ No	☐ Unknown

If yes, you may need a 1200-C permit from the Oregon Department of Environmental Quality (DEQ).

[*] Not required by the Corps for a complete application, but is necessary for individual permits before a permit decision can be rendered.

Is the fill or dredged material a carrier of contaminants from on-site or off- site spills?	☑ Yes	☐ No	☐ Unknown
Has the fill or dredged material been physically and/or chemically tested?	☑ Yes	☐ No	☐ Unknown

If yes, explain in Block 6 and provide references to any physical/chemical testing report(s).

Has a cultural resource (archaeological) survey been performed on the project area?	☑ Yes	☐ No	☐ Unknown

If yes, provide a copy of the survey with this application to the Corps only. Do not describe any resources in this document.

Will the project result in new impervious surfaces or the redevelopment of existing surfaces? Yes ☐ No ☒

If yes, the Applicant must submit a post-construction stormwater management plan to DEQ's 401 WQC program for review and approval, see http://www.deq.state.or.us/wq/sec401cert/docs/stormwaterGuidelines.pdf

Identify any other federal agency that is funding, authorizing or implementing the project.

Agency Name	Contact Name	Phone Number	Most Recent Date of Contact
US EPA	Sean Sheldrake	206.553.1220	5/23/18

List other certificates or approvals/denials required or received from other federal, state or local agencies for work described in this application. For example, certain activities that require a Corps permit also require 401 Water Quality Certification (WQC) from Oregon Department of Environmental Quality (DEQ). For DEQ, please note that all projects that qualify for a Nationwide 401 WQC will be invoiced a fee. Projects that do not qualify for the Nationwide certification will be invoiced based on project complexity. See http://www.oregon.gov/deq/wq/wqpermits/Pages/Section-401-Fees.aspx

Agency	Certificate/ approval / denial description	Date Applied
DSL	Sand and Gravel Removal Application	Concurrent with original JPA. Will submit new application based on additional removal volume.
DEQ	401 Water Quality Certification (required for all projects in the Portland Harbor).	Concurrent with original JPA. Project changes require new WQC review.
NMFS	Biological Opinion (BiOp)	Concurrent with original JPA. Original BiOp issued on 5/24/18. BiOp amendment may be needed.
City of Portland Bureau of Development Services	Land Use Compatibility Statement (LUCS)	Received 11/9/17

Other DSL and/or Corps Actions Associated with this Site (Check all that apply.)

☐ Work proposed on or over lands owned by or leased from the Corps (may require authorization pursuant to 33 USC 408).

☑ State owned waterway	DSL Waterway Lease #	
☑ Other Corps or DSL Permits	Corps # 92-00933	DSL #
☐ Violation for Unauthorized Activity	Corps #	DSL #
☐ Wetland and Waters Delineation	Corps #	DSL #

Submit the entire delineation report to the Corps; submit only the concurrence letter (if complete) and approved maps to DSL. If not previously submitted to DSL, send under a separate cover letter.

(9) IMPACTS, RESTORATION/REHABILITATION, AND COMPENSATORY MITIGATION

A. Describe unavoidable environmental impacts that are likely to result from the proposed project. Include permanent, temporary, direct, and indirect impacts.

- Some direct temporary and permanent impacts will result from sediment removal from the berthing area. Temporary increases in turbidity and loss/disturbance of some benthic macroinvertebrates will result from dredging and cover placement activities. Placement of a 2.5-inch rounded gravel habitat layer over the armored side slope will reduce habitat impacts from riprap placement. Benthic invertebrates are expected to recolonize the dredge prism and side slope area following project activities. Recovery will be enhanced through sediment accretion over time. Removal of contaminated sediments will result in a net improvement in sediment quality at the project site. River sediments will be placed on a barge and transported to a transload facility and disposal at an approved disposal site.
- Temporary impacts (e.g., noise, barge movement) would occur from construction activity during dredging and cover placement operations.
- Dredged material will be replaced with up to one foot of cover material in the berthing area that will provide a means to minimize contaminant resuspension and provide a physical barrier for leave surface sediments. Over the dredged sediment surface on the slope beneath and behind the dock, up to 2 feet of cover material will be placed. The top layer would fill interstitial spaces of the riprap on the slope and would approximately meet NMFS' sediment size gradation requirements. Benthic recovery on the shallow water side slopes will be enhanced through sediment accretion over time.

B. For temporary removal or fill or disturbance of vegetation in waterbodies, wetlands or riparian (i.e., streamside) areas, discuss how the site will be restored after construction to include the timeline for restoration.

One extra foot of sediment is proposed for removal within the area proposed for dredging within the berthing area. After dredging is complete, a 1-foot-thick cover of sediment material will be placed over the dredged area in the berthing area to bring the final elevation to -34 feet CRD. This amended sediment material is intended to cover any potentially contaminated sediment and remain in place until the final remedy for the site is completed. Over the dredged sediment surface on the slope beneath and behind the dock, up to 2 feet of cover material will be placed. No permanent or temporary vegetation disturbance is proposed.

Compensatory Mitigation

C. Proposed mitigation approach. Check all that apply:

☐ Permittee-responsible Onsite Mitigation	☐ Permittee-responsible Offsite mitigation	☐ Mitigation Bank or in-lieu fee program	☐ Payment to Provide (not approved for use with Corps permits)

D. Provide a brief description of mitigation approach and the rationale for choosing that approach. If you believe mitigation should not be required, explain why.

The project would remove and dispose of contaminated sediment within the Portland Harbor Superfund Site and cover the dredged area in the berthing area with approximately 1-foot of clean sediment. The new cover materials are expected to provide a functional improvement to water quality and reduce exposure of aquatic organisms to sediment contaminants following dredging activities. In addition to the carbon amendment material and the protective armor placed on the dredge slope, an additional 6 inches of rounded stone will be placed to minimize impacts on fish habitat. This smaller stone will be placed in lieu of larger stone that would be more protective against propeller wash but less fish-friendly. This material would not be stable under extreme propeller wash conditions but future inspections will evaluate if additional type or size of material is needed in future years. The 2.5-inch diameter stone was selected consistent with past projects on the Willamette River and would approximately meet NMFS' recommended sediment size gradation for optimal habitat. The EPA- required cover materials over the dredge prism and side slopes would serve as mitigation for the project. The project has been designed to integrate a top cover layer that meets both EPA and NMFS requirements and so would not require further mitigation.

Dredging and cover placement will occur within the Willamette River in-water work period (July 1 to October 31) to minimize impacts to ESA-listed fish species. There is no Submerged Aquatic Vegetation (SAV) at the project site. The benthic populations that exist in the sediment will reestablish itself in the new sediment cover substrate provided, particularly when sediments accumulate on top of the cover layer. Dredging will result in a net increase in the flood storage capacity of the river, slightly reducing the risk of flood hazards compared to existing conditions.

Mitigation Bank / In-Lieu Fee Information: Name of mitigation bank or in-lieu fee project: Type of credits to be purchased:			
If you are proposing permittee-responsible mitigation, have you prepared a compensatory mitigation plan? ☐ Yes. Submit the plan with this application and complete the remainder of this section. ☐ No. A mitigation plan will need to be submitted (for DSL, this plan is required for a complete			
Mitigation Location Information (Fill out only if permittee-responsible mitigation is proposed)			
Mitigation Site Name/Legal Description	Mitigation Site Address	Tax Lot #	
County	City	Latitude & Longitude (in DD.DDDD format)	
Township	Range	Section	Quarter/Quarter

(10) ADJACENT PROPERTY OWNERS FOR PROJECT AND MITIGATION SITE

☐ **Pre-printed mailing labels of adjacent property owners attached separately.**	**Project Site Adjacent Property Owners**	**Mitigation Site Adjacent Property Owners**

Contact Name
Address 1
Address 2
City, ST ZIP Code

Shore Terminals, LLC.
ATTN: Tillman Davis
PO Box 780339
San Antonio, TX 78230

Contact Name
Address 1
Address 2
City, ST ZIP Code

ExxonMobil Oil Corp.
Property Tax Division
PO Box 53
Houston, TX 77001

Contact Name
Address 1
Address 2
City, ST ZIP Code

Linnton Water Credits LLC.
3317 17th Street #200
Oakland, CA 94612

(10) CITY/COUNTY PLANNING DEPARTMENT LAND USE AFFIDAVIT (TO BE COMPLETED BY LOCAL PLANNING OFFICIAL)

I have reviewed the project described in this application and have determined that:

- ☐ This project is not regulated by the comprehensive plan and land use regulations.
- ☒ This project is consistent with the comprehensive plan and land use regulations.
- ☐ This project will be consistent with the comprehensive plan and land use regulations when the following local approval(s) are obtained:
  - ☐ Conditional Use Approval
  - ☐ Development Permit
  - ☐ Other Permit (see comment section)
- ☐ This project is not consistent with the comprehensive plan. Consistency requires:
  - ☐ Plan Amendment
  - ☐ Zone Change
  - ☐ Other Approval or Review (see comment section)

An application ☐ has ☐ has not been filed for local approvals checked above.

Local planning official name (print)	Title	City / County (circle one)
Lara Lehman	City Planner	Portland

Signature	Date
	11.9.17

Comments:
Dredging and channel maintenance are exempt from Greenway Review per PCC 33.440.320.H.

(11) COASTAL ZONE CERTIFICATION

If the proposed activity described in your permit application is within the Oregon coastal zone, the following certification is required before your application can be processed. A public notice will be issued with the certification statement, which will be forwarded to the Oregon Department of Land Conservation and Development (DLCD) for its concurrence or objection. For additional information on the Oregon Coastal Zone Management Program, contact DLCD at 635 Capitol Street NE, Suite 150, Salem, Oregon 97301 or call 503-373-0050.

CERTIFICATION STATEMENT

I certify that, to the best of my knowledge and belief, the proposed activity described in this application complies with the approved Oregon Coastal Zone Management Program and will be completed in a manner consistent with the program.

Not Applicable—Not within the Oregon coastal zone.

Print /Type Name	Title
Signature	**Date**

(13) SIGNATURES

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and, to the best of my knowledge and belief, this information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities. By signing this application I consent to allow Corps or DSL staff to enter into the above-described property to inspect the project location and to determine compliance with an authorization, if granted. I hereby authorize the person identified in the authorized agent block below to act in my behalf as my agent in the processing of this application and to furnish supplemental information in support of this permit application. I understand that the granting of other permits by local, county, state or federal agencies does not release me from the requirement of obtaining the permits requested before commencing the project. I understand that payment of the required state processing fee does not guarantee permit issuance.

To be considered complete, the fee must accompany the application to DSL. The fee is not required for submittal of an application to the Corps.

Fee Amount Enclosed	$1,129 [$805 (commercial operators fill base fee) + $324 (fill volume fee)]

Applicant Signature (required) must match the name in Block 2

Print Name Michael Hammell	Title General Counsel and Secretary
Signature Michael Hammell	Date 1/7/19

Authorized Agent Signature

Print Name Andy Clodfelter	Title Fisheries Biologist/ESA Specialist
Signature Andy Clodfelter	Date 1/7/19

Landowner Signature(s)*

Landowner of the Project Site (if different from applicant)

Print Name	Title
Signature	Date

Landowner of the Mitigation Site (if different from applicant)

Print Name	Title
Signature	Date

Department of State Lands, Property Manager (to be completed by DSL)

If the project is located on state-owned submerged and submersible lands, DSL staff will obtain a signature from the Land Management Division of DSL. A signature by DSL for activities proposed on state-owned submerged/submersible lands only grants the applicant consent to apply for a removal-fill permit. A signature for activities on state-owned submerged and submersible lands grants no other authority, express or implied and a separate proprietary authorization may be required.

Print Name	Title
Signature	Date

* Not required by the Corps.

(14) ATTACHMENTS

- ☑ Drawings
  - ☑ Location map with roads identified
  - ☑ U.S.G.S topographic map
  - ☑ Tax lot map
  - ☑ Site plan(s)
  - ☑ Cross section drawing(s)
  - ☑ Recent aerial photo
  - ☐ Project photos
  - ☐ Erosion and Pollution Control Plan(s), if applicable
  - ☐ DSL/Corps Wetland Concurrence letter and map, if approved and applicable
- ☐ Pre-printed labels for adjacent property owners (Required if more than 5)
- ☑ **Incumbency Certificate** if applicant is a partnership or corporation
- ☐ Restoration plan or rehabilitation plan for temporary impacts
- ☐ Mitigation plan
- ☐ Wetland functional assessment and/or stream functional assessment
- ☐ Alternatives analysis
- ☐ Biological assessment (if requested by Corps project manager during pre-application coordination.)
- ☐ Stormwater management plan (may be required by the Corps or DEQ)

Send Completed form to:

U.S. Army Corps of Engineers
ATTN: CENWP-OD-GP
PO Box 2946
Portland, OR 97208-2946
Phone: 503-808-4373
portlandpermits@usace.army.mil

Counties:
Baker, Clackamas, Clatsop, Columbia, Gilliam, Grant, Hood River, Lincoln, Malheur, Morrow, Multnomah, Polk, Sherman, Tillamook, Umatilla, Union, Wallowa, Wasco, Washington, Wheeler, Yamhill

OR

U.S. Army Corps of Engineers
ATTN: CENWP-OD-GE
211 E. 7th AVE, Suite 105
Eugene, OR 97401-2722
Phone: 541-465-6868
portlandpermits@usace.army.mil

Counties:
Benton, Coos, Crook, Curry, Deschutes, Douglas, Jackson, Jefferson, Josephine, Harney, Klamath, Lake, Lane, Linn, Marion

Send Completed form to:

DSL - West of the Cascades:

Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279
Phone: 503-986-5200

OR

DSL - East of the Cascades:

Department of State Lands
1645 NE Forbes Road, Suite 112
Bend, Oregon 97701
Phone: 541-388-6112

Send all Fees to:
Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279
Pay by Credit Card Online:
https://apps.oregon.gov/dsl/EPS/

Revised Cap Modeling Memorandum

2019-03-15

AECOM
111 SW Columbia
Portland, OR 97201
aecom.com

Project name:
SeaPort Midstream Partners
Portland Terminal Maintenance Dredging

Project ref:
605528028

To:
Juan Medina, TransMontaigne

CC:
AECOM: Scott Kranz, Kris Carbonneau

From:
AECOM: Dominick Bossalini, Kerri Bridges, Kataryzna Krzanowska, Michael L. Spera

Date:
March 15, 2019

Memo

Subject: Temporary Cover Modeling for the SeaPort Terminal Maintenance Dredging Project

Introduction

This memo provides a summary of the chemical breakthrough and propeller wash modeling conducted for the evaluation of the temporary cover to be placed in and adjacent to the proposed dredge area following maintenance dredging at the SeaPort Portland Terminal. The temporary cover modeling utilizes chemical analytical data obtained from sediment samples collected from the berth area below the anticipated post-dredge surface (i.e., z layer) in September 2017.

The design objectives for the temporary cover were based on cover requirements defined in the Record of Decision, Portland Harbor Superfund Site (ROD) issued by the U.S. Environmental Protection Agency (EPA) in January 2017 and from input from the U.S. Army Corps of Engineers (Corps) and US EPA during conference calls. These objectives are:

- A carbon-amended layer should be included to sequester contaminants of concern (COC) from water upwelling through the underlying sediment without compromising constructability or stability.
- The cover should include an armor stone resistant to over-turning by propeller wash action and should prevent migration of underlying particles through the armor stone.

The cover is temporary in that it will be replaced or updated with the end solution determined by the EPA for the Portland Harbor Superfund site.

Temporary Cover Breakthrough Modeling

Berth Area. The temporary cover design in the berth area includes placement of a 12-inch thick cover with the upper 6-inch armor layer designed to resist propeller wash-induced erosion and the lower 6 inches designed as an amended layer with activated carbon to reduce the flux of Site COCs from the post-dredge surface to surface water. The design allows the Contractor to select from two carbon amendment options which were selected from a total of four options modeled during design as follows:

- Bulk mixture of granular activated carbon (GAC) and sand amended with 1% by weight of activated carbon throughout the 6 inch (15.24 cm) layer.
- Bulk mixture of GAC and sand with 1% by weight of activated carbon in a lower 3 inch (7.62 cm) lift overlain by unamended sand to complete a 6-inch (15.24 cm) layer.
- AquaGate+PAC5%™ 1 inch layer (minimum) overlain by 5 inches of sand to complete a 6-inch (15.24 cm) layer.

- Bulk mixture of 20% AquaGate+PAC5%™ with 80% AASHTO#8 by weight in a 4 inch (10.16 cm) layer overlain by sand to complete a 6-inch (15.24 cm) layer. (AASHTO#8 was selected to most closely match the particle size used in the manufacture of AquaGate+PAC)

Under Dock and Adjacent Slope Area. As indicated in the Geotechnical Slope Stability Memorandum, the under dock area and adjacent side slopes are stable at 1.5H:1V. Some regions beneath and adjacent to the dock currently exceed this slope angle and/or will exceed this slope angle after the berth area is dredged. In order to address this stability issue, the 90% Design has been revised to include sediment removal to achieve a maximum slope of 1.5H:1V in these areas, and placement of an activated carbon amendment layer over the dredged slope areas as shown in Figure 1 below. The slope will also need an armor layer to protect the cover from propeller wash-induced erosion. Two options for the amended cover for the under dock and adjacent slope area were considered as follows:

- Bulk mixture of GAC and sand with 1% by weight of activated carbon in a 3 inch (7.62 cm) layer overlain by sand to a depth of 6 inches
- Application of a Reactive Core Mat (RCM) amended with carbon.

The amended cover will be placed on the slope where dredged; an unamended cover will be used where needed to extend the cover for suitable anchoring in accordance with manufacturer's specifications.

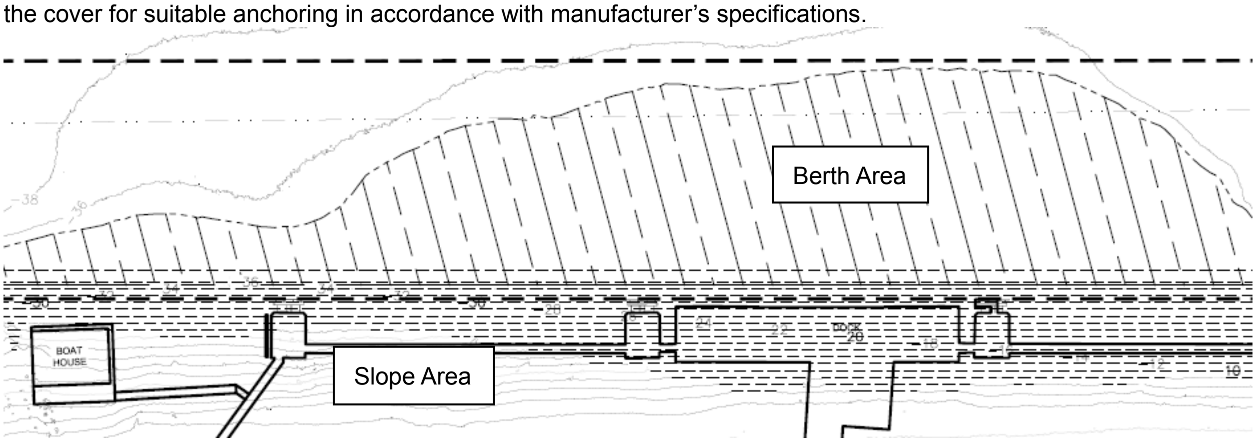

Figure 1: Berth Area and Under-Dock/Adjacent Slope Area to be Dredged

Model Input

Modeling was conducted using a transient model developed by the Reible Research Group at Texas Tech University, commonly used for sediment cover/cap evaluations and designs. The CapSim v3.5 transient model (Shen, et al., 2017) was used to simulate concentrations of Total PAHs and Total PCBs over time within the cover area to evaluate effectiveness. For the purposes of this modeling, cover effectiveness was evaluated based on two sediment thresholds in the bioactive zone: Total PAH concentration of 17 mg/kg (ppm) and Total PCB concentration of 110 µg/kg (ppb) which are the Sediment Evaluation Framework (SEF) Freshwater Benthic Toxicity Screening Levels as well as Total PAH concentration of 23 mg/kg and Total PCB concentration of 9 µg/kg which are the Portland Harbor ROD cleanup levels. A conservative estimate of the depth of the bioactive zone (BAZ) of 10 cm (4 in) was used.

The model was run for Total PAHs and Total PCBs using estimated porewater concentrations in underlying sediment calculated based on maximum sediment concentrations from the z-layer collected in the berth area in September 2017, measured fraction organic carbon (foc), and literature values of organic carbon partition coefficient (Koc) from the Oregon DEQ RBDM database (DEQ, 2015). Tables 1 and 2 present the site-specific sediment data from both the z-layer (depths below the anticipated post-dredge surface) and within the dredge prism and the calculated porewater concentrations used in the model. The porewater concentrations used as input to the model were conservatively selected as the maximum estimated concentrations based on the z-layer samples.

Table 3 presents a summary of the various input parameters used in the CapSim model for the amended covers. In addition to the underlying porewater concentration, upwelling (Darcy) velocity and contaminant sorption coefficients to the cover material are key inputs for the model. The upwelling velocity used for evaluating advective transport of contaminants in porewater through the cover was based on a calibrated groundwater flow model generated for the site that was reviewed and approved by DEQ (URS 2013, 2014). For added conservatism, the high end of the velocity range (57 cm/yr) was simulated in the model.

The model simulates non-linear sorption of PAHs and PCBs to activated carbon. For Total PAHs, Freundlich coefficients ($logK_f$ and 1/n values) for activated carbon from Texas Tech University based on Walters and Luthy (1984) were utilized. The lowest of the values of the three predominant PAHs (phenanthrene, flouranthene, and pyrene) observed in the sediment data was used ($logK_f$ of 7.22). For Total PCBs, Freundlich coefficients for activated carbon were based on Gomez-Eyles et al., 2013. The average of the reported values for the congeners was used ($logK_f$ of 8.48 and 1/n of 0.84). As a conservative sensitivity analysis for both PAHs and PCBs, one order-of-magnitude lower values of $logK_f$ (6.22 for Total PAHs and 7.48 for Total PCBs) were also modeled in the berth area, as well as for the model of the slope area. A sensitivity analysis was also performed on select model runs for a higher assumed fraction organic carbon in the bioactive zone (4% compared to 2% used in the base model runs).

The various model runs simulate the total thickness of the placed material of 12 inches in the Berth Area or 9 inches in the Under Dock/Slope Area including both the amended layer (with varying thicknesses) and the armor layer. Although the model includes material above the amended layer, it is simulating fines/sediments in the voids of the armor layer, including bioturbation in the top 4 inches (10 cm). As noted in Table 3, for long-term predictions the model assumes fines (sediments) deposit on the cover and fill the voids of the armor layer and that the fraction organic carbon (foc) over time in the bioactive zone (top 10 cm) would be similar to current sediments. Below 10 cm of the armor layer, the voids of the stone are assumed filled by sands from below and conservatively assumed with a very low foc (and thus negligible partitioning). As the model results are compared to sediment-based screening values, predicted concentrations at the bottom of the bioactive zone at a depth of 10 cm (where there is a higher foc and thus more conservative) are compared to the sediment screening levels. In addition, predicted concentrations at a depth of 15 cm (bottom of armor layer) are also presented in the results tables.

Summary of Breakthrough Model Results

Tables 4 and 5 present a summary of the CapSim model output for Total PAHs and Total PCBs for the four carbon amendment options in the berth area and two carbon amendment options in the slope area. Model predictions of Total PAH and Total PCB concentrations at three time periods (30, 50, and 100 years) are presented as well as the predicted time to exceedance of the cover effectiveness thresholds at the bottom of the BAZ (10 cm) as well as at the bottom of the armor layer (15 cm).

Total PAHs

As summarized in Table 4, the predicted times to exceed both thresholds for all cover options in the berth area are over 99 years including the sensitivity analyses for the bulk mixtures of GAC and sand (runs 2 and 4) and the bulk mixture of AquaGate+PAC and AASHTO#8 (run 8). For the sensitivity analysis for the AquaGate+PAC layer option using a one order-of-magnitude lower value of $logK_f$ (run 6), the predicted concentration at 100 years is less than the Portland Harbor ROD cleanup level but slightly greater than the SEF toxicity screening level (with a predicted time to exceedance of 99 years). The predicted concentration at 100 years for the sensitivity run using the higher foc in the BAZ for the thinner bulk mixture of GAC and sand (run 4a) was less than the screening levels.

For the slope area, the predicted concentration at 100 years (runs 9 and 10) is less than the Portland Harbor ROD cleanup level but slightly greater than the SEF toxicity screening level for run 9 (with a predicted time to exceedance of approximately 100 years). For the sensitivity analysis using a higher foc in the BAZ layer (run 9a), the predicted times to exceed the thresholds are over 90 years. For the slope area model runs, the more conservative (i.e., lower) Freundlich coefficient ($logK_f$) was used.

Total PCBs

As summarized in Table 5, the predicted times to exceed both thresholds for the amended cover options in the berth area are well over 100 years for all model runs including the sensitivity analyses (runs 2, 4, and 6).

For the slope area, the predicted times to exceed both thresholds are also over 100 years (runs 7 and 8) as well as the sensitivity run for the higher foc in the BAZ (run 7a).

<u>Temporary Cover Propeller Wash Modeling and Material Gradation</u>

The temporary cover has been evaluated for erosive forces resulting from wind and vessel generated waves, flood current and propeller wash. The critical conditions for the cover were identified as the 100 year flood current and propeller wash which have been evaluated.[1] Waves produced by wind and vessels are not critical for the berth area of the dock.

The propeller wash action calculation used the Blaauw and Kaa (1978) methodology referenced in *Guidance for In-Situ Subaqueous Capping of Contaminated Sediment* (USEPA, 1998)) for the berth area and methodology from *Guidelines for Protecting Berthing Structures from Scour Caused by Ships* (PIANC, 2015) was used for the slope area. The calculation uses two vessels with powerful engines and deep draft appropriate for the project area and which are used in the Portland Harbor Feasibility Study (the Crown Point Tidewater tug and the "Large Tug"). It further assumes the MLLW[2] of 1.95 ft Columbia River Datum (CRD) is a worst case scenario because this will bring the propeller closest to the cover layer and produce the largest velocities close to the riverbed. The MLLW level was taken from datums for the Vancouver, WA NOAA tide gauge since it is closer to the project site than the Morrison Bridge on the Willamette River in downtown Portland, OR.

Propeller Wash Stone Calculation

The propeller wash stone calculation is shown on Figure 1 in Appendix A along with input parameters used in the calculation. A key input assumption used in the calculation is the engine power.

After speaking with site personnel (Scott Vawter, TLPMS HSSE Advisor) and with Josh Burrows at Tidewater Port Captain's office about how the tug operates at the terminal, the Tidewater Crown Point tug was evaluated at 70% engine power. The Tidewater tug is a large vessel that can maneuver four barges on the Willamette River; it would not be used at full engine power to maneuver one barge at the Portland terminal. The Tidewater tug was reported as using 50 to 70% engine power to push a barge toward the river when leaving the dock which can occur at various distances off from the dock fender. When the Tidewater tug is maneuvering a barge toward the dock, the tug is reported to use up to 30% engine power. Consequently, the propeller wash stone calculation was assessed at 70% for the Tidewater tug. The "Large Tug" was evaluated at 80% power as this was used in the Portland Harbor Feasibility Study (USEPA 2016).

The erosion protection layer was also assessed for stability during 100 year flood river currents. The depth averaged velocity of approximately 3.6 ft/sec (FEMA, 2010) was used in calculations and the stone sizing for propeller wash is sufficient to resist the river currents.

<u>Berth Area</u>

As shown in Appendix A, the design vessels suggest an armor stone in the D_{50} range of 2.3 to 2.7 inches is sufficient to resist overturning by the design vessels using USEPA 1998. The armor layer for the temporary cover was selected to be a D_{50} of 2.7 inches and a total thickness of 6 inches (2 x D_{50}).

<u>Under Dock Slope Area</u>

The sizing of the armor stone was calculated for the proposed 1.5H:1V dredge slope under the same conditions using PIANC 2015. Propeller wash on a slope is a more severe situation because the slope can experience the direct impact of propeller wash velocities. When leaving the dock with a barge, the Tidewater Crown Point tug lines up a barge with the downriver fender and pivots the barge before pushing it to the middle of the Willamette. This is when the tug uses the most power, 50-70% and can be closest to the dock, up to 5 feet. The propeller wash velocity was calculated for the slope at water elevations

[1] Waves produced from wind and vessels typically have short wave periods, short wave lengths (distance between wave crests) and have minimal effect on the river bed in deep water. The Portland Harbor RI/FS (USEPA 2016) calculated the 100 year return period wave height and period for RM 4.5 to be 1.6 feet and 2.5 seconds, respectively. The wave length can be calculated as 32 feet using Eqn II-1-15 (USACE 2008). Waves can be checked to see if they classified as deepwater waves according to: water depth/wave length > 0.5 (Table II-1-1, USACE, 2008). Using the design water depth at the berth of 35 feet (ft) for Mean Lower Low Water (MLLW) conditions divided by the 100 year wind wave length, returns a value greater than 0.5; therefore, the wind wave will not influence the river bottom. Vessel data used in Macfarlane et al (2008) to determine characteristic wake patterns have wake periods between 1 and 2.2 seconds. Consequently, wind and vessel waves were not evaluated for the cover within the berth area. However, cover in the slope area was assessed for stability against wind and vessel waves as this area is in water shallow enough for the waves to affect the riverbed.

[2] MLLW is the average of the lower low water height of each tidal day observed over the tidal epoch of the years 1983 to 2001. Lower water levels can occur though not on the same frequency as MLLW.

between MLLW (1.95 ft CRD) and OHW (14.82 ft CRD) to determine the armor rock sizing. However, at higher water elevations, the vessel sits higher in the water and further away from the slope. Prop wash velocities are slightly reduced at this greater distance and calculations were made to determine the armor rock size reduction.

Therefore, and as shown in Appendix A, the design vessels suggest an armor stone with a D_{50} of 12.2 inches on the slope above elevation -8.2 ft CRD (for water elevation of MLLW) and can be reduced down to 10 inches above elevation -4.6 ft CRD behind the dock (for a water level of 5.7 ft CRD). Because tugs operate at diminished power around the floating boat house, armor stone for the cover behind the boat house could be reduced to a median diameter of 2.5 inches and placed at a thickness of $2XD_{50}$. This modification also improves the habitat conditions in this area.

The armor stone sizing was evaluated for stability against vessel wake waves using USACE 2008 (Part VI, Chapter 5). The Portland Harbor FEIS advises a 2.8 ft vessel wake for this area of the Willamette River. For stability under vessel wake, the median rock size should be increased to a median rock size of 14 inches above -3 ft CRD. The minimum elevation for the large rock was determined using a low river elevation of 0 ft CRD as recorded for the Columbia River at Vancouver, Washington. The USACE 1984 recommends that the armor rock should be extended downslope below the minimum still water level equal to the design wave height and this calculates an elevation of -2.8 ft CRD and rounded to -3 ft CRD. The rock sizing is summarized in the table below.

Table 1: Rock Sizing for Slope Area

Lowest Elevation (ft CRD)	Highest Elevation (ft CRD)	Median Rock Size (in)	Controlling Force
-8.2	-4.6	12.2	Propeller Wash
-4.6	-3	9.9	Propeller Wash
-3	-2	14	Vessel Wake

Note: Elevations for propeller wash were calculated for the level of the propeller relative to the slope and elevations for the vessel wake were calculated using USACE 1984 recommendations. For slope stability, smaller rock will not be used below -8.2 ft CRD on the slope and the 12.2 inch rock shall extend up from the toe of the slope. It’s also impractical to step down the rock size to 10 inches for 1.6 ft along the slope and also impractical to use the 14 inch rock for only 1 ft along the slope (the top of the cap is at -2 ft CRD). It’s logical to construct the slope using the 12.2 inch rock up to -4.6 ft CRD and to then transition to the 14 inch rock for the remainder of the slope.

Design convention for underwater armor layers suggests a rock layer thickness of 2 times the median rock size. A similar project in the Willamette River near the Portland Terminal (the Zidell Barge property) used 1 times the median rock size on the river slopes to minimize the cover thickness. For similar reasons as well as the temporary nature of this cover design, the Portland terminal includes a 1 times D_{50} layer under the dock area. . Due to agency interest for maintaining habitat in shallow water areas, this 1 times the median rock layer is augmented with a 6-inch layer of 2.5 inch stone. The slope will be monitored annually to observe movement and potential need for additional material.

Filter Layer Sizing

A carbon amendment layer to sequester dissolved PAHs and PCBs must both sorb the contaminants of concern as well as prevent underlying sediment from migrating through the overlying armor stone. The function of a granulated filter design is based on grain size and proportion of particles between foundation and filter materials and recommended indices to meet the design criteria as follows:

Retention: $\frac{D_{15(filter)}}{D_{85(foundation)}} < 5$

Permeability: $\frac{D_{15(filter)}}{D_{15(foundation)}} > 5$

Internal Stability: $\frac{D_{60(filter)}}{D_{10\,(filter)}} > 10$

Two granular materials were selected for filter design evaluation for purposes of maintaining two options for a carbon-amended layer. As noted above, one material is a coarse sand which has been used successfully to blend and place a granular activated carbon layer; and the second is a granular material similar to the gradation used to manufacture AquaGate+PAC™. The gradation data and comparison of design criteria are provided on Appendix B for both the coarse sand/granular material as filter layer (with sediment as the foundation layer) and for the armor stone (with the coarse sand/granular material as foundation layer). The gradations represented in Appendix B are incorporated into the Technical Specifications for the project.

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USACE 1994. Hydraulic Design of Flood Control Channels, EM 1110-2-1601, United States Army Corps of Engineers

USACE 1995, Design of Coastal Revetments, Seawalls, and Bulkheads, EM 1110-2-1614, United States Army Corps of Engineers

USACE 2008, Coastal Engineering Manual, Part II, Chapter 1, EM 1110-2-1100, United States Army Corps of Engineers

USEPA 1998. Assessment and Remediation of Contaminated Sediments (ARCS) Program. Guidance for In-Situ Subaqueous Capping of Contaminated Sediments. United States Environmental Protection Agency, Great Lakes National Program Office 77 West Jackson Boulevard, Chicago, IL.

USEPA 2016. Portland Harbor RI/FS Feasibility Study. Prepared by United States Environmental Protection Agency and CDM Smith. June 2016

Attachments

Table 1: Sediment Samples and Calculated Porewater, Total PAHs

Table 2: Sediment Samples and Calculated Porewater, Total PCBs

Table 3: Summary of CapSim Model Input

Table 4: CapSim Model Output, Total PAHs

Table 5: CapSim Model Output, Total PCBs

Appendix A: Propeller Wash Calculations

Appendix B: Sediment Gradation Checks

Appendix A: Propeller Wash Calculations

Maynord - Propeller Wash Calculations

The propeller wash for two design watercraft that may be operating at the Seaport Terminal were evaluated to determine the stable size for gravel used in the erosion protection layer and layer thickness. The vessels included the Crown Point Tidewater tug and the "large tug" particulars from the Portland Harbor FS. The tugs are the most severe situation due to the boat engine power and propeller depth. A water level of MLLW (1.95 ft CRD) was used as the worst case scenario for low tide that occurs on a regular basis and water depth evaluated is 35.95 ft. The Crowley Commitment articulated tug and barge were not evaluated for the erosion protection layer because it is most likely that this barge will be docked with assistance from the Willamette river tugs. This has been verified with Crowley. The ambient current of 2.5 fps was taken from data from USGS 14211720 WILLAMETTE RIVER AT PORTLAND, OR for October 2017 to Feb 2018. This was the maximum average river current recorded during that time period. Additional data was not available for that location however the flood event river velocities are 3.6 fps which indicates that 2.5 fps for an operational case is reasonable.

The calculated values for bottom flow velocities and bottom shear are based on the methods presented in Blaauw and Kaa (1978), as referenced in Guidance for In-Situ Subaqueous Capping of Contaminated Sediments (USEPA, 1998). The critical parameters associated with the equations to determine the propeller wash forces include water depth, horse power, and the size of the propellers. Fields for user input are highlighted in yellow.

Parameter	Description		Unit	Notes / References
Maximum Bottom Velocity	$V_{b(max)}$ =	$C_1U_oD_p/H_p$	Ft/sec	Equation #1 (Eqn 3 in USEPA 1998)
Propeller Constant 1	C_1 =	0.22 for non-ducted propellers	Unitless	USEPA 1998
		0.30 for ducted propellers	Unitless	
Jet Velocity Exiting Propellers	U_o =	See Calculation Below	Ft/sec	
Applied Engineer/Power Ratio	D_o =	0.71 D_p for non-ducted propeller	Ft	D_o=D_p for ducted propellers (Eqn 6 in USEPA 1998)
		D_p for ducted propellers	Ft	
Propeller Diameter	D_p =	Varies by Boat	Ft	D_o=0.85D_p for tunnel propellers (Verhey 1983)
Distance from Propeller Shaft to River Bottom	H_p =	River Depth - Maximum Draft	Ft	
Jet Velocity Existing Propellers	U_o =	$C_2 * ((P_{dp}/(D_p{}^2))^{(1/3)}$	Ft/sec	Equation #2 (Eqn 4 in USEPA 1998)
Applied Engine/Propeller Power	P_{dp} =	Varies by Boat	hp	
Propeller Constant 2	C_2 =	9.72 for non-ducted propellers	Unitless	Eqn 4 in USEPA 1998
		7.68 for ducted propellers	Unitless	
Armor Stone Size	D_{50} =	$(V_{bmax}/C_3)^2/(g \times \delta)$	FT	Equation #3 (Eqn 5 in USEPA 1998)
Armor Stone Size (minimum)	D_{50} =	Varies	FT	
Experimental Coefficient	C_3 =	0.60 for no movement	Unitless	Page A-10, USEPA 1998
		0.70 for small transport	Unitless	Page A-10, USEPA 1998
Gravitational Constant	g =	32.17	Ft/sec^2	
Delta	δ =	$(a_s-a_w)/a_w$	Unitless	Eqn 5 in USEPA 1998
Unit weight of Armor Stone	a_s =	165	lbs/CF	
Unit Weight of Water	a_w =	63.8	lbs/CF	
Safety Factor	SF =	1.5	Unitless	
Design Thickness for Armor Layer	Tc =	2 * D_{50} * SF	IN	Equation #4
Rock Sizing for Flood Control Channels				
Safety Factor	SF =	1.1	Unitless	
Stability coefficient	C_s =	0.3	Unitless	0.3 for angular rock, 0.375 for rounded rock
Vertical velocity distribution coefficient	C_v =	1	Unitless	1.0 for straight channels
Thickness coefficient	C_T =	1	Unitless	1.0 for thickness = 1xD_{100} or 1.5xD_{50}
Local depth of flow	d =	varies	ft	
Side slope correction factor	K1 =	0.43	Unitless	From side slope calc and for steep slope, not flat
Current velocity	V =	varies	Ft/sec2	
Armor Stone Size for Current Velocity	D_{30} =	$S_fC_sC_vC_Td((1/\delta)^5 x(V/sqrt(K_1gd)))^{2.5}$	FT	Equation #6. Eqn 2 in USEPA 1998

Maynord - Propeller Wash Calculations

Mostly Likely Cases for Boats traveling within the cap area

		Ambient current at MLLW (+1.95 ft CRD)	**No current at MLLW (+1.95 ft CRD)**	
		Tidewater Crown Point Tug	**Portland Harbor FS**	
		Large Tug	**Large Tug**	
Boat Description[1]	**Units**	**Situation 1**	**Situation 2**	**Reference**
Rated horsepower per Engine	hp	2240	1650	From documentation on vessels (Background Info sheet)
Power Evaluated	%	70%	80%	Taken from Portland Harbor FS methodology for maximum reasonable HP applied
Applied Engine Power	hp	1568	1320	
Number of propellers	Each	2	2	From documentation on vessels (Background Info sheet)
Propeller diameter (D_p)	Ft	7.67	8.00	From documentation on vessels (Background Info sheet)
Type of propeller (non-ducted or ducted)	Unitless	Ducted	ducted	From documentation on vessels (Background Info sheet)
No movement or small transport expected for cap?	Unitless	no movement	no movement	
Applied Engineer/Power Ratio (D_o)	Unitless	7.67	8.00	
Water Depth	Ft	35.95	35.95	Final design elevation of -34 ft CRD plus MLLW
Maximum Draft	Ft	14.00	13.00	From documentation on vessels (Background Info sheet)
Distance from Propeller Shaft to River Bottom (H_p)	Ft	25.78	26.95	
Propeller Constant 1 (C_1)	Unitless	0.3	0.3	
Propeller Constant 2 (C_2)	Unitless	7.68	7.68	
Experimental Coefficient 3 (C_3)	Unitless	0.6	0.6	Higher value of C_3 is used instead of 0.55 as recommended for harbor areas since a large tug operating at 70-80% engine power at the dock is an unusual occurrence.
Jet Velocity Existing Propellers (U_o) (Using Equation #2)	Ft/sec	22.70	20.85	
Maximum Bottom Velocity ($V_{b(max)}$) (Using Equation #1)	Ft/sec	2.02	1.86	
Bottom (assumed) Velocity due to Current	ft/sec	2.50	0.00	Depth averaged velocity from FEMA 2010
δ	Unitless	1.59	1.59	
Armor Stone Size (D_{50}) for river current (Eqn #6)	IN	0.42		Eqn #6 is converted to D50 using D30 x (D85/D15)^(1/3) from USEPA 1998 and D85/D15 relation from gradation suggested by K. Carbonneau 3/27/18. D85 = 2.76 " and D15 = 1.35". The conversion factor is 1.27.
Armor Stone Size (D_{50}) (Using Equation #3)	IN	2.7	2.3	
Armor Layer Thickness	IN	5.36	4.50	Layer thickness is 2 x D50.
SF	Unitless	1.0	1.0	
Design Thickness for Armor Layer Considering Propeller Wash (Using Equation #4)	IN	**5.36**	**4.50**	

Notes:

Ft = Feet

Ft/sec = feet per second

hp = horsepower

References:

Blaauw, H.B., and E.J. van de Kaa. 1978. Erosion of bottom and Sloping Banks Caused by the Screw-Race of Maneuvering Ships. International Harbor Congress. Antwerp, Belgium. 1978.

FEMA, 2010. Flood Insurance Study, City of Portland, Oregon, Multnomah, Clackamas and Washington Counties. Federal Emergency Management Agency, Nov 26, 2010

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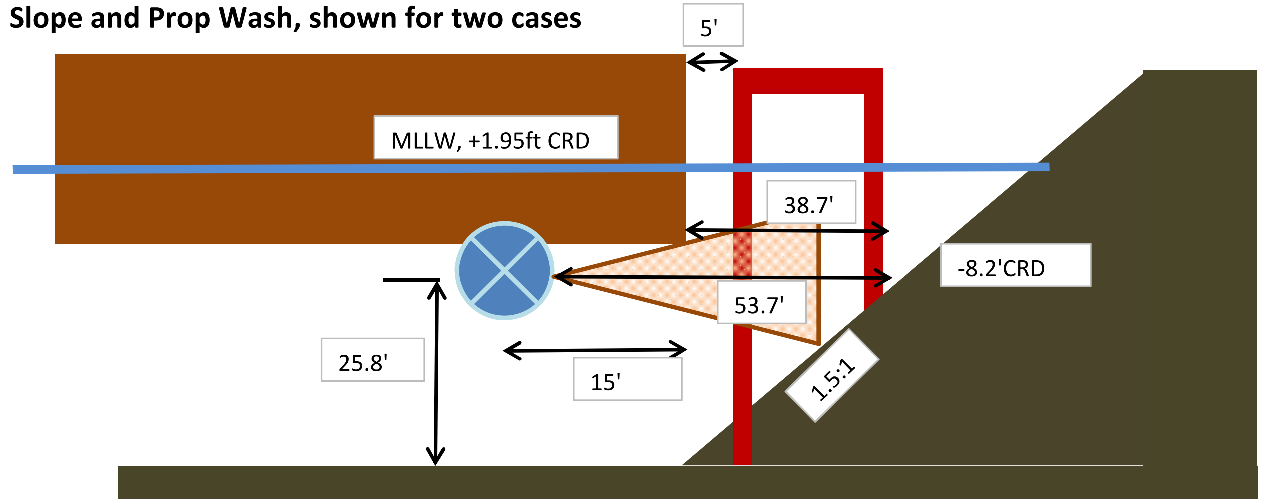
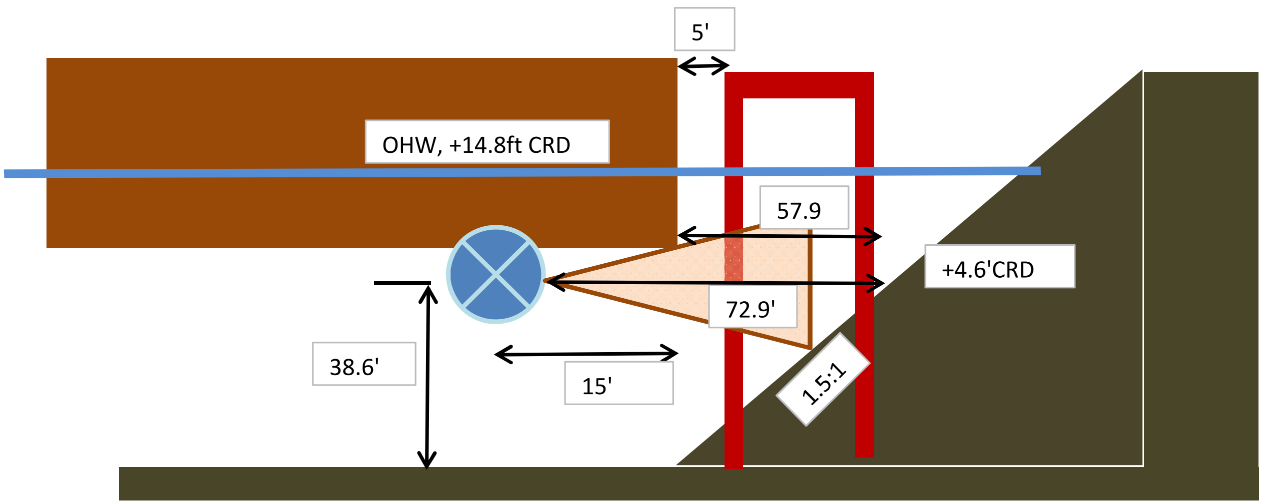
USEPA 2016. Portland Harbor RI/FS Feasibility Study. Prepared by United States Environmental Protection Agency and CDM Smith. June 2016

Slope and Prop Wash, shown for two cases



MLLW, +1.95 ft CRD

33.7 slope angle in deg
25.8 length of vertical, ft
38.7 length of horiz, ft
53.7 added 15 ft behind tug



OHW, +14.8 CRD

33.7 slope angle in deg
38.6 length of vertical, ft
57.9 length of horiz, ft
72.9 added 15 ft behind tug

Propeller Wash on Slope (PIANC 2015)

Tidewater Crown Point Tug, MLLW

		Variable	Value	Eqn reference and notes	Variable	Value	Eqn reference and notes
hp or ht (ft)	25.8	hp or ht (m)	7.9	distance between prop shaft and bed	C3	1.17	coeffcient for Eqn 8-26, 1.17 for ducted, 1.48 for free props
h (m)	11.0	Dp (m)	2.3	Propeller diameter	P_D (W)	1,657,600	max installed engine power, using 0.74 conversion and confirmed
		hp/Dp	3.36		ρw (kg/m3)	1,000	freshwater density
		a	0.6	coefficient used in Eqn 8-29 assuming only bottom and surface influences	fp (%)	70%	percent of engine power used
		Vo (m/s)	6.9	outflow velocity, Eqn 8-26	ρs (kg/m3)	1600	granite density, submerged
		x (m)	16.4	distance between prop and slope contact			
		A	1.2	Eqn 8-30			
		$V_{max,s}$ (m/s)	2.6	m/s, Eqn 8-29 at location of jet wash on slope			
		Bcrit	1	coefficient from PIANC, range 0.9 to 1.25			
D85 (in)	17.0	D85(m)	0.43	using PIANC eqn 10-25			
D50 (in)	12.2	D50(m)	0.31	using 1.4 as a conversion			

Tidewater Crown Point Tug, OHW (14.8 CRD)

		Variable	Value	Eqn reference and notes	Variable	Value	Eqn reference and notes
hp or ht (ft)	38.6	hp or ht (m)	11.8	distance between prop shaft and bed	C3	1.17	coeffcient for Eqn 8-26, 1.17 for ducted, 1.48 for free props
h (m)	14.9	Dp (m)	2.3	Propeller diameter	P_D (W)	1,657,600	max installed engine power, using 0.74 conversion and confirmed
		hp/Dp	5.03		ρw (kg/m3)	1,000	freshwater density
		a	0.6	coefficient used in Eqn 8-29 assuming only bottom and surface influences	fp (%)	70%	percent of engine power used
		Vo (m/s)	6.9	outflow velocity, Eqn 8-26	ρs (kg/m3)	1600	granite density, submerged
		x (m)	22.2	distance between prop and slope contact			
		A	1.0	Eqn 8-30			
		$V_{max,s}$ (m/s)	1.9	m/s, Eqn 8-29 at location of jet wash on slope			
		Bcrit	1	coefficient from PIANC, range 0.9 to 1.25			
D85 (in)	8.7	D85(m)	0.22	using PIANC eqn 10-25			
D50 (in)	6.2	D50(m)	0.16	using 1.4 as a conversion			

Tidewater Crown Point Tug, 5.7 CRD

		Variable	Value	Eqn reference and notes	Variable	Value	Eqn reference and notes
hp or ht (ft)	29.4	hp or ht (m)	9.0	distance between prop shaft and bed	C3	1.17	coeffcient for Eqn 8-26, 1.17 for ducted, 1.48 for free props
h (m)	12.1	Dp (m)	2.3	Propeller diameter	P_D (W)	1,657,600	max installed engine power, using 0.74 conversion and confirmed
		hp/Dp	3.83		ρw (kg/m3)	1,000	freshwater density
		a	0.6	coefficient used in Eqn 8-29 assuming only bottom and surface influences	fp (%)	70%	percent of engine power used
		Vo (m/s)	6.9	outflow velocity, Eqn 8-26	ρs (kg/m3)	1600	granite density, submerged
		x (m)	18.0	distance between prop and slope contact			
		A	1.2	Eqn 8-30			
		$V_{max,s}$ (m/s)	2.4	m/s, Eqn 8-29 at location of jet wash on slope			
		Bcrit	1	coefficient from PIANC, range 0.9 to 1.25			
D85 (in)	13.9	D85(m)	0.35	using PIANC eqn 10-25			
D50 (in)	9.9	D50(m)	0.25	using 1.4 as a conversion			

Sources:

BAW (2010). Code of Practice, Principles for the Design of Bank and Bottom Protection for Inland Waterways, Federal Waterways Engineering and Research Institute, Karlsruhe.

PIANC (2015). Guidelines for Protecting Berthing Structures from Scour Caused by Ships, Maritime Navigation Commission. PIANC Report No. 15

Rock Armor Design (Hudson)[a]

Scenario 1

	Slope Scenario	Non-Breaking 1.5 horizontal : 1 vertical	Breaking Wave	Valid Data Range
	Armor Scenario	**1**	**2**	
1	Wind-Wave Height (H), ft	2.80	2.80	0.1 to 100.0
2	Cotangent of Structure Slope (cot Θ)	1.5	1.5	1.5 to 3.0
3	Unit Weight of Rock (w_r), lb/ft^3	165	165	-
4	Unit Weight of Water (w_w), lb/ft^3	62	62	-
5	Stability Coefficient (K_D)	4	2	-
6	Delta (Δ)	1.64	1.64	-
7	Median Armor Stone Weight (W_{50}), lbs	136	272	-
8	Median Diameter (in)	11	14	-
9	Layer Thickness (Γ_{Armor}) (ft) =	1.9	2.4	-

Riprap Gradation (Hudson)[b]

2H:1V Slope

Armor Layer

-	Stone Grade	Weight (lbs)	Cubic Equivalent (in)	
9	Maximum	532	18	
10	Median	271.61	14.17	
11	Minimum	109	10	
12	Layer Thickness (Γ_{Armor}) (ft) =	2.4		
	Filter Layer			
-	**Percent Less Than by Weight**	**Weight (lbs)**	**Cubic Equivalent (in)**	**Stone Screen Size (in)[c]**
13	100	2.86	3.1	4
14	85	1.70	2.6	3
15	50	0.50	1.7	2
16	15	0.15	1.2	1
17	0	0.09	1.0	1
18	Layer Thickness (Γ_{Armor}) (ft) =	1.0		

Number	Equation
1 to 5	User Inputs
6	$\Delta = w_r/w_w - 1$
7	$W_{50}=(D_{50}/w_r)^{1/3}$
8	$D_{50}=W_{50}{}^{1/3}/w_r * 1.15$
9	$\Gamma_{armor} = 2(W_{50}/w_r)^{1/3}$

Sources:

[a]USACE (2011). Coastal Engineering Manual (CEM) Part VI Chapter 5. EM 1110-2-1100. Prepared for U.S. Army Corps of Engineers.

[b]CERC (1992). Automated Coastal Engineering System (ACES) Technical Reference - Chapter 4-4. Coastal Engineering Research Center.

Rock Sizing for Currents

	Value	Notes
V (ft/s)	3.60	from FEMA 2010
Sf	1.1	
Cs	0.3	for angular rock
Cv	1	for straight channels
CT	1	for thickness
d	3	local depth of flow in ft
yw	62.4	lb/ft3
ys	165	lb/ft3
Slope	1.5	H:1V
g	32.2	ft/s2
Slope	0.59	in radians
Angle of Repose	38	in degrees
	0.66	in radians
K1	0.43	Correction factor using eqn 3-4
term 1	0.99	
term 2	0.78	
term 3	0.56	
D30 (in)	1.47	eqn 3-3
D50 (in)	2.21	

$$D_{30} = S_f C_s C_V C_T d \left[\left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{1/2} \frac{V}{\sqrt{K_1 g d}} \right]^{2.5} \qquad (3\text{-}3)$$

where

D_{30} = riprap size of which 30 percent is finer by weight, length

Sources:

USACE (1994). Hydraulic Design of Flood Control Channels. EM 1110-2-1601. Prepared for U.S. Army Corps of Engineers.

Loading Criteria and Armorstone Sizing

Loading Criteria	H_s (ft)	$V_{critical}$ (ft/s)	Mean diameter D_{50} (in)	Mean mass (lbs)	Notes
Wave load - Boat wake	2.8		14.2	274	Boat wake from Portland Harbor FS
100 yr river current		3.6	2.2	1	From FEMA 2010
Tidewater Crown Point Tug		8.5	12.2	175	
Portland Large Tug		8.2	11.2	135	

Appendix B: Sediment Gradation Checks

Appendix B - Soil Filter Calculations

Granulated Filter Design Criteria

1. Retention Criterion

Formula:

$$\frac{D_{15\,(filter)}}{d_{85(base)}} < 4\ -5$$

Calculation:

Sand for GAC Cover

Z-Layer to Sand			*Sand to Stone*		
$\frac{0.297}{0.09}$	=	**3.3**	$\frac{10}{2.1}$	=	**4.8**

Granular Material for AquaGate+PAC Cover

Z-Layer to Sand			*Sand to Stone*		
$\frac{0.40}{0.09}$	=	**4.4**	$\frac{10}{4.76}$	=	**2.1**

2. Permeability Criterion

Formula:

$$\frac{D_{15\,(filter)}}{d_{15(base)}} > 4\ -5$$

Calculation:

Sand for GAC Cover

Z-Layer to Sand			*Sand to Stone*		
$\frac{0.297}{0.005}$	=	**61.9**	$\frac{10}{0.297}$	=	**33.7**

Granular Material for AquaGate+PAC Cover

Z-Layer to Sand			*Sand to Stone*		
$\frac{0.4}{0.005}$	=	**83.3**	$\frac{10}{0.4}$	=	**25.0**

3. Internal Stability Criterion

Formula:

$$\frac{D_{60(filter)}}{D_{10(filter)}} < 10$$

Calculation:

Sand for GAC Cover

Z-Layer to Sand			*Sand to Stone*		
$\frac{1.19}{0.23}$	=	**5.2**	$\frac{65.2}{8}$	=	**8.2**

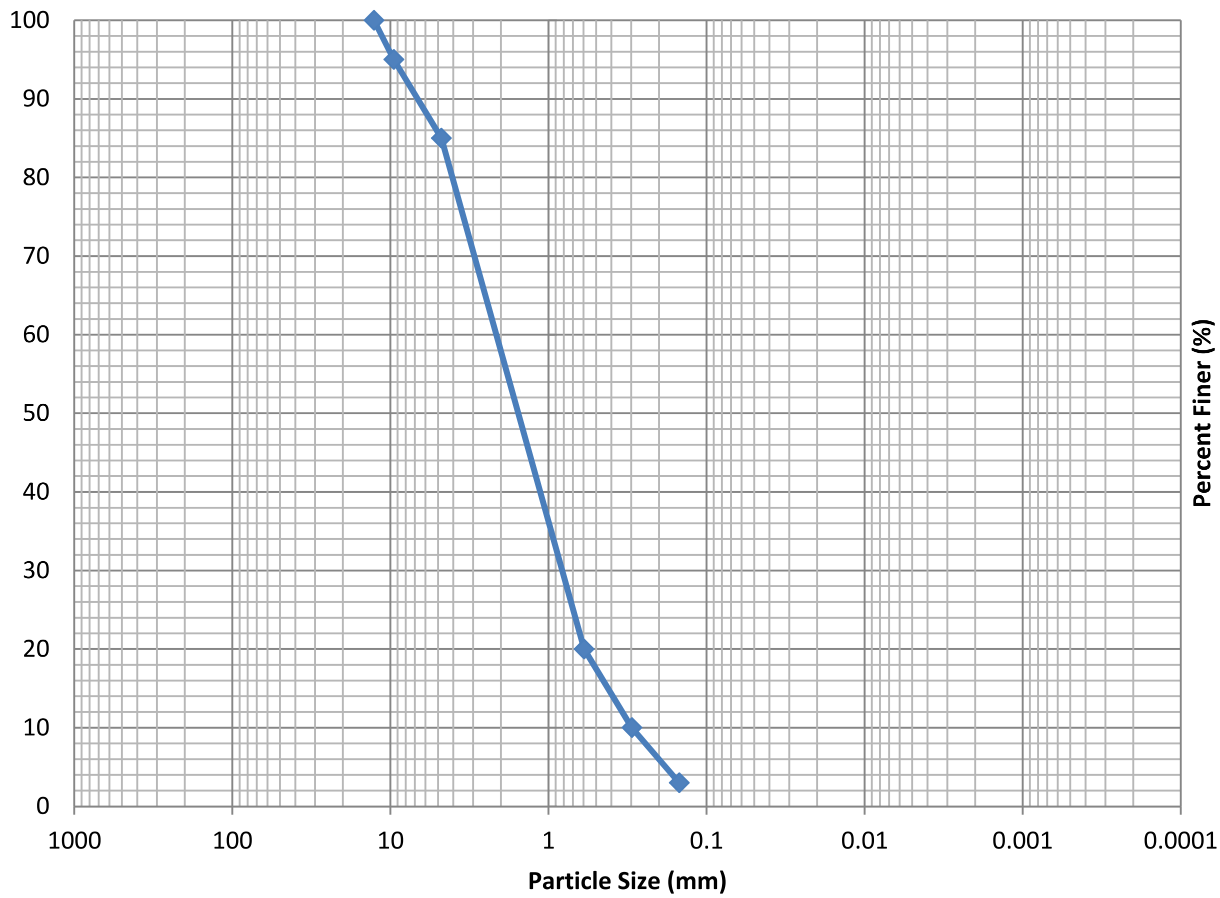
Granular Material for AquaGate+PAC Cover

Z-Layer to Sand			*Sand to Stone*		
$\frac{2.2}{0.297}$	=	**7.4**	$\frac{65.2}{8}$	=	**8.2**

Appendix B - Soil Filter Calculations

Granular Material for AquaGate+PAC Cover

Sieve No.	*Sieve Size, mm*	*Percent Finer, %*
1/2 in.	12.7	100
3/8 in.	9.51	95
No. 4	4.76	85
No. 30	0.595	20
No. 50	0.297	10
No. 100	0.149	3

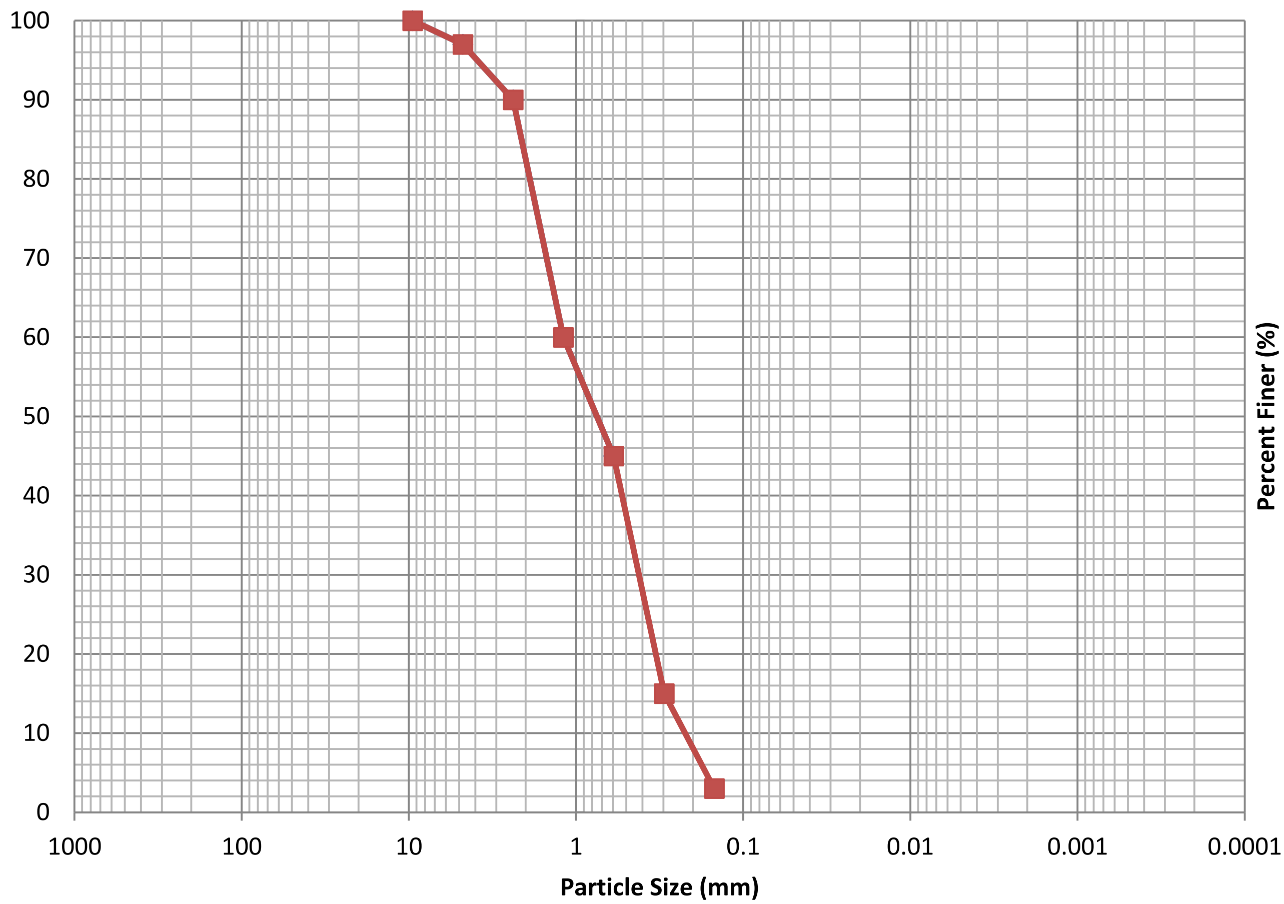


D Values For Calculations	
D_{85}	4.76
D_{60}	2.2
D_{15}	0.4
D_{10}	0.297

Appendix B - Soil Filter Calculations

Sand for GAC Cover

Sieve No.	*Sieve Size, mm*	*Percent Finer, %*
3/8 in.	9.51	100
No. 4	4.76	97
No. 8	2.38	90
No. 16	1.19	60
No. 30	0.595	45
No. 50	0.297	15
No. 100	0.149	3

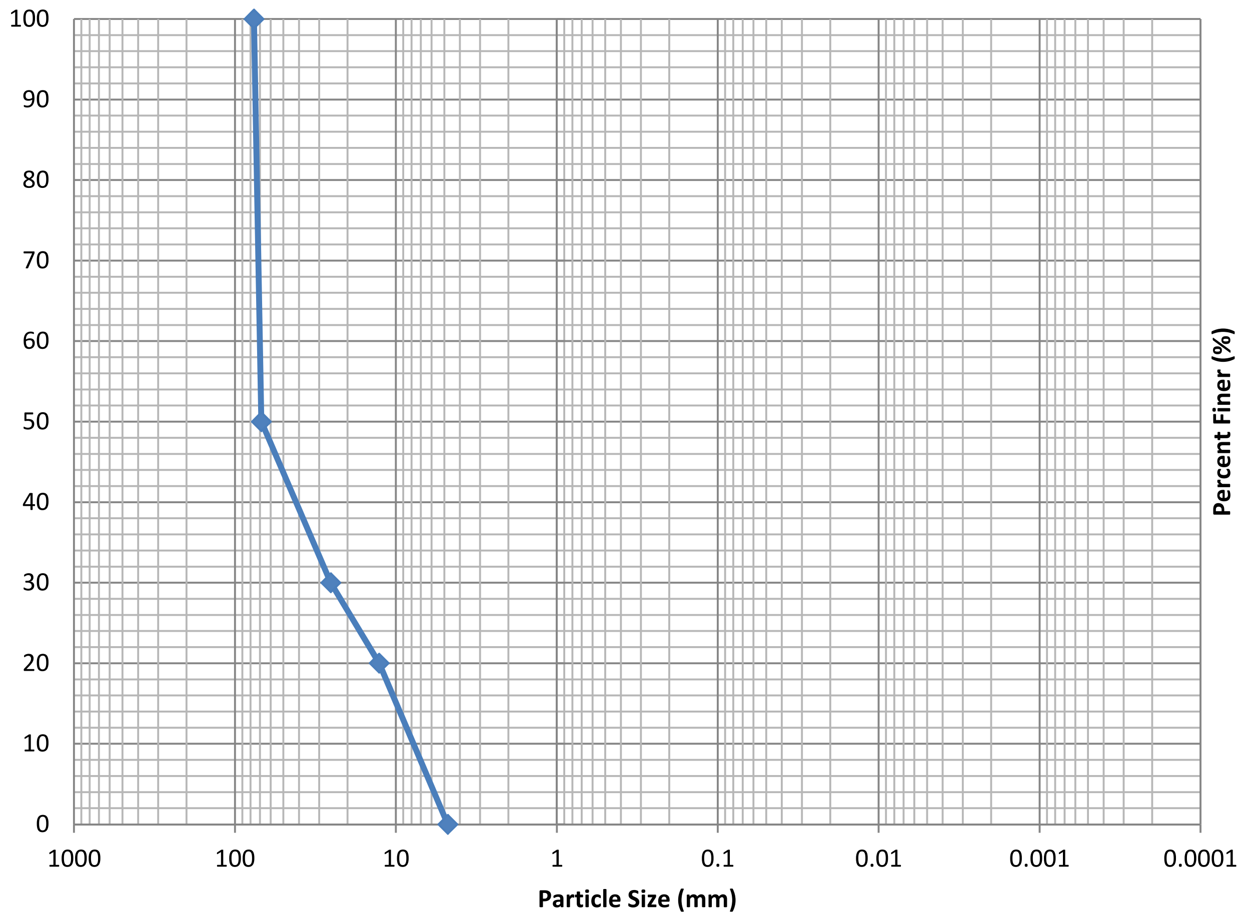


D Values For Calculations	
D_{85}	2.1
D_{60}	1.19
D_{15}	0.297
D_{10}	0.23

Appendix B - Soil Filter Calculations

Stone Layer

Sieve No.	*Sieve Size, mm*	*Percent Finer, %*
3 in.	76.2	100
2.7 in.	68.58	50
1 in.	25.4	30
1/2 in.	12.7	20
No. 4	4.76	0



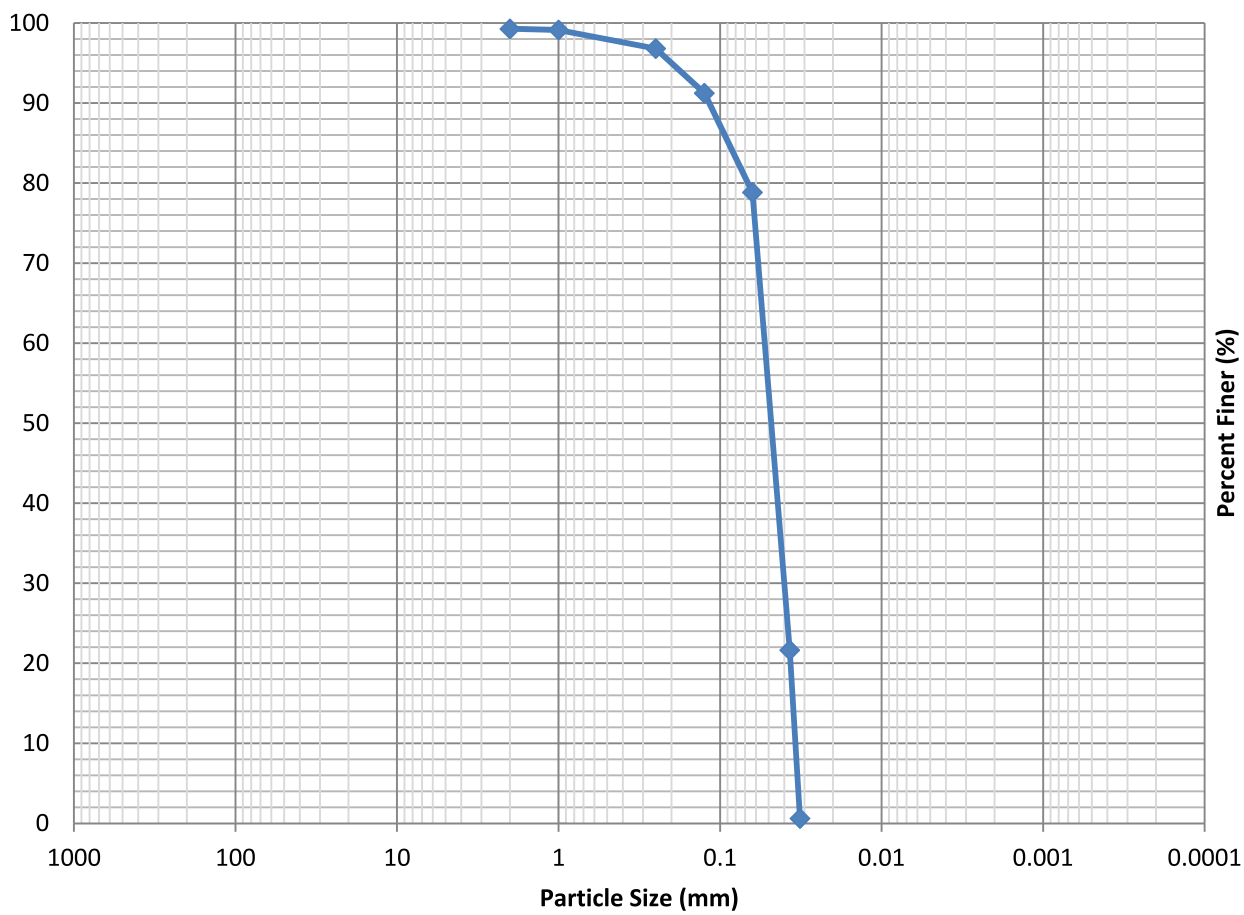
D Values For Calculations	
D_{85}	73.1
D_{60}	65.2
D_{15}	10
D_{10}	8

Appendix B - Soil Filter Calculations

Z-Layer (Post Dredge Sediment Surface)*

Sieve No.	*Sieve Size, mm*	*Percent Finer, %*
No. 10	2	99.27
No. 18	1	99.13
No. 60	0.25	96.80
No. 120	0.125	91.24
No. 230	0.063	78.83
No. 400	0.037	21.64
No. 450	0.032	0.61

*Z-Layer gradation was determined by averaging the gradation of the six cores reported on Table 2. Sediment Samples - Physical Analytical Results of Attachment E – Sediment Characterization Report from the *Seaport Midstream Maintenance Dredging Documents for Bid* issued on April 30th, 2018



D Values For Calculations	
D_{85}	0.09
D_{60}	0.026
D_{15}	0.0048
D_{10}	0.0045

Tables

Table 1. Sediment Samples and Calculated Porewater, Total PAHs

Analytes (units)	Sediment Analytical Results														Sediment Analytical Results			
Sample Type	Z-Layer Samples														Dredge Prism - Final Composite Samples			
DMMU Number	2						1								2		1	
Core Location	2A		2B		2C		1A		1B		1C				2A, 2B, & 2C		1A, 1B, & 1C	
Core ID	2A-ANA-1		2B-ANA-2		2C-ANA-2		1A-ANA-2		1B-ANA-1		1C-ANA-1				See SCR Table 1		See SCR Table 1	
Sample ID	OP1-ZL-2A*		OP1-ZL-2B		OP1-ZL-2C		OP1-ZL-1A		OP1-ZL-1B		OP1-ZL-1C				OP1-DMMU-2		OP1-DMMU-1	
Sample Date	9/7/2017		9/6/2017		9/7/2017		9/8/2017		9/8/2017		9/8/2017				9/6/2017		9/8/2017	
Sample Depth (feet BSS)	7.3 to 9.3		6.5 to 8.5		6.7 to 8.7		6.1 to 8.1		7.7 to 9.7		7.9 to 9.9				0 to Varies		0 to Varies	
Sample Elevation (feet CRD)	-35 to -37		-35 to -37		-35 to -37		-35 to -37		-35 to -37		-35 to -37				Varies to -35		Varies to -35	
Polycyclic Aromatic Hydrocarbons (µg/kg)																		
2-Methylnaphthalene	540		270		350		170		11		870				490		84	
Acenaphthene	2,300		1,300		1,800		520		38		6,900				3,600		280	
Acenaphthylene	430		170		150		110		17		370				320		46	
Anthracene	1,700		670		920		250		35		4,000				3,300		150	
Fluorene	1,600		820		1,000		390		27		4,400				2,600		240	
Naphthalene	1,500		470		430		330		27		1,500				1,200		170	
Phenanthrene	18,000		5,400		6,100		2,600		170		33,000				20,000		1,400	
Benz(a)anthracene	5,300		1,200		910		800		150		4,800				4,300		360	
Benzo(a)pyrene	7,600		1,400		860		1,000		210		5,700				5,400		420	
Benzo(b)fluoranthene	7,500		1,500		930		1,100		230		5,700				5,300		470	
Benzo(g,h,i)perylene	6,700		1,300		720		870		160		4,400				4,600		350	
Benzo(k)fluoranthene	2,500		440		300		370		75		1,800				1,800		160	
Chrysene	6,700		1,400		1,100		980		170		5,800				4,900		450	
Dibenz(a,h)anthracene	820		170		110		130		25		610				590		51	
Fluoranthene	19,000		3,800		3,000		2,400		300		19,000				16,000		1,200	
Indeno(1,2,3-cd)pyrene	5,600		1,100		610		760		150		3,800				3,800		300	
Pyrene	22,000		4,800		3,800		2,700		350		23,000				19,000		1,200	
Total LPAHs	*25,530*	*T*	*8,830*	*T*	*10,400*	*T*	*4,200*	*T*	*314*	*T*	*50,170*	*T*			*31,020*	*T*	*2,286*	*T*
Total HPAHs	*83,720*	*T*	*17,110*	*T*	*12,340*	*T*	*11,110*	*T*	*1,820*	*T*	*74,610*	*T*			*65,690*	*T*	*4,961*	*T*
Total PAHs (ug/kg)	109,250	T	25,940	T	22,740	T	15,310	T	2,134	T	124,780	T			96,710	T	7,247	T
foc(%)	2.6		2.2		2.2		1.9		2.0		2.3				2.3		1.9	
logKoc [1]	4.74		4.74		4.74		4.74		4.74		4.74				4.74		4.74	
Estimated Porewater Concentration (ug/L)	77		22		19		15		2		100				77		7	
Average Porewater (ug/L)	39														42			
Max Porewater (ug/L)	100														77			
Average Porewater (ug/L)	40																	
Max Porewater (ug/L)	100																	

Note:

[1] The predominant PAHs in the z-layer sediment are phenanthrene, fluoranthene, and pyrene. The Oregon Department of Environmental Quality (DEQ), Chemical Data Table from DEQ's Risk-Based Concentrations for Individual Chemicals (November, 2015) reports Koc values for fluoranthene and pyrene. As the LogKoc values for these two PAHs are nearly identical (4.735 for pyrene and 4.744 for fluoranthene), the average value of 4.74 was used.

Table 2. Sediment Samples and Calculated Porewater, Total PCBs

Analytes (units)	Sediment Analytical Results												Sediment Analytical Results			
Sample Type	Z-Layer Samples												Dredge Prism - Final Composite Samples			
DMMU Number	2						1						2		1	
Core Location	2A		2B		2C		1A		1B		1C		2A, 2B, & 2C		1A, 1B, & 1C	
Core ID	2A-ANA-1		2B-ANA-2		2C-ANA-2		1A-ANA-2		1B-ANA-1		1C-ANA-1		See SCR Table 1		See SCR Table 1	
Sample ID	OP1-ZL-2A*		OP1-ZL-2B		OP1-ZL-2C		OP1-ZL-1A		OP1-ZL-1B		OP1-ZL-1C		OP1-DMMU-2		OP1-DMMU-1	
Sample Date	9/7/2017		9/6/2017		9/7/2017		9/8/2017		9/8/2017		9/8/2017		9/6/2017		9/8/2017	
Sample Depth (feet BSS)	7.3 to 9.3		6.5 to 8.5		6.7 to 8.7		6.1 to 8.1		7.7 to 9.7		7.9 to 9.9		0 to Varies		0 to Varies	
Sample Elevation (feet CRD)	-35 to -37		-35 to -37		-35 to -37		-35 to -37		-35 to -37		-35 to -37		Varies to -35		Varies to -35	
PCB Aroclors (µg/kg)																
Aroclor 1016	4.7	U	4.9	U	4.7	U	4.8	U	4.3	U	4.2	U	4.6	U	4.8	U
Aroclor 1221	4.7	U	4.9	U	4.7	U	4.8	U	4.3	U	4.2	U	4.6	U	4.8	U
Aroclor 1232	4.7	U	4.9	U	4.7	U	4.8	U	4.3	U	4.2	U	4.6	U	4.8	U
Aroclor 1242	4.7	U	160		130		120		12	J	48		54		4.8	U
Aroclor 1248	4.7	U	4.9	U	4.7	U	4.8	U	4.3	U	4.2	U	4.6	U	4.8	U
Aroclor 1254	9.7	U	120		100		88	J	15	J	68		60		11	J
Aroclor 1260	11	J	63		69		55		7.1	J	49		31	J	9.4	J
Total PCBs (ug/kg)	11	JT	343	T	299	T	263	JT	34	JT	165	T	145	JT	20.4	JT
foc(%)	2.6		2.2		2.2		1.9		2.0		2.3		2.3		1.9	
logKoc [1]	5.12		5.12		5.12		5.12		5.12		5.12		5.12		5.12	
Estimated Porewater Concentration (ug/L)	3.23E-03		1.19E-01		1.04E-01		1.06E-01		1.30E-02		5.48E-02		4.81E-02		8.20E-03	
Average Porewater (ug/L)	0.07												0.03			
Max Porewater (ug/L)	0.12												0.05			
Average Porewater (ug/L)	0.06															
Max Porewater (ug/L)	0.12															

Note:

[1] Value for Total PCBs from Oregon Department of Environmental Quality (DEQ). Chemical Data Table from DEQ's Risk-Based Concentrations for Individual Chemicals. November, 2015.

Table 3. Summary of CapSim Model Input

Parameter		Units	Total PAHs	Total PCBs	Notes
Underlying Sediment					
Sediment concentration	C_{sed}	ug/kg	124,780	343	Maximum sediment concentrations (see Tables 1 and 2)
Estimated porewater concentration	C_{pw}	ug/L	100	0.12	Based on a site-specific underlying sediment concentrations and sample-specific fraction organic carbon (see Tables 1 and 2), and literature partition coefficients from the Oregon RBDM database.
Thickness	h_{sed}	cm	30.48	30.48	Thickness of underlying sediment layer used in model.
Porosity	f_{sed}		0.4	0.4	Assumed
Bulk density	r_{sed}	g/cm^3	1.56	1.56	Assumed
Partition coefficient	$log\ K_{oc}/logKd$	log L/kg	4.74	5.12	Literature values (see Note 1)
Fraction organic carbon	foc_{sed}		2.2%	2.2%	Site specific (average)
Activated Carbon Layer (Bulk Mixture of GAC+Sand) for select model runs					
Thickness	h_{ac}	cm	7.62 15.24	7.62 15.24	Design (simulation of 3 inches or 6 inches of GAC+Sand mixture)
Percent GAC in Active Layer			1% 0.5%	1% 0.5%	Assumed minimum dosage of 1% of activated carbon by weight mixed with sand within the amended layer portion of the 12-inch cover in a Berth Area. In the Under Dock/Slope Area, a lower dosage (0.5%) was used within the amended layer portion of the 9-inch cover.
GAC density in Active Layer	r_{ac}	g/cm^3	0.015 0.008	0.015 0.008	Calculated based on dry bulk density of 1.52 g/cm^3 of sand+AC mixture and 1% or 0.5% of activated carbon by weight mixed with sand.
Freundlich coefficient	$log\ K_f$	log $(ug/kg)/(ug/L)^{(1/n)}$	7.22	8.48	See Note 2 below
Freundlich coefficient	K_f	$(ug/kg)/(ug/L)^{(1/n)}$	1.65E+07	3.02E+08	See Note 2 below
Freundlich coefficient 1/n	$1/n$	-	0.41	0.84	See Note 2 below
Activated Carbon Layer (AquaGate+PAC 5%™) for select model runs					
Thickness	h_{ac}	cm	2.54	2.54	Design (assumed based on minimum 1 inch thickness of AquaGate+PAC 5%™)
Percent GAC in Active Layer			2.0%	2.0%	AquaGate+PAC 5%™ (which is typically 2 to 5% activated carbon [AquaBlok, Ltd., 2016], 2% minimum simulated)
GAC density in Active Layer	r_{ac}	g/cm^3	0.027	0.027	Calculated based on dry bulk density of 85 lb/ft^3 of AquaGate+PAC and 2% activated carbon (from vendor, AquaBlok, Ltd. 2016).
Freundlich coefficient	$log\ K_f$	log $(ug/kg)/(ug/L)^{(1/n)}$	7.22	8.48	See Note 2 below
Freundlich coefficient	K_f	$(ug/kg)/(ug/L)^{(1/n)}$	1.65E+07	3.02E+08	See Note 2 below
Freundlich coefficient 1/n	$1/n$	-	0.41	0.84	See Note 2 below
Activated Carbon Layer (Bulk Mixture of AquaGate+PAC 5%™ +AASHTO#8) for select model runs					
Thickness	h_{ac}	cm	10.16	10.16	Design (assumed based on minimum 4 inch thickness of AquaGate+PAC 5%™+AASHTO#8 mixture)
Percent GAC in Active Layer			0.4%	0.4%	Assumed mixture of 20% AquaGate+PAC 5%™ (which is typically 2 to 5% activated carbon, 2% minimum simulated) and 80% AASHTO#8 by weight
GAC density in Active Layer	r_{ac}	g/cm^3	0.006	0.006	Calculated based on dry bulk density of AquaGate+PAC with 2% activated carbon (from vendor) and bulk density of AASHTO#8.
Freundlich coefficient	$log\ K_f$	log $(ug/kg)/(ug/L)^{(1/n)}$	7.22	8.48	See Note 2 below
Freundlich coefficient	K_f	$(ug/kg)/(ug/L)^{(1/n)}$	1.65E+07	3.02E+08	See Note 2 below
Freundlich coefficient 1/n	$1/n$	-	0.41	0.84	See Note 2 below
Activated Carbon Layer (Reactive Core Mat (RCM) with GAC) for select model runs					
Thickness	h_{ac}	cm	1.0	1.0	Design (based on 1 cm thickness of RCM)
Percent GAC in Active Layer		%	100	100	Cetco RCM with GAC
GAC density in Active Layer		g/cm^3	0.2	0.2	Cetco RCM with GAC 0.4 lb/ft^2 activated carbon mass per area
Freundlich coefficient	$log\ K_f$	log $(ug/kg)/(ug/L)^{(1/n)}$	6.22	7.48	See Note 2 below
Freundlich coefficient	K_f	$(ug/kg)/(ug/L)^{(1/n)}$	1.65E+06	3.02E+07	See Note 2 below
Freundlich coefficient 1/n	$1/n$	-	0.41	0.84	See Note 2 below

Table 3. Summary of CapSim Model Input

Parameter		Units	Total PAHs	Total PCBs	Notes
Armor Layer (Fines)					
Thickness above active carbon layer within 1 ft thick cover in Berth Area or within 9 inch thick cover in Under Dock/Slope Area	h_{sand}	cm	Varies	Varies	Design (Berth Area: 22.86 cm above 7.62 cm mixture of GAC+Sand, 15.24 cm above 15.24 cm mixture of GAC+Sand, 27.94 cm above 2.54 cm of AquaGate+PAC, or 20.32 cm above 10.16 cm of AquaGate+PAC+AASHTO#8 mixture. Under Dock/Slope Area: 15.24 cm above 7.62 cm mixture of GAC+Sand). Note, for long-term predictions the model assumes sand/fines deposit on the cover and fill the voids of the armor layer.
Porosity	f_{sand}	-	0.4	0.4	Assumed
Bulk density	r_{sand}	g/cm^3	1.56	1.56	Assumed based on the typical sand particle density of 2.65 g/cm^3 and porosity of 0.4.
Partition coefficient	$log\ K_{oc}/logKd$	log L/kg	4.74	5.12	Literature values (see Note 1)
Fraction organic carbon	foc_{sand}	%	0.04%	0.04%	Typical for sand source material
Fraction organic carbon in bioturbation zone	foc_{bio}	%	2%	2%	Assumed increase in foc over time in bioactive zone such that future foc would be similar to current sediments. Sensitivity analysis was run for select caps with BAZ foc of 4%.
General Input					
Molecular diffusivity	$D_{i,w}$	cm^2/s	7.25E-06	6.10E-06	Literature values (see Note 1).
Darcy velocity	V	cm/yr	57	57	Based on a calibrated groundwater flow model generated for the site. For added conservatism, the high end of the range was simulated in the cap model.
Dispersivity	α_{sand}	cm	1.5	1.5	Calculated based on model simulated cover thickness (0.05*Total Thickness [30.48 cm], as per Reible steady-state cap model based on Lampert and Reible, 2009)
Bioturbation	-	-	Yes	Yes	Assumed 10 cm
Porewater biodiffusion coefficient	D_{bio}^{pw}	cm^2/yr	100	100	Assumed (CapSim default value)
Particle biodiffusion coefficient	D_{bio}^{p}	cm^2/yr	1	1	Assumed (CapSim default value)
Consolidation	-	cm	No	No	Consolidation of underlying sediment is expected to be negligible after dredging and placement of the1 ft thick cover
Deposition	-	-	No	No	Conservative (no deposition)
Decay	-	-	No	No	Conservative (no decay)
Depth of Interest 1	z	cm	10	10	Bottom of BAZ (Model predictions at this depth are compared to the sediment screening values below).
Depth of Interest 2	z	cm	15	15	Bottom of armor layer (fines) (Model predictions at this depth are also compared to the sediment screening values below).
SEF Freshwater Benthic Toxicity Screening Levels		ug/kg	17,000	110	
Portland Harbor ROD Cleanup Levels		ug/kg	23,000	9	

Notes:

[1] Partition coefficients and molecular diffusivity for Total PAHs and Total PCBs are based on Oregon Department of Environmental Quality (DEQ), 2015. Chemical Data Table from DEQ's Risk-Based Concentrations for Individual Chemicals. November, 2015. For Total PAHs, the values for pyrene were used.

[2] Freundlich coefficients used for non-linear sorption of contaminants to activated carbon. For Total PAHs, Freundlich coefficients from Texas Tech University based on Walters, R.W., Luthy, R.G., 1984 (Equilibrium adsorption of polycyclic aromatic hydrocarbons from water onto activated carbon. Environmental science & technology 18, 395-403). The lowest of the values (for phenanthrene) of the three predominant PAHs (phenanthrene, flouranthene, and pyrene) observed in the sediment data was used. For PCBs, Freundlich coefficients are based on Gomez-Eyles et al., 2013 (Table S2 for select organics for CAC-Coal in Supporting Information). The average of the reported values of Freundlich coefficients (Kf and 1/n) for the congeners was used. As a sensitivity analysis, one order-of-magnitude lower values of logKf (6.22 for Total PAHs and 7.48 for PCBs) were modeled.

Table 4. CapSim Model Output, Total PAHs

Model Run	Units	Model Runs Based on Estimated Maximum Porewater Concentration											
		Bulk Mixture of GAC+Sand (1% AC by weight)					AquaGate+PAC5%™ (Min 2% AC by weight)		Bulk Mixture of AquaGate+PAC5%™ (Min 2% AC by weight) + AASHTO#8		Under Dock/Slope Area		
		6 inch amended layer at bottom of 12-inch thick cover		3 inch amended layer at bottom of 12-inch thick cover			Min 1 inch AG+PAC layer at bottom of 12-inch thick cover		Min 4 inch amended layer at bottom of 12-inch thick cover		Min 3 inch amended layer at bottom of 9-inch thick cover		RCM with GAC at bottom of 12-inch thick cover
		1	2	3	4	4a (BAZfoc=4%)	5	6	7	8	9	9a (BAZfoc=4%)	10
Underlying Sediment Concentration	ug/kg	124,780	124,780	124,780	124,780	124,780	124,780	124,780	124,780	124,780	124,780	124,780	124,780
Estimated Underlying Porewater Concentration	ug/L	100	100	100	100	100	100	100	100	100	100	100	100
Total Cover Thickness	cm	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	22.86	22.86	30.48
Amended (Active) Layer Thickness	cm	15.24	15.24	7.62	7.62	7.62	2.54	2.54	10.16	10.16	7.62	7.62	1.0
Activated Carbon (AC) Density in Amended Layer	g/cm^3	0.015	0.015	0.015	0.015	0.015	0.027	0.027	0.006	0.006	0.008	0.008	0.2
AC Freundlich Coefficient log Kf	log $(ug/kg)/(ug/L)^{(1/n)}$	7.22	6.22	7.22	6.22	6.22	7.22	6.22	7.22	6.22	6.22	6.22	6.22
AC Freundlich Coefficient 1/n	--	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
Cover Thickness Above Amended Layer (includes 10 cm BAZ)	cm	15.24	15.24	22.86	22.86	22.86	27.94	27.94	20.32	20.32	15.24	15.24	29.48
SEF Freshwater Benthic Toxicity Screening Level	ug/kg	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000
Portland Harbor ROD Cleanup Level	ug/kg	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000
Model Results at the Bottom of Bioactive Zone (Depth of 10 cm)													
Predicted Sediment Concentrations (ug/kg)[1]	30 yr	1.47E-133	4.02E-98	3.32E-56	5.55E-35	1.05E-34	2.53E-14	4.68E-04	1.48E-107	2.66E-88	1.04E-22	9.34E-24	1.84E-18
	50 yr	6.83E-129	3.33E-86	1.34E-52	2.09E-26	3.95E-26	1.53E-12	5.17E+01	3.26E-103	5.51E-84	1.30E-10	3.62E-11	3.91E-09
	100 yr	8.19E-117	1.73E-66	3.41E-47	2.76E-10	5.23E-10	2.22E-10	1.83E+04	1.12E-97	2.73E-77	1.77E+04	3.37E+04	7.26E+01
Predicted Time to Exceedance (SEF Freshwater Benthic Toxicity Screening Level)	years	>100	>100	>100	>100	>100	>100	99	>100	>100	100	91	>100
Predicted Time to Exceedance (Portland Harbor ROD Cleanup Level)	years	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	95	>100
Model Results at Depth of 15 cm													
Predicted Sediment Concentrations (ug/kg)[2]	30 yr	7.14E-134	7.75E-98	6.43E-57	2.32E-35	2.32E-35	2.93E-15	1.15E-04	3.36E-108	6.34E-89	1.27E-22	1.27E-23	1.54E-18
	50 yr	7.85E-128	1.27E-86	1.41E-53	6.83E-27	6.83E-27	1.13E-13	6.98E+00	4.41E-104	6.52E-85	1.71E-10	4.97E-11	1.02E-09
	100 yr	1.23E-117	9.05E-67	2.72E-48	9.45E-11	9.45E-11	1.13E-11	8.04E+02	1.19E-98	2.51E-78	9.16E+02	9.18E+02	9.09E+00
Predicted Time to Exceedance (SEF Freshwater Benthic Toxicity Screening Level)	years	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100
Predicted Time to Exceedance (Portland Harbor ROD Cleanup Level)	years	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100
Model Results at the Bottom of Bioactive Zone													
Predicted Porewater Concentrations (ug/L)[3]	30 yr												2.60E-17
	50 yr												2.14E-09
	100 yr												1.48E+00
Predicted Time to Breakthrough (1% of initial porewater concentration)	years												97

Note:

1. Model-predicted solid-phase concentrations at bottom of bioactive zone (BAZ) (depth of approximately 10 cm below top of cover with foc=2%).
2. Model-predicted solid-phase concentrations at bottom of armor layer (fines) (depth of approximately 15 cm below top of cover with foc=0.04%).
3. Model-predicted dissolved-phase (porewater) concentrations at the top of RCM with GAC layer.

Table 5. CapSim Model Output, Total PCBs

Model Run	Units	Model Runs Based on Estimated Maximum Porewater Concentration								
		Bulk Mixture of GAC+Sand (1% AC by weight)		AquaGate+PAC5%™ (Min 2% AC by weight)		Bulk Mixture of AquaGate+PAC5%™ (Min 2% AC by weight) + AASHTO#8		Under Dock/Slope Area		
		3 inch amended layer at bottom of 12-inch thick cover		Min 1 inch AG+PAC layer at bottom of 12-inch thick cover		Min 4 inch amended layer at bottom of 12-inch thick cover		Min 3 inch amended layer at bottom of 9-inch thick cover		RCM with GAC at bottom of 12-inch thick cover
		1	2	3	4	5	6	7	7a (BAZfoc=4%)	8
Underlying Sediment Concentration	ug/kg	343	343	343	343	343	343	343	343	343
Estimated Underlying Porewater Concentration	ug/L	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Total Cover Thickness	cm	30.48	30.48	30.48	30.48	30.48	30.48	22.86	22.86	30.48
Amended (Active) Layer Thickness	cm	7.62	7.62	2.54	2.54	10.16	10.16	7.62	7.62	1.0
Activated Carbon (AC) Density in Amended Layer	g/cm^3	0.015	0.015	0.027	0.027	0.006	0.006	0.008	0.008	0.2
AC Freundlich Coefficient log Kf	log $(ug/kg)/(ug/L)^{(1/n)}$	8.48	7.48	8.48	7.48	8.48	7.48	7.48	7.48	7.48
AC Freundlich Coefficient 1/n	--	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Cover Thickness Above Amended Layer (includes 10 cm BAZ)	cm	22.86	22.86	27.94	27.94	20.32	20.32	15.24	15.24	29.48
SEF Freshwater Benthic Toxicity Screening Level	ug/kg	110	110	110	110	110	110	110	110	110
Portland Harbor ROD Cleanup Level	ug/kg	9	9	9	9	9	9	9	9	9
Model Results at the Bottom of Bioactive Zone (Depth of 10 cm)										
Predicted Sediment Concentrations (ug/kg)[1]	30 yr	9.20E-72	1.24E-58	5.17E-21	2.50E-17	9.54E-27	9.52E-23	3.38E-53	5.61E-55	2.13E-42
	50 yr	4.73E-68	1.79E-54	1.27E-19	3.00E-17	1.44E-25	1.43E-21	3.69E-50	1.50E-51	1.47E-39
	100 yr	1.90E-63	5.50E-50	4.39E-18	5.75E-14	3.97E-24	3.93E-20	5.53E-46	7.85E-47	2.57E-34
Predicted Time to Exceedance (SEF Freshwater Benthic Toxicity Screening Level)	years	>100	>100	>100	>100	>100	>100	>100	>100	>100
Predicted Time to Exceedance (Portland Harbor ROD Cleanup Level)	years	>100	>100	>100	>100	>100	>100	>100	>100	>100
Model Results at Depth of 15 cm										
Predicted Sediment Concentrations (ug/kg)[2]	30 yr	3.50E-72	6.75E-59	6.93E-22	2.70E-18	1.15E-27	1.14E-23	1.13E-53	1.50E-55	5.22E-44
	50 yr	8.89E-69	3.38E-55	1.04E-20	1.64E-17	1.14E-26	1.13E-22	1.14E-50	1.02E-52	6.34E-40
	100 yr	1.80E-64	6.98E-51	2.28E-19	3.45E-15	2.13E-25	2.11E-21	1.31E-46	3.09E-48	5.07E-36
Predicted Time to Exceedance (SEF Freshwater Benthic Toxicity Screening Level)	years	>100	>100	>100	>100	>100	>100	>100	>100	>100
Predicted Time to Exceedance (Portland Harbor ROD Cleanup Level)	years	>100	>100	>100	>100	>100	>100	>100	>100	>100
Predicted Porewater Concentrations (ug/L)[3]	30 yr									3.59E-42
	50 yr									1.35E-39
	100 yr									1.84E-35
Predicted Time to Breakthrough (1% of initial porewater concentration)	years									>100

Note:

1. Model-predicted solid-phase concentrations at bottom of bioactive zone (BAZ) (depth of approximately 10 cm below top of cover with foc=2%).
2. Model-predicted solid-phase concentrations at bottom of armor layer (fines) (depth of approximately 15 cm below top of cover with foc=0.04%).
3. Model-predicted dissolved-phase (porewater) concentrations at the top of RCM with GAC layer.

Revised Dredge Slope Stability Analysis Memorandum

2019-04-03

AECOM Imagine it. Delivered.

AECOM
111 SW Columbia
Portland, OR 97201
aecom.com

Project name:
Seaport Midstream Portland Terminal Maintenance Dredging

Project ref:
605528028

To:
Juan Medina, TransMontaigne

From:
AECOM: Abby Chin, Mike Gardner

CC:
AECOM: Scott Kranz, Kris Carbonneau

Date:
April 3, 2019

Memo

Subject: Dredge Slope Stability Analysis at Seaport Midstream Portland Terminal – Revision 1

Introduction

This memo provides a summary of the slope stability analysis and modeling results supporting the 1.5H:1V (Horizontal: Vertical) proposed dredge slope beneath and adjacent to the Portland Terminal dock structure. The analysis addresses the June 4, 2018 EPA General Comment #2 on Appendix C – Temporary Cover Modeling Memorandum which requested a slope stability evaluation be prepared to show that a 1.5H:1V slope will remain stable. The slope stability analysis was performed for existing, short term (undrained, construction conditions), long term (drained, final conditions), and seismic conditions for the 1.5H:1V slope. Input parameters for the model were developed from results of a geotechnical investigation conducted at the terminal in October 2018.

Geotechnical Investigation

A geotechnical investigation was conducted on October 18-19, 2018. The investigation at the terminal consisted of three Cone Penetration Tests (CPTs) to a depth of 22-26 feet below sediment surface (bss), and four sediment cores to a depth of 5 feet bss. Test locations are shown on Figure 1. Locations indicated in grey show the proposed test locations while locations shown in black show the constructed locations; some were moved in the field due to the water depth at the time of the investigation. A second sediment core was collected at location B18-02 due to poor recovery (20 percent), the second core location is shown as B18-02B. Core logs and CPT logs are provided in Attachment 1.

A total of six samples were collected and analyzed for grain size with hydrometer, moisture content, and organic content; four of those samples were analyzed for Atterberg limits and specific gravity due to insufficient recovery. Results of the analyses are provided in Table 1.

Table 1: Geotechnical Laboratory Test Results

Analysis	Boring ID (Sample Depth)					
	B18-01 (2'-4')	B18-02B- (1.5'-3.5')	B18-02B (4.5'-5')	B18-03 (0'-0.3')	B18-03 (0.3'-2.5')	B18-03 (2.5'-5')
USCS Classification	ML (Silt)	(MH) Elastic Silt	ML (Silt)	ML (Sandy Silty)	ML (Sandy Silt)	ML (Silt)
Moisture Content	70.0%	62.2%	39.3%	41.1%	39.8%	38.4%
Organic Content	1.3%	7.7%	3.8%	4.0%	2.7%	2.9%
Atterberg Limits	NP	69-53-16	*	*	NP	NP
Specific Gravity	2.61	2.68	*	2.94	2.79	*

Notes:
Atterberg Limits: Liquid Limit-Plastic Limit-Plasticity Index
NP: Non-plastic
*Insufficient material to perform the test in accordance with ASTM D 4318 (Atterberg Limits) or D 854 (Specific Gravity)

The core and CPT locations were chosen to approximate the top of the dredge slope (i.e., the upper elevation corresponding to slopes that needed modification to reduce slope angle to 1.5H:1V). Cross sections showing the results of the investigation are included in Figure 2. The sediment was observed to be soft silt with a trace of sand. At location B18-02B, a poorly graded fine sand was observed from 4.5-5 ft below sediment surface (bss). At location B18-03, a stiff non-plastic silt was observed from 2.5-5 ft bss. Laboratory sampling confirmed the material to be a non-plastic silt and sandy silt at B18-01 and B18-03. An elastic silt was observed at B18-02B from the sample obtained at 1.5-3.5 ft bss.

From the CPT locations, a 0-4 ft thick layer of soft sediment (silt) was observed overlying a 2.5-4.5 ft thick layer of soft to medium stiff clay. The underlying material was observed to be a varying clayey silt/silty clay/sand silt material.

A cross section was chosen near CPT18-02 for the slope stability model based on the observed subsurface conditions and the proximity to the dock structure. This representative section, with the subsurface layers and assumed soil properties, is provided as Figure 3. The grade of the existing slope is variable, in general it ranges from approximately 1H:1V to 2H:1V.

Representative cross sections for the construction/short term condition and final construction/long term condition are provided as Figure 4 and Figure 5 respectively. The construction condition depicts the 1.5H:1V cut that will occur during dredging. The final construction condition includes the rip rap placed as the cap. Rip rap will fill the key cut at the bottom of the dredge slope and be placed at a 1.5H:1V angle along the slope.

Slope Stability Analysis

The slope stability analysis was performed by using the computer program Slope/W by Geo-Slope International (2012). Each case was analyzed using the grid and radius method to determine the associated factor of safety (FS). The analytical modeling results are included as Attachment 2. The Morgenstern-Price method was used for all analyses. Ten analyses (cases) were performed:

1. existing conditions,
2. short term conditions/construction conditions (undrained),
3. long term conditions/final conditions (drained),
4. seismic conditions (short term),
5. seismic conditions (long term),
6. seismic conditions (existing),
7. short term conditions/construction conditions (undrained) with the soft sediment modeled as clay,
8. seismic conditions (short term with the soft sediment modeled as clay),
9. sensitivity analysis (short term); and

10. sensitivity analysis (short term seismic).

The short term condition refers to the condition of the sediment immediately after dredging when the soil has been unloaded and remains in the undrained condition. The short term condition occurs during construction and prior to the placement of the cap/riprap. The long term condition refers to the sediment after the time period necessary for the soil to reach drained conditions and assumes there are no excess pore pressures. This condition will occur after construction has been completed and the cap has been placed. A sensitivity analysis was added to the model to determine the impacts of a lower undrained shear strength on the calculated factor of safety for the short term analyses.

Modeling Parameters

Soil parameters were determined based on the results of the laboratory testing and the CPT data. The laboratory testing provided data for the soft sediment layer. CPT data was used to determine the parameters for the deeper clay and clayey silt/silty clay/sandy silt layers. The assumed parameters were also compared to historical data from the site using the Final Geotechnical Analysis Report from URS (2007). Similar soils were observed near the sheet pile wall in the 2007 report.

Soil parameters used in the analyses are summarized in Table 2 below. The soil properties used were solely based on the data from the October 2018 geotechnical investigation (Attachment 1). Correlations from the laboratory results to unit weight, friction angle, and cohesion are based on Unified Facilities Criteria (UFC) 3-220-03FA (2004), WSDOT Geotechnical Design Manual (2013), and Bowles (1997). The calculated N value from the CPT tests was used to determine appropriate unit weight and friction angle values based on the tables provided in the references. The undrained shear strength was halved for the sensitivity analysis to 400 psf as noted in the table below.

Table 2: Slope Stability Model Input Parameters

Material	Unit Weight (pcf)	Short Term (Undrained) Condition		Long Term (Drained) Condition	
		Friction Angle (deg)	Cohesion (psf)	Friction Angle (deg)	Cohesion (psf)
Soft Sediment	110	28	0	28	0
Soft Sediment – Clay	110	0	200	28	0
Clay	110	0	800	28	0
Clay (Sensitivity Analysis)	110	0	400	28	0
Clayey Silt/Silty Clay/Sandy Silt	115	34	0	34	0
Impenetrable Bedrock	NA	NA	NA	NA	NA
Rip rap	130	45	0	45	0

A pseudo-static analysis was conducted to account for earthquake loadings. In this analysis an equivalent static horizontal force is applied to the embankment to account for earthquake induced ground acceleration. A horizontal seismic design coefficient of 0.1 was evaluated. This value represents roughly half the peak ground acceleration (PGA) (0.2g) for an earthquake with a 500 year recurrence interval. Use of half the PGA is standard practice for slope stability analysis. The ODOT seismic hazard map shows a 500 year PGA of approximately 0.175g (2016). For this analysis, a PGA of 0.2g was used which is a more conservative PGA.

Slope Stability Modeling Results

The minimum factor of safety values for slope stability analyses were obtained from the Oregon Department of Transportation (ODOT) Geotechnical Design Manual (2018). The values are summarized in Table 3 below.

Table 3: Minimum Required Factor of Safety (ODOT 2018)

Case	Minimum Required Factor of Safety
Slope that supports structures	1.5
Slopes adjacent to, but not supporting structures	1.3
Embankment side slopes	1.25
Cut slopes	1.25
Seismic loading	1.1

For this analysis, the target factor of safety for the short term condition (cut slope) is 1.25. The short term condition is observed during the dredging prior to the placement of the cap/riprap. The existing dock structure is not supported by the slope. However, because a slope failure may result in damage to the dock, the final constructed slope will be analyzed as if it supported a structure. The target factor of safety for the long term condition (slope that supports structures) is 1.5. The long term model is representative of the final conditions after the placement of the cap. The target factor of safety for the pseudo-static (seismic) analysis is 1.1 for both the short and long term conditions.

Results of the analyses are summarized in Table 4; corresponding graphical results are presented in Attachment 2.

Table 4: Slope /W Results - Factor of Safety

Case	Calculated Factor of Safety	Target Factor of Safety
1 – Existing Conditions (Figure A-1)	1.8	1.5
2 – Short Term (Undrained) Conditions (Figure A-2)	1.9	1.25
3 – Long Term (Drained) Conditions (Figure A-3)	1.6	1.5
4 – Short Term (Undrained) Seismic Conditions (Figure A-4)	1.3	1.1
5 – Long Term (Drained) Seismic Conditions (Figure A-5)	1.0	1.1
6 – Existing Conditions – Seismic (Figure A-6)	1.0	1.1
7 – Short Term (Undrained) Conditions* (Figure A-7)	2.0	1.25
8 – Short Term (Undrained) Seismic Conditions* (Figure A-8)	1.3	1.1
9 – Short Term (Undrained) Sensitivity Analysis (Figure A-9)	1.7	1.5
10 – Short Term (Undrained) Seismic Conditions Sensitivity Analysis (Figure A-10)	1.1	1.1

Notes:
*The short term analysis was conducted a second time with the soft sediment modeled as a cohesive layer (Soft Sediment – Clay) to exhibit the impacts of cohesion on the model.

The short term analysis with the soft sediment modeled as cohesive and cohesionless, both result in an FS greater than the required 1.25. The long term condition modeled with a riprap cover results in an FS of 1.6 which is greater than the target FS of 1.5. Based on these results shown in the table above, a 1.5H:1V dredge slope would be stable during non-seismic conditions.

The FS for seismic loading for short term (undrained) conditions is 1.3 which is greater than the target FS of 1.1. The seismic loading under drained conditions results in a FS less than 1.1; however, for comparison, a pseudo-static analysis was completed for existing conditions. The calculated factor of safety was 1.0 indicating that the cap will be just as stable under final conditions as it is under existing conditions. Due to the fact that the constructed cap does not result in an FS lower than existing, the calculated FS being 1.0 as opposed to 1.1 for long term seismic conditions should not be a limiting factor for the 1.5H:1V dredge slope. The results of the sensitivity analysis conducted with an undrained shear strength value of 400 psf (halved from 800 psf) results in an acceptable factor of safety for both the short term and short term seismic conditions.

Temporary Cover Plan

Localized sloughing may occur during the dredging process. Material that sloughs off should be removed prior to placing backfill. A sediment temporary cover plan detailing the requirements of removing any slough material from the base of the slope should be prepared. The plan should include details of a temporary backfill to be used in the event that the final cap cannot be placed before the end of the fish window.

Veneer Stability

The final cover system will include either a Reactive Core Mat (RCM) or a geocell system backfilled with granular media overlain by armor stone. The resistance of the RCM against sliding is referred to as the veneer stability and it is calculated using the angle of the slope and the friction angle of the material interface. The veneer stability is typically estimated using site specific materials assuming an infinite slope. Veneer stability was not performed for the slope cover system during this design modification; however, testing has been performed during design at other nearby sites on the Willamette River and can be used as evidence this system is stable. The test data for direct shear testing of an organoclay RCM and a silty-sandy soil determined the peak friction angle for infinite slopes to be 30 degrees. The Zidell Barge site remediation project utilized an RCM on slopes from 12H:1V up to 1.5H:1V (i.e., up to 33 degrees). The conditions at Zidell, much like the conditions at the SeaPort terminal, include bounding the RCM both at the top and bottom of slope increasing the angle at which the material is stable. Given the proximity of this site to the SeaPort terminal (i.e., similar soil conditions), the similar construction approach using RCM at slopes of 1.5H:1V and shallower, and the evidence that the Zidell Barge site has remained stable for over 10 years post-construction, AECOM believes that the veneer stability of the RCM cover is valid.

References

Bowles, Joseph (1997) Foundation Analysis and Design, Fifth Edition.
GEO-SLOPE International Ltd. 2012. Slope/W Modeling Program. Calgary, Alberta, 2012.
ODOT (2016), 2016 ODOT Seismic Hazard Maps
ODOT (2018), Geotechnical Design Manual, Version 2.0, June 1, 2018.
UFC (2004), United Facilities Criteria – Soils and Geology Procedures for Foundation Design of Building and Other Structures, UFC 3-220-03FA, January 16, 2004.
URS (2007), Final Geotechnical Analyses Report, Proposed Seawall Replacement, BP Terminal 22, Dated April 1, 2007, URS Job #38476256, Prepared for BP West Coast Products, LLC
WSDOT (2013) Geotechnical Design Manual, M 46-03.08. October 2013.

Figures

Figure 1: Sediment Investigation Location Plan and Profile

Figure 2: Sediment Investigation Sections

Figure 3: Representative Cross Section – Existing Conditions

Figure 4: Representative Cross Section – Construction Conditions (Short Term)

Figure 5: Representative Cross Section – Final Conditions (Long Term)

Attachments

Attachment 1: Geotechnical Investigation

Attachment 2: Slope Stability Modeling Output

Figures

ANSI D 22" x 34"

Approved:

Checked:

Designer:

Project Management Initials:

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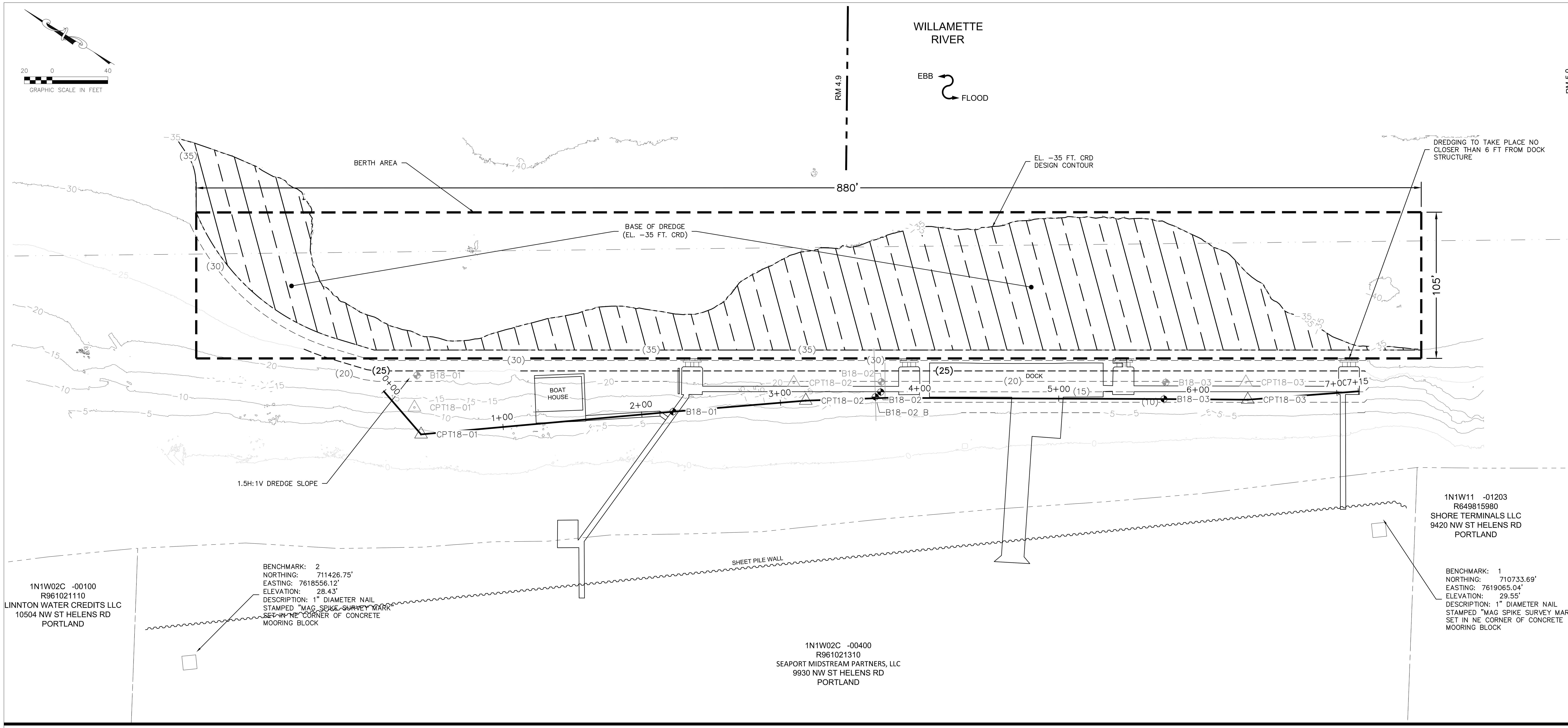

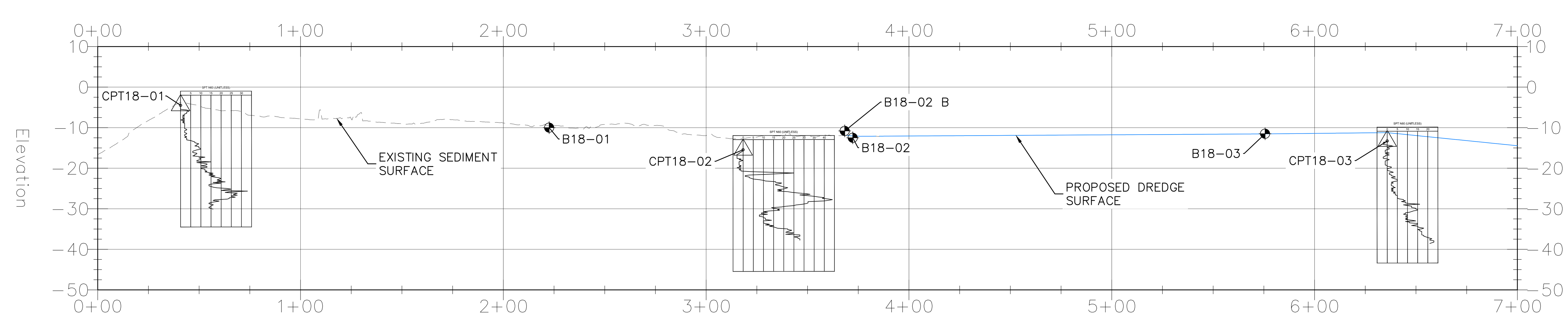

AECOM

PROJECT

PORTLAND TERMINAL MAINTENANCE SEDIMENT INVESTIGATION

CLIENT

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CONSULTANT

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REGISTRATION

NOTES:

1. MULTIBEAM BATHYMETRIC SURVEY CONDUCTED BY SOLMAR HYDRO, INC. DECEMBER 28, 2017.
2. VERTICAL DATUM: COLUMBIA RIVER DATUM (CRD), FEET
3. HORIZONTAL DATUM: NAD 83, STATE PLANE OREGON NORTH, INTERNATIONAL FEET.
4. OHWL: 14.9 FT CRD

LEGEND:

- PROPOSED SEDIMENT CORE LOCATION
- PROPOSED CPT LOCATION
- SEDIMENT CORE LOCATION
- CPT LOCATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
0	2018-10-23	SEDIMENT INVESTIGATION RESULTS

PROJECT NUMBER

60558028

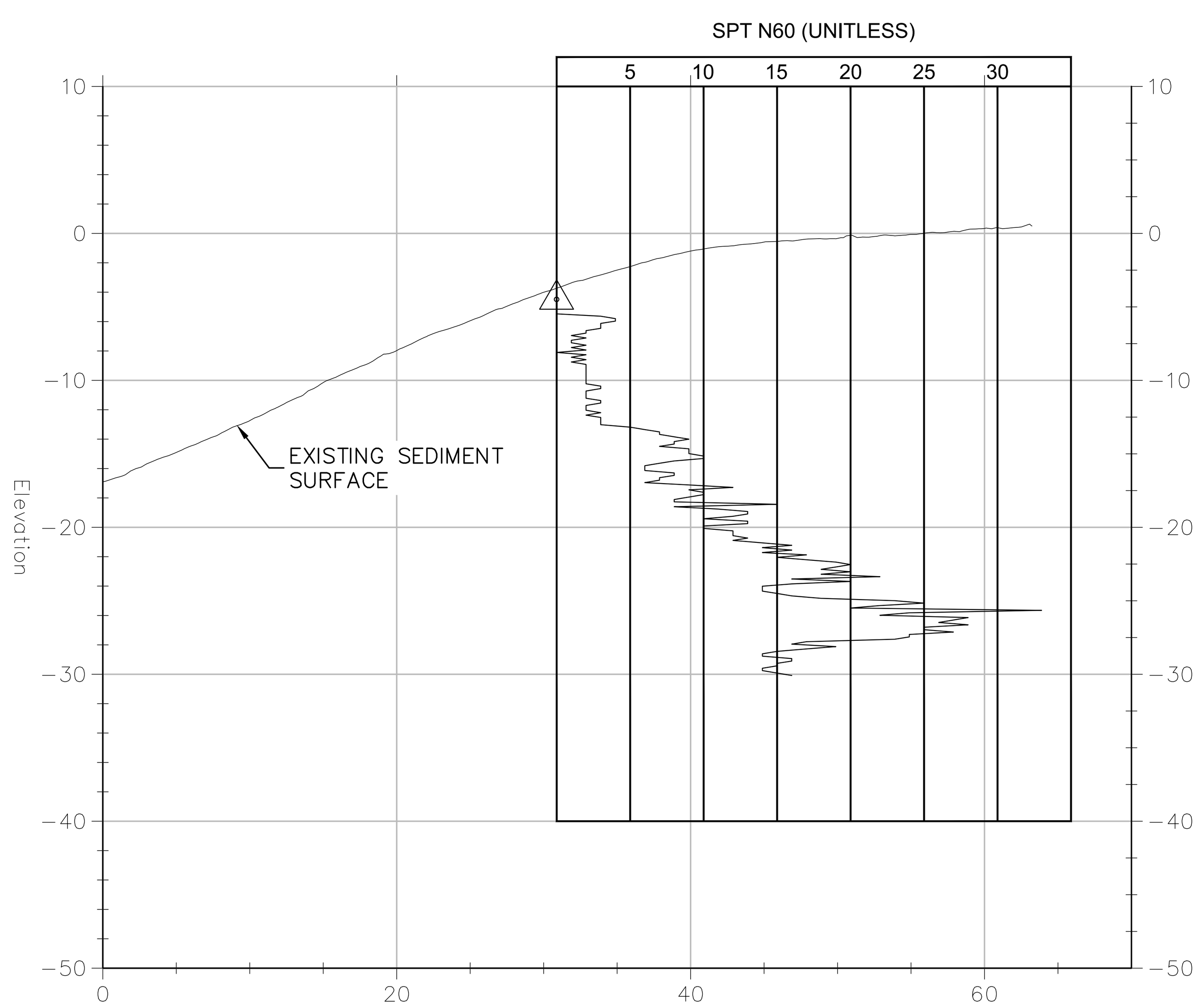
SHEET TITLE

SEDIMENT INVESTIGATION LOCATION PLAN AND PROFILE

SHEET NUMBER

FIGURE 1

CPT-01



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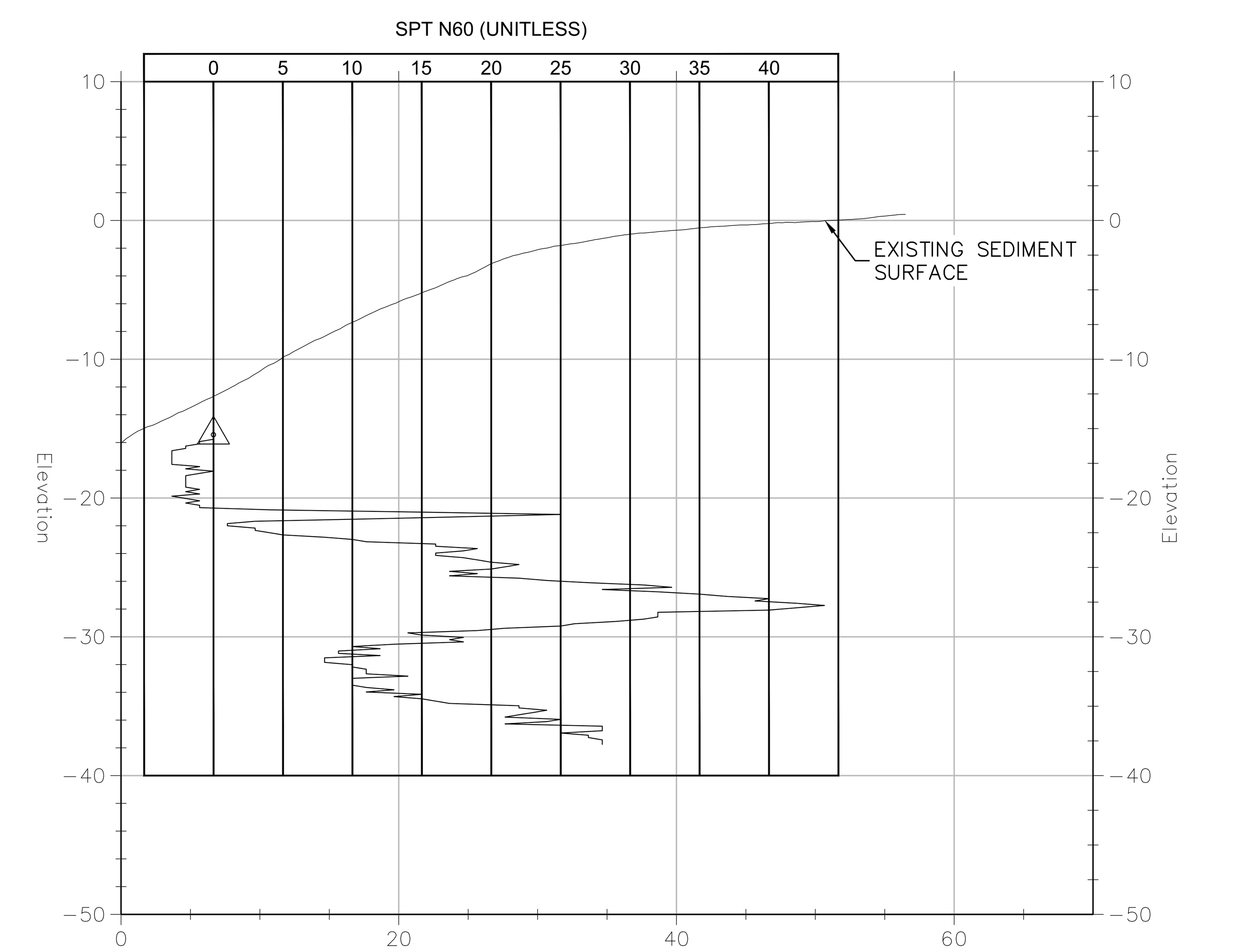

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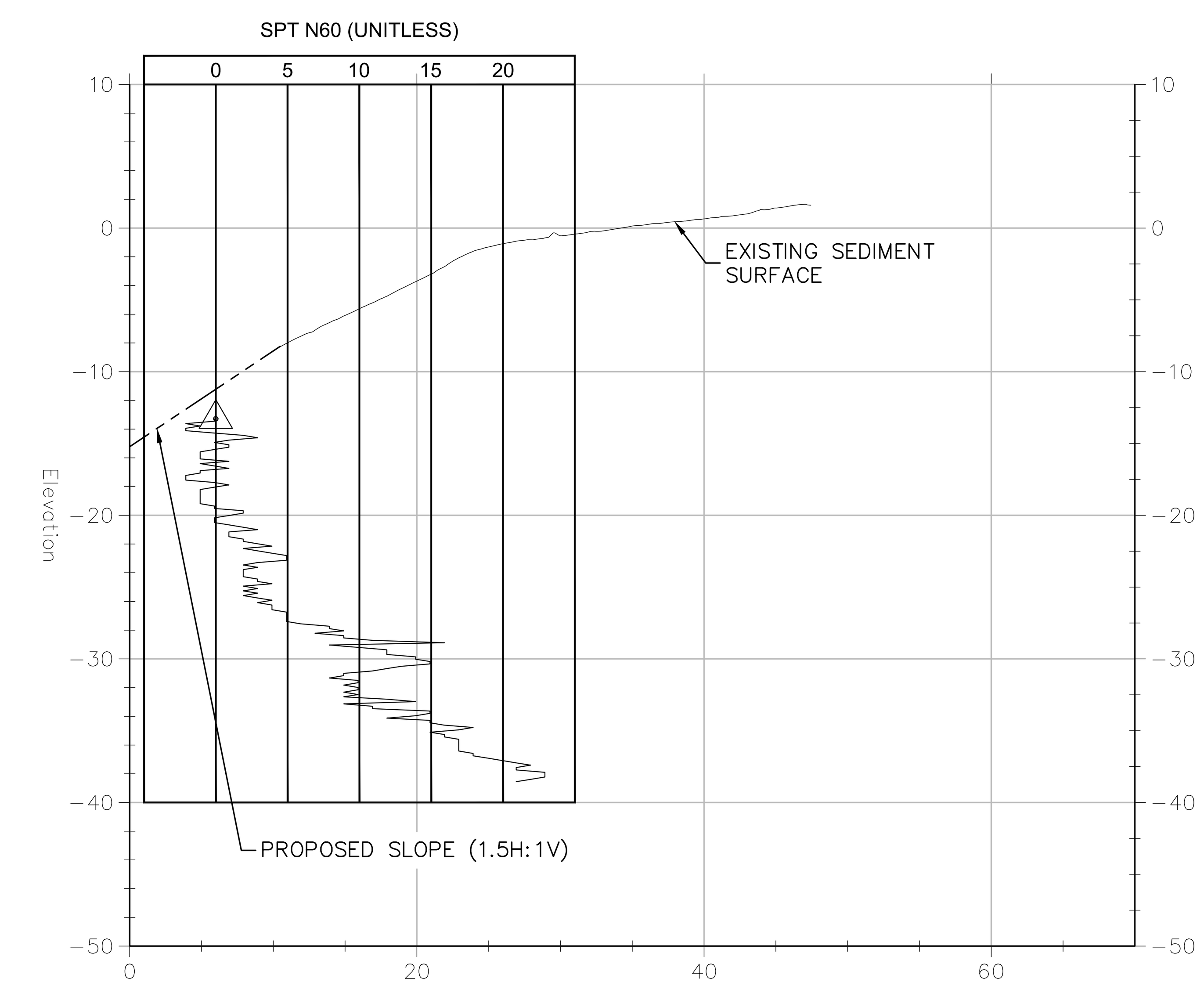

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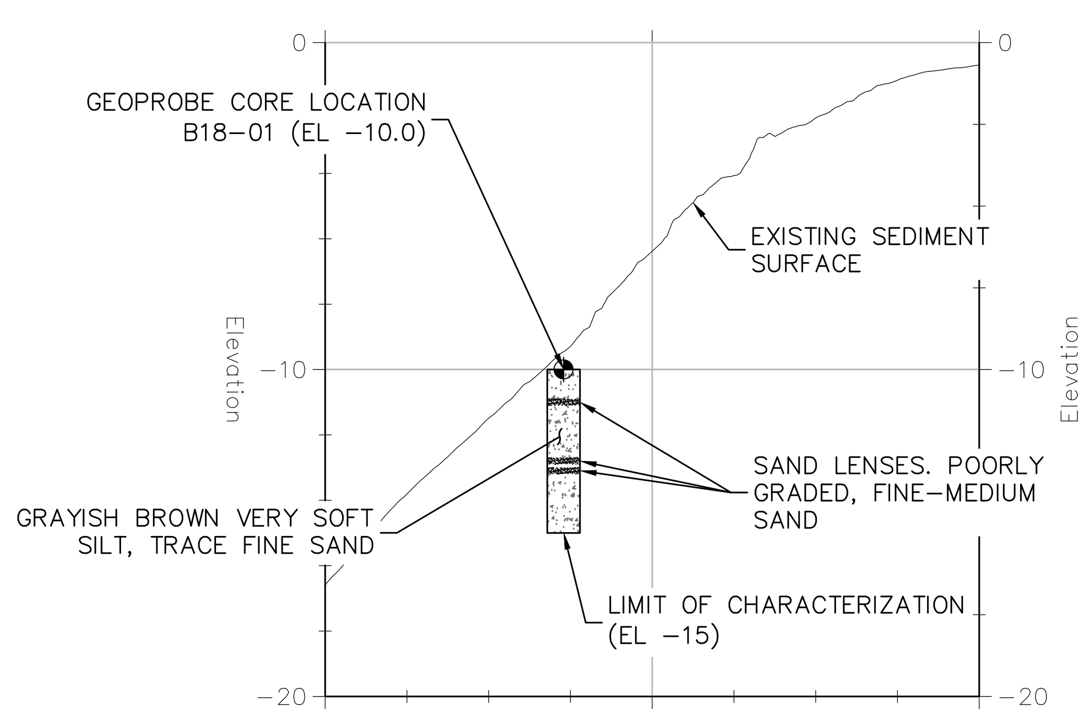
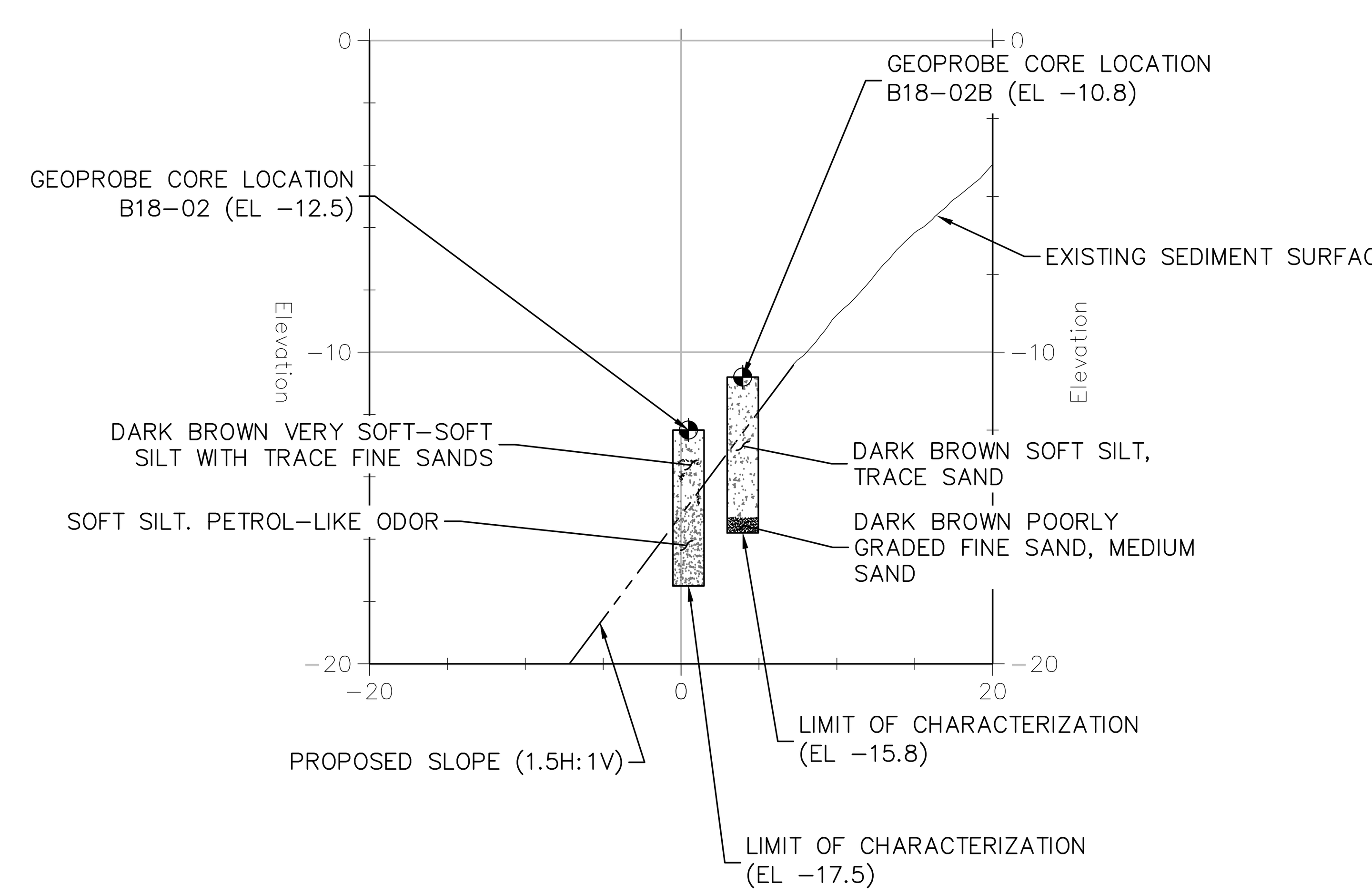


B18-02 & B18-02B



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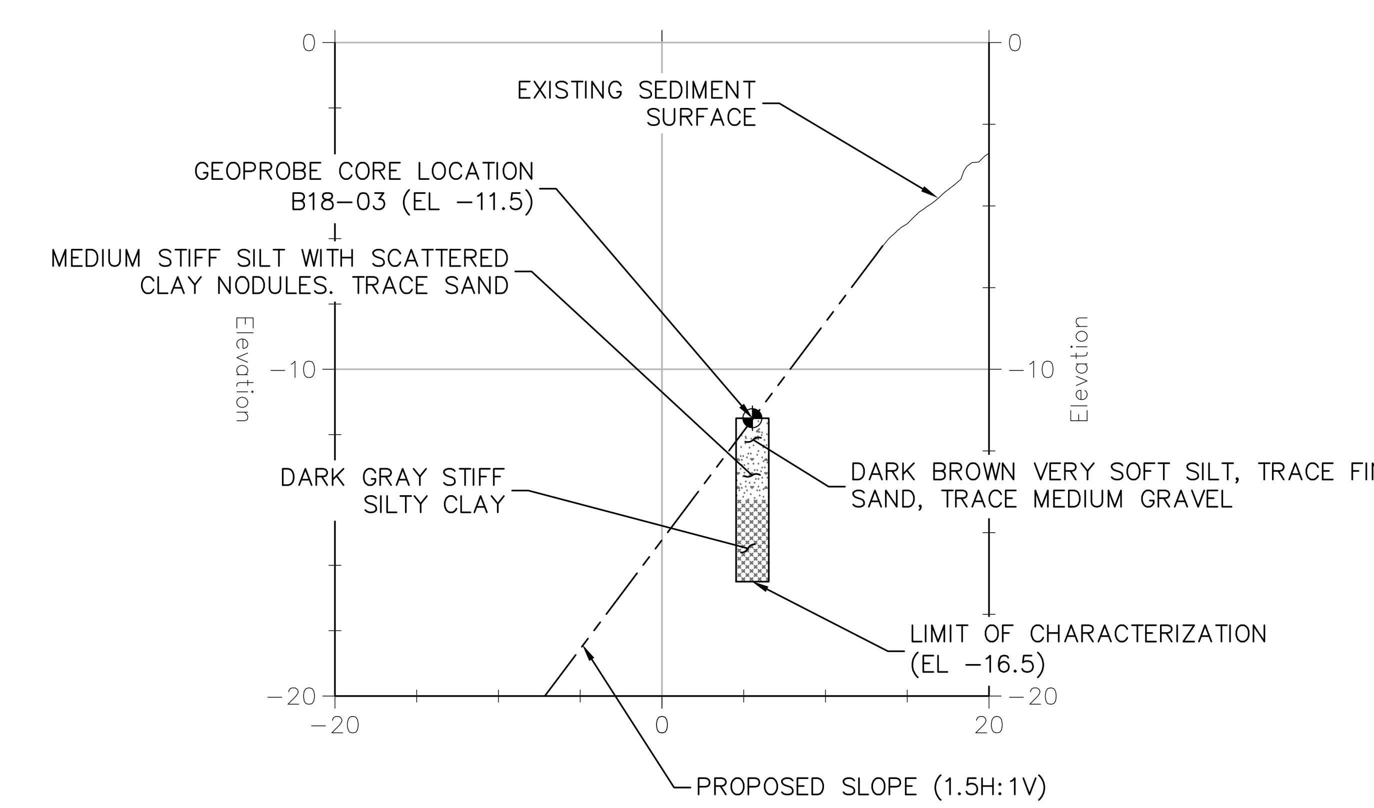

GRAPHIC SCALE IN FEET

AECOM

PROJECT

PORTLAND TERMINAL MAINTENANCE SEDIMENT INVESTIGATION

CLIENT

SEAPORT MIDSTREAM PARTNERS, LLC
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REGISTRATION

NOTES:

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2. VERTICAL DATUM: COLUMBIA RIVER DATUM (CRD), FEET
3. HORIZONTAL DATUM: NAD 83, STATE PLANE OREGON NORTH, INTERNATIONAL FEET.
4. OHWL: 14.9 FT CRD

LEGEND:

PROPOSED SEDIMENT CORE LOCATION
PROPOSED CPT LOCATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
0	2018-10-23	SEDIMENT INVESTIGATION RESULTS

PROJECT NUMBER

60558028

SHEET TITLE

SEDIMENT INVESTIGATION SECTIONS

SHEET NUMBER

FIGURE 2

Project Management Initials: Designer: Checked: Approved:

Last saved by: CHINA2(2018-12-18) Last Plotted: 2018-12-18
Filename: P:\JOBS\REM_ENG\PROJECT FILES\PORTLAND-SEAPORT SEDIMENT DREDGING\900-CAD_GIS\910-CAD\20-SHEETS\CONSTRUCTION DRAWINGS\SEDIMENT INVESTIGATION FIGURES_20181023.DWG

Figure 3: Representative Cross Section - Existing Conditions

Assumptions:
Name: Soft Sediment Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Bedrock Model: Bedrock (Impenetrable)

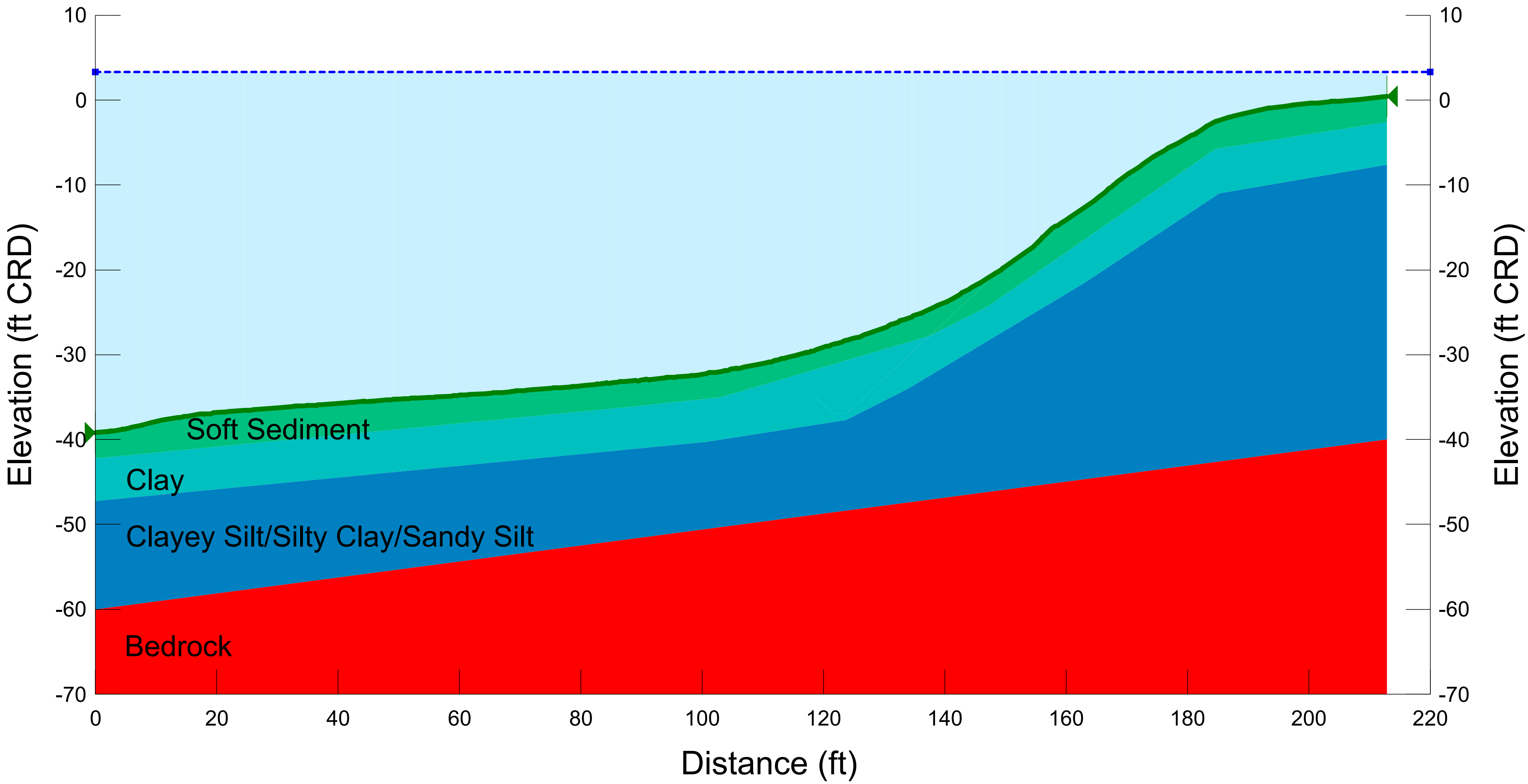


Figure 4: Representative Cross Section - Construction Conditions (Short Term)

Assumptions:
Name: Soft Sediment Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Bedrock Model: Bedrock (Impenetrable)

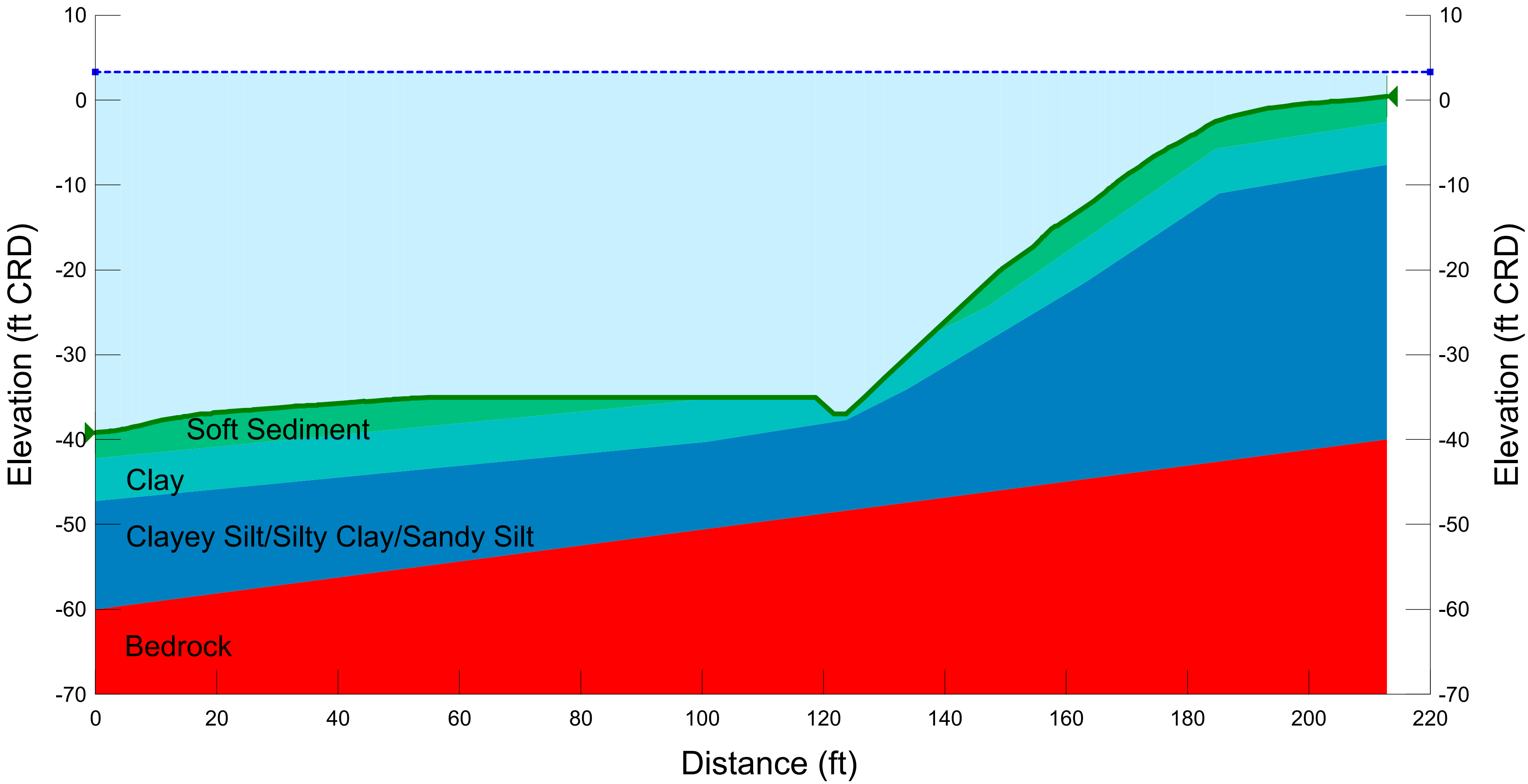
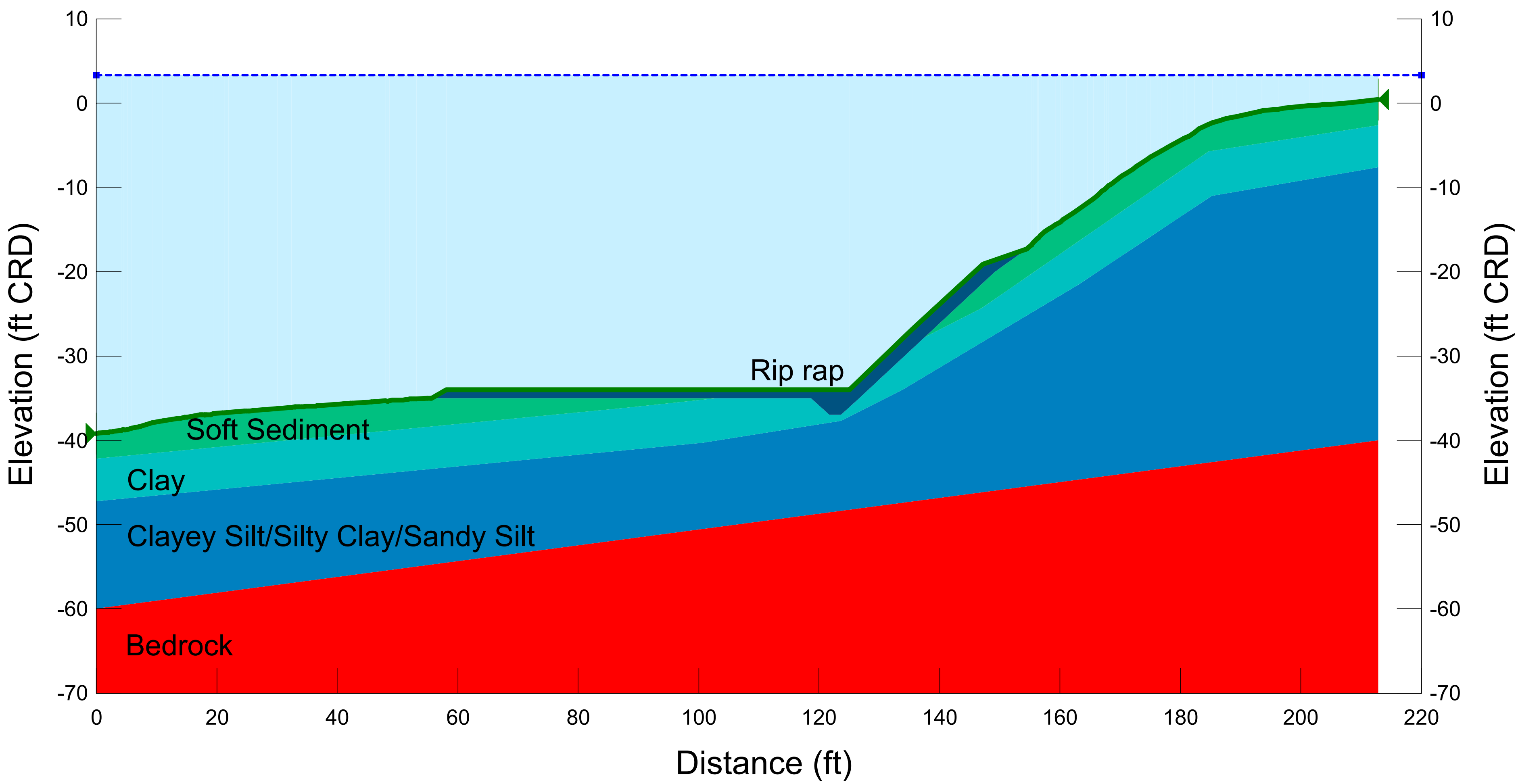


Figure 5: Representative Cross Section - Final Conditions (Long Term)

Assumptions:
Name: Soft Sediment (Clay) Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Bedrock Model: Bedrock (Impenetrable)
Name: Rip Rap Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 45 °



Attachment 1: Geotechnical Investigation

AECOM

Client:	TransMontaigne
Project Number:	60558028
Site Location:	Seaport Midstream Portland Terminal
Coordinates	
Drilling Method:	Cone Penetration Testing using Geoprobe track rig
Sample Type(s):	N/A
Boring Diameter:	

BORING ID: B18-01

Sheet:	1 of 1
Monitoring Well Installed:	N/A
Screened Interval:	N/A
Depth of Boring:	5 feet below mudline
Water Level:	N/A

Weather:	Foggy 60s
Drilling Contractor:	Oregon Geotechnical Explorations
Logged By:	N. MOODY
Ground Elevation:	
Date/Time Started:	10/19/18
Date/Time Finished:	10/19/18

mud line

Depth (ft) (bss) below mudline	Geologic sample ID	Sample Depth (ft)	~~Blows per 6"~~ Elevation ft CRD	Recovery (inches)	Headspace (ppm)	U.S.C.S	MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, consistancy, odor, and Geologic Unit (If Known)	Lab Sample ID	Lab Sample Depth (Ft.)
0–5		↕ (0–5)	-11 to -15	70%	N/A	ML	Very soft, SILT, trace fine sand, very dark grayish brown color; thin (1/4 inch) sand lenses at 1 ft, 2.8 ft, & 3 ft poorly graded SAND, fine-med.	B18-01-2-4	2-4 ft bss ①
5			-15				Terminate at 5ft below mudline or -15 ft CRD		
6									
7									
8									
9									
10							① B18-01-2-4		

NOTES: Water level = 3.3 ft CRD @ 1516 on tide board
water depth = 13.3 ft (leadline)

Date	Time	Depth to groundwater while drilling

Checked by: Date:

bss = below mudline or sediment surface

AECOM

Client: TransMontaigne	**BORING ID:** B18-02
Project Number: 60558028	
Site Location: Seaport Midstream Portland Terminal	
Coordinates	Sheet: 1 of 1
Drilling Method: Cone Penetration Testing using Geoprobe track rig	Monitoring Well Installed: N/A
Sample Type(s): N/A — Boring Diameter:	Screened Interval: N/A
Weather: Foggy 60s — Logged By: N. MOODY — Date/Time Started: 10/19/18	Depth of Boring: 5 feet below mudline
Drilling Contractor: Oregon Geotechnical Exploration — Ground Elevation: — Date/Time Finished: 10/19/18	Water Level: N/A

Depth (ft) 655	Geologic sample ID	Sample Depth (ft)	~~Blows per 6"~~ Elevation ft CRD	~~Recovery (inches)~~	Headspace (ppm)	U.S.C.S	MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, consistancy, odor, and Geologic Unit (If Known)	Lab Sample ID	Lab Sample Depth (Ft.)
0 mud line		0–5							
1			-13.5				very soft - soft SILT trace fine sands very dark brown		0-5
2				20%	N/A	ML		B18-02 -0-5	
3							@ mid pt change to soft slight petro-like odor		
4									
5									
6			-17.5				Terminate at 5ft bss or 17.5ft CRD		
7									
8									
9									
10							① B18-02-0-5		
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

①

NOTES: Tide board @ 1354 = 2.5ft CRD
water depth (leadline) = 15 ft

Date	Time	Depth to groundwater while drilling

Checked by Date:

AECOM

Client: TransMontaigne	BORING ID: B18-02B
Project Number: 60558028	
Site Location: Seaport Midstream Portland Terminal	
Coordinates	Sheet: 1 of 1
Drilling Method: Cone Penetration Testing using Geoprobe track rig	Monitoring Well Installed: N/A
Sample Type(s): N/A	Boring Diameter:
Weather: Foggy 60s	Logged By: N. MOODY
Date/Time Started: 10/19/18	Screened Interval: N/A
Drilling Contractor: Oregon Geotechnical Explorations	Ground Elevation:
Date/Time Finished: 10/19/18	Depth of Boring: 5 feet bss
	Water Level: N/A

Depth (ft) ft bss	Geologic sample ID	Sample Depth (ft)	~~Blows per 6"~~ Elevation ft CRD	Recovery ~~(inches)~~	Headspace (ppm)	U.S.C.S	MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, consistancy, odor, and Geologic Unit (If Known)	Lab Sample ID	Lab Sample Depth (Ft.)
1		0–5	11.8	50%			Soft SILT, trace sand v. dark brown		
2					N/A	ML		B18-02B-1.5-3.5	1.5-3.5 ①
3									
4							@ 4.5 ft change poorly graded fine sand, medium v. dark gray		
5						SP		B18-02B-4.5-5	4.5-5 ②
6			-15.8				Terminate at 5 ft bss or -15.8 ft CRD		
7									
8									
9									
10							① B18-02B-1.5-3.5		
11							② B18-02B-4.5-5		
12									
13									
14									
15									
16									
17									
18									
19									
20									

NOTES: Tide board reading @ 1435 = 3 ft CRD
Water depth (leadline) = 13.8 ft.

Date	Time	Depth to groundwater while drilling

Checked by: Date:

AECOM

Client: TransMontaigne	BORING ID: B18-03
Project Number: 60558028	
Site Location: Seaport Midstream Portland Terminal	
Coordinates	Sheet: 1 of 1
Drilling Method: Cone Penetration Testing using GeoProbe track rig	Monitoring Well Installed: N/A
Sample Type(s): N/A — Boring Diameter:	Screened Interval: N/A
Weather: Foggy 60s — Logged By: N. MOODY — Date/Time Started: 10/19/18	Depth of Boring: 5ft bss
Drilling Contractor: Oregon Geotechnical Exploration — Ground Elevation: — Date/Time Finished: 10/19/18	Water Level: N/A

Depth (ft)	Geologic sample ID	Sample Depth (ft)	~~Blows per 6"~~ Elevation Ft CRD	Recovery (inches)	Headspace (ppm)	U.S.C.S	MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, consistancy, odor, and Geologic Unit (If Known)	Lab Sample ID	Lab Sample Depth (Ft.)
0–5		0–5	-12.5	60%	N/A	ML	V. soft SILT, v. dark brown trace fine sand, trace rounded med. gravel	1	0-0.3
							medium stiff SILT, with scattered clay noddles, trace sand (change at 0.3ft)	2	0.3-2.5
						CL	@ 2.5ft - v. dark grey silty clay, stiff.	3	2.5-5
5			~~16~~.5				Terminate at 5ft bss or -16.5ft CRD		

1 B18-03-0-0.3

2 B18-03-0.3-2.5

3 B18-03-2.5-5

NOTES: Tide board reading @ 1435 = 3ft CRD
Lead line water depth = 14.5 feet.

Date	Time	Depth to groundwater while drilling

Checked by Date:

AECOM

Client: Trans Montaigne	BORING ID: CPT18-01
Project Number: 60558028	
Site Location: Seaport Midstream Portland Terminal	
Coordinates:	Sheet: 1 of 1
Drilling Method: Cone Penetration Testing w/ Geoprobe track rig	Monitoring Well Installed: N/A
Sample Type(s): N/A Boring Diameter:	Screened Interval: N/A
Weather: Clear 60s Logged By: N. Moody Date/Time Started: 10/18/18	Depth of Boring: 25.8 ft bgs
Drilling Contractor: Oregon Geotechnical Explorations Ground Elevation: Date/Time Finished: 10/18/18	Water Level: N/A

Depth below water surface (ft)	Depth below mudline (ft)	Elevation (ft CRD)					MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, consistancy, odor, and Geologic Unit (If Known)	Lab Sample ID	Lab Sample Depth (Ft.)
0		2.4					water depth = 6.7 feet	None	
6.7	0	-4.3					mudline.		
28							@ 28 ft Harder to push.		
32.5	25.8	-30.1					Stop driving CPT @ 25.8 ft below mud line		

Depth scale: 1, 2, 3, 4, 5, 6, 6.7, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 32.5, 34, 36, 38, 40

NOTES:

Date	Time	Depth to groundwater while drilling

Checked by   Date:

AECOM

Client:	Trans Montaigne
Project Number:	60558028
Site Location:	Seaport Midstream Portland Terminal
Coordinates:	
Drilling Method:	Cone Penetration Testing w/ Geoprobe track rig
Sample Type(s):	N/A
Boring Diameter:	
Weather:	Fog 60s
Logged By:	N. MOODY
Date/Time Started:	10/19/18
Date/Time Finished:	10/19/18
Drilling Contractor:	Oregon Geotechnical Explorations
Ground Elevation:	
BORING ID:	CPT18-02
Sheet:	1 of 1
Monitoring Well Installed:	N/A
Screened Interval:	N/A
Depth of Boring:	22.7 ft below mudline
Water Level:	N/A

Depth below water surface (ft)	Depth below mudline (ft)	Elevation (ft CRD)					MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, consistancy, odor, and Geologic Unit (If Known)	Lab Sample ID	Lab Sample Depth (Ft.)
		0.8					∇		
1									
2									
3									
4									
5								None	
6									
8									
10									
12									
14									
16	0	-15.2					Mudline		
18									
20									
22									
24									
26									
28									
30									
32									
34									
36									
38	22.7	-37.9					Refusal - broke CPT Rods (lost tip)		
38.7							Stop driving CPT at 22.7 ft below mudline		
40									

NOTES:

Date	Time	Depth to groundwater while drilling

Checked by Date:

AECOM

Client: Trans Montaigne	BORING ID: CPT18-03
Project Number: 60558028	
Site Location: Seaport Midstream Portland Terminal	
Coordinates:	Sheet: 1 of 1
Drilling Method: Cone Penetration Testing w/ Geoprobe track rig	Monitoring Well Installed: N/A
Sample Type(s): N/A — Boring Diameter:	Screened Interval: N/A

Weather: FOG 60s	Logged By: N. MOODY	Date/Time Started: 10/19/18	Depth of Boring: 25.5 ft below mudline
Drilling Contractor: Oregon Geotechnical Explorations	Ground Elevation:	Date/Time Finished: 10/19/18	Water Level: N/A

Depth below water surface (ft)	Depth below mudline (ft)	Elevation (ft CRD)					MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, consistancy, odor, and Geologic Unit (If Known)	Lab Sample ID	Lab Sample Depth (Ft.)
0		0							
1–12							water depth = 13.1 ft		
13.1 ft	0	-13.1					Mudline		
14–36									
38.6	25.5	-38.6					Stop CPT push at 25.5 ft below mudline		
40									

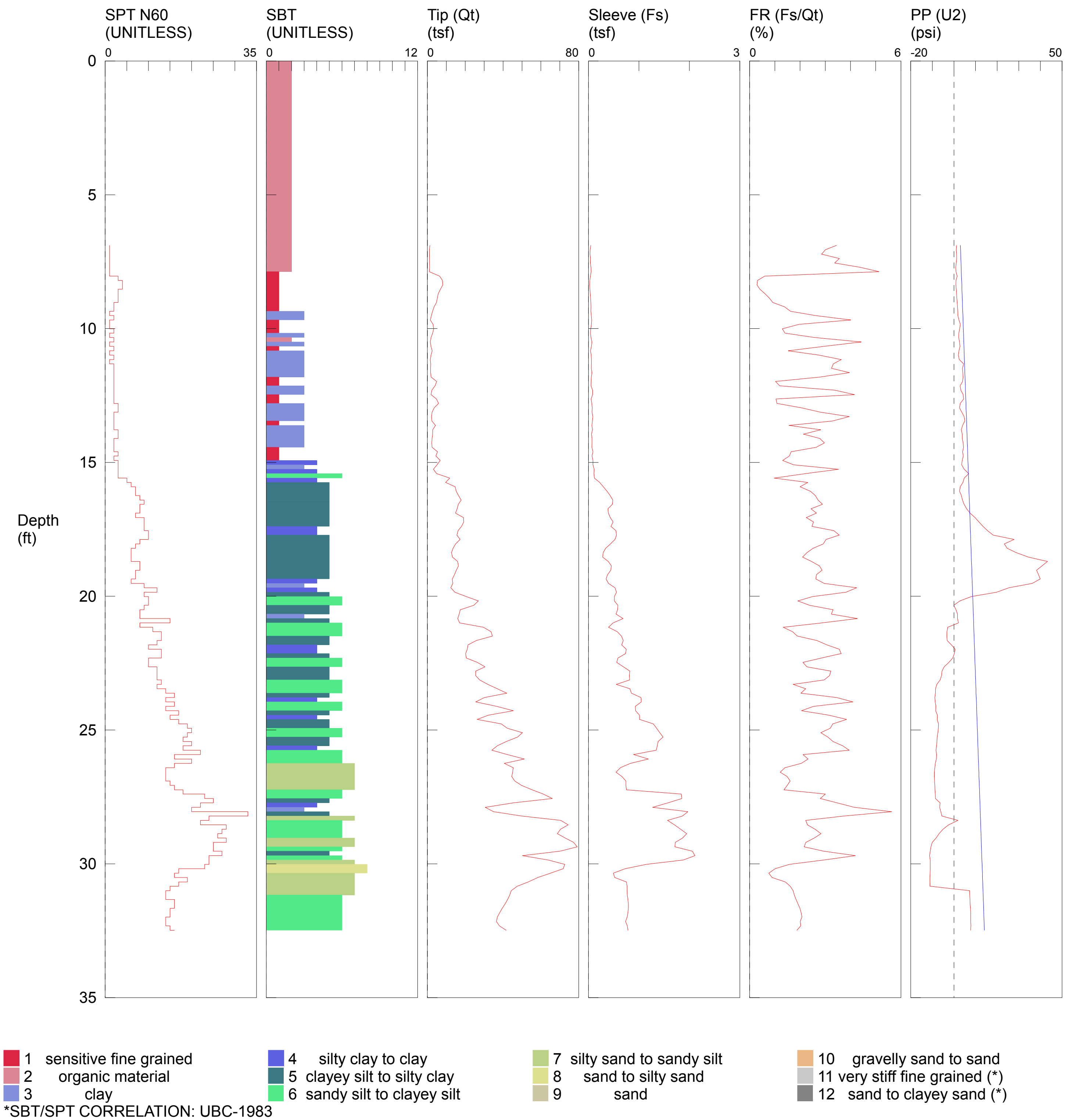
NOTES:

Date	Time	Depth to groundwater while drilling

Checked by Date:

AECOM / CPT-18-01 / 9930 NW St Helens Rd Portland

OPERATOR: OGE DMM
CONE ID: DDG1452
HOLE NUMBER: CPT-18-01
TEST DATE: 10/18/2018 2:17:21 PM
TOTAL DEPTH: 32.480 ft



AECOM / CPT-18-01 / 9930 NW St Helens Rd Portland

OPERATOR: OGE DMM
CONE ID: DDG1452
HOLE NUMBER: CPT-18-01
TEST DATE: 10/18/2018 2:17:21 PM
TOTAL DEPTH: 32.480 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
6.890	1.35	0.0465	3.442	1.198	1	2	organic material
7.054	1.04	0.0313	3.008	1.037	1	2	organic material
7.218	1.03	0.0295	2.853	1.206	1	2	organic material
7.382	1.10	0.0390	3.556	1.254	1	2	organic material
7.546	1.11	0.0374	3.369	1.032	1	2	organic material
7.710	1.12	0.0492	4.386	0.829	1	2	organic material
7.874	0.97	0.0496	5.134	0.893	1	2	organic material
8.038	6.44	0.0384	0.596	1.449	3	1	sensitive fine grained
8.202	7.95	0.0248	0.313	0.938	4	1	sensitive fine grained
8.366	8.11	0.0236	0.291	0.842	4	1	sensitive fine grained
8.530	6.87	0.0277	0.403	1.021	3	1	sensitive fine grained
8.694	5.70	0.0345	0.605	1.222	3	1	sensitive fine grained
8.858	5.26	0.0408	0.776	1.302	3	1	sensitive fine grained
9.022	4.78	0.0438	0.916	1.462	2	1	sensitive fine grained
9.186	3.54	0.0490	1.383	1.609	2	1	sensitive fine grained
9.350	2.71	0.0440	1.621	1.695	1	1	sensitive fine grained
9.514	2.08	0.0542	2.601	1.813	2	3	clay
9.678	1.53	0.0614	4.009	2.315	1	3	clay
9.843	2.94	0.0576	1.960	2.925	1	1	sensitive fine grained
10.007	3.24	0.0419	1.293	2.623	2	1	sensitive fine grained
10.171	2.75	0.0386	1.403	2.205	1	1	sensitive fine grained
10.335	1.91	0.0492	2.573	2.165	2	3	clay
10.499	1.52	0.0670	4.421	2.588	1	2	organic material
10.663	1.89	0.0558	2.955	2.754	2	3	clay
10.827	2.53	0.0387	1.530	2.254	1	1	sensitive fine grained
10.991	1.90	0.0524	2.754	2.013	2	3	clay
11.155	1.56	0.0565	3.629	2.438	1	3	clay
11.319	1.69	0.0562	3.320	4.470	2	3	clay
11.483	1.66	0.0539	3.243	3.940	2	3	clay
11.647	1.67	0.0660	3.955	4.058	2	3	clay
11.811	1.99	0.0552	2.775	4.208	2	3	clay
11.975	4.87	0.0498	1.023	3.986	2	1	sensitive fine grained
12.139	4.02	0.0479	1.194	2.858	2	1	sensitive fine grained
12.303	2.36	0.0795	3.373	3.160	2	3	clay
12.467	1.93	0.0804	4.157	4.277	2	3	clay
12.631	4.79	0.0500	1.043	4.430	2	1	sensitive fine grained
12.795	5.84	0.0632	1.084	2.914	3	1	sensitive fine grained
12.959	3.56	0.0731	2.053	2.582	3	3	clay
13.123	2.46	0.0689	2.802	3.558	2	3	clay
13.287	2.16	0.0855	3.949	4.662	2	3	clay
13.451	2.31	0.0761	3.293	5.002	2	3	clay
13.615	4.27	0.0665	1.559	3.975	2	1	sensitive fine grained
13.780	2.77	0.0779	2.813	3.384	3	3	clay
13.944	2.76	0.0590	2.134	3.818	3	3	clay

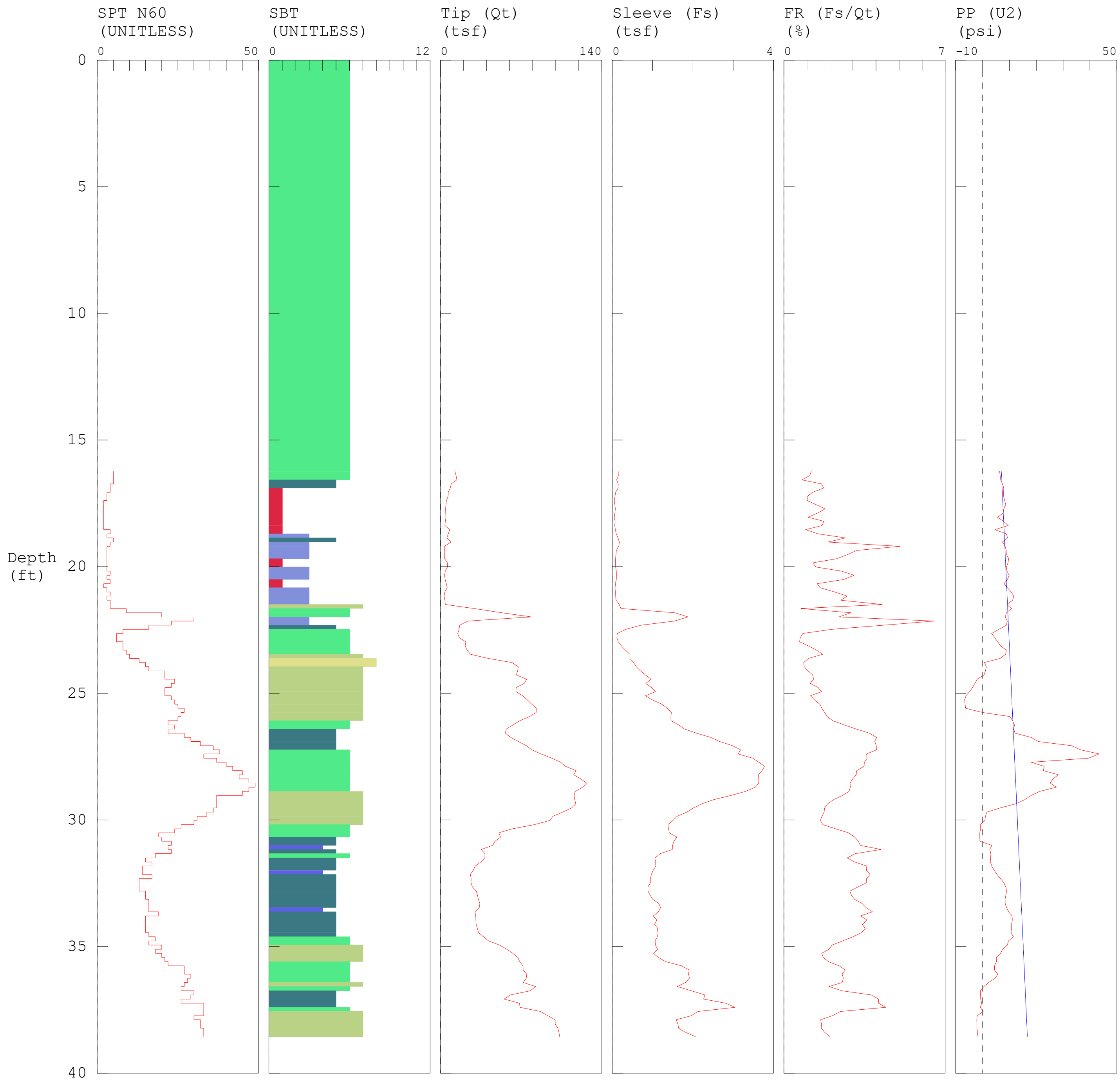
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
14.108	2.49	0.0694	2.783	3.809	2	3	clay
14.272	2.30	0.0683	2.966	4.275	2	3	clay
14.436	2.49	0.0657	2.638	4.382	2	3	clay
14.600	5.33	0.0876	1.644	3.983	3	1	sensitive fine grained
14.764	4.46	0.0702	1.575	4.317	2	1	sensitive fine grained
14.928	6.72	0.0879	1.309	3.796	3	1	sensitive fine grained
15.092	5.06	0.0882	1.742	3.513	3	4	silty clay to clay
15.256	3.16	0.1114	3.528	4.740	3	3	clay
15.420	4.86	0.1077	2.215	6.785	3	4	silty clay to clay
15.584	11.78	0.1142	0.970	4.689	5	6	sandy silt to clayey silt
15.748	9.58	0.2211	2.308	4.136	6	4	silty clay to clay
15.912	14.65	0.2929	1.999	2.909	7	5	clayey silt to silty clay
16.076	15.21	0.3666	2.410	2.574	7	5	clayey silt to silty clay
16.240	16.44	0.4277	2.602	3.422	8	5	clayey silt to silty clay
16.404	17.80	0.4828	2.712	3.938	9	5	clayey silt to silty clay
16.568	16.35	0.4722	2.889	4.684	8	5	clayey silt to silty clay
16.732	15.69	0.3818	2.433	5.774	8	5	clayey silt to silty clay
16.896	14.83	0.3924	2.646	7.445	7	5	clayey silt to silty clay
17.060	19.08	0.4285	2.246	9.720	9	5	clayey silt to silty clay
17.224	19.18	0.4852	2.530	11.511	9	5	clayey silt to silty clay
17.388	18.02	0.4456	2.473	13.407	9	5	clayey silt to silty clay
17.552	16.23	0.5419	3.338	15.481	10	4	silty clay to clay
17.717	15.58	0.5532	3.551	18.120	10	4	silty clay to clay
17.881	17.27	0.5225	3.026	27.776	8	5	clayey silt to silty clay
18.045	14.94	0.4359	2.918	23.293	7	5	clayey silt to silty clay
18.209	13.55	0.3409	2.516	24.619	6	5	clayey silt to silty clay
18.373	12.73	0.2896	2.275	28.797	6	5	clayey silt to silty clay
18.537	13.21	0.2771	2.098	34.419	6	5	clayey silt to silty clay
18.701	15.95	0.3909	2.451	43.233	8	5	clayey silt to silty clay
18.865	16.40	0.4538	2.768	40.688	8	5	clayey silt to silty clay
19.029	15.27	0.4387	2.873	38.223	7	5	clayey silt to silty clay
19.193	14.24	0.3770	2.647	39.121	7	5	clayey silt to silty clay
19.357	13.17	0.3455	2.624	39.894	6	5	clayey silt to silty clay
19.521	13.41	0.3960	2.953	36.181	9	4	silty clay to clay
19.685	12.32	0.5224	4.239	25.413	12	3	clay
19.849	14.49	0.5531	3.816	19.686	9	4	silty clay to clay
20.013	20.55	0.5122	2.493	8.028	10	5	clayey silt to silty clay
20.177	26.90	0.5137	1.910	2.729	10	6	sandy silt to clayey silt
20.341	24.50	0.5807	2.370	-0.096	9	6	sandy silt to clayey silt
20.505	17.39	0.5757	3.311	0.960	8	5	clayey silt to silty clay
20.669	16.78	0.5435	3.238	1.607	8	5	clayey silt to silty clay
20.833	16.00	0.6834	4.272	1.604	15	3	clay
20.997	16.98	0.4859	2.862	2.069	8	5	clayey silt to silty clay
21.161	29.65	0.3951	1.332	-2.844	11	6	sandy silt to clayey silt
21.325	33.64	0.5720	1.701	-3.275	13	6	sandy silt to clayey silt
21.490	34.35	0.6501	1.892	-3.299	13	6	sandy silt to clayey silt
21.654	25.87	0.6904	2.669	-3.160	12	5	clayey silt to silty clay
21.818	21.47	0.6574	3.062	-1.163	10	5	clayey silt to silty clay
21.982	21.01	0.7476	3.557	0.548	13	4	silty clay to clay
22.146	20.19	0.7321	3.626	0.192	13	4	silty clay to clay
22.310	20.56	0.5830	2.835	-0.593	10	5	clayey silt to silty clay
22.474	26.41	0.5572	2.110	-2.395	10	6	sandy silt to clayey silt
22.638	30.41	0.6910	2.272	-4.587	12	6	sandy silt to clayey silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
22.802	25.53	0.8206	3.214	-5.518	12	5	clayey silt to silty clay
22.966	25.51	0.8083	3.169	-5.772	12	5	clayey silt to silty clay
23.130	27.59	0.8150	2.954	-6.445	13	5	clayey silt to silty clay
23.294	31.93	0.5506	1.724	-7.918	12	6	sandy silt to clayey silt
23.458	36.89	0.8201	2.223	-8.525	14	6	sandy silt to clayey silt
23.622	41.92	0.8514	2.031	-8.557	16	6	sandy silt to clayey silt
23.786	30.08	1.0395	3.456	-8.833	14	5	clayey silt to silty clay
23.950	25.52	1.0446	4.093	-8.694	16	4	silty clay to clay
24.114	36.61	0.9265	2.531	-8.378	14	6	sandy silt to clayey silt
24.278	45.43	0.9333	2.054	-8.498	17	6	sandy silt to clayey silt
24.442	32.15	1.0097	3.140	-7.654	15	5	clayey silt to silty clay
24.606	26.29	1.0102	3.842	-7.790	17	4	silty clay to clay
24.770	39.01	1.2851	3.294	-7.173	19	5	clayey silt to silty clay
24.934	42.17	1.3493	3.200	-7.210	20	5	clayey silt to silty clay
25.098	50.19	1.4133	2.816	-7.459	19	6	sandy silt to clayey silt
25.262	47.65	1.4762	3.098	-7.753	18	6	sandy silt to clayey silt
25.427	41.73	1.3787	3.304	-7.913	20	5	clayey silt to silty clay
25.591	36.95	1.3627	3.688	-8.039	18	5	clayey silt to silty clay
25.755	34.03	1.3430	3.947	-8.303	22	4	silty clay to clay
25.919	42.21	0.8918	2.113	-8.028	16	6	sandy silt to clayey silt
26.083	51.17	1.1858	2.317	-8.186	20	6	sandy silt to clayey silt
26.247	40.62	0.8302	2.044	-8.656	16	6	sandy silt to clayey silt
26.411	45.33	0.6319	1.394	-8.843	14	7	silty sand to sandy silt
26.575	45.04	0.5441	1.208	-9.081	14	7	silty sand to sandy silt
26.739	44.57	0.6610	1.483	-9.087	14	7	silty sand to sandy silt
26.903	46.18	0.7403	1.603	-9.001	15	7	silty sand to sandy silt
27.067	49.70	0.7399	1.489	-8.883	16	7	silty sand to sandy silt
27.231	55.41	0.7529	1.359	-8.782	18	7	silty sand to sandy silt
27.395	61.24	1.8379	3.001	-8.686	23	6	sandy silt to clayey silt
27.559	66.00	1.8502	2.803	-8.581	25	6	sandy silt to clayey silt
27.723	45.30	1.5732	3.473	-6.403	22	5	clayey silt to silty clay
27.887	30.59	1.2705	4.154	-6.616	20	4	silty clay to clay
28.051	34.95	1.9675	5.629	-6.066	33	3	clay
28.215	49.83	1.8607	3.734	-5.622	24	5	clayey silt to silty clay
28.379	70.44	1.5660	2.223	1.858	22	7	silty sand to sandy silt
28.543	74.38	1.7046	2.292	-2.510	28	6	sandy silt to clayey silt
28.707	70.35	1.8240	2.593	-5.061	27	6	sandy silt to clayey silt
28.871	68.72	1.9453	2.831	-6.881	26	6	sandy silt to clayey silt
29.035	72.87	1.8651	2.559	-8.245	28	6	sandy silt to clayey silt
29.199	77.28	1.7201	2.226	-10.062	25	7	silty sand to sandy silt
29.364	79.18	1.7124	2.162	-10.656	25	7	silty sand to sandy silt
29.528	70.06	2.0580	2.938	-10.995	27	6	sandy silt to clayey silt
29.692	50.23	2.1087	4.198	-11.295	24	5	clayey silt to silty clay
29.856	63.86	1.8779	2.941	-10.961	24	6	sandy silt to clayey silt
30.020	72.61	1.1466	1.579	-10.987	23	7	silty sand to sandy silt
30.184	71.76	0.7262	1.012	-10.998	17	8	sand to silty sand
30.348	65.07	0.4920	0.756	-11.049	16	8	sand to silty sand
30.512	58.33	0.5188	0.889	-11.145	19	7	silty sand to sandy silt
30.676	53.24	0.7521	1.413	-11.169	17	7	silty sand to sandy silt
30.840	47.48	0.7631	1.607	-11.100	15	7	silty sand to sandy silt
31.004	44.28	0.7640	1.725	7.229	14	7	silty sand to sandy silt
31.168	43.50	0.7696	1.769	7.301	14	7	silty sand to sandy silt
31.332	42.37	0.7798	1.840	7.381	16	6	sandy silt to clayey silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
31.496	41.10	0.7880	1.917	7.496	16	6	sandy silt to clayey silt
31.660	39.54	0.7879	1.992	7.590	15	6	sandy silt to clayey silt
31.824	38.20	0.7793	2.040	7.737	15	6	sandy silt to clayey silt
31.988	36.96	0.7663	2.073	7.769	14	6	sandy silt to clayey silt
32.152	36.48	0.7321	2.007	7.739	14	6	sandy silt to clayey silt
32.316	38.04	0.7702	2.025	7.814	15	6	sandy silt to clayey silt
32.480	41.61	0.7802	1.875	7.664	16	6	sandy silt to clayey silt

AECOM / CPT-18-02 / 9930 NW St Helens Rd Portland

OPERATOR: OGE DMM
CONE ID: DDG1452
HOLE NUMBER: CPT-18-02
TEST DATE: 10/19/2018 12:33:37 PM
TOTAL DEPTH: 38.550 ft



1	sensitive fine grained	4	silty clay to clay	7	silty sand to sandy sil	10	gravelly sand to sand
2	organic material	5	clayey silt to silty cl	8	sand to silty sand	11	very stiff fine grained (*)
3	clay	6	sandy silt to clayey si	9	sand	12	sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

AECOM / CPT-18-02 / 9930 NW St Helens Rd Portland

OPERATOR: OGE DMM
CONE ID: DDG1452
HOLE NUMBER: CPT-18-02
TEST DATE: 10/19/2018 12:33:37 PM
TOTAL DEPTH: 38.550 ft

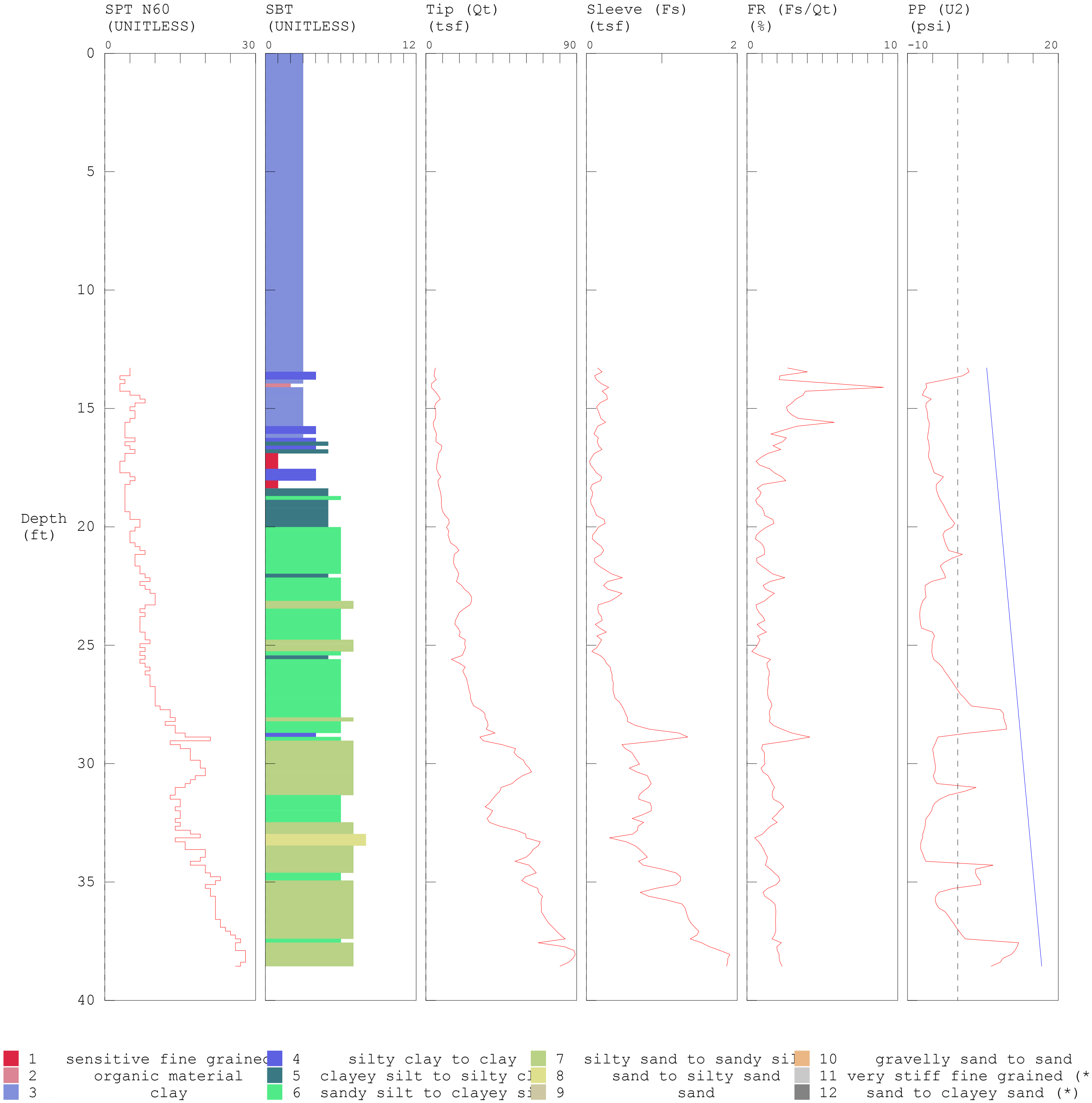
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
16.240	12.40	0.1467	1.184	6.352	5	6	sandy silt to clayey silt
16.404	13.43	0.1504	1.119	6.603	5	6	sandy silt to clayey silt
16.568	14.16	0.1096	0.774	6.710	5	6	sandy silt to clayey silt
16.732	9.12	0.1488	1.632	7.469	4	5	clayey silt to silty clay
16.896	8.46	0.1456	1.722	7.862	4	5	clayey silt to silty clay
17.060	6.67	0.0831	1.246	7.844	3	1	sensitive fine grained
17.224	6.57	0.0665	1.013	7.838	3	1	sensitive fine grained
17.388	5.06	0.0512	1.012	8.282	2	1	sensitive fine grained
17.552	4.59	0.0643	1.403	8.664	2	1	sensitive fine grained
17.717	4.27	0.0763	1.787	7.878	2	1	sensitive fine grained
17.881	4.48	0.0652	1.457	7.737	2	1	sensitive fine grained
18.045	4.62	0.0482	1.045	5.627	2	1	sensitive fine grained
18.209	4.12	0.0712	1.729	7.787	2	1	sensitive fine grained
18.373	3.72	0.0618	1.660	9.533	2	1	sensitive fine grained
18.537	7.90	0.0746	0.945	4.571	4	1	sensitive fine grained
18.701	6.74	0.0994	1.476	8.883	3	1	sensitive fine grained
18.865	5.31	0.1417	2.668	9.319	5	3	clay
19.029	9.28	0.1771	1.909	7.418	4	5	clayey silt to silty clay
19.193	3.22	0.1617	5.023	8.394	3	3	clay
19.357	3.20	0.1005	3.145	8.822	3	3	clay
19.521	3.32	0.0921	2.770	8.857	3	3	clay
19.685	3.56	0.0814	2.286	9.731	3	3	clay
19.849	5.91	0.0741	1.253	9.461	3	1	sensitive fine grained
20.013	5.90	0.0818	1.387	8.894	3	1	sensitive fine grained
20.177	4.08	0.1023	2.509	9.137	4	3	clay
20.341	3.40	0.1037	3.047	9.918	3	3	clay
20.505	3.96	0.1021	2.578	9.247	4	3	clay
20.669	5.01	0.0726	1.448	8.023	2	1	sensitive fine grained
20.833	5.73	0.0898	1.567	9.250	3	1	sensitive fine grained
20.997	3.67	0.0804	2.194	10.688	4	3	clay
21.161	3.03	0.0832	2.744	11.597	3	3	clay
21.325	3.85	0.0950	2.465	11.166	4	3	clay
21.490	4.07	0.1737	4.266	9.049	4	3	clay
21.654	28.99	0.2135	0.736	10.798	9	7	silty sand to sandy silt
21.818	53.34	1.5537	2.913	8.913	20	6	sandy silt to clayey silt
21.982	78.80	1.8790	2.385	8.440	30	6	sandy silt to clayey silt
22.146	23.68	1.5430	6.515	9.218	23	3	clay
22.310	16.57	0.7188	4.337	8.875	16	3	clay
22.474	16.06	0.3345	2.082	6.119	8	5	clayey silt to silty clay
22.638	14.86	0.1222	0.822	3.360	6	6	sandy silt to clayey silt
22.802	16.19	0.1145	0.707	4.625	6	6	sandy silt to clayey silt
22.966	21.91	0.1486	0.678	5.577	8	6	sandy silt to clayey silt
23.130	21.29	0.2275	1.069	6.793	8	6	sandy silt to clayey silt
23.294	23.07	0.3251	1.409	8.894	9	6	sandy silt to clayey silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
23.458	25.95	0.4365	1.682	8.592	10	6	sandy silt to clayey silt
23.622	41.27	0.4389	1.063	6.595	13	7	silty sand to sandy silt
23.786	62.03	0.5307	0.856	0.738	15	8	sand to silty sand
23.950	67.34	0.5937	0.882	1.409	16	8	sand to silty sand
24.114	66.81	0.7010	1.049	1.075	21	7	silty sand to sandy silt
24.278	65.81	0.8221	1.249	0.585	21	7	silty sand to sandy silt
24.442	74.80	0.9619	1.286	-1.968	24	7	silty sand to sandy silt
24.606	72.64	0.8308	1.144	-2.844	23	7	silty sand to sandy silt
24.770	65.59	0.9708	1.480	-3.695	21	7	silty sand to sandy silt
24.934	65.50	1.0701	1.634	-4.812	21	7	silty sand to sandy silt
25.098	71.28	0.8219	1.153	-6.157	23	7	silty sand to sandy silt
25.262	75.37	0.9975	1.323	-6.646	24	7	silty sand to sandy silt
25.427	79.20	1.2316	1.555	-6.445	25	7	silty sand to sandy silt
25.591	83.03	1.3678	1.647	-6.306	27	7	silty sand to sandy silt
25.755	82.98	1.4661	1.767	-0.064	26	7	silty sand to sandy silt
25.919	77.16	1.4526	1.883	10.260	25	7	silty sand to sandy silt
26.083	68.86	1.4566	2.115	11.172	22	7	silty sand to sandy silt
26.247	62.73	1.6494	2.629	11.875	24	6	sandy silt to clayey silt
26.411	57.12	1.7891	3.132	11.597	22	6	sandy silt to clayey silt
26.575	56.26	2.0868	3.709	12.086	27	5	clayey silt to silty clay
26.739	60.80	2.4439	4.020	18.080	29	5	clayey silt to silty clay
26.903	67.59	2.6662	3.945	20.745	32	5	clayey silt to silty clay
27.067	74.47	2.9850	4.008	33.133	36	5	clayey silt to silty clay
27.231	79.16	3.1825	4.020	36.531	38	5	clayey silt to silty clay
27.395	87.21	3.1251	3.584	43.364	33	6	sandy silt to clayey silt
27.559	96.61	3.4868	3.609	39.445	37	6	sandy silt to clayey silt
27.723	104.18	3.6349	3.489	18.104	40	6	sandy silt to clayey silt
27.887	108.47	3.7772	3.482	22.969	42	6	sandy silt to clayey silt
28.051	117.67	3.7168	3.159	22.627	45	6	sandy silt to clayey silt
28.215	115.52	3.6259	3.139	28.233	44	6	sandy silt to clayey silt
28.379	121.74	3.6311	2.983	26.212	47	6	sandy silt to clayey silt
28.543	126.69	3.6337	2.868	25.180	49	6	sandy silt to clayey silt
28.707	123.28	3.5496	2.879	27.474	47	6	sandy silt to clayey silt
28.871	116.90	3.3019	2.825	21.237	45	6	sandy silt to clayey silt
29.035	115.99	2.9450	2.539	18.090	37	7	silty sand to sandy silt
29.199	116.48	2.5215	2.165	15.778	37	7	silty sand to sandy silt
29.364	117.38	2.2164	1.888	12.313	37	7	silty sand to sandy silt
29.528	113.73	2.0128	1.770	6.480	36	7	silty sand to sandy silt
29.692	106.01	1.8490	1.744	1.655	34	7	silty sand to sandy silt
29.856	97.43	1.6099	1.652	1.064	31	7	silty sand to sandy silt
30.020	95.05	1.5041	1.583	0.874	30	7	silty sand to sandy silt
30.184	81.36	1.3774	1.693	-0.882	26	7	silty sand to sandy silt
30.348	62.35	1.4000	2.245	-0.706	24	6	sandy silt to clayey silt
30.512	50.55	1.4144	2.798	-1.005	19	6	sandy silt to clayey silt
30.676	52.03	1.5989	3.073	-1.021	20	6	sandy silt to clayey silt
30.840	47.38	1.5301	3.230	-0.989	23	5	clayey silt to silty clay
31.004	45.21	1.4956	3.308	3.465	22	5	clayey silt to silty clay
31.168	35.33	1.4904	4.218	2.724	23	4	silty clay to clay
31.332	38.43	1.1909	3.098	3.090	18	5	clayey silt to silty clay
31.496	38.49	1.0574	2.747	3.064	15	6	sandy silt to clayey silt
31.660	34.93	1.0740	3.074	2.887	17	5	clayey silt to silty clay
31.824	30.06	1.0806	3.595	3.441	14	5	clayey silt to silty clay
31.988	28.38	1.0151	3.577	4.323	14	5	clayey silt to silty clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
32.152	25.88	0.9680	3.740	5.430	17	4	silty clay to clay
32.316	26.46	0.9475	3.581	6.686	13	5	clayey silt to silty clay
32.480	26.39	0.9470	3.589	7.966	13	5	clayey silt to silty clay
32.644	27.56	0.8870	3.219	8.640	13	5	clayey silt to silty clay
32.808	30.96	0.8856	2.861	8.974	15	5	clayey silt to silty clay
32.972	32.12	0.9403	2.927	8.696	15	5	clayey silt to silty clay
33.136	32.78	1.0026	3.059	8.429	16	5	clayey silt to silty clay
33.301	34.07	1.1552	3.390	8.477	16	5	clayey silt to silty clay
33.465	33.58	1.1984	3.569	8.977	16	5	clayey silt to silty clay
33.629	29.78	1.1437	3.840	9.712	19	4	silty clay to clay
33.793	30.55	1.0153	3.324	11.017	15	5	clayey silt to silty clay
33.957	30.61	1.1069	3.617	11.105	15	5	clayey silt to silty clay
34.121	30.83	1.0498	3.405	10.846	15	5	clayey silt to silty clay
34.285	31.95	1.1276	3.529	10.744	15	5	clayey silt to silty clay
34.449	32.91	1.1090	3.370	10.642	16	5	clayey silt to silty clay
34.613	37.27	1.1179	3.000	11.490	18	5	clayey silt to silty clay
34.777	41.58	1.0624	2.555	9.656	16	6	sandy silt to clayey silt
34.941	51.16	1.0695	2.091	9.247	20	6	sandy silt to clayey silt
35.105	57.52	1.1243	1.955	7.429	18	7	silty sand to sandy silt
35.269	62.67	1.0271	1.639	6.718	20	7	silty sand to sandy silt
35.433	67.17	1.1460	1.706	5.130	21	7	silty sand to sandy silt
35.597	68.73	1.3293	1.934	5.192	22	7	silty sand to sandy silt
35.761	71.58	1.7211	2.405	4.491	27	6	sandy silt to clayey silt
35.925	71.66	1.9065	2.660	4.408	27	6	sandy silt to clayey silt
36.089	74.84	1.8900	2.525	5.686	29	6	sandy silt to clayey silt
36.253	74.39	1.9144	2.574	4.737	28	6	sandy silt to clayey silt
36.417	71.69	1.8135	2.529	2.299	27	6	sandy silt to clayey silt
36.581	82.44	1.6104	1.953	0.529	26	7	silty sand to sandy silt
36.745	77.93	1.9649	2.521	-0.802	30	6	sandy silt to clayey silt
36.909	60.68	2.2987	3.788	-0.778	29	5	clayey silt to silty clay
37.073	55.13	2.2633	4.105	-0.658	26	5	clayey silt to silty clay
37.238	68.55	2.8132	4.104	-0.302	33	5	clayey silt to silty clay
37.402	68.92	3.0429	4.415	-0.842	33	5	clayey silt to silty clay
37.566	86.73	2.1271	2.453	0.294	33	6	sandy silt to clayey silt
37.730	93.10	1.9552	2.100	-1.976	30	7	silty sand to sandy silt
37.894	99.60	1.5858	1.592	-2.147	32	7	silty sand to sandy silt
38.058	99.60	1.6262	1.633	-2.125	32	7	silty sand to sandy silt
38.222	101.87	1.6477	1.617	-2.125	33	7	silty sand to sandy silt
38.386	102.86	1.8146	1.764	-1.890	33	7	silty sand to sandy silt
38.550	103.26	2.0600	1.995	-1.735	33	7	silty sand to sandy silt

AECOM / CPT-18-03 / 9930 NW St Helens Rd Portland

OPERATOR: OGE DMM
CONE ID: DDG1452
HOLE NUMBER: CPT-18-03
TEST DATE: 10/19/2018 11:19:06 AM
TOTAL DEPTH: 38.550 ft



*SBT/SPT CORRELATION: UBC-1983

AECOM / CPT-18-03 / 9930 NW St Helens Rd Portland

OPERATOR: OGE DMM
CONE ID: DDG1452
HOLE NUMBER: CPT-18-03
TEST DATE: 10/19/2018 11:19:06 AM
TOTAL DEPTH: 38.550 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
13.287	5.52	0.1491	2.702	1.898	5	3	clay
13.451	5.21	0.2077	3.988	2.254	5	3	clay
13.615	4.92	0.1075	2.186	1.000	3	4	silty clay to clay
13.780	6.12	0.1304	2.131	-2.387	4	4	silty clay to clay
13.944	3.40	0.1972	5.798	-6.346	3	3	clay
14.108	3.25	0.2948	9.061	-6.186	3	2	organic material
14.272	5.36	0.2079	3.882	-6.750	5	3	clay
14.436	7.23	0.2682	3.707	-7.052	7	3	clay
14.600	8.54	0.2771	3.243	-5.282	8	3	clay
14.764	6.05	0.1801	2.977	-6.290	6	3	clay
14.928	5.11	0.1342	2.624	-6.371	5	3	clay
15.092	5.81	0.1558	2.682	-6.119	6	3	clay
15.256	5.91	0.1746	2.955	-6.010	6	3	clay
15.420	5.64	0.1918	3.398	-5.975	5	3	clay
15.584	4.38	0.2535	5.790	-5.716	4	3	clay
15.748	4.53	0.1485	3.281	-5.678	4	3	clay
16.076	6.33	0.1005	1.588	-5.913	4	4	silty clay to clay
16.240	6.03	0.1579	2.617	-6.060	6	3	clay
16.404	6.05	0.1429	2.363	-5.817	4	4	silty clay to clay
16.568	9.49	0.1636	1.724	-5.681	5	5	clayey silt to silty clay
16.732	9.20	0.2063	2.242	-5.651	6	4	silty clay to clay
16.896	7.60	0.1059	1.394	-5.804	4	5	clayey silt to silty clay
17.060	7.37	0.0694	0.941	-5.798	4	1	sensitive fine grained
17.224	6.82	0.0412	0.604	-5.480	3	1	sensitive fine grained
17.388	6.45	0.0539	0.836	-5.210	3	1	sensitive fine grained
17.552	6.38	0.0973	1.525	-4.970	3	1	sensitive fine grained
17.717	7.26	0.1319	1.816	-4.676	5	4	silty clay to clay
17.881	8.84	0.2039	2.307	-2.871	6	4	silty clay to clay
18.045	7.19	0.1848	2.568	-3.478	5	4	silty clay to clay
18.209	7.43	0.0782	1.053	-4.275	4	1	sensitive fine grained
18.373	7.97	0.0537	0.674	-4.307	4	1	sensitive fine grained
18.537	8.72	0.0816	0.936	-4.120	4	5	clayey silt to silty clay
18.701	9.07	0.0752	0.829	-3.834	4	5	clayey silt to silty clay
18.865	9.27	0.0526	0.567	-3.462	4	6	sandy silt to clayey silt
19.029	9.23	0.0622	0.674	-2.962	4	5	clayey silt to silty clay
19.193	9.38	0.0935	0.997	-2.585	4	5	clayey silt to silty clay
19.357	10.09	0.1122	1.112	-2.176	5	5	clayey silt to silty clay
19.521	11.46	0.1340	1.169	-1.810	5	5	clayey silt to silty clay
19.685	13.66	0.2324	1.701	-1.195	7	5	clayey silt to silty clay
19.849	13.87	0.2491	1.796	-0.618	7	5	clayey silt to silty clay
20.013	12.30	0.1582	1.286	-1.120	6	5	clayey silt to silty clay
20.177	13.73	0.1257	0.916	-2.588	5	6	sandy silt to clayey silt
20.341	13.15	0.0832	0.633	-2.957	5	6	sandy silt to clayey silt
20.505	13.92	0.0771	0.554	-2.729	5	6	sandy silt to clayey silt

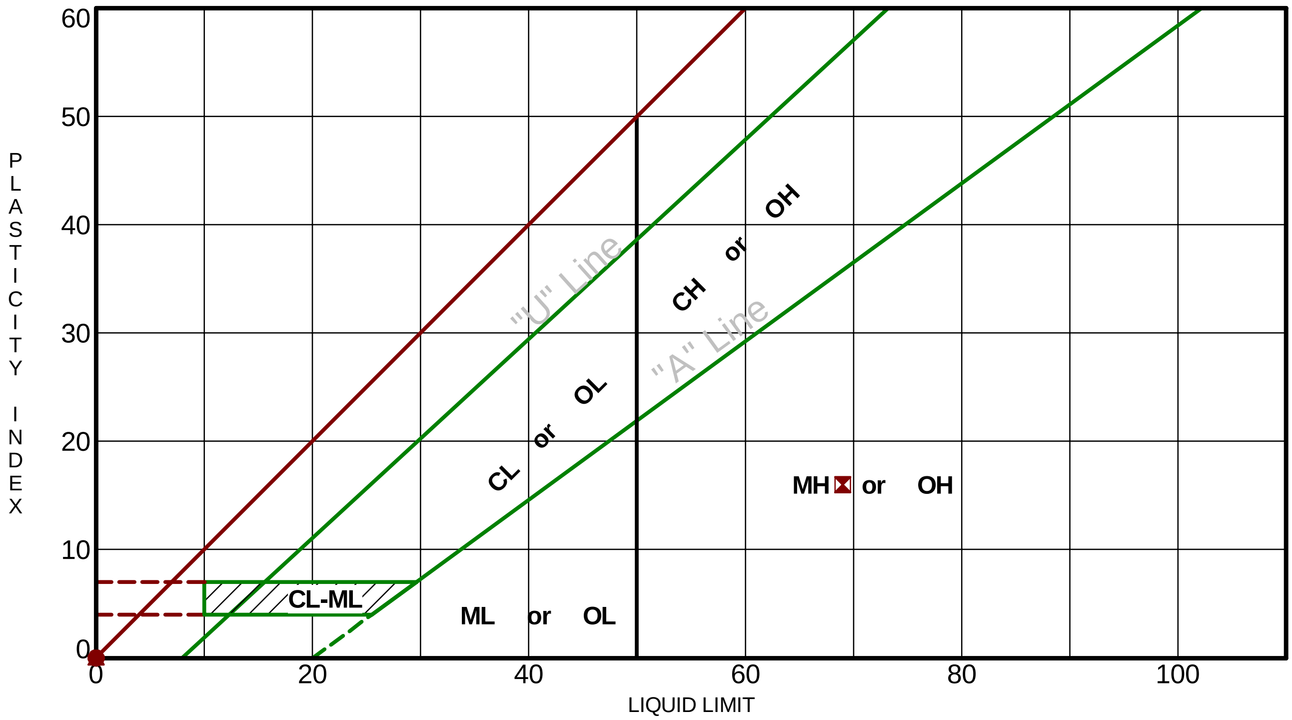
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
20.669	14.67	0.1337	0.912	-2.500	6	6	sandy silt to clayey silt
20.833	17.94	0.1985	1.107	-2.163	7	6	sandy silt to clayey silt
20.997	19.69	0.2284	1.160	-1.799	8	6	sandy silt to clayey silt
21.161	16.89	0.1956	1.158	0.898	6	6	sandy silt to clayey silt
21.325	16.68	0.1063	0.637	-1.131	6	6	sandy silt to clayey silt
21.490	16.38	0.1096	0.669	-2.671	6	6	sandy silt to clayey silt
21.654	17.16	0.1662	0.969	-3.470	7	6	sandy silt to clayey silt
21.818	18.53	0.2499	1.349	-3.112	7	6	sandy silt to clayey silt
21.982	19.65	0.3316	1.688	-2.695	8	6	sandy silt to clayey silt
22.146	19.01	0.4757	2.502	-2.395	9	5	clayey silt to silty clay
22.310	18.25	0.2772	1.519	-5.274	7	6	sandy silt to clayey silt
22.474	21.36	0.2281	1.068	-6.488	8	6	sandy silt to clayey silt
22.638	23.08	0.2870	1.243	-6.523	9	6	sandy silt to clayey silt
22.802	25.94	0.4704	1.813	-6.427	10	6	sandy silt to clayey silt
22.966	27.26	0.4030	1.479	-6.328	10	6	sandy silt to clayey silt
23.130	27.22	0.3140	1.154	-6.964	10	6	sandy silt to clayey silt
23.294	26.30	0.1566	0.596	-7.266	8	7	silty sand to sandy silt
23.458	22.65	0.1496	0.661	-7.472	7	7	silty sand to sandy silt
23.622	19.80	0.1589	0.803	-7.557	8	6	sandy silt to clayey silt
23.786	18.88	0.1969	1.043	-7.547	7	6	sandy silt to clayey silt
23.950	17.58	0.2080	1.183	-7.493	7	6	sandy silt to clayey silt
24.114	17.32	0.1167	0.674	-7.389	7	6	sandy silt to clayey silt
24.278	19.26	0.1779	0.924	-7.175	7	6	sandy silt to clayey silt
24.442	20.47	0.2627	1.283	-5.039	8	6	sandy silt to clayey silt
24.606	19.70	0.1378	0.700	-4.609	8	6	sandy silt to clayey silt
24.770	23.49	0.2019	0.860	-4.935	9	6	sandy silt to clayey silt
24.934	23.15	0.1715	0.741	-5.119	7	7	silty sand to sandy silt
25.098	23.65	0.1376	0.582	-5.111	8	7	silty sand to sandy silt
25.262	22.70	0.0718	0.316	-5.176	7	7	silty sand to sandy silt
25.427	21.64	0.1820	0.841	-5.042	8	6	sandy silt to clayey silt
25.591	15.22	0.2379	1.563	-4.820	7	5	clayey silt to silty clay
25.755	19.90	0.2633	1.323	-3.887	8	6	sandy silt to clayey silt
25.919	23.46	0.3154	1.344	-3.112	9	6	sandy silt to clayey silt
26.083	22.01	0.3237	1.470	-2.649	8	6	sandy silt to clayey silt
26.247	23.17	0.3408	1.471	-2.053	9	6	sandy silt to clayey silt
26.411	24.30	0.3400	1.399	-1.556	9	6	sandy silt to clayey silt
26.575	24.69	0.3545	1.436	-1.005	9	6	sandy silt to clayey silt
26.739	25.38	0.3533	1.392	-0.508	10	6	sandy silt to clayey silt
26.903	25.78	0.3519	1.365	0.035	10	6	sandy silt to clayey silt
27.067	26.44	0.3638	1.376	0.556	10	6	sandy silt to clayey silt
27.231	26.63	0.3785	1.421	1.353	10	6	sandy silt to clayey silt
27.395	27.34	0.4361	1.595	1.978	10	6	sandy silt to clayey silt
27.559	28.54	0.4709	1.650	2.681	11	6	sandy silt to clayey silt
27.723	32.67	0.4965	1.520	8.464	13	6	sandy silt to clayey silt
27.887	35.19	0.5186	1.474	9.103	13	6	sandy silt to clayey silt
28.051	35.36	0.5436	1.537	9.129	14	6	sandy silt to clayey silt
28.215	36.58	0.5428	1.484	9.314	12	7	silty sand to sandy silt
28.379	37.13	0.6458	1.739	9.621	14	6	sandy silt to clayey silt
28.543	36.02	0.8329	2.312	9.688	14	6	sandy silt to clayey silt
28.707	41.24	1.2287	2.979	2.200	16	6	sandy silt to clayey silt
28.871	32.23	1.3428	4.167	-3.965	21	4	silty clay to clay
29.035	34.22	0.9601	2.805	-4.259	13	6	sandy silt to clayey silt
29.199	45.45	0.4699	1.034	-4.574	15	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
29.364	53.57	0.5154	0.962	-4.994	17	7	silty sand to sandy silt
29.528	52.57	0.6021	1.145	-4.911	17	7	silty sand to sandy silt
29.692	54.66	0.6338	1.159	-4.756	17	7	silty sand to sandy silt
29.856	58.21	0.6684	1.148	-4.638	19	7	silty sand to sandy silt
30.020	59.40	0.7040	1.185	-4.497	19	7	silty sand to sandy silt
30.184	61.60	0.5693	0.924	-4.419	20	7	silty sand to sandy silt
30.348	63.09	0.6665	1.056	-4.571	20	7	silty sand to sandy silt
30.512	57.73	0.8078	1.399	-4.871	18	7	silty sand to sandy silt
30.676	54.03	0.8343	1.544	-4.652	17	7	silty sand to sandy silt
30.840	51.49	0.8585	1.667	-4.144	16	7	silty sand to sandy silt
31.004	44.97	0.8195	1.822	3.633	14	7	silty sand to sandy silt
31.168	44.09	0.7488	1.698	1.347	14	7	silty sand to sandy silt
31.332	41.74	0.6974	1.671	-1.869	13	7	silty sand to sandy silt
31.496	39.72	0.6929	1.745	-3.561	15	6	sandy silt to clayey silt
31.660	38.02	0.8449	2.222	-4.550	15	6	sandy silt to clayey silt
31.824	35.26	0.8617	2.444	-4.996	14	6	sandy silt to clayey silt
31.988	39.84	0.8594	2.157	-5.208	15	6	sandy silt to clayey silt
32.152	38.53	0.7502	1.947	-5.678	15	6	sandy silt to clayey silt
32.316	36.56	0.6053	1.656	-6.336	14	6	sandy silt to clayey silt
32.480	37.91	0.7595	2.003	-6.448	15	6	sandy silt to clayey silt
32.644	44.22	0.6838	1.546	-6.518	14	7	silty sand to sandy silt
32.808	53.68	0.6785	1.264	-6.721	17	7	silty sand to sandy silt
32.972	59.58	0.6139	1.030	-6.972	19	7	silty sand to sandy silt
33.136	59.78	0.3072	0.514	-6.980	14	8	sand to silty sand
33.301	68.23	0.5284	0.774	-7.325	16	8	sand to silty sand
33.465	67.16	0.6455	0.961	-7.389	16	8	sand to silty sand
33.629	64.03	0.7092	1.108	-7.352	20	7	silty sand to sandy silt
33.793	62.38	0.7612	1.220	-7.017	20	7	silty sand to sandy silt
33.957	59.66	0.8087	1.355	-6.710	19	7	silty sand to sandy silt
34.121	53.22	0.6909	1.298	-6.379	17	7	silty sand to sandy silt
34.285	61.55	0.7530	1.223	7.020	20	7	silty sand to sandy silt
34.449	63.87	0.9931	1.555	3.585	20	7	silty sand to sandy silt
34.613	65.86	1.1896	1.806	3.507	21	7	silty sand to sandy silt
34.777	59.38	1.2480	2.102	3.842	23	6	sandy silt to clayey silt
34.941	57.17	1.2473	2.182	4.480	22	6	sandy silt to clayey silt
35.105	61.56	1.1922	1.937	4.619	20	7	silty sand to sandy silt
35.269	66.77	0.9184	1.375	-0.885	21	7	silty sand to sandy silt
35.433	67.21	0.7152	1.064	-3.759	21	7	silty sand to sandy silt
35.597	69.52	0.8215	1.182	-4.374	22	7	silty sand to sandy silt
35.761	68.84	1.0723	1.558	-4.497	22	7	silty sand to sandy silt
35.925	68.70	1.2670	1.844	-4.272	22	7	silty sand to sandy silt
36.089	69.03	1.3074	1.894	-3.796	22	7	silty sand to sandy silt
36.253	68.92	1.3219	1.918	-2.545	22	7	silty sand to sandy silt
36.417	70.33	1.3387	1.903	-1.917	22	7	silty sand to sandy silt
36.581	71.75	1.3559	1.890	-1.409	23	7	silty sand to sandy silt
36.745	73.42	1.3907	1.894	-0.818	23	7	silty sand to sandy silt
36.909	75.79	1.4379	1.897	-0.342	24	7	silty sand to sandy silt
37.073	77.94	1.4894	1.911	0.249	25	7	silty sand to sandy silt
37.238	80.32	1.4648	1.824	0.813	26	7	silty sand to sandy silt
37.402	83.15	1.3772	1.656	1.510	27	7	silty sand to sandy silt
37.566	66.96	1.5255	2.278	12.089	26	6	sandy silt to clayey silt
37.730	82.70	1.6333	1.975	11.795	26	7	silty sand to sandy silt
37.894	88.36	1.7735	2.007	11.380	28	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	FR (Fs/Qt) (%)	PP (U2) (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
38.058	89.21	1.9041	2.134	10.648	28	7	silty sand to sandy silt
38.222	87.78	1.8755	2.137	8.940	28	7	silty sand to sandy silt
38.386	85.24	1.8705	2.195	8.466	27	7	silty sand to sandy silt
38.550	79.98	1.8605	2.326	6.633	26	7	silty sand to sandy silt

ATTERBERG LIMITS RESULTS

ASTM D4318

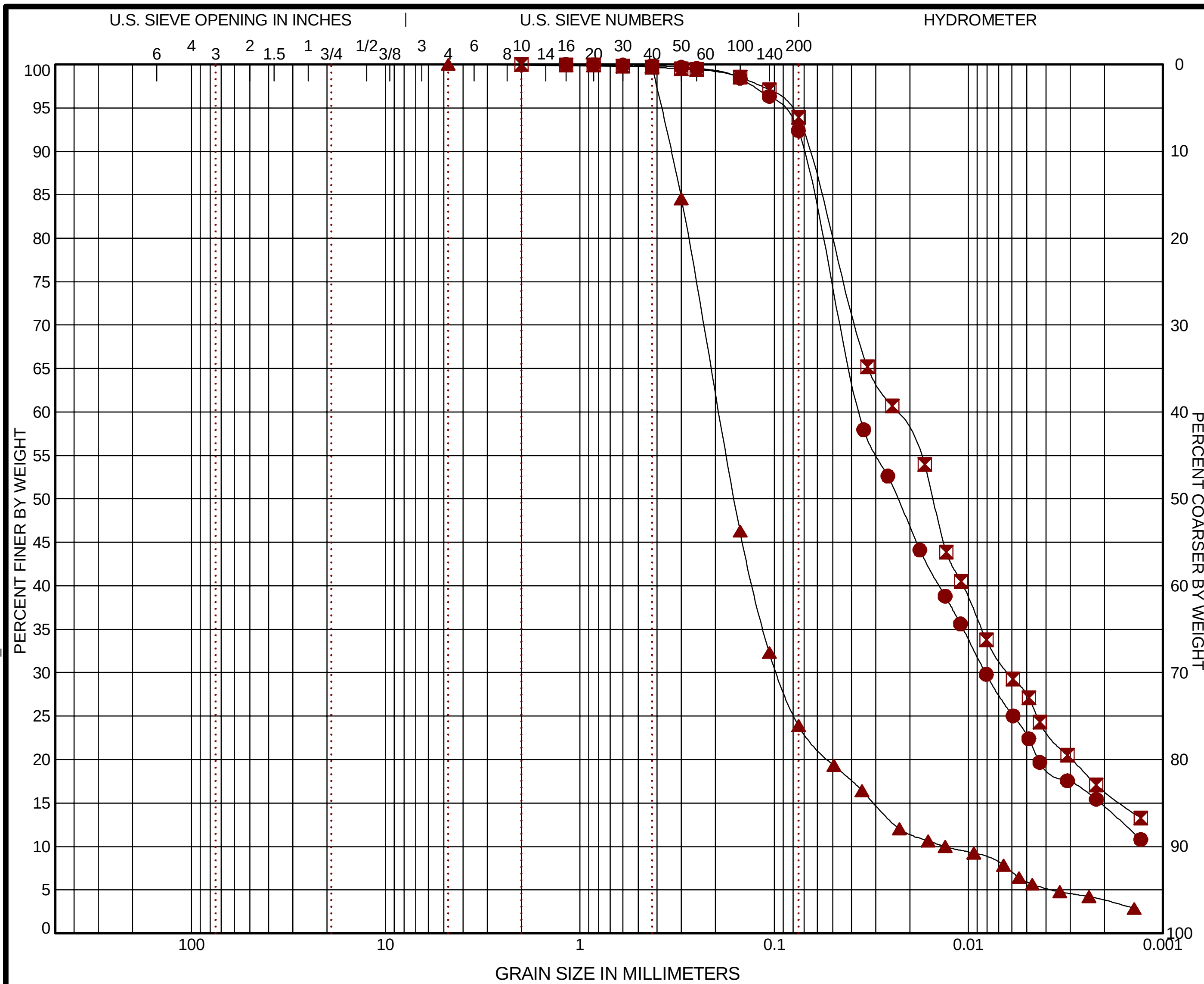


	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	**B18-01**	**2 - 4**	**NP**	**NP**	**NP**	**92**	**ML**	**SILT**
⊠	**B18-02B**	**1.5 - 3.5**	**69**	**53**	**16**	**94**	**MH**	**ELASTIC SILT**
▲	**B18-03**	**0.3 - 2.5**	**NP**	**NP**	**NP**	**68**	**ML**	**SANDY SILT**
★	**B18-03**	**2.5 - 5**	**NP**	**NP**	**NP**	**86**	**ML**	**SILT**

PROJECT: AECOM Lab Testing Program, Oct 2018	Terracon 4103 SE International Way, Ste 300 Portland, OR	PROJECT NUMBER: 82185077
SITE: 4103 SE International Way Portland, OR		CLIENT: AECOM Technical Services, Inc. Portland, OR
		EXHIBIT: B-1

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**B18-01**	**2 - 4**	**0.0**	**0.0**	**7.6**	**69.7**		**22.7**	**ML**
⊠	**B18-02B**	**1.5 - 3.5**	**0.0**	**0.0**	**6.1**	**66.6**		**27.3**	**MH**
▲	**B18-02B**	**4.5 - 5**	**0.0**	**0.0**	**76.1**	**17.9**		**6.0**	**ML**

	GRAIN SIZE		
	●	⊠	▲
D_{60}	**0.036**	**0.024**	**0.192**
D_{30}	**0.008**	**0.006**	**0.096**
D_{10}			**0.013**
	COEFFICIENTS		
C_C			**3.64**
C_U			**14.51**

●		⊠		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#10	**100.0**	**#10**	**100.0**	**#10**	**100.0**
#16	**100.0**	**#16**	**99.96**	**#16**	**100.0**
#20	**99.97**	**#20**	**99.91**	**#20**	**100.0**
#30	**99.94**	**#30**	**99.81**	**#30**	**100.0**
#40	**99.84**	**#40**	**99.7**	**#40**	**100.0**
#50	**99.68**	**#50**	**99.49**	**#50**	**99.74**
#60	**99.55**	**#60**	**99.4**	**#60**	**84.52**
#100	**98.42**	**#100**	**98.54**	**#100**	**46.29**
#140	**96.33**	**#140**	**97.1**	**#140**	**32.32**
#200	**92.37**	**#200**	**93.88**	**#200**	**23.9**

SOIL DESCRIPTION

● SILT (ML)

⊠ ELASTIC SILT (MH)

▲ SILT (ML)

REMARKS

●

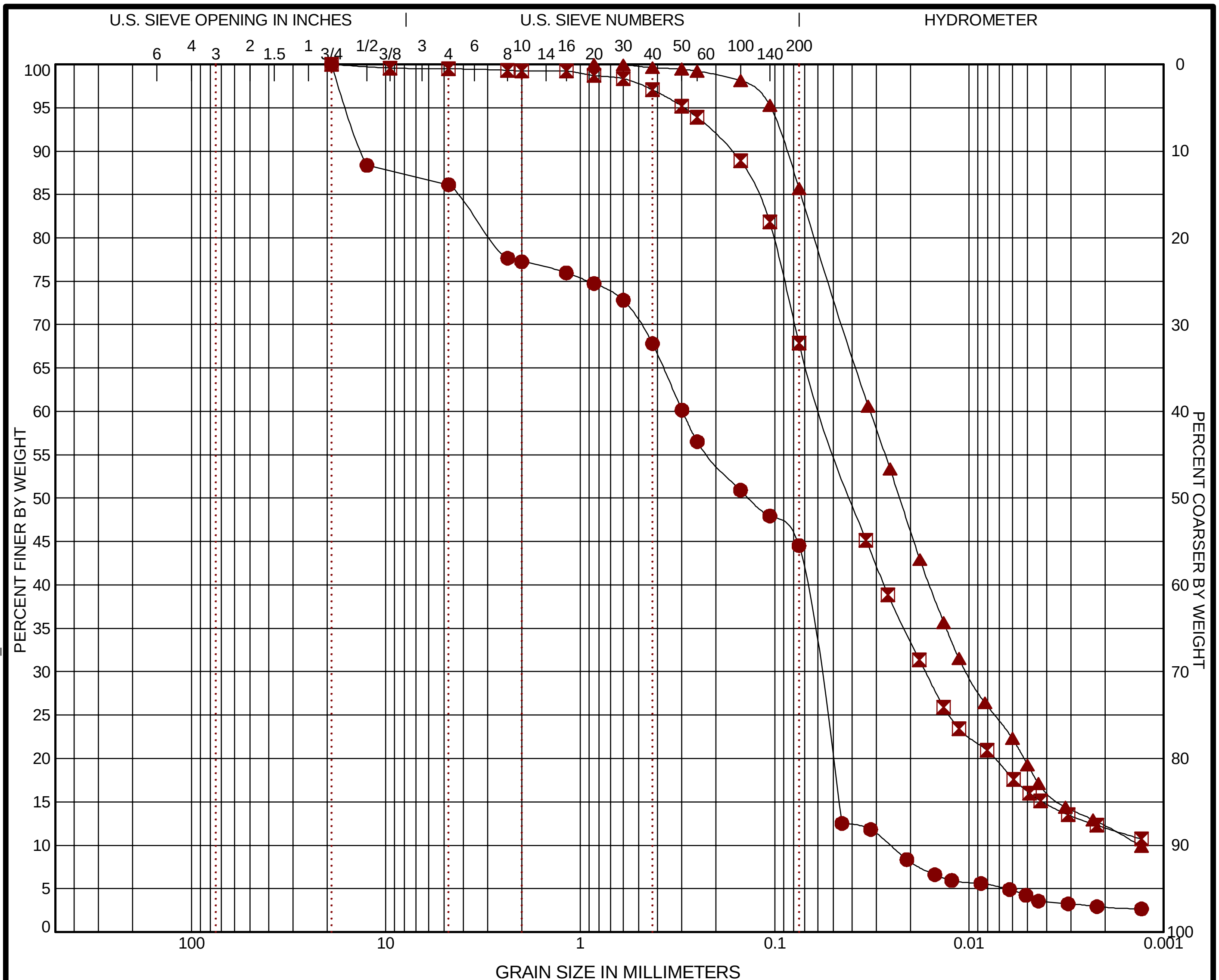
⊠

▲ ASSUMED, NO ATTERBERG LIMITS RESULTS

PROJECT: AECOM Lab Testing Program, Oct 2018	Terracon 4103 SE International Way, Ste 300 Portland, OR	PROJECT NUMBER: 82185077
SITE: 4103 SE International Way Portland, OR		CLIENT: AECOM Technical Services, Inc. Portland, OR
		EXHIBIT: B-1

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**B18-03**	**0 - 0.3**	**0.0**	**13.9**	**41.6**	**40.4**		**4.1**	**ML**
⊠	**B18-03**	**0.3 - 2.5**	**0.0**	**0.5**	**31.6**	**51.7**		**16.2**	**ML**
▲	**B18-03**	**2.5 - 5**	**0.0**	**0.0**	**14.3**	**66.5**		**19.2**	**ML**

	GRAIN SIZE ●	GRAIN SIZE ⊠	GRAIN SIZE ▲
D_{60}	**0.298**	**0.057**	**0.032**
D_{30}	**0.06**	**0.017**	**0.01**
D_{10}	**0.026**		**0.001**
COEFFICIENTS			
C_C	**0.46**		**2.47**
C_U	**11.61**		**24.24**

● Sieve	● % Finer	⊠ Sieve	⊠ % Finer	▲ Sieve	▲ % Finer
3/4"	**100.0**	**3/4"**	**100.0**	**#16**	**100.0**
1/2"	**88.36**	**1/2"**	**99.58**	**#20**	**100.0**
3/8"	**86.12**	**3/8"**	**99.48**	**#30**	**99.94**
#4	**77.66**	**#4**	**99.31**	**#40**	**99.62**
#8	**77.24**	**#8**	**99.24**	**#50**	**99.44**
#16	**75.96**	**#10**	**99.24**	**#60**	**99.22**
#20	**74.74**	**#20**	**98.71**	**#140**	**98.12**
#30	**72.81**	**#30**	**98.36**	**#100**	**95.29**
#40	**67.81**	**#40**	**97.06**	**#200**	**85.7**
#50	**60.15**	**#50**	**95.18**		
#60	**56.51**	**#60**	**93.89**		
#100	**50.92**	**#100**	**88.87**		
#140	**47.94**	**#140**	**81.84**		
#200	**44.53**	**#200**	**67.88**		

SOIL DESCRIPTION

● SANDY SILT (ML)

⊠ SANDY SILT (ML)

▲ SILT (ML)

REMARKS

● ASSUMED, NO ATTERBERG LIMITS RESULTS

⊠

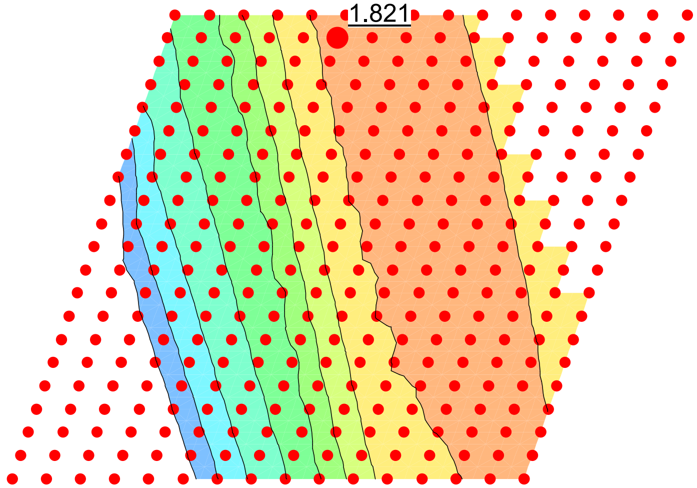
▲

PROJECT: AECOM Lab Testing Program, Oct 2018	Terracon 4103 SE International Way, Ste 300 Portland, OR	PROJECT NUMBER: 82185077
SITE: 4103 SE International Way Portland, OR		CLIENT: AECOM Technical Services, Inc. Portland, OR
		EXHIBIT: B-2

Attachment 2: Slope Stability Modeling Output

Existing Conditions

AECOM
Portland SeaPort
Slope Stability Analysis



Assumptions:
Name: Soft Sediment   Model: Mohr-Coulomb   Unit Weight: 110 pcf   Cohesion': 0 psf   Phi': 28 °
Name: Clayey Silt-Silty Clay-Sandy Silt   Model: Mohr-Coulomb   Unit Weight: 115 pcf   Cohesion': 0 psf   Phi': 34 °
Name: Clay   Model: Mohr-Coulomb   Unit Weight: 110 pcf   Cohesion': 0 psf   Phi': 28 °
Name: Bedrock   Model: Bedrock (Impenetrable)

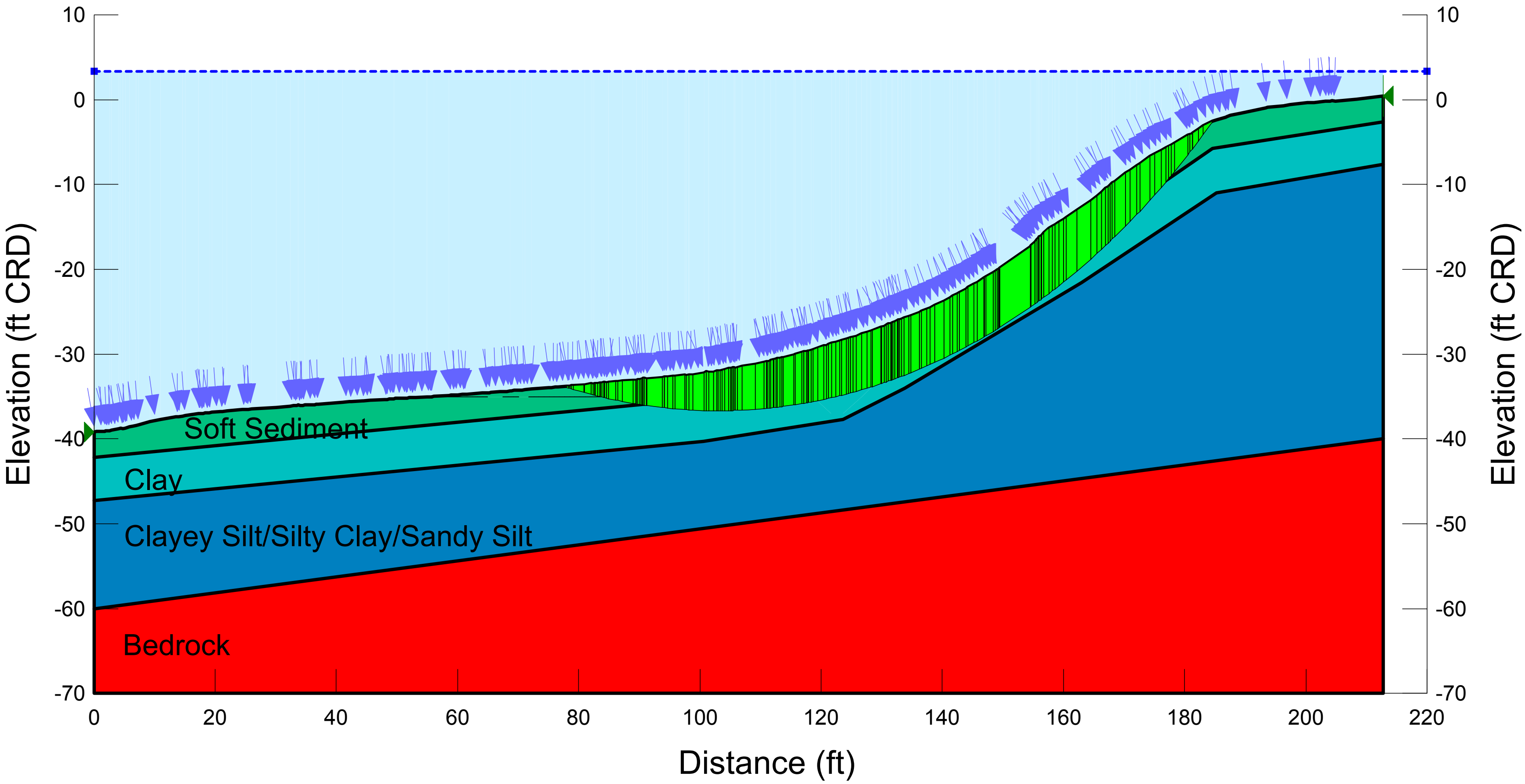


Figure A-1

1.5:1 Dredge - Short-term Undrained Condition

AECOM
Portland SeaPort
Slope Stability Analysis

Assumptions:
Name: Soft Sediment Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 800 psf
Name: Bedrock Model: Bedrock (Impenetrable)

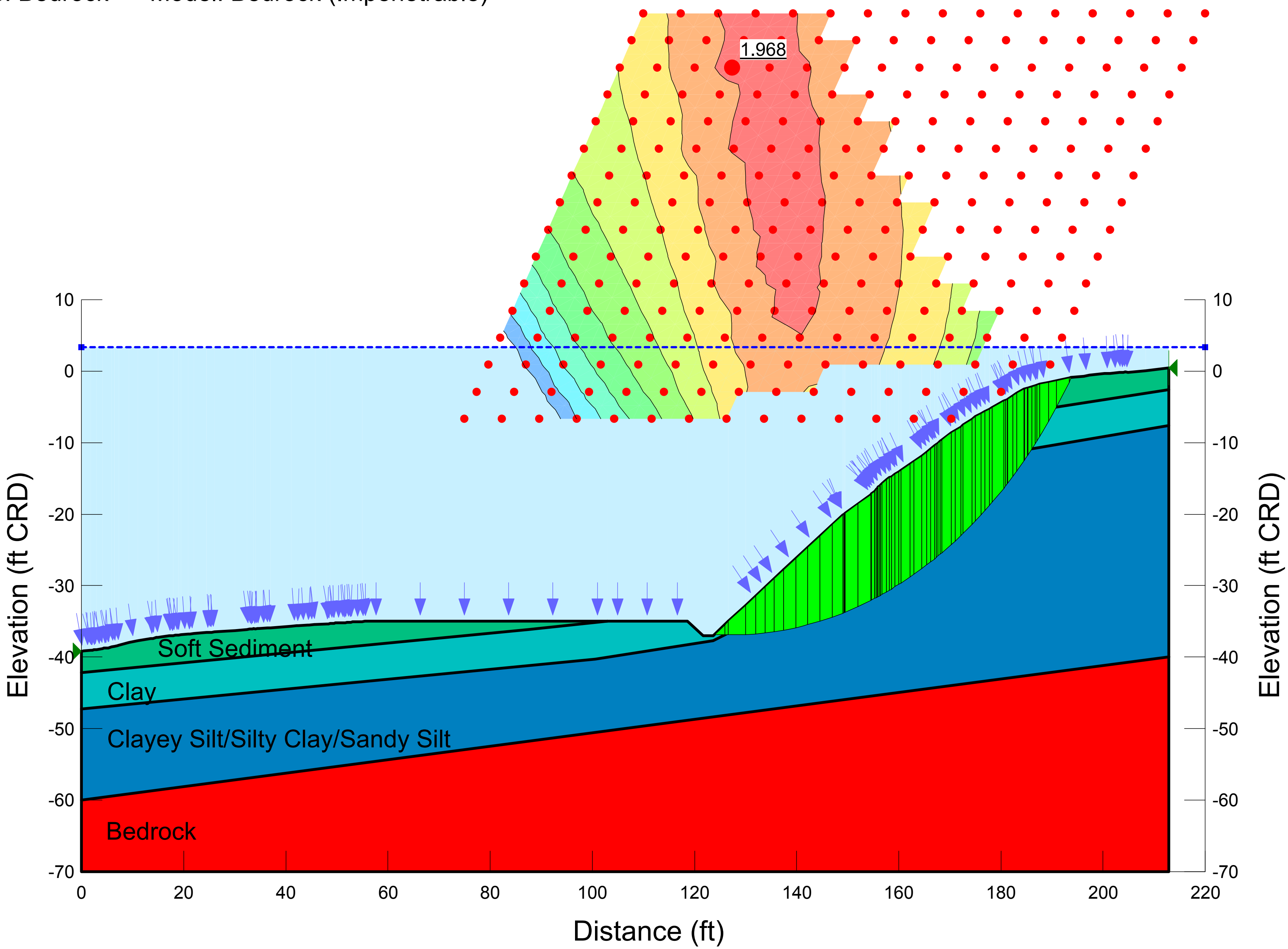


Figure A-2

1.5:1 Dredge - Long-term Drained Condition

AECOM
Portland SeaPort
Slope Stability Analysis

Assumptions:
Name: Soft Sediment (Clay) Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Bedrock Model: Bedrock (Impenetrable)
Name: Rip Rap Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 45 °

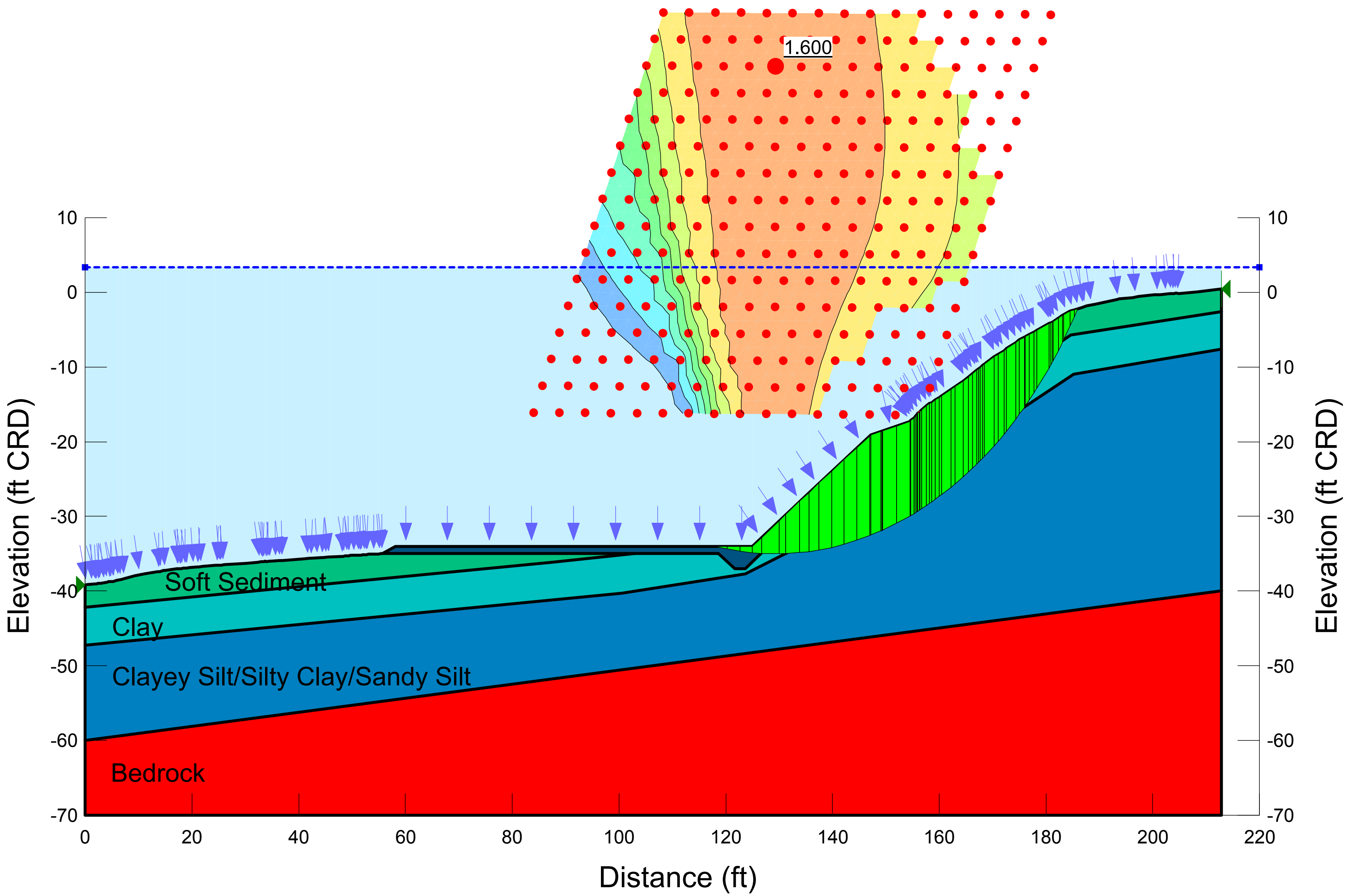


Figure A-3

1.5:1 Dredge - Short-term Undrained Condition - Seismic

AECOM
Portland SeaPort
Slope Stability Analysis

Assumptions:
Name: Soft Sediment (Clay) Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 200 psf
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 800 psf
Name: Bedrock Model: Bedrock (Impenetrable)
Horz Seismic Coef.: 0.1

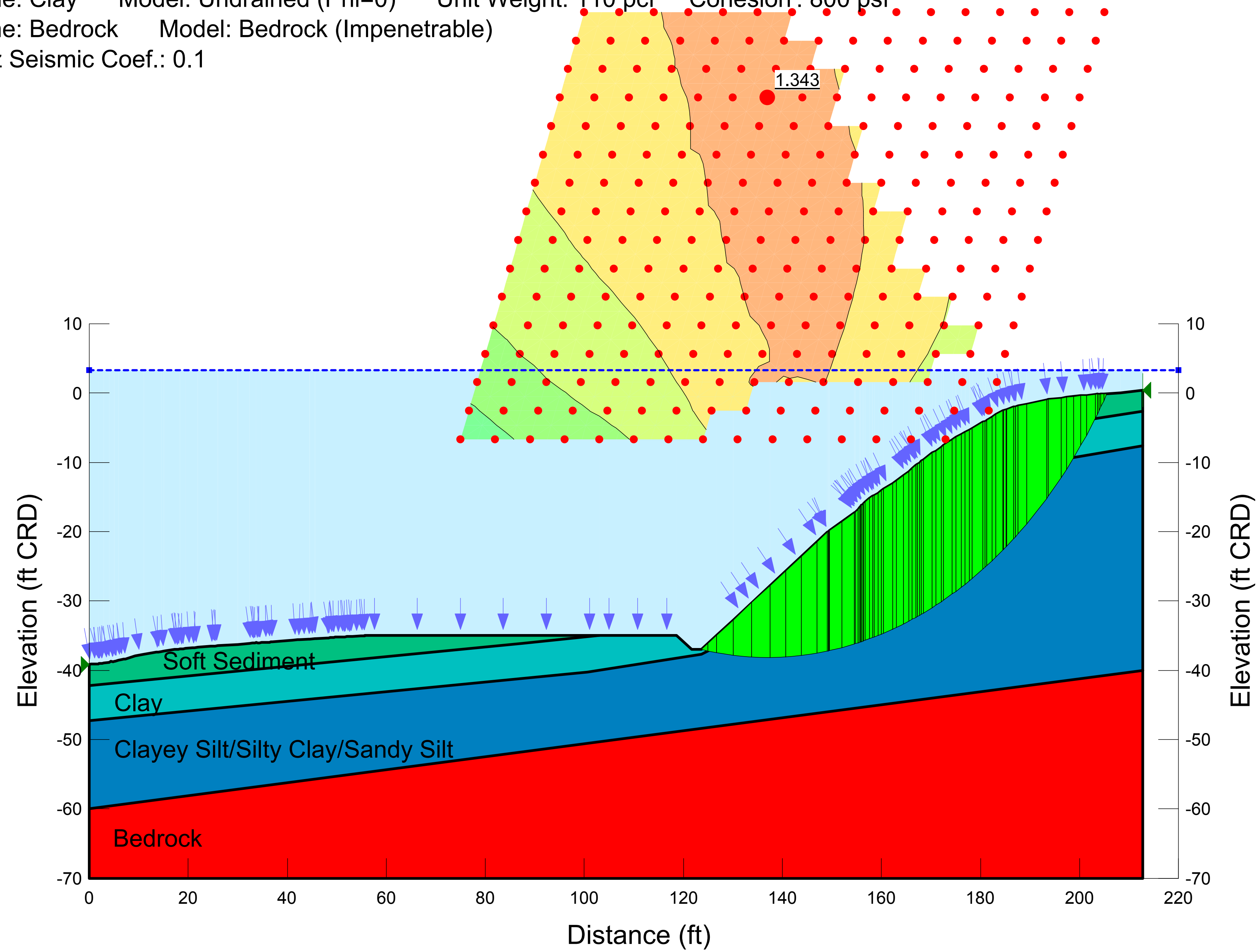


Figure A-4

1.5:1 Dredge - Long-term Drained Condition - Seismic

AECOM
Portland SeaPort
Slope Stability Analysis

Assumptions:
Name: Soft Sediment (Clay) Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Bedrock Model: Bedrock (Impenetrable)
Name: Rip Rap Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 45 °
Horz Seismic Coef.: 0.1

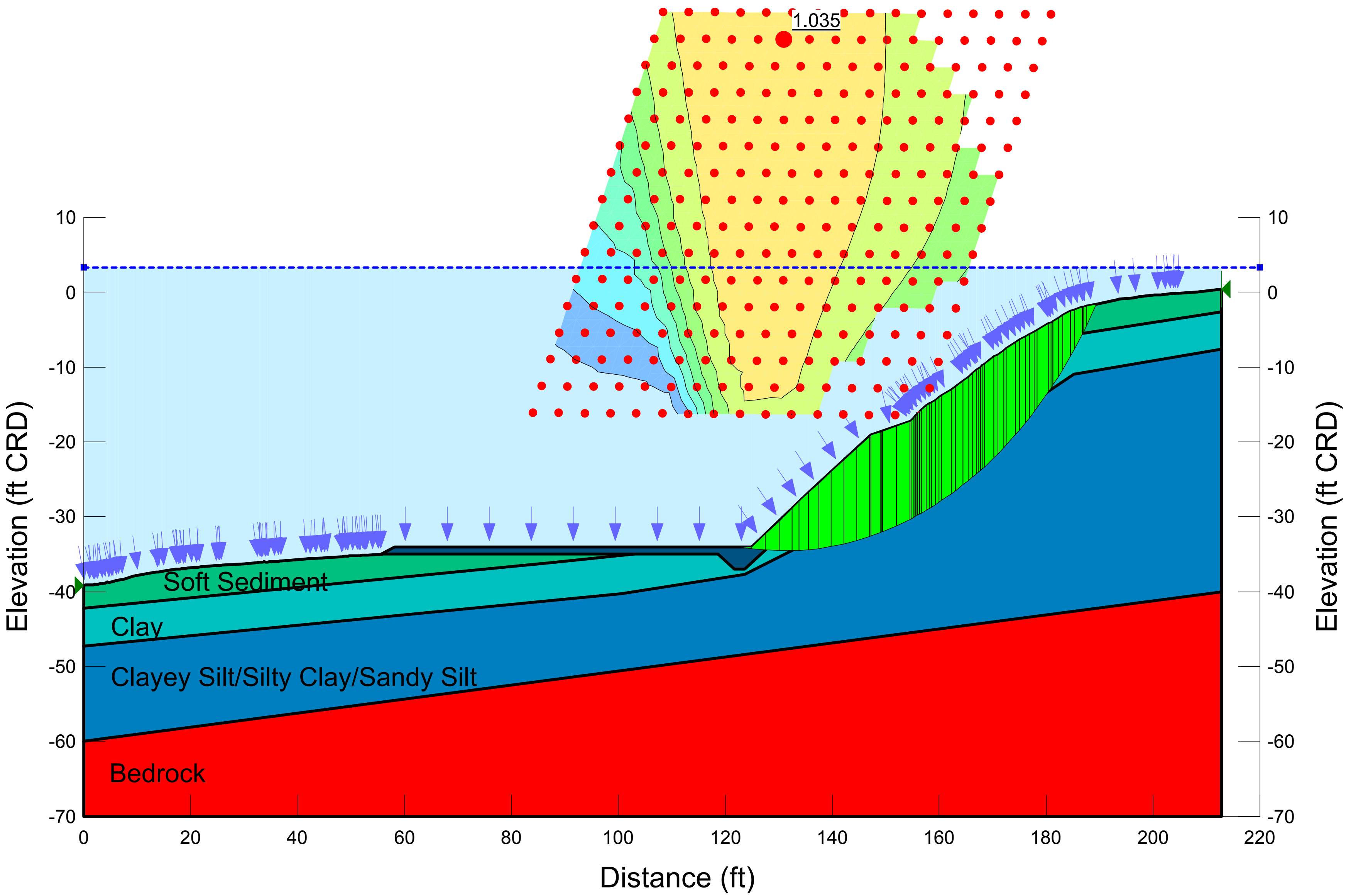
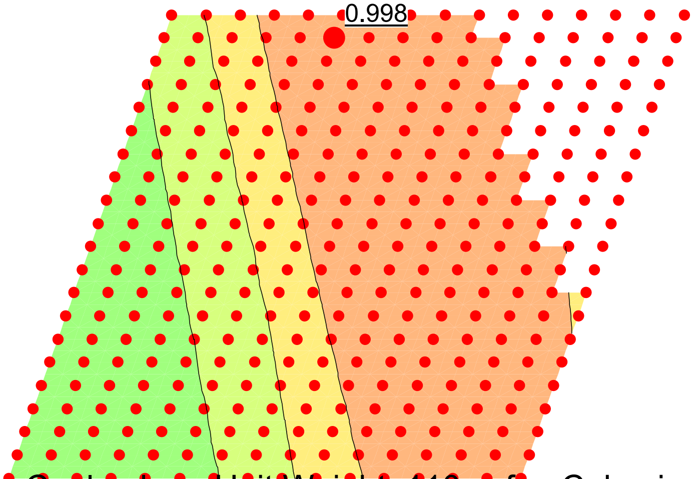


Figure A-5

Existing Conditions - Seismic

AECOM
Portland SeaPort
Slope Stability Analysis



Assumptions:
Name: Soft Sediment Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Bedrock Model: Bedrock (Impenetrable)
Horz Seismic Coef.: 0.1

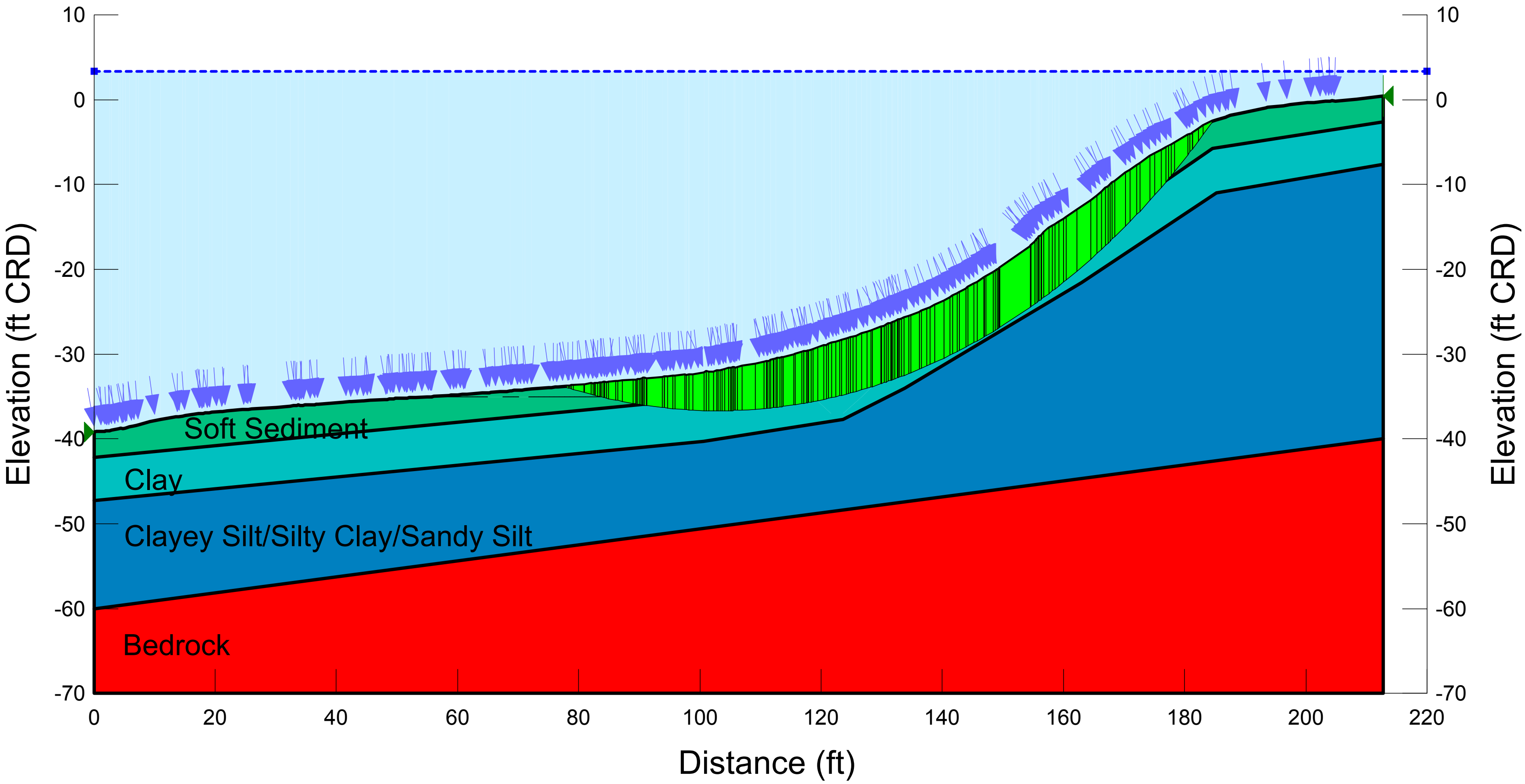


Figure A-6

1.5:1 Dredge - Short-term Undrained Condition
*Soft sediment modeled as clay

AECOM
Portland SeaPort
Slope Stability Analysis

Assumptions:
Name: Soft Sediment (Clay) Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 200 psf
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 800 psf
Name: Bedrock Model: Bedrock (Impenetrable)

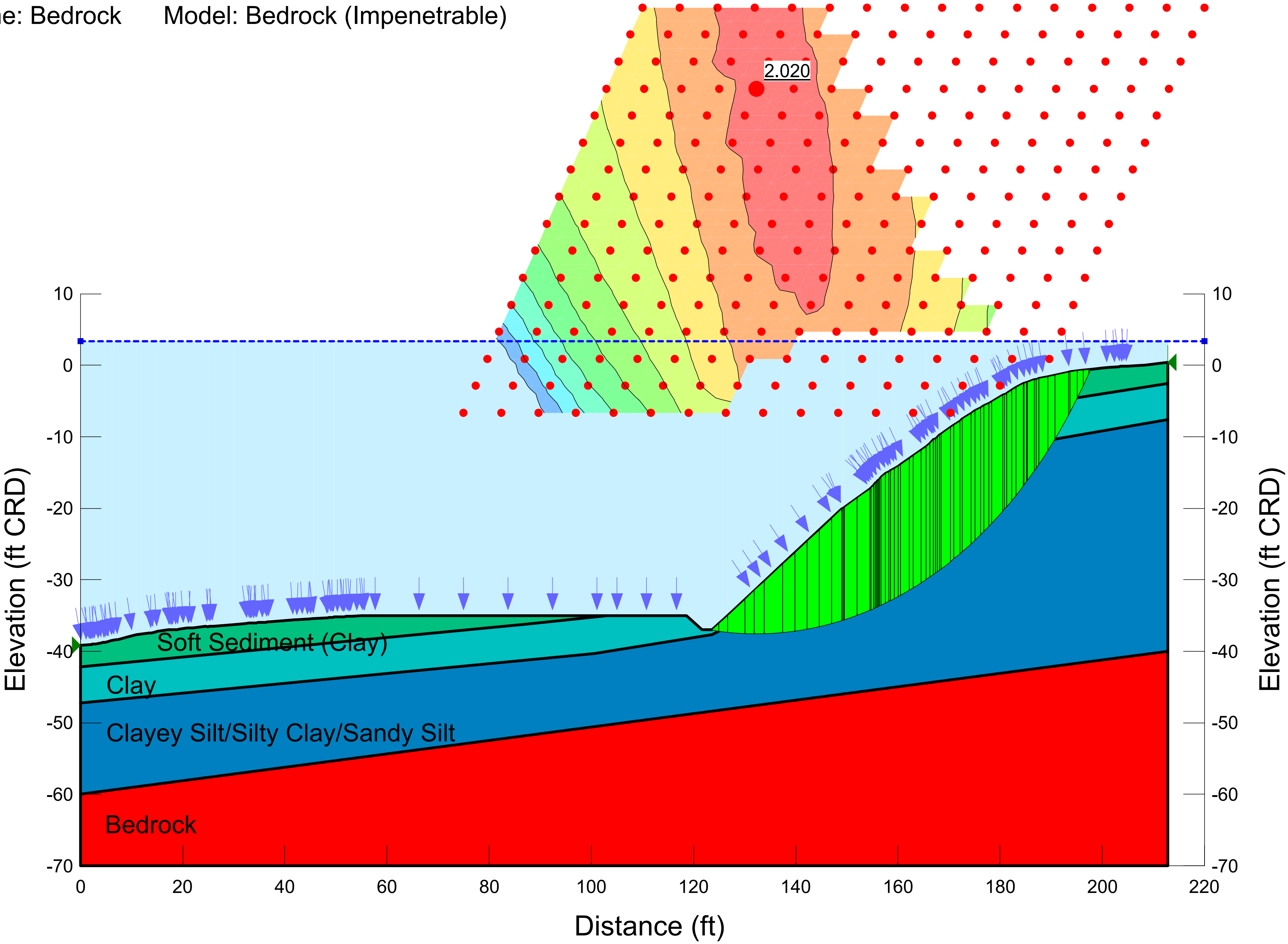


Figure A-7

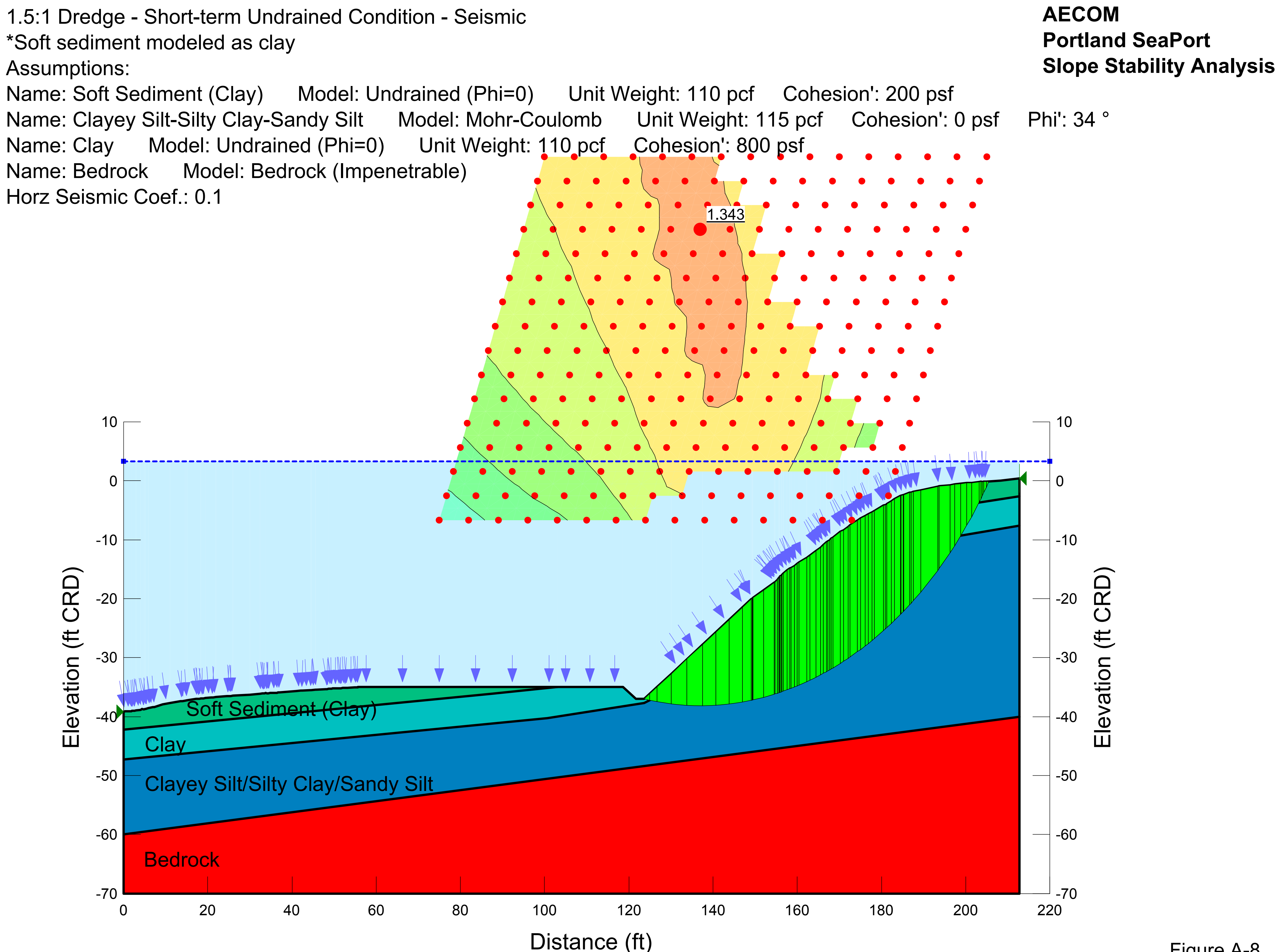

1.5:1 Dredge - Short-term Undrained Condition - Seismic
*Soft sediment modeled as clay
Assumptions:
Name: Soft Sediment (Clay) Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 200 psf
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 800 psf
Name: Bedrock Model: Bedrock (Impenetrable)
Horz Seismic Coef.: 0.1
AECOM
Portland SeaPort
Slope Stability Analysis
1.343
Soft Sediment (Clay)
Clay
Clayey Silt/Silty Clay/Sandy Silt
Bedrock
Elevation (ft CRD)
Elevation (ft CRD)
10
0
-10
-20
-30
-40
-50
-60
-70
0
20
40
60
80
100
120
140
160
180
200
220
Distance (ft)

Figure A-8

1.5:1 Dredge - Short-term Undrained Condition - Sensitivity Analysis

AECOM
Portland SeaPort
Slope Stability Analysis

Assumptions:
Name: Soft Sediment Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 28 °
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 400 psf
Name: Bedrock Model: Bedrock (Impenetrable)

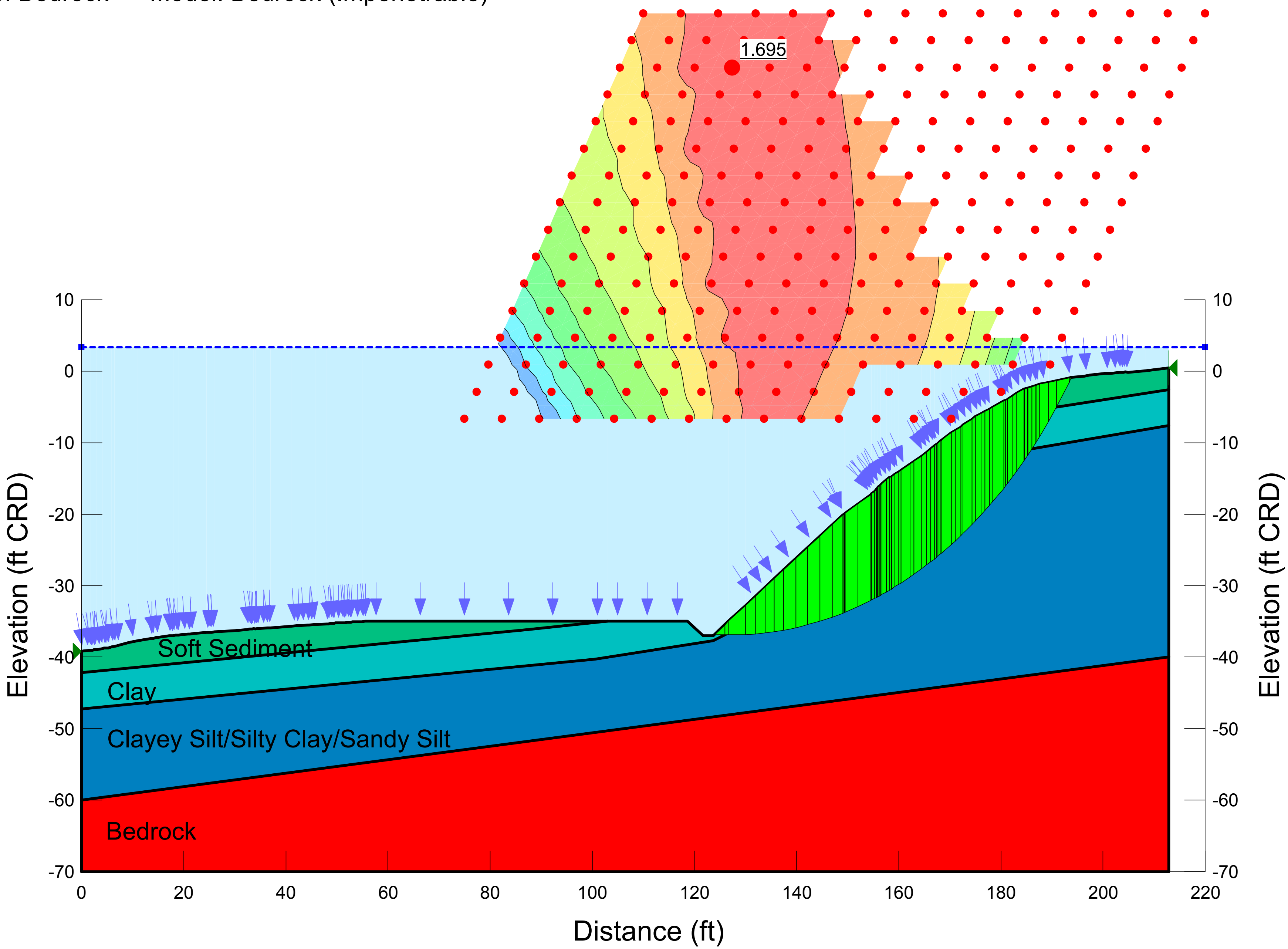


Figure A-9

1.5:1 Dredge - Short-term Undrained Condition - Seismic - Sensitivity Analysis

AECOM
Portland SeaPort
Slope Stability Analysis

Assumptions:
Name: Soft Sediment (Clay) Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 200 psf
Name: Clayey Silt-Silty Clay-Sandy Silt Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 34 °
Name: Clay Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion': 400 psf
Name: Bedrock Model: Bedrock (Impenetrable)
Horz Seismic Coef.: 0.1

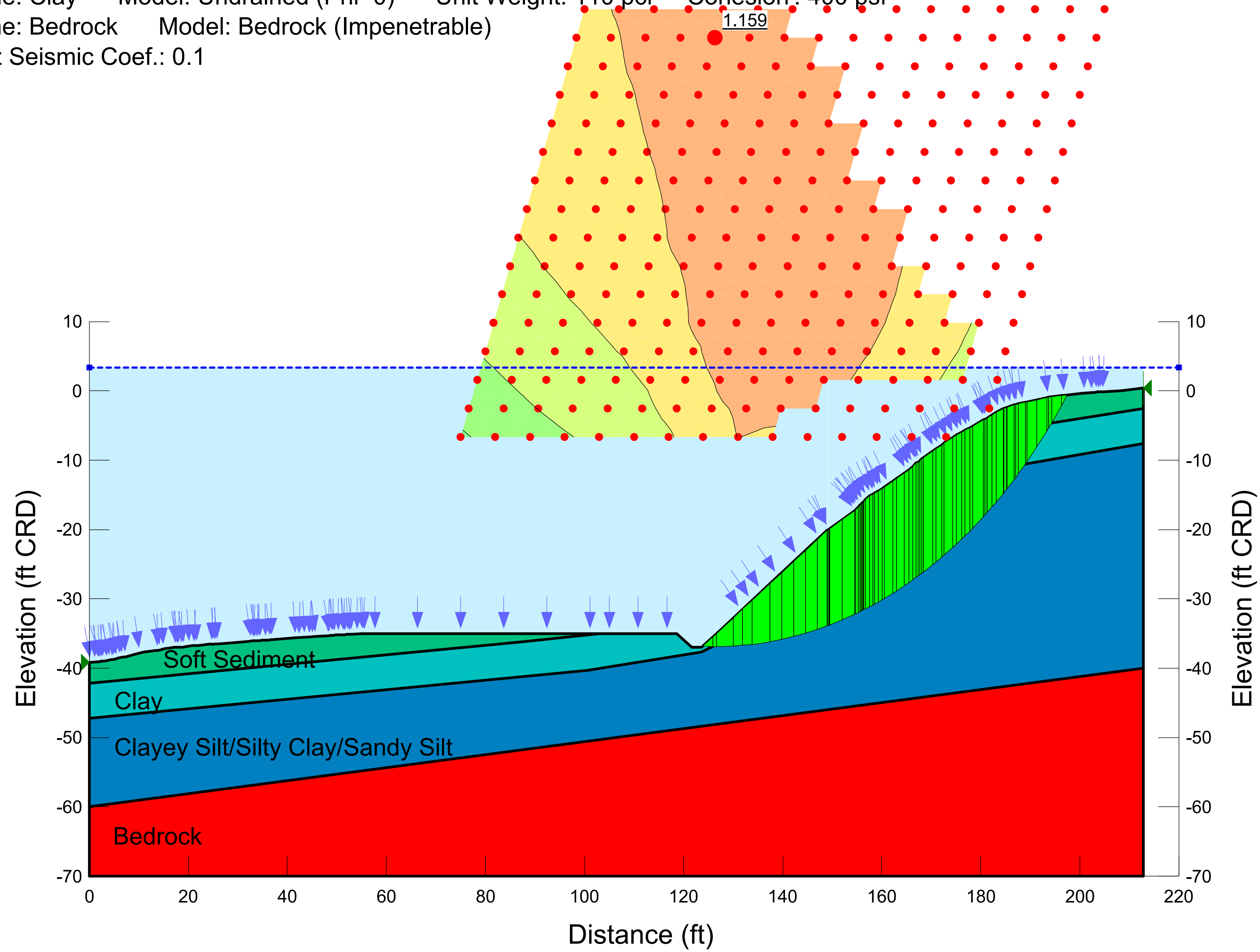


Figure A-10

Response to Comments After Public Notice

2019-03-11

Response to Comments for Portland Terminal Maintenance Project (Corps # NWP-2009-946-3)

Table 1. Corps Public Notice Comments – 3/11/19

Comment Number	Comment	Response
DEQ Comments		
Comment 1	The Willamette River is classified as water quality limited under the Federal Clean Water Act and is listed on the Section 303(d) List of impaired water bodies for the parameters of Aldrin, biological criteria, chlordane, copper, cyanide, DDE, 4,4, DDT, 4,4, dieldrin, hexachlorobenzene, iron, lead, pentachlorophenol, PCBs, chlorophyll a; and has an Environmental Protection Agency Total Maximum Daily Load (TMDL) developed for the parameters of dioxin(2,3,7,8-TCDD). In addition, the entire Lower Willamette Basin has a TMDL for all perennial streams and fish-bearing intermittent stream for temperature, mercury, and E. coli. Projects that may exacerbate listed parameters are not permissible.	Best Management Practices (BMPs) will be applied during maintenance dredging activities to prevent water quality impacts, as described in the Joint Permit Application (JPA) and the Contract Specifications. Turbidity monitoring will be performed during in-water work activities to ensure compliance with federal and state water quality criteria. Following maintenance dredging, a temporary sediment cover will be constructed over the entire dredge area and side slopes. The temporary cover will sequester COCs in pore water to prevent exposure of contaminants to aquatic receptors.
Comment 2	The applicant will be invoiced per OAR 340-048-0055. The modifications to this 401 WQC will incur a Tier 2B fee of $12,105.00. Payment of invoice is required before the 401 Water Quality Certification can be issued.	The applicant acknowledges that they will be responsible for paying the invoice before the 401 Water Quality Certification can be issued.
Comment 3	Please describe how dewatering is proposed to occur and the potential water quality impacts from dewatering.	The JPA and Contract Specifications describe the proposed dewatering options and BMPs, which will be implemented to prevent water quality impacts. The specific dewatering means and methods will be determined by the Contractor; performance objectives are outlined in the Contract Specifications. Water quality controls will be implemented according to Specification Section 01562 – River Water Quality Control. On-barge sediment dewatering and water management will be implemented according to Specification Section 02080 – Sediment Handling and Dewatering. The management of collected water from both sediment dewatering and other incidental waters related to the project will be implemented

Comment Number	Comment	Response
		according to Specification Section 02245 – Construction Water Treatment. Please refer to the updated JPA Permit Package and enclosed specifications for the requested information.
Comment 4	Please describe the best management practices that will be implemented to reduce water quality impacts from the project.	Water quality management performance objectives are outlined in the specifications referenced in Comment 3. The Contractor will be required to provide a Water Quality Monitoring Plan (WQMP), which meets project and regulatory objectives. The WQMP will incorporate or refer to other plans that incorporate BMPs.
Comment 5	Please provide a copy of the most current Portland Sediment Evaluation Team memorandum.	DEQ was sent a copy of the most recent PSET memorandum (dated February 5, 2018) by mail on January 25, 2019 when we responded to their initial comments. This submittal also included responses to the USEPA's June 4, 2018 comments on the original 90% Design Documents and Temporary Cover Modeling Memorandum (dated January 5, 2019). Additional responses to EPA comments are enclosed with this submittal.
Comment 6	This project has a nexus with DEQ Cleanup. Note that the DEQ 401 program will be coordinating with DEQ Cleanup on this project.	The applicant is actively engaged with the DEQ Cleanup Program Project Manager and has communicated the planned maintenance dredging activity. However, it should be recognized that this project involves maintenance dredging and is not affiliated with any remedial action activities in the Portland Harbor Superfund Site.
Comment 7	Has this project undergone NOAA/MNFS review? If so, please provide a copy of the letter of concurrence or biological opinion from NOAA.	The National Marine Fisheries Service issued a Biological Opinion (WCR-2018-9312) (BiOp) for the original project in May 2018. Since that BiOp was issued, the project was modified to address EPA's request that the dredge side slope be protected against erosive forces resulting from "wind and vessel generated waves, current, or propeller wash" Because the area disturbed by dredging and

Comment Number	Comment	Response
		sediment cover placement now exceeds the re-consultation threshold of 2.1 acres, the Corps may need to re-consult with NMFS.
Comment 8	The applicant is required to consider and describe the potential water quality impacts which could result from implementing the proposal, evaluate whether the proposal would cause or contribute to violations of each applicable water quality standard adopted pursuant to OAR Chapter 340 Division 041, and identify actions to avoid or mitigate degradation of water quality. Projects that could further degrade listed parameters or be listed are not permissible.	The JPA describes potential water quality impacts from the proposed project and minimization measures (e.g., BMPs) that will be implemented to prevent impacts. Although turbidity releases are unavoidable during maintenance dredging and sediment cover placement, the Contractor is required to meet federal and state requirements related to the protection of water quality and aquatic habitat in the lower Willamette River.
Confederated Tribes of Warm Springs Reservation of Oregon Comment		
Comment 9	As the technical reviewer for NHPA Section 106 and other cultural resource issues for the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO), the CTWSRO Tribal Historic Preservation Office (THPO) has concerns with the potential effects to historic properties or cultural resources within the Project Area of Potential Effects (APE). The Project APE is within the areas of concern for the CTWSRO.	Maintenance dredging is unlikely to affect cultural resources since the dredge prism contains very little native, undredged material. It is anticipated that the US Army Corps of Engineers will issue an Inadvertent Discovery Plan with the forthcoming Corps permit. The applicant will adhere to the plan and immediately notify the Corps Portland District, Regulatory Branch if human remains or cultural resources are discovered during project activities. The project would not affect any historic properties.
Yakama Nation Fisheries Comments		
Comment 10	We have serious concerns about this work moving forward as a dredge maintenance permit rather than full coordination with the ROD requirements through EPA. It is concerning that the proposed permit's public notice fails to mention that these sediments are known to be contaminated or located within the Portland Harbor NPL Site. It also does not require coordination with EPA. However, we understand through conversation with Sarah Greenfield of ODEQ (February 6, 2019) that EPA has been coordinated with and may require additional work components (ex. analytical testing of project sediments per the ROD Table 17). Any EPA requirements, CERCLA status, and coordination with EPA actions must be made transparent in these types of permit applications.	The project involves maintenance dredging and is not a remedial action project. In addition, the applicant is not a potential responsible party (PRP) associated with the Portland Harbor Superfund Site. However, the EPA has an opportunity to comment and provide recommendations on all Portland Harbor projects when a Public Notice is issued. The applicant has engaged in extensive coordination with the Corps and EPA to ensure consistency with the EPA's applicable ROD requirements for the cleanup of the Portland Harbor Superfund Site. The

Comment Number	Comment	Response
		Public Notice did indicate that the project is located in the Willamette River at River Mile 4.9 (which is within the Portland Harbor Superfund Site) and also stated that the interagency Portland Sediment Evaluation Team (PSET) has determined that all project sediments are unsuitable for unconfined, aquatic disposal and exposure, which indicates that portions of the site contain certain sediment contaminant concentrations that exceed SEF criteria thresholds. The applicant's proposal satisfies ODEQ, EPA, and Corps requirements for managing sediment during the maintenance dredging project.
Comment 11	1. If this work is allowed to move forward without complying with the ROD it will potentially preclude cleanup options for the SMA. Therefore, under the Rivers and Harbors Act (RHA) regulations at 33 CFR § 320.4(a), the proposed activity is contrary and detrimental to the public's interest in complete and timely remediation of the Portland Harbor NPL Site. Any foreseeable benefits that the applicant or the public would receive from this permit are heavily outweighed by the possible detriments caused by any potential deviations from the ROD (which is the product of sixteen years of EPA investigation and deliberation).	The proposed maintenance dredging project has incorporated relevant ROD requirements, which are intended to prevent exposure to sediment. The Corps and EPA have been actively involved in the maintenance dredge design project. The proposed temporary covers prevent exposure to sediment within the dredge area until the final remedial action is performed by the responsible party.
Comment 12	2. Any dredging within the SMA must be conducted as part of a final cleanup action in accordance with the Portland Harbor ROD cleanup requirements. Otherwise, the proposed investigation, final dredge leave surface elevations, and capping will potentially preclude investigation and cleanup options for this SMA. In addition, all discussion of how the sediments will be investigated, handled, and disposed of default decision-making authority to Portland Sediment Evaluation Team (PSET). It is unclear what level of coordination with EPA is intended. This permit application, which has been filed by an operator of a hazardous release facility within the NPL Site, appears to be an attempt to circumvent EPA authority and supplant it with an alternative regulatory scheme under Corps of Engineers oversight.	The EPA has been actively involved with this project to ensure that it meets the applicable conditions of the ROD. However, this project involves maintenance dredging at an existing marine facility and is not intended to serve as a final remedial action at the site. The applicant is not a PRP for the Portland Harbor Superfund Site. A temporary sediment cover will be placed over the dredged area, which will adequately prevent contaminant transport until the final remedial action is performed by the responsible party. As described in the Public Notice, project sediments were evaluated in accordance with the Sediment Evaluation Framework for the Pacific Northwest (SEF) and dredged material testing has been subject to PSET review. The applicant has been working in close

Comment Number	Comment	Response
		coordination with both the Corps and EPA to ensure that the project is consistent with applicable ROD requirements.
Comment 13	3. The Corps of Engineers should defer to EPA authority and recommend including this proposed activity as part of an Administrative Settlement Agreement and Order on Consent for Remedial Design/Remedial Action under CERCLA. EPA's Record of Decision has precluded any Section 404 authority to grant a permit for construction work that would potentially be contrary to the selected CERCLA remedial action. This is consistent with the Letter of Agreement between the Corps, EPA, and Oregon DEQ Concerning the Lower Willamette River.	The Corps has deferred to EPA authority on this project regarding compliance with the applicable conditions of the ROD until the final remedial action is implemented. However, the applicant is not a responsible party and cannot wait to perform maintenance dredging at their facility until the final remedial action is performed. The EPA will ensure that the project is not contrary to any future CERCLA remedial action performed at this site.
Comment 14	4. This application describes a process that is contrary to the ROD remedial design requirements for additional investigation needs, SMA (hot spot) delineation, dredge decision trees, cap design, and disposal criteria. As described in the application, this permit would allow for a 10 year dredge maintenance period with multiple dredge maintenance events. The initial event would dredge a 2.7 acre basin to a depth of - 35 to 37 feet Columbia River Datum (CRD), which has not been demonstrated to be adequate for SMA (hotspot) removal. The application assigns PSET as the lead authority for most decisions. The proposed dredge material will be evaluated in accordance with the Sediment Evaluation Framework for the Pacific Northwest (SEF) as determined by PSET, which is a protocol and set of decision criteria that is not in compliance with the ROD. Sediment disposal suitability would also be determined by PSET, despite ROD disposal requirements. A 1 to 2 foot thick sand cap may be placed, without adequate consideration of protective cleanup requirements and review by all involved governments. It also allows for a 2nd dredge event within 10 years, which also does not require compliance with ROD sediment delineation or cleanup needs and could potentially disturb additional contaminated SMA (hotspot) sediments.	The purpose of this maintenance dredging project is to dredge sediment in the berth area to the original design elevation and does not constitute a remedial action project. However, the applicant is actively coordinating with the EPA on this project to maintain compliance with the applicable ROD requirements. For example, the applicant is installing a protective temporary sediment cover over the post-dredge surface, consistent with the EPA's ROD recommendations for the cleanup of the Portland Harbor Superfund Site. This will prevent contaminant mobilization until the final remedial action is performed by the responsible party.
Comment 15	5. The proposed activity does not qualify for an NWP 35 (Maintenance Dredging) because it would result in discharges of sediments containing toxic pollutants from the SMA in violation of General Condition 6 of the NWP. Any such discharges will significantly affect the aquatic environment, requiring an Environmental Impact Statement pursuant to NEPA for an individual project permit. However, even an individual permit should be denied by the Corps as	The Corps intends to issue an individual Section 10/404 permit for this project. Further, the DEQ will issue a Section 401 Water Quality Certification, which will describe conditions for managing discharge water to prevent impacts to water quality. All sediments will be disposed of at an approved

Comment Number	Comment	Response
	contrary to the public interest, and legally precluded by cleanup decisions already made by EPA pursuant to CERCLA.	upland facility that accepts contaminated sediments. Although not relevant to this project, the final remedial design for the Portland Harbor Superfund Site has not yet been completed so no final cleanup decisions have been made by the EPA.
Comment 16	6. Because of the probable discharge of heavily contaminated sediments from the SMA into the Lower Willamette River, the proposed activity does not qualify for a water quality certification under Section 401 of the Clean Water Act.	Return water will be managed so that it does not degrade water quality in the lower Willamette River. The applicant has provided specifications for potential water quality management processes, which could be implemented depending on the conditions contained in the DEQ's Section 401 Water Quality Certification. The DEQ has issued water quality certifications for numerous projects in Portland Harbor and we do not foresee any difficulties in ensuring that water quality is adequately protected for this project.
Comment 17	7. Although we do see that this work provides the benefit of earlier contaminated sediment removal from the Portland Harbor, we have concerns that this permit and several other recent permit applications for maintenance and dredge maintenance have the potential to be a "work around" for ROD requirements. Allowing this work to move forward outside of the CERCLA process will result in large changes in the characteristic of the material within the SMA before full delineation and remedial design has been completed. This unknown/untracked amount of change has the potential to result in a deterrent to final cleanup of this area per the ROD due to dredging induced changes in the SWACs once RD sampling is completed. This type of scenario equates to hot spot removal outside of the CERCLA process which we understand is not allowed in an area covered by a ROD. Lastly, we think that urgent operational needs for maintenance dredging at the PH site could be accommodated under the ROD. Instead, if this work is allowed to move forward under EPA's CERCLA authority, then any potential actions will be in full compliance of the ROD. We do not want to set a bad precedent for the Portland Harbor NPL Site, possibly encouraging other CERCLA responsible parties to apply for similar permits in order to avoid ROD requirements.	We appreciate your acknowledgment that this project will remove contaminated sediment and reduce exposure to aquatic organisms. This maintenance dredge project is not a cleanup project and the responsible party will coordinate with the EPA to conduct a remedial action in full compliance with ROD requirements. The EPA is requiring that the project install a temporary sediment cover layer over the entire dredge to prevent contaminant transport until the final remedial action is completed by the responsible party. Placement of a temporary cover will not change the characterization of any underlying sediment contaminants.
EPA Comments		
Comment 18	**<u>Seaport Portland Terminal Specifications</u>** EPA's June 4, 2018 comment on turbidity monitoring was incorporated in the	Paragraph 3.4.B.2 of Section 01562 has been revised as follows: Ambient upstream turbidity

Comment Number	Comment	Response
	specifications with some modifications. All modifications are acceptable except for the number of independent measurements for background turbidity monitoring requested in General Comment 1.b. which stated that: "Background turbidity will be established prior to the start of any active in-water work. A minimum of seven independent measurements at all applicable water depths will be made at the upstream monitoring station over the course of a two-day period just prior to construction initiation." EPA recommends using a minimum of seven independent measurements.	will be established prior to the start of any active in-water work. **A minimum of seven** independent measurements at applicable water depths (see paragraph 7 herein) will be made at the upstream and downstream monitoring stations for a period of time that is sufficient to characterize normal and customary industrial use and impact on surface water turbidity (minimum of a one-week period just prior to construction initiation). For NTU measurements, the 90th percentile upper confidence limit on the mean will be used to represent initial ambient conditions. Upstream and downstream measurements during this period facilitate a better understanding of turbidity conditions when river flow reverses.
	Attachment D – Temporary Cover Modeling Memo	
Comment 19	1. The responses to EPA's June 4, 2018 comments (Specific Comments 4 and 5) agree with EPA that the armor layer should not be included in the cap modeling. However, Tables 4 and 5 present three thicknesses for the cap; total cover thickness, amended layer thickness, and sand layer thickness which includes the bioactive zone. If the armor layer is not being modeled it should not be presented in the output tables. For example, in Model Run 1 for PAHs a 6-inch sand layer and a 6-inch amended layer is shown. This implies that a 12-inch cap is being modeled but the text indicates that this scenario has a single 6-inch amended layer with a 6-inch armor layer. Resolve these inconsistencies and revise the output tables as needed.	As described in the memo and noted in Table 3 (model input) and Tables 4 and 5 (model results), the various model runs simulate the total thickness of the placed material of 12 inches in the Berth Area or 9 inches in the Under Dock/Slope Area including both the amended layer (with varying thicknesses) and the armor layer. Although the model includes material above the amended layer, it is simulating fines/sediments in the voids of the armor layer, including bioturbation in the top 4 inches (10 cm). As noted in Table 3, for long-term predictions the model assumes fines (sediments) deposit on the cover and fill the voids of the armor layer and that the fraction organic carbon (foc) over time in the bioactive zone (top 10 cm) would be similar to current sediments. Below 10 cm of the armor layer, the voids of the stone are assumed filled by sands from below and conservatively assumed with a very low foc (and thus negligible partitioning). As the model results are compared to sediment-based screening values, predicted concentrations at the bottom of the bioactive zone (where there is a

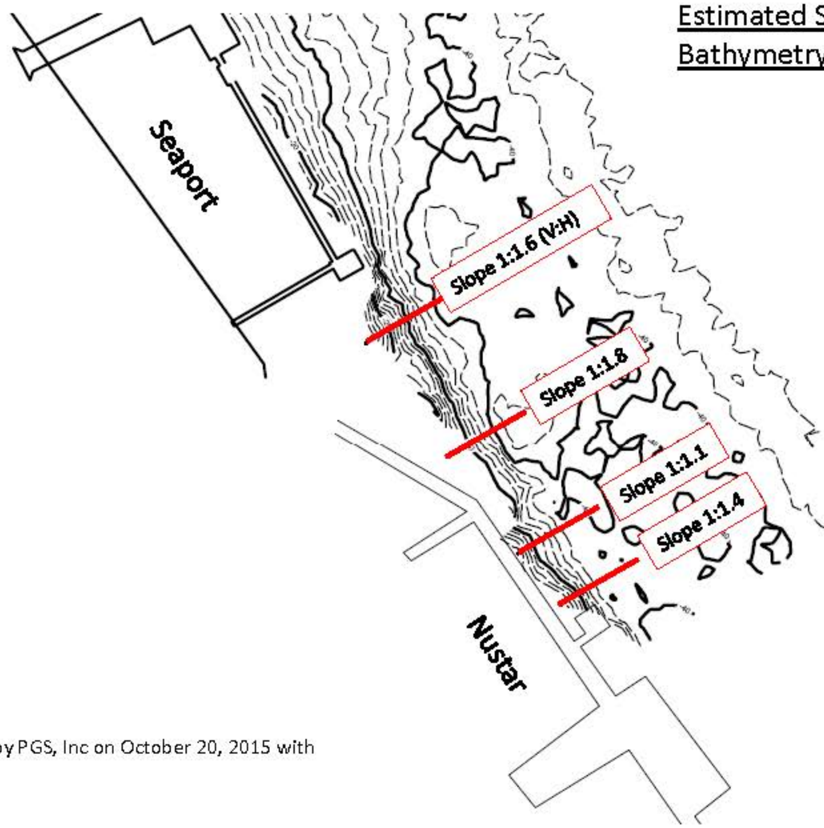
Comment Number	Comment	Response
		higher foc and thus more conservative) are compared to the screening levels. This will be clarified in the revised memo. In addition, predicted concentrations at a depth of 15 cm (bottom of "armor layer") will also be presented in the results tables (along with the results at the bottom of the bioactive zone at a depth of 10 cm that are currently presented).
Comment 20	2. The response to Specific Comment 7 (from EPA's June 4, 2018 comments) states that: "Since the partition coefficients are higher for dioxins than the partition coefficients for Total PAHs and Total PCBs, it is expected that the cover options will also be protective for dioxins. Therefore, dioxins were not included in the modeling evaluation." This needs to be stated in the memo with supporting information. The dioxins do not need to be modeled but simple calculations comparing dioxin porewater concentrations/partition coefficients with PCB and PAH concentrations/partition coefficients can be used to support the discussion for not including dioxins.	The supporting documentation for dioxins (as 2,3,7,8-TCDD) is provided in the attached table. Based on the higher partition coefficients (Koc and Kf) for dioxins compared to both PAHs and PCBs as well as a lower ratio of maximum sediment concertation to the ROD cleanup level as compared to PCBs, the cover options would be protective for dioxins based on the modeling conducting for PAHs and PCBs. This is illustrated in the attached table.
Comment 21	3. Review of the armor stone design calculations indicates several issues that need to be resolved before the armor stone design can be considered final. These are listed below and elaborated in the Specific Comments: – Use of a coefficient that is inconsistent with EPA guidance for the berth area – Apparent inconsistency between the text and calculations presented for the under-dock slope area – Unknown reference and formulation used to size armor stone for vessel wake	Responses to each issue have been added below under the Specific Comments.
Comment 22	**Attachment A, Footnote 1:** The rationale and calculation described in the footnote for excluding wave impacts on the temporary cover only includes wind waves. Revise the text to include a similar calculation for vessel waves or provide a reference for the period associated with vessel waves. Also, revise the footnote to indicate that although vessel wake is not relevant for the berth area, it is evaluated and used to size armor stone in the under-dock slope area.	A reference has been added to Attachment A for the wave period associated with vessel wakes in the Memo as requested. A sentence has been added to the footnote to explain that wind and vessel waves were used for the design of the armor rock on the slope behind the dock.
Comment 23	**Attachment A, Section titled *Temporary Cover Propeller Wash Modeling and Material Gradation:*** Although the text references different methods that were applied to characterize propeller wash and armor stone	Project locations have been added to the Memo for each calculation method.

Comment Number	Comment	Response
	sizing (Blaauw and Kaa [1978] in combination with USEPA [1998], and PIANC [2015]), it is not clear from the text what approach was used for a given portion of the project location. Revise the text to indicate what formulation was applied in the berth area and what formulation applied in the under-dock slope area.	
Comment 24	**Attachment A, Section titled *Propeller Wash Stone Calculation: Under Dock Slope Area*, and Appendix A:** Either the text describing the armor stone sizing and the calculations presented in Appendix A are not consistent or the calculations presented in Appendix A are not well described in the text. For instance, the text refers to calculations also being performed at 8.2 ft CRD whereas the graphic in Appendix A shows calculations at 14.8 ft CRD and 8.4 ft CRD, and the calculations sheet in Appendix A only presents calculations for 14.8 ft. Similarly, it is not clear how the elevations associated with the various armor stone sizes shown in Table 1 were established. Another example involves an armor stone size of 10 inches mentioned in the text but not included in the calculations presented in Appendix A. Revise the text and the calculations presented in Appendix A as appropriate to 1.) address these perceived issues and 2.) present all elements of the design calculations.	The text in the Memo has been revised to add clarity. Water elevations including and between 1.95 and 14.8 ft CRD were used in the propeller wash calculations. Calculations have been added to Appendix A to show how the elevations for the different rock sizes were calculated. The rock sizes shown in Table 1 vary as a function of depth because the environmental parameters affecting sizing (propeller wash, waves, currents) also vary by depth. The calculation for the 10-inch rock has been added.
Comment 25	**Attachment A, Section titled *Propeller Wash Stone Calculation***: Revise the text to indicate what formulation and reference was used to calculate the armor stone size necessary to withstand vessel wake in the under-dock slope area.	The Memo text and Appendix A have been revised to provide the information requested. Rock sizing was calculated using the Hudson method.
Comment 26	**Attachment A, Table 1 attachment:** For completeness, consider adding the elevation associated with the upper limit of armor stone placement in the under-dock slope area, either in the table or in the associated text.	The Memo Table 1 has been revised to indicate the elevation associated with the upper limit of stone placement.
Comment 27	**Attachment A, Table 3 attachment:** The input parameters for the underlying sediment and the active carbon layers is missing from Table 3 in Attachment D. Revise the table to be consistent with the version of Table 3 provided at the end of Attachment G. Additionally, the bulk density notes for Table 3 shown in Attachment G indicate that bulk density “will not significantly affect model results”. This may be true; however, EPA disagrees with including such statements without supporting evaluations or documentation. Remove this caveat from the notes.	This comment will be addressed in the revised document.
Comment 28	**Attachment A, Appendix A, *Maynord - Propeller Wash Calculations* attachment:** The coefficient C_3 in the armor stone sizing calculation used a value of 0.6. However, the referenced USEPA (1998) recommends a value of 0.55 for no movement rather than 0.6 as indicated in the tabulation presented in Appendix A. Using C_3=0.55 results in calculated armor stone ranging from 2.7 to 3.2 inches instead of 2.3 to 2.7 inches using C_3=0.6.	The C3 value of 0.6 was used in this design because the propeller wash assumptions used are conservative. Using the C3 value of 0.55 would be overly conservative in tandem with the worst-case propeller wash assumptions. This is true particularly since

Comment Number	Comment	Response
	Revise the armor stone sizing calculations using the USEPA recommended value for the coefficient C_3 or provide the rationale supporting the use of a higher value than recommended by USEPA for coefficient C_3.	the cover is temporary. SeaPort intends on monitoring the conditions beneath the dock after placement and incorporating maintenance measures into the program.
Comment 29	**Attachment A, Appendix A, *Maynord - Propeller Wash Calculations* attachment:** Equation #6 in combination with the gradation factor $(D85/D15)^{(1/3)}$ used in sizing armor stone to resist river currents is also consistent with Eq. 2 on page A-5 of USEPA (1998). Include this reference since it shows consistency with USEPA recommendations for armor stone sizing.	The reference noted has been added to the Memo Appendix A as requested.
Comment 30	**Attachment A, Appendix B attachment:** A sieve size in the soil filter calculations for the stone layer has changed from 2.5 to 2.7 inches. Provide clarification for this change.	The soil filter calculations were revised to correct the median rock size. The D50 was incorrectly stated as 2.5 inches in the previous version; the D50 was corrected to 2.7 inches.
	Attachment B – Geotechnical Slope Stability Memo	
Comment 31	Provide the selected target factors of safety for the short term (undrained), long term (drained) and pseudo-static evaluations.	The minimum required factor of safety values according to the ODOT Geotechnical Design Manual are: short term – 1.25, long term – 1.5, pseudo-static – 1.1. These values have been added to the Memo as a new Table 3, they have also been added to the former Table 3, now Table 4, to provide a comparison between the calculated and target FS values.
Comment 32	In selecting target slope stability factors of safety for static and seismic loading conditions, due consideration should be given to impacts of potential dredging-induced slope displacement on pier pile integrity.	The factors of safety shown in response to comment 31 are acceptable to SeaPort and protective of the dock. The design does not change the condition that the dock was originally designed for. SeaPort accepts responsibility for risk of the piles and dock structure. A factor of safety of 1.5 is used for the long-term stability which as noted in comment 36 is the widely used target factor of safety for long-term (drained) stability evaluations of slopes.
Comment 33	Clarify whether a strength reduction factor was used for the pseudo-static analyses. If not, provide the rationale for not using reduced strengths in the pseudo-static analysis.	A strength reduction factor was not used. A pseudo-static analysis is standard practice and conservative. It is an appropriate analysis

Comment Number	Comment	Response
		for this slope.
Comment 34	The commonly used seismic coefficient of 0.5 which is used in the pseudo-static analyses assumes that up to 1 meter of displacement of the slope is acceptable. The seismic coefficient should be selected based on acceptable slope displacements considering impacts of slope displacement on pier pile foundations and cap integrity.	The ODOT seismic hazard map was used to determine a PGA of 0.175g. A more conservative PGA of 0.2g was chosen. The seismic design coefficient is typically half of the PGA which is standard practice. Therefore, a seismic coefficient of 0.1 was used in the pseudo-static analysis. The analysis for the long-term seismic condition was redone to include the riprap cover which resulted in a calculated FS of 1.0. A pseudo-static analysis was also completed for the existing conditions which resulted in a calculated FS of 1.0. Despite not meeting the target FS of 1.1, the final constructed slope will not result in a FS lower than the existing conditions. Furthermore, the seawall constructed at the site landward of the dock consists of two rows of tiebacks and a sheet pile wall. The wall was built to stabilize the slope and protect the terminal from landslides due to earthquakes. The area in front of the seawall was dredged using cofferdams and backfilled with engineered fill. Due to the presence of the seawall, the amount of material that could slide as a result of an earthquake is small.
Comment 35	Provide rationale for modeling the 'Soft Sediment' as a cohesionless material with frictional shear strength properties. Cone Penetration Test (CPT) 18-02 identifies the surficial material below the mudline as 'Sensitive Fine Grained' or 'Clay'. The sample collected at 1.5 feet depth at nearby boring B18-02 has a Plasticity Index of 16 and approximately 94 percent fines which does not support the assumption of drained material properties for the 'Soft Sediment' layer at this location.	Two models were added to the analysis to model the soft sediment as a cohesive material. The short-term analysis and short-term seismic analysis were modeled with a cohesive layer and are referenced in the Memo as Case 7 and Case 8 respectively. Adding cohesion to this layer results in a higher or equal factor of safety. The assumption of the soft sediment being a cohesionless layer is a more conservative approach to the analysis.
Comment 36	The estimated factor of safety of 1.2 for the long-term drained conditions is less than the widely used target factor of safety of 1.5 for long-term (drained) stability evaluations of slopes. This indicates that the slope will not achieve	The estimated factor of safety of 1.2 for the long-term drained condition was based on the dredged slope prior to the installation of the

Comment Number	Comment	Response
	acceptable factors of safety after excess pore pressure have drained in the long term. The explanation provided for the estimated factor of safety of 1.2 under drained conditions not being applicable based on the fine-grained nature of the sediment is not acceptable.	cap. The long-term analyses were redone to include the riprap cap layer. The model for Case 3 referenced in the Memo shows that an acceptable factor of safety of 1.6 is achieved when a riprap is included in the model. Additionally, the NuStar property adjacent to the Site was recently dredged and the material was allowed to naturally slough. As shown on the attached figure, October 2015 bathymetric survey data show that the slope angles range from 1.1H:1V to 1.8H:1V. These naturally occurring slopes at the adjacent site, in addition to the existing natural slopes at the Site ranging from 1H:1V to 2H:1V, further support the model results that a 1.5H:1V dredge slope will be achieved in this material.
Comment 37	The Section 'Modeling Parameters' states that the soil properties are based on the 2018 geotechnical investigations. Interpretations of shear strength parameters from CPT investigations should be documented in the stability Dredge Slope Stability Analysis Memorandum	The soil parameters used for the model are based on correlations from the following references: UFC 3-220-03FA, WSDOT Geotechnical Design Manual, and Bowles Foundation Analysis and Design. These references have been added to the Memo. Two models were added to the memo for a sensitivity analysis. In these models, the cohesion was modeled as 400 psf instead of 800 psf for the short-term stability and short-term seismic stability analyses.
Comment 38	Provide a reference or basis for selecting a peak ground acceleration (PGA) of 0.4g for the 500-year earthquake recurrence interval for the pseudo-static evaluation.	A PGA of 2.0 was chosen based on the ODOT Seismic Hazard Map. Please also see the response to comment 34.



Estimated Slopes at Nustar Dock using 2015 Bathymetry

Bathymetric survey taken by PGS, Inc on October 20, 2015 with vertical datum of C.R.D.

Response to Comment 16 Table. Comparison of 2,3,7,8-TCDD to PAHs and PCBs.

Parameter		Units	Total PAHs	Total PCBs	2,3,7,8-TCDD	Notes
Underlying Sediment						
Sediment concentration	C_{sed}	ug/kg	124,780	343	2.99E-03	Maximum sediment concentrations (see Tables 1 and 2)
Estimated porewater concentration	C_{pw}	ug/L	100	0.12	6.26E-07	Based on a site-specific underlying sediment concentrations and sample-specific fraction organic carbon (see Tables 1 and 2), and literature partition coefficients from the Oregon RBDM database.
Partition coefficient	$log\ K_{oc}/logKd$	log L/kg	4.74	5.12	5.40	Literature values (see Note 1)
Fraction organic carbon	foc_{sed}		2.2%	2.2%	2.2%	Site specific (average)
Activated Carbon Layer						
Freundlich coefficient	$log\ K_f$	$\log (ug/kg)/(ug/L)^{(1/n)}$	7.22	8.48	8.48	See Note 2 below
Freundlich coefficient	K_f	$(ug/kg)/(ug/L)^{(1/n)}$	1.65E+07	3.02E+08	3.02E+08	See Note 2 below
Freundlich coefficient 1/n	*1/n*	-	0.41	0.84	0.84	See Note 2 below
Portland Harbor ROD Cleanup Level		ug/kg	23,000	9	2.00E-04	
Ratio of Maximum Sediment to ROD Value			5.43	38.11	14.95	

Notes:

[1] Partition coefficients for Total PAHs,Total PCBs and 2,3,7,8-TCDD are based on Oregon Department of Environmental Quality (DEQ), 2015. Chemical Data Table from DEQ's Risk-Based Concentrations for Individual Chemicals. November, 2015. For Total PAHs, the values for pyrene were used.

[2] Freundlich coefficients used for non-linear sorption of contaminants to activated carbon. For Total PAHs, Freundlich coefficients from Texas Tech University based on Walters, R.W., Luthy, R.G., 1984 (Equilibrium adsorption of polycyclic aromatic hydrocarbons from water onto activated carbon. Environmental science & technology 18, 395-403). The lowest of the values (for phenanthrene) of the three predominant PAHs (phenanthrene, flouranthene, and pyrene) observed in the sediment data was used. For PCBs, Freundlich coefficients are based on Gomez-Eyles et al., 2013 (Table S2 for select organics for CAC-Coal in Supporting Information). The average of the reported values of Freundlich coefficients (Kf and 1/n) for the congeners was used. As a sensitivity analysis, one order-of-magnitude lower values of logKf (6.22 for Total PAHs and 7.48 for PCBs) were modeled. For 2,3,7,8-TCDD (not reported in Table S2), a Freundlich coefficient value similar to the value for PCBs (or higher) would be expected. This is a conservative assumption since dioxins/furans have higher Koc than PCBs.

Comment Number	Comment	Response
NMFS Comments		
Comment 39	New project maps, drawings, and schematics that reflect the change in project area and design from the original submission.	We have modified the project figures to more clearly indicate the proposed dredge and fill limits. The enclosed drawing package should indicate how the project has changed relative to the original submittal.
Comment 40	Descriptions and acreages of habitat types pre- and post-project. Please use the habitat types on pages 11-13 of the document linked. Shallow water habitat may be considered -15 feet CRD instead of -20 feet CRD. Please contact me if you have questions about how to break out the habitat types for this particular site.	As requested, we have attached a table to this document that provides descriptions and acreages of pre- and post- project habitat types.
Comment 41	Analysis of whether the gravel placed over the riprap will remain in place for the length of the project. What assurances will the applicant provide that this will be maintained and the riprap will not become exposed?	The small diameter gravel placed over the riprap provides a habitat layer while increasing the overall depth of the protective armor layer to 18”. Theoretical calculations suggest that this small diameter stone could be susceptible to movement in certain high propwash impact areas. The side slope adjacent to the dock is generally accretional which suggests that sediment deposition will deposit over the rounded gravel over time, which would help facilitate recolonization of benthic organisms. The sediment cover layer will remain in place until the remedial action is implemented, which is expected to occur over the next 10-20 years.
Comment 42	An explanation of what "temporary" means when referring to the cap (How many years will it remain in place conservatively?).	The EPA-required temporary cover material cannot be removed without EPA approval and it has been designed to remain effective for up to 100 years, or well after the final remedial action is implemented by the responsible party. The final action is expected to be completed within the next 10-20 years, by the responsible party, but the exact timing of this action is unknown.
Comment 43	An explanation of how the applicant considered shallower slopes to allow smaller material to be adequately protective.	During the planning process, AECOM, on behalf of the applicant considered a 2H:1V side slope. This shallower side slope would result in removing engineered backfill

Comment Number	Comment	Response
		associated with a previous sediment interim removal action, conducted by the previous terminal owner (BP Westcoast Products). In addition, the shallower slope would be difficult to construct given the proximity of the dock, sediment removal under the dock shoreline, and seawall. The impacts to shallow water habitat for the 2:1 side slope were determined to be significantly greater than the proposed action. The estimated total cubic yardage of sediment that would need to be removed to attain a 2H:1V slope is 15,000 cubic yards, a 5,600 cubic yard increase over the current removal volume. It is anticipated that temporary cover material would then need to be placed over this entire area. As such, the environmental and economic costs of this alternative were determined to be prohibitive.
Comment 44	A description of what stabilizing geosynthetic structures and activated carbon reinforced core mats are.	Geosynthetic geocells and activated carbon reinforced core mats are types of stabilizing synthetic structures that may be used to sequester contaminants on the dredge slope. The geosynthetic geocell structure is produced from High Density Polyethylene (HDPE) and contains three dimensional cells that would be backfilled with carbon-amended sand material. No specific product is specified but representative information is available on the Presto Geosystems website. The activated carbon core mat is a carbon-filled geosynthetic mat that would placed over the slope. No specific product is specified but representative information is available on the CETCO website.
Comment 45	Procedures the applicant plans to use to prevent ESA-listed fish from being trapped inside the sediment curtain during dredging.	Turbidity curtains would be only used if needed during dredging and sand cover placement activities for this project. The curtain would be installed in panels and would not completely surround the entire operation, and ESA-listed fish potentially migrating into the work area would be able to escape.

Response to Comment #40. Aquatic Habitat Characteristics and Acreages at the SeaPort Maintenance Dredging Project Site.

HEA Habitat Category	Habitat Characteristics	Habitat Description	Acres
Pre-Project Conditions			
Main Channel (below ordinary low water)	Shallow water (0-15 feet deep), gravel and finer substrates	Slopes range from 1:1 to 3:1; sand/silt/clay substrate.	0.13
	Shallow water (0-15 feet deep), pile-supported structure	Slopes range from 1:1 to 3:1; sand/silt/clay substrate.	0.34
	Deep water (>15 feet deep), natural substrates	Accretional and erosional areas; slope varies from 1:1 near the dock to <5:1 in mid-berthing area; sand/silt/clay substrate.	1.90
		SUM	2.37
Proposed Post-Project Conditions			
Main Channel (below ordinary low water)	Shallow water (0-15 feet deep), artificial substrates - Dredge side slopes (amended and unamended cover)	Dredge slope adjacent to the berthing area will be stabilized to 1.5:1. Shallower areas will remain at a slope of 3:1. Cover layer will consist of 6-inch layer of small rounded gravel (D50=2.7”) on top of 12-inch layer of large angular rock (D50=12.2”).	0.05
	Shallow water (0-15 feet deep), pile supported structure - Dredge side slopes (amended and unamended cover)	Dredge slope adjacent to the berthing area will be stabilized to 1.5:1. Shallower areas will remain at a slope of 3:1. Cover layer will consist of 6-inch layer of small rounded gravel (D50=2.7”) on top of 12-inch layer of large angular rock (D50=12.2”).	0.20
	Deep water (>15 feet deep), artificial substrates - Berthing area	Flat bottom surface. Cover layer will consist of 6-inch layer of small angular rock (D50=2.5”) on top of 6-inch layer of clean sand and gravel.	1.32
	Deep water (>15 feet deep), artificial substrates - Side slopes	Side slopes will be stabilized at a slope of 1.5:1. Cover layer will consist of 6-inch layer of small rounded gravel (D50=2.7”) on top of 12-inch layer of large angular rock (D50=12.2”).	0.32
	Deep water (>15 feet deep), pile-supported structure - Side slopes	Side slopes will be stabilized at a slope of 1.5:1. Cover layer will consist of 6-inch layer of small rounded gravel (D50=2.7”) on top of 12-inch layer of large angular rock (D50=12.2”).	0.48
		SUM	2.37

Notes: No work is proposed within the riparian corridor or within the active channel margin (ACM) (between ordinary high water and ordinary low water).
Amended cover may include a 6” geocell layer underneath the armor stone layer.
From elevation -2 to -4’ CRD, the armor stone D50 would be 14”.

Final 2019 Application and Design Drawings

2019-06-11

AECOM

AECOM
111 SW Columbia St., Suite 1500
Portland, OR 97201
USA
aecom.com

Date
June 11, 2019

Oregon Department of State Lands
ATTN: Ms. Melinda Butterfield
775 Summer Street NE, Suite 100
Salem, OR 97301-1279

SeaPort Midstream Partners, LLC Maintenance Dredging at the Portland Terminal (River Mile 4.9 of the Willamette River) – FINAL SUBMITTAL of Oregon Removal/Fill Permit Application Package (60800-RF)

Dear Ms. Butterfield:

TLP Management Services LLC (applicant) and SeaPort Midstream Partners, LLC (upland property owner) are proposing to perform maintenance dredging to reestablish navigable berth elevations (depths) for current and future vessels that use their Portland Terminal, located at River Mile 4.9 of the lower Willamette River (LWR) in Portland, Oregon. On January 7, 2019, AECOM submitted an updated removal/fill permit application package to the Oregon Department of State Lands (DSL) and US Army Corps of Engineers (USACE) to perform this dredging activity on behalf of the applicant and property owner. The updated permit application described the US Environmental Protection Agency (EPA)-required temporary cover placement activity not included in the initial December 2017 permit application package.

On March 15, AECOM submitted a revised permit application package to address DSL's comments received on February 14. Along with the application, we included a Response to Comment form describing our response to each DSL comment provided in their checklist. The application then was submitted for a shortened public review period and all comments were received by May 29.

This final permit application package has been prepared to meet DSL's request for a final complete updated application and to address all remaining public comments received. It is our understanding that all regulatory agencies have agreed to the design changes. We are also sending this application package to the USACE so that they have the most up-to-date project information available to finalize their permit. As previously mentioned, we are requesting a swift review and approval process to allow SeaPort the necessary time to prepare for a July 1, 2019 in-water work start-up date.

Should you require additional information about this permit application or the project, please contact me at (503) 948-7234 or by email at andy.clodfelter@aecom.com.

Sincerely,

Andy Clodfelter
Senior Fisheries Biologist/ Regulatory Compliance Specialist
AECOM

Cc: Juan Medina (agent for Seaport Midstream Partners, LLC)
Michael Hammell (TLP Management Services LLC)
Melody White (US Army Corps of Engineers)
Scott Kranz (AECOM)

Enclosures:

- Final Joint Permit Application
- Updated Figures
- Response to May 29, 2019 DSL Public Comments
- Habitat Equivalency Analysis (HEA) Documentation

Joint Permit Application

This is a joint application, and must be sent to both agencies, who administer separate permit programs. Alternative forms of permit applications may be acceptable; contact the Corps and DSL for more information.

Date Stamp

U.S. Army Corps of Engineers Portland District	Oregon Department of State Lands
Corps Action ID Number: NWP-2006-946-3	DSL Number: 60800-RF

(1) TYPE OF PERMIT(S) IF KNOWN (check all that apply)

Corps: ☒ Individual ☐ Nationwide No.: _______ ☐ Regional General _______ ☐ Other _____________

DSL: ☒ Individual ☐ General Permit ☐ No State Permit Required ☐ Waiver

(2) APPLICANT AND LANDOWNER CONTACT INFORMATION

	Applicant	Property Owner (if different)	Authorized Agent (if applicable) ☑ Consultant ☐ Contractor
Name (Required)	Michael Hammell		Andy Clodfelter
Business Name	TLP Management Services LLC		AECOM
Mailing Address 1	PO Box 5660		111 SW Columbia St.
Mailing Address 2			Suite 1500
City, State, Zip	Denver, CO 80217		Portland, OR 97201
Business Phone	303-626-8200		503-948-7234
Cell Phone			
Fax	303-626-8228		503-222-4292
Email	mhammell@transmontaigne.com		andy.clodfelter@aecom.com

(3) PROJECT INFORMATION

A. Provide the project location.

Project Name	Latitude & Longitude*
Portland Terminal Maintenance Dredging	45.5948°, -122.7782°

Project Address / Location	City (nearest)	County
9930 NW St. Helens Road (Highway 30)	Portland, OR (Linnton)	Multnomah

Township	Range	Section	Quarter / Quarter	Tax Lot
1N	1W	2C	NE/SW	N/A (in-water, adjacent to 400)

Brief Directions to the Site:
From Portland, take US Highway 30 north for 7.5 miles. The site is approximately 1 mile north of the St. Johns Bridge. Approximately 0.5 mile before Linnton, turn right into the Portland Terminal facility (opposite NW Hoge Ave.).

B. What types of waterbodies or wetlands are present in your project area? (Check all that apply.)

☑ River / Stream ☐ Non-Tidal Wetland ☐ Lake / Reservoir / Pond

☐ Estuary or Tidal Wetland ☐ Other ☐ Pacific Ocean

Waterbody or Wetland Name**	River Mile	6th Field HUC Name	6th Field HUC (12 digits)
Willamette River	4.9	Willamette River	170900120202

* In decimal format (e.g., 44.9399, -123.0283)
** If there is no official name for the wetland or waterbody, create a unique name (such as "Wetland 1" or "Tributary A").

C. Indicate the project category. (Check all that apply.)		
☐ Commercial Development	☐ Industrial Development	☐ Residential Development
☐ Institutional Development	☐ Agricultural	☐ Recreational
☐ Transportation	☐ Restoration	☐ Bridge
☑ Dredging	☐ Utility lines	☐ Survey or Sampling
☐ In- or Over-Water Structure	☑ Maintenance	☑ Other: Temporary cover layer placement

(4) PROJECT DESCRIPTION

A. Summarize the overall project including work in areas both in and outside of waters or wetlands.

Dredging Dimensions and Volumes:

The proposed project includes maintenance dredging at the facility dock to reestablish original berth elevations (depths) for docking current and future vessels. The facility dock has a 2.1-acre berth area—approximately 880 feet long (measured parallel to the navigation channel) and 105 feet wide (from the dock face to just beyond the navigation channel). Approximately 1.1 acres of the 2.1-acre berthing area is proposed to be dredged.

The project objective is to lower the substrate elevation within the berthing area to a final elevation of -34 feet Columbia River Datum (CRD). This will require dredging to -35 feet CRD so that a 1-foot temporary cover layer (up to 1,850 cubic yards [cy] of material) can be placed over the post-dredge sediment surface to achieve a final elevation of -34 feet CRD. The dredge prism includes the berthing area as well as side slopes that need to be dredged to facilitate slope stability and material placement. Side slopes of the dredge prism will be dredged to achieve a final slope of no steeper than 1.5H:1V, which has been modeled to be stable[1]. Most of the side slope dredging will occur along deeper portions of the slope (<-20 feet CRD). Where dredging occurs on the side slopes to reduce slope angles to no steeper than 1.5H:1V, a minimum 18-inch thick temporary cover will also be placed as described below.

Dredging of the berthing area and side slopes will remove approximately 9,400 cy of material. Incorporating additional allowance for an over-dredge depth of one foot, the maximum removal volume for the dredge prism is 12,100 cy of sediment. It is possible that dredging activities could inadvertently dredge as much as 2 feet beyond the target depth (to -37 feet CRD) in certain locations. If some areas are unintentionally dredged deeper than -35 feet CRD, the contractor would still just place a one-foot cover layer over those areas. Since the contractor will not be compensated for any costs associated with dredging over 6 inches beyond the dredge design depth or for dredging outside of the prescribed dredge prism limits, we anticipate that the final post-dredging surface will be very close to meeting the design depths described above.

Based on a 2017 bathymetric survey, elevations within the berthing area range from -20 feet CRD at the far northwest boundary and descend to -40 feet CRD near the southern boundary. The potential future navigation channel elevation (outside of the berthing area) is -48 feet CRD. River sediment elevations are variable at this site; the target dredge depth will require dredging between 1 and 15 feet of sediment within the dredge prism.

The applicant is required to maintain suitable berthing depths to meet contractual obligations. Thus, the requested permit durations (10 years for the US Army Corps of Engineers [Corps] and 5 years for Oregon Department of State Lands [DSL]) will allow the applicant the option to perform additional maintenance dredging if sediment in-fill occurs within the berthing area more quickly than anticipated during this time period. Although additional dredging is unlikely within the permit duration based on the dredging history at this site and the design vessel draft, the berthing area is generally depositional and the applicant requests flexibility to be able to maintain sediment depths at their terminal. This additional dredge event would involve mechanical dredging down to an elevation of -34 feet (to the elevation of the proposed cover layer) and a total removal volume of up to 5,000 cy of sediment (based on historical sediment accretion rates). If necessary, the additional dredging would also adhere to Sediment Evaluation Framework (SEF) and US Environmental Protection Agency (EPA) requirements and be performed in a similar manner as the initial dredging event described herein. If future dredging is needed in areas where the temporary cover is not present, then a permit modification would be prepared to request authorization to place additional temporary cover material.

Temporary Cover Layer:

Based on the sediment sampling results within the dredge prism and leave surface, the Portland Sediment Evaluation Team (PSET) suitability determination, and subsequent discussions with EPA, a 1-foot thick cover layer will be placed

[1] AECOM 2018. Dredge Slope Stability Analysis at Seaport Midstream Portland Terminal. Prepared for TransMontaigne Management Services, LLC. December 18, 2018.

over the post-dredge surface in the berthing area after the initial dredging event, consistent with the EPA's 2017 Record of Decision (ROD) recommendations for the cleanup of the Portland Harbor Superfund Site. The cover material will consist of a carbon-amended layer of up to 6 inches thick with a minimum 6-inch thick angular gravel overlay (D_{50}=2.7 inches) to reduce potential scour from propeller wash. Calculations indicate this gravel size would better resist displacement of the underlying sand layer from propeller wash than a 2.5" D_{50} gravel overlay.[2]

The EPA is requiring sediment contaminant sequestering and armoring of the affected areas of the dredge side slopes as well as the berthing area. AECOM has performed modeling to design a slope cover that would meet ROD requirements. As such, in the side slope area, the carbon-amended layer will consist of 6 inches of granular material (similar to the berthing area) but will be placed into either a stabilizing geosynthetic structure or an activated carbon filled reinforced core mat (RCM/AC). The carbon-amended layer would only be placed on the side-slopes where dredging is required to achieve a 1.5H:1V stable slope. Unamended sand material would be placed on other portions of the side slopes. The sand layer will be covered by a 12.2-inch D_{50} rock layer with 6 inches of 2.5-inch D_{100} beach mix overlaying and filling the interstitial spaces between the larger rock to maintain fish habitat. The beach mix layer will consist of rounded stone (2.5 inches or less in size) that also contains smaller gravel and sand to maintain fish habitat and provide appropriate substrate habitat for colonization by benthic organisms. This substrate material was selected to meet National Marine Fisheries Service's (NMFS's) recommended sediment size requirements for optimal habitat[3,4,5]. The 2017 EPA ROD also recommends that this material should be applied to the "uppermost layer of all caps and dredge leave surfaces in shallow areas". It is anticipated that most of the beach mix will remain in place although some of this material may be washed away by strong currents, waves at low water levels, or from strong propeller wash in localized areas. However, it is likely that if silt or sand were placed over the riprap layer, it would be washed away completely and would not protect the underlying material or meet EPA ROD requirements. The carbon amendment is required to sequester dissolved polychlorinated biphenyls (PCB) and polycyclic aromatic hydrocarbons (PAH) concentrations (contaminants of concern) from water upwelling through the post-dredge surface. Modeling results suggest the cover layer will prevent the chemical breakthrough and migration of PCBs from the leave surface for well over 30 years. The cover layer is intended to function until the final remedy is performed at the site.

Cover materials will be delivered to the site via barge. Materials will be placed using a barge-mounted crane or excavator with a clam-shell bucket, or other similar specialized equipment as determined by the contractor. All cover placement activities for the berthing area will be staged from the water, with no proposed heavy equipment use on the shoreline. For the side slope cover operations, some shoreline equipment may be needed as access to the area is limited.

Different placement methods would be evaluated to determine the best approach for accurately placing material while reducing disturbance of the sediment surface or underlying cover layer. The carbon-amended sand layer will be placed first. It is anticipated that this material would be placed by a mechanical bucket or Telebelt® system but other methods could also be used, depending on feasibility, effectiveness, or to reduce aquatic impacts. For bucket-deployment operations, the bucket would be suspended above the water surface, then opened, and the material would be released through a slow sweeping motion over a pre-determined placement grid. If a Telebelt® system is used, the boom conveyor would be fixed at an appropriate angle established by the operator for deployment, and the conveyor belt speed would be adjusted for accurate placement thickness as established on barge or land. Grid size will be selected in advance to deposit the material in desired lifts. Due to the need to anchor the engineered geosynthetic materials, the deployment of cover material may extend as shallow as -2 feet CRD.

An erosion protection layer will then be installed above the amendment layer to protect it from propeller wash. Effort will be taken to accurately place the cover material. However, some cover materials (particularly finer sand particles in the amendment layer) may drift a short distance outside of the placement area. Further, the cover layer may exceed design depths in certain areas due to the challenges of placing sediment at exact depths in a dynamic river system. Thus, the estimated fill volumes and dimensions provided in Sections 4H and 4I have been calculated to account for potential inaccuracies associated with the placement of cover material in the river. Bathymetric surveys will be completed to ensure that the cover materials are placed across the intended area and at the intended thickness.

In summary, it is projected that the berthing area will require removal of up to 7,550 cy of sediment to achieve an elevation of -35' CRD while the under-dock slope area will require removal of up to 4,250 cy of sediment to achieve a

[2] AECOM 2019. Temporary Cover Modeling for the Proposed SeaPort Terminal Maintenance Dredging Project. Technical Memo to TransMontaigne Management Services LLC. January 7, 2019.

[3] NMFS 2011. Endangered Species Act Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Conservation Recommendations for the ZRZ Realty Company Contaminant Cleanup, Multnomah County, Oregon (6th Field HUC: 170900120302) (COE No. NWP-2007-962).

[4] AECOM 2017. Appendix B to Biological Assessment for PGE RM 13.1 Remedy Implementation Project. RM 13.1 Sediment Capping Project – Existing Site Habitat Conditions and Evaluation of Improvements/Impacts from Remedy Implementation. March 2017.

[5] NMFS 2017. Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for Portland General Electric's River Mile 13.1 Remedy Implementation on the Willamette River (HUC 170900120202), Multnomah County, Oregon (Corps No.: NWP-2015-454/1).

minimum 1.5H:1V slope angle under the dock. In addition, approximately 300 cy of material will be removed near the toe of the slope to form an anchor trench for the geosynthetic material used in the side slope cover construction. This total volume incorporates an additional 2,700 cy as an over-dredge allowance. In the berthing area, 805 cy of carbon-amended backfill will be placed and overlain with 1,045 cy of protective armor stone. On top of the slope area, 960 cy of carbon-amended backfill or 6,690 square yards (sy) of RCM/AC overlain by 2,950 cy of protective armor would be placed. Removal/fill volumes are summarized in Section 4 (F to I).

Water quality monitoring will be conducted during construction operations, pursuant to federal and state permit conditions. Turbidity curtains would be only used if needed or required during dredging and sand cover placement activities for this project. The curtain would be installed in panels and would not completely surround the entire operation, and Endangered Species Act (ESA)-listed fish potentially migrating into the work area would be able to escape.

Sediment materials will not be compacted, as consolidation will be allowed to occur through natural settlement. The top cover layer in the berth area (2.7” D_{50} angular gravel) would be close to meeting NMFS’ recommended sediment size gradation for optimal habitat; however, the berthing area is located in deep water habitat that does not support optimal foraging habitat for salmonids. The shallow water portions of the side slopes may provide some seasonal rearing and foraging opportunities for juvenile salmonids (particularly Chinook), although most juvenile salmonids are known to obtain most of their prey items from pelagic sources. The 2.5-inch D_{100} beach mix placed over the riprap material would reduce impacts to fish habitat. Further, a previous study conducted at the site found that the side slope adjacent to the dock is generally accretional[6] which suggests that sediment will deposit over the temporary cover over time, which would help facilitate recolonization of benthic organisms.

As recommended by the EPA for other Portland Harbor sites, one 10-point composite sample of the cover material will be collected (one sample for every 500 cubic yards of fill) prior to delivery to the project site. The sample will be submitted for geotechnical and chemical/analytical tests to characterize the properties of the cover material. The analytical test results will be compared with the Portland Harbor ROD cleanup levels to ensure that the project does not introduce additional contaminants into the system.

The EPA-required temporary cover material cannot be removed without EPA approval and it has been designed to remain effective for up to 100 years. The final action is expected to be completed within the next 10-20 years by the responsible party but the exact timing is unknown. It is anticipated that removal of the temporary cover material would occur during the recommended Oregon Department of Fish and Wildlife (ODFW) in-water work window. However, the responsible party is responsible for defining remedial action timing, methods, and sediment disposal methods.

Monitoring and Maintenance

The applicant will perform annual inspections and monitoring of the berth area and the slope. The annual monitoring will consist of a bathymetric survey to assess the condition of the cover. Areas of the cover that cannot be assessed by bathymetric survey will be assessed using point by point elevations employing divers. The survey data will be utilized to determine if there is an elevation change (negative) greater than 3 inches across 10 percent or more of the cap area. If the rounded stone is displaced due to prop wash effects in localized areas, additional stone will be placed to ensure that the stone continues to cover the interstitial space within the larger riprap layer. Because a majority of the temporary cover is located in a depositional area, sand and silt will accumulate over time, which will improve shallow water habitat conditions. The frequency of monitoring may be modified based upon the results of the bathymetric surveys and the scour and sediment accretions that are observed.

B. Describe work within waters and wetlands.

Work within wetlands:

N/A – All work will be performed from floating barges within the Willamette River channel to the extent feasible. Low water levels may require some of the work to be conducted from the shoreline or above the steel sheet pile for access purposes. There are no designated wetlands along the shoreline. Dredged sediments will be placed on a barge and shipped to a permitted transload facility, where the sediment will be transferred to a truck for transport to a Resource Conservation and Recovery Act (RCRA) Subtitle D permitted facility for disposal as a non-hazardous contaminated dredged material.

[6] AECOM 2016. Preliminary Engineering Cost Estimate for BP Bulk Terminal 22T Maintenance Dredging and Capping. Technical Memorandum. Prepared for Alana Scoon, BP. December 20, 2016.

Work within waters:

Dredging of the sediment will be accomplished with a mechanical dredge. A mechanical dredge consists of a crane that is mounted on the deck of a barge. Mechanical dredging uses a bucket to scoop the submerged sediment.

An "environmental" dredge bucket will be used to the extent practicable. These buckets are equipped with rubber seals and special ports that reduce resuspension of residual sediment. Sediment will be dredged from the river and placed on a transfer barge for transport to a transload facility for disposal. Decant water generated during dredging may be dewatered from the barge, pumped to an upland holding tank for treatment and disposal with a permit, or transported with the dredged material to a disposal facility. It may be feasible that the decant water be released back into the river in the vicinity of dredging since sediment concentrations are below their respective elutriate testing trigger levels per SEF guidelines[7]. Decant water on the barge, if discharged, would be filtered through hay bales and geotextile fabric prior to release into the river. Any release of decant water to the river will comply with state and federal water quality criteria. The contractor will ultimately determine how decant water will be managed to ensure compliance with federal, state, and local permit conditions. Prior to transporting the barge, the scuppers will be raised and sealed to prevent water from leaking from the barge during transfer. The initial dredging event is currently planned for 2019 using the mechanical dredging method and standard dredged material transport barges.

C. Construction Methods. Describe how the removal and/or fill activities will be accomplished to minimize impacts to waters and wetlands.

As described above, an environmental dredge bucket is proposed to be used. This type of bucket creates a seal when scooping that encloses the potentially contaminated sediments and minimizes resuspension and spillage back into the water column. If sediment removal is difficult to achieve using an environmental bucket, a clamshell dredge with a digging bucket or other suitable bucket may be used.

Sediment will be dredged from the river and placed on a sealed barge for transport but it will remain in the area of dredging for up to 24 hours to allow free water to drain from the sediment. When ready for transport, the scuppers will be raised and sealed (i.e., no water will leak from the barge, as any exposed barge weep holes should be sealed prior to placing sediment within the barge). Engineering controls will be implemented such as a containment boom around the area of discharge and any observable sheen would be remediated with an absorbent boom during dewatering activities. Any release of decant water to surface waters will comply with state and federal water quality criteria.

The dredging operation is anticipated to use a 12 hour per day and 5-6 day per week work shift. This reduces the possibility of errors during night hours (e.g., low visibility) and allows one day per week for any repairs to equipment. It is estimated that it will take approximately 60-70 days to perform maintenance dredging and place the cover material for this project. The exposure of aquatic organisms to suspended sediment in the water column would be limited to the duration of mechanical dredging and cover placement. Dredging will occur within the Willamette River in-water work period (July 1 to October 31) to minimize impacts to ESA-listed fish species.

(4) PROJECT DESCRIPTION (continued)

D. Describe source of fill material and disposal locations if known

Disposal Locations: Based on the analysis of contaminant concentrations, sediment will be disposed as a RCRA Subtitle D waste. After sediment is placed on a barge and allowed to dewater for a set period of time (typically 24 hours), it will be transported from the Willamette River to a transload facility selected by the contractor. Sediment will be stabilized on the barge or at the transload facility using Portland cement, lime, etc., as required by the landfill. It will be loaded onto trucks for transport and disposal at the landfill. The transportation operation will take approximately 1 to 2 days to complete for each barge. The dredged sediment will be disposed at a permitted RCRA Subtitle D landfill.

Backfill Material: The cover material will consist of clean material sourced from a local supplier or manufacturer. As appropriate, cover material will be tested prior to placement in the river.

E. Construction timeline.

What is the estimated project start date?	July 1, 2019 (initial event)
What is the estimated project completion date?	October 31, 2019 (initial event)

Is any of the work underway or already complete?
If yes, please describe.

[7] https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll11/id/2548

Sediment core sampling was completed within the proposed dredge footprint in the summer of 2017 to examine the sediments within the proposed dredged area and leave surface. Sediment samples were tested for contaminants and to determine the grain sizes/texture of material for the proposed cover layer. Geotechnical investigations were performed in October 2018 to gather data used in the modeling of slope stability. No other work has been completed to date. The estimated total time to dredge and place the cover layer over the dredge prism and side slope is expected to take the entire 4-month in-water work window and may extend beyond this time particularly in consideration of the limited access to the under-dock areas. An in-water work extension would be requested from the Corps and DSL if additional time is needed to complete project activities outside of the in-water work window. An effort will be made to limit those activities to placement of clean cover material.

F. Removal Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

Wetland / Waterbody Name *	Removal Dimensions					Duration of Impact**	Material***
	Length (ft.)	Width (ft.)	Depth (ft.)	Area (sq.ft. or ac.)	Volume (c.y.)		
Willamette River (berthing area)	880	Varies	1-15	1.1 ac.	7,850	Permanent	River sediment (silt, sand, clay)
Willamette River (dredge side slope)	880	Varies	1-12	0.6 ac.	4,250	Permanent	River sediment (silt, sand, clay)
Willamette River (berthing area)- Future maintenance event (if needed)	880	Varies	1-5	2.1 ac. (maximum)	5,000	Permanent	River sediment (silt, sand, clay)

G. Total Removal Volumes and Dimensions

Total Removal to Wetlands and Other Waters	Length (ft.)	Area (sq. ft or ac.)	Volume (c.y.)
Total Removal to Wetlands			
Total Removal Below Ordinary High Water	880	2.7 ac. (maximum)	17,100
Total Removal Below Highest Measured Tide			
Total Removal Below High Tide Line			
Total Removal Below Mean High Water Tidal Elevation			

H. Fill Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

Wetland / Waterbody Name*	Fill Dimensions					Duration of Impact**	Material***
	Length (ft.)	Width (ft.)	Depth (ft.)	Area (sq. ft. or ac.)	Volume (c.y.)		
Willamette River (berthing area)	880	Varies	0.5	1.1 ac.	805	Permanent	Clean sand, gravel, and activated carbon
Willamette River (berthing area)	880	Varies	0.5	1.1 ac.	1,045	Permanent	Small, angular rock (D_{50}=2.7”)
Willamette River (dredge side slope)	880	Varies	1	1.4 ac.	1,970	Permanent	Large, angular rock (D_{50}=12.2”)
Willamette River (dredge side slope)	880	Varies	0.5	1.4 ac.	980	Permanent	Small, rounded gravel (D_{50}=2.5”)
Willamette River (dredge side slope)	880	Varies	0.5	1.4 ac.	960	Permanent	Clean sand, gravel, and activated carbon
Willamette River (dredge side slope) – Potential Demobilization Material (if needed)	880	Varies	0.1	1.4 ac.	192	Temporary	Clean sand and activated carbon

(4) PROJECT DESCRIPTION (CONTINUED)

I. Total Fill Volumes and Dimensions

Total Fill to Wetlands and Other Waters	Length (ft.)	Area (sq. ft or ac.)	Volume (c.y.)
Total Fill to Wetlands			
Total Fill Below Ordinary High Water	880	2.5 ac.	5,952
Total Fill Below Highest Measured Tide			
Total Fill Below High Tide Line			
Total Fill Below Mean High Water Tidal Elevation			

*If there is no official name for the wetland or waterbody, create a unique name (such as "Wetland 1" or "Tributary A").
**Indicate the days, months or years the fill or removal will remain. Enter "permanent" if applicable. For DSL, permanent removal or fill is defined as being in place for 24 months or longer.
*** Example: soil, gravel, wood, concrete, pilings, rock etc.

(5) PROJECT PURPOSE AND NEED

Provide a statement of the purpose and need for the overall project.

The purpose of the proposed project is to reestablish original ship berth elevations (depths) for current and future vessels that dock at the Portland Terminal. Dredging to -34 feet CRD will reestablish the berth to its original design depth; an additional foot of sediment will be removed (i.e., to -35 feet CRD) to accommodate placement of a 1-foot temporary cover layer that is consistent with the 2017 Portland Harbor Superfund Site ROD requirements for certain surface sediment contaminants that exceed ROD cleanup levels.

Maintenance dredging is necessary to bring the mudline elevations down to a berth elevation consistent with the original design and permit, which will allow current and future vessels to safely access the terminal. The applicant is required to maintain these navigable depths within the Portland Terminal berthing area to meet contractual requirements. The proposed maintenance dredging activities are not associated with any potential future remedial action activities that may be performed by the responsible party at this site. However, since the proposed activities are located within an area identified for future remediation in the ROD, the EPA has requested that dredging and cover placement activities meet the intent of the ROD requirements to help ensure protection of human health and aquatic receptors until the final remedial action is completed.

Removal of sediment within the berthing area will result in a bank cut that increases the slope angle beneath the adjacent dock. Consequently, additional material will be removed from the slope to reach a stable angle of 1.5H:1V. The dredged slope area will receive a cover layer similar to the berthing area; however, because of the angle, additional stabilization geosynthetics (e.g., geocell or RCM/AC) will be needed. These reactive media covers will prevent dissolved chemicals of concern from the underlying sediment to upwell into the surface water. To protect the cover materials, riprap armor will be placed over it. In order to construct the cover and key in the armor, a 1-foot deep trench will be constructed along the dock at the point of intersection between the slope and the berthing area. The anchor trench will provide a key for the temporary cover on the slope. A cross-section of the trench is shown on the attached figures.

(6) DESCRIPTION OF RESOURCES IN PROJECT AREA

A. Describe the existing physical and biological characteristics of each wetland or waterbody. Reference the wetland and waters delineation report if one is available. Include the list of items provided in the instructions.

Wetlands: N/A. Proposed maintenance activities would not impact any wetlands.

Waterway: The Willamette River is the waterbody in which the site dredging will occur. Its Cowardin classification is Riverine Tidal, Unconsolidated Bottom, Permanently flooded. At the proposed dredge site, the Willamette River is tidally influenced and substrate elevations vary. Substrate within the berthing area is primarily composed of fine-grained material (i.e., sand, silt, and clay), and substrate within the dredge prism includes material that has accumulated since the last dredging event (c.1993). Based on a 2017 bathymetric survey, the substrate elevations within the Portland Terminal dredge prism ranges from -20 feet CRD at the far northwest boundary and descend to -40 feet CRD near the southern boundary. Substrate elevations shallower than -35 CRD will be dredged within the berthing area. At the project site (RM 4.9), the ordinary high water elevation for the Willamette River is +14.9 feet CRD (+16.6 feet NGVD/+18 feet City of Portland Datum).[8] The dredge prism does not provide salmonid spawning habitat but is suitable for providing food for rearing and migrating juvenile salmonids. However, since most of the dredge prism is deeper than -20 feet CRD, most food production is likely derived from pelagic sources (rather than from the benthic environment). Cover material would be placed over the post-dredge side slope at elevations ranging from -2 to -34 feet CRD. However, a top layer of 2.5-inch D_{100} beach mix would be placed on top of the cover material to reduce the potential for piscivorous predation of salmonids and allow for benthic recolonization once sediments redeposit on this layer over time.

Within the Portland Harbor, the lower Willamette River (LWR) is located in the predominantly urban setting of the greater Portland metropolitan region. Ecological functions and services historically provided by the river have been highly degraded by development. The lower reach of the river (from RM 0 to 11.6) has been dredged to maintain the 40-foot-deep navigation channel for commercial shipping, while docks, piers, bulkheads (seawalls), placement of fill, and rock revetment (riprap) have replaced much of the natural bank habitat. Riparian habitat is discontinuous and limited by industrial development. The river has been channelized and off-channel areas developed; many tributaries have been piped; and the river has been disconnected from its floodplain as the lower valley was urbanized. Silt

[8] http://www.nwd-wc.usace.army.mil/nwp/Reports/Portland_Harbor.pdf

loading to the LWR has increased over historical levels due to logging, agriculture, road building, and urban and suburban development within the watershed. Historical development has also contributed to changes in water quality. The proposed project does not represent a significant disturbance over existing conditions.

The Willamette River, from RM 0 to 24.5, is currently listed on the Oregon Department of Environmental Quality (DEQ) 303(d) list as water quality limited for several parameters, including heavy metals, pesticides, bacteria, and temperature.[9] Contaminated sediments are present at discrete locations within Portland Harbor due to historical and ongoing releases of contamination from industrial sources in the Harbor, as well as from urban runoff and upstream sources. For these reasons, the Portland Harbor is currently designated as a Superfund Site by the Environmental Protection Agency (EPA). The Willamette River at the project site flows northwest and is approximately 1,500 feet wide.

From 1973 through 2007, average annual mean flow in the Willamette River was approximately 33,000 cubic feet per second at the Morrison Bridge (near RM 12.8) in Portland. Low flow typically occurs between September and early November, prior to the onset of winter rains. Flows generally increase in response to regional storms due to the highly developed, urban matrix surrounding the river. The large amount of impervious area in the Portland Metro region results in rapid runoff to the river during storm events. During periods of low and medium flows, tidal effects are evident up to Willamette Falls (RM 26.5). Additionally, reverse flow has been measured as far upstream as Ross Island (RM 15) during low flow periods.

The project site has been highly developed for industrial use and currently provides limited habitat for wildlife. The project site is located in Zone 5 (Site 5.4) of the Lower Willamette River Wildlife Habitat Inventory.[10] According to the inventory, wildlife habitat in this area has a rank of IV (lowest rank). The inventory states “although there is some vegetative cover, the vegetation is scattered and the area highly disturbed. The remainder of the bank tends to be riprapped, with minimal vegetative cover.”[11]

Physical/Chemical Tests: Historical sediment sampling occurred within the proposed dredge area in 2004 and 2005, and two surface grab samples (up to 1 foot deep) and two vibracore samples (up to 4 feet deep) were collected.[12] Both surface grab samples had one or more analyte detections above the SEF screening levels and ROD cleanup levels. These analytes included arsenic, mercury, nickel, total carcinogenic PAHs, and total PCBs. Both vibracore samples had one or more analytes detected at concentrations above these levels as well, including arsenic, mercury, total carcinogenic PAHs, total chlordane, dieldrin, total PCBs, and diesel range hydrocarbons.

Sediment sampling for chemical testing was recently conducted from September 6 to 9, 2017 in support of the proposed maintenance dredging. The sediment sample results are summarized in the Sediment Characterization Report (SCR). The sediment sampling consisted of six cores that were advanced between 5 and 9 feet below sediment surface and analyzed for conventional chemical and physical parameters. The results were generally consistent with past sediment results that identified chemicals of concern at levels that exceeded SEF screening levels and ROD cleanup levels within the dredge prism and leave surface (post-dredge surface that would remain after the dredged material is removed). The dredge prism analytical results included specific analytes that exceeded both the SEF screening level and ROD cleanup levels, which indicate the sediment dredge material would not be suitable for unconfined, aquatic disposal.[13] The results confirmed that future dredged sediment will be acceptable for disposal at a Resource Conservation and Recovery Act (RCRA) Subtitle D Landfill. None of the analytes detected in the dredge prism samples exceeded elutriate triggers, indicating dredged material is not expected to cause adverse water quality effects at the point of dredging.

A geotechnical investigation was conducted on October 18-19, 2018[14]. The investigation at the terminal consisted of three Cone Penetration Tests (CPTs) to a depth of 22-26 feet below sediment surface (bss), and four sediment cores to a depth of 5 feet bss. A total of six samples were collected and analyzed for grain size and hydrometer, moisture content, and organic content. A subset of four samples was analyzed for Atterberg limits and specific gravity due to insufficient recovery. The data were used to conduct a slope stability analysis which was performed using the computer program Slope/W by Geo-Slope International (2012). The model predicts the Factor of Safety associated with varying slope conditions including short and long term but drained and undrained under normal and seismic conditions. The side slope of 1.5H:1V was found to be stable for the sediment characteristics under all conditions except for long term drained seismic conditions which are not consistent with the intent of the cover material.

Engineering controls and conservation measures will be followed to manage and control any sheening that occurs in the water column during dredging or dewatering activities. The SCR results were reviewed by PSET through the SEF

[9] https://www.oregon.gov/deq/wq/Pages/WQ-Assessment.aspx
[10] City of Portland 1986. Lower Willamette River Wildlife Habitat Inventory, Bureau of Planning. March 1986.
[11] *Ibid*.
[12] AECOM 2017. Sampling and Analysis Plan. Portland Terminal, Portland, OR. August 25, 2017.
[13] AECOM 2017. Sediment Characterization Report. Portland Terminal, Portland, OR. October 31, 2017.
[14] AECOM 2018. Dredge Slope Stability Analysis at Seaport Midstream Portland Terminal. Technical Memo to TransMontaigne Management Services LLC. December 18, 2018.

process to inform potential sediment management planning efforts and evaluate project sediments under the Portland Harbor Superfund Site ROD. The PSET concurred with AECOM's SCR findings. The dredge prism was found to be "not suitable for unconfined, aquatic placement" per the SEF guidance.[15] Further, the post-dredge surface was also found to be "not suitable for unconfined, aquatic exposure" per EPA's ROD. Thus, at the request of the EPA, a temporary cover layer will be placed over the post-dredge surface to help prevent resuspension and disturbance of sediment contaminants at this location until the final remedy is completed at the site. A cover layer will also be placed over the dredged slope surface for the same purposes.

100-year Floodplain: The dredging project is located within the 100-year floodplain (Zone AE) and will be conducted completely below the mean lower low water line; it will not adversely affect flood storage capacity.

Endangered Species Act (ESA)-Listed and Sensitive Fish: Based on review of the National Marine Fisheries Service (NMFS) web site (http://www.nwr.noaa.gov) and Oregon Biodiversity Information Center (ORBIC) data acquired for the project in 2017, five federally listed salmonids are known to occur in the LWR (Table 1). Federally threatened bull trout (*Salvelinus confluentus*), Southern DPS green sturgeon (*Acipenser medirostris*), and eulachon (*Thaleichthys pacificus*) are not expected to occur in the LWR. Pacific lamprey (*Entosphenus tridentatus*) is a federal species of concern that occurs in the LWR.

Table 1. Federally Listed Salmonids that Occur within the Lower Willamette River

Salmonids	Federal Status
Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River ESU, spring & fall runs	Threatened
Chinook salmon (*O. tshawytscha*) Upper Willamette River ESU, spring run	Threatened
Coho salmon (*O. kisutch*) Lower Columbia River ESU	Threatened
Steelhead (*O. mykiss*), Lower Columbia River DPS, winter run	Threatened
Steelhead (*O. mykiss*) Upper Willamette River DPS	Threatened

ESU= Evolutionary Significant Unit; DPS= Distinct Population Segment

Salmonids that were spawned in the Willamette River or its tributaries may utilize the project area for rearing and/or migration. Adult salmonids tend to move upstream in a directed migration pattern, utilizing deeper water habitats more frequently than juvenile salmonids. Some adult salmonids (e.g., spring Chinook and winter steelhead) may hold in shallow or deep-water areas of the LWR for several weeks prior to spawning in upstream tributaries. Use of the project area by most juvenile salmonids would be limited to the peak outmigration period, which generally runs from March through June. Juvenile salmonids, particularly sub-yearling Chinook salmon that were spawned in the Willamette River or its tributaries, may utilize shoreline or off-channel rearing areas during their migration. Fall and spring Chinook salmon that out-migrate during their first year of life are expected to use the action area for longer periods than yearling spring Chinook salmon and steelhead trout, which tend to migrate further offshore and swim more rapidly through the LWR. Lower abundances of juvenile Chinook salmon may be present during fall and winter, but higher water temperatures likely preclude juvenile rearing during summer and early fall.

ESA-Listed and Sensitive Wildlife and Plants: Steller sea lion (*Eumetopias jubatus*) and California sea lions (*Zalophus californianus*) also are found in the LWR and some migrate to Willamette Falls to feed on salmon, steelhead, and sturgeon. Although not listed, these species are protected under the Marine Mammal Protection Act (MMPA) of 1972.

The bald eagle (*Haliaeetus leucocephalus*) was removed from the ESA list by the US Fish and Wildlife Service (USFWS), and ESA consultation is no longer required (72 FR 37373). However, bald eagles will continue to be protected under the Bald and Golden Eagle Protection Act (16 United States Code [U.S.C.] 668a-d), Migratory Bird Treaty Act (16 U.S.C 703-712), and the National Bald Eagle Management Guidelines. In the Willamette River, the closest bald eagle nest sites (Forest Park, Smith Lake, and near the Sauvie Island Bridge) are located within 2 miles of the project, and bald eagles are occasionally observed roosting along the shoreline of the LWR. However, based on the proposed nature of dredging work, no effects to bald eagles are anticipated.

Tricolored blackbird (*Agelaius tricolor*) is a federal species of concern that has been observed in the vicinity of the site. State-listed wildlife species may also occur in the vicinity of the project site, including the bald eagle, American peregrine falcon (*Falco peregrinus*), great blue heron (*Ardea herodias*), double-crested cormorant (*Phalacrocorax auritus*), great egret (*Ardea alba*), osprey (*Pandion haliaetus*), and red-tailed hawk (*Buteo jamaicensis*), and painted turtle (*Chrysemys picta*). No habitat exists in the project area for any state or federally listed plant species.

Cultural Resources: The proposed dredging would occur on submerged sediment that was dredged to the same depth in 1993 when the dock facility was constructed; therefore, the possibility of encountering cultural resources is considered very low, and no further site investigations or archaeological monitoring is recommended. Dredged

[15] PSET 2018. Level 2 Dredged Material Suitability Determination for Maintenance Dredging of TLP's (formerly BP US Pipelines and Logistics) Portland Terminal on the Lower Willamette River (RM 5.1W). February 5, 2018.

sediments would be disposed at an authorized upland disposal site . If any cultural artifacts are discovered during the course of the project, dredging activities will cease immediately, and a qualified (staff) archaeologist and the State Historic Preservation Office will both be notified before dredging is allowed to continue.
B. Describe the existing navigation, fishing and recreational use of the waterbody or wetland.
The LWR is primarily used for navigation and industrial uses. Berth dredging would maintain access for deep and shallow-draft vessels that navigate to and call at the terminal. Being within a Superfund Site, limited fishing and recreation occur in the Portland Harbor, but these are not the primary uses. Although the berthing area could provide some deep-water fishing or recreational opportunities when it is not in use, no public access is allowed at the terminal facility or dock. The Willamette River is approximately 0.25-mile wide at the project location; therefore, it is wide enough such that the proposed project would not prohibit navigation, fishing, and recreational uses.

(7) PROJECT SPECIFIC CRITERIA AND ALTERNATIVES ANALYSIS

Describe project-specific criteria necessary to achieve the project purpose. Describe alternative sites and project designs that were considered to avoid or minimize impacts to the waterbody or wetland.[16]

The proposed project is a maintenance activity specific to the project location. Dredging depth must be able to accommodate ship berth elevations for current and expected future vessels that dock at the facility. The -34 foot CRD dredge design depth is the original design depth, and was the depth of the most recent authorized dredging activity at the project site in 1993. This depth has been determined to be sufficient for expected future vessels under current ownership. Dredging to a depth of -35 feet CRD is necessary to allow for placement of a one-foot cover layer to meet EPA and SEF requirements. A No Action Alternative would not meet the purpose of restoring the berth to its original design depth and would not accommodate ongoing authorized maritime activities. Removal of sediment within the berthing area will result in a bank cut that increases the slope angle beneath the adjacent dock. Consequently, additional material will be removed from the slope to reach a stable angle of no steeper than 1.5H:1V which will reduce the potential for sediment fallback that could occur from steepened slopes. The dredge slope area will receive a cover layer similar to the berthing area and riprap armor to prevent propeller wash and current from displacing it. In addition to the armor, 6 inches of 2.5-inch beach mix will be placed within the interstitial spaces of the riprap on the slope to minimize impacts on fish habitat. This smaller stone will be placed in lieu of larger stone that would be more protective against propeller wash but less fish-friendly.

(8) ADDITIONAL INFORMATION

Are there state or federally listed species on the project site?	☑ Yes	☐ No	☐ Unknown
Is the project site within designated or proposed critical habitat?	☑ Yes	☐ No	☐ Unknown
Is the project site within a national Wild and Scenic River ?	☐ Yes	☑ No	☐ Unknown
Is the project site within a State Scenic Waterway?	☐ Yes	☑ No	☐ Unknown
Is the project site within the 100-year floodplain?	☑ Yes	☐ No	☐ Unknown

If yes to any of the above, explain in Block 6 and describe measures to minimize adverse effects to these resources in Block 7.

Is the project site within the Territorial Sea Plan (TSP) Area? **If yes, attach TSP review as a separate document for DSL.**	☐ Yes	☑ No	☐ Unknown
Is the project site within a designated Marine Reserve? **If yes, certain additional DSL restrictions will apply.**	☐ Yes	☑ No	☐ Unknown
Will the overall project involve ground disturbance of one acre or more? **If yes, you may need a 1200-C permit from the Oregon Department of Environmental Quality (DEQ).**	☐ Yes	☑ No	☐ Unknown
Is the fill or dredged material a carrier of contaminants from on-site or off- site spills?	☑ Yes	☐ No	☐ Unknown

[16] Not required by the Corps for a complete application, but is necessary for individual permits before a permit decision can be rendered.

Has the fill or dredged material been physically and/or chemically tested? **If yes, explain in Block 6 and provide references to any physical/chemical testing report(s).**	☑ Yes	☐ No	☐ Unknown
Has a cultural resource (archaeological) survey been performed on the project area? **If yes, provide a copy of the survey with this application to the Corps only. Do not describe any resources in this document.**	☑ Yes	☐ No	☐ Unknown

Will the project result in new impervious surfaces or the redevelopment of existing surfaces? Yes ☐ No ☒
If yes, the Applicant must submit a post-construction stormwater management plan to DEQ's 401 WQC program for review and approval, see http://www.deq.state.or.us/wq/sec401cert/docs/stormwaterGuidelines.pdf

Identify any other federal agency that is funding, authorizing or implementing the project.

Agency Name	Contact Name	Phone Number	Most Recent Date of Contact
US EPA	Hunter Young	503.326.5020	4/25/19

List other certificates or approvals/denials required or received from other federal, state or local agencies for work described in this application. For example, certain activities that require a Corps permit also require 401 Water Quality Certification (WQC) from Oregon Department of Environmental Quality (DEQ). For DEQ, please note that all projects that qualify for a Nationwide 401 WQC will be invoiced a fee. Projects that do not qualify for the Nationwide certification will be invoiced based on project complexity. See http://www.oregon.gov/deq/wq/wqpermits/Pages/Section-401-Fees.aspx

Agency	Certificate/ approval / denial description	Date Applied
DSL	Sand and Gravel Removal Application	Concurrent with original and updated JPA. Re-submitted application with updated removal volume on 5/30/19.
DEQ	401 Water Quality Certification (required for all projects in the Portland Harbor).	Concurrent with original and updated JPA. Project changes require WQC review.
NMFS	Biological Opinion (BiOp)	BA submitted with original JPA. Original BiOp issued on 5/24/18. BA amendment submitted with updated JPA. New BiOp will be completed by 6/14/19.
City of Portland Bureau of Development Services	Land Use Compatibility Statement (LUCS)	Received 11/9/17

Other DSL and/or Corps Actions Associated with this Site (Check all that apply.)

☐ Work proposed on or over lands owned by or leased from the Corps (may require authorization pursuant to 33 USC 408).

☑ State owned waterway	DSL Waterway Lease #	
☑ Other Corps or DSL Permits	Corps # 92-00933	DSL #
☐ Violation for Unauthorized Activity	Corps #	DSL #
☐ Wetland and Waters Delineation	Corps #	DSL #

Submit the entire delineation report to the Corps; submit only the concurrence letter (if complete) and approved maps to DSL. If not previously submitted to DSL, send under a separate cover letter.

(9) IMPACTS, RESTORATION/REHABILITATION, AND COMPENSATORY MITIGATION

A. Describe unavoidable environmental impacts that are likely to result from the proposed project. Include permanent, temporary, direct, and indirect impacts.

- Some direct temporary and permanent impacts will result from sediment removal from the berthing area. Temporary increases in turbidity and loss/disturbance of some benthic macroinvertebrates will result from dredging and cover placement activities. Placement of a 2.5-inch D_{100}beach mix habitat layer over the armored side slope will reduce habitat impacts from riprap placement. Benthic invertebrates are expected to recolonize the dredge prism and side slope area following project activities. Recovery will be enhanced through sediment accretion over time. Removal of contaminated sediments will result in a net improvement in sediment quality at the project site. River sediments will be placed on a barge and transported to a transload facility and disposal at an approved disposal site.

- Temporary impacts (e.g., noise, barge movement) would occur from construction activity during dredging and cover placement operations.

- Dredged material will be replaced with up to one foot of cover material in the berthing area that will provide a means to minimize contaminant resuspension and provide a physical barrier for leave surface sediments. Over the dredged sediment surface on the slope beneath and behind the dock, up to 2 feet of cover material will be placed. The top layer would fill interstitial spaces of the riprap on the slope and would approximately meet NMFS' sediment size gradation requirements. Benthic recovery on the shallow water side slopes will be enhanced through sediment accretion over time.

B. For temporary removal or fill or disturbance of vegetation in waterbodies, wetlands or riparian (i.e., streamside) areas, discuss how the site will be restored after construction to include the timeline for restoration.

One extra foot of sediment is proposed for removal within the area proposed for dredging within the berthing area. After dredging is complete, a 1-foot-thick cover of sediment material will be placed over the dredged area in the berthing area to bring the final elevation to -34 feet CRD. This amended sediment material is intended to cover any potentially contaminated sediment and remain in place until the final remedy for the site is completed. Over the dredged sediment surface on the slope beneath and behind the dock, up to 2 feet of cover material will be placed. No permanent or temporary vegetation disturbance is proposed.

Compensatory Mitigation

C. Proposed mitigation approach. Check all that apply:

☐ Permittee-responsible Onsite Mitigation	☐ Permittee-responsible Offsite mitigation	☒ Mitigation Bank or in-lieu fee program	☐ Payment to Provide (not approved for use with Corps permits)

D. Provide a brief description of mitigation approach and the rationale for choosing that approach. If you believe mitigation should not be required, explain why.

The project would remove and dispose of contaminated sediment within the Portland Harbor Superfund Site and cover the dredged area in the berthing area with approximately 1-foot of clean sediment. The new cover materials are expected to provide a functional improvement to water quality and reduce exposure of aquatic organisms to sediment contaminants following dredging activities. In addition to the carbon amendment material and the protective armor placed on the dredge slope, an additional 6 inches of beach mix will be placed to minimize impacts on fish habitat. This smaller material will be placed in lieu of larger stone that would be more protective against propeller wash but less fish-friendly. This material would not be stable under extreme propeller wash conditions but future inspections will evaluate if additional type or size of material is needed in future years. The 2.5-inch D_{100} diameter material was selected consistent with past projects on the Willamette River and would meet NMFS' recommended sediment size gradation for optimal habitat.

In addition, NMFS prepared a Habitat Equivalency Analysis (HEA), which is a model that allows NMFS to assess the value of habitat for species at a site listed under the ESA[17]. Using HEA, NMFS compares habitat value at a site before a project is implemented with the habitat value after a project is completed. Value is measured in discounted service acre years, or DSAYs. HEA can also account for the time it takes habitats to become fully functional by discounting the value, generally at a rate of 3% per year. The NMFS HEA assessment found that the habitat value is reduced by 3.2 DSAYs due to the proposed action.

[17] USACE et al. 2016. Permitting assistance tools for bankwork projects in or near Portland Harbor. Prepared by USACE, NOAA, DEQ. November 2016.

The applicant has agreed to purchase 3.2 DSAY credits from RestorCap, LLC, on behalf of Linnton Water Credits, LLC (LWC). These credits will be generated from LWC's Linnton Restoration Project. This project is adjacent to the project site and involves transforming an existing industrial parcel along the Willamette River into a habitat site that includes new off-channel habitat, enhanced shallow water and active channel margin habitats, and new/restored riparian and upland forested habitat. The mitigation bank purchase was selected because NMFS will accept Natural Resource Damage (NRD) Credits approved by the Portland Harbor Trustee Council (Trustee Council) for use by parties wishing to settle potential ESA liabilities. This is also a more rapid and easier way for the applicant to demonstrate mitigation for the project than if they were to perform their own on-site mitigation. A receipt showing proof of purchase of the DSAY credits will be provided to DSL in mid-June 2019 so that DSL can issue a removal fill permit for the project.

Dredging and cover placement will occur within the Willamette River in-water work period (July 1 to October 31) to minimize impacts to ESA-listed fish species. There is no Submerged Aquatic Vegetation (SAV) at the project site. The benthic populations that exist in the sediment will reestablish itself in the new sediment cover substrate provided, particularly when sediments accumulate on top of the cover layer. Dredging will result in a net increase in the flood storage capacity of the river, slightly reducing the risk of flood hazards compared to existing conditions.

Mitigation Bank / In-Lieu Fee Information:
Name of mitigation bank or in-lieu fee project:
RestorCap, LLC on behalf of Linnton Water Credits, LLC

Type of credits to be purchased: 3.2 DSAY credits

If you are proposing permittee-responsible mitigation, have you prepared a compensatory mitigation plan? NA

☐ Yes. Submit the plan with this application and complete the remainder of this section.

☐ No. A mitigation plan will need to be submitted (for DSL, this plan is required for a complete

Mitigation Location Information (Fill out only if permittee-responsible mitigation is proposed)

Mitigation Site Name/Legal Description	Mitigation Site Address	Tax Lot #
County	City	Latitude & Longitude (in DD.DDDD format)

Township	Range	Section	Quarter/Quarter

(10) ADJACENT PROPERTY OWNERS FOR PROJECT AND MITIGATION SITE

☐ **Pre-printed mailing labels of adjacent property owners attached separately.**	**Project Site Adjacent Property Owners**	**Mitigation Site Adjacent Property Owners**
Contact Name **Address 1** **Address 2** **City, ST ZIP Code**	Shore Terminals, LLC. ATTN: Tillman Davis PO Box 780339 San Antonio, TX 78230	
Contact Name **Address 1** **Address 2** **City, ST ZIP Code**	ExxonMobil Oil Corp. Property Tax Division PO Box 53 Houston, TX 77001	
Contact Name **Address 1** **Address 2** **City, ST ZIP Code**	Linnton Water Credits LLC. 3317 17th Street #200 Oakland, CA 94612	

(10) CITY/COUNTY PLANNING DEPARTMENT LAND USE AFFIDAVIT (TO BE COMPLETED BY LOCAL PLANNING OFFICIAL)

I have reviewed the project described in this application and have determined that:

☐ This project is not regulated by the comprehensive plan and land use regulations.

☒ This project is consistent with the comprehensive plan and land use regulations.

☐ This project will be consistent with the comprehensive plan and land use regulations when the following local approval(s) are obtained:

- ☐ Conditional Use Approval
- ☐ Development Permit
- ☐ Other Permit (see comment section)

☐ This project is not consistent with the comprehensive plan. Consistency requires:

- ☐ Plan Amendment
- ☐ Zone Change
- ☐ Other Approval or Review (see comment section)

An application ☐ has ☐ has not been filed for local approvals checked above.

Local planning official name (print)	Title	City / County (circle one)
Lara Lehman	City Planner	Portland

Signature	Date
	11.9.17

Comments:
Dredging and channel maintenance are exempt from Greenway Review per PCC 33.440.320.H.

(11) COASTAL ZONE CERTIFICATION

If the proposed activity described in your permit application is within the Oregon coastal zone, the following certification is required before your application can be processed. A public notice will be issued with the certification statement, which will be forwarded to the Oregon Department of Land Conservation and Development (DLCD) for its concurrence or objection. For additional information on the Oregon Coastal Zone Management Program, contact DLCD at 635 Capitol Street NE, Suite 150, Salem, Oregon 97301 or call 503-373-0050.

CERTIFICATION STATEMENT

I certify that, to the best of my knowledge and belief, the proposed activity described in this application complies with the approved Oregon Coastal Zone Management Program and will be completed in a manner consistent with the program.

Not Applicable—Not within the Oregon coastal zone.

Print /Type Name	Title
Signature	Date

(13) SIGNATURES

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and, to the best of my knowledge and belief, this information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities. By signing this application I consent to allow Corps or DSL staff to enter into the above-described property to inspect the project location and to determine compliance with an authorization, if granted. I hereby authorize the person identified in the authorized agent block below to act in my behalf as my agent in the processing of this application and to furnish supplemental information in support of this permit application. I understand that the granting of other permits by local, county, state or federal agencies does not release me from the requirement of obtaining the permits requested before commencing the project. I understand that payment of the required state processing fee does not guarantee permit issuance.

To be considered complete, the fee must accompany the application to DSL. The fee is not required for submittal of an application to the Corps.

Fee Amount Enclosed	$4,349 [$805 x 5 years (commercial operators fill base fee) + $324 (fill volume fee)]

Applicant Signature (required) must match the name in Block 2

Print Name Michael Hammell	Title General Counsel and Secretary
Signature [signature]	Date 6/11/19

Authorized Agent Signature

Print Name Andy Clodfelter	Title Fisheries Biologist/ESA Specialist
Signature [signature]	Date 6/11/19

Landowner Signature(s)*

Landowner of the Project Site (if different from applicant)

Print Name	Title
Signature	Date

Landowner of the Mitigation Site (if different from applicant)

Print Name	Title
Signature	Date

Department of State Lands, Property Manager (to be completed by DSL)

If the project is located on state-owned submerged and submersible lands, DSL staff will obtain a signature from the Land Management Division of DSL. A signature by DSL for activities proposed on state-owned submerged/submersible lands only grants the applicant consent to apply for a removal-fill permit. A signature for activities on state-owned submerged and submersible lands grants no other authority, express or implied and a separate proprietary authorization may be required.

Print Name	Title
Signature	Date

* Not required by the Corps.

(14) ATTACHMENTS

- ☑ Drawings
  - ☑ Location map with roads identified
  - ☑ U.S.G.S topographic map
  - ☑ Tax lot map
  - ☑ Site plan(s)
  - ☑ Cross section drawing(s)
  - ☑ Recent aerial photo
  - ☐ Project photos
  - ☐ Erosion and Pollution Control Plan(s), if applicable
  - ☐ DSL/Corps Wetland Concurrence letter and map, if approved and applicable
- ☐ Pre-printed labels for adjacent property owners (Required if more than 5)
- ☑ **Incumbency Certificate** if applicant is a partnership or corporation
- ☐ Restoration plan or rehabilitation plan for temporary impacts
- ☑ Mitigation Plan
- ☐ Wetland functional assessment and/or stream functional assessment
- ☐ Alternatives analysis
- ☐ Biological assessment (if requested by Corps project manager during pre-application coordination.)
- ☐ Stormwater management plan (may be required by the Corps or DEQ)
- ☑ Response to DSL Comments

Send Completed form to:

U.S. Army Corps of Engineers
ATTN: CENWP-OD-GP
PO Box 2946
Portland, OR 97208-2946
Phone: 503-808-4373
portlandpermits@usace.army.mil

Counties:
Baker, Clackamas, Clatsop, Columbia, Gilliam, Grant, Hood River, Lincoln, Malheur, Morrow, Multnomah, Polk, Sherman, Tillamook, Umatilla, Union, Wallowa, Wasco, Washington, Wheeler, Yamhill

OR

U.S. Army Corps of Engineers
ATTN: CENWP-OD-GE
211 E. 7th AVE, Suite 105
Eugene, OR 97401-2722
Phone: 541-465-6868
portlandpermits@usace.army.mil

Counties:
Benton, Coos, Crook, Curry, Deschutes, Douglas, Jackson, Jefferson, Josephine, Harney, Klamath, Lake, Lane, Linn, Marion

Send Completed form to:

DSL - West of the Cascades:

Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279
Phone: 503-986-5200

OR

DSL - East of the Cascades:

Department of State Lands
1645 NE Forbes Road, Suite 112
Bend, Oregon 97701
Phone: 541-388-6112

Send all Fees to:
Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279
Pay by Credit Card Online:
https://apps.oregon.gov/dsl/EPS/

INCUMBENCY CERTIFICATE

TLP Management Services LLC (entity name as recorded with the Secretary of State, Oregon)

I, Michael A. Hammell, do hereby certify that:

1. I am the duly elected and acting General Counsel and Secretary (position) of TLP Management Services LLC (entity name as recorded with the Secretary of State, Oregon), a limited liability company (entity type) organized and existing in good standing under the laws of the State of Oregon (the "Entity"); and

2. I have the authority to submit, on behalf of the Entity, this application for a permit to conduct removal-fill within waters of the state (as evidenced by my signature on the application) and to commit the Entity to comply with all resulting permit conditions, including any mitigation obligations, resulting from the issuance of the permit.

Witness, my signature and the seal of the Entity this 5th day of January, 20~~17~~ 18.

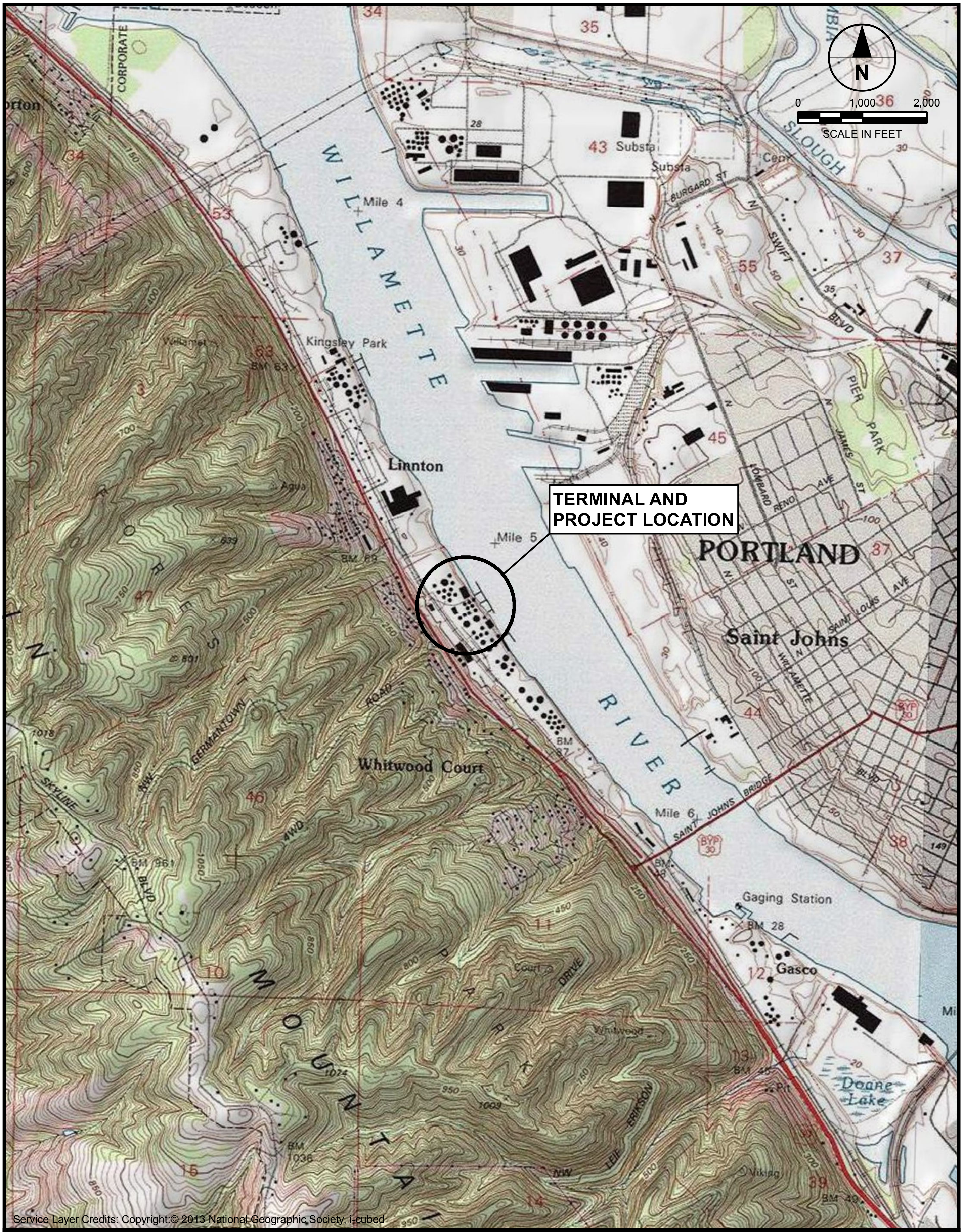
[signature]

Signature

Name: Michael A. Hammell

Title: General Counsel and Secretary

Figures



Filename: K:\BP\MXD\2017_JPA\Fig 1 Location Map.mxd

SeaPort Midstream Partners, LLC
Portland Terminal
Maintenance Dredging
9930 NW St. Helens Road, Portland, Oregon
Project No.: 60558028 Date:2017-12-04

Location Map

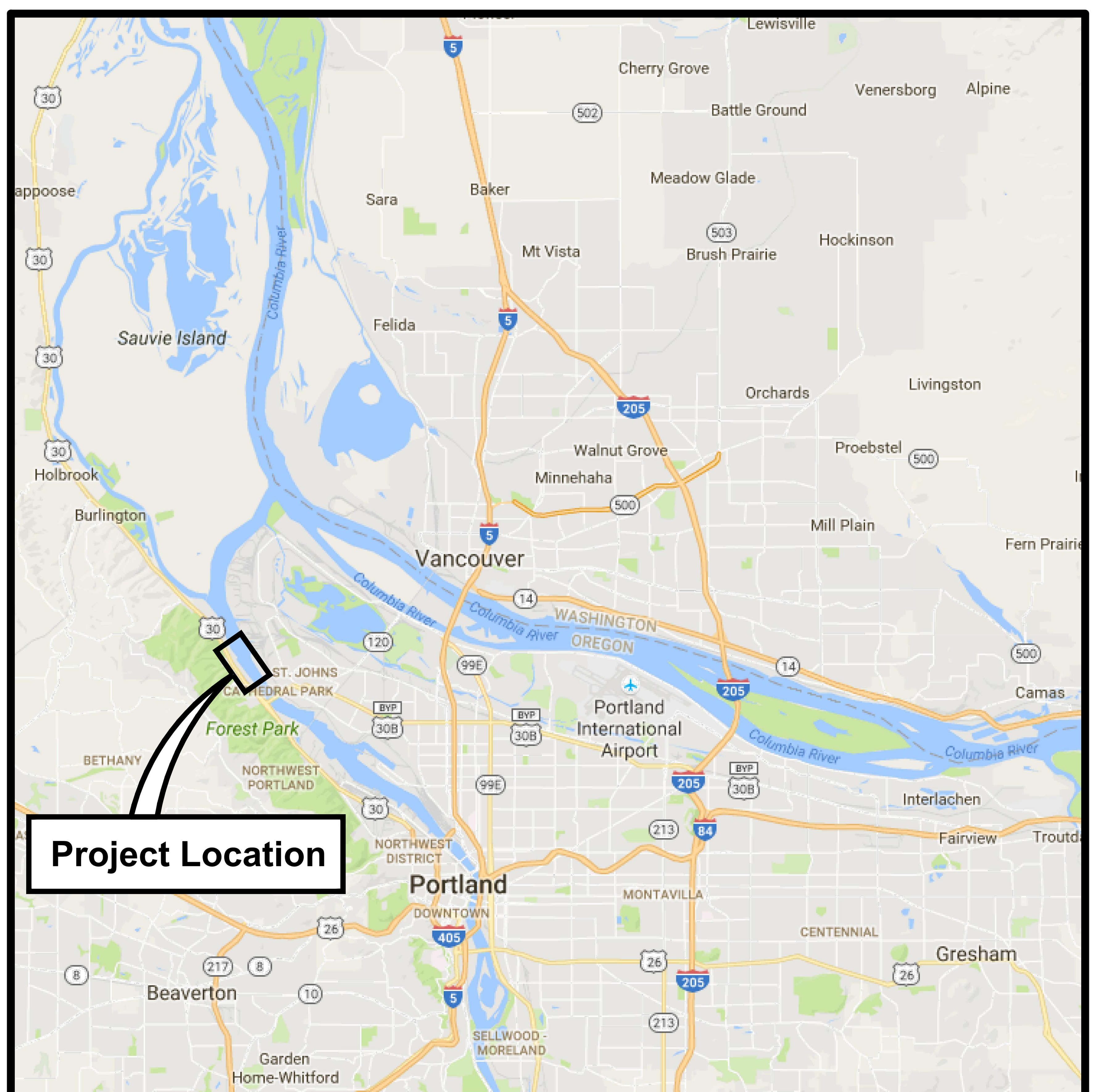
AECOM

Figure: 1

PORTLAND TERMINAL MAINTENANCE DREDGING

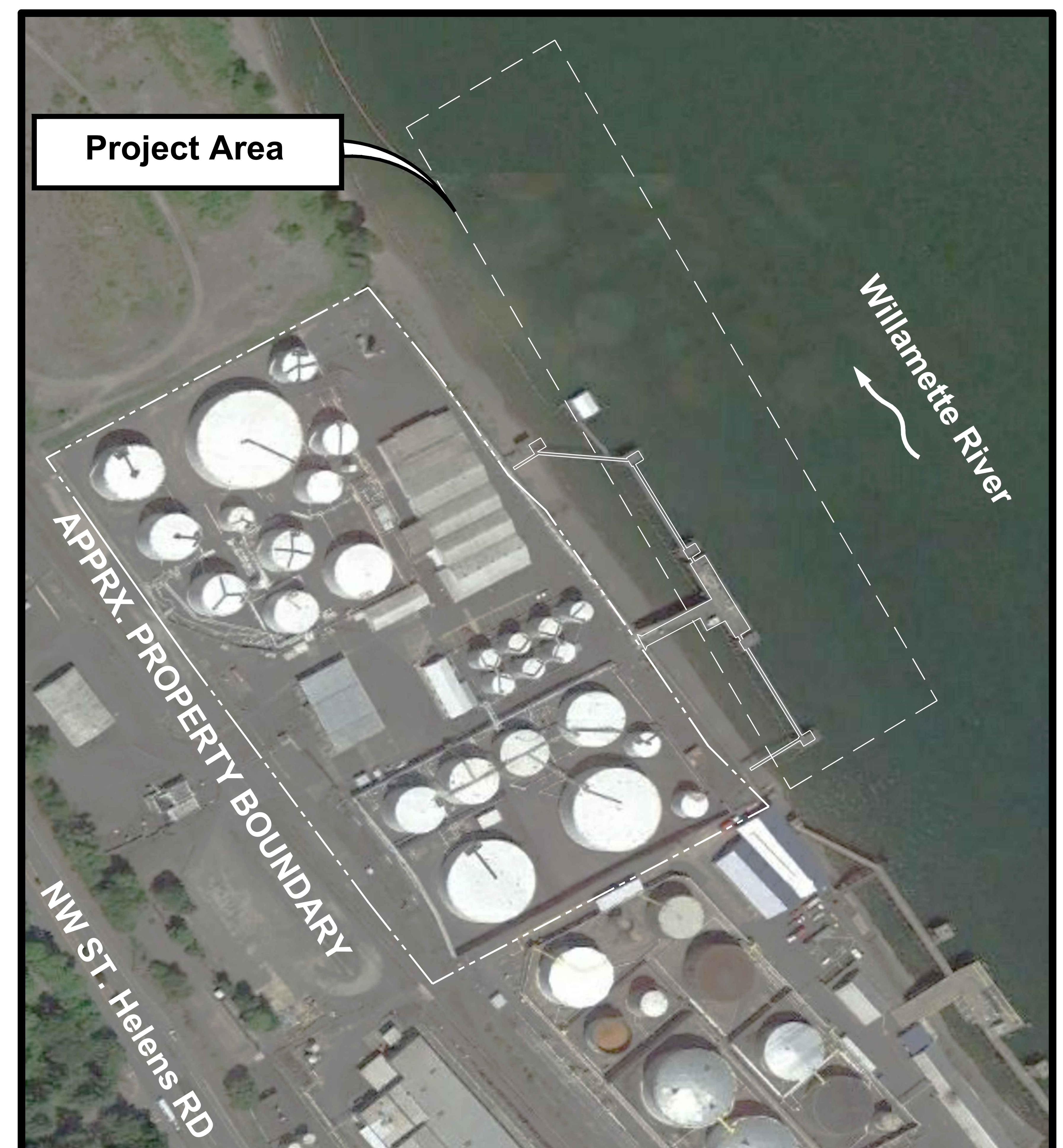
DRAWING INDEX

SHEET #	FIGURE #	SHEET TITLE
1	G-01	TITLE SHEET, VICINITY MAP, AND LOCATION
2	G-02	GENERAL NOTES
3	C-01	EXISTING CONDITIONS AND TURBIDITY MONITORING
4	C-02	DREDGE PLAN
5	C-03	TEMPORARY COVER FOR BERTH
6	C-04	TEMPORARY COVER FOR SLOPE
7	C-05	CROSS SECTIONS



VICINITY MAP

NTS



SITE MAP

NTS

AECOM

PROJECT

PORTLAND TERMINAL MAINTENANCE ISSUE FOR PERMIT

CLIENT

SEAPORT MIDSTREAM PARTNERS, LLC
Portland Terminal
9930 NW ST. Helens Road
Portland, Oregon

CONSULTANT

AECOM
111 SW Columbia St, Suite 1500
Portland Oregon 97201
503.222.7200 tel 503.222.4292 fax
www.aecom.com

REGISTRATION

PRELIMINARY
NOT FOR CONSTRUCTION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
4	2019-01-07	ISSUE FOR PERMIT
3	2018-04-30	ISSUE FOR BID
2	2018-03-25	90% DESIGN/ISSUE FOR PERMIT
1	2018-02-09	60% DESIGN
0	2017-09-01	30% DESIGN

PROJECT NUMBER

60558028

SHEET TITLE

TITLE SHEET, VICINITY MAP, AND LOCATION

SHEET NUMBER

G-01

ANSI D 22" x 34"

Project Management Initials: Designer: Checked: Approved:

Last saved by: BOSSALINID(2019-01-02) Last Plotted: 2019-01-02
Filename: K:\60558028 SEAPORT SEDIMENT DREDGING\900-CAD_GIS\910-CAD\20-SHEETS\CONSTRUCTION DRAWINGS\ISSUE FOR PERMIT\G-01.DWG

Printed on ___% Post-Consumer Recycled Content Paper

ABBREVIATIONS:

CL	CENTER LINE
CONC.	CONCRETE
CPD	CITY OF PORTLAND DATUM
CRD	COLUMBIA RIVER DATUM
CY	CUBIC YARD
DWG	DRAWING(S)
EA	EACH
EL.	ELEVATION
EXIST.	EXISTING
FT(')	FOOT(FEET)
IN(")	INCH(ES)
MAX	MAXIMUM
MIN	MINIMUM
OHWL	ORDINARY HIGH WATER
OLW	ORDINARY LOW WATER
MHHW	MEAN HIGHER HIGH WATER
MHW	MEAN HIGH WATER
MLW	MEAN LOW WATER
MLLW	MEAN LOWER LOW WATER
REF	REFERENCE
SF	SQUARE FEET
TYP	TYPICAL
USGS	U.S. GEOLOGICAL SURVEY

SITE INFORMATION:

FOR PROPERTY LINES SEE SHEET 03

* CITY = PORTLAND
* COUNTY = MULTNOMAH
* TAX MAP #SECTION 02 1N 1W
* TAX LOT #400

SURVEY CONTROL:

HORIZONTAL DATUM: NAD83, STATE PLANE OREGON NORTH, INTERNATIONAL FEET

VERTICAL DATUM: CRD

CONTROL BENCHMARKS: SITE HORIZONTAL AND VERTICAL CONTROL

BENCHMARK: 1	BENCHMARK: 2
NORTHING: 710732.573'	NORTHING: 711425.518'
EASTING: 7619065.482'	EASTING: 7618556.522'
ELEVATION: 29.55'	ELEVATION: 28.43'
DESCRIPTION: 1" DIAMETER NAIL STAMPED "MAG SPIKE SURVEY MARK" SET IN NE CORNER OF CONCRETE MOORING BLOCK	DESCRIPTION: 1" DIAMETER NAIL STAMPED "MAG SPIKE SURVEY MARK" SET IN NE CORNER OF CONCRETE MOORING BLOCK

TIDAL INFORMATION:

TIDES ARE ACCORDING TO THE MORRISON BRIDGE NOAA TIDE PREDICTION STATION (#9439221). USGS MAINTAINS A RIVER LEVEL GAGE (#14211720) AT THIS LOCATION.

OHWL	14.9 FT CRD
MHHW	5.3 FT CRD
MHW	4.8 FT CRD
MLW	1.9 FT CRD
MLLW	1.6 FT CRD

GENERAL NOTES:

1. ALL WORK PERFORMED AND MATERIALS INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS AND ORDINANCES. CONTRACTOR SHALL GIVE ALL NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK.
2. IN THE EVENT OF AN EMERGENCY MOVE ALL WORKERS AND EQUIPMENT TO AN AREA DIRECTED BY THE OWNER.
3. THE WORK SHALL INCLUDE FURNISHING ALL MATERIALS, EQUIPMENT, APPURTENANCES AND LABOR NECESSARY TO COMPLETE ALL WORK AS INDICATED ON THE DRAWINGS AND IN THE SPECIFICATIONS.
4. THE CONTRACTOR SHALL RECEIVE IN WRITING, AUTHORIZATION TO PROCEED BEFORE STARTING WORK ON ANY ITEM NOT CLEARLY DEFINED OR IDENTIFIED BY THE CONTRACT DOCUMENTS. WORK PERFORMED WITHOUT WRITTEN AUTHORIZATION PRIOR TO THE START OF WORK WILL NOT BE PAID.
5. CONTRACTOR TO COORDINATE ALL SITE ACTIVITIES WITH THE OWNER AND ENGINEER ON A DAILY BASIS.
6. THE CONTRACTOR SHALL SUPERVISE AND DIRECT ALL THE WORK. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES FOR COORDINATING ALL PORTIONS OF THE WORK UNDER THE CONTRACT.
7. THE CONTRACTOR SHALL MAKE NECESSARY PROVISIONS TO PROTECT EXISTING DOCK, PAVING, UTILITIES, ETC. FURTHER INFORMATION AS TO LIABILITY IS IN SPECIFICATION.
8. CONTRACTOR ASSUMES FULL RESPONSIBILITY FOR PROTECTION OF EXISTING FACILITIES FROM DAMAGE DUE TO CONTRACTOR'S OPERATIONS. ANY DAMAGE CAUSED BY THE CONTRACTOR SHALL BE REPAIRED BY THE OWNER UNLESS OTHERWISE AGREED TO IN WRITING AND AT NO COST TO THE OWNER.
9. CONTRACTOR STAGING AND EMPLOYEE PARKING WILL BE RESPONSIBILITY OF THE CONTRACTOR.
10. SURVEY INFORMATION PROVIDED IN NAD83 OREGON STATE PLANE NORTH COORDINATE SYSTEM.
11. SURVEY PROVIDED BY SOLMAR HYDRO DATED JUNE 2012 AND DEC 2017.
12. LOCATIONS OF ALL EXISTING FACILITIES AS SHOWN ON THE DRAWINGS ARE BASED ON FIELD SURVEY, AS-BUILT DRAWINGS AND GIS INFORMATION. LOCATIONS ARE APPROXIMATE AND NOT GUARANTEED TO BE COMPLETE OR ACCURATE. LOCATIONS SHOULD BE FIELD VERIFIED BY CONTRACTOR AS REQUIRED.
13. CONTRACTOR SHALL MAINTAIN THE SITE CLEAR OF DEBRIS, SUCH AS PAPER, TRASH OR ANY OTHER DEPOSITS, ON A DAILY BASIS. ALL MATERIALS COLLECTED DURING CLEANING OPERATIONS SHALL BE DISPOSED OF OFF SITE BY THE CONTRACTOR.
14. WHERE A CONSTRUCTION DETAIL IS NOT SHOWN OR NOTED, THE CONTRACTOR SHALL REQUEST CLARIFICATION THROUGH AN RFI.
15. DETAILS ARE INTENDED TO SHOW END RESULT OF DESIGN. MINOR MODIFICATIONS MAY BE REQUIRED TO ACTUAL FIELD DIMENSIONS OR CONDITIONS, AND SUCH MODIFICATIONS SHALL BE INCLUDED AS PART OF THE WORK.
16. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL NOTES.

UTILITIES:

1. OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. YOU MAY OBTAIN COPIES OF THE RULES BY CALLING THE CENTER (503.232.1987).
2. CONTRACTOR TO FIELD VERIFY DEPTH AND LOCATION OF ANY EXISTING UNDERGROUND UTILITIES WITHIN THE WORK LIMITS PRIOR TO DREDGING AND NOTIFY THE OWNER AND ENGINEER OF ANY CONFLICT IMMEDIATELY.

DOCK STABILITY:

1. THE CONTRACTOR SHALL CHECK AND VERIFY DOCK IS STABLE DURING DREDGING OPERATION USING DAILY MEASUREMENTS. THE PLAN FOR OBTAINING DAILY MEASUREMENTS SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO COMMENCING DREDGING. ANY VERTICAL OR HORIZONTAL MOVEMENT OF THE DOCK SHALL BE NOTIFIED TO THE ENGINEER IMMEDIATELY. MORE DETAIL IS IN SPECIFICATION SECTION 01110.

CONSTRUCTION NOTES:

1. DESIGN AND CONSTRUCTION INFORMATION, IN ADDITION TO THE DESIGN DRAWINGS, MAY BE PRESENTED IN THE PROJECT DOCUMENTS. THE CONTRACTOR SHALL COMPLETE THE CONSTRUCTION TO MEET ALL THE REQUIREMENTS IDENTIFIED IN THESE DRAWINGS AND TECHNICAL SPECIFICATIONS.
2. THE CONTRACTOR SHALL IDENTIFY ANY DISCREPANCIES BETWEEN THE CONTRACT DOCUMENTS AND THE ACTUAL SITE CONDITIONS ENCOUNTERED PRIOR TO CONSTRUCTION IN WRITING TO THE OWNER. NO DEVIATIONS FROM THE PLANS OR SPECIFICATIONS SHALL BE COMPLETED BY THE CONTRACTOR, WITHOUT PRIOR, WRITTEN APPROVAL BY THE OWNER.
3. ALL PROJECT WORK SHALL BE PERFORMED WITHIN THE PROJECT BOUNDARY, IDENTIFIED ON THE DRAWINGS AND IN THE PERMITS. NO WORK SHALL BE PERFORMED OUTSIDE THE PROJECT BOUNDARY WITHOUT PRIOR, WRITTEN APPROVAL BY THE OWNER.
4. THE CONTRACTOR SHALL NOT ADDRESS PUBLIC REQUESTS FOR INFORMATION. ALL PUBLIC REQUESTS FOR INFORMATION SHALL BE DIRECTED TO THE OWNER FOR RESPONSE.
5. ALL CONSTRUCTION ACTIVITIES SHALL BE CONDUCTED FROM RIVER VESSELS AND BARGES. NO EQUIPMENT, WITH THE EXCEPTION OF SURVEY CONTROL POINT ESTABLISHMENT, SHALL BE STAGED FROM SHORE WITHOUT PRIOR WRITTEN APPROVAL.
6. THE CONTRACTOR SHALL DECONTAMINATE ANY EQUIPMENT THAT COMES IN CONTACT WITH THE SEDIMENT DURING THE DREDGING ACTIVITIES.
7. THE CONTRACTOR SHALL PREVENT THE MIGRATION OF CONSTRUCTION-RELATED DEBRIS, FUELS, LUBRICANTS, DREDGE RESIDUALS, OR OTHER POLLUTANTS INTO THE WATERWAY AND BEYOND THE WORK AREA.
8. THE CONTRACTOR SHALL INSPECT ALL EQUIPMENT DAILY TO ENSURE THE EQUIPMENT IS FREE OF LEAKS AND IS OPERATIONAL IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.

TEMPORARY COVER:

1. THE CONTRACTOR SHALL PLACE A 12 INCH COVER OVER THE BERTH AREA CONSISTING OF A CARBON AMENDMENT LAYER AND AN EROSION PROTECTION LAYER SIZED BASED ON PROPELLER SCOUR CALCULATIONS. THE UPPER ELEVATION OF THE LAYER WILL MAINTAIN THE FINAL ELEVATION (-34 FEET CRD) AS DESCRIBED IN THE SPECIFICATIONS SECTION 02325.
2. THE CONTRACTOR SHALL PLACE A STABLE COVER OVER THE SLOPE AREA CONSISTING OF A CARBON-AMENDED LAYER AND EROSION PROTECTION LAYER SIZED BASED ON PROPELLER SCOUR CALCULATIONS. THE CARBON AMENDMENT LAYER SHALL CONSIST OF MATERIAL IDENTIFIED ON THESE DRAWINGS. THE CARBON-AMENDMENT LAYER SHALL BE APPLIED TO ALL SLOPE DREDGE AREAS; SLOPE AREAS NOT DREDGED DO NOT REQUIRE CARBON-AMENDED MATERIAL BUT MAY BE COVERED WITH GEOSYNTHETIC TO ALLOW ANCHORING.
3. THE SOURCE OF ALL MATERIALS TO BE USED IN THE COVER SHALL BE SUBMITTED TO THE OWNER FOR APPROVAL, BEFORE MOBILIZING THE MATERIAL TO THE WORK AREA.
4. THE THICKNESS OF THE PLACED COVER LAYER SHALL BE VERIFIED AS DESCRIBED IN THE SPECIFICATIONS.

SURVEYING:

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND MAINTAINING SURVEY CONTROL POINTS AND VERIFYING THE GRADES THROUGHOUT THE CONSTRUCTION ACTIVITIES.
2. THE ACTUAL PROJECT BASELINE CONDITIONS ENCOUNTERED AT THE SITE MAY VARY FROM THOSE SHOWN AND IDENTIFIED IN THE PROJECT DOCUMENTS. ANY DIFFERENCES BETWEEN THE ACTUAL CONDITIONS ENCOUNTERED SHALL BE IDENTIFIED BY THE CONTRACTOR IN WRITING TO THE OWNER.
3. THE CONTRACTOR SHALL PROVIDE COMPLETE SURVEY COVERAGE TO THE EVENTS IDENTIFIED IN THE SURVEY SPECIFICATION.
4. OWNER APPROVAL OF THE SURVEY WILL BE BASED ON A 1-FOOT BY 1-FOOT GRIDDED DATA INTERPOLATION.
5. SURVEY DATA SHALL BE COLLECTED AND PRESENTED IN ACCORDANCE WITH TECHNICAL SPECIFICATION 01722.
6. BATHYMETRIC SURVEYING SHALL BE CONDUCTED DURING A PERIOD OF HIGH TIDE. MULTI-BEAM BATHYMETRIC SURVEY SHALL EXTEND TO THE HIGHEST ELEVATION ALLOWABLE ALONG THE WESTERN BOUNDARY OF THE AREA TO BE DREDGED, AND SHALL BE SUPPLEMENTED WITH SINGLE BEAM BATHYMETRIC SURVEY AS NEEDED TO ENSURE SURVEY COVERAGE.
7. BATHYMETRIC SURVEYING SHALL BE PERFORMED IN ACCORDANCE WITH THE US ARMY CORPS OF ENGINEERS PUBLICATION EM-1110-2-1003.
8. ALL SURVEYS SHALL BE COLLETED AND REPORTED TO THE PROJECT VERTICAL AND HORIZONTAL DATUM AS STATED IN THE SURVEY CONTROL SECTION OF THIS PAGE.

TURBIDITY MONITORING STATIONS:

1. DEPENDING ON PERMIT REQUIREMENTS, THE CONTRACTOR MAY BE REQUIRED TO MODIFY DREDGING ACTIVITIES OR STOP WORK IF THE DOWNCURRENT (COMPLIANCE) TURBIDITY READING EXCEEDS THE PERMITTED WATER QUALITY CRITERIA.
2. MONITORING STATION LOCATIONS SHOWN ON CONSTRUCTION DRAWINGS ARE APPROXIMATE. FINAL LOCATIONS WILL BE ESTABLISHED AFTER SITE SPECIFIC PERMIT CONDITIONS ARE ISSUED.
3. TURBIDITY CURTAINS SHALL BE DEPLOYED CONSISTENT WITH TECHNICAL SPECIFICATION 01562.

WASTE MANAGEMENT:

1. THE CONTRACTOR SHALL CONTAIN ALL WASTE, INCLUDING, BUT NOT LIMITED TO DREDGED SEDIMENT, DECON WATER, PPE, AND DEBRIS.
2. THE CONTRACTOR SHALL PROFILE THE WASTE PRIOR TO DISPOSAL AT A LICENSED DISPOSAL FACILITY, APPROVED BY THE OWNER.
3. THE CONTRACTOR SHALL PREPARE A WASTE PROFILE FOR THE SOLID WASTE, SEDIMENT AND DEBRIS, AS REQUIRED BY THE DISPOSAL FACILITY. TABLE 4 AND APPENDIX D OF AECOM'S OCTOBER 31, 2017 SEDIMENT CHARACTERIZATION REPORT INCLUDES THE SAMPLE TABLES AND LABORATORY REPORTS FOR PREPARING THE SEDIMENT WASTE PROFILE.
4. ADDITIONAL TREATMENT INCLUDING STABILIZATION, IF NEEDED, OF SEDIMENT TO BE COORDINATED AT TRANSLOADING FACILITY.
5. SEDIMENT TRANSLOADING FACILITY SHALL FOLLOW THE PERMIT REQUIREMENTS SO SEDIMENT IS CONTAINED DURING TRANSFER FROM WATERTIGHT BARGE.
6. THE CONTRACTOR SHALL PREPARE A WASTE PROFILE FOR THE DISPOSAL OF CONSTRUCTION WATER. REPRESENTATIVE SAMPLES ARE REQUIRED FOR EACH TYPE OF WASTE WATER GENERATED DURING CONSTRUCTION ACTIVITIES AT THE PORTLAND TERMINAL. THE WATER SAMPLE SHALL BE TESTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE APPROVED DISPOSAL FACILITY, IN ADDITION TO THE FOLLOWING:
   a. TOTAL RCRA 8 METALS (ARSENIC, BARIUM, CADMIUM, CHROMIUM, LEAD, MERCURY, SELENIUM, AND SILVER BY EPA METHODS 6020 AND 7471)
   b. POLYCHLORINATED BIPHENYLS AS AROCLORS (EPA METHOD 8082)
   c. VOLATILE ORGANIC COMPOUNDS (EPA METHOD 8260B)
   d. FLASH POINT
   e. PH (EPA METHOD 150.1)
7. ALL SEDIMENT AND WATER QUANTITIES DISPOSED OF OUTSIDE OF THE PROJECT SITE SHALL BE DOCUMENTED (I.E. TIPPING TICKETS FROM THE LANDFILL) AND COPIES PROVIDED TO THE ENGINEER.

OIL AND SHEEN MANAGEMENT:

1. THE CLIENT STORES THEIR OIL CONTAINMENT BOOM AT THE PILE CALLED OUT ON C-01. THE OIL BOOM IS MOVED INTO PLACE ONCE A VESSEL IS DOCKED. THE CONTRACTOR NEEDS TO MOVE ALL EQUIPMENT OUT OF THE BERTH AREA FROM 7PM FRIDAY TO 7AM MONDAY EXCEPT IN THE CASE OF EMERGENCY. IN THE CASE OF EMERGENCY, THE CONTRACTOR SHOULD BE PREPARED TO MOVE ALL EQUIPMENT OUT OF THE BERTH AREA AT A MINIMUM OF 4 HOURS NOTICE. MOST VESSELS SCHEDULED SHOULD BE KNOWN A WEEK AHEAD OF TIME.
2. THE SEDIMENT TO BE DREDGED MAY PRODUCE AN OIL SHEEN ONCE DISTURBED. THE CONTRACTOR IS TO USE A CONTAINMENT BOOM (PROVIDED BY THE CONTRACTOR) TO CONTAIN ANY OIL SHEEN. SHEEN PRODUCED BY THE SEDIMENT DOES NOT NEED TO BE REPORTED HOWEVER UNCONTROLLED RELEASES OF OIL PRODUCTS INTO THE WILLAMETTE RIVER FROM CONTRACTOR EQUIPMENT IS TO BE REPORTED TO THE PROPER AUTHORITIES. MORE DETAIL IS IN SPECIFICATION 01561.

LEGEND:

EXISTING OIL BOOM PILE

CONCRETE

TURBIDITY MONITORING STATIONS

BENCHMARK

2017 CHEMISTRY CORE LOCATIONS

2018 SEDIMENT CORE LOCATIONS

2018 CPT LOCATIONS

DOCK

BASE OF DREDGE

BERTH AREA COVER PLACEMENT

APPROXIMATE AREA FOR GEOSYNTHETIC TO ALLOW ANCHORING PLACEMENT

ELEVATION -2' CRD CONTOUR

APPROXIMATE TOP OF AMENDED SLOPE

NAVIGATION CHANNEL

EXISTING SHEET PILE

BERTH BOUNDARY

TAXLOTS

8 / 10 EXISTING ELEVATION CONTOURS 2' INTERVAL 10' INDEX

8 / 10 POST-DREDGE ELEVATION CONTOURS 2' INTERVAL 10' INDEX

PROJECT BOUNDARY

AECOM

PROJECT

PORTLAND TERMINAL MAINTENANCE ISSUE FOR PERMIT

CLIENT

SEAPORT MIDSTREAM PARTNERS, LLC

Portland Terminal
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Portland, Oregon

CONSULTANT

AECOM
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4	2019-01-05	ISSUE FOR PERMIT
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2	2018-03-25	90% DESIGN/ISSUE FOR PERMIT
1	2018-02-09	60% DESIGN
0	2017-09-01	30% DESIGN

PROJECT NUMBER

60558028

SHEET TITLE

GENERAL NOTES

SHEET NUMBER

G-02

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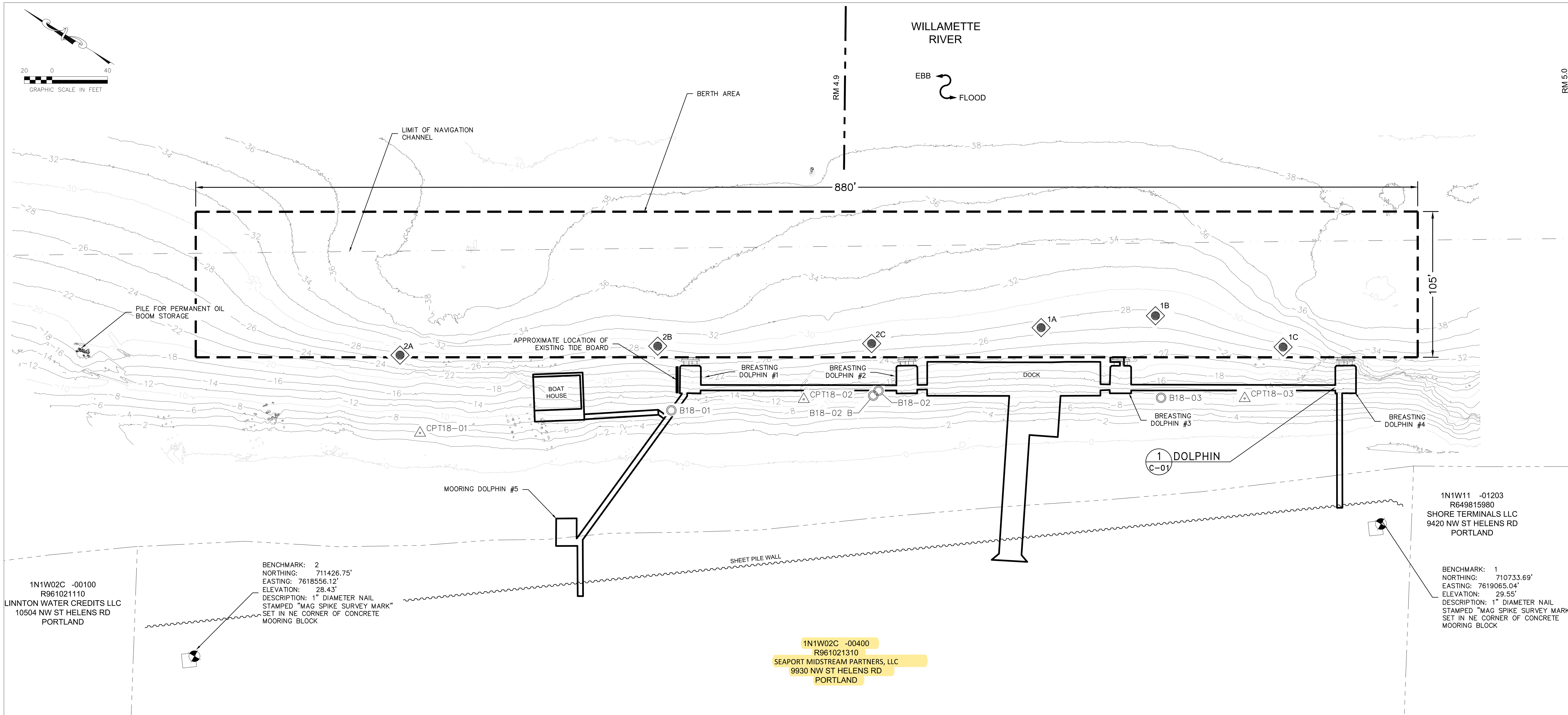
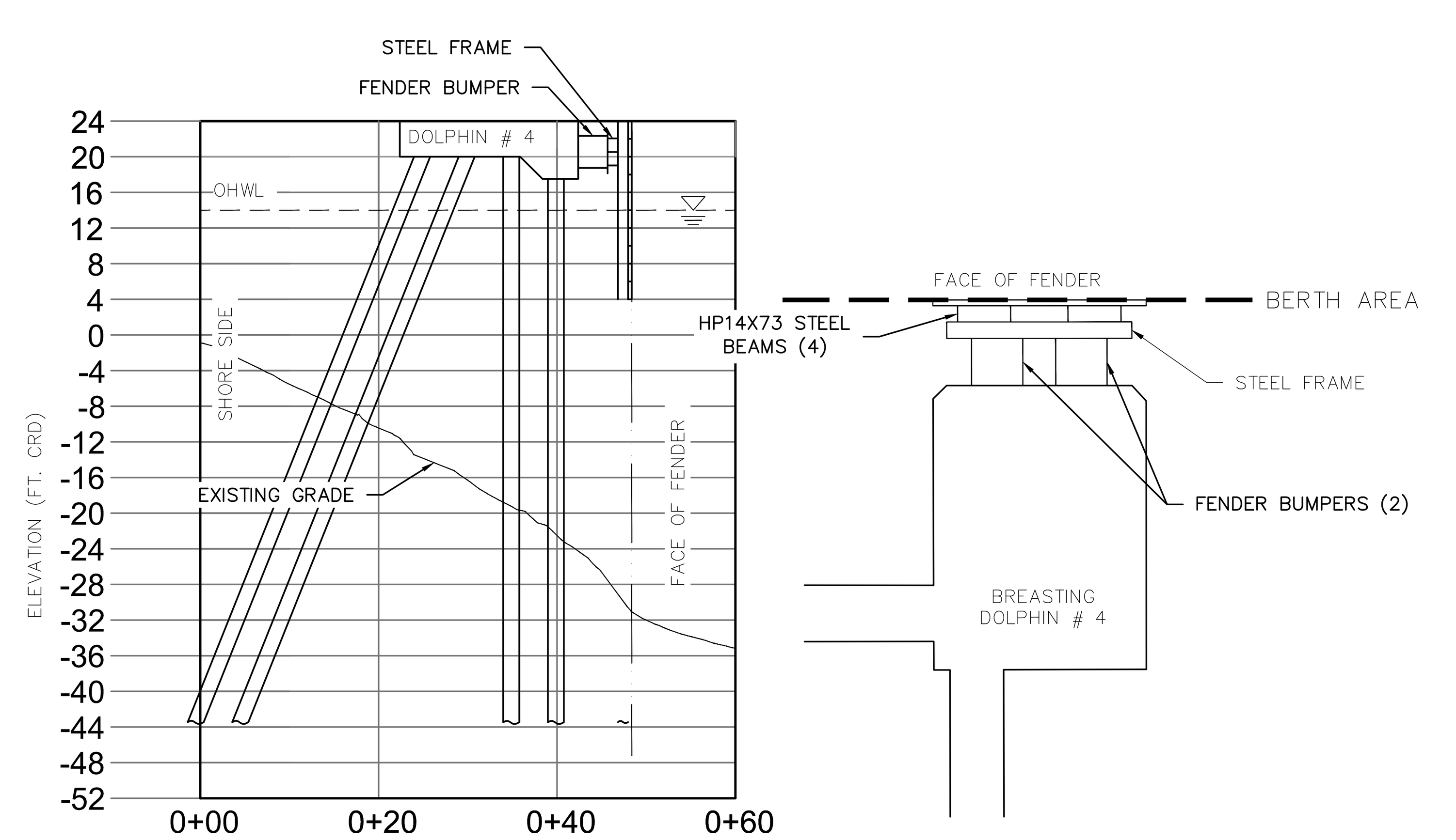
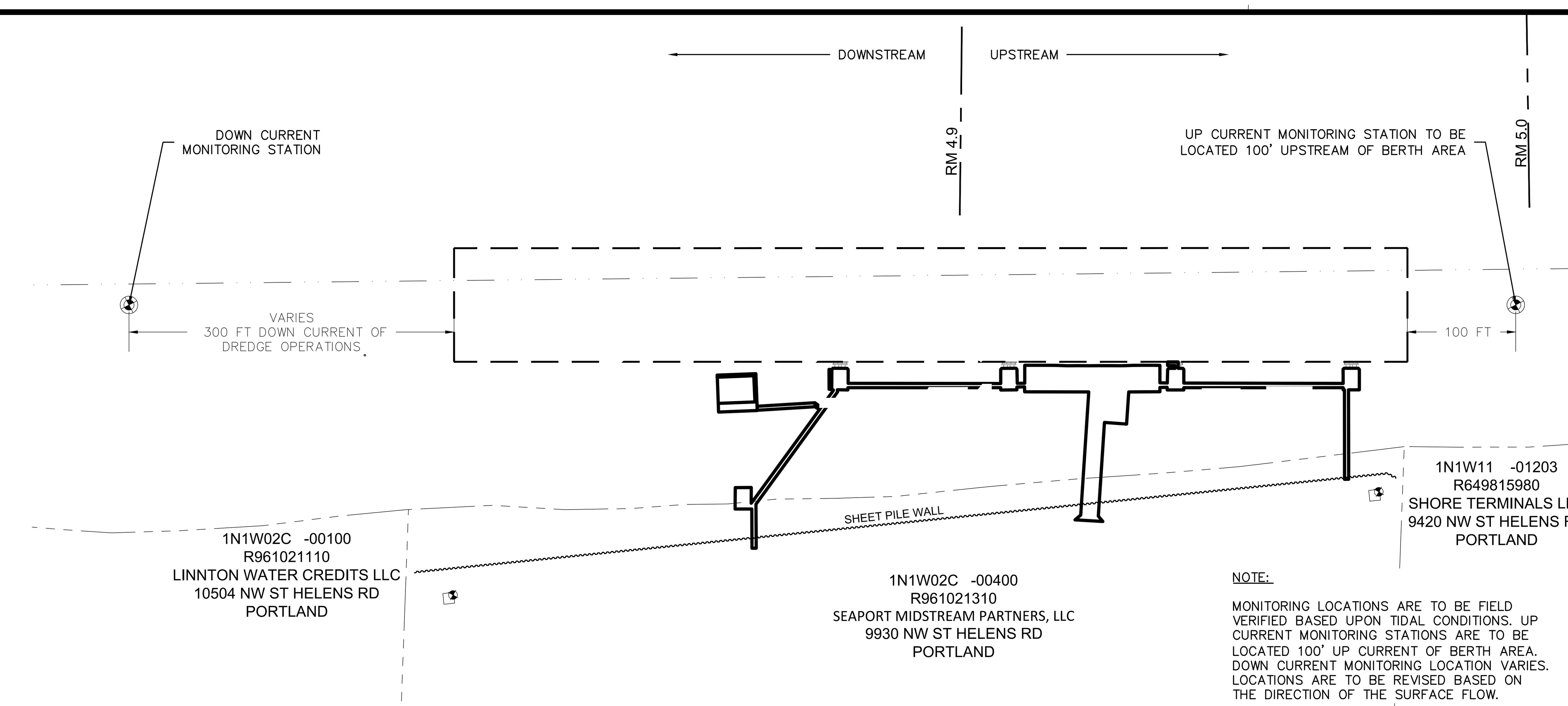




1 DOLPHIN, PROFILE AND PLAN (TYP.) C-01



NOTE:
MONITORING LOCATIONS ARE TO BE FIELD VERIFIED BASED UPON TIDAL CONDITIONS. UP CURRENT MONITORING STATIONS ARE TO BE LOCATED 100' UP CURRENT OF BERTH AREA. DOWN CURRENT MONITORING LOCATION VARIES. LOCATIONS ARE TO BE REVISED BASED ON THE DIRECTION OF THE SURFACE FLOW.

2 TYPICAL TURBIDITY MONITORING LOCATIONS C-01

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PROJECT NUMBER
60558028

SHEET TITLE
EXISTING CONDITIONS AND TURBIDITY MONITORING

SHEET NUMBER
C-01

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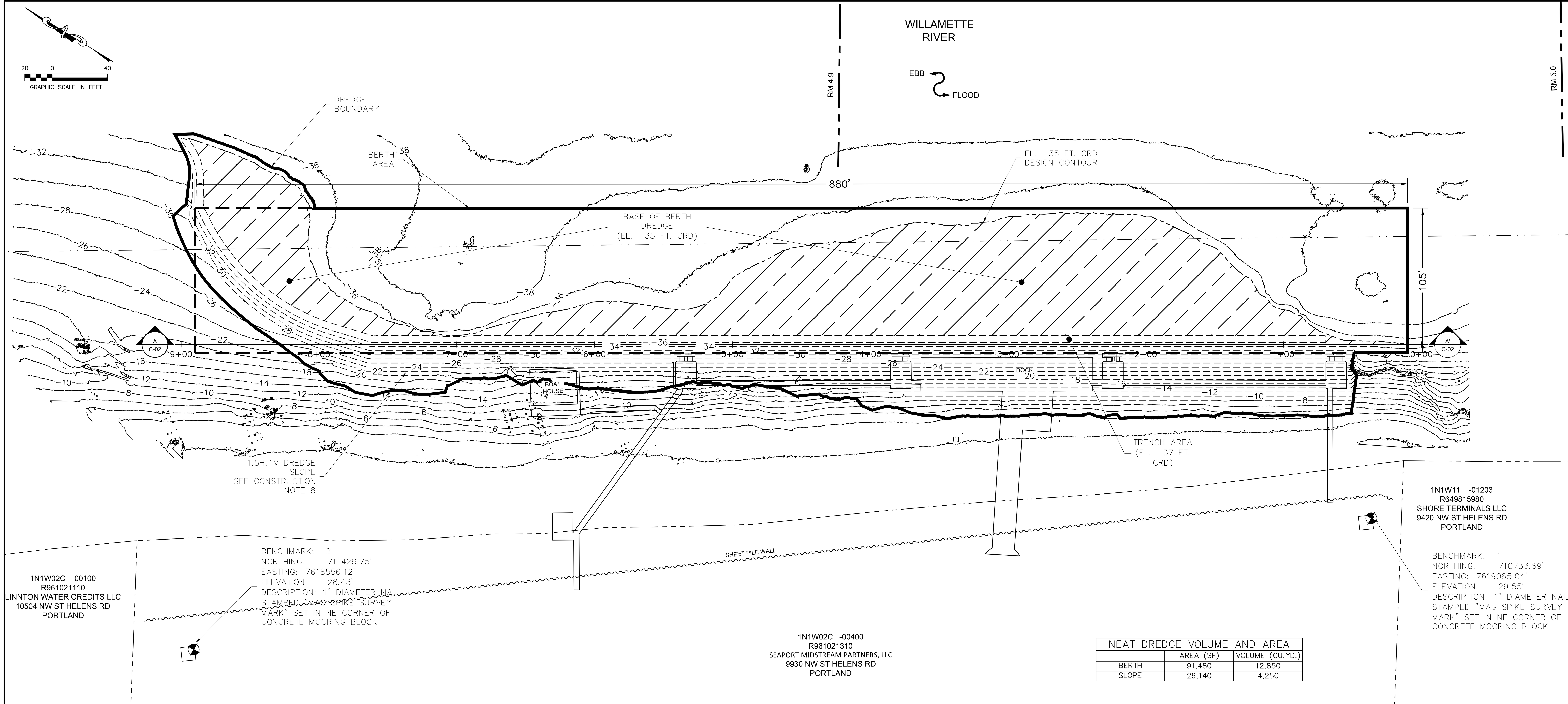
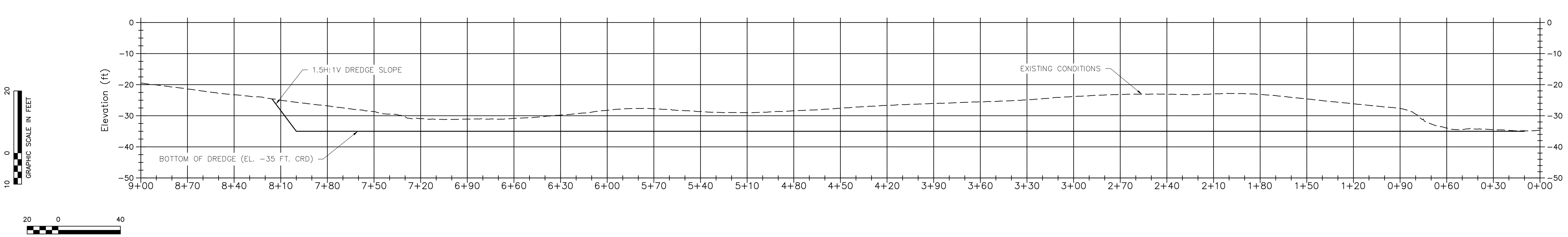


NEAT DREDGE VOLUME AND AREA		
	AREA (SF)	VOLUME (CU.YD.)
BERTH	91,480	12,850
SLOPE	26,140	4,250

PROFILE A-A'



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DREDGE PLAN

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C-02

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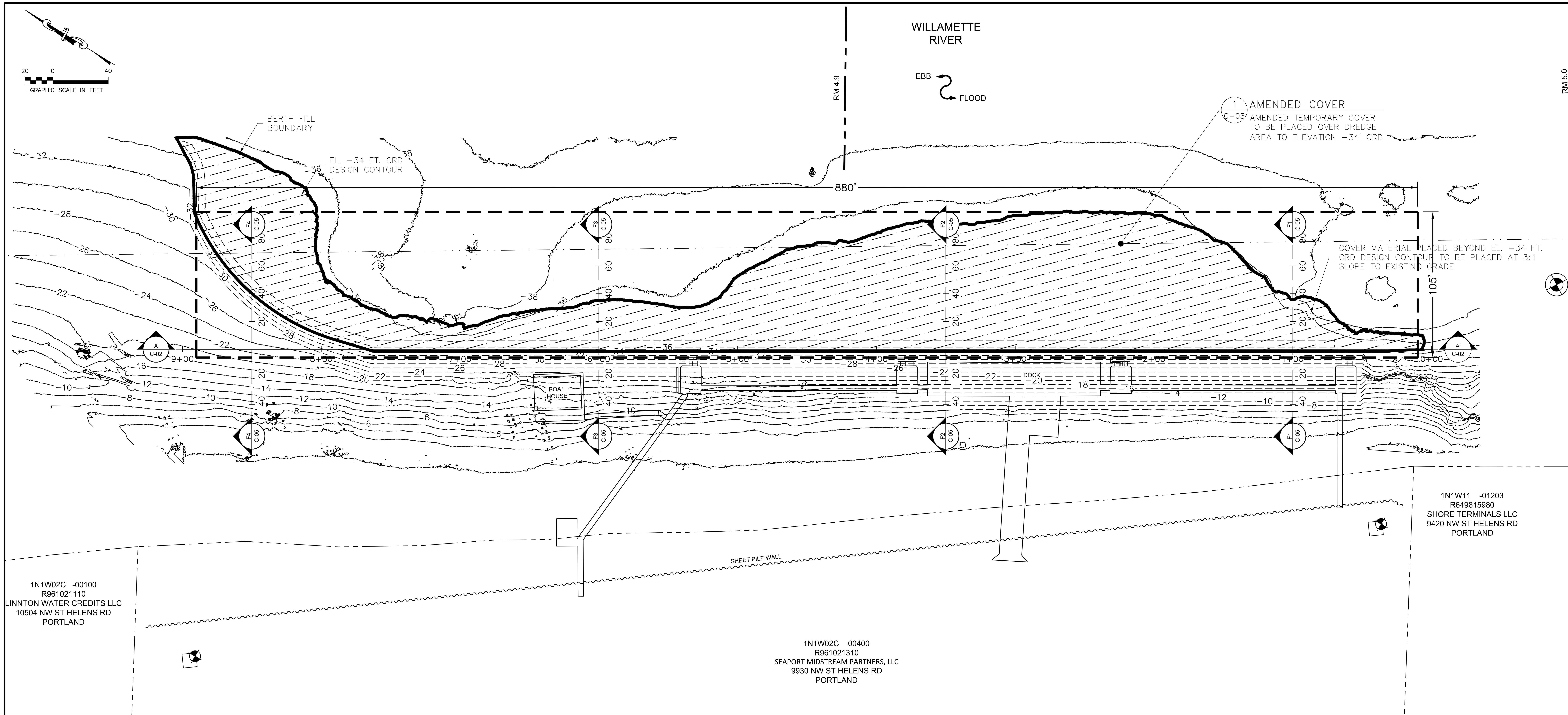

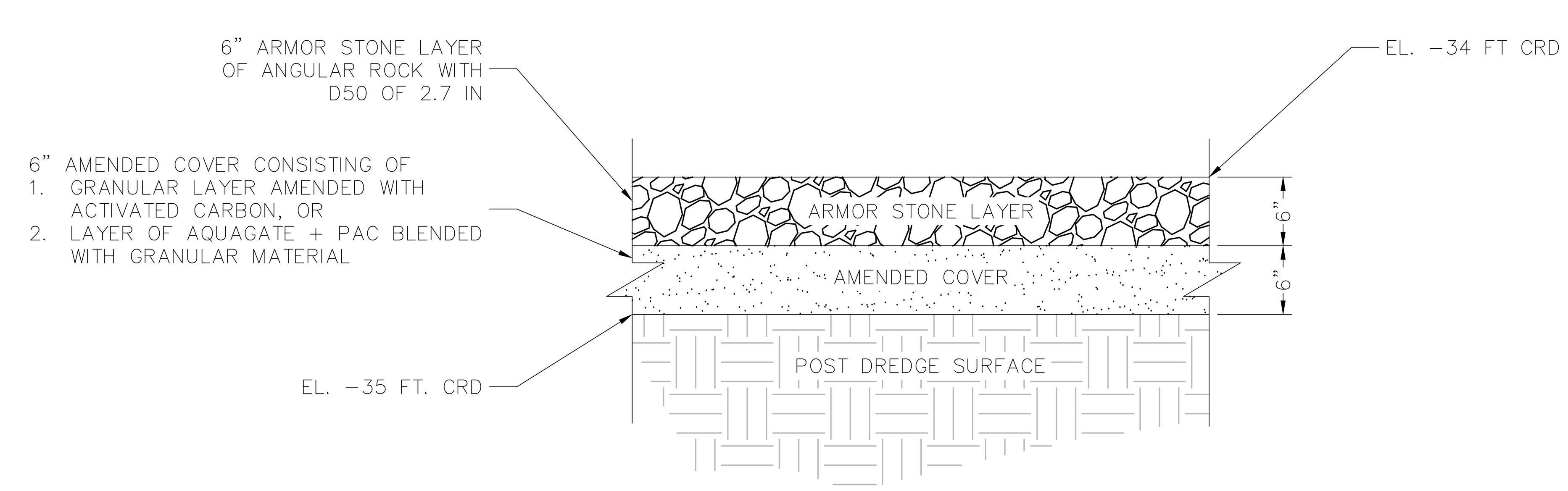

1 C-03 CARBON AMENDED COVER

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PROJECT NUMBER

60558028

SHEET TITLE

TEMPORARY COVER FOR BERTH

SHEET NUMBER

C-03

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Project Management Initials:

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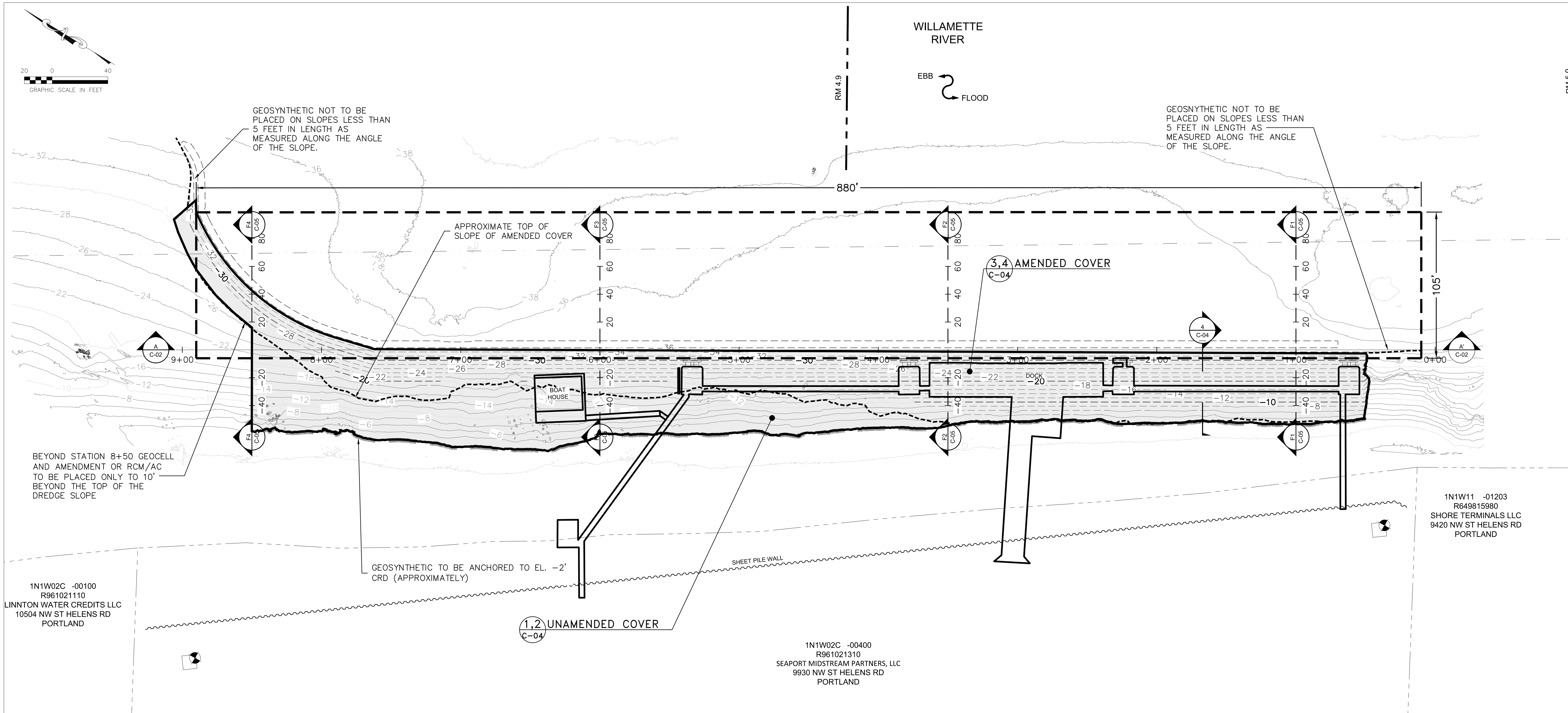
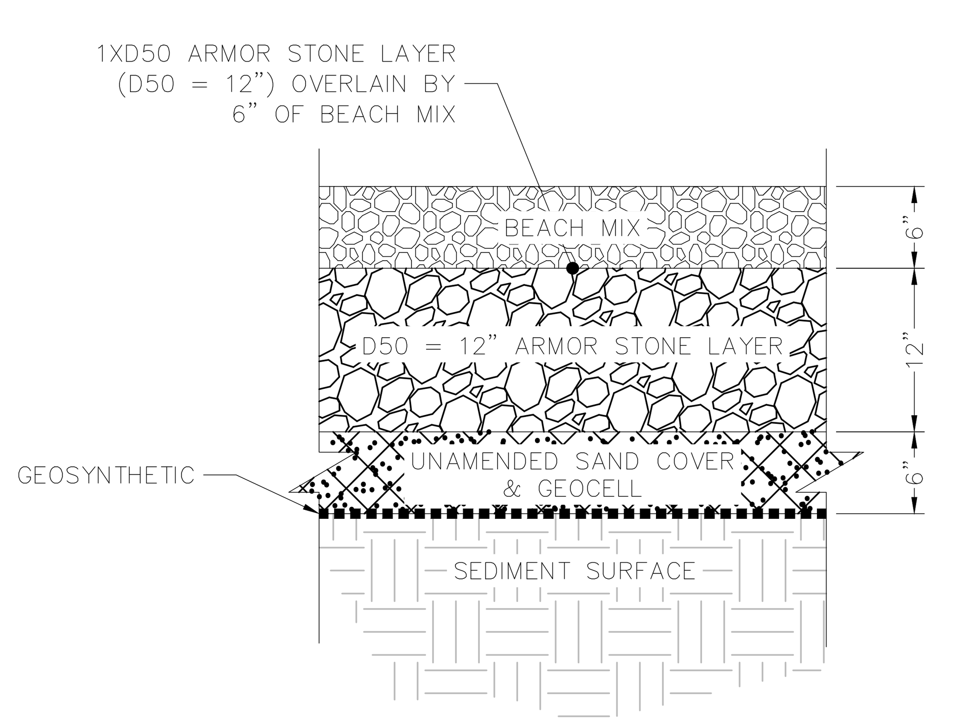
Designer:

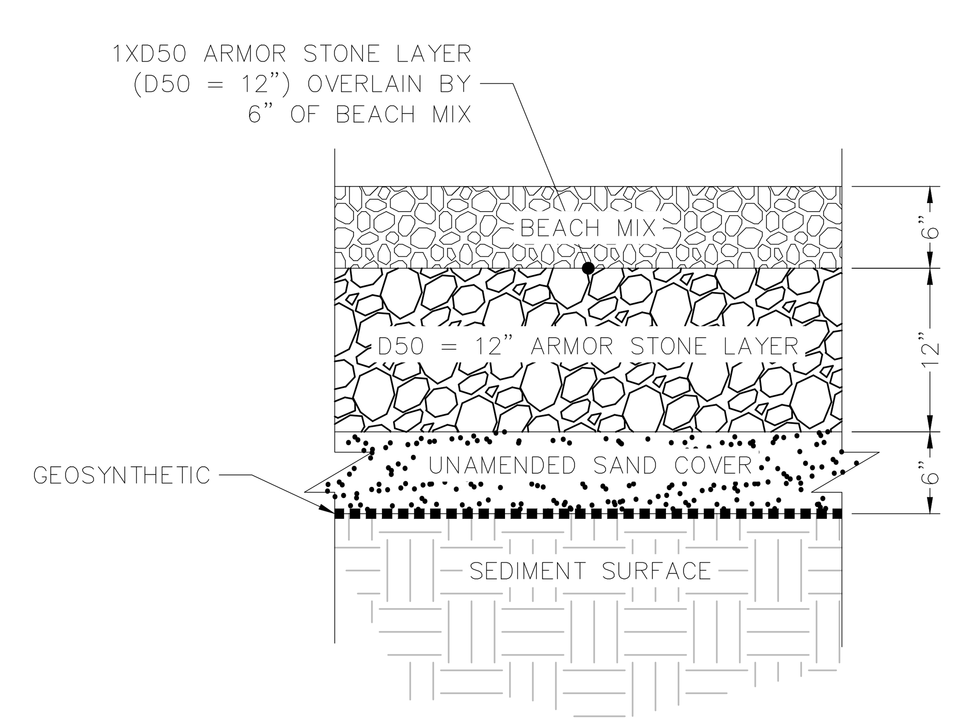
Project Management Initials:





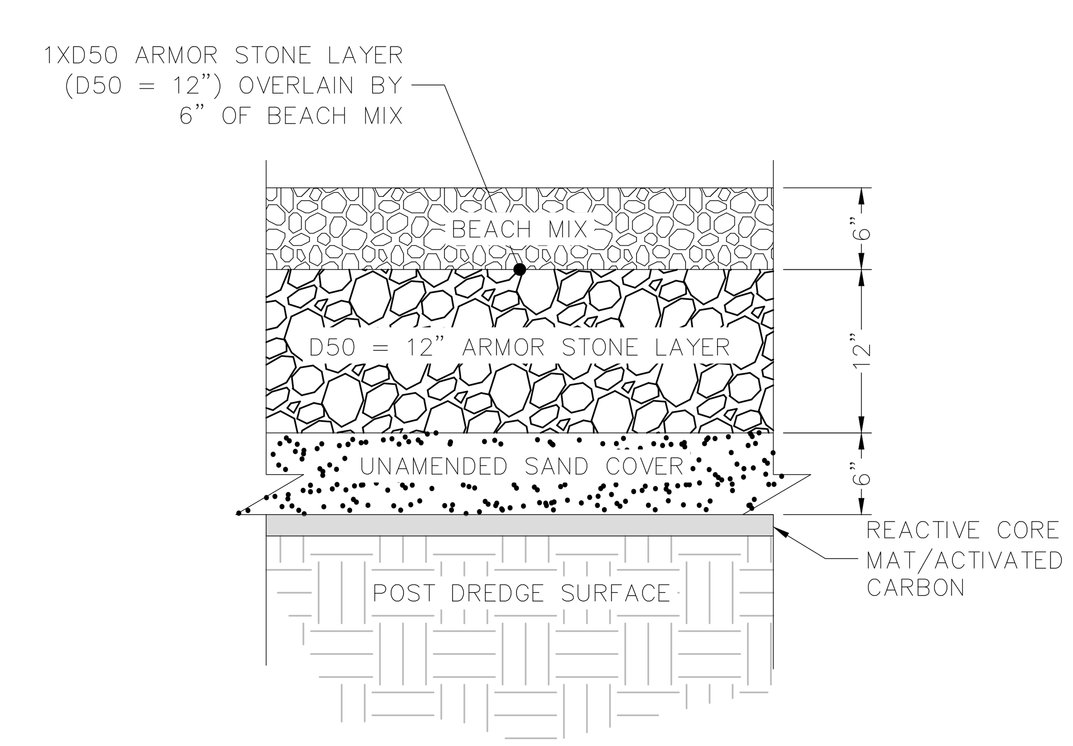
NOTE:
AT ELEVATION -4' CRD THE D50 FOR THE ARMOR STONE INCREASES FROM 12" TO 14".

1 UNAMENDED COVER; GEOCELL
C-04



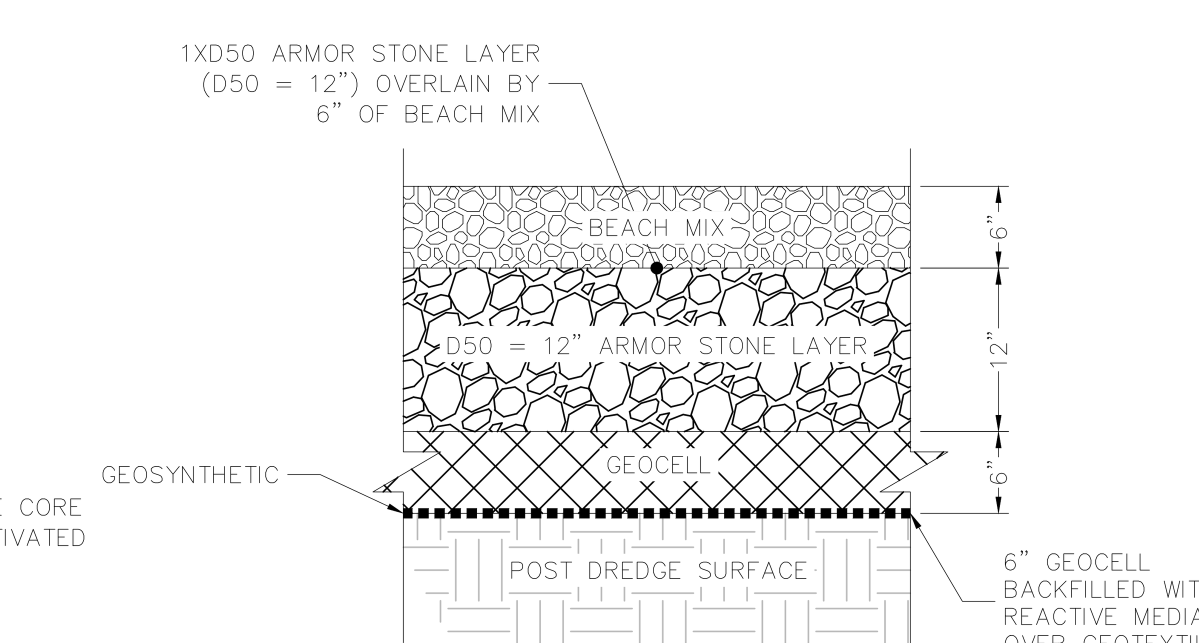
NOTE:
AT ELEVATION -4' CRD THE D50 FOR THE ARMOR STONE INCREASES FROM 12" TO 14".

2 UNAMENDED COVER; GEOSYNTHETIC
C-04



NOTE:
CARBON AMENDED MATERIAL SHALL BE PLACED TO A DISTANCE OF 10 FT BEYOND THE TOP OF THE DREDGE SLOPE OR TO THE END OF THE GEOSYNTHETIC, WHICHEVER IS ENCOUNTERED FIRST.

3 REACTIVE CORE MAT/ ACTIVATED CARBON COVER
C-04



NOTE:
CARBON AMENDED MATERIAL SHALL BE PLACED TO A DISTANCE OF 10 FT BEYOND THE TOP OF THE DREDGE SLOPE OR TO THE END OF THE GEOSYNTHETIC, WHICHEVER IS ENCOUNTERED FIRST.

4 GEOCELL COVER WITH CARBON REACTIVE MEDIA
C-04

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I/R	DATE	DESCRIPTION

PROJECT NUMBER

60558028

SHEET TITLE

TEMPORARY COVER FOR SLOPE

SHEET NUMBER

C-04

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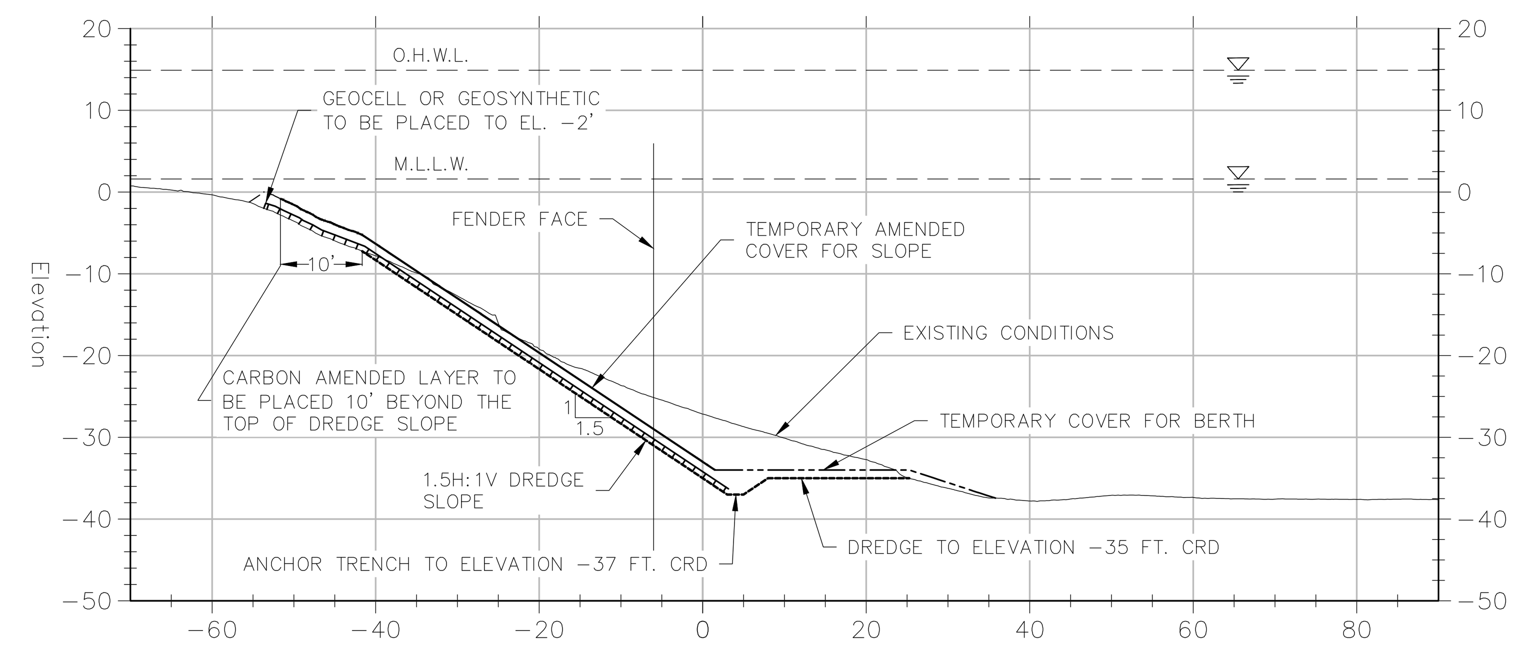
SECTION F1



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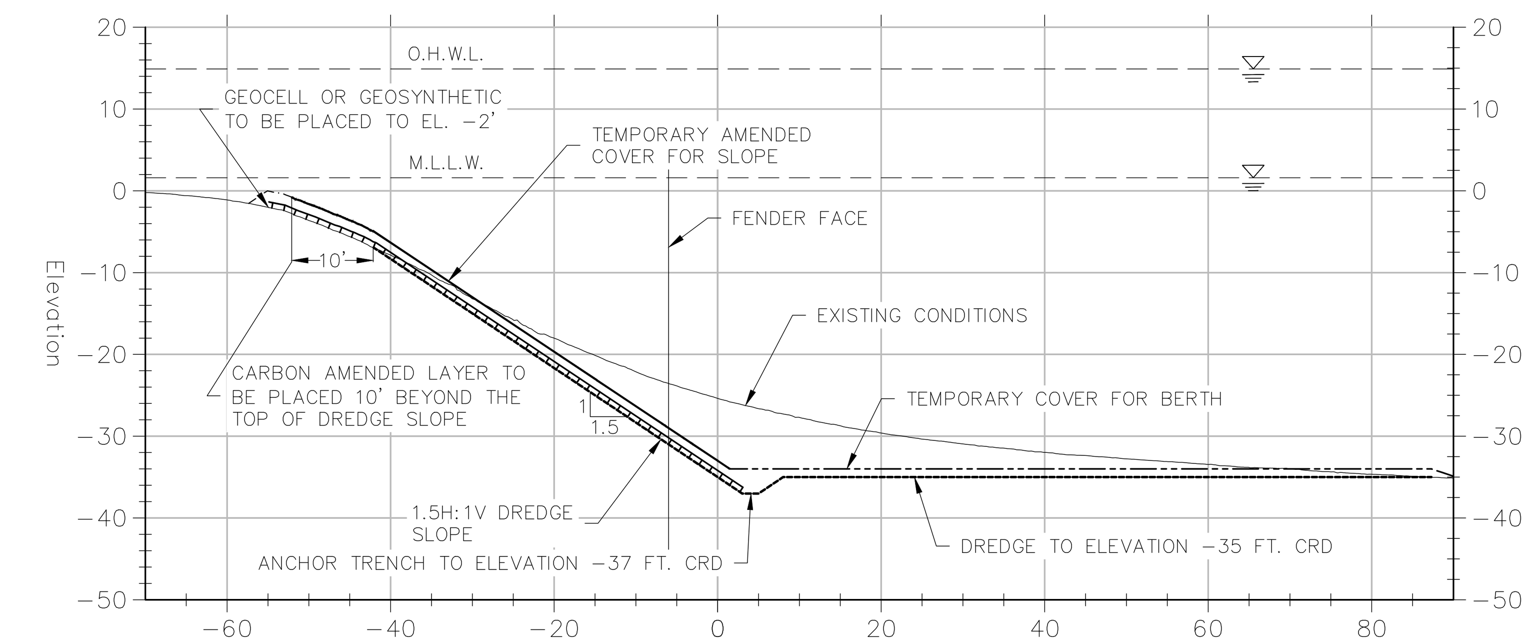

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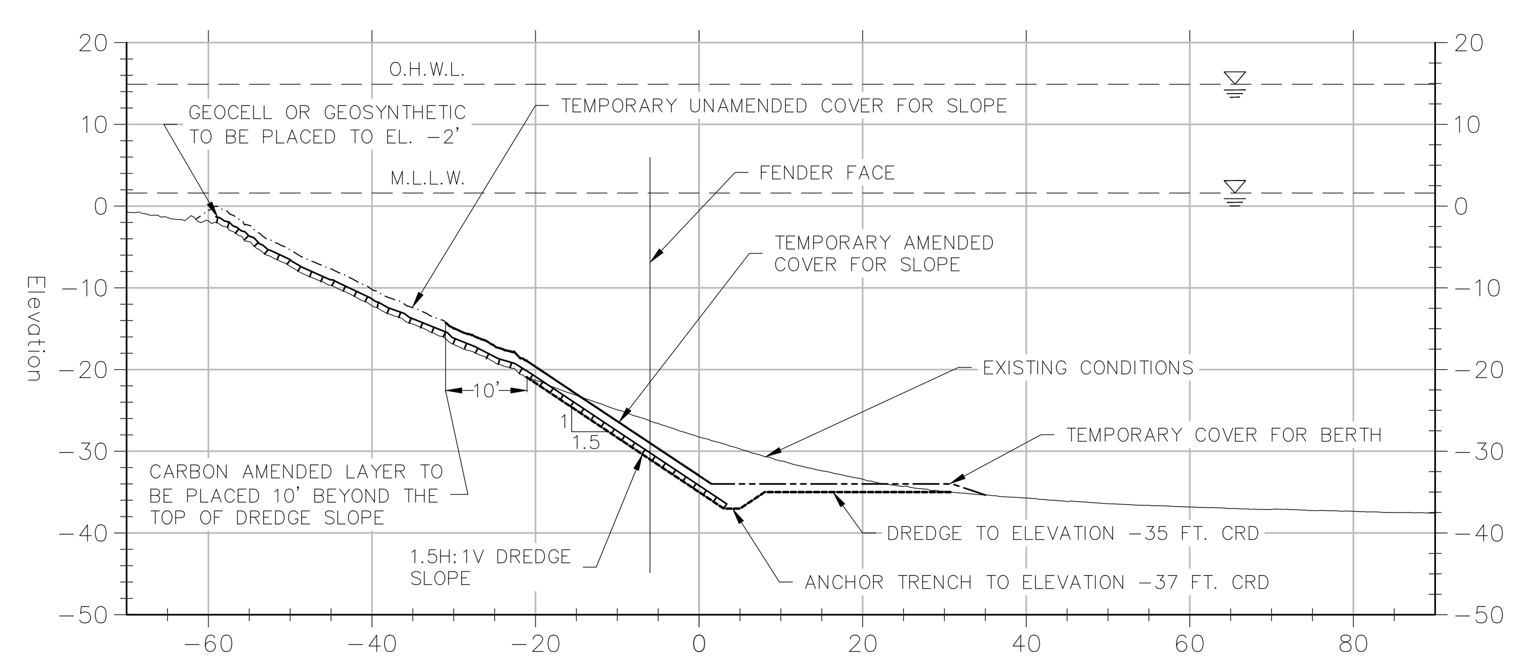

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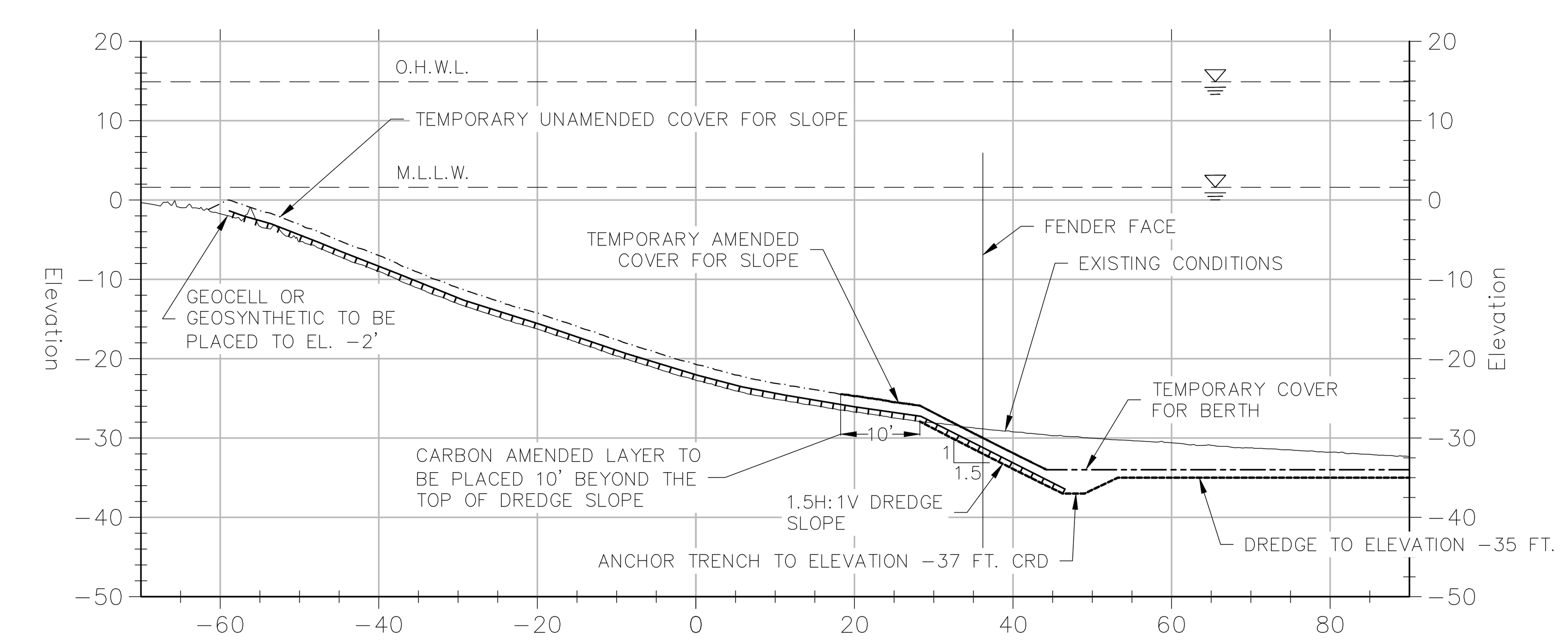

GRAPHIC SCALE IN FEET

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SHEET TITLE

CROSS SECTIONS

SHEET NUMBER

C-05

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Attachment A

Complete Response to May 29, 2019 DSL Comments on 60800RF Application

AECOM Imagine it. Delivered.

Attachment A. Complete Response to May 29, 2019 DSL Comments on 60800RF Application

Comment Number	Comment	Response
Comments That Should Be Addressed		
Comment 1	**Genevieve Angle, NMFS.** "*We would like to see documentation provided that the proposed layer over the large rock will remain in place consistently over the long term*." Please provide documentation from NMFS stating this comment has been fully addressed.	We have proactively addressed this issue with the National Marine Fisheries Service (NMFS) through phone calls and emails. In our Response to NMFS Comments dated May 20, 2019, we included a memorandum that discussed potential prop wash forces at the site and described the potential for localized erosion over portions of the temporary cover. The memo included a preliminary monitoring and maintenance plan describing how the client proposes to conduct annual inspections and monitoring of the berth area and slope. However, NMFS subsequently stated that hydraulic and geomorphic modeling would be required to fully evaluate whether the rounded gravel would remain in place. Because the modeling results requested by NMFS are not available, NMFS prepared a Habitat Equivalency Analysis (HEA) which assumed the smaller rock would be lost and not be replaced, contributing to the high number of Discounted-Service-Acre-Year (DSAY) credits required to be purchased to offset adverse habitat impacts from the project. NMFS is planning to issue a Biological Opinion for the project in mid-June, which will include monitoring and maintenance measures to ensure the temporary cover remains in place consistently over the long term. SeaPort has committed to inspecting the presence of the 2.5" D_{100} rock after short term use of the facility and modify the frequency of monitoring based upon the results.
Comment 2	**Genevieve Angle, NMFS.** "*We would like documentation that the applicant has adequately addressed the habitat value loss NMFS has determined will take place due to the proposed action.*" After the alternative with the least impacts is determined impractical (see question #4 below), provide a mitigation plan to address proposed habitat loss. According to NMFS, the habitat value will be reduced by 3.2 DSAYs due to the proposed action. If credits are to be purchased, a receipt showing proof of purchase must be provided to DSL prior to permit modification issuance.	On behalf of the applicant (SeaPort), AECOM provided NMFS with habitat types and values proposed for the HEA, along with justifications in the form of habitat descriptions and photographs. The applicant also adjusted the design of the temporary cover layer by proposing a "beach mix" top layer on the side slopes. This layer will consist of rounded gravel (2.5 inches or less in size) as well as a mix of smaller gravel and sand to maintain fish habitat and provide appropriate substrate habitat for colonization by benthic organisms (EPA 2017 ROD). AECOM also provided a monitoring and maintenance plan that will be implemented (see response to Comment 1 above).
Comment 3	**EPA Requirement.** EPA provided feedback to USACE requiring a temporary backfill if the temporary cover is unable to be placed during the approved in-water work window. No such work has been included in the DSL application. Either discuss why this work is not needed when requested by the EPA or update the application to include this proposed work.	Although it is expected that the project will be completed within the approved in-water work window, we have included the placement of temporary demobilization material along the side slopes as a contingency measure in the final JPA. This would involve placement of a 1-inch thick activated carbon (AC) sand layer over the dredged side slopes. The project would then be completed during the next in-water work window.

Comment Number	Comment	Response
Comments That Should Be Addressed		
Comment 4	**Alternative Analysis-Natural Sediment.** Please discuss why the project does not proposed covering the rock with 1-foot of natural sediment, especially in the shallower water habitat area? The rock beach-mix is not "similar to the natural existing river bottom" (ROD page 61).	In their 2017 ROD, the EPA designated "beach mix" as the preferred backfill material to be applied to the uppermost layer of all caps and dredge leave surfaces in shallow areas. "Beach mix" is defined as a "mix of sand, gravel and inorganic material used for anchoring caps to prevent erosion". It also provides optimal substrate to facilitate recovery of the benthic community. For this project, the beach mix will consist of a 2.5-inch D_{100} layer, which consists of a range of sand, gravel, and rounded stone gradations that would enhance habitat complexity and improve benthic conditions for macroinvertebrates, relative to the predominantly silt substrate that currently exists at the site. This beach mix substrate differs from the existing substrate but contains sediment gradations that are more favorable to salmonids and benthic invertebrates. The project site, including the berth area and slopes, is subject to net sediment accumulation. Over time, it is anticipated that finer-grained material will accumulate into the interstitial spaces and cover the stone. It would be very difficult to effectively place a consistent silt material over the temporary cover area. Placement of this material would significantly impact water quality conditions and the material would be even more susceptible to displacement from prop wash and river currents than the proposed beach mix material. Thus, a 1-foot top layer of silt was not selected for engineering and environmental reasons and would not meet EPA requirements.
Comment 5	**Slope.** If you have any information to show that the adjacent site has a 1.5V:1H slopes, please provide that to DSL as this will help strengthen your position when we present the information to the Director for review. DSL file # 51437's record shows the adjacent site is 3:1 based on the DSL received and approved application and as-built report.	A screen shot of the portion of the adjacent NuStar property was previously provided to DSL. It does not show the entire site but just the portion adjacent to the SeaPort facility. That portion shows slopes steeper than 1.5V:1H, which are stable.
Previously Provided Comments		
Comment 6	**Multi-year Permit.** DSL received payment for a 1-year permit. The application requests a 5-year permit. To issue a 5-year permit, DSL requires payment upfront. Based on the latest application, the permittee would need to an additional $3,220 for the remaining 4-years ($805 base fee x 4 more years = $3,220).	On behalf of the applicant, AECOM has provided payment for the additional $3,220 through the Oregon DSL Electronic Payment System so that a 5-year permit can be issued.
Comment 7	**Proprietary Authorization.** The applicant needs to obtain necessary proprietary authorizations prior to performing any work. Please continue to coordinate with Richard Fitzgerald at 503-986-5260 or via email at richard.w.fitzgerald@dsl.state.or.us.	Per his request, we provided an updated sand and gravel application to Mr. Fitzgerald on May 30 that included the additional removal volume requested. The applicant has provided all supplemental documentation that was requested by DSL. We will continue to follow up with Mr. Fitzgerald to be sure that he has everything he needs to issue the license.
Comment 8	**EPA Contact.** What is the name and contact information for the EPA person providing the review comments for this	Hunter Young is the EPA Remedial Project Manager for this project. His contact information is as follows:

Comment Number	Comment	Response
Comments That Should Be Addressed		
	project? (AECOM provided a response in 5/21/2019 email)	Hunter Young U.S. Environmental Protection Agency Region 10 - Oregon Operations Office Young.Hunter@epa.gov 503.326.5020 However, I would include Sean Sheldrake on any of your correspondence since he provided the original June 4, 2018 comments that required the temporary cover armoring layer on the side slopes. His contact info is as follows: Sean Sheldrake, RPM U.S. Environmental Protection Agency Region 10, Unit Diving Officer sheldrake.sean@epa.gov 206.225.6528
Comment 9	**Function and Value Assessment.** What are the pre and post functions and values of the proposed project, especially within the shallow water areas? We need functions and values assessment. (AECOM provided a response in 5/21/2019 email)	While information on functional attributes was included with the original JPA, we recognize that the modified project design now includes placement of a temporary cover within shallow water areas. Some of the information previously provided applies to the shallow water areas, but we have provided additional detail to describe functions and values with a particular focus on the shallow water portion of the project site. We have also attached Table 1, which describes habitat types and descriptions at the project site. This table was provided to the National Marine Fisheries Service (NMFS) so that they could complete their Habitat Equivalency Analysis (HEA). This table also provides rationale for why we believe that the pre-project habitat value is relatively low with respect to salmonids based on the disturbed and degraded existing conditions at the project site. We anticipate that the post-project habitat value will be similar to, if not better than current conditions due to the reduced exposure to sediment contaminants and placement of a “beach mix” over the riprap which could result in a healthier and richer benthic community than what currently exists on the slope. Below, we address the hydrologic, geomorphic, biological, and chemical/nutrient functions at the project site in more detail. HYDROLOGIC FUNCTIONS Section 6 of the JPA describes hydrological conditions for the lower Willamette River (LWR) that are applicable to the project area. Daily, seasonal, and inter-annual variations in flow results from tidal conditions, storm events, snowmelt, and operation of hydroelectric dams and reservoirs. Tides cause the river stage to rise and fall up to several feet through a tidal cycle. During the dry season, when river discharge is low, rising tides can cause intermittent flow reversals throughout the project area.

Comment Number	Comment	Response
Comments That Should Be Addressed		
		Industrial areas within Portland Harbor have been armored or protected with revetments to prevent flooding and provide suitable conditions for industrial land-uses. As a result, this section of the river has lost much of its original floodplain connectivity. Flow regulation and irrigation diversions have changed the magnitude and shape of the annual flow hydrograph, reducing peak flow by more than 40% and peak river stage by 0.5 to 2.5 meters (1.6 to 8.2 feet) during the spring and summer months (Kukulka and Jay 2003). Groundwater interchange likely plays an important role in habitat forming processes throughout the lower Willamette River. Some scientists believe that human actions have reduced the surface extent of the Willamette's hyporheic zone by about 80 percent by regulating flow and armoring river banks (such as with riprap) (Gregory et al. 2002 *in* WRI 2004). It is likely that bank armoring and bulkheads have reduced hyporheic water transfer in localized areas in Portland Harbor. Further studies are needed to better understand water transfer processes between surface and subsurface areas within the project area. GEOMORPHIC FUNCTIONS The sediment transport regime in the LWR mainstem is highly dynamic and this section of the river experiences erosion and deposition throughout the year. Sediment flushing flows occur during the winter and spring months. Although it can be stated that the channels are generally in a state of equilibrium, certain areas consistently experience shoaling. Upriver dams have reduced sediment transport through the system, which has resulted in a sand budget deficit. Some scientists believe that this deficit has likely contributed to lower water levels in the river, which in turn, has decreased habitat availability during high flows and channel depths during low-flow periods (Templeton and Jay 2013). The SeaPort berthing area is situated in a net depositional area. Surface sediment sampling in shallow water areas shoreward of the dock facility has found that sediments are comprised of silt to sandy silt with an organic content between 2.7 and 4 percent. Cone Penetration Tests (CPTs) performed on the slope found a 0-4 ft thick layer of soft sediment (silt) overlying a 2.5-4.5 ft thick layer of soft to medium stiff clay (AECOM 2019). The grade of the existing side slope is variable and relatively steep; in general it ranges from approximately 1H:1V to 2H:1V. However, a slope stability analysis found that the long-term condition modeled with a riprap cover results in an Factor of Safety (FS) of 1.6 which is greater than the target FS of 1.5. Based on these results, a 1.5H:1V dredge slope would be stable during non-seismic conditions. The FS for seismic loading for short term (undrained) conditions is 1.3 which is greater than the target FS of 1.1.

Comment Number	Comment	Response
Comments That Should Be Addressed		
		The seismic loading under drained conditions results in a FS less than 1.1; however, for comparison, a pseudo-static analysis was completed for existing conditions. The calculated factor of safety was 1.0 indicating that the temporary cover will be just as stable under final conditions as it is under existing conditions (*ibid.).* The existing sandy silt substrate, naturally steep side-slopes, and routine impact from tugs and vessels does not provide optimal conditions for benthic organisms. In Portland Harbor, benthic invertebrates such as oligochaetes and chironomids have been found to be present in low abundances in most fine-grained (silts) areas (LWG 2004). This is likely because these organisms cannot tolerate low dissolved oxygen levels. The top layer of the temporary cover would consist of a D100 2.5 inch “beach mix” layer that consists of a range of sand, gravel, and rounded stone gradations that would enhance habitat complexity and improve benthic conditions for macroinvertebrates. Although some of the top cover material could erode in localized areas along the northern 1/3 of the dock facility, regular monitoring and maintenance will be performed to replace any material that is lost. Because a majority of the temporary cover is located in a depositional area, sand and silt will accumulate over time, which will improve shallow water habitat conditions. BIOLOGICAL FUNCTIONS Although the lower Willamette River has been subject to development and industrialization over the past 150 years, this river system supports a dynamic biodiversity of aquatic and terrestrial species. Fish and wildlife species that may be present within the project area are described in Section 6 of the Joint Permit Application. This river system provides and maintains essential habitat features for several anadromous salmonids and other important fish species. Shallow water areas at the project site may provide important rearing and refugia habitat for juvenile Chinook and some steelhead trout that migrate more slowly through the lower river. However, shallow water areas that contain pile-supported structures are considered less valuable because they provide more shading and hiding opportunities for predators. Most of the shallow water areas at the project site (72%) consists of this type of habitat. The riparian community has been fragmented due to industrial development, but areas adjacent to the project site provide suitable habitat for birds and mammals and a terrestrial food source for fish species. CHEMICAL AND NUTRIENT FUNCTIONS Nutrient cycles within the Willamette River has distinct temporal and spatial patterns (Sullivan et al. 2001 in Gilbert 2011). Elevated nutrient and DOC concentrations are attributed to runoff from agricultural lands in the

Comment Number	Comment	Response
Comments That Should Be Addressed		
		Willamette Valley (Prahl et al. 1997). A study conducted in June 1992 found that the lower Willamette River had significantly higher nutrient and dissolved organic carbon (DOC) concentrations than those in the Columbia River. Nutrient concentrations in the Willamette River were significantly higher (10x higher ammonium and phosphate, 75x higher nitrate + nitrite) than that of the Columbia River mainstem (Prahl et al. 1998). The project area supports production of diatoms during the spring months, but most phytoplankton transported through the project area is derived from upstream reservoirs (Simenstad et al. 1990). Existing water and sediment quality conditions at the project site are described in the Joint Permit Application. The project will improve water and sediment quality and provide an overall habitat benefit by reducing exposure of aquatic organisms to sediment contaminants. REFERENCES AECOM. 2019. Dredge Slope Stability Analysis at Seaport Midstream Portland Terminal – Revision 1. Prepared for TransMontaigne and Submitted to the US Army Corps of Engineers. April 3, 2019. Gilbert, M. 2011. Nutrient loading and transformations in the Columbia River estuary determined by high resolution in situ sensors. Master's Thesis. September 23, 2011. Kukulka, T., and D.A. Jay. 2003. Impacts of Columbia River Discharges on Salmonid Habitat: 1. a Nonstationary Fluvial Tidal Model. Journal of Geophysical Research, Vol. 108, no. C9, 3293. LWG (Lower Willamette Group). 2004. Portland Harbor RI/FS Round 1 Work Plan. Appendix B: Ecological Risk Assessment Approach Attachments B1 Through B9. April 23, 2004. Prahl, F. G., Small, L. F., and Eversmeyer, B. 1997. Biogeochemical characterization of suspended particulate matter in the Columbia River estuary. Marine Ecology Progress Series 160: 173-184. Prahl, F.G., L.F. Small, B.A. Sullivan, J. Cordell, C.A. Simenstad, B.C. Crump, and J.A. Baross. 1998. Biogeochemical gradients in the lower Columbia River. Hydrobiologia 361:37-52. Simenstad, C. A., C. D. McIntire, and L. F. Small. 1990. Consumption processes and food-web structure in the Columbia River estuary. Prog. Oceanogr. 25:271–297. Templeton, W. and Jay, D. 2013. Lower Columbia River Sand Supply and Removal: Estimates of Two Sand Budget Components. J. Waterway, Port, Coastal, Ocean Eng., 10.1061. WRI (Willamette Restoration Initiative). 2004. Willamette Subbasin Plan. Prepared for the Northwest Power and Conservation Council.

Comment Number	Comment	Response
Comments That Should Be Addressed		
Comment 10	**Director Approval.** DSL will coordinate with the director regarding the following items. a. Will the DSL Director approve 1.5V:1H slope? LWRMP standard is 3:1 slope. b. Does the proposed rock fit under the LWRMP? If no, will the DSL Director approve it?	Please inform the DSL Director that we are requesting an expedited review process to address these issues so that we can obtain the DSL permit in time for dredging to begin on July 1, 2019.

Attachment B

HEA Documentation

Table 1. Aquatic Habitat Characteristics, Acreages, and Proposed HEA Values at the SeaPort Maintenance Dredging Project Site. (AECOM provided to NMFS on 5/20/19 to assist in their HEA Process)

HEA Habitat Category	Habitat Characteristics[1]	Habitat Description	Photo Number[2]	Portland Harbor Draft HEA Values (NMFS 2014 *in* USACE et al. 2016)	Proposed SeaPort HEA Values		Justification for Proposed Habitat Value	Acres
					Existing Condition	Post-Remedy Condition		
Pre-Project Conditions								
Main Channel (below ordinary low water)	Shallow water (0-15 feet deep), gravel and finer substrates	Accretional and erosional areas; slopes range from 1H:1V to 3H:1V; sand/silt/clay substrate.	1,2,3,4	1	0.5	NA	The existing value is reduced from the recommended HEA salmonid value due to site-specific conditions: contaminated sediments; steep slopes; very silty sediments; active marine facility and disturbance from vessels and prop wash; poor shoreline habitat conditions (sheet pile wall, stormwater discharge outfall; no riparian habitat).	0.13
	Shallow water (0-15 feet deep), pile-supported structure	Accretional and erosional areas; slopes range from 1H:1V to 3H:1V; sand/silt/clay substrate.	1,3,4,5,6,7,8	0.1	0.05	NA	The existing value is reduced from the recommended HEA salmonid value due to site-specific conditions: contaminated sediments; steep slopes; very silty sediments; active marine facility and disturbance from vessels and prop wash; presence of dock structure and pilings; poor shoreline habitat conditions (sheet pile wall, outfall; no riparian habitat).	0.34
	Deep water (>15 feet deep), natural substrates	Accretional and erosional areas; slope varies from 1H:1V near the dock to <5H:1V in mid-berthing area; sand/silt/clay substrate.	7,8	0.1	0.05	NA	The existing value is reduced from the recommended HEA salmonid value due to site-specific conditions: contaminated sediments, steep slopes, very silty sediments; disturbance from vessels and prop wash; adjacent marine dock facility	1.90
							SUM	**2.37**
Proposed Post-Project Conditions								
Main Channel (below ordinary low water)	Shallow water (0-15 feet deep), artificial substrates - Dredge side slopes (amended and unamended cover)	Slope adjacent to the berthing area will be stabilized to 1.5H:1V. Shallower areas will remain at a slope of 3H:1V. Cover layer will consist of 6-inch layer of beach mix (D100=2.5”) on top of 12-inch layer of large angular rock (D50=12.2”).	NA	1	NA	0.5	The temporary cover will provide an overall habitat benefit due to slope stabilization and reduced exposure of aquatic organisms to sediment contaminants; however, the proposed post-project value would be reduced from the recommended HEA salmonid value because artificial material would be installed to protect the geosynthetic material and amended and unamended sand cover from prop wash. However, the top cover would consist of a D100 2.5 inch “beach mix” layer that consists of a range of sand, gravel, and rounded stone gradations that would enhance habitat complexity and improve benthic conditions for macroinvertebrates. Although some of the top cover material could erode in localized areas along the northern 1/3 of the dock facility, regular monitoring and maintenance will be performed to replace any material that is lost. Based on these factors, we suggest that the post-project HEA salmonid value should be the same as existing conditions.	0.18
	Shallow water (0-15 feet deep), pile supported structure - Dredge side slopes (amended and unamended cover)	Slope adjacent to the berthing area will be stabilized to no more than 1.5H:1V. Shallower areas will remain at existing or shallower slopes. Cover layer will consist of 6-inch layer of beach mix (D100=2.5”) on top of 12-inch layer of large angular rock (D50=12.2”).	NA	0.1	NA	0.05	Same rationale as above.	0.41
	Deep water (>15 feet deep), artificial substrates - Berthing area	Flat bottom surface. Cover layer will consist of 6-inch layer of small angular rock (D50=2.7”) on top of 6-inch layer of clean sand and gravel.	NA	0.05	NA	0.05	The temporary cover will provide an overall habitat benefit by reducing exposure of aquatic organisms to sediment contaminants. The rock cover layer will help keep the sand in place. The analysis uses the value proposed by NMFS for deep water artificial substrates.	1.09
	Deep water (>15 feet deep), artificial substrates - Side slopes	Slopes adjacent to the berthing area will be stabilized at a slope of 1.5H:1V. Cover layer will consist of 6-inch layer of beach mix (D100=2.5”) on top of 12-inch layer of large angular rock (D50=12.2”).	NA	0.05	NA	0.05	The analysis uses the value proposed by NMFS for deep water artificial substrates. The reduced exposure of aquatic organisms to sediment contaminants will offset effects of artificial substrate placement.	0.31
	Deep water (>15 feet deep), pile-supported structure - Side slopes	Side slopes adjacent to berthing area will be stabilized at a slope of 1.5H:1V. Cover layer will consist of 6-inch layer of beach mix (D100=2.5”) on top of 12-inch layer of large angular rock (D50=12.2”).	NA	0.05	NA	0.05	The analysis uses the value proposed by NMFS for deep water artificial substrates. The reduced exposure of aquatic organisms to sediment contaminants will offset effects of artificial substrate placement.	0.39
							SUM	**2.37**

Notes:

[1] Depths in this column refer to feet below Ordinary Low Water. Ordinary Low Water (Mean Low Water) = Elevation +1.9 ft. CRD; Shallow water habitat= 0 to 15 feet below MLW (or between +1.9 CRD and -13.1 CRD)

[2] See Appendix A, Photo Log for site photos.

USACE et al. 2016. Permitting assistance tools for bankwork projects in or near Portland Harbor. Prepared by USACE, NOAA, DEQ. November 2016.

No work is proposed within the riparian corridor or within the active channel margin (ACM) (between ordinary high water and ordinary low water).

Amended cover may include a 6” geocell layer underneath the armor stone layer.

From elevation -2’ to -4’ CRD, the armor stone D50 would be 14”

From: Genevieve Angle - NOAA Federal <genevieve.angle@noaa.gov>
Sent: Wednesday, May 22, 2019 4:21 PM
To: Clodfelter, Andy <Andy.Clodfelter@aecom.com>
Cc: Kranz, Scott <scott.kranz@aecom.com>; melody.j.white@usace.army.mil; BUTTERFIELD Melinda <melinda.butterfield@state.or.us>
Subject: Re: SeaPort Portland Terminal Dredging - Revised/Supplemental Response to Comments

Hi Andy,

Attached please find the HEA based on the project described in your 5/20 submission. The HEA shows that the habitat value is reduced by 3.2 DSAYs due to the proposed action. The following points may help you interpret the results:

- The HEA must be run for the full time frame and not limited to 20 years due to the fact that this action will re-set the baseline for any future HEA in the project area.
- The existing shallow water habitat is given a reduced value due to the relatively poor adjacent shoreline conditions, and the existing deep water habitat is given a reduced value due to the adjacent marine facilities.
- The proposed shallow water habitat is further reduced in value due to the potential for riprap exposure. The monitoring plan outlined in the final paragraph of the submission is insufficient to ensure that the rounded gravel remains in place over the riprap on a consistent basis.
- The proposed deep water habitat is further reduced in value due to the presence of angular rock over more than half of the area, as well as the potential exposure of riprap on the side slopes (see monitoring plan comment in previous bullet).

Genevieve Angle
Division Manager/Biologist
NOAA Fisheries West Coast Region
Phone:(503)231-2223
genevieve.angle@noaa.gov

GENERAL INPUTS

3.0%	Discount Rate		Total Acres in site boundary	2.37	DSAYs/acre	-1.3
2019	Base Year		Acres with restoration change	2.37		
2019	Start Year		% of site modified	100.0%		
2319	Model End Year					

Current Habitats

Total **10.0**

Habitat type	Acres Converted	Habitat quality adj factor	PV DSAYs per acre converted	Quality Adj. PV DSAYs per acre converted	Quality Adj. PV DSAYs
Shallow; gravel or natural rock	0.13	0.8	34.3	27.5	3.6
Shallow covered	0.34	0.08	34.3	2.7	0.9
Deep; natural substrate	1.90	0.085	34.3	2.9	5.5
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-
NA	0.00	0	34.3	-	-

Restored Habitats

Total **6.8**

Habitat type	Acres Restored	Habitat quality adj factor	Restoration Trajectory	Credit Segment 1 PV DSAYs per acre	Credit Segment 2 PV DSAYs per acre	Credit Segment 3 PV DSAYs per acre	Total PV DSAYs per acre restored	Total Quality Adj. PV DSAYs per acre restored	Quality Adj. PV DSAYs
Shallow; artificial	0.18	0.5	1	1.0	33.3	-	34.3	17.2	3.1
Deep; artificial substrate	1.78	0.05	1	1.0	33.3	-	34.3	1.7	3.1
Shallow: covered reduced	0.41	0.05	1	1.0	33.3	-	34.3	1.7	0.7
NA	0.00	0	NA	NA	NA	NA	-	-	-
NA	0.00	0	NA	NA	NA	NA	-	-	-
NA	0.00	0	NA	NA	NA	NA	-	-	-
NA	0.00	0	NA	NA	NA	NA	-	-	-
NA	0.00	0	NA	NA	NA	NA	-	-	-
NA	0.00	0	NA	NA	NA	NA	-	-	-
NA	0.00	0	NA	NA	NA	NA	-	-	-
NA	0.00	0	NA	NA	NA	NA	-	-	-
NA	0.00	0	NA	NA	NA	NA	-	-	-
NA	0.00	0	NA	NA	NA	NA	-	-	-

TOTAL CREDIT (Restored minus Current)

(3.2)

Final Dredge Plan and Approval NWP-2006-946

2019-07-25

From: Holm, James A CIV USARMY CENWP (USA)
To: Carbonneau, Kristine; Young, Hunter; Peterson, Lance; White, Melody J CIV USARMY CENWP (US); EDWARDS Blair; Kranz, Scott; ANDERSON Peter; Starr, Ben; Clodfelter, Andy; Chin, Abby; Karl Bernard; Doug Hall; Jim Dugan; Juan Medina
Cc: Jim Swatman
Subject: RE: PSET Dredge Plan Review Meeting
Date: Thursday, July 25, 2019 8:39:04 AM

Good morning Kris,

The PSET has no further comments on the dredge plan. If you encounter sediment-related issues during dredging, please do not hesitate to contact me, Melody, Blair, and Hunter. When you finalize the post-dredge and disposal report, please submit it electronically to me, Melody, Blair, Hunter, and NMFS.

Sincerely,
James

James A. Holm
Sediment Quality Team: Biologist & PSET Lead
Waterways Maintenance, Channels and Harbors
USACE - Portland District
503-808-4963 (desk), 503-758-5571 (cell)
james.a.holm@usace.army.mil

-----Original Message-----
From: Carbonneau, Kristine [mailto:Kris.Carbonneau@aecom.com]
Sent: Wednesday, July 24, 2019 7:33 PM
To: Young, Hunter <Young.Hunter@epa.gov>; Holm, James A CIV USARMY CENWP (USA) <James.A.Holm@usace.army.mil>; Peterson, Lance <petersonle@cdmsmith.com>; White, Melody J CIV USARMY CENWP (US) <Melody.J.White@usace.army.mil>; EDWARDS Blair <Blair.EDWARDS@state.or.us>; Kranz, Scott <scott.kranz@aecom.com>; ANDERSON Peter <Peter.ANDERSON@state.or.us>; Starr, Ben <ben.starr@aecom.com>; Clodfelter, Andy <Andy.Clodfelter@aecom.com>; Chin, Abby <Abby.Chin@aecom.com>; Karl Bernard <kbernard@transmontaigne.com>; Doug Hall <dhall@transmontaigne.com>; Jim Dugan <jdugan@transmontaigne.com>; Juan Medina <jmedina@transmontaigne.com>
Cc: Jim Swatman <jswatman@transmontaigne.com>
Subject: [Non-DoD Source] RE: PSET Dredge Plan Review Meeting

Thank you Hunter.

From: Young, Hunter [mailto:Young.Hunter@epa.gov]
Sent: Wednesday, July 24, 2019 7:40 PM
To: Carbonneau, Kristine; Holm, James A CIV USARMY CENWP (USA); Peterson, Lance; White, Melody J CIV USARMY CENWP (US); EDWARDS Blair; Kranz, Scott; ANDERSON Peter; Starr, Ben; Clodfelter, Andy; Chin, Abby; Karl Bernard; Doug Hall; Jim Dugan; Juan Medina
Cc: Jim Swatman
Subject: RE: PSET Dredge Plan Review Meeting

Kris,

EPA Cleanup has no further questions regarding the Dredge Plan.

Thank you,

Hunter Young

U.S. Environmental Protection Agency

Region 10 - Oregon Operations Office

Young.Hunter@epa.gov <mailto:Young.Hunter@epa.gov>

(503)-326-5020

From: Carbonneau, Kristine <Kris.Carbonneau@aecom.com>
Sent: Monday, July 22, 2019 4:14 PM
To: Holm, James A CIV USARMY CENWP (USA) <James.A.Holm@usace.army.mil>; Peterson, Lance <petersonle@cdmsmith.com>; White, Melody J CIV USARMY CENWP (US) <Melody.J.White@usace.army.mil>; EDWARDS Blair <Blair.EDWARDS@state.or.us>; Young, Hunter <Young.Hunter@epa.gov>; Kranz, Scott <scott.kranz@aecom.com>; ANDERSON Peter <Peter.ANDERSON@state.or.us>; Starr, Ben <ben.starr@aecom.com>; Clodfelter, Andy <Andy.Clodfelter@aecom.com>; Chin, Abby <Abby.Chin@aecom.com>; Karl Bernard <kbernard@transmontaigne.com>; Doug Hall <dhall@transmontaigne.com>; Jim Dugan <jdugan@transmontaigne.com>; Juan Medina <jmedina@transmontaigne.com>
Cc: Jim Swatman <jswatman@transmontaigne.com>
Subject: RE: PSET Dredge Plan Review Meeting

Hello,

Please find attached the updated Dredge Plan. Please note you were also copied on an email to DEQ and NMFS concerning the location of water quality monitoring buoys which was discussed at our 7/17/19 meeting and noted that AECOM needed to follow up directly with them for confirmation of our approach. We have received NMFS approval of that plan and awaiting DEQ. It is our understanding with the submission of this updated plan and approval of the water quality monitoring program by DEQ, we should have all necessary review/approvals from PSET. Please let us know if this is not correct.

Thanks,

Kris Carbonneau

From: Carbonneau, Kristine
Sent: Friday, July 19, 2019 3:30 PM
To: Holm, James A CIV USARMY CENWP (USA); Peterson, Lance; White, Melody J CIV USARMY CENWP (US); EDWARDS Blair; Young, Hunter; Kranz, Scott; ANDERSON Peter; Starr, Ben; Clodfelter, Andy; Chin, Abby; Karl Bernard; Doug Hall; Jim Dugan; Juan Medina
Cc: Jim Swatman
Subject: RE: PSET Dredge Plan Review Meeting

Hello James, Lance and Hunter (and others),

Thank you again for your time on Wednesday to review comments on the PSET Dredge and Disposal Plan. We have worked through the edits that were discussed and waiting on some additional information from Pacific Pile and Marine. On the call I optimistically thought we could provide it today, but it looks like it is more realistically going to be Monday.

Have a nice weekend,

Kris Carbonneau

Kristine M. Carbonneau, P.E.

Senior Remediation Engineer

AECOM

1 Federal Street, 8th Floor

Boston, MA 02110

+1 617 371 4498 Direct

Dredging Plan

Portland Terminal
9930 NW Saint Helens Road, Portland, Oregon

SeaPort Midstream Partners, LLC

AECOM Project Reference: Portland Terminal Maintenance Dredging
AECOM Project Number: 60558028

July 22, 2019

Quality information

Prepared by	Checked by
Kristine Carbonneau, P.E. Senior Technologist	Scott Kranz, R.G. Senior Program Manager

Revision History

Revision	Revision date	Details
1	7/22/19	Incorporated comments and changes discussed at the 7/17 PSET meeting
2		
3		
4		
5		

Prepared for:

SeaPort Midstream Partners, LLC

Submitted to:

PSET, USACE
James Holm

EPA Region 10
Hunter Young

Prepared by:

Scott Kranz, R.G.
Project Manager

AECOM
111 SW Columbia, Suite 1500
Portland OR, 97201
aecom.com

Table of Contents

Figures

Abbreviations

CFR	Code of Federal Regulations
CRD	Columbia River Datum
cy	cubic yard
EPA	US Environmental Protection Agency
gpm	gallons per minute
GPS	global positioning system
OR DSL	Oregon Department of State Lands
OR DEQ	Oregon Department of Environmental Quality
NMFS	National Marine Fisheries Service
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PPM	Pacific Pile and Marine
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RTK	real-time kinematic
SeaPort	SeaPort Midstream Partners, LLC
Solmar	Solmar Hydro Inc.

1. Introduction

AECOM has prepared this Dredging Plan on behalf of SeaPort Midstream Partners, LLC (SeaPort) and its dredging contractor, Pacific Pile and Marine (PPM). This plan summarizes the anticipated means and methods PMM will use to conduct the maintenance dredging project in accordance with the construction drawings, technical specifications and the project permits.

1.1 Location and Regulatory Setting

This project will be conducted at the SeaPort Portland Terminal located at 9930 NW Saint Helens Road in the Willamette River (river mile 4.9) in Portland, Multnomah County, Oregon. The terminal consists of a bulk petroleum storage and transfer facility dock on the west side of the Willamette River (Figure 1).

This maintenance dredge project is located within the Portland Harbor Superfund Site (PHSS) and additional environmental requirements have been incorporated into the construction contract documents (i.e., drawings and technical specifications) in accordance with the special conditions of the following project permits and/or consultation with supporting agencies:

- Department of the Army Nationwide Permit No. NWP-2006-946-3
- National Marine Fisheries Service (NMFS) Biological Opinion No. WCRO-2019-00011
- Oregon Department of State Lands (OR DSL) Removal/Fill Authorization No. 60800-RF
- Oregon Department of Environmental Quality (OR DEQ) 401 Water Quality Certification No. 2006-946-3

1.2 Project Description

The purpose of the Project is to perform maintenance dredging at the SeaPort Portland Terminal to reestablish original berthing depths for current and future vessels. The facility's berth area is approximately 825 feet along the navigation channel and extends 105 feet from the dock to the navigation channel (Figure 2).

The project will restore the berth to the original authorized elevation of -34 feet Columbia River datum (CRD). As a requirement to conducting this maintenance project within the boundary of the PHSS, dredging will be performed to -35 feet CRD to accommodate placement of a temporary cover layer over the post-dredge surface to address sediment concentrations exceeding the Environmental Protection Agency (EPA) PHSS Record of Decision (ROD) cleanup levels.

The bathymetric survey (baseline conditions mapped in 2015 with updated berthing area survey conducted in 2017) indicates the sediment surface elevations within the Project boundary range from -21 feet CRD near the center of the dock and descend to -45 feet CRD near the navigation channel. Dredging to the target depth is estimated to require from 1 to 19 feet of sediment removal within the project boundary. The estimated removal volume for this project is 9,400 cy.

The project will be completed during the Willamette River in-water work window from July 1 to October 31, 2019.

2. Construction Approach

This section provides a general description and overview of the sequence of means and methods PPM will employ to complete the maintenance dredging project.

2.1 Dredging

The following dredging equipment will be mobilized to the project site by Boyer Towing Service. Prior to arrival onsite, each piece of equipment (e.g. barge, excavator buckets) will be decontaminated.

- **Dredge barge**. A Hitachi 1200-6 fixed-arm, hydraulic excavator fitted with a 70-ft dredge arm will be secured to the deck of a barge, the Lash IV, which has hydraulically operated spuds. The dredge bucket will be a five cubic yard (cy), closed, environmental Young bucket with sharpened steel teeth mounted to the digging edge of the bucket. Additional buckets will be available should there be a need. The excavator's hydraulic system will use biodegradable oil in place of petroleum-based oil. For precise spatial positioning, the excavator will be equipped with inclinometers on the dredge arm and bucket, as well as heading sensors on the body of the excavator.
- **Material barges**. Two scow barges, the Chetco and Umpqua, will be used to hold and transport dredged sediments for disposal. Each barge will have a 2500-ton capacity. The Chetco measures approximately 210 x 55 x 15 ft (length, width, height). The Umpqua's dimensions are approximately 204 x 52 x 12 ft. Each barge is fitted with 6 ft high, water-tight side boards and has concrete wear decks.

The preliminary dredge plan is illustrated in Figure 1. To begin dredging, the dredge barge will be maneuvered into position using a tug boat. Once positioned, the dredge barge will engage anchoring spuds to hold itself in place. In each dredge cycle, the excavator's bucket will remove approximately 4 cy of sediment. The sediment material will be compressed as the bucket is closed, reducing the volume of entrained water. The excavator will place dredged material directly into a scow barge. A minimum 1 ft of freeboard will be maintained between the top of the dredged material and the top of the dredge rails to prevent overtopping or spills.

The sensors mounted to the excavator will be used in conjunction with a real-time kinematic global positioning system (RTK-GPS) and HYPACK 2019 dredging software to facilitate precise positioning and location tracking. This system will allow the position of the bucket to be monitored, in real-time. Two GPS antennas mounted on the rear of the excavator will provide additional position and direction data.

2.2 Dredged Material Management

The sediment to be removed by this project are impacted by chemicals of concern, including polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), diesel, heavy oil, and dioxin/furans. Based on the sediment characterization data as provided to PSET on October 31, 2017, it has been determined the sediment is not a hazardous waste under the Resource Conservation and Recovery Act (RCRA) (40 CFR 261) and is therefore acceptable for disposal in a non-hazardous, RCRA Subtitle D, landfill facility.

Dredged material will be transported in the sealed dredged material barges, via tugs operated by Boyer Towing, to the permitted Waste Connections transloading facility located in The Dalles, OR. At this facility, the sediment will be dewatered, stabilized with drying agents (as needed), transloaded to trucks, and transported for disposal at the Wasco County Landfill.

2.3 Placement of Sediment Cover

At the completion of dredging, a cover layer will be placed over the berthing area and side-slopes between elevations -2 to -35 ft CRD.

2.3.1 Material Sources and Acceptance

Activated carbon will be obtained from the Calgon Carbon Corporation and shipped to the CalPortland facility in Portland, OR for blending with cover material. Sand and gravel, carbon-amended sand mixtures, and rounded cobble stone will be shipped to the project location via material barge from the CalPortland facility. Armor stone will most likely be obtained from Columbia Granite and shipped via barges from a marine facility in Vancouver, WA. Geosynthetic materials will be obtained from NW Linings and shipped from the marine facility in Vancouver, WA.

Representative samples of each material will be submitted for physical and chemical characterization, as applicable, per the requirements outlined in the project technical specifications. Chemical characterization will include analysis and comparison to EPA ROD Cleanup Levels, identified on Table 17 and DEQ Clean Fill Standards. One 10-point composite will be collected for every 500 cy of imported material. To ensure the suitability of each material, the results of all testing will be inspected for compliance with the technical specifications prior to shipment of materials to the project. Tabulated lab data and analytical reports will be provided to the EPA.

2.3.2 Berthing Area

In the berthing area (Figure 3), the cover layer will be constructed to a 1-ft thickness. The materials will consist of a 6-inch layer of clean granular material and activated carbon overlain with a 6-inch, minimum, layer of angular armor stone. The armor stone will have a gradation that consists of at least 50 percent, by weight, of material with a diameter of 2.7 inches (D_{50} equal to 2.7 inches). Materials will be placed on the river bed by the dredging excavator in accordance with the drawings and technical specifications.

2.3.3 Slope-Area

In the slope area (Figure 4), the cover layer will consist of a 6-inch layer of carbon-amended granular materials for side-slopes where dredging is performed to achieve a 1.5H:1V stable slope maximum. The remaining side-slope areas will be covered with a 6-inch layer of an unamended granular material. To provide stability, the cover material will be placed into a geosynthetic structure (i.e., a 6-inch geocell system) and then overlain with an armor layer. For areas at an elevation less than -4 ft CRD, the cover layer will be overlain by a rock layer with a 12.2-inch D_{50}. A 6-inch layer of beach mix will be placed on the rock layer to fill interstices within the larger rock and provide appropriate substrate habitat for colonization by benthic organisms. The beach mix will consist of rounded cobble stone (2.5 inches or less in size), sand, and gravel.

Following dredging, the geocell system will be placed using the dredge excavator, in coordination with divers provided by Crux Diving. First, a geosynthetic fabric will be placed in longitudinal strips perpendicular to the slope as shown on the drawings and anchored per manufacture recommendations. Diver and hydrographic surveys will be used to verify required placement is achieved. Once in place, a geocell material will be placed on top of the geosynthetic in 8 x 27-ft grids. Once the required coverage and anchoring of the geosynthetic materials have been verified, cover material will be placed into the geocell using the excavator bucket. A hydrographic survey and/or diver-assisted point by point verification will be used to verified placement tolerances. Following acceptable placement of the amended sand, the armor stone will be placed using the excavation. A subsequent survey will be completed to confirm acceptable placement of the armor stone layer, and then beach mix will be placed and surveyed for final acceptance of the amended sediment cover.

2.4 Surveying

PPM has retained eTrac, Inc. (eTrac) to serve as its independent, licensed hydrographic surveyor. eTrac will complete the following activities in accordance with the project technical specifications:

1. Pre-construction baseline survey
2. Construction quality control progress surveys

3. Final dredge survey
4. Final placement surveys for each cover type
5. Final record document survey

In addition, eTrac will install the base station for and calibrate the dredge's RTK-GPS system. It will also install tide boards for tracking water elevations.

The survey vessel, the Spectrum, will be equipped with a universal sonar mount for side-mounted multibeam data collection. The inertial navigation system to be used for the survey is an Applanix POS MV Wavemaster which consists of a coupled global navigation satellite system and motion reference unit to allow for accurate vessel positioning that accounts for movement of the vessel (i.e., heave, pitch and roll).

2.5 Water Quality

PPM will employ, in accordance with the permit conditions, a range of best management practices (BMPs) to minimize sediment loss and generation of turbidity during dredging and cover placement. BMPs will include, but are not limited to:

- Sequence and scheduling of work activities, to the extent practicable, to minimize magnitude and duration of in-water disturbances and potential for impacting placed cover material
- Use of a closed, environmental bucket
- Use of an experienced dredge operator and supporting crew
- Controlled production rates to limit resuspension and speed at which bucket moves through water column (to minimize loss of adhered sediment)
- Dredged sediment will be released over a sealed dredged material barge, not back into the water
- Precise bucket positioning with RTK-GPS system
- Controlled dredging in slope areas to minimize sloughing
- Use of silt curtain around the dredge barge
- Use of floating absorbent booms to capture floating debris or sheen

Additional BMPs or engineering controls will be implemented as contingency measures, as determined necessary based on observed water quality monitoring results and working conditions.

2.5.1 Water Quality Monitoring Program

PPM has retained Gravity Consulting LLC to conduct its construction water quality program. Gravity will execute the monitoring program consistent with permit requirements to maximum extent possible unless otherwise noted herein. Two floating water quality stations will be installed for this project. The equipment will consist of NexSens CB-450-R buoys which include a polymer-coated foam hull, three 10-watt solar panels, integrated battery harness, an Airmar depth sensor, and a solar regulator with cellular modem capabilities. The buoys will connect to a cellular network to provide access to the data in real-time. For monitoring turbidity, a turbidity sensor, compliant with International Organization of Standardization 7027, will be installed and will have a wiper to prevent fouling.

In accordance with the OR DEQ 401 water quality certification, one water quality station will be placed approximately 100 ft upstream, in an undisturbed location, to monitor background conditions. The second will be placed approximately 100 ft downstream to measure compliance with the permit. The maintenance dredge project is located in an active portion of the River; there is ongoing remedial efforts at RestoreCap just downstream and active shipping at NuStar just upstream. Monitoring stations will be adjusted to minimize the potential for navigation/safety hazards and influence of adjacent site activities, in consultation with OR DEQ. Stationary buoys may also be supplemented with manual measurements to address change conditions in the field from addressing potential impacts from sources other than this project. Turbidity will be monitored at two-hour intervals when in-water work is being conducted. The background turbidity, location, date, time, and tidal stage will be recorded immediately prior to monitoring at the downstream compliance point. Turbidity readings will be recorded in daily logs and will include any observed turbidity exceedances and associated response actions taken to control the work. The following OR DEQ 401 permit conditions will be strictly followed:

Measured Turbidity Level (Above Background)	Action Required at 1st Monitoring Interval	Action Required at 2nd Monitoring Interval
0 to 5 NTU	Continue to monitor	Continue to monitor
6 to 29 NTU	Modify BMPs and continue to monitor	Stop work after 4 hrs at 6 to 29 NTU above background
30 to 49 NTU	Modify BMPs and continue to monitor	Stop work after 2 hrs at 30 to 49 NTU above background
> 50 NTU	Stop work	Stop work

2.6 Construction Water Management

PPM has identified two methods for managing construction waters, including water that decants from stored dredged material, decontamination liquids and other aqueous waste streams generated by this work.

2.6.1 On-site Management

Dredge material barges will be dewatered on site prior to transporting to the offload facility. The dredge material barges will be equipped with 4 well points, one located in each corner of the barge. Standing water will drain toward each sump pump. Straw bales, filter fabric or similar means will be used to minimize suspended sediment at the pump intake point. The water will then be pumped from the well intake point using a 2” trash pump or submersible electric point back to the dredge area where it originated and inside the silt curtain.

Water quality standards will be monitored in accordance with permits. If an exceedance occurs and the root cause is considered to be from discharging water into the curtained area, PPM will employ BMP’s including but not limited to the following:

- Use of a flocculant sock on the discharge hose to collect additional suspended sediment;
- Slow the flow or use fewer pumps to transfer the water; or
- Isolate areas of the barge to allow sediments to settle out of the water prior to pumping.

2.6.2 Offsite Management and Disposal

Additional free water that decants from the dredged sediment during transport to the transloading facility will be either 1) mixed with a drying agent and disposed at Wasco County Landfill; or 2) collected in 5,000 gallon trucks and transported for disposal in Boardman, OR.

2.7 Vessel Management

The Columbia and Willamette Waterway is a busy industrial traffic route with numerous users. Continuous coordination is required to ensure safe use of the waterway for PPM and its subcontractors as well as other users. To minimize the potential for waterway conflict, PPM will strictly adhere to Coast Guard regulations, waterway rules, and right-of-way hierarchy. PPM will also coordinate closely with tenants and other waterway users to minimize potential conflicts.

The right-of-way practices defined by the International Regulations for Preventing Collisions at Sea will be followed. During transit, right-of-way will be determined by communications between the two vessels. On the Columbia and Willamette Waterway, two marine VHF channels, 16 and 19, are used to communicate between vessels. In general, the larger vessel will be provided right-of-way.

2.8 Environmental Controls

The environmental resources within the project boundaries and those directly in contact with the equipment that is used will be protected for the duration of the project.

2.8.1 Spill Prevention

A Spill, Prevention, Control, and Countermeasure (SPCC) Plan is under development. The SPCC will identify potential sources for spills and outline responsive actions to be taken in the event of a spill or release. The SPCC Plan will describe notification and reporting procedures, including an outline of personnel responsibilities and associated training requirements.

Where possible, staging of materials will be at least 150 ft from the water's edge. Full containment will be provided for any potential contaminants, including but not limited to fuels, oils and chemicals, that are staged within 150 ft of the water. Vehicles and equipment operating within 150 ft of water will be inspected for leaks daily. Waste chemicals will be collected and disposed in a manner consistent with applicable federal, state and local regulations. Spill prevention and containment supplies will be maintained onsite. In the event a spill occurs, it will be immediately reported to the Oregon Emergency Response System (1-800-452-0311). A project maintenance and inspection log will be maintained and made available upon request.

2.8.2 Air Resources

Odors will be controlled during all construction activities. If nuisance ordinance (OAR 340-208-0300) odor thresholds are exceeded at any point, work will stop, or activities will be restricted in a manner that maintains the nuisance odor below acceptable levels. Additionally, construction activities will be monitored for flammable or combustible vapors, in accordance with the project technical specifications.

2.8.3 Solid Waste Management

All solid wastes (e.g. personal protective equipment) will be placed in containers that are maintained and emptied as needed. Handling, storage, and disposal will be conducted in a manner that prevents releases to the environment. All generated solid wastes will be collected, transported and disposed in accordance with applicable federal, state and local requirements.

2.8.4 Archaeological Resources

In the event any suspected archaeological resources, artifacts, or human remains are encountered during construction, all activities will stop, and the State Historic Preservation Office will be immediately contacted (503-986-0674).

2.9 Safety

PPM has prepared a site-specific health and safety plan (HASP) for this project. The HASP details roles, responsibilities and training requirements for the contractor's personnel, including subcontractors. The HASP will also identify the work zones and decontamination procedures as it relates the contaminated materials. Additionally, the HASP identifies specific communication and reporting protocols for health and safety concerns and incidents. Daily and monthly health and safety meetings will be held to review pertinent safe work practices, personal protective equipment, and work hazards. PPM's health and safety program strictly adheres to all applicable federal, state and local regulations.

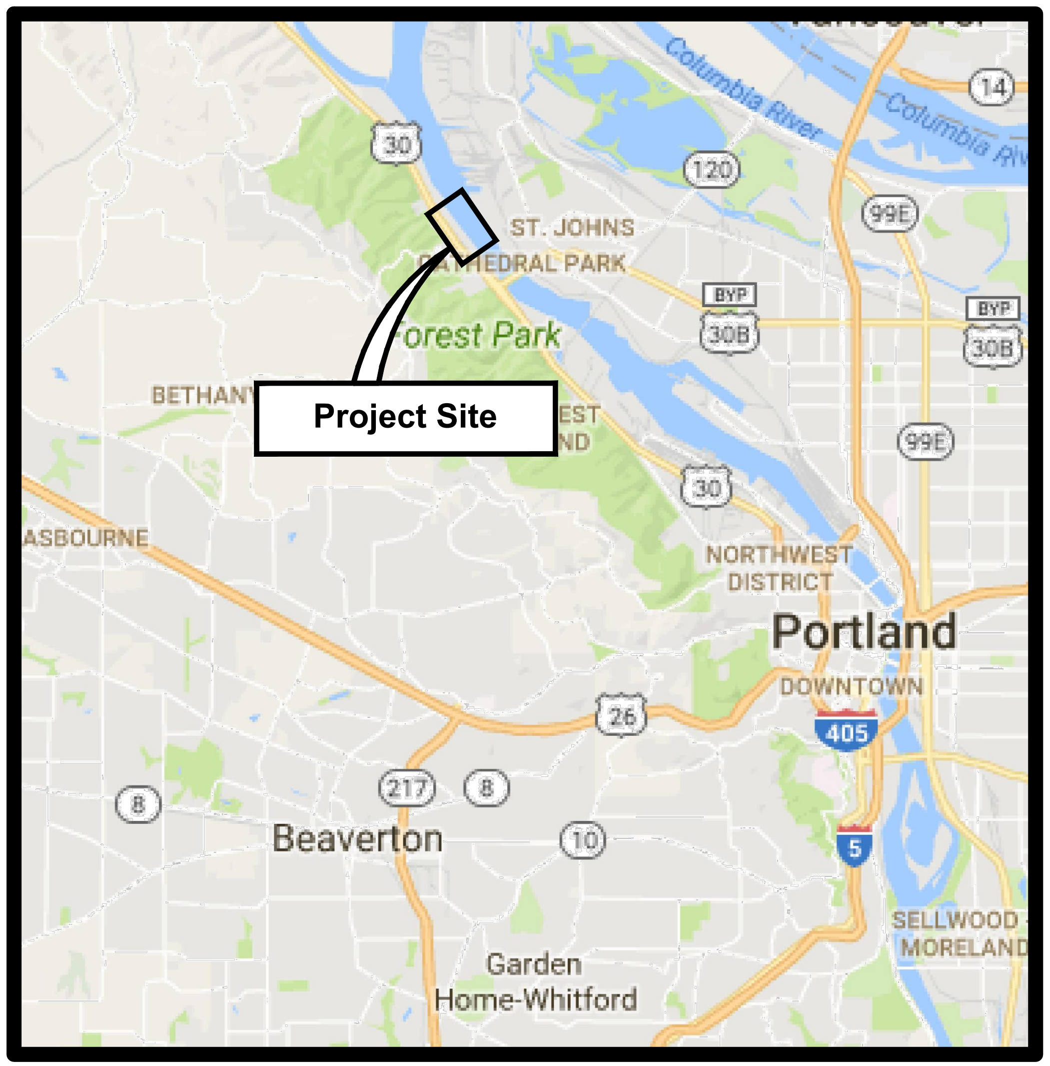
2.10 Schedule

In accordance with the project permit conditions, the project will be completed during the Willamette River in-water work window from July 1 to October 31, 2019. Dredging activities are anticipated to commence on July 29, 2019. Mobilization of all equipment, including surveying and water quality monitoring equipment, will occur in the preceding week.

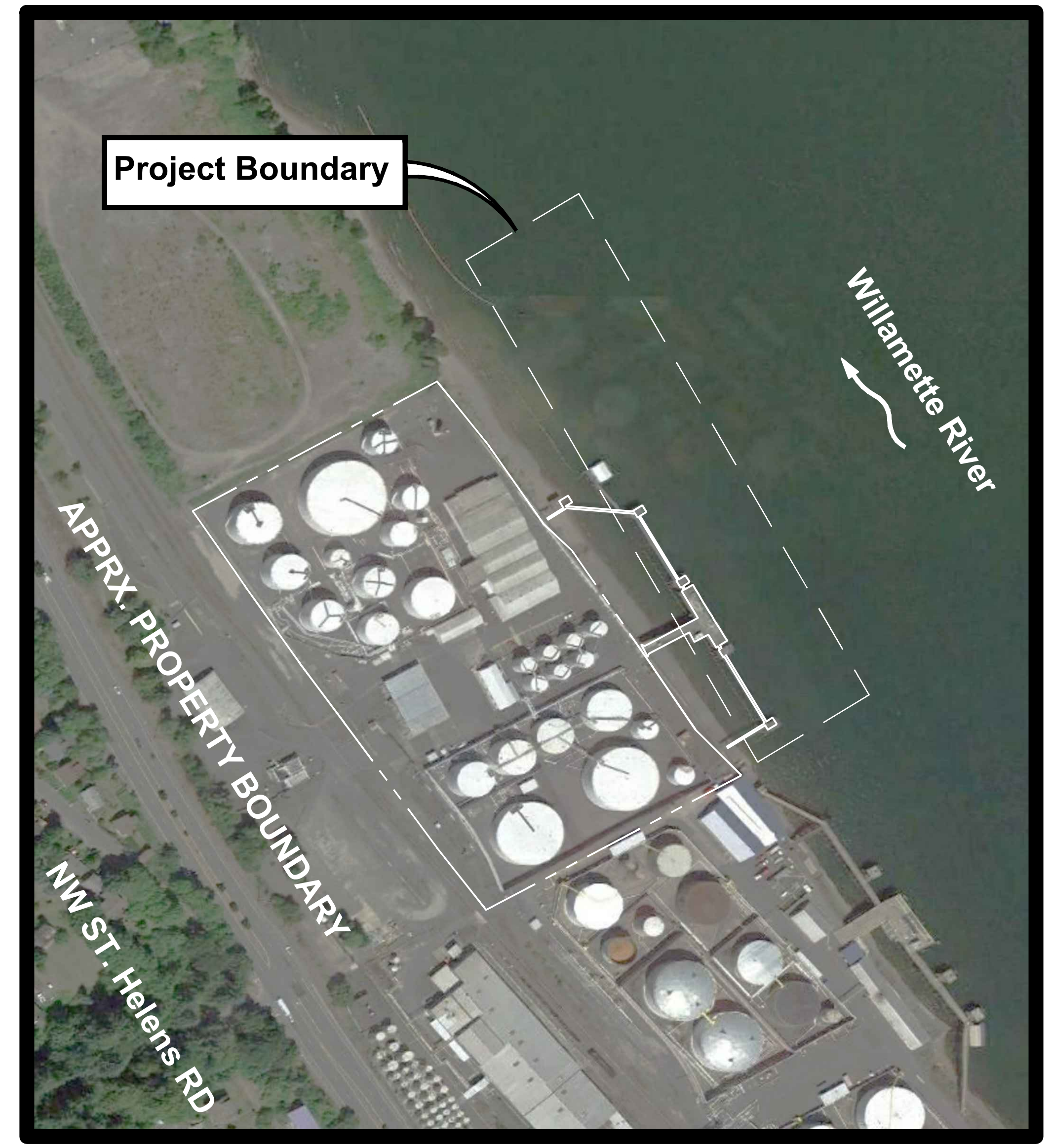
It is estimated that dredging will be completed within 20 working days. Placement of cover within the berth and slope areas is estimated to require an additional 40 working days. The anticipated completion date for this project is on or before October 31, 2019.

Figures

Last saved by: CHINA2(2019-07-04) Last Plotted: 2019-07-05
Filename: C:\USERS\CHINA2\DESKTOP\910-CAD\20-SHEETS\CONSTRUCTION DRAWINGS\ISSUED FOR PERMIT\2019-07-03 SEAPORT DREDGE PLAN FIGURE 1.DWG
Project Management Initials: Designer:_ Checked:_ Approved:_ ANSI B 11" x 17"



VICINITY MAP
NTS



SITE MAP
NTS

Issue Status: DRAFT

AECOM

FIG 1

VICINITY PLAN AND SITE MAP

PORTLAND TERMINAL MAINTENANCE DREDGE
SEAPORT MIDSTREAM PARTNERS, LLC
Project No.: 60558028 Date: 2019-07-03

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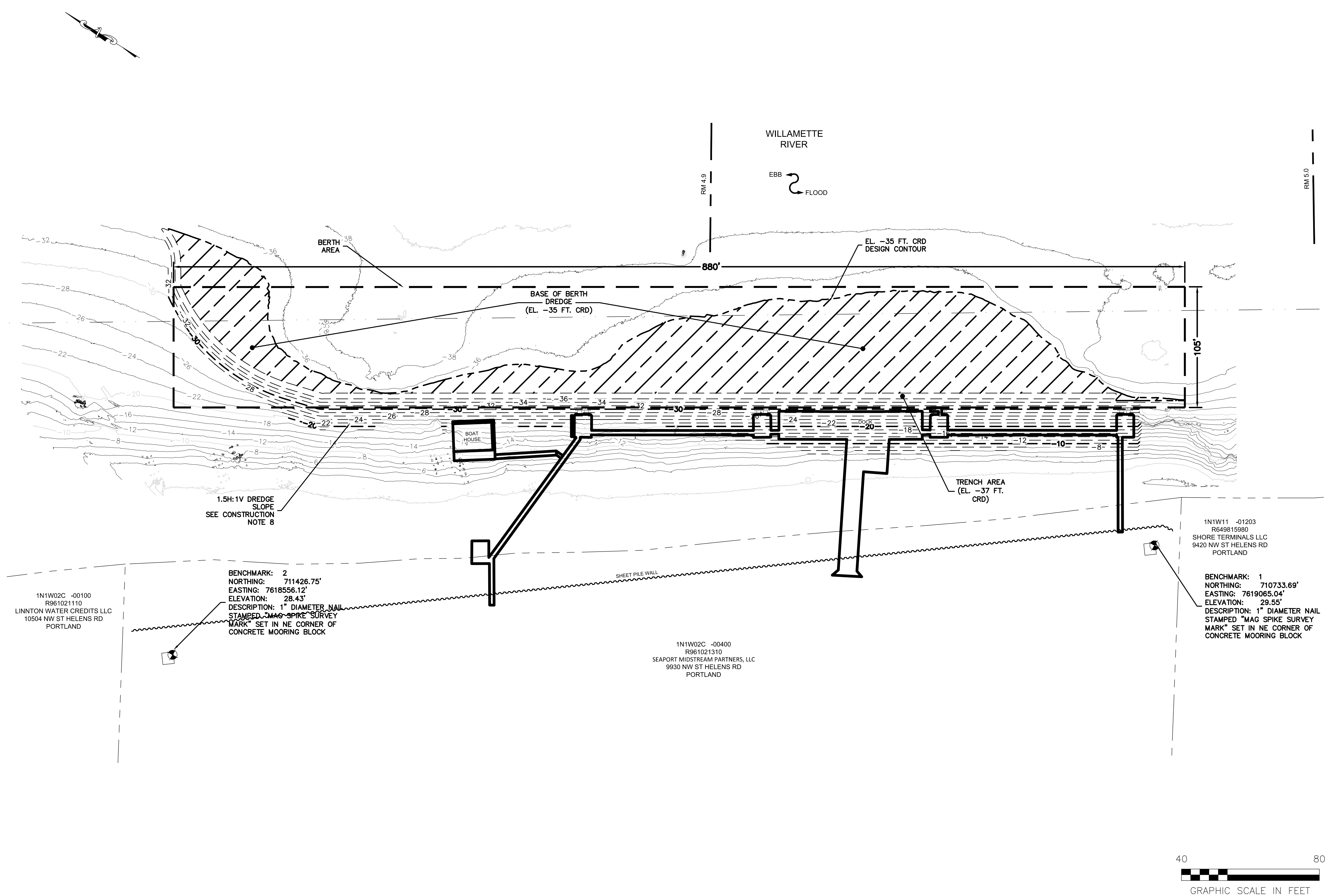
Project Management Initials: Designer: Checked: Approved: ANSI B 11" x 17"



Issue Status: DRAFT

AECOM

FIG 2

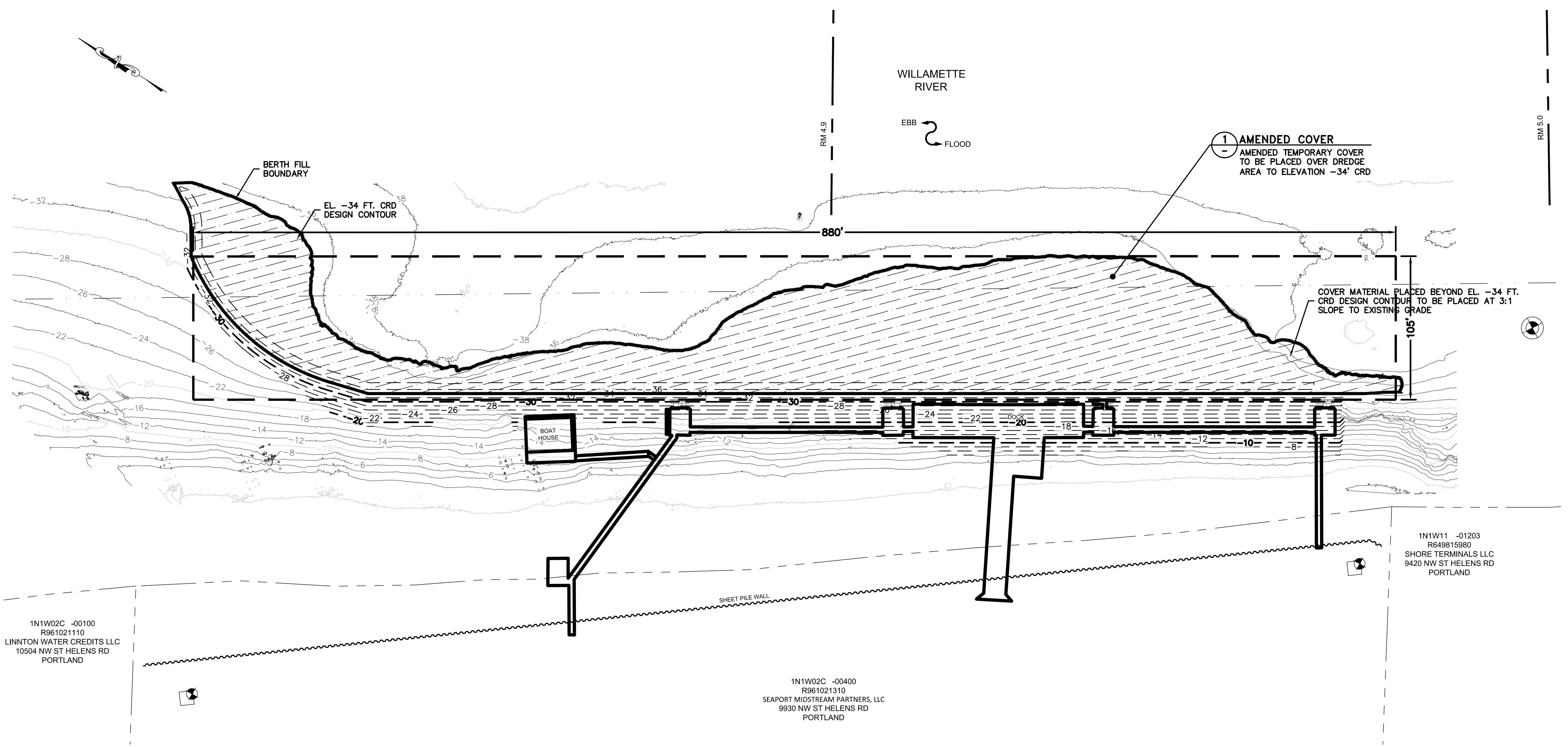
DREDGE PLAN

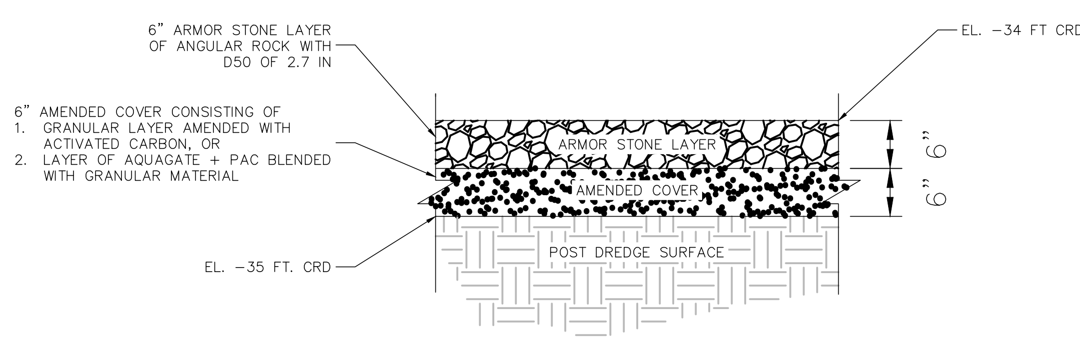
PORTLAND TERMINAL
MAINTENANCE DREDGE
SEAPORT MIDSTREAM PARTNERS, LLC
Project No.: 60558028 Date: 2019-07-03

Issue Status: DRAFT

AECOM

FIG 3





1 – CARBON AMENDED COVER

40 80

GRAPHIC SCALE IN FEET

TEMPORARY COVER
FOR BERTH

PORTLAND TERMINAL
MAINTENANCE DREDGE
SEAPORT MIDSTREAM PARTNERS, LLC
Project No.: 60558028 Date: 2019-07-03

Last saved by: CHINA2(2019-07-04) Last Plotted: 2019-07-22
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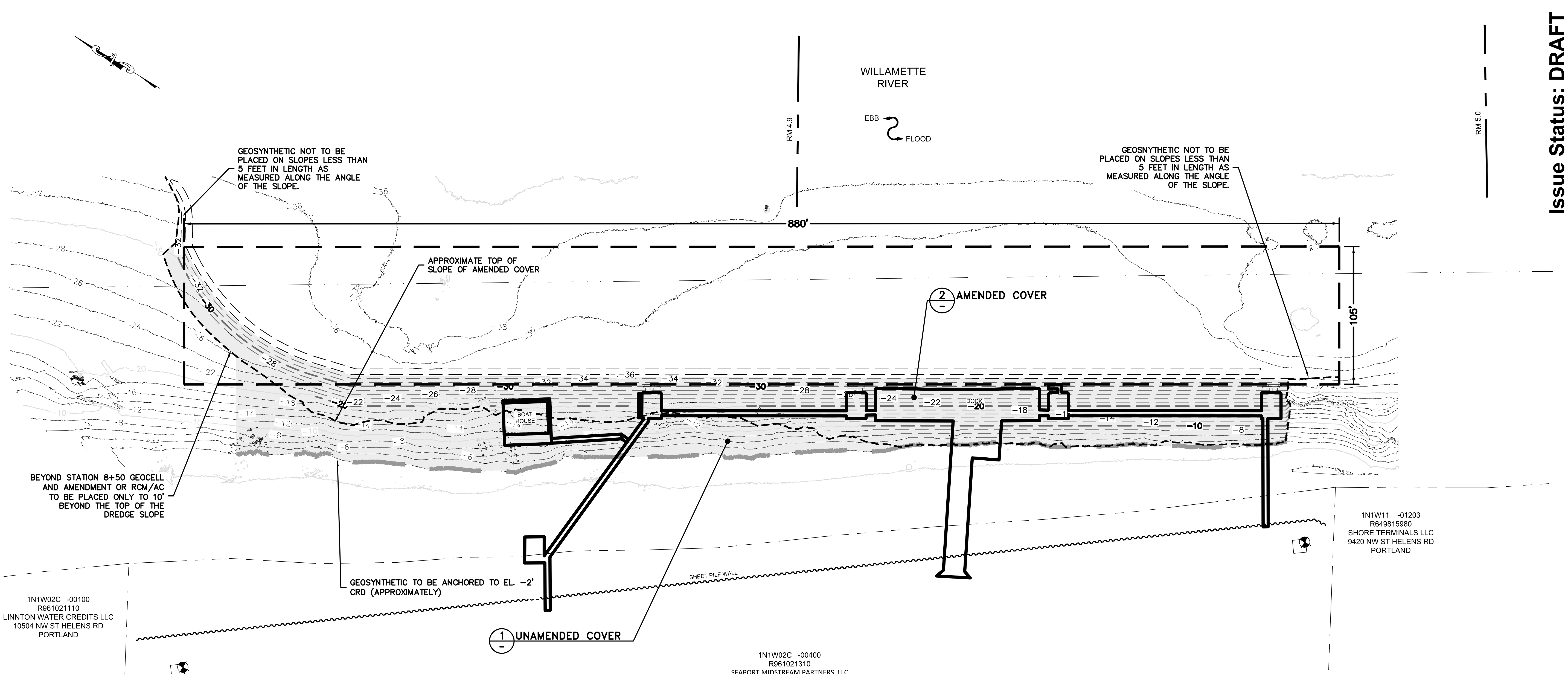
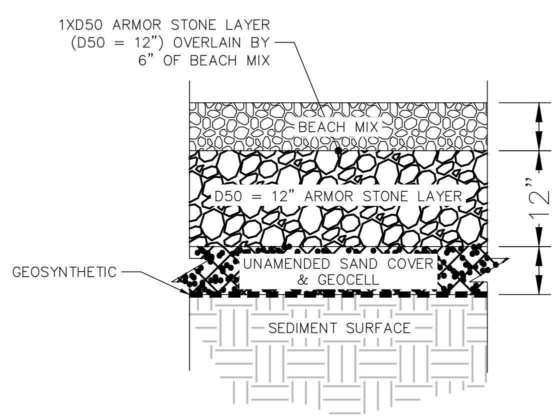
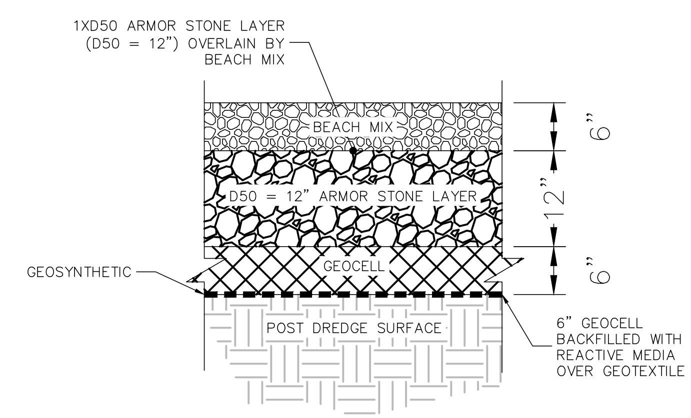
Project Management Initials: __ Designer: __ Checked: __ Approved: __ ANSI B 11" x 17"





NOTE:
AT ELEVATION -4' CRD THE D50 FOR THE ARMOR STONE INCREASES FROM 12" TO 14".

1 UNAMENDED COVER; GEOCELL



NOTE:
CARBON AMENDED MATERIAL SHALL BE PLACED TO A DISTANCE OF 10 FT BEYOND THE TOP OF THE DREDGE SLOPE OR TO THE END OF THE GEOSYNTHETIC, WHICHEVER IS ENCOUNTERED FIRST.

2 GEOCELL COVER WITH CARBON REACTIVE MEDIA

40 80
GRAPHIC SCALE IN FEET

Issue Status: DRAFT

AECOM

FIG 4

TEMPORARY COVER FOR SLOPE

PORTLAND TERMINAL
MAINTENANCE DREDGE
SEAPORT MIDSTREAM PARTNERS, LLC
Project No.: 60558028 Date: 2019-07-03

Modification for Carbon Amended Sand Installation

2019-08-27

(Relevant Passages Outlined in Red)

From: Young, Hunter
To: White, Melody J CIV USARMY CENWP (US)
Subject: [Non-DoD Source] FW: SeaPort Carbon Amended Sand Installation
Date: Tuesday, August 27, 2019 12:54:13 PM

Hey Melody,

Just keeping you in the loop at SeaPort. See below as FYI.

Hunter Young
U.S. Environmental Protection Agency
Region 10 - Oregon Operations Office
Young.Hunter@epa.gov
(503)-326-5020

From: Carbonneau, Kristine <Kris.Carbonneau@aecom.com>
Sent: Tuesday, August 27, 2019 12:19 PM
To: Young, Hunter <Young.Hunter@epa.gov>
Cc: Kranz, Scott <scott.kranz@aecom.com>; Peterson, Lance <petersonle@cdmsmith.com>
Subject: RE: SeaPort Carbon Amended Sand Installation

Thank you Lance and hello Hunter.

Yesterday I followed up on an email from Lance on 1) the analytical report for the sand material that is proposed for use at SeaPort (both w/ and w/o carbon amendment); and 2) the approach for confirming carbon content in the amended sand. This email is to document that call and the discussion.

- Scott Kranz provided the sand material analytical data to Lance Peterson on 8/16 as provided by the contractor. On 8/21, Lance replied indicating: *We are unable to assess if Specialty Analytics achieved Detection Limits (DLs) less than the ROD Table 17 CUL for cPAHs. While the results for cPAHs are reported as ND, the Reporting Limit (16.7 ug/kg) is higher than ROD Table 17 CUL (9 ug/kg) and we are unable to definitively conclude the DLs are below 9 ug/kg. To allow for a meaningful comparison of the import material data and Table 17 CULs, can you see if Specialty Analytics can provide the analyte DLs as a supplement to their lab package?* AECOM forwarded that request to the contractor who forwarded it onto Specialty Analytics. A revised report was generated and provided to AECOM on 8/23, however, there were several analytes (organo pesticides) that were still reporting "0" for DL. AECOM requested follow up and Specialty Minerals provided a second revision on 8/26. That report was forwarded to Lance yesterday afternoon.
    - Lance confirmed receipt and indicated he would have it reviewed on 8/27. Kris indicated that PPM is looking to start carbon blending ASAP and preferably Friday of this week.

- Scott Kranz indicated in an email on 8/23 to Lance Peterson that the carbon amendment and verification process was discussed with the contractor. Based on other projects AECOM and the contractor have been involved with, and due to the turn around time it takes for analytical results, it is proposed that the carbon dose be increased from 1 to 1.5% and that the thickness of placement be increased to the full geocell thickness – approximately 6". The design calls for 1% in 3 inches. With the addition of carbon - by dose rate and by thickness - the in-place verification can be eliminated and prevent slowing of the overall construction. Kris further explained to Lance on Monday, 8/26, that the contractor's plan is to deploy the geocell, backfill with sand/amended sand and place armor in cells across the slope so that when leaving for the weekend, each cell is complete to prevent disturbance.
    - Lance confirmed the message and indicated he would have someone review it on 8/27.

Please let me know if you have any questions.

Kris

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kris.carbonneau@aecom.com

From: Peterson, Lance [mailto:PetersonLE@cdmsmith.com]
Sent: Tuesday, August 27, 2019 9:53 Am
To: Carbonneau, Kristine
Cc: Kranz, Scott
Subject: RE: SeaPort Carbon Amended Sand Installation

Kris, can you please document our conversation in writing as an amendment to Scott's e-mail so there is something in writing that EPA can respond to? Please send to Hunter Young and copy me. Thanks.

Lance

From: Carbonneau, Kristine <Kris.Carbonneau@aecom.com>
Sent: Monday, August 26, 2019 4:32 PM
To: Peterson, Lance <PetersonLE@cdmsmith.com>
Cc: Kranz, Scott <scott.kranz@aecom.com>

Subject: RE: SeaPort Carbon Amended Sand Installation

Thanks Lance for calling today. I am in tomorrow all day so feel free to call my cell with any questions: 9788355971.

Kris

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kris.carbonneau@aecom.com

From: Peterson, Lance [mailto:PetersonLE@cdmsmith.com]
Sent: Monday, August 26, 2019 7:12 PM
To: Carbonneau, Kristine
Subject: FW: SeaPort Carbon Amended Sand Installation

From: Kranz, Scott <scott.kranz@aecom.com>
Sent: Friday, August 23, 2019 12:36 PM
To: Young, Hunter <Young.Hunter@epa.gov>; Peterson, Lance <PetersonLE@cdmsmith.com>
Subject: SeaPort Carbon Amended Sand Installation

Hunter and Lance

We would like to simplify placement of the carbon amended sand, which will be quickly followed by the armor stone by adding additional carbon to the sand before placement and eliminating the requirement for testing carbon content. The requirement is for a minimum of 3 inches of sand with 1% carbon. We plan on installing six inches of sand and are proposing to add 1.5% carbon. The 1.5% sand mixture will be saturated prior to installation using the dredging bucket to spread. The material will be released at the water surface to observe the material coming out of the bucket. The dredge equipment does not have a mechanism to tell them the amount the jaws of the bucket are open, and the operator needs to watch the material. Is our the proposed method acceptable without confirmation testing?

Thanks.

Scott Kranz, RG
AVP, Senior Program Manager
D 503-478-2764   C 503-816-6643
scott.kranz@aecom.com

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