PACIFIC groundwater GROUP

SURFACE AND SUBSURFACE SEDIMENT FIELD SAMPLING AND DATA REPORT HEAD OF SWAN ISLAND LAGOON PORTLAND HARBOR SUPERFUND SITE

MAY 3, 2019

SURFACE AND SUBSURFACE SEDIMENT FIELD SAMPLING AND DATA REPORT HEAD OF SWAN ISLAND LAGOON PORTLAND HARBOR SUPERFUND SITE

Prepared for:

de maximis, inc.

Prepared by:

Pacific Groundwater Group
2377 Eastlake Avenue East, Suite 200
Seattle, Washington 98102
206.329.0141
www.pgwg.com

May 3, 2019
DMXI_SIL_FSDR_FINAL_05032019

TABLE OF CONTENTS

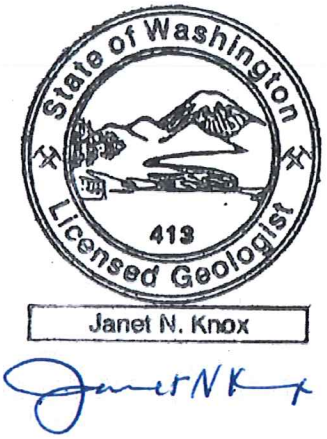
TABLES

FIGURES

APPENDICES

SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.



Janet N. Knox
Principal Environmental Geochemist
Washington State Geologist No. 413

Jeffrey S. Parker
Environmental Geologist
Oregon State Geologist No. 2381

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
ALS	ALS Environmental in Kelso, Washington
ASAOC	Administrative Settlement Agreement and Order on Consent
ASTM	American Society for Testing and Materials
BaP	Benzo(a)Pyrene
cm	centimeter
COCs	contaminants of concern
CRD	Columbia River Datum
CSM	Conceptual Site Model
DGPS	differential global positioning system
ENR	Enhanced Natural Recovery
EPA	United States Environmental Protection Agency
FS	feasibility study
FSP	Field Sampling Plan
FSR	Field Sampling Report
FSDR	Field Sampling Data Report
ft	feet
Gravity	Gravity Marine Services
ID	identification number
IDW	investigation-derived waste
LWG	Lower Willamette Group
mm	millimeters
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAD83	North American Datum of 1983
NAPL	Non-aqueous phase liquid
NAVD88	North American Vertical Datum of 1988
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PID	photoionization detector
PDI	Pre-Remedial Design Investigation
PGG	Pacific Groundwater Group
PHSS	Portland Harbor Superfund Site
Pre-RD Group	Pre-Remedial Design AOC Investigation Group
PTW	principal threat waste
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RPD	redox potential discontinuity
RI	remedial investigation
RM	river mile
ROD	Record of Decision
RTK	Real-Time Kinetic
SDU	Sediment Decision Unit
SIL	Swan Island Lagoon
SMA	Sediment Management Area
SOP	Standard Operating Procedure
SOW	Statement of Work
TestAmerica	TestAmerica Laboratories
TEF	Toxicity Equivalency Factor
TOC	total organic carbon
USACE	United States Army Corps of Engineers

1.0 INTRODUCTION

This Field Sampling and Data Report (FSDR) describes the focused surface and subsurface sediment sampling efforts performed in the head of the Swan Island Lagoon (Head of SIL) Study Area (Study Area). Except where noted, all surface and subsurface sediment field activities, including navigational positioning, sample collection, sample handling and processing, and data management, followed the procedures and guidelines specified in the Head of Swan Island Lagoon Sediment Field Sampling Plan (Head of SIL Sediment FSP) (Pacific Groundwater Group [PGG] 2018).

The Record of Decision (ROD) for the Portland Harbor Superfund Site (PHSS) (Figure 1) located in Portland, Oregon, described a post-ROD sampling effort to delineate and refine the sediment management area (SMA) footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-Remedial Design Agreement and Order on Consent Investigation Group (Pre-RD Group) to conduct the Pre-Remedial Design Investigation and Baseline Sampling (PDI) studies at the PHSS (EPA 2017b). The ASAOC includes a Statement of Work (SOW) and the PDI Work Plan (Geosyntec 2017), which generally describe the agreed upon field investigation activities, data analyses, schedule, and deliverables for the PDI.

Following the submittal of the more general PDI Work Plan, the Pre-RD Group submitted to EPA Field Sampling Plans (FSPs) that specify sampling scopes for surface sediment, core, biological, and bathymetry investigations. The PDI Surface Sediment FSP (AECOM and Geosyntec 2018a) and the PDI Subsurface Sediment FSP (AECOM and Geosyntec, 2018b) detail PDI sampling throughout the PHSS, including the Swan Island Lagoon (SIL). Collectively, 74 surface samples and 14 subsurface cores were identified for collection in the SIL for the PDI studies.

The Head of SIL Sediment FSP was prepared to support sediment sampling in the Head of SIL Study Area (Figure 2) and to complement the PDI investigation. This FSDR 1) summarizes those field sampling activities including sampling locations, requested sample analyses, sample collection methods, and any deviations from the Head of SIL Sediment FSP and 2) summarizes the validated data, laboratory reports, and data validation package.

1.1 OBJECTIVES

In the SIL, the PDI data will supplement and update the 1997-2007 Remedial Investigation/Feasibility Study (RI/FS) surface sediment data for purposes of remedial design and evaluating remedy effectiveness, but the PDI effort will collect fewer samples for the SIL than included in the RI/FS dataset. The surface and subsurface sediment data presented in this Head of SIL FSDR supplements the PDI data to support (1) the refinement of the Head of SIL SMA footprint and technology assignments, (2) the delineation of the extent of principal threat waste (PTW), and (3) the evaluation of remedy effectiveness, particularly as baseline sampling for an Enhanced Natural Recovery (ENR) Pilot Study.

1.2 FSDR DOCUMENT OVERVIEW

This Head of SIL FSDR follows the document structure of the Portland Harbor Remedial Investigation/Feasibility Study Round 2 Surface and Beach Sediment Field Sampling Report (FSR) (Integral 2005a) and Portland Harbor Remedial Investigation/Feasibility Study Round 2B Subsurface Sediment FSR (Integral 2005b).

Section 2, Field Sampling Procedures, describes how sediment samples were collected, handled, and described in the field and the Quality Assurance (QA) and Quality Control (QC) procedures used to ensure the quality of the data. Section 3, Laboratory Analyses and Data Management, describes the chemical and physical analyses conducted, the data management procedures, and the laboratory deviations from the Head of SIL Sediment Sampling FSP. Section 4, Analytical Results, summarizes the laboratory sample analysis results for the parameters tested using the validated data. Section 5 lists the references cited in this FSDR.

Supporting information is provided in several appendices:

- Appendix A: Positional Data
- Appendix B: Field Notebooks
- Appendix C: Sediment Grab Sampling Logs
- Appendix D: Sediment Core Sampling Logs
- Appendix E: Investigation-Derived Waste Disposal
- Appendix F: Photographs
- Appendix G: Analytical Laboratory Data Summary Reports
- Appendix H: Data Validation Reports
- Appendix I: Validated Analytical Results

2.0 FIELD SAMPLING PROCEDURES

Field sampling was conducted from October 23, 2018 through October 24, 2018. Table 1 summarizes the numbers and types of samples collected and the analyses performed. Surface sediment (0-30 cm) samples were collected on October 24, 2018 from 10 locations throughout the Head of SIL Study Area. Subsurface sediment core samples were collected on October 23, 2018 from three Head of SIL Study Area locations. Target and actual sample locations are presented in Figure 2 and listed on Table 2.

The field sampling followed the procedure described in the Head of SIL Sediment FSP (PGG 2018). The Head of SIL Sediment FSP follows the Surface and Subsurface Sediment FSP sampling and analysis protocols produced by the Pre-RD Group (AECOM and Geosyntec 2018a and 2018b) as derived from the Lower Willamette Group (LWG) RI Rounds 2 and 3 FSPs (Integral Consulting [Integral] 2004 and 2006).

2.1 SAMPLING VESSELS

Gravity Marine Consulting LLC (Gravity) operated the vessel and performed the surface and subsurface sediment sampling activities, under the coordination and oversight of the Field Coordinator per the Head of SIL Sediment FSP. Gravity utilized one sampling vessel, the 27-foot R/V *Methow* equipped with a hydraulic power grab sampler and Vibratory Core Tube Driver (vibracore) to complete the work.

2.2 NAVIGATION AND STATION POSITIONING

Station positioning and vertical control were performed as outlined in the Head of SIL Sediment FSP. Gravity used a Trimble 461 Real-Time Kinetic (RTK) DGPS with Hypack Survey software. The DGPS accuracy was confirmed each morning and evening to a known land-based survey point at the end of the dock located at the Fred Devine Diving and Salvage Company (Fred Divine) (property ID R315704). Confirmed station locations were recorded to the nearest whole foot in North American Datum 1983 (NAD83) Oregon State Plane Coordinate System, Oregon North Zone, international feet.

Vertical control was established using an on-board fathometer positioned at the starboard bow to measure depth to mudline at sample locations. Water depths were converted to elevations in feet North American Vertical Datum of 1988 (NAVD88) based on the river stage at the time of sampling as recorded at the Morrison Street Bridge located at RM 12.7. The gauge reports a value that is 0.3 feet above Columbia River Datum (CRD). CRD depths were converted to NAVD88 elevations using the USACE conversion for Mile 7.5 to Broadway Bridge: CRD is 5.28 feet above the NAVD88 elevation at RM 9.7.

Positional data recorded by Gravity including: sampling locations, times, and depths are reported in Appendix A. Note that core sample retrieval times vary slightly between Appendix A and the field forms because Gravity recorded the time at which location data were recorded and the field forms report the time the sample was brought onboard the vessel.

2.3 SURFACE SEDIMENTS

Surface sample collection and processing followed the procedures specified in the Head of SIL Sediment FSP. Minor deviations from the FSP are discussed in Section 2.9.

Surface sediments from all 10 of 10 locations were submitted to analytical laboratories for chemical testing (see Section 3). Consistent with the Head of SIL Sediment FSP, a field duplicate from 1 location (10% of samples submitted for analysis) and MS/MSD sample volume was also submitted for chemical analysis. An equipment rinseate blank was submitted.

Table 2 lists each location sampled, the target and actual coordinates, depth to mudline, river stage, and mudline elevation. Table 3 lists the samples collected, the date and time sampled, and the analyses conducted.

2.3.1 Grab Sample Collection

A hydraulic power grab sampler was used to collect surface sediment from the upper 0 to 30 cm of sediment at each sample location (Figure 2). The following criteria define a successful grab attempt (PSEP 1996; Integral 2004):

1. No or minimal excess water leaking from the jaws of the sampler (due to debris in the jaws of the sampler).

2. No excessive turbidity in the overlying water of the sampler.

3. Sampler did not over-penetrate (i.e., overflow the sampler or come in contact with the sampler lid, which occurred at >35 cm).

4. Sediment surface appears to be intact with minimal disturbance.

5. Program-specific minimum penetration (20 cm) has been achieved.

Grab samples were attempted until either the above criteria were met or three consecutive casts of the grab sampler failed to meet the criteria. For locations where no sample attempt met all of the acceptance criteria, the best attempt was retained for analysis. Sample location and settings of the power grab were adjusted to facilitate successful grab attempts. Generally, when debris was encountered, the location was adjusted to avoid debris. When insufficient penetration or overpenetration occurred, weights were added or removed from the sampler, respectively, and the pontoons on the sampler were lowered or raised, respectively, until an acceptable sample was collected, or maximal adjustments to the power grab were made. Grabs were accepted, rejected, or stored on the vessel pending further grab attempts so that the best sample was retained.

For 9 of 10 locations the first attempt was successful. At location G-9.15, due to low penetration three attempts were made. Attempt 1, which had the greatest recovery, was retained for sample collection. Table 4 summarizes the number of grab attempts and rationale for any sample rejection at each location, as well as visual observations of the presence/absence paint chips, black angular vitreous sand, and plastic.

After grab sample acceptance, the overlying water was siphoned off and the sediment surface and first cut of the sediment surface were photographed in the hydraulic power grab. Photographs are provided in Appendix F.

As specified in the Head of SIL Sediment FSP, one rinseate blank was prepared and submitted to the laboratory for analysis for surface-sampling equipment.

2.3.2 Grab Sample Handling and Processing

After grab sample acceptance, a vertically integrated sample of sediments from the top to the bottom of the hydraulic power grab was collected using a stainless-steel spoon, avoiding sediments in contact with the sides of the sampler. The sediment sample was placed in a large, stainless-steel bowl and homogenized. A minimum of 1.8 liters of sediment was required for chemical analysis. Once the sediment sample was homogenized to a uniform consistency and color, it was visually described and recorded

on sediment grab sample field logs. The following information was recorded: grab recovery depth (nearest cm), degree of leakage, or sediment surface disturbance; sediment grain size, texture, and color; presence, type, and strength of odors; redox-potential discontinuity (RPD) thickness; and any obvious biological or anthropogenic material. Copies of all grab sample field logs are provided in Appendix C.

The homogenized sediment sample was distributed into the appropriate laboratory-provided sampling containers using a stainless steel-spoon, capped, and labeled. Subsamples were placed together in zip-locked bags and stored in a cooler on ice until the end of the sampling day. At the end of each sampling day, all coolers were off-loaded, and samples were logged to chain of custody forms and stored in coolers on ice in a locked box-van sealed with a custody seal. Coolers were checked daily for adequate ice and samples were shipped via courier and field staff under chain of custody with seals to the analytical laboratories for analysis. Copies of chain of custody forms are included in the laboratory reports (Appendix G).

To aid in identification of anthropogenic and biological material in the sediments, following sample collection, a separate subsample of approximately 2 liters of sediments from each grab was sieved through #10 and #20 sieves (2 mm and 0.8 mm, respectively) by washing the sample through the sieves with site water using a hose. Any anthropogenic detritus (e.g., paint chips, sandblast grit, glass, metal, plastic), or biologic material (e.g., chironomids, clams, wood debris) retained on the sieves was described. Anthropogenic detritus is summarized in Table 4. Sieves were photographed (Appendix F).

2.4 SUBSURFACE SEDIMENTS

Subsurface sample collection and processing followed the procedures specified in the SIL Sediment FSP. Minor deviations from the Head of SIL Sediment FSP are discussed in Section 2.9.

Three sediment cores were collected from three locations throughout the Head of SIL Study Area. All locations identified in the Head of SIL FSP were sampled. Table 2 lists each location sampled, the target and actual coordinates, depth to mudline, river stage, and mudline elevation. Table 3 lists the samples collected, the date and time sampled, and the analyses conducted.

In accordance with the Head of SIL Sediment FSP, 3 to 9 subsurface sediment samples from each location, representative of sediments at various depths, were submitted to analytical laboratories for chemical testing (see Section 3). A total of 27 sediment samples and one duplicate were collected and submitted to the analytical laboratories. A total of 24 samples and one duplicate were analyzed for chemical and physical analyses. Total solids were analyzed in three core catcher samples that were not requested for chemical and physical analyses. Table 5 lists the minimum recovery length, drive depth, actual recovered depth, and percent recovered.

2.4.1 Core Sample Collection

Subsurface sediment cores were collected using a vessel-deployed vibracore. The vibracore was equipped with either a 15-ft or 20-ft aluminum or polycarbonate core tube (4-inch diameter) lined with a polycarbonate liner to help core recovery and processing. At each location, a single core was driven to at least 125% of the location-specific minimum recovery depth or the refusal depth. Depth to refusal (the maximum depth the vibracore can be driven into the bottom) and core sample recovery are functions of location-specific sediment textures and stratigraphy. Each core was retrieved on deck and accepted if each of the following acceptance criterion, consistent with the RI and the PDI criteria, was met:

1. 125% of minimum recovery depth is attained.
2. Overlying water is present and the surface is intact.
3. Core has at least 80% recovery versus penetration.
4. Core tube is in good condition (not excessively bent).

The first attempt at each location resulted in a successful core recovery; additional attempts were not necessary. Cores were secured onboard the vessel with the upper end of the core tube elevated and transported immediately to the dock for processing (Table 5).

2.4.2 Sample Handling and Processing

Core samples were processed concurrently with core collection. Cores were offloaded immediately after collection and processed at the dock the same day collected. The core liner was extracted to a sampling tray without cutting the core tube.

Core tube liners were extracted while keeping the top of the core tube elevated. First, the core catcher was removed from the bottom of the core tube and sediments in contact with the core catcher were placed in aluminum foil then archived for potential future analysis. The liner was then grasped in hand and manually pulled from the bottom of the tube while the core tube was hammered to break adhesion between the tube and liner. After extraction, the liner was divided into shorter sections based on apparent stratigraphic breaks, which were secured water tight with a zip tie, labeled with the location identification number (ID), section number, and top and bottom, and stored horizontally until processed. For processing, core sections were placed on a sampling tray and the liner was opened longitudinally with a decontaminated knife and stainless-steel blade.

The cores were photographed prior to sampling generally following the RI Round 2 FSP procedures (Integral 2004) as cited in the PDI Subsurface Sediment FSP (AECOM and Geosyntec 2018b).

After each core was cut open, an experienced geologist described the sediment on a core sampling log following standard operating procedures (SOPs) provided in the Head of SIL Sediment FSP. For each core, the following information was recorded to a sediment core processing form:

- Physical sediment description (i.e., sediment type, density/consistency, color)

- Odor (e.g., hydrogen sulfide, petroleum)
- Visual stratification and lenses
- Vegetation
- Debris
- Evidence of biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen and sheen jar test
- Other distinguishing characteristics or features
- Shear strength within each sample interval measured using a hand-held field torvane
- Compressive strength within each sample interval measured using a pocket penetrometer.
- PID headspace reading using a mini-RAE 3000 photoionization detector (PID) with 10.6 eV lamp

The core materials were divided longitudinally, and sampled material was collected from the center volume of the core length to avoid potentially smeared sediments along the core liner.

The sampled half of the core was sectioned into sampling intervals as follows. The upper 0 - 1 ft and 1 - 2 ft intervals were collected for comparability to the uppermost LWG RI (0 -1 ft) and PDI (0 – 2 ft) intervals (PGG 2018). Below 2 feet, the sample intervals were based on the visual determination of lithologic units. The minimum sampling interval thickness was 1-ft and maximum thickness 3-ft (AECOM and Geosyntec 2018b, PGG 2018). The boundaries of lithologic units were determined primarily by changes in the top two dominant grain sizes estimated visually (e.g., a change from a silty sand to a gravelly sand or to a sandy silt) (Integral 2004). Major changes in the depositional regime, or presence/absence of anthropogenic material/indicators such as sheen, Non-aqueous phase liquid (NAPL), or debris were listed in the FSP to determine lithologic units but had limited usefulness in the three collected cores (PGG 2018, AECOM and Geosyntec 2018b).

The retained sediment from the very bottom of the core, regardless of the bottom sample interval thickness, was also collected and archived.

Sample handling and storage procedures followed those described for surface sediment samples (Section 2.3.2). Consistent with the Head of SIL Sediment FSP, one rinseate blank and one field duplicate were collected.

2.5 SAMPLE IDENTIFICATION

Surface sediment samples were collected between River Miles 8.80 and 9.15 within Swan Island Lagoon (Figure 2). This section describes how sample locations were combined with sampling dates and depths to uniquely identify each surface and subsurface sample.

2.5.1 Surface Sample Nomenclature

Sample nomenclature was developed as follows to relate samples to the grid pattern and sample interval. All samples have a unique identifying sample ID that includes the following:

- Grid node. Alphanumeric code for each node. Letter A to T identify cross- river position, and numbers identify sample river-mile to the second decimal place (e.g., E-9.02).
- Sample Depth. The actual depth interval of the collected sample (top ## to bottom ##). For example, if the penetration depth of the grab sampler is 27 cm, the sample ID included "0to27".
- Sample Date. The date of sample collection was added to the sample ID in the following month, day, year format: MMDDYY

For example, a surface grab sample from grid node E-9.02, where the grab sampler penetrated to a depth of 26 cm and was collected on October 24, 2018 would have the sample ID E-9.02-0to26-102418.

Field duplicate sample IDs substituted the grid node with a numerical sequence beginning at 512 (e.g. 512-0to29-102418). Equipment rinesate blanks IDs combined the numerical sequence beginning at 611 and the date (e.g. 611-102418). Additional data fields that describe each unique sample feature, location, and attributes were recorded in the field forms and are included in the project database.

2.5.2 Subsurface Sample Nomenclature

Sample nomenclature was developed as follows to relate samples to the grid node, sample type, and sample interval. All samples have a unique identifying sample ID that includes the following:

- Grid node. Alphanumeric code for each node. Letter A to T identify cross- river position, and numbers identify sample river-mile to the second decimal place (e.g., E-9.02).
- Sample type. SC for Sediment Core.
- Sample Depth. The actual depth interval of the collected sample in tenths of a foot (top ## to bottom ##). For example, if the depth interval is 0 to 1 ft, the sample ID includes "00to10".
- Sample Date. The date of sample collection was added to the sample ID in the following month, day, year format: MMDDYY

For example, a sediment core sample from grid node E-9.02 for the 0 to 1 ft interval collected on October 23, 2018 would have the sample ID E-9.02-SC-00to10-102318.

Field duplicate samples substituted the grid node for numerical sequence beginning at 511 (e.g. 511-20to40-102318). Equipment rinseate blanks combined a numerical sequence beginning at 612 and the date (e.g. 612-102418). Additional data fields that

describe each unique sample feature, location, and attributes were recorded in the field forms and are included in the project database.

2.6 EQUIPMENT DECONTAMINATION PROCEDURES

Equipment decontamination procedures were performed as described in the Head of SIL Sediment FSP. Decontamination of field sampling equipment occurred between stations and, when appropriate, between grab attempts within stations. The decontamination steps included an initial rinse with vessel river water to dislodge particles, a scrub with brush and Liquinox™ phosphate-free detergent, and then a rinse with deionized water. Grab sampler decontamination was performed by Gravity under supervision of the Field Coordinator. Sampling spoons and bowls were covered with aluminum foil until use (dull side down). Core tubes and core catchers were washed in a similar manner. Gloves were replaced before and after handling each sample or conducting decontamination procedures. For recasts at a location, the grab sampler was rinsed/sprayed with river water until all solid material was removed.

2.7 INVESTIGATION-DERIVED WASTE DISPOSAL

Investigation-derived waste (IDW) disposal occurred as described in the Head of SIL Sediment FSP. Excess sediment was containerized in four 55 gallon barrels set-up and facilitated by NRC. NRC provided drums with dock-side containment, drum storage, designation, and disposal services. See Appendix E for documentation of IDW disposal.

Any excess water or sediment spilled on the deck of the sampling vessel was washed into the surface waters at the collection site before proceeding to the next station. Phosphate-free detergent-bearing liquid wastes from decontamination of the grab sampling equipment was also washed overboard.

Tyvek, gloves, paper towels, plastic sheeting, and other non-hazardous waste material generated during sampling was placed in heavyweight garbage bags or other appropriate containers and placed in normal refuse containers for disposal at a non-hazardous solid waste landfill. Used core tubes were washed and then recycled.

2.8 FIELD DOCUMENTATION

All field activities and observations were noted in bound field logbooks (Appendix B). Information included personnel, date, time, sampling vessel, station designation, sampler, types of samples collected, and observations such as weather conditions, complications, and other details associated with the sampling effort. Sample description forms were also completed for all samples; copies of sediment grab sampling logs are provided in Appendix C. Copies of sediment core sampling logs are provided in Appendix D.

A sample collection checklist was produced prior to sampling and completed following sampling operations at each station. The checklist included station designations, types of subsamples to be collected (including the number and types of jars), and whether field duplicate or laboratory QC analysis samples were collected.

2.9 DEVIATIONS FROM THE SIL SEDIMENT FSP

As summarized in Section 2, the surface and subsurface sediment sampling efforts followed the sampling procedures described in the Head of SIL Sediment FSP with only minor deviations.

2.9.1 Target Station Changes

Figure 2 shows actual sample locations for all surface and subsurface sediment samples collected. Table 2 includes target and actual sample coordinates for all surface stations sampled.

Grab samples were obtained within 16 feet or less from the target location, except for location E-8.99 which was shifted approximately 55 feet due to a floating dock. Core samples were obtained within approximately 15 feet or less from the target location.

2.9.2 Sample Collection Procedures

Grab samples targeted the top 30 cm of sediment. Minimum grab sample target recovery depths (≥ 20 cm) could not be met at 1 location (G-9.15) in the three repeated attempts to meet the target depth. therefore, the sample was collected from the best attempt as described in Section 2.3.1.

Grab sediment remaining after sample collection was sieved through #10 (2.0 mm) and #20 (0.85 mm) standard mesh soil sieves. The sediment was washed through the sieve and materials larger than the mesh openings were retained on the sieve. The biological and anthropogenic materials retained on the sieves were described in the field logs.

Core samples were collected using fixed anchors rather than a virtual anchoring system to keep the vessel on station. Additional PID headspace, sheen jar test, penetrometer and torvane measurements were collected at every core sample interval rather than by larger lithologic units.

2.9.3 Quality Assurance/Quality Control

There were no deviations in the frequency of duplicate samples or rinseate blanks.

3.0 LABORATORY ANALYSES AND DATA MANAGEMENT

This section summarizes the chemical and physical analyses performed for the characterization of surface and subsurface sediment samples.

3.1 PHYSICAL AND CHEMICAL ANALYSES

For analytical consistency with the Pre-RD Group 2018 sediment sampling effort, the same laboratories, analytical and preparation methods were used to perform the physical and chemical analyses for this investigation:

- ALS in Kelso, Washington, analyzed for chlorinated pesticides, PAHs, and total solids.
- TestAmerica in:
  - Fife, Washington, analyzed for PCB Aroclors, TOC, grain size, and total solids.
  - Sacramento, California, analyzed for dioxins/furans.
  - Knoxville, Tennessee, analyzed for PCB congeners and specific gravity.

These analytes include the Portland Harbor sediment focused-COCs specified in Tables 17 and 21 of the ROD (EPA 2017a). The analytes and analytical methods are provided in Table 6. The analytes and analytical methods, laboratories, and limits described in the Head of SIL Sediment QAPP and FSP (PGG 2018) are consistent with those described in the Pre-RD Group QAPP (AECOM and Geosyntec, 2018c). Individual analytes were also used to calculate analyte totals following the procedures described in Appendix E 2018 PDI Surface Sediment Database in the Pre-RD Group Footprint Report (AECOM and Geosyntec 2019) The calculated total analytes are listed in Table 7. A description of summation rules is provided in Section 3.5 Data Management.

3.2 FIELD QUALITY ASSURANCE /QUALITY CONTROL

Field quality assurance/quality control (QA/QC) samples were collected with the surface sediment and subsurface sediment samples as specified in the Head of SIL Sediment FSP. Field duplicates, temperature blanks, and rinseate blanks were collected as outlined in the Head of SIL Sediment FSP (Table 8). Rinseate blanks were collected by pouring deionized water over the power grab, sampling bowls, and spoons after field decontamination.

3.2.1 Sample Storage, Transport, and Custody

As stated in Section 2.3.2, homogenized sediment samples were distributed into the appropriate laboratory-provided sampling containers using a stainless-steel spoon, capped, and labeled. Subsamples of a given sample were placed together in zip-locked bags and packed in a cooler. Ice in sealed plastic bags was then placed in the cooler to maintain a temperature of approximately 4ºC. Coolers were stored onboard until the end of the sampling day. At the end of each sampling day, all coolers were off-loaded and samples were logged to chain of custody forms. Samples were repacked into coolers with bubble wrap to prevent breakage. Each cooler was clearly labeled with the respective analytical laboratory name, name of project, company name, and contact phone number to enable positive identification. The associated chain-of-custody forms were placed into a zip-locked bag and taped on the inside lid of each cooler. A temperature blank was added to each cooler, and a custody seal was applied. Coolers were stored in a locked box-van sealed with a custody seal. Coolers were checked daily for adequate ice and approximately twice each week, samples were shipped via courier and by field personnel to the analytical laboratories for analysis.

3.2.2 Field Duplicates

As described in the Head of SIL Sediment FSP, field duplicates were collected for every 20 samples collected. Because there were fewer than 20 surface-sediment locations, one field duplicate was collected and analyzed. One field duplicate sample was collected and

analyzed within the subsurface core samples. For stations where field duplicates were collected, approximately twice the volume of sediment was collected into a stainless-steel bowl from the grab sampler or core interval. This entire sediment volume was homogenized, then distributed among sample containers and field duplicate containers. Field duplicate samples were stored, transported, and logged using the same procedures as standard sediment samples. See Table 3 for a summary of field duplicate information including the sample IDs, collection date and time, and analytical methods

3.2.3 Field Rinseate Blanks

As described in the Head of SIL Sediment FSP, rinseate blanks were collected either for every 20 samples collected or every 1 week of field activities. Given these collection criteria, one field rinseate blank was collected for the surface sediment samples and one field rinseate blank was collected for the subsurface core samples. Rinseate blanks were collected by pouring deionized water over sampling equipment (spoons, bowls, and the grab sampler) after decontamination. Water poured over the equipment was collected in a stainless bowl and transferred to bottles using a decontaminated stainless-steel funnel. Rinseate blank bottles were stored, transported, and logged using the same procedures as standard sediment samples. Deionized water was sourced from laboratory provided-and-filled glass jugs.

3.3 LABORATORY DEVIATIONS FROM THE SIL SEDIMENT FSP

Analytical laboratories adhered to all QA/QC procedures outlined in the Head of SIL Sediment FSP. Laboratories provided all data in electronic format and QA/QC reports, including a narrative of the standard QA/QC protocols. Data validation and data management was performed according to the Head of SIL Sediment FSP by a third-party data validator, Ecochem, Inc. (Appendix H).

Organochlorine Pesticides were not specified in the FSP for analysis. Subsequently, the six isomers (2,4’-DDE, 4,4’-DDE, 2,4’-DDT, 4,4’-DDT, 2,4’-DDD, 4,4’-DDD) were analyzed by ALS as requested by PGG using the ALS SOP (CWA1699A) method, the same method and laboratory used by the Pre-RD Group (AECOM and Geosyntec 2018b).

3.4 DATA QUALITY AND USABILITY

Independent data validation was performed on all results by Ecochem, Inc. Full validation (EPA Stage 4) was performed on a minimum of 10% of the data as specified in the Head of SIL Sediment FSP. A summary-level (EPA Stage 2) validation review was conducted on the remaining data. The data validation report (Appendix H) summarizes data validation and provides detailed information regarding all data qualifiers.

Data qualified as undetected are usable for all intended purposes. Data qualified as estimated or tentatively identified may be less accurate or precise than unqualified data though are usable for all intended purposes. Data not meeting the data quality criteria were qualified as undetected, estimated, tentatively identified, or rejected during validation, in accordance with the Head of SIL Sediment FSP.

3.5 DATA MANAGEMENT

Following data validation, Ecochem provided PGG with composite EQuIS formatted EDDs of the final validated data. PGG imported the EDDs into the project's Access-based structured Relational Database Management System (RDMS).

3.5.1 Calculated Totals

Individual analytes were used to calculate analyte totals following the procedures described in Appendix E. 2018 PDI Surface Sediment Database in the Pre-RD Group Footprint Report (AECOM and Geosyntec 2019) and Appendix E3. SCRA Database and Data Management in the EPA's Portland Harbor Remedial Investigation (EPA 2016). See Table 7 for a list of calculated total analytes and required number of analytes for the calculation.

The general summation rules are as follows:

- Calculated totals are the sum of all detected results plus a single value for all the non-detects of one half of the highest reporting detection limit for that sample. When all the individual analytes for a sample are non-detect the highest detection limit is used and the result is qualified with a "U" flag.

- Total Toxic Equivalents (TEQs) (e.g. carcinogenic PAHs) are calculated using Toxicity Equivalency Factors (TEFs) for each analyte. Total TEQs are calculated as the sum of each detected concentration multiplied by the corresponding TEF value plus a single value as one half of the highest toxicity-weighted non-detect concentration for that sample. When all of the analytes were not detected in a given sample the reported total TEQ value was the highest analyte detection limit multiplied by the TEF and the result is qualified with a "U" flag.

- For PCB Aroclors, calculated totals are the sum of detected results. When all the individual analytes for a sample are non-detect, the highest detection limit is used and the result is qualified with a "U" flag.

All totals calculations qualifiers are appended with "T" descriptors to indicate the value is a calculated total. Additionally, "A" descriptors are appended when the sum is based on a limited number of analytes.

3.5.2 Significant Figures

Results provided by the analytical laboratories and data validator were stored as text and double data types. The text values retain the correct number of significant figures for the analytical data and calculated totals. The double data type retains the digits present in the original result. For calculated totals, this means all significant figures were carried through the calculation. For example, the sum of results with 2 significant figures each, 22 + 0.33, is stored in text data type as "22" and double data type as "22.33".

4.0 ANALYTICAL RESULTS

This section summarizes chemistry and physical results for surface and subsurface sediment samples.

4.1 SURFACE SEDIMENT RESULTS

Table 9 presents a summary of focused COC results for the 10 surface sediment locations that were analyzed, including the percent of detections, the range of detected concentrations, and percent of detections exceeding Remedial Action Levels (RALs). .

Analytical results for focused COCs are provided in Tables 11a-g. Data tables containing full results for each sample are presented in Appendix I. Figures 3 through 9 present focused COC results by location. Note that these figures also display the sampling results for the 2018 PDI surface sediment samples (AECOM and Geosyntec 2019).

4.2 SUBSURFACE SEDIMENT RESULTS

Table 10 presents a summary of focused COC results for the 27 subsurface sediment samples analyzed, including the percent of detections, the range of detected concentrations, and percent of detections exceeding Remedial Action Levels (RALs).

Analytical results for focused COCs are provided in Tables 11a-g. Data tables containing full results for each sample are presented in Appendix I. Profiles of focused COC results for each core are included in Figures 10 through 12.

5.0 REFERENCES

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.) 2018a. Surface Sediment Field Sampling Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. FINAL. Portland Harbor Superfund Site. May 23, 2018 (Revision 1 with revised protocol June 6, 2018; Revision 2 with new upriver stations June 22, 2018).

AECOM and Geosyntec 2018b. Subsurface Sediment Field Sampling Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. FINAL. Portland Harbor Superfund Site. Rev 1 (April 3, 2018); Rev 2 (May 30, 2018); Rev 3 (July 10, 2018), Rev 4 (July 12, 2018).

AECOM and Geosyntec. 2018c. Quality Assurance Project Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. FINAL. Portland Harbor Superfund Site. October 19, 2018.

AECOM and Geosyntec 2019. Pre-Remedial Design Footprint Report, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling Portland Harbor Superfund Site Portland, Oregon. January 7, 2019.

EPA (United States Environmental Protection Agency). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Office of Research and Development. EPA/600/R-93/0-89. July.

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

EPA 2017b. ASAOC between US EPA and the Pre-RD AOC Group for Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. December 18, 2017.

Geosyntec. 2017. PDI Work Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling; Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group as an attachment to the ASAOC for EPA Region 10. December 19, 2017.

Integral 2004. Round 2 Field Sampling Plan - Sediment Sampling and Benthic Toxicity Testing Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 21 June (Sediment Sampling SOPs in Appendix F [June 21]. Note: some of the SOPs are dated March 22 in the June version.

Integral 2005a. Round 2 Field Sampling Report - Sediment Sampling and Benthic Toxicity Testing Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. January 4, 2004.

Integral 2005b. Round 2B Field Sampling Report – Subsurface Sediment Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. December 29, 2005.

Integral 2006. Preliminary Upstream & Downstream Sediment Data Evaluation and Round 3A Field Sampling Plan for Upstream & Downstream Sediment Sampling. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 13 October.

Pacific Groundwater Group, 2018. Head of Swan Island Lagoon Sediment Field Sampling Plan, Swan Island Lagoon, Portland Harbor Superfund Site. Prepared for de maximis, inc. October 22, 2018.

PSEP (Puget Sound Estuary Program) 1996. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, Washington. Tetra Tech and HRA, Inc., Bellevue, Washington.

Table 1. Summary of Sediment Sample Types, Numbers, and Analyses

		Grab Samples		Core Samples	
Parameter Group	Method	Number of Samples Analyzed	Number of Analysis Results[1]	Number of Samples Analyzed	Number of Analysis Results[1]
Conventionals - Density/Specific Gravity	D854	11	22	25	50
Conventionals - Grain Size	D422	11	66	25	150
Conventionals - TOC	SW9060	11	11	25	25
Conventionals - Total Solids	E160.3/D2216	11	33	28	78
Dioxins/Furans	CWA1613B	11	33	25	75
DDx	CWA1699M	11	66	25	150
PAHs	SW8270D-SIM	11	198	25	450
PCB Aroclors	SW8082A	11	77	25	175
PCB Congeners	E1668A	11	2409	25	5475

1 Number of laboratory-provided results, including laboratory provided summations of analyte sets.
Summations calculated after laboratory analyses are not included in the result counts. Field duplicates are inclucluded.

Acronyms:

DDx = dichlorodiphenyltrichloroethane and its derivatives

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyls

TOC = Total Organic Carbon

Table 2. Sediment Location Information

Location ID	Target Location (NAD 83) X	Target Location (NAD 83) Y	Actual Location (NAD 83) X	Actual Location (NAD 83) Y	Water Depth (feet)	River Stage (feet NAVD 88)	Mudline Elev. (feet NAVD 88)
Surface Sample Locations							
A-9.03	7636157	698931	7636154	698937	20.49'	6.31'	-14.18'
B-9.00	7636024	699128	7636028	699123	22.88'	6.73'	-16.15'
B-9.15	7636686	698597	7636684	698591	10.45'	9.30'	-1.15'
C-8.94	7635895	699372	7635895	699372	25.05'	7.30'	-17.75'
D-8.83	7635510	699806	7635503	699808	29.08'	7.74'	-21.34'
D-8.90	7635818	699564	7635824	699557	26.26'	7.55'	-18.71'
D-9.09	7636558	698896	7636573	698900	15.30'	6.74'	-8.56'
E-8.99	7636235	699345	7636181	699356	24.00'	7.00'	-17.00'
E-9.02	7636336	699213	7636341	699211	22.88'	6.44'	-16.44'
G-9.15	7636965	698936	7636972	698933	10.22'	7.73'	-2.49'
Subsurface Sample Locations							
D-8.90-SC	7635818	699564	7635829	699554	23.90'	6.42'	-17.48'
D-9.09-SC	7636558	698896	7636560	698897	15.40'	5.99'	-9.41'
E-9.02-SC	7636336	699213	7636330	699215	22.60'	6.79'	-15.81'

Oregon State Plane Coordinate System, Oregon North Zone

Horizontal Locations (X,Y) are North American Datum 1983 (NAD83), international feet

NAVD88 - North American Vertical Datum 1988

River stage is from the Morrison Street Bridge Station (PRT03)

Elev. = Elevation

Table 3. Sediment Sample Dates and Analyses

Sample ID	Sample Date	Top (cm)	Bottom (cm)	Analytical Methods										Field Duplicate	MS/ MSD
				D854 Sp. Gravity	D422 Grain Size	SW9060 TOC	E160.3 T. Solids	D2216 T. Solids	CWA1613B Dioxins/Furans	SW8270D-SIM PAHs	SW8082A PCB Arcolors	E1668A PCB Congeners	CWA1699M DDx		
Surface Samples															
A-9.03-0to26-102418	10/24/18 1:28 PM	0	26	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
B-9.00-0to29-102418	10/24/18 11:19 AM	0	29	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
512-0to29-102418	10/24/18 11:19 AM	0	29	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	X	
B-9.15-0to30-102418	10/24/18 3:47 PM	0	30	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
C-8.94-0to27-102418	10/24/18 9:55 AM	0	27	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.83-0to25-102418	10/24/18 8:33 AM	0	25	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-0to27-102418	10/24/18 9:10 AM	0	27	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-9.09-0to29-102418	10/24/18 2:05 PM	0	29	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-8.99-0to28-102418	10/24/18 10:40 AM	0	28	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-9.02-0to26-102418	10/24/18 12:07 PM	0	26	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		X
G-9.15-0to18-102418	10/24/18 2:46 PM	0	18	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Subsurface Samples															
D-8.90-SC-00to10-102318	10/23/18 4:40 PM	0	30	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-SC-10to20-102318	10/23/18 4:50 PM	30	61	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-SC-20to40-102318	10/23/18 5:00 PM	61	122	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-SC-40to62-102318	10/23/18 5:20 PM	122	189	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-SC-62to80-102318	10/23/18 5:30 PM	189	244	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-SC-80to103-102318	10/23/18 6:00 PM	244	314	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-SC-103to120-102318	10/23/18 6:10 PM	314	366	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-SC-120to140-102318	10/23/18 7:00 PM	366	427	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-SC-140to160-102318	10/23/18 7:10 PM	427	488	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-8.90-SC-160to164-102318	10/23/18 7:20 PM	488	500	-	-	-	Y	-	-	-	-	-	-		
D-9.09-SC-00to10-102318	10/23/18 1:30 PM	0	30	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-9.09-SC-10to20-102318	10/23/18 1:40 PM	30	61	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-9.09-SC-20to40-102318	10/23/18 1:50 PM	61	122	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		X
511-20to40-102318	10/23/18 1:50 PM	61	122	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	X	
D-9.09-SC-40to60-102318	10/23/18 2:30 PM	122	183	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-9.09-SC-60to80-102318	10/23/18 2:40 PM	183	244	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-9.09-SC-80to100-102318	10/23/18 3:10 PM	244	305	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-9.09-SC-100to117-102318	10/23/18 3:20 PM	305	357	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
D-9.09-SC-117to121-102318	10/23/18 3:40 PM	357	369	-	-	-	Y	-	-	-	-	-	-		
E-9.02-SC-00to10-102318	10/23/18 10:22 AM	0	30	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-9.02-SC-10to20-102318	10/23/18 10:32 AM	30	61	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-9.02-SC-20to40-102318	10/23/18 10:42 AM	61	122	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-9.02-SC-40to60-102318	10/23/18 11:10 AM	122	183	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-9.02-SC-60to80-102318	10/23/18 11:20 AM	183	244	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-9.02-SC-80to100-102318	10/23/18 12:10 PM	244	305	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-9.02-SC-100to115-102318	10/23/18 12:20 PM	305	351	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-9.02-SC-115to130-102318	10/23/18 12:40 PM	351	396	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
E-9.02-SC-130to133-102318	10/23/18 12:50 PM	396	405	-	-	-	Y	-	-	-	-	-	-		

"Y" indicates sample was analyzed by listed method, "-" indicates sample was not analyzed.

Sp. Gravity = Specific Gravity/Density

T. Solids = Total Solids

DDx = dichlorodiphenyltrichloroethane and its derivatives

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyls

TOC = Total Organic Carbon

Table 4. Surface Sediment Grab Sample Attempts and Summary of Visual Observations

Station ID	Sample Attempt #			Sample Attempt No. Collected	Reason for Multiple Attempts				Visual Observations		
	1	2	3		Debris	Rocks	Low Penetration	Over-penetration	Paint	Vitreous sand	Plastic
	Recovery Depth (cm)										
A-9.03	26			1							
B-9.00	29			1							
B-9.15	30			1							x
C-8.94	27			1							
D-8.83	25			1					x		
D-8.90	27			1					x		
D-9.09	29			1							
E-8.99	28			1					x		
E-9.02	26			1							
G-9.15	18	16	17	1			x		x		x

cm = centimeters

Table 5. Subsurface Sediment Core Measurements, and Collection and Processing Dates

Station ID	Core Collection Date	Processing Date	Minimum Recovery Length (ft)	Actual Drive Length (ft)	Actual Recovered Length (ft)	% Recovery
D-8.90	10/23/2018	10/23/2018	10.8	18.1	16.4	91%
D-9.09	10/23/2018	10/23/2018	8.0	14.0	12.1	86%
E-9.02	10/23/2018	10/23/2018	8.0	13.9	13.3	96%

ft = feet

Percent Recovery = Recovered Length/Drive Length * 100

Table 6. Laboratory Analytical Methods and Analytes

Parameter Group	Parameter	Units	CAS No.	Method
Conventional	Clay	%	STL00587	D422
Conventional	Silt	%	STL00586	D422
Conventional	Fine Sand	%	STL00585	D422
Conventional	Medium Sand	%	STL00584	D422
Conventional	Coarse Sand	%	STL00583	D422
Conventional	Gravel	%	STL00581	D422
Conventional	Density	g/cm3	STL00183	D854
Conventional	Specific Gravity	unitless	--	D854
Conventional	Total Solids	%	--	E160.3/D2216
Conventional	Carbon, Total Organic	mg/kg	7440-44-0	SW9060
Dioxins/Furans	1,2,3,7,8-PeCDD	ug/Kg	40321-76-4	CWA1613B
Dioxins/Furans	2,3,4,7,8-PeCDF	ug/Kg	57117-31-4	CWA1613B
Dioxins/Furans	2,3,7,8-TCDD	ug/Kg	1746-01-6	CWA1613B
DDx	4,4'-DDD	ug/kg	72-54-8	CWA1699M
DDx	4,4'-DDE	ug/kg	72-55-9	CWA1699M
DDx	4,4'-DDT	ug/kg	50-29-3	CWA1699M
DDx	o,p'-DDD	ug/Kg	53-19-0	CWA1699M
DDx	o,p'-DDE	ug/Kg	3424-82-6	CWA1699M
DDx	o,p'-DDT	ug/Kg	789-02-6	CWA1699M
PAHs	2-Methylnaphthalene	ug/Kg	91-57-6	SW8270D-SIM
PAHs	Acenaphthene	ug/Kg	83-32-9	SW8270D-SIM
PAHs	Acenaphthylene	ug/Kg	208-96-8	SW8270D-SIM
PAHs	Anthracene	ug/Kg	120-12-7	SW8270D-SIM
PAHs	Benzo(a)anthracene	ug/Kg	56-55-3	SW8270D-SIM
PAHs	Benzo(a)pyrene	ug/Kg	50-32-8	SW8270D-SIM
PAHs	Benzo(b)fluoranthene	ug/Kg	205-99-2	SW8270D-SIM
PAHs	Benzo(g,h,i)perylene	ug/Kg	191-24-2	SW8270D-SIM
PAHs	Benzo(k)fluoranthene	ug/Kg	207-08-9	SW8270D-SIM
PAHs	Chrysene	ug/Kg	218-01-9	SW8270D-SIM
PAHs	Dibenzo(a,h)anthracene	ug/Kg	53-70-3	SW8270D-SIM
PAHs	Dibenzofuran	ug/Kg	132-64-9	SW8270D-SIM
PAHs	Fluoranthene	ug/Kg	206-44-0	SW8270D-SIM
PAHs	Fluorene	ug/Kg	86-73-7	SW8270D-SIM
PAHs	Indeno(1,2,3-cd)pyrene	ug/Kg	193-39-5	SW8270D-SIM
PAHs	Naphthalene	ug/Kg	91-20-3	SW8270D-SIM
PAHs	Phenanthrene	ug/Kg	85-01-8	SW8270D-SIM
PAHs	Pyrene	ug/Kg	129-00-0	SW8270D-SIM
PCB Aroclors	PCB-1016	ug/kg	12674-11-2	SW8082A
PCB Aroclors	PCB-1221	ug/kg	11104-28-2	SW8082A
PCB Aroclors	PCB-1232	ug/kg	11141-16-5	SW8082A
PCB Aroclors	PCB-1242	ug/kg	53469-21-9	SW8082A
PCB Aroclors	PCB-1248	ug/kg	12672-29-6	SW8082A
PCB Aroclors	PCB-1254	ug/kg	11097-69-1	SW8082A
PCB Aroclors	PCB-1260	ug/kg	11096-82-5	SW8082A
PCB Congeners	PCB-1	ng/g	2051-60-7	E1668A
PCB Congeners	PCB-2	ng/g	2051-61-8	E1668A
PCB Congeners	PCB-3	ng/g	2051-62-9	E1668A
PCB Congeners	PCB-4	ng/g	13029-08-8	E1668A
PCB Congeners	PCB-5	ng/g	16605-91-7	E1668A
PCB Congeners	PCB-6	ng/g	25569-80-6	E1668A
PCB Congeners	PCB-7	ng/g	33284-50-3	E1668A
PCB Congeners	PCB-8	ng/g	34883-43-7	E1668A
PCB Congeners	PCB-9	ng/g	34883-39-1	E1668A

Table 6. Laboratory Analytical Methods and Analytes

Parameter Group	Parameter	Units	CAS No.	Method
PCB Congeners	PCB-10	ng/g	33146-45-1	E1668A
PCB Congeners	PCB-11	ng/g	2050-67-1	E1668A
PCB Congeners	PCB-12	ng/g	2974-92-7	E1668A
PCB Congeners	PCB-13	ng/g	2974-90-5	E1668A
PCB Congeners	PCB-14	ng/g	34883-41-5	E1668A
PCB Congeners	PCB-15	ng/g	2050-68-2	E1668A
PCB Congeners	PCB-16	ng/g	38444-78-9	E1668A
PCB Congeners	PCB-17	ng/g	37680-66-3	E1668A
PCB Congeners	PCB-18	ng/g	37680-65-2	E1668A
PCB Congeners	PCB-19	ng/g	38444-73-4	E1668A
PCB Congeners	PCB-20	ng/g	38444-84-7	E1668A
PCB Congeners	PCB-21	ng/g	55702-46-0	E1668A
PCB Congeners	PCB-22	ng/g	38444-85-8	E1668A
PCB Congeners	PCB-23	ng/g	55720-44-0	E1668A
PCB Congeners	PCB-24	ng/g	55702-45-9	E1668A
PCB Congeners	PCB-25	ng/g	55712-37-3	E1668A
PCB Congeners	PCB-26	ng/g	38444-81-4	E1668A
PCB Congeners	PCB-27	ng/g	38444-76-7	E1668A
PCB Congeners	PCB-28	ng/g	7012-37-5	E1668A
PCB Congeners	PCB-29	ng/g	15862-07-4	E1668A
PCB Congeners	PCB-30	ng/g	35693-92-6	E1668A
PCB Congeners	PCB-31	ng/g	16606-02-3	E1668A
PCB Congeners	PCB-32	ng/g	38444-77-8	E1668A
PCB Congeners	PCB-33	ng/g	38444-86-9	E1668A
PCB Congeners	PCB-34	ng/g	37680-68-5	E1668A
PCB Congeners	PCB-35	ng/g	37680-69-6	E1668A
PCB Congeners	PCB-36	ng/g	38444-87-0	E1668A
PCB Congeners	PCB-37	ng/g	38444-90-5	E1668A
PCB Congeners	PCB-38	ng/g	53555-66-1	E1668A
PCB Congeners	PCB-39	ng/g	38444-88-1	E1668A
PCB Congeners	PCB-40	ng/g	38444-93-8	E1668A
PCB Congeners	PCB-41	ng/g	52663-59-9	E1668A
PCB Congeners	PCB-42	ng/g	36559-22-5	E1668A
PCB Congeners	PCB-43	ng/g	70362-46-8	E1668A
PCB Congeners	PCB-44	ng/g	41464-39-5	E1668A
PCB Congeners	PCB-45	ng/g	70362-45-7	E1668A
PCB Congeners	PCB-46	ng/g	41464-47-5	E1668A
PCB Congeners	PCB-47	ng/g	2437-79-8	E1668A
PCB Congeners	PCB-48	ng/g	70362-47-9	E1668A
PCB Congeners	PCB-49	ng/g	41464-40-8	E1668A
PCB Congeners	PCB-50	ng/g	62796-65-0	E1668A
PCB Congeners	PCB-51	ng/g	68194-04-7	E1668A
PCB Congeners	PCB-52	ng/g	35693-99-3	E1668A
PCB Congeners	PCB-53	ng/g	41464-41-9	E1668A
PCB Congeners	PCB-54	ng/g	15968-05-5	E1668A
PCB Congeners	PCB-55	ng/g	74338-24-2	E1668A
PCB Congeners	PCB-56	ng/g	41464-43-1	E1668A
PCB Congeners	PCB-57	ng/g	70424-67-8	E1668A
PCB Congeners	PCB-58	ng/g	41464-49-7	E1668A
PCB Congeners	PCB-59	ng/g	74472-33-6	E1668A
PCB Congeners	PCB-60	ng/g	33025-41-1	E1668A
PCB Congeners	PCB-61	ng/g	33284-53-6	E1668A
PCB Congeners	PCB-62	ng/g	54230-22-7	E1668A

Table 6. Laboratory Analytical Methods and Analytes

Parameter Group	Parameter	Units	CAS No.	Method
PCB Congeners	PCB-63	ng/g	74472-34-7	E1668A
PCB Congeners	PCB-64	ng/g	52663-58-8	E1668A
PCB Congeners	PCB-65	ng/g	33284-54-7	E1668A
PCB Congeners	PCB-66	ng/g	32598-10-0	E1668A
PCB Congeners	PCB-67	ng/g	73575-53-8	E1668A
PCB Congeners	PCB-68	ng/g	73575-52-7	E1668A
PCB Congeners	PCB-69	ng/g	60233-24-1	E1668A
PCB Congeners	PCB-70	ng/g	32598-11-1	E1668A
PCB Congeners	PCB-71	ng/g	41464-46-4	E1668A
PCB Congeners	PCB-72	ng/g	41464-42-0	E1668A
PCB Congeners	PCB-73	ng/g	74338-23-1	E1668A
PCB Congeners	PCB-74	ng/g	32690-93-0	E1668A
PCB Congeners	PCB-75	ng/g	32598-12-2	E1668A
PCB Congeners	PCB-76	ng/g	70362-48-0	E1668A
PCB Congeners	PCB-77	ng/g	32598-13-3	E1668A
PCB Congeners	PCB-78	ng/g	70362-49-1	E1668A
PCB Congeners	PCB-79	ng/g	41464-48-6	E1668A
PCB Congeners	PCB-80	ng/g	33284-52-5	E1668A
PCB Congeners	PCB-81	ng/g	70362-50-4	E1668A
PCB Congeners	PCB-82	ng/g	52663-62-4	E1668A
PCB Congeners	PCB-83	ng/g	60145-20-2	E1668A
PCB Congeners	PCB-84	ng/g	52663-60-2	E1668A
PCB Congeners	PCB-85	ng/g	65510-45-4	E1668A
PCB Congeners	PCB-86	ng/g	55312-69-1	E1668A
PCB Congeners	PCB-87	ng/g	38380-02-8	E1668A
PCB Congeners	PCB-88	ng/g	55215-17-3	E1668A
PCB Congeners	PCB-89	ng/g	73575-57-2	E1668A
PCB Congeners	PCB-90	ng/g	68194-07-0	E1668A
PCB Congeners	PCB-91	ng/g	68194-05-8	E1668A
PCB Congeners	PCB-92	ng/g	52663-61-3	E1668A
PCB Congeners	PCB-93	ng/g	73575-56-1	E1668A
PCB Congeners	PCB-94	ng/g	73575-55-0	E1668A
PCB Congeners	PCB-95	ng/g	38379-99-6	E1668A
PCB Congeners	PCB-96	ng/g	73575-54-9	E1668A
PCB Congeners	PCB-97	ng/g	41464-51-1	E1668A
PCB Congeners	PCB-98	ng/g	60233-25-2	E1668A
PCB Congeners	PCB-99	ng/g	38380-01-7	E1668A
PCB Congeners	PCB-100	ng/g	39485-83-1	E1668A
PCB Congeners	PCB-101	ng/g	37680-73-2	E1668A
PCB Congeners	PCB-102	ng/g	68194-06-9	E1668A
PCB Congeners	PCB-103	ng/g	60145-21-3	E1668A
PCB Congeners	PCB-104	ng/g	56558-16-8	E1668A
PCB Congeners	PCB-105	ng/g	32598-14-4	E1668A
PCB Congeners	PCB-106	ng/g	70424-69-0	E1668A
PCB Congeners	PCB-107	ng/g	70424-68-9	E1668A
PCB Congeners	PCB-108	ng/g	70362-41-3	E1668A
PCB Congeners	PCB-109	ng/g	74472-35-8	E1668A
PCB Congeners	PCB-110	ng/g	38380-03-9	E1668A
PCB Congeners	PCB-111	ng/g	39635-32-0	E1668A
PCB Congeners	PCB-112	ng/g	74472-36-9	E1668A
PCB Congeners	PCB-113	ng/g	68194-10-5	E1668A
PCB Congeners	PCB-114	ng/g	74472-37-0	E1668A
PCB Congeners	PCB-115	ng/g	74472-38-1	E1668A

Table 6. Laboratory Analytical Methods and Analytes

Parameter Group	Parameter	Units	CAS No.	Method
PCB Congeners	PCB-116	ng/g	18259-05-7	E1668A
PCB Congeners	PCB-117	ng/g	68194-11-6	E1668A
PCB Congeners	PCB-118	ng/g	31508-00-6	E1668A
PCB Congeners	PCB-119	ng/g	56558-17-9	E1668A
PCB Congeners	PCB-120	ng/g	68194-12-7	E1668A
PCB Congeners	PCB-121	ng/g	56558-18-0	E1668A
PCB Congeners	PCB-122	ng/g	76842-07-4	E1668A
PCB Congeners	PCB-123	ng/g	65510-44-3	E1668A
PCB Congeners	PCB-124	ng/g	70424-70-3	E1668A
PCB Congeners	PCB-125	ng/g	74472-39-2	E1668A
PCB Congeners	PCB-126	ng/g	57465-28-8	E1668A
PCB Congeners	PCB-127	ng/g	39635-33-1	E1668A
PCB Congeners	PCB-128	ng/g	38380-07-3	E1668A
PCB Congeners	PCB-129	ng/g	55215-18-4	E1668A
PCB Congeners	PCB-130	ng/g	52663-66-8	E1668A
PCB Congeners	PCB-131	ng/g	61798-70-7	E1668A
PCB Congeners	PCB-132	ng/g	38380-05-1	E1668A
PCB Congeners	PCB-133	ng/g	35694-04-3	E1668A
PCB Congeners	PCB-134	ng/g	52704-70-8	E1668A
PCB Congeners	PCB-135	ng/g	52744-13-5	E1668A
PCB Congeners	PCB-136	ng/g	38411-22-2	E1668A
PCB Congeners	PCB-137	ng/g	35694-06-5	E1668A
PCB Congeners	PCB-138	ng/g	35065-28-2	E1668A
PCB Congeners	PCB-139	ng/g	56030-56-9	E1668A
PCB Congeners	PCB-140	ng/g	59291-64-4	E1668A
PCB Congeners	PCB-141	ng/g	52712-04-6	E1668A
PCB Congeners	PCB-142	ng/g	41411-61-4	E1668A
PCB Congeners	PCB-143	ng/g	68194-15-0	E1668A
PCB Congeners	PCB-144	ng/g	68194-14-9	E1668A
PCB Congeners	PCB-145	ng/g	74472-40-5	E1668A
PCB Congeners	PCB-146	ng/g	51908-16-8	E1668A
PCB Congeners	PCB-147	ng/g	68194-13-8	E1668A
PCB Congeners	PCB-148	ng/g	74472-41-6	E1668A
PCB Congeners	PCB-149	ng/g	38380-04-0	E1668A
PCB Congeners	PCB-150	ng/g	68194-08-1	E1668A
PCB Congeners	PCB-151	ng/g	52663-63-5	E1668A
PCB Congeners	PCB-152	ng/g	68194-09-2	E1668A
PCB Congeners	PCB-153	ng/g	35065-27-1	E1668A
PCB Congeners	PCB-154	ng/g	60145-22-4	E1668A
PCB Congeners	PCB-155	ng/g	33979-03-2	E1668A
PCB Congeners	PCB-156	ng/g	38380-08-4	E1668A
PCB Congeners	PCB-157	ng/g	69782-90-7	E1668A
PCB Congeners	PCB-158	ng/g	74472-42-7	E1668A
PCB Congeners	PCB-159	ng/g	39635-35-3	E1668A
PCB Congeners	PCB-160	ng/g	41411-62-5	E1668A
PCB Congeners	PCB-161	ng/g	74472-43-8	E1668A
PCB Congeners	PCB-162	ng/g	39635-34-2	E1668A
PCB Congeners	PCB-163	ng/g	74472-44-9	E1668A
PCB Congeners	PCB-164	ng/g	74472-45-0	E1668A
PCB Congeners	PCB-165	ng/g	74472-46-1	E1668A
PCB Congeners	PCB-166	ng/g	41411-63-6	E1668A
PCB Congeners	PCB-167	ng/g	52663-72-6	E1668A
PCB Congeners	PCB-168	ng/g	59291-65-5	E1668A

Table 6. Laboratory Analytical Methods and Analytes

Parameter Group	Parameter	Units	CAS No.	Method
PCB Congeners	PCB-169	ng/g	32774-16-6	E1668A
PCB Congeners	PCB-170	ng/g	35065-30-6	E1668A
PCB Congeners	PCB-171	ng/g	52663-71-5	E1668A
PCB Congeners	PCB-172	ng/g	52663-74-8	E1668A
PCB Congeners	PCB-173	ng/g	68194-16-1	E1668A
PCB Congeners	PCB-174	ng/g	38411-25-5	E1668A
PCB Congeners	PCB-175	ng/g	40186-70-7	E1668A
PCB Congeners	PCB-176	ng/g	52663-65-7	E1668A
PCB Congeners	PCB-177	ng/g	52663-70-4	E1668A
PCB Congeners	PCB-178	ng/g	52663-67-9	E1668A
PCB Congeners	PCB-179	ng/g	52663-64-6	E1668A
PCB Congeners	PCB-180	ng/g	35065-29-3	E1668A
PCB Congeners	PCB-181	ng/g	74472-47-2	E1668A
PCB Congeners	PCB-182	ng/g	60145-23-5	E1668A
PCB Congeners	PCB-183	ng/g	52663-69-1	E1668A
PCB Congeners	PCB-184	ng/g	74472-48-3	E1668A
PCB Congeners	PCB-185	ng/g	52712-05-7	E1668A
PCB Congeners	PCB-186	ng/g	74472-49-4	E1668A
PCB Congeners	PCB-187	ng/g	52663-68-0	E1668A
PCB Congeners	PCB-188	ng/g	74487-85-7	E1668A
PCB Congeners	PCB-189	ng/g	39635-31-9	E1668A
PCB Congeners	PCB-190	ng/g	41411-64-7	E1668A
PCB Congeners	PCB-191	ng/g	74472-50-7	E1668A
PCB Congeners	PCB-192	ng/g	74472-51-8	E1668A
PCB Congeners	PCB-193	ng/g	69782-91-8	E1668A
PCB Congeners	PCB-194	ng/g	35694-08-7	E1668A
PCB Congeners	PCB-195	ng/g	52663-78-2	E1668A
PCB Congeners	PCB-196	ng/g	42740-50-1	E1668A
PCB Congeners	PCB-197	ng/g	33091-17-7	E1668A
PCB Congeners	PCB-198	ng/g	68194-17-2	E1668A
PCB Congeners	PCB-199	ng/g	52663-75-9	E1668A
PCB Congeners	PCB-200	ng/g	52663-73-7	E1668A
PCB Congeners	PCB-201	ng/g	40186-71-8	E1668A
PCB Congeners	PCB-202	ng/g	2136-99-4	E1668A
PCB Congeners	PCB-203	ng/g	52663-76-0	E1668A
PCB Congeners	PCB-204	ng/g	74472-52-9	E1668A
PCB Congeners	PCB-205	ng/g	74472-53-0	E1668A
PCB Congeners	PCB-206	ng/g	40186-72-9	E1668A
PCB Congeners	PCB-207	ng/g	52663-79-3	E1668A
PCB Congeners	PCB-208	ng/g	52663-77-1	E1668A
PCB Congeners	PCB-209	ng/g	2051-24-3	E1668A

Table 6. Laboratory Analytical Methods and Analytes

Parameter Group	Parameter	Units	CAS No.	Method
PCB Congeners	Polychlorinated biphenyls, Total	ng/g	1336-36-3	E1668A
PCB Congeners	Total Dichlorobiphenyls	ng/g	25512-42-9	E1668A
PCB Congeners	Total Heptachlorobiphenyls	ng/g	28655-71-2	E1668A
PCB Congeners	Total Hexachlorobiphenyls	ng/g	26601-64-9	E1668A
PCB Congeners	Total Monochlorobiphenyls	ng/g	27323-18-8	E1668A
PCB Congeners	Total Nonachlorobiphenyls	ng/g	53742-07-7	E1668A
PCB Congeners	Total Octachlorobiphenyls	ng/g	55722-26-4	E1668A
PCB Congeners	Total Pentachlorobiphenyls	ng/g	25429-29-2	E1668A
PCB Congeners	Total Tetrachlorobiphenyls	ng/g	26914-33-0	E1668A
PCB Congeners	Total Trichlorobiphenyls	ng/g	25323-68-6	E1668A

ug/kg = micrograms per kilogram
ng/g = nanograms per gram
% = percent
g/cm3 = grams per cubic centimeter
DDx = dichlorodiphenyltrichloroethane and its derivatives
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyls
DDE = dichlorodiphenyldichloroethylene
DDD = dichlorodiphenyldichloroethane
DDT = dichlorodiphenyltrichloroethane
HxCDD = heptachlorodibenzo-para-dioxin
HpCDF = heptachlorodibenzofuran
HxCDD = hexachlorodibenzo-p-dioxin
HxCDF = hexachlorodibenzofuran
PeCDD = pentachlorodibenzo-p-dioxin
PeCDF = pentachlorodibenzofuran
TCDD = tetrachlorodibenzo-p-dioxin
TCDF = tetrachloro dibenzo-p-furan

Table 7. Calculated Total Analytes And Required Number of Analytes

Parameter Group	Parameter	Units	CAS No.	Method	Expected Analytes	Limited Analytes ("A" Qualify)	Do Not Sum
DDx	CALC_TOTAL_DDx_ND_PDI	ug/Kg	--	CWA1699M	6	<6	--
DDx	CALC_TOTAL_DDD_ND_PDI	ug/Kg	--	CWA1699M	2	<2	--
DDx	CALC_TOTAL_DDE_ND_PDI	ug/Kg	--	CWA1699M	2	<2	--
DDx	CALC_TOTAL_DDT_ND_PDI	ug/Kg	--	CWA1699M	2	<2	--
PAHs	CALC_TOTAL_PAH_ND_PDI	ug/Kg	--	SW8270D-SIM	17	<17	<10
PAHs	CALC_TOTAL_LPAH_ND_PDI	ug/Kg	--	SW8270D-SIM	7	<10	<3
PAHs	CALC_TOTAL_HPAH_ND_PDI	ug/Kg	--	SW8270D-SIM	10	<7	<5
PAHs	CALC_TOTAL_CPAH_ND_PDI	ug/Kg	--	SW8270D-SIM	7	<7	<5
PCB Aroclors	CALC_TOTAL_AROCLORS_ND_ZERO	ug/kg	--	SW8082A	7	<7	<2
PCB Congeners	CALC_TOTAL_PCB_ND_PDI	ng/g	--	E1668A	209	<150	<100

ug/kg = micrograms per kilogram

ng/g = nanograms per gram

PCB = polychlorinated biphenyls

DDx = dichlorodiphenyltrichloroethane and its derivatives

DDE = dichlorodiphenyldichloroethylene

DDD = dichlorodiphenyldichloroethane

DDT = dichlorodiphenyltrichloroethane

PAH = polycyclic aromatic hydrocarbon

CPAH = carcingogenic PAHs

LPAH = light PAHs

HPAH = heavy PAHs

PCB congeners are counted by individual congeners regardless of coelutions (e.g. a valid PCB-108/124 result counts as 2 analytes)

'A' descriptor - indicates the total value is based on limited number of analytes.

-- - Not applicable.

Total concentrations from component analytes calculated with Pre-Remedial Design Investigation summation rules for DDx, PAHs, PCB Congeners, and chlordanes (AECOM and Geosyntec 2019, Appendix E). Total Aroclors, DDD, DDE, and DDT were calculated with EPA Remedial Investigation summation rules (EPA, 2016 (Appendix A3. Table A3-3)) as the Pre-Remedial Design Investigation report did not include summation rules.

Table 8. Summary of Quality Control Samples

QA/QC Sample Type	Frequency
Temperature Blanks	1 per cooler
Blind Field Duplicates	2 per 35 samples
Field Equipment Rinsate Blanks	2 per 35 samples
Matrix Spike/ Matrix Spike Duplicate	2 per 35 samples

QA/QC = quality assurance/quality control

Table 9. Summary of Surface Sediment Exceedances of ROD Remedial Action Levels for Focused COCs

Analyte	ROD Remedial Action Level[1]	Units	Number of Samples[2]	% Detected	% Non-Detect	% Detections Exceeds RAL	Minimum Detected Result	Maximum Detected Result
1,2,3,7,8-PeCDD	0.0008	ug/kg	10	70	30	60	0.00032 J	0.0047 J
2,3,4,7,8-PeCDF	0.2	ug/kg	10	70	30	0	0.0017 J	0.0063 J
2,3,7,8-TCDD	0.0006	ug/kg	10	50	50	50	0.00068 J	0.0013 J
Total PCBs Aroclors	75	ug/kg	10	100	0	0	22 T	65 T
Total PCBs Congeners	75	ug/kg	10	100	0	90	16 JT	140 JT
Total PAHs	30000[3]	ug/kg	10	100	0	0	360 JT	3900 JT
Total DDx	160	ug/kg	10	100	0	0	2.5 T	12 T

1 Remedial Action Levels (RALs) correspond to EPA Record of Decision (ROD) Table 21

2 Exceedance summary does not include QC sample results

3 Level is from Proposed Explanation of Significant Differences (PESD), Appendix A1, Updated Record of Decision Table 21 (EPA 2018)

DDx = dichlorodiphenyltrichloroethane and its derivatives

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyls

ROD = Record of Decision

PESD = Proposed Explanation of Significant Differences

PeCDD = pentachlorodibenzo-p-dioxin

PeCDF = pentachlorodibenzofuran

TCDD = tetrachlorodibenzo-p-dioxin

COC = Constituent of Concern

J = Reported result is an estimate

U = Analyte was not detected in sample

T = Total concentration from component analytes calculated with Pre-Remedial Design Investigation summation rules (AECOM and Geosyntec 2019, Appendix E). Total Aroclors calculated with EPA Remedial Investigation summation rules (EPA 2016 (Appendix A3. Table A3-3)).

A = Summed value based on limited number of analytes.

Table 10. Summary of Subsurface Sediment Exceedances of ROD Remedial Action Levels for Focused COCs

Analyte	ROD Remedial Action Level[1]	Units	Number of Samples[2]	% Detected	% Non-Detect	% Detections Exceeds RAL	Minimum Detected Result	Maximum Detected Result
1,2,3,7,8-PeCDD	0.0008	ug/kg	24	96	4	96	0.002 J	0.0039 J
2,3,4,7,8-PeCDF	0.2	ug/kg	24	83	17	0	0.0018 J	0.0042 J
2,3,7,8-TCDD	0.0006	ug/kg	24	92	8	92	0.001	0.0019
Total PCBs Aroclors	75	ug/kg	24	100	0	29	17 JT	110 T
Total PCBs Congeners	75	ug/kg	24	100	0	100	140 JT	620 JT
Total PAHs	30000[3]	ug/kg	24	100	0	0	460 JT	9800 JT
Total DDx	160	ug/kg	24	100	0	0	6.6 T	18 T

1 Remedial Action Levels (RALs) correspond to EPA Record of Decision (ROD) Table 21

2 Exceedance summary does not include QC sample results

3 Level is from Proposed Explanation of Significant Differences (PESD), Appendix A1, Updated Record of Decision Table 21 (EPA 2018)

DDx = dichlorodiphenyltrichloroethane and its derivatives

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyls

ROD = Record of Decision

PESD = Proposed Explanation of Significant Differences

PeCDD = pentachlorodibenzo-p-dioxin

PeCDF = pentachlorodibenzofuran

TCDD = tetrachlorodibenzo-p-dioxin

COC = Constituent of Concern

J = Reported result is an estimate

U = Analyte was not detected in sample

T = Total concentration from component analytes calculated with Pre-Remedial Design Investigation summation rules (AECOM and Geosyntec 2019, Appendix E). Total Aroclors calculated with EPA Remedial Investigation summation rules (EPA 2016 (Appendix A3. Table A3-3)).

A = Summed value based on limited number of analytes.

Table 11a. Analytical Results for Total PCBs Congeners (Calculated Total)

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (9 ug/kg)	Exceeds RAL[2] (75 ug/kg)	RAL EF
Surface Samples							
512-0to29-102418	10/24/18 11:19 AM	72	JT	ug/kg	Yes	No	0.96
A-9.03-0to26-102418	10/24/18 1:28 PM	97	JT	ug/kg	Yes	Yes	1.29
B-9.00-0to29-102418	10/24/18 11:19 AM	76	JT	ug/kg	Yes	Yes	1.01
B-9.15-0to30-102418	10/24/18 3:47 PM	110	JT	ug/kg	Yes	Yes	1.47
C-8.94-0to27-102418	10/24/18 9:55 AM	95	JT	ug/kg	Yes	Yes	1.27
D-8.83-0to25-102418	10/24/18 8:33 AM	140	JT	ug/kg	Yes	Yes	1.87
D-8.90-0to27-102418	10/24/18 9:10 AM	97	JT	ug/kg	Yes	Yes	1.29
D-9.09-0to29-102418	10/24/18 2:05 PM	92	JT	ug/kg	Yes	Yes	1.23
E-8.99-0to28-102418	10/24/18 10:40 AM	83	JT	ug/kg	Yes	Yes	1.11
E-9.02-0to26-102418	10/24/18 12:07 PM	130	JT	ug/kg	Yes	Yes	1.73
G-9.15-0to18-102418	10/24/18 2:46 PM	16	JT	ug/kg	Yes	No	0.21
Subsurface Samples							
511-20to40-102318	10/23/2018 13:50	160	JT	ug/kg	Yes	Yes	2.13
D-8.90-SC-00to10-102318	10/23/18 4:40 PM	220	JT	ug/kg	Yes	Yes	2.93
D-8.90-SC-10to20-102318	10/23/18 4:50 PM	620	JT	ug/kg	Yes	Yes	8.27
D-8.90-SC-20to40-102318	10/23/18 5:00 PM	350	JT	ug/kg	Yes	Yes	4.67
D-8.90-SC-40to62-102318	10/23/18 5:20 PM	320	JT	ug/kg	Yes	Yes	4.27
D-8.90-SC-62to80-102318	10/23/18 5:30 PM	280	JT	ug/kg	Yes	Yes	3.73
D-8.90-SC-80to103-102318	10/23/18 6:00 PM	460	JT	ug/kg	Yes	Yes	6.13
D-8.90-SC-103to120-102318	10/23/18 6:10 PM	270	JT	ug/kg	Yes	Yes	3.60
D-8.90-SC-120to140-102318	10/23/18 7:00 PM	190	JT	ug/kg	Yes	Yes	2.53
D-8.90-SC-140to160-102318	10/23/18 7:10 PM	260	JT	ug/kg	Yes	Yes	3.47
D-8.90-SC-160to164-102318	10/23/18 7:20 PM	NA					
D-9.09-SC-00to10-102318	10/23/18 1:30 PM	140	JT	ug/kg	Yes	Yes	1.87
D-9.09-SC-10to20-102318	10/23/18 1:40 PM	150	JT	ug/kg	Yes	Yes	2.00
D-9.09-SC-20to40-102318	10/23/18 1:50 PM	160	JT	ug/kg	Yes	Yes	2.13
D-9.09-SC-40to60-102318	10/23/18 2:30 PM	210	JT	ug/kg	Yes	Yes	2.80
D-9.09-SC-60to80-102318	10/23/18 2:40 PM	440	JT	ug/kg	Yes	Yes	5.87
D-9.09-SC-80to100-102318	10/23/18 3:10 PM	230	JT	ug/kg	Yes	Yes	3.07

Table 11a. Analytical Results for Total PCBs Congeners (Calculated Total)

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (9 ug/kg)	Exceeds RAL[2] (75 ug/kg)	RAL EF
D-9.09-SC-100to117-102318	10/23/18 3:20 PM	240	JT	ug/kg	Yes	Yes	3.20
D-9.09-SC-117to121-102318	10/23/18 3:40 PM	NA					
E-9.02-SC-00to10-102318	10/23/18 10:22 AM	200	JT	ug/kg	Yes	Yes	2.67
E-9.02-SC-10to20-102318	10/23/18 10:32 AM	150	JT	ug/kg	Yes	Yes	2.00
E-9.02-SC-20to40-102318	10/23/18 10:42 AM	440	JT	ug/kg	Yes	Yes	5.87
E-9.02-SC-40to60-102318	10/23/18 11:10 AM	240	JT	ug/kg	Yes	Yes	3.20
E-9.02-SC-60to80-102318	10/23/18 11:20 AM	250	JT	ug/kg	Yes	Yes	3.33
E-9.02-SC-80to100-102318	10/23/18 12:10 PM	330	JT	ug/kg	Yes	Yes	4.40
E-9.02-SC-100to115-102318	10/23/18 12:20 PM	270	JT	ug/kg	Yes	Yes	3.60
E-9.02-SC-115to130-102318	10/23/18 12:40 PM	230	JT	ug/kg	Yes	Yes	3.07
E-9.02-SC-130to133-102318	10/23/18 12:50 PM	NA					

[1] MCL = Minimum Cleanup Level; corresponds to EPA Record of Decision Table 17

[2] RAL = Remedial Action Level; corresponds to EPA Record of Decision Table 21

EF = Exceedance Factor (Result/RAL); Non-detects shown as less than (<) the calculated value.

NC = Not Calculated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

NE = Not Evaluated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

J = Reported result is an estimate.

U = Analyte was not detected in sample.

T = Total concentration from component analytes calculated with Pre-Remedial Design Investigation summation rules (AECOM and Geosyntec 2019, Appendix E)

A = Summed value based on limited number of analytes

R = Rejected

N = Tentatively Identified

PCB = polychlorinated biphenyls

Table 11b. Analytical Results for Total PCBs Aroclors (Calculated Total)

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (9 ug/kg)	Exceeds RAL[2] (75 ug/kg)	RAL EF
Surface Samples							
512-0to29-102418	10/24/18 11:19 AM	44	JT	ug/kg	Yes	No	0.59
A-9.03-0to26-102418	10/24/18 1:28 PM	40	JT	ug/kg	Yes	No	0.53
B-9.00-0to29-102418	10/24/18 11:19 AM	37	JT	ug/kg	Yes	No	0.49
B-9.15-0to30-102418	10/24/18 3:47 PM	39	T	ug/kg	Yes	No	0.52
C-8.94-0to27-102418	10/24/18 9:55 AM	40	T	ug/kg	Yes	No	0.53
D-8.83-0to25-102418	10/24/18 8:33 AM	65	T	ug/kg	Yes	No	0.87
D-8.90-0to27-102418	10/24/18 9:10 AM	38	JT	ug/kg	Yes	No	0.51
D-9.09-0to29-102418	10/24/18 2:05 PM	42	T	ug/kg	Yes	No	0.56
E-8.99-0to28-102418	10/24/18 10:40 AM	32	JT	ug/kg	Yes	No	0.43
E-9.02-0to26-102418	10/24/18 12:07 PM	36	JT	ug/kg	Yes	No	0.48
G-9.15-0to18-102418	10/24/18 2:46 PM	22	T	ug/kg	Yes	No	0.29
Subsurface Samples							
511-20to40-102318	10/23/2018 13:50	21	JT	ug/kg	Yes	No	0.28
D-8.90-SC-00to10-102318	10/23/18 4:40 PM	37	T	ug/kg	Yes	No	0.49
D-8.90-SC-10to20-102318	10/23/18 4:50 PM	84	T	ug/kg	Yes	Yes	1.12
D-8.90-SC-20to40-102318	10/23/18 5:00 PM	48	JT	ug/kg	Yes	No	0.64
D-8.90-SC-40to62-102318	10/23/18 5:20 PM	41	T	ug/kg	Yes	No	0.55
D-8.90-SC-62to80-102318	10/23/18 5:30 PM	38	JT	ug/kg	Yes	No	0.51
D-8.90-SC-80to103-102318	10/23/18 6:00 PM	110	T	ug/kg	Yes	Yes	1.47
D-8.90-SC-103to120-102318	10/23/18 6:10 PM	80	T	ug/kg	Yes	Yes	1.07
D-8.90-SC-120to140-102318	10/23/18 7:00 PM	42	T	ug/kg	Yes	No	0.56
D-8.90-SC-140to160-102318	10/23/18 7:10 PM	27	T	ug/kg	Yes	No	0.36
D-8.90-SC-160to164-102318	10/23/18 7:20 PM	NA					
D-9.09-SC-00to10-102318	10/23/18 1:30 PM	26	JT	ug/kg	Yes	No	0.35
D-9.09-SC-10to20-102318	10/23/18 1:40 PM	17	JT	ug/kg	Yes	No	0.23
D-9.09-SC-20to40-102318	10/23/18 1:50 PM	23	JT	ug/kg	Yes	No	0.31
D-9.09-SC-40to60-102318	10/23/18 2:30 PM	20	JT	ug/kg	Yes	No	0.27
D-9.09-SC-60to80-102318	10/23/18 2:40 PM	110	JT	ug/kg	Yes	Yes	1.47
D-9.09-SC-80to100-102318	10/23/18 3:10 PM	59	JT	ug/kg	Yes	No	0.79

Table 11b. Analytical Results for Total PCBs Aroclors (Calculated Total)

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (9 ug/kg)	Exceeds RAL[2] (75 ug/kg)	RAL EF
D-9.09-SC-100to117-102318	10/23/18 3:20 PM	65	JT	ug/kg	Yes	No	0.87
D-9.09-SC-117to121-102318	10/23/18 3:40 PM	NA					
E-9.02-SC-00to10-102318	10/23/18 10:22 AM	24	JNT	ug/kg	Yes	Yes	2.67
E-9.02-SC-10to20-102318	10/23/18 10:32 AM	17	JNT	ug/kg	Yes	Yes	2.00
E-9.02-SC-20to40-102318	10/23/18 10:42 AM	57	JT	ug/kg	Yes	Yes	5.87
E-9.02-SC-40to60-102318	10/23/18 11:10 AM	56	JT	ug/kg	Yes	Yes	3.20
E-9.02-SC-60to80-102318	10/23/18 11:20 AM	39	JT	ug/kg	Yes	Yes	3.33
E-9.02-SC-80to100-102318	10/23/18 12:10 PM	100	JT	ug/kg	Yes	Yes	4.40
E-9.02-SC-100to115-102318	10/23/18 12:20 PM	85	JT	ug/kg	Yes	Yes	3.60
E-9.02-SC-115to130-102318	10/23/18 12:40 PM	75	JT	ug/kg	Yes	Yes	3.07
E-9.02-SC-130to133-102318	10/23/18 12:50 PM	NA					

[1] MCL = Minimum Cleanup Level; corresponds to EPA Record of Decision Table 17

[2] RAL = Remedial Action Level; corresponds to EPA Record of Decision Table 21

EF = Exceedance Factor (Result/RAL); Non-detects shown as less than (<) the calculated value

NC = Not Calculated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

NE = Not Evaluated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

J = Reported result is an estimate.

U = Analyte was not detected in sample.

T = Total concentration from component analytes calculated with EPA Remedial Investigation summation rules (EPA, 2016 (Appendix A3. Table A3-3))

A = Summed value based on limited number of analytes

R = Rejected

N = Tentatively Identified

PCB = polychlorinated biphenyls

Table 11c. Analytical Results for Total PAHs (Calculated Total)

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (23000 ug/kg)	Exceeds RAL[2] (30000 ug/kg)[3]	RAL EF
Surface Samples							
512-0to29-102418	10/24/18 11:19 AM	1300	JT	ug/kg	No	No	0.04
A-9.03-0to26-102418	10/24/18 1:28 PM	3900	JT	ug/kg	No	No	0.13
B-9.00-0to29-102418	10/24/18 11:19 AM	1300	JT	ug/kg	No	No	0.04
B-9.15-0to30-102418	10/24/18 3:47 PM	2000	T	ug/kg	No	No	0.07
C-8.94-0to27-102418	10/24/18 9:55 AM	1500	JT	ug/kg	No	No	0.05
D-8.83-0to25-102418	10/24/18 8:33 AM	1600	T	ug/kg	No	No	0.05
D-8.90-0to27-102418	10/24/18 9:10 AM	1600	T	ug/kg	No	No	0.05
D-9.09-0to29-102418	10/24/18 2:05 PM	1400	T	ug/kg	No	No	0.05
E-8.99-0to28-102418	10/24/18 10:40 AM	1500	JT	ug/kg	No	No	0.05
E-9.02-0to26-102418	10/24/18 12:07 PM	1400	JT	ug/kg	No	No	0.05
G-9.15-0to18-102418	10/24/18 2:46 PM	360	JT	ug/kg	No	No	0.01
Subsurface Samples							
511-20to40-102318	10/23/2018 13:50	970	JT	ug/kg	No	No	0.03
D-8.90-SC-00to10-102318	10/23/18 4:40 PM	680	JT	ug/kg	No	No	0.02
D-8.90-SC-10to20-102318	10/23/18 4:50 PM	2000	JT	ug/kg	No	No	0.07
D-8.90-SC-20to40-102318	10/23/18 5:00 PM	1300	JT	ug/kg	No	No	0.04
D-8.90-SC-40to62-102318	10/23/18 5:20 PM	1000	JT	ug/kg	No	No	0.03
D-8.90-SC-62to80-102318	10/23/18 5:30 PM	620	JT	ug/kg	No	No	0.02
D-8.90-SC-80to103-102318	10/23/18 6:00 PM	850	JT	ug/kg	No	No	0.03
D-8.90-SC-103to120-102318	10/23/18 6:10 PM	1100	JT	ug/kg	No	No	0.04
D-8.90-SC-120to140-102318	10/23/18 7:00 PM	1000	JT	ug/kg	No	No	0.03
D-8.90-SC-140to160-102318	10/23/18 7:10 PM	980	JT	ug/kg	No	No	0.03
D-8.90-SC-160to164-102318	10/23/18 7:20 PM	NA					
D-9.09-SC-00to10-102318	10/23/18 1:30 PM	590	JT	ug/kg	No	No	0.02
D-9.09-SC-10to20-102318	10/23/18 1:40 PM	900	JT	ug/kg	No	No	0.03
D-9.09-SC-20to40-102318	10/23/18 1:50 PM	860	JT	ug/kg	No	No	0.03
D-9.09-SC-40to60-102318	10/23/18 2:30 PM	2200	JT	ug/kg	No	No	0.07
D-9.09-SC-60to80-102318	10/23/18 2:40 PM	2200	JT	ug/kg	No	No	0.07
D-9.09-SC-80to100-102318	10/23/18 3:10 PM	1100	JT	ug/kg	No	No	0.04

Table 11c. Analytical Results for Total PAHs (Calculated Total)

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (23000 ug/kg)	Exceeds RAL[2] (30000 ug/kg)[3]	RAL EF
D-9.09-SC-100to117-102318	10/23/18 3:20 PM	1400	JT	ug/kg	No	No	0.05
D-9.09-SC-117to121-102318	10/23/18 3:40 PM	NA					
E-9.02-SC-00to10-102318	10/23/18 10:22 AM	460	JT	ug/kg	No	No	0.02
E-9.02-SC-10to20-102318	10/23/18 10:32 AM	890	JT	ug/kg	No	No	0.03
E-9.02-SC-20to40-102318	10/23/18 10:42 AM	9800	JT	ug/kg	No	No	0.33
E-9.02-SC-40to60-102318	10/23/18 11:10 AM	1000	JT	ug/kg	No	No	0.03
E-9.02-SC-60to80-102318	10/23/18 11:20 AM	1300	JT	ug/kg	No	No	0.04
E-9.02-SC-80to100-102318	10/23/18 12:10 PM	1600	JT	ug/kg	No	No	0.05
E-9.02-SC-100to115-102318	10/23/18 12:20 PM	890	JT	ug/kg	No	No	0.03
E-9.02-SC-115to130-102318	10/23/18 12:40 PM	820	JT	ug/kg	No	No	0.03
E-9.02-SC-130to133-102318	10/23/18 12:50 PM	NA					

[1] MCL = Minimum Cleanup Level; corresponds to Proposed Explanation of Significant Differences, Appendix A1, Updated Record of Decision Table 17 (EPA, 2018)

[2] RAL = Remedial Action Level; corresponds to Proposed Explanation of Significant Differences, Appendix A1, Updated Record of Decision Table 21 (EPA, 2018)

[3] EPA has not yet finalized the ESD; further adjustments to the values for PAHs may be necessary when EPA finalizes the document.

EF = Exceedance Factor (Result/RAL); Non-detects shown as less than (<) the calculated value

NC = Not Calculated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

NE = Not Evaluated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

J = Reported result is an estimate.

U = Analyte was not detected in sample.

T = Total concentration from component analytes calculated with EPA Remedial Investigation summation rules (EPA, 2016 (Appendix A3. Table A3-3))

A = Summed value based on limited number of analytes

R = Rejected

N = Tentatively Identified

PAHs = polycyclic aromatic hydrocarbons

Table 11d. Analytical Results for 2,3,7,8-TCDD

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (0.0002 ug/kg)	Exceeds RAL[2] (0.0006 ug/kg)	RAL EF
Surface Samples							
512-0to29-102418	10/24/18 11:19 AM	0.00074	J	ug/kg	Yes	Yes	1.23
A-9.03-0to26-102418	10/24/18 1:28 PM	0.001	U	ug/kg	NE	NE	NC
B-9.00-0to29-102418	10/24/18 11:19 AM	0.00073	U	ug/kg	NE	NE	NC
B-9.15-0to30-102418	10/24/18 3:47 PM	0.00068	J	ug/kg	Yes	Yes	1.13
C-8.94-0to27-102418	10/24/18 9:55 AM	0.00061	U	ug/kg	NE	NE	NC
D-8.83-0to25-102418	10/24/18 8:33 AM	0.00076	U	ug/kg	NE	NE	NC
D-8.90-0to27-102418	10/24/18 9:10 AM	0.0013	J	ug/kg	Yes	Yes	2.17
D-9.09-0to29-102418	10/24/18 2:05 PM	0.0011	J	ug/kg	Yes	Yes	1.83
E-8.99-0to28-102418	10/24/18 10:40 AM	0.00095	J	ug/kg	Yes	Yes	1.58
E-9.02-0to26-102418	10/24/18 12:07 PM	0.0011	J	ug/kg	Yes	Yes	1.83
G-9.15-0to18-102418	10/24/18 2:46 PM	0.00018	U	ug/kg	No	No	<0.3
Subsurface Samples							
511-20to40-102318	10/23/2018 13:50	0.0013		ug/kg	Yes	Yes	2.17
D-8.90-SC-00to10-102318	10/23/18 4:40 PM	0.0012		ug/kg	Yes	Yes	2.00
D-8.90-SC-10to20-102318	10/23/18 4:50 PM	0.0011	J	ug/kg	Yes	Yes	1.83
D-8.90-SC-20to40-102318	10/23/18 5:00 PM	0.0015	J	ug/kg	Yes	Yes	2.50
D-8.90-SC-40to62-102318	10/23/18 5:20 PM	0.0014		ug/kg	Yes	Yes	2.33
D-8.90-SC-62to80-102318	10/23/18 5:30 PM	0.0014		ug/kg	Yes	Yes	2.33
D-8.90-SC-80to103-102318	10/23/18 6:00 PM	0.0016		ug/kg	Yes	Yes	2.67
D-8.90-SC-103to120-102318	10/23/18 6:10 PM	0.0016		ug/kg	Yes	Yes	2.67
D-8.90-SC-120to140-102318	10/23/18 7:00 PM	0.0019		ug/kg	Yes	Yes	3.17
D-8.90-SC-140to160-102318	10/23/18 7:10 PM	0.0014		ug/kg	Yes	Yes	2.33
D-8.90-SC-160to164-102318	10/23/18 7:20 PM	NA					
D-9.09-SC-00to10-102318	10/23/18 1:30 PM	0.00067	U	ug/kg	NE	NE	NC
D-9.09-SC-10to20-102318	10/23/18 1:40 PM	0.0014		ug/kg	Yes	Yes	2.33
D-9.09-SC-20to40-102318	10/23/18 1:50 PM	0.0013		ug/kg	Yes	Yes	2.17
D-9.09-SC-40to60-102318	10/23/18 2:30 PM	0.0015	J	ug/kg	Yes	Yes	2.50
D-9.09-SC-60to80-102318	10/23/18 2:40 PM	0.0014		ug/kg	Yes	Yes	2.33
D-9.09-SC-80to100-102318	10/23/18 3:10 PM	0.0014		ug/kg	Yes	Yes	2.33

Table 11d. Analytical Results for 2,3,7,8-TCDD

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (0.0002 ug/kg)	Exceeds RAL[2] (0.0006 ug/kg)	RAL EF
D-9.09-SC-100to117-102318	10/23/18 3:20 PM	0.0013		ug/kg	Yes	Yes	2.17
D-9.09-SC-117to121-102318	10/23/18 3:40 PM	NA					
E-9.02-SC-00to10-102318	10/23/18 10:22 AM	0.00041	U	ug/kg	NE	No	<0.68
E-9.02-SC-10to20-102318	10/23/18 10:32 AM	0.0013		ug/kg	Yes	Yes	2.17
E-9.02-SC-20to40-102318	10/23/18 10:42 AM	0.0016		ug/kg	Yes	Yes	2.67
E-9.02-SC-40to60-102318	10/23/18 11:10 AM	0.0014		ug/kg	Yes	Yes	2.33
E-9.02-SC-60to80-102318	10/23/18 11:20 AM	0.001		ug/kg	Yes	Yes	1.67
E-9.02-SC-80to100-102318	10/23/18 12:10 PM	0.0018		ug/kg	Yes	Yes	3.00
E-9.02-SC-100to115-102318	10/23/18 12:20 PM	0.0015		ug/kg	Yes	Yes	2.50
E-9.02-SC-115to130-102318	10/23/18 12:40 PM	0.0012		ug/kg	Yes	Yes	2.00
E-9.02-SC-130to133-102318	10/23/18 12:50 PM	NA					

[1] MCL = Minimum Cleanup Level; corresponds to EPA Record of Decision Table 17

[2] RAL = Remedial Action Level; corresponds to EPA Record of Decision Table 21

EF = Exceedance Factor (Result/RAL); Non-detects shown as less than (<) the calculated value

NC = Not Calculated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

NE = Not Evaluated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

J = Reported result is an estimate.

U = Analyte was not detected in sample.

T = Total concentration from component analytes calculated with EPA Remedial Investigation summation rules (EPA, 2016 (Appendix A3. Table A3-3))

A = Summed value based on limited number of analytes

R = Rejected

N = Tentatively Identified

TCDD = tetrachlorodibenzo-p-dioxin

Table 11e. Analytical Results for 1,2,3,7,8-PeCDD

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (0.0002 ug/kg)	Exceeds RAL[2] (0.0008 ug/kg)	RAL EF
Surface Samples							
512-0to29-102418	10/24/18 11:19 AM	0.0024	U	ug/kg	NE	NE	NC
A-9.03-0to26-102418	10/24/18 1:28 PM	0.0047	J	ug/kg	Yes	Yes	5.88
B-9.00-0to29-102418	10/24/18 11:19 AM	0.0028	U	ug/kg	NE	NE	NC
B-9.15-0to30-102418	10/24/18 3:47 PM	0.002	J	ug/kg	Yes	Yes	2.50
C-8.94-0to27-102418	10/24/18 9:55 AM	0.002	U	ug/kg	NE	NE	NC
D-8.83-0to25-102418	10/24/18 8:33 AM	0.0024	J	ug/kg	Yes	Yes	3.00
D-8.90-0to27-102418	10/24/18 9:10 AM	0.0022	U	ug/kg	NE	NE	NC
D-9.09-0to29-102418	10/24/18 2:05 PM	0.0028	J	ug/kg	Yes	Yes	3.50
E-8.99-0to28-102418	10/24/18 10:40 AM	0.003	J	ug/kg	Yes	Yes	3.75
E-9.02-0to26-102418	10/24/18 12:07 PM	0.0024	J	ug/kg	Yes	Yes	3.00
G-9.15-0to18-102418	10/24/18 2:46 PM	0.00032	J	ug/kg	Yes	No	0.40
Subsurface Samples							
511-20to40-102318	10/23/2018 13:50	0.0027	J	ug/kg	Yes	Yes	3.38
D-8.90-SC-00to10-102318	10/23/18 4:40 PM	0.0027	J	ug/kg	Yes	Yes	3.38
D-8.90-SC-10to20-102318	10/23/18 4:50 PM	0.0022	J	ug/kg	Yes	Yes	2.75
D-8.90-SC-20to40-102318	10/23/18 5:00 PM	0.0022	J	ug/kg	Yes	Yes	2.75
D-8.90-SC-40to62-102318	10/23/18 5:20 PM	0.0024	J	ug/kg	Yes	Yes	3.00
D-8.90-SC-62to80-102318	10/23/18 5:30 PM	0.0024	J	ug/kg	Yes	Yes	3.00
D-8.90-SC-80to103-102318	10/23/18 6:00 PM	0.0029	J	ug/kg	Yes	Yes	3.63
D-8.90-SC-103to120-102318	10/23/18 6:10 PM	0.0027	J	ug/kg	Yes	Yes	3.38
D-8.90-SC-120to140-102318	10/23/18 7:00 PM	0.0039	J	ug/kg	Yes	Yes	4.88
D-8.90-SC-140to160-102318	10/23/18 7:10 PM	0.0028	J	ug/kg	Yes	Yes	3.50
D-8.90-SC-160to164-102318	10/23/18 7:20 PM	NA					
D-9.09-SC-00to10-102318	10/23/18 1:30 PM	0.0022	J	ug/kg	Yes	Yes	2.75
D-9.09-SC-10to20-102318	10/23/18 1:40 PM	0.0026	J	ug/kg	Yes	Yes	3.25
D-9.09-SC-20to40-102318	10/23/18 1:50 PM	0.0029	J	ug/kg	Yes	Yes	3.63
D-9.09-SC-40to60-102318	10/23/18 2:30 PM	0.0023	J	ug/kg	Yes	Yes	2.88
D-9.09-SC-60to80-102318	10/23/18 2:40 PM	0.0025	J	ug/kg	Yes	Yes	3.13
D-9.09-SC-80to100-102318	10/23/18 3:10 PM	0.0024	J	ug/kg	Yes	Yes	3.00

Table 11e. Analytical Results for 1,2,3,7,8-PeCDD

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (0.0002 ug/kg)	Exceeds RAL[2] (0.0008 ug/kg)	RAL EF
D-9.09-SC-100to117-102318	10/23/18 3:20 PM	0.0017	U	ug/kg	NE	NE	NC
D-9.09-SC-117to121-102318	10/23/18 3:40 PM	NA					
E-9.02-SC-00to10-102318	10/23/18 10:22 AM	0.0032	J	ug/kg	Yes	Yes	4.00
E-9.02-SC-10to20-102318	10/23/18 10:32 AM	0.0029	J	ug/kg	Yes	Yes	3.63
E-9.02-SC-20to40-102318	10/23/18 10:42 AM	0.0033	J	ug/kg	Yes	Yes	4.13
E-9.02-SC-40to60-102318	10/23/18 11:10 AM	0.0028	J	ug/kg	Yes	Yes	3.50
E-9.02-SC-60to80-102318	10/23/18 11:20 AM	0.002	J	ug/kg	Yes	Yes	2.50
E-9.02-SC-80to100-102318	10/23/18 12:10 PM	0.0026	J	ug/kg	Yes	Yes	3.25
E-9.02-SC-100to115-102318	10/23/18 12:20 PM	0.0021	J	ug/kg	Yes	Yes	2.63
E-9.02-SC-115to130-102318	10/23/18 12:40 PM	0.002	J	ug/kg	Yes	Yes	2.50
E-9.02-SC-130to133-102318	10/23/18 12:50 PM	NA					

[1] MCL = Minimum Cleanup Level; corresponds to EPA Record of Decision Table 17

[2] RAL = Remedial Action Level; corresponds to EPA Record of Decision Table 21

EF = Exceedance Factor (Result/RAL); Non-detects shown as less than (<) the calculated value

NC = Not Calculated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

NE = Not Evaluated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

J = Reported result is an estimate.

U = Analyte was not detected in sample.

T = Total concentration from component analytes calculated with EPA Remedial Investigation summation rules (EPA, 2016 (Appendix A3. Table A3-3))

A = Summed value based on limited number of analytes

R = Rejected

N = Tentatively Identified

PeCDD = pentachlorodibenzo-p-dioxin

Table 11f. Analytical Results for 2,3,4,7,8-PeCDF

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (0.0003 ug/kg)	Exceeds RAL[2] (0.2 ug/kg)	RAL EF
Surface Samples							
512-0to29-102418	10/24/18 11:19 AM	0.0034	J	ug/kg	Yes	No	0.02
A-9.03-0to26-102418	10/24/18 1:28 PM	0.0063	J	ug/kg	Yes	No	0.03
B-9.00-0to29-102418	10/24/18 11:19 AM	0.0029	U	ug/kg	NE	No	<0.02
B-9.15-0to30-102418	10/24/18 3:47 PM	0.0017	J	ug/kg	Yes	No	0.01
C-8.94-0to27-102418	10/24/18 9:55 AM	0.0031	J	ug/kg	Yes	No	0.02
D-8.83-0to25-102418	10/24/18 8:33 AM	0.0045	J	ug/kg	Yes	No	0.02
D-8.90-0to27-102418	10/24/18 9:10 AM	0.0031	J	ug/kg	Yes	No	0.02
D-9.09-0to29-102418	10/24/18 2:05 PM	0.0027	J	ug/kg	Yes	No	0.01
E-8.99-0to28-102418	10/24/18 10:40 AM	0.003	U	ug/kg	NE	No	<0.02
E-9.02-0to26-102418	10/24/18 12:07 PM	0.0026	J	ug/kg	Yes	No	0.01
G-9.15-0to18-102418	10/24/18 2:46 PM	0.00018	U	ug/kg	No	No	<0.001
Subsurface Samples							
511-20to40-102318	10/23/2018 13:50	0.0022	J	ug/kg	Yes	No	0.01
D-8.90-SC-00to10-102318	10/23/18 4:40 PM	0.0024	U	ug/kg	Yes	No	<0.01
D-8.90-SC-10to20-102318	10/23/18 4:50 PM	0.0027	J	ug/kg	Yes	No	0.01
D-8.90-SC-20to40-102318	10/23/18 5:00 PM	0.0039	J	ug/kg	Yes	No	0.02
D-8.90-SC-40to62-102318	10/23/18 5:20 PM	0.0029	J	ug/kg	Yes	No	0.01
D-8.90-SC-62to80-102318	10/23/18 5:30 PM	0.0023	J	ug/kg	Yes	No	0.01
D-8.90-SC-80to103-102318	10/23/18 6:00 PM	0.0026	J	ug/kg	Yes	No	0.01
D-8.90-SC-103to120-102318	10/23/18 6:10 PM	0.0022	J	ug/kg	Yes	No	0.01
D-8.90-SC-120to140-102318	10/23/18 7:00 PM	0.0023	J	ug/kg	Yes	No	0.01
D-8.90-SC-140to160-102318	10/23/18 7:10 PM	0.0029	J	ug/kg	Yes	No	0.01
D-8.90-SC-160to164-102318	10/23/18 7:20 PM	NA					
D-9.09-SC-00to10-102318	10/23/18 1:30 PM	0.0022	J	ug/kg	Yes	No	0.01
D-9.09-SC-10to20-102318	10/23/18 1:40 PM	0.0018	J	ug/kg	Yes	No	0.01
D-9.09-SC-20to40-102318	10/23/18 1:50 PM	0.0022	J	ug/kg	Yes	No	0.01
D-9.09-SC-40to60-102318	10/23/18 2:30 PM	0.002	J	ug/kg	Yes	No	0.01
D-9.09-SC-60to80-102318	10/23/18 2:40 PM	0.0021	J	ug/kg	Yes	No	0.01
D-9.09-SC-80to100-102318	10/23/18 3:10 PM	0.0033	J	ug/kg	Yes	No	0.02

Table 11f. Analytical Results for 2,3,4,7,8-PeCDF

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (0.0003 ug/kg)	Exceeds RAL[2] (0.2 ug/kg)	RAL EF
D-9.09-SC-100to117-102318	10/23/18 3:20 PM	0.0023	J	ug/kg	Yes	No	0.01
D-9.09-SC-117to121-102318	10/23/18 3:40 PM	NA					
E-9.02-SC-00to10-102318	10/23/18 10:22 AM	0.00089	U	ug/kg	NE	No	<0.004
E-9.02-SC-10to20-102318	10/23/18 10:32 AM	0.002	J	ug/kg	Yes	No	0.01
E-9.02-SC-20to40-102318	10/23/18 10:42 AM	0.002	J	ug/kg	Yes	No	0.01
E-9.02-SC-40to60-102318	10/23/18 11:10 AM	0.0021	J	ug/kg	Yes	No	0.01
E-9.02-SC-60to80-102318	10/23/18 11:20 AM	0.0042	J	ug/kg	Yes	No	0.02
E-9.02-SC-80to100-102318	10/23/18 12:10 PM	0.0022	U	ug/kg	NE	No	<0.01
E-9.02-SC-100to115-102318	10/23/18 12:20 PM	0.0015	U	ug/kg	NE	No	<0.01
E-9.02-SC-115to130-102318	10/23/18 12:40 PM	0.0026	J	ug/kg	Yes	No	0.01
E-9.02-SC-130to133-102318	10/23/18 12:50 PM	NA					

[1] MCL = Minimum Cleanup Level; corresponds to EPA Record of Decision Table 17

[2] RAL = Remedial Action Level; corresponds to EPA Record of Decision Table 21

EF = Exceedance Factor (Result/RAL); Non-detects shown as less than (<) the calculated value

NC = Not Calculated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

NE = Not Evaluated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

J = Reported result is an estimate.

U = Analyte was not detected in sample.

T = Total concentration from component analytes calculated with EPA Remedial Investigation summation rules (EPA, 2016 (Appendix A3. Table A3-3))

A = Summed value based on limited number of analytes

R = Rejected

N = Tentatively Identified

PeCDF = pentachlorodibenzofuran

Table 11g. Analytical Results for Total DDx (Calculated Total)

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (6.1 ug/kg)	Exceeds RAL[2] (160 ug/kg)	RAL EF
Surface Samples							
512-0to29-102418	10/24/18 11:19 AM	5.8	JT	ug/kg	No	No	0.04
A-9.03-0to26-102418	10/24/18 1:28 PM	12	T	ug/kg	Yes	No	0.08
B-9.00-0to29-102418	10/24/18 11:19 AM	5.8	JT	ug/kg	No	No	0.04
B-9.15-0to30-102418	10/24/18 3:47 PM	7.8	T	ug/kg	Yes	No	0.05
C-8.94-0to27-102418	10/24/18 9:55 AM	8.7	T	ug/kg	Yes	No	0.05
D-8.83-0to25-102418	10/24/18 8:33 AM	5.6	T	ug/kg	No	No	0.04
D-8.90-0to27-102418	10/24/18 9:10 AM	6.9	T	ug/kg	Yes	No	0.04
D-9.09-0to29-102418	10/24/18 2:05 PM	6	T	ug/kg	No	No	0.04
E-8.99-0to28-102418	10/24/18 10:40 AM	7.2	JT	ug/kg	Yes	No	0.05
E-9.02-0to26-102418	10/24/18 12:07 PM	9.6	T	ug/kg	Yes	No	0.06
G-9.15-0to18-102418	10/24/18 2:46 PM	2.5	T	ug/kg	No	No	0.02
Subsurface Samples							
511-20to40-102318	10/23/2018 13:50	7.9	T	ug/kg	Yes	No	0.05
D-8.90-SC-00to10-102318	10/23/18 4:40 PM	8	T	ug/kg	Yes	No	0.05
D-8.90-SC-10to20-102318	10/23/18 4:50 PM	12	T	ug/kg	Yes	No	0.08
D-8.90-SC-20to40-102318	10/23/18 5:00 PM	15	T	ug/kg	Yes	No	0.09
D-8.90-SC-40to62-102318	10/23/18 5:20 PM	13	JT	ug/kg	Yes	No	0.08
D-8.90-SC-62to80-102318	10/23/18 5:30 PM	12	T	ug/kg	Yes	No	0.08
D-8.90-SC-80to103-102318	10/23/18 6:00 PM	16	T	ug/kg	Yes	No	0.10
D-8.90-SC-103to120-102318	10/23/18 6:10 PM	14	JT	ug/kg	Yes	No	0.09
D-8.90-SC-120to140-102318	10/23/18 7:00 PM	12	T	ug/kg	Yes	No	0.08
D-8.90-SC-140to160-102318	10/23/18 7:10 PM	18	T	ug/kg	Yes	No	0.11
D-8.90-SC-160to164-102318	10/23/18 7:20 PM	NA					
D-9.09-SC-00to10-102318	10/23/18 1:30 PM	7.2	T	ug/kg	Yes	No	0.05
D-9.09-SC-10to20-102318	10/23/18 1:40 PM	6.6	T	ug/kg	Yes	No	0.04
D-9.09-SC-20to40-102318	10/23/18 1:50 PM	6.8	T	ug/kg	Yes	No	0.04
D-9.09-SC-40to60-102318	10/23/18 2:30 PM	16	T	ug/kg	Yes	No	0.10
D-9.09-SC-60to80-102318	10/23/18 2:40 PM	7.4	T	ug/kg	Yes	No	0.05
D-9.09-SC-80to100-102318	10/23/18 3:10 PM	11	T	ug/kg	Yes	No	0.07

Table 11g. Analytical Results for Total DDx (Calculated Total)

Sample ID	Sample Date	Result	Flag	Units	Exceeds MCL[1] (6.1 ug/kg)	Exceeds RAL[2] (160 ug/kg)	RAL EF
D-9.09-SC-100to117-102318	10/23/18 3:20 PM	12	T	ug/kg	Yes	No	0.08
D-9.09-SC-117to121-102318	10/23/18 3:40 PM	NA					
E-9.02-SC-00to10-102318	10/23/18 10:22 AM	11	T	ug/kg	Yes	No	0.07
E-9.02-SC-10to20-102318	10/23/18 10:32 AM	13	T	ug/kg	Yes	No	0.08
E-9.02-SC-20to40-102318	10/23/18 10:42 AM	12	T	ug/kg	Yes	No	0.08
E-9.02-SC-40to60-102318	10/23/18 11:10 AM	13	T	ug/kg	Yes	No	0.08
E-9.02-SC-60to80-102318	10/23/18 11:20 AM	11	T	ug/kg	Yes	No	0.07
E-9.02-SC-80to100-102318	10/23/18 12:10 PM	13	T	ug/kg	Yes	No	0.08
E-9.02-SC-100to115-102318	10/23/18 12:20 PM	11	T	ug/kg	Yes	No	0.07
E-9.02-SC-115to130-102318	10/23/18 12:40 PM	12	T	ug/kg	Yes	No	0.08
E-9.02-SC-130to133-102318	10/23/18 12:50 PM	NA					

[1] MCL = Minimum Cleanup Level; corresponds to EPA Record of Decision Table 17

[2] RAL = Remedial Action Level; corresponds to EPA Record of Decision Table 21

EF = Exceedance Factor (Result/RAL); Non-detects shown as less than (<) the calculated value

NC = Not Calculated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

NE = Not Evaluated; result is non-detect with a detection limit greater than MCL or RAL, or result is "R" qualified.

J = Reported result is an estimate.

U = Analyte was not detected in sample.

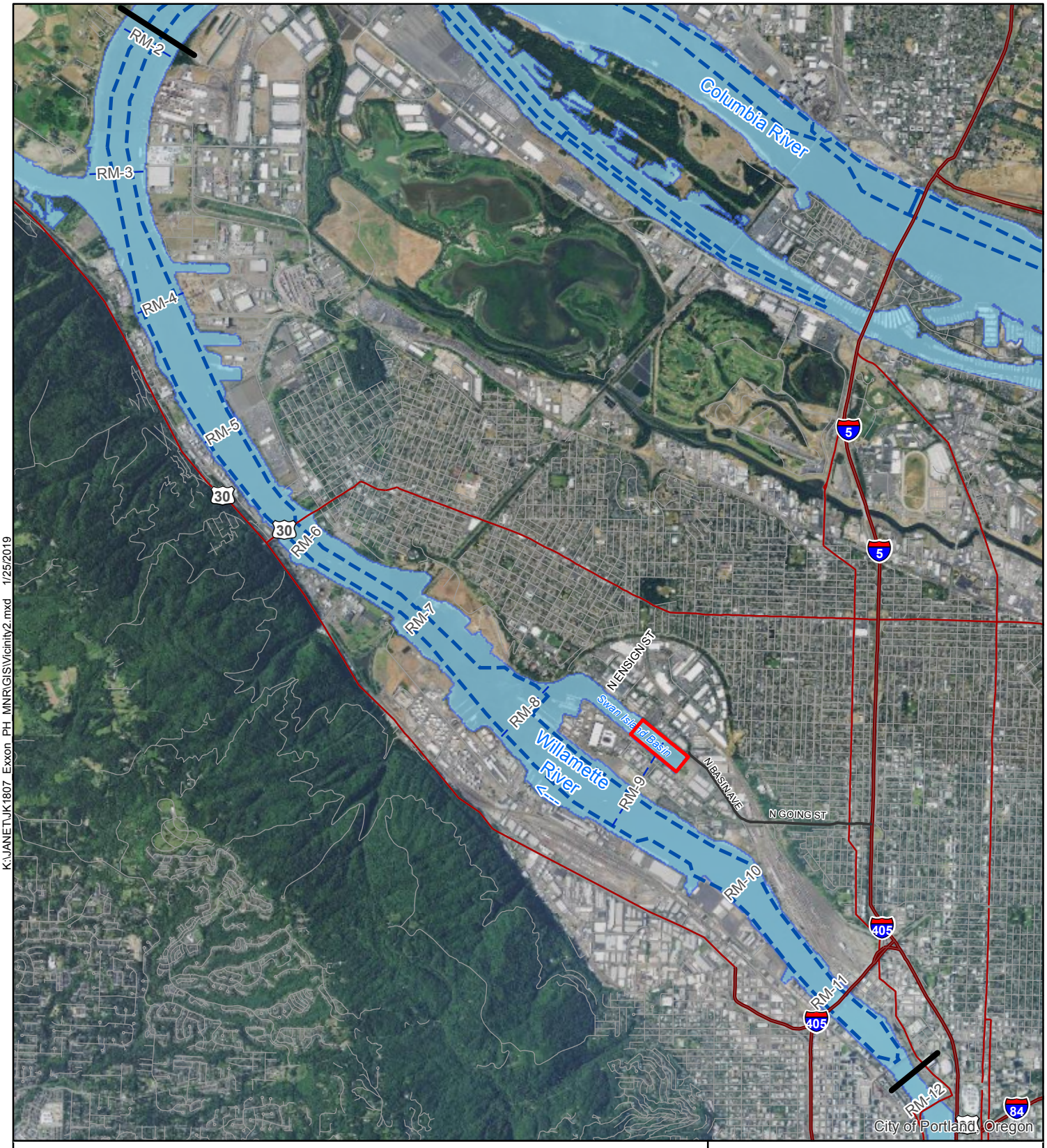
T = Total concentration from component analytes calculated with EPA Remedial Investigation summation rules (EPA, 2016 (Appendix A3. Table A3-3))

A = Summed value based on limited number of analytes

R = Rejected

N = Tentatively Identified

DDx = dichlorodiphenyltrichloroethane and its derivatives



K:\JANET\JK1807_Exxon_PH_MNR\GIS\Vicinity2.mxd 1/25/2019

Project Area
Federal Navigation Channel
Superfund Site Boundary (RM 1.9 to 11.8)
River Mile
Ordinary High Water

N

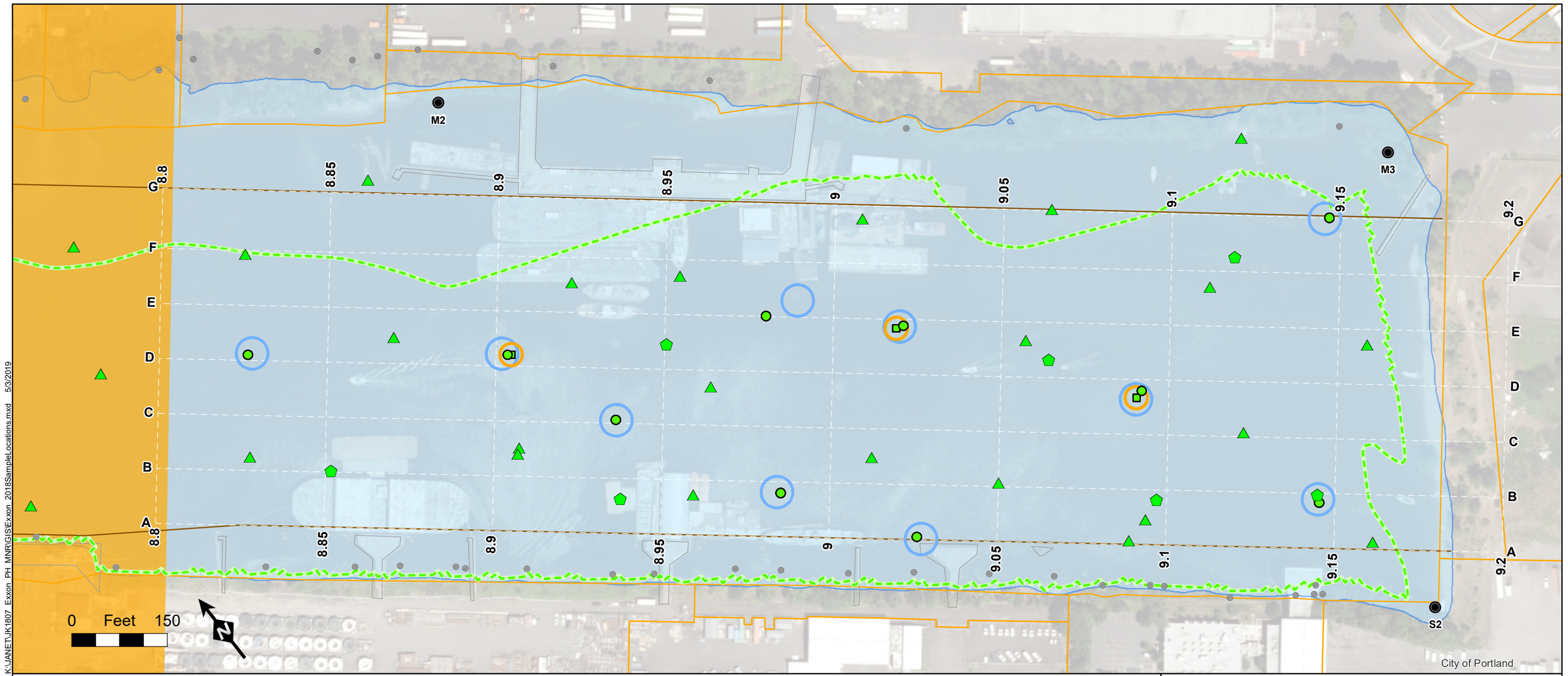
0 Miles 1

Figure 1

Portland Harbor Site Map

Head of Swan Island Lagoon
Field Sampling Data Report

PGG



Surface Sediment Sample

- Head of SIL Location
- Head of SIL Proposed Sample Target
- PDI Sample Location
- Post-FS Location

Subsurface Sediment Sample

- Head of SIL Location
- Head of SIL Proposed Target

- Essential Salmonid Habitat 2015
- City of Portland Stormwater Outfall
- Non-City Outfall
- Harbor Line
- ROD Sediment Management Area (SMA)
- Docks and Structures
- Taxlot Boundary
- Ordinary High Water (City of Portland, 2013)

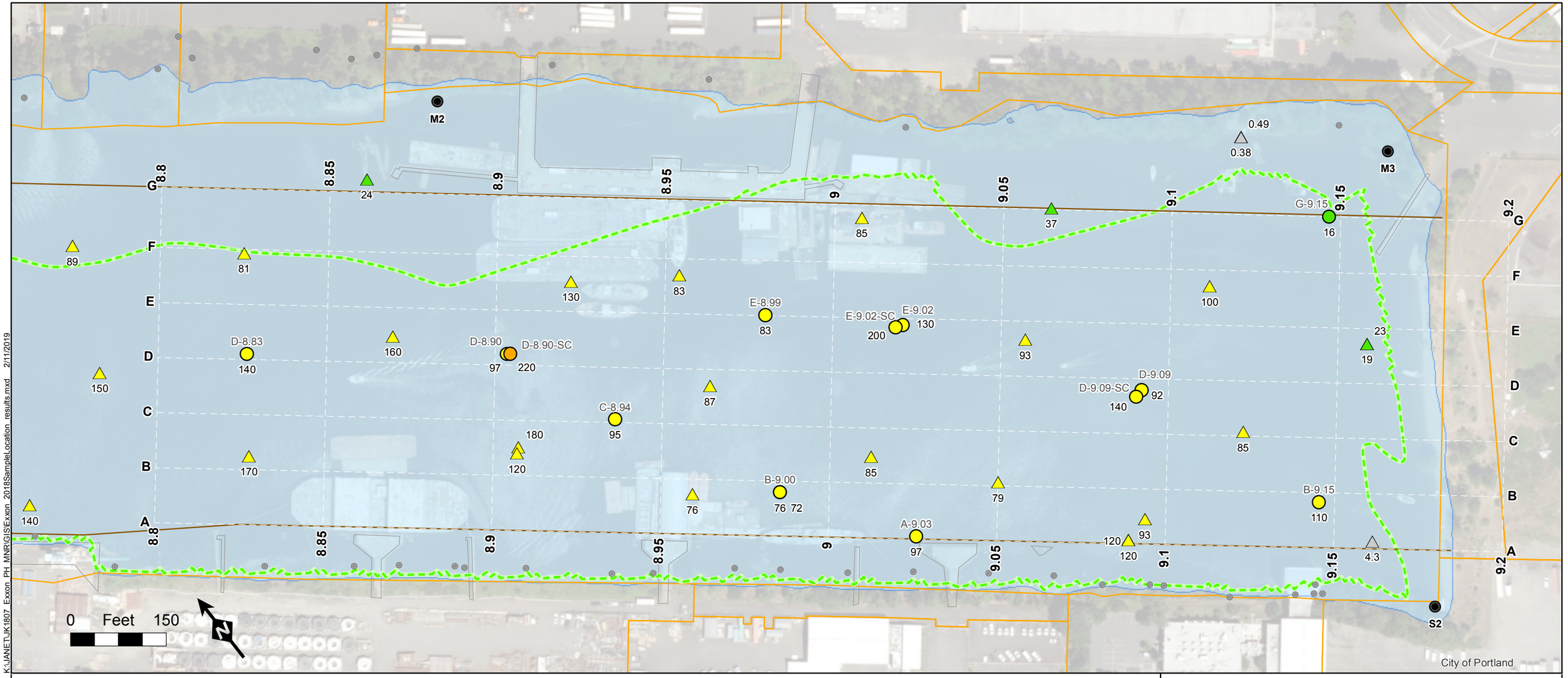
Figure 2

Swan Island Lagoon
Sediment Sampling Locations

Head of Swan Island Lagoon
Field Sampling Data Report

PgG

K:\JANET\JK1807_Exxon_PH_MNR\GIS\Exxon_2018SampleLocation_results.mxd 2/11/2019



Surface Sediment Sample Total PCB Congeners Concentration

- ≤ ROD CUL (9 µg/kg)
- > ROD CUL (9 µg/kg) and ≤ ROD RAL (75 µg/kg)
- > ROD RAL (75 µg/kg) and ≤ PTW (200 µg/kg)
- > PTW (200 µg/kg) and ≤ Nav ROD RAL (1,000 µg/kg)
- > Nav ROD RAL (1,000 µg/kg)

B-9.00 Exxon Sample with Sample Grid Location

PDI Sample

CUL - Cleanup Level
RAL - Remedial Action Levels
PTW - Principal Threat Waste
ROD - Record of Decision
SC - Sediment Core

Notes:
1. Total PCBs are the sum of individual PCB congeners calculated per PDI data summation rules (Appendix E, Pre-Remedial Design Footprint Report (AECOM & Geosyntec, 2019)).
2. Data Qualifiers not shown.

- City of Portland Stormwater Outfall
- Non-City Outfall
- Harbor Line
- ROD Sediment Management Area (SMA)
- Docks and Structures
- Taxlot Boundary
- Ordinary High Water (City of Portland, 2013)

Figure 3

Surface Sediment Sample Concentration - Total PCB Congeners

Head of Swan Island Lagoon
Field Sampling Data Report

PgG

K:\JANET\JK1807 Exxon PH MNR\GIS\Exxon 2018SampleLocation_results.mxd 2/11/2019

M2

M3

G-9.15
19

59

E-8.99
24

E-9.02-SC
23

E-9.02
29

62
66

D-8.83
58

D-8.90
31

D-8.90-SC
32

51

D-9.09
D-9.09-SC
35
20

C-8.94
32

70

77

B-9.00
35
28

A-9.03
32

64

B-9.15
62
34

S2

8.8 8.85 8.9 8.95 9 9.05 9.1 9.15 9.2

A B C D E F G

0 Feet 150

N

City of Portland

Surface Sediment Sample Total PCB Aroclors Concentration

- ≤ ROD CUL (9 µg/kg)
- > ROD CUL (9 µg/kg) and ≤ ROD RAL (75 µg/kg)
- > ROD RAL (75 µg/kg) and ≤ PTW (200 µg/kg)
- > PTW (200 µg/kg) and ≤ Nav ROD RAL (1,000 µg/kg)
- > Nav ROD RAL (1,000 µg/kg)

B-9.00 Exxon Sample with Sample Grid Location

Post-FS Sample

CUL - Cleanup Level
RAL - Remedial Action Levels
PTW - Principal Threat Waste
ROD - Record of Decision
SC - Sediment Core

- City of Portland Stormwater Outfall
- Non-City Outfall
- Harbor Line
- ROD Sediment Management Area (SMA)
- Docks and Structures
- Taxlot Boundary
- Ordinary High Water (City of Portland, 2013)

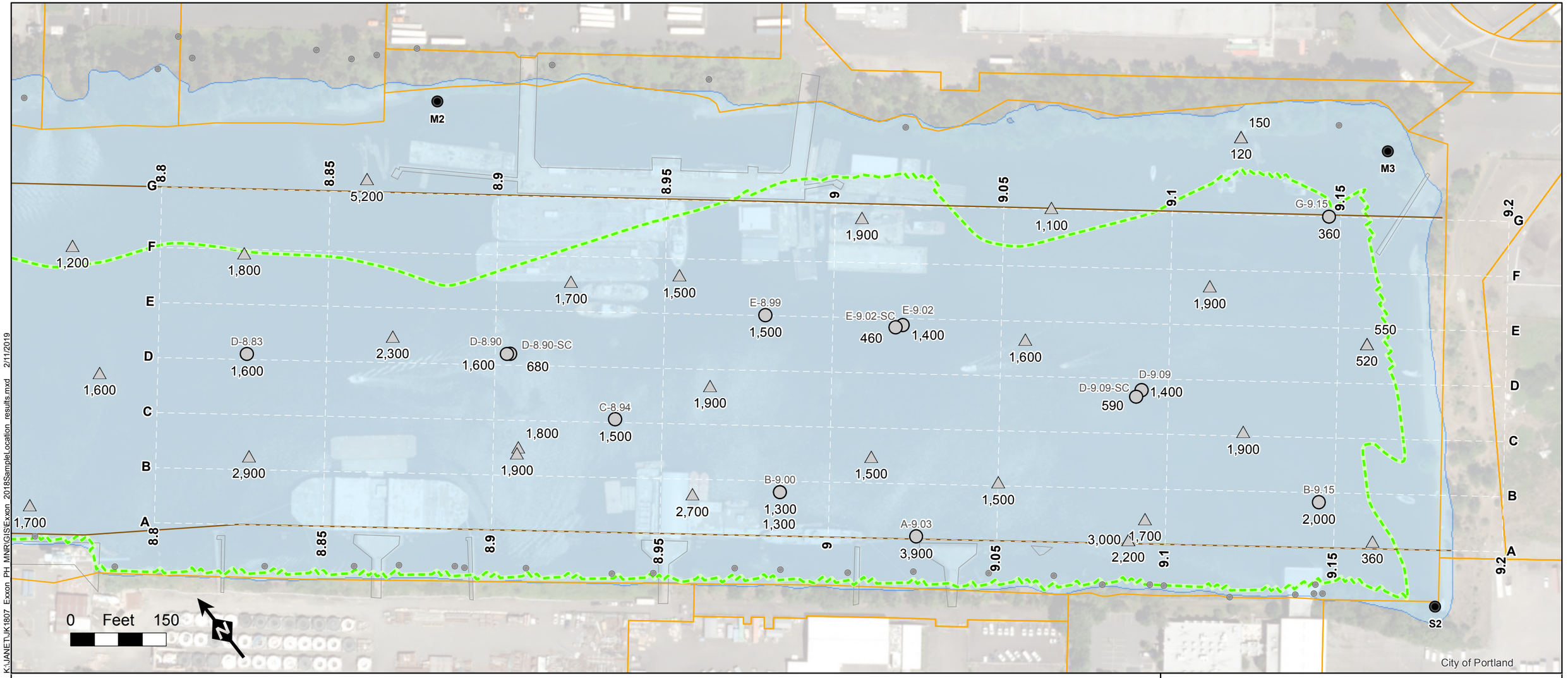
Notes:
1. Total PCBs are the sum of individual Aroclor detections calculated per PDI data summation rules (Appendix E, Pre-Remedial Design Footprint Report (AECOM & Geosyntec, 2019)).
2. Data Qualifiers not shown.

Figure 4

Surface Sediment Sample Concentration - Total PCB Aroclors

Head of Swan Island Lagoon
Field Sampling Data Report

PgG



Surface Sediment Sample Total PAHs Concentration

- ≤ ESD CUL (23,000 µg/kg)
- > ESD CUL (23,000 µg/kg) and ≤ ESD RAL (30,000 µg/kg)
- > ESD RAL (30,000 µg/kg) and ≤ ESD nav RAL (170,000 µg/kg)
- > ESD nav RAL (170,000 µg/kg) and ≤ ESD PTW (774,000 µg/kg)
- > ESD PTW (774,000 µg/kg)

B-9.00 Exxon Sample with Sample Grid Location

PDI Sample

CUL - Cleanup Level
RAL - Remedial Action Levels
PTW - Principal Threat Waste
ROD - Record of Decision
ESD - Explanation of Significant Differences
SC - Sediment Core

Notes:
1. Total PAHs are the sum of Light PAHs and Heavy PAHs calculated per PDI data summation rules (Appendix E, Pre-Remedial Design Footprint Report (AECOM & Geosyntec, 2019)).
2. Data Qualifiers not shown.
3. ESD CUL, RAL, and PTW PAH values are proposed by EPA in 2018 and not yet final.

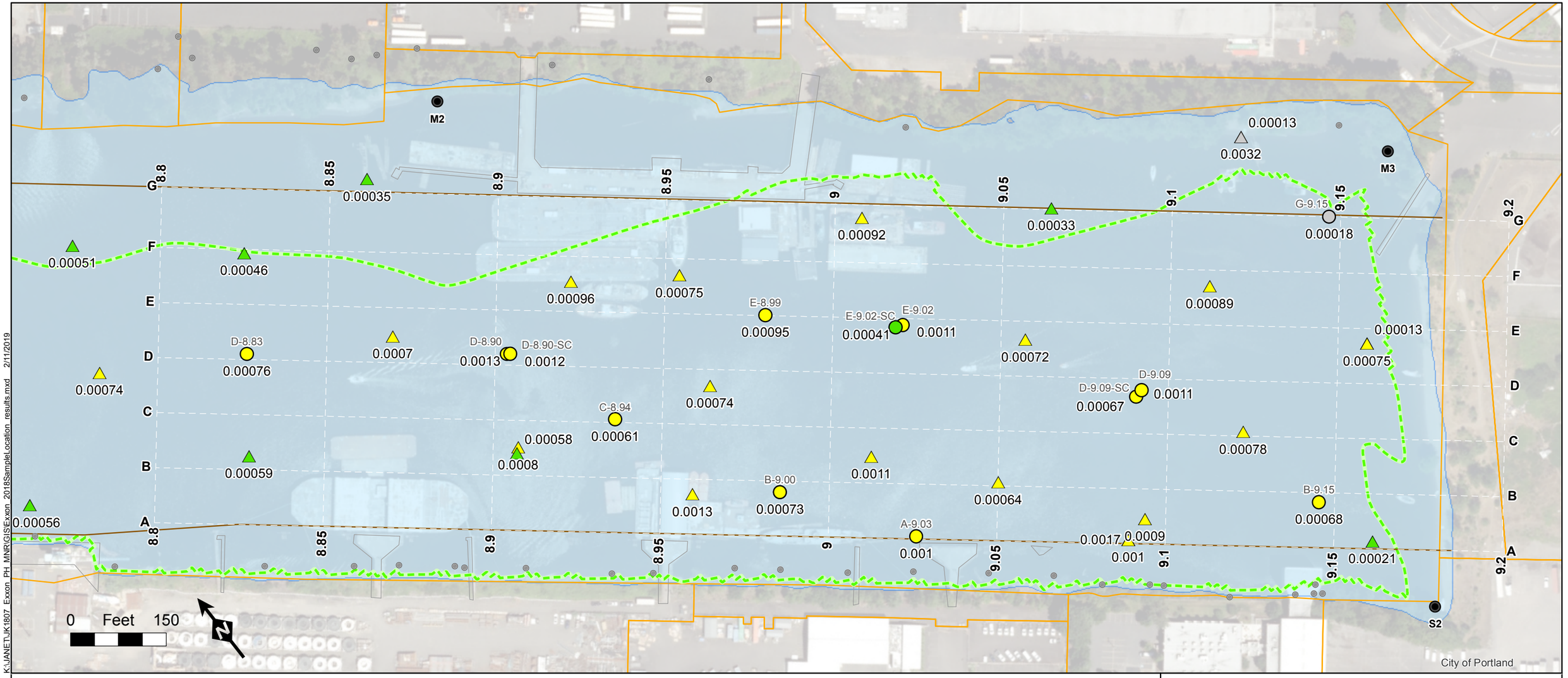
- City of Portland Stormwater Outfall
- Non-City Outfall
- Harbor Line
- ROD Sediment Management Area (SMA)
- Docks and Structures
- Taxlot Boundary
- Ordinary High Water (City of Portland, 2013)

Figure 5

Surface Sediment Sample Concentration - Total PAHs

Head of Swan Island Lagoon
Field Sampling Data Report

PgG



Surface Sediment Sample 2,3,7,8-TCDD Concentration

- ≤ ROD CUL (0.0002 µg/kg)
- > ROD CUL (0.0002 µg/kg) and ≤ ROD RAL (0.0006 µg/kg)
- > ROD RAL (0.0006 µg/kg) and ≤ nav ROD RAL (0.002 µg/kg)
- > nav ROD RAL (0.002 µg/kg) and ≤ PTW (0.01 µg/kg)
- > PTW (0.01 µg/kg)

B-9.00 Exxon Sample with Sample Grid Location

PDI Sample

CUL - Cleanup Level
RAL - Remedial Action Levels
PTW - Principal Threat Waste
ROD - Record of Decision
SC - Sediment Core

Notes:
1. Data Qualifiers not shown.

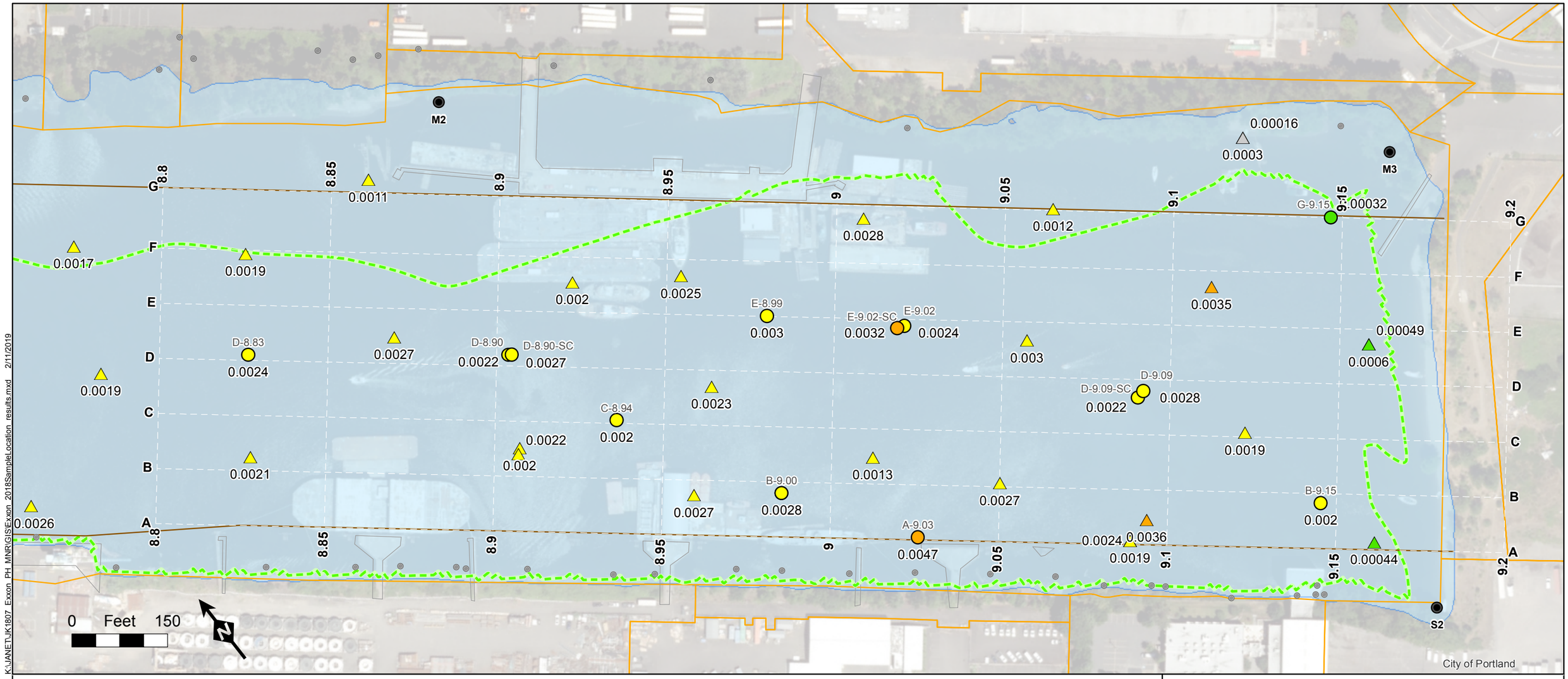
- City of Portland Stormwater Outfall
- Non-City Outfall
- Harbor Line
- ROD Sediment Management Area (SMA)
- Docks and Structures
- Taxlot Boundary
- Ordinary High Water (City of Portland, 2013)

Figure 6

Surface Sediment Sample Concentration - 2,3,7,8-TCDD

Head of Swan Island Lagoon
Field Sampling Data Report

PgG



K:\JANET\JK1807 Exxon PH MNR\GIS\Exxon 2018SampleLocation results.mxd 2/11/2019

Surface Sediment Sample 1,2,3,7,8-PeCDD Concentration

- ≤ ROD CUL (0.0002 µg/kg)
- > ROD CUL (0.0002 µg/kg) and ≤ ROD RAL (0.0008 µg/kg)
- > ROD RAL (0.0008 µg/kg) and ≤ nav ROD RAL (0.003 µg/kg)
- > nav ROD RAL (0.003 µg/kg) and ≤ PT W (0.01 µg/kg)
- > PTW (0.01 µg/kg)

B-9.00 Exxon Sample with Sample Grid Location

PDI Sample

CUL - Cleanup Level
RAL - Remedial Action Levels
PTW - Principal Threat Waste
ROD - Record of Decision
SC - Sediment Core

Notes:
1. Data Qualifiers not shown.

- City of Portland Stormwater Outfall
- Non-City Outfall
- Harbor Line
- ROD Sediment Management Area (SMA)
- Docks and Structures
- Taxlot Boundary
- Ordinary High Water (City of Portland, 2013)

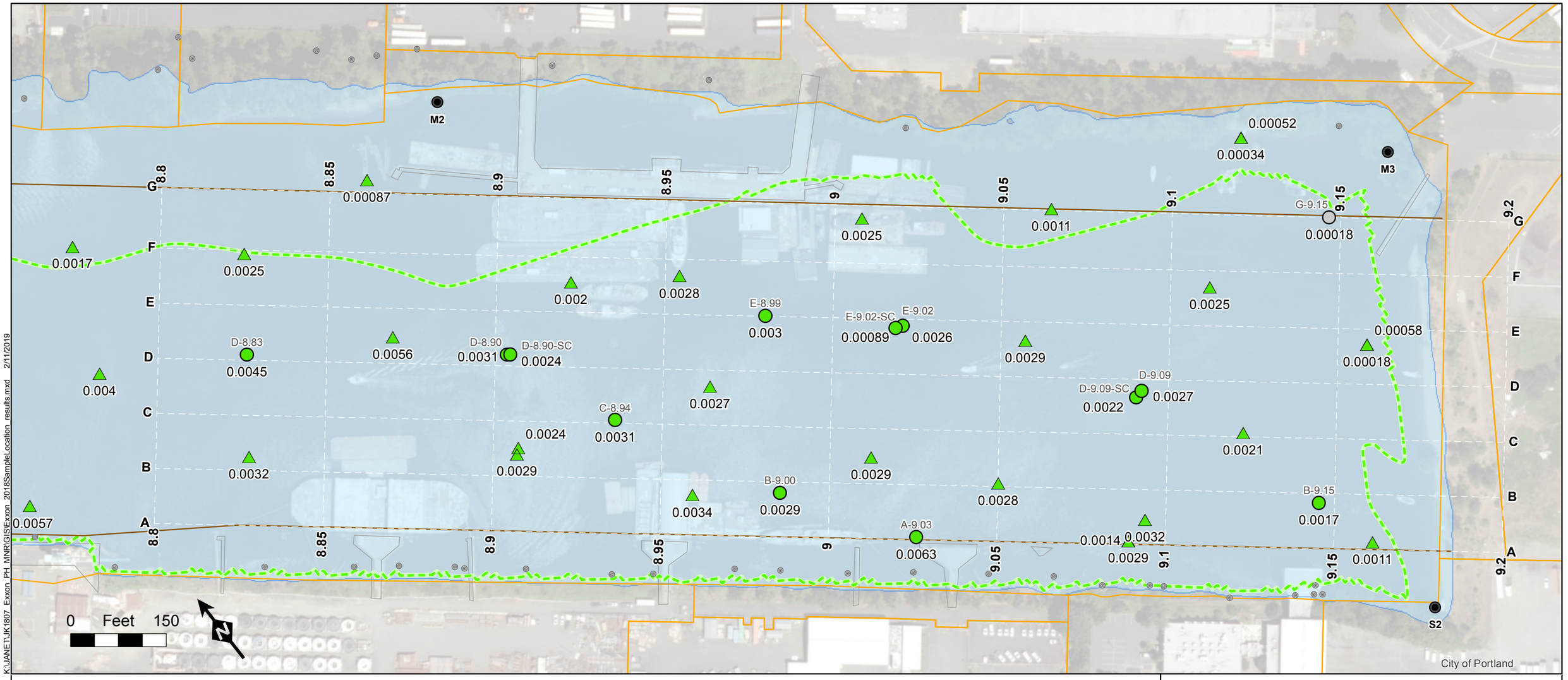
Figure 7

Surface Sediment Sample Concentration - 1,2,3,7,8-PeCDD

Head of Swan Island Lagoon
Field Sampling Data Report

PgG

K:\JANET\JK1807_Exxon_PH_MNR\GIS\Exxon_2018SampleLocation_results.mxd 2/11/2019



Surface Sediment Sample 2,3,4,7,8-PeCDF Concentration

- ≤ ROD CUL (0.0003 µg/kg)
- > ROD CUL (0.0003 µg/kg) and ≤ ROD RAL/PTW (0.2 µg/kg)
- > ROD RAL/PTW (0.2 µg/kg) and ≤ nav ROD RAL (1.0 µg/kg)
- > nav ROD RAL (1.0 µg/kg)

B-9.00
Exxon Sample with Sample Grid Location
PDI Sample

CUL - Cleanup Level
RAL - Remedial Action Levels
PTW - Principal Threat Waste
ROD - Record of Decision
SC - Sediment Core

Notes:
1. Data Qualifiers not shown.

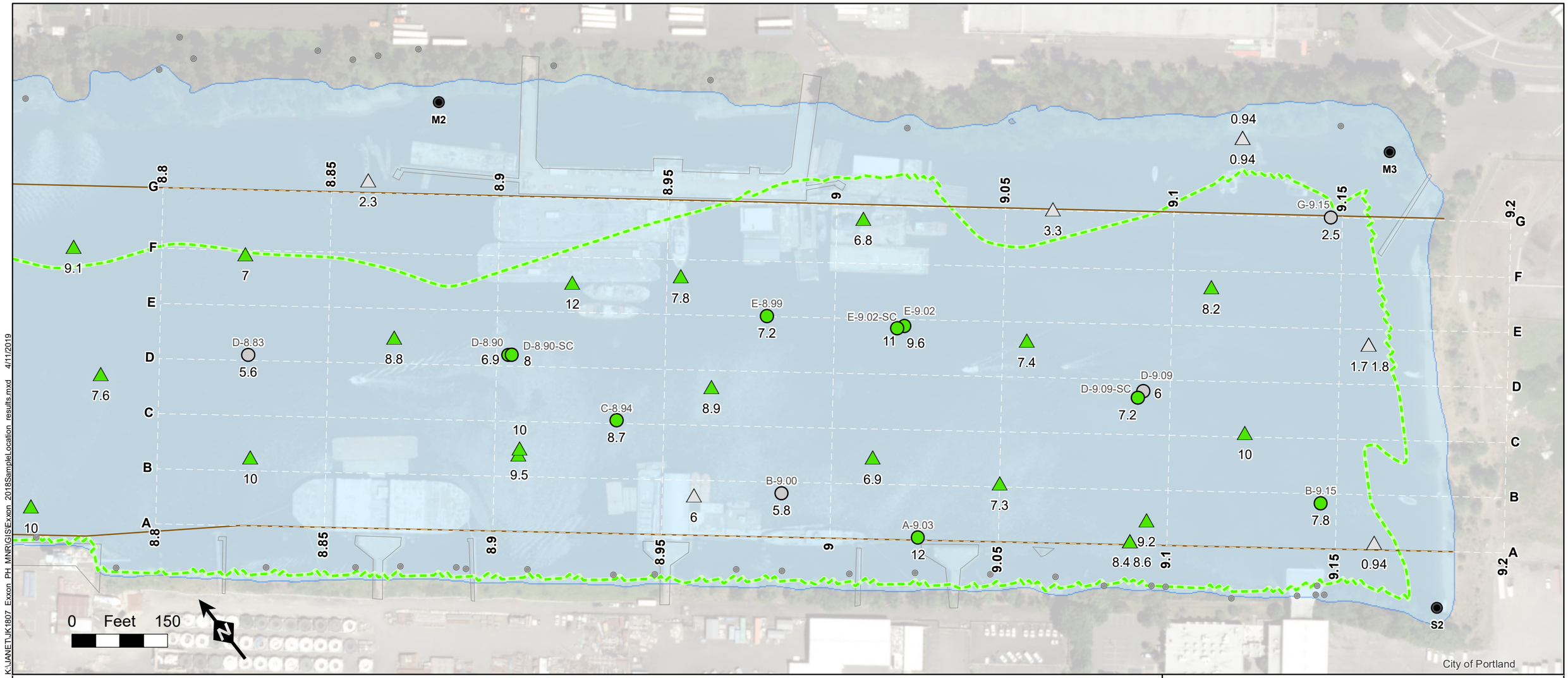
- City of Portland Stormwater Outfall
- Non-City Outfall
- Harbor Line
- ROD Sediment Management Area (SMA)
- Docks and Structures
- Taxlot Boundary
- Ordinary High Water (City of Portland, 2013)

Figure 8

Surface Sediment Sample Concentration - 2,3,4,7,8-PeCDF

Head of Swan Island Lagoon
Field Sampling Data Report

PgG



Surface Sediment Sample DDx Concentration

- ≤ ROD CUL (6.1 µg/kg)
- > ROD CUL (6.1 µg/kg) and ≤ROD RAL (160 µg/kg)
- > ROD RAL (160 µg/kg) and ≤nav ROD RAL (650 µg/kg)
- > nav ROD RAL (650 µg/kg) and ≤PTW (7,050 µg/kg)
- > PTW (7,050 µg/kg)

B-9.00 Exxon Sample with Sample Grid Location

PDI Sample

CUL - Cleanup Level
RAL - Remedial Action Levels
PTW - Principal Threat Waste
ROD - Record of Decision
SC - Sediment Core

Notes:
1. DDx is the sum of 6 isomers calculated per PDI data summation rules (Appendix E, Pre-Remedial Design Footprint Report (AECOM & Geosyntec, 2019)).
2. Data Qualifiers not shown.

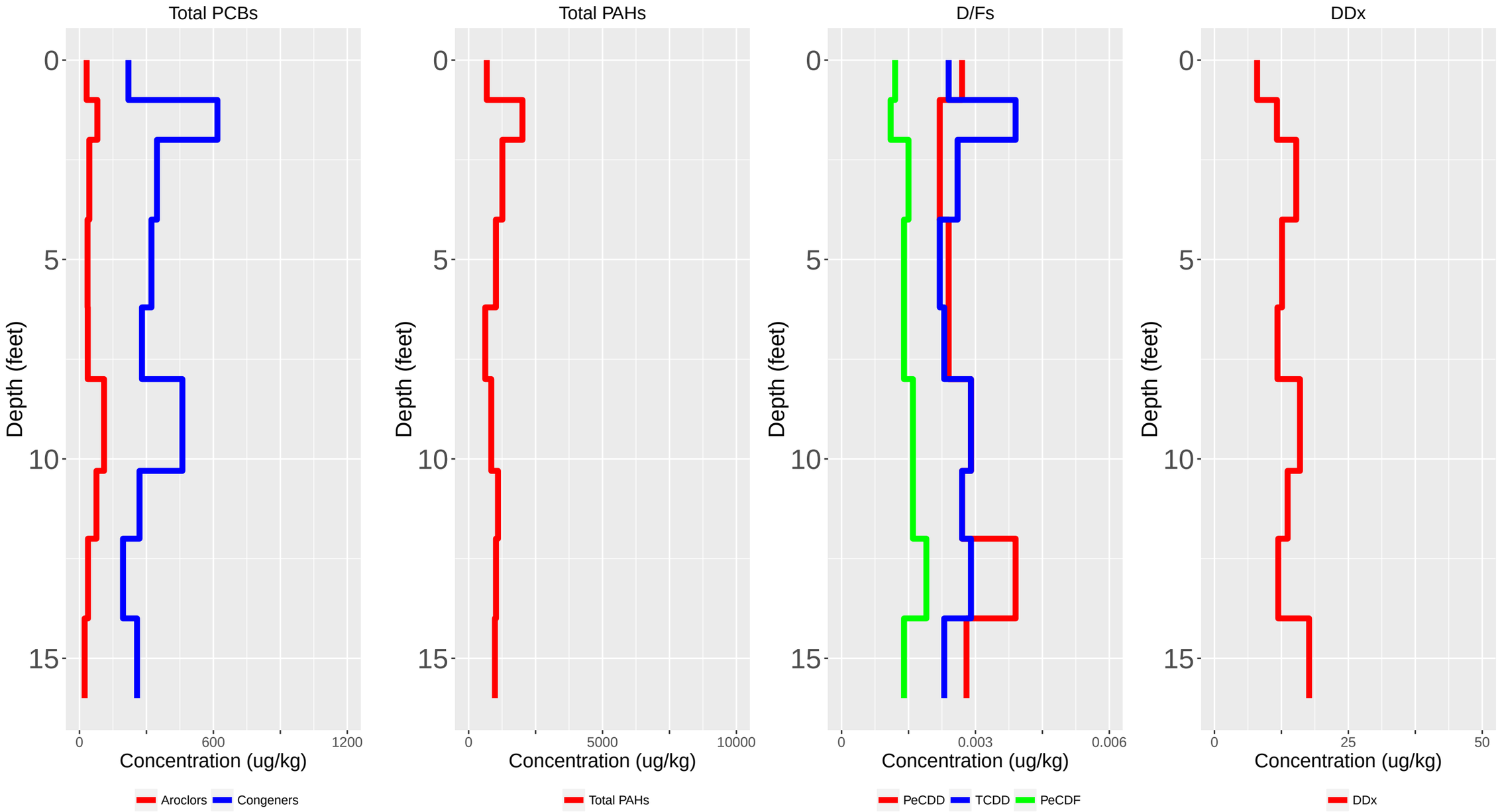
- City of Portland Stormwater Outfall
- Non-City Outfall
- Harbor Line
- ROD Sediment Management Area (SMA)
- Docks and Structures
- Ordinary High Water (City of Portland, 2013)

Figure 9

Surface Sediment Sample Concentration - DDx

Head of Swan Island Lagoon
Field Sampling Data Report

PgG



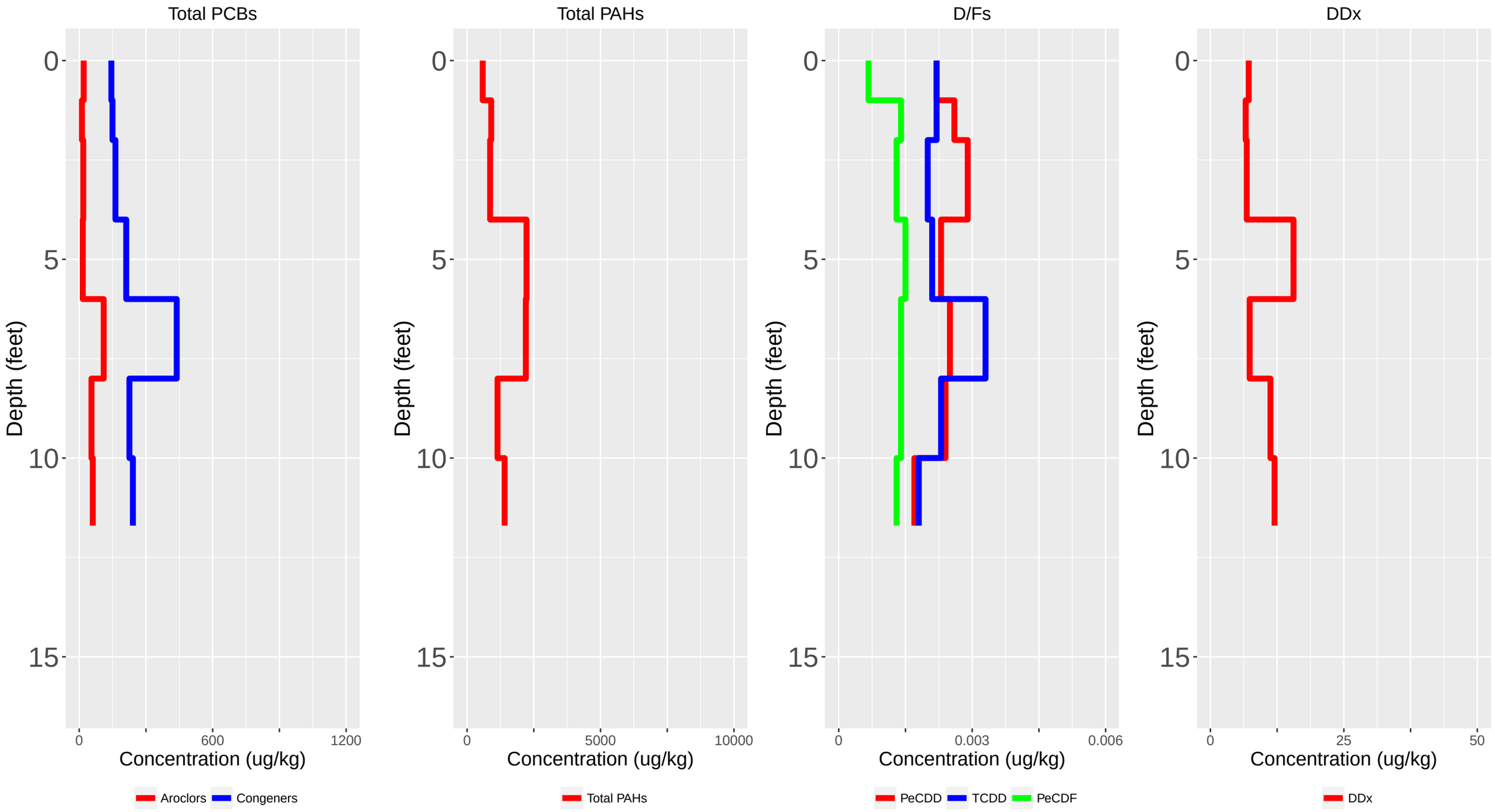
PeCDD = 1,2,3,7,8−PeCDD, TCDD = 2,3,7,8−TCDD, PeCDF = 2,3,4,7,8−PeCDF
PAHs = polycyclic aromatic hydrocarbons, PCBs = polychlorinated biphenyls, DDx = dichlorodiphenyltrichloroethane and its derivatives
ug/Kg = micrograms per kilogram

Prepared 04/12/2019 20:01

Figure 10. Subsurface Sediment Concentration Profile − Core D−8.90

Head of Swan Island Lagoon
Field Sampling Data Report

PgG



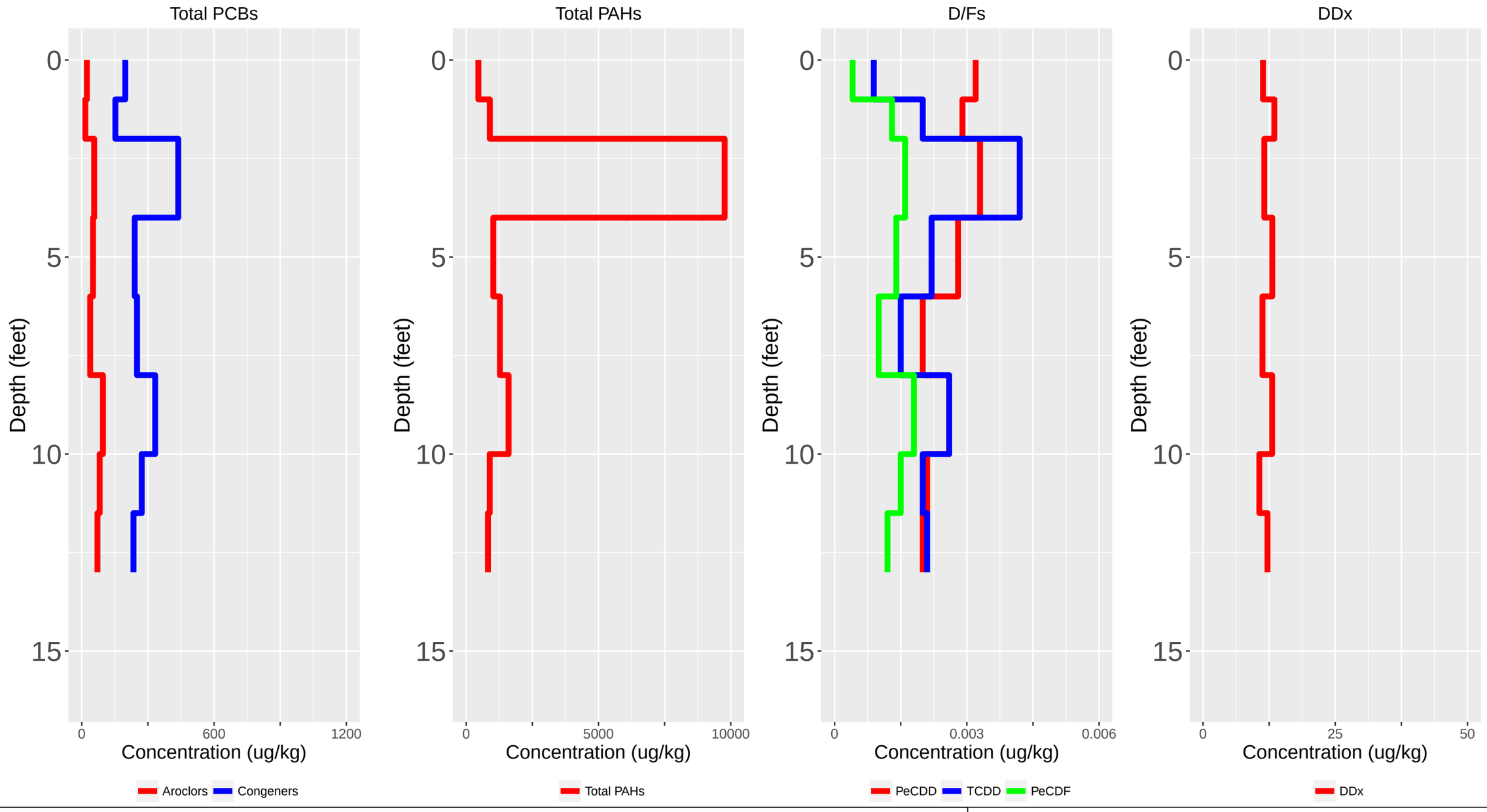
PeCDD = 1,2,3,7,8−PeCDD, TCDD = 2,3,7,8−TCDD, PeCDF = 2,3,4,7,8−PeCDF
PAHs = polycyclic aromatic hydrocarbons, PCBs = polychlorinated biphenyls, DDx = dichlorodiphenyltrichloroethane and its derivatives
ug/Kg = micrograms per kilogram

Prepared 04/12/2019 20:01

Figure 11. Subsurface Sediment Concentration Profile − Core D−9.09

Head of Swan Island Lagoon
Field Sampling Data Report

PgG



PeCDD = 1,2,3,7,8−PeCDD, TCDD = 2,3,7,8−TCDD, PeCDF = 2,3,4,7,8−PeCDF
PAHs = polycyclic aromatic hydrocarbons, PCBs = polychlorinated biphenyls, DDx = dichlorodiphenyltrichloroethane and its derivatives
ug/Kg = micrograms per kilogram

Prepared 04/12/2019 20:01

Figure 12. Subsurface Sediment Concentration Profile − Core E−9.02

Head of Swan Island Lagoon
Field Sampling Data Report

PgG