SOURCE CONTROL REVIEW MEMORANDUM

South Park Marina
Seattle, Washington

Prepared for Submittal to:

Washington State Department of Ecology on behalf of

City of Seattle, Seattle City Light
The Port of Seattle
South Park Marina Limited Partnership

Prepared by
Aspect Consulting

Project No. 190293-A-2.4 • September 6, 2022 • FINAL

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Contents

List of Tables

List of Figures

List of Appendices

This Source Control Review Memorandum is prepared and submitted to the Washington State Department of Ecology (Ecology) in accordance with Scope of Work Task 2a in Agreed Order No. DE 16185 (AO) for the South Park Marina Site (Site) located at 8604 Dallas Avenue South in Seattle, Washington (Figure 1). The Site is located between river mile (RM) 3.3 and 3.5 immediately adjacent to the Lower Duwamish Waterway (LDW) Superfund Site. The goal of this source control review is to provide the information necessary for Ecology to make a determination regarding "source control sufficiency" for the Site as defined in the LDW Source Control Strategy (Strategy; Ecology, 2016). To meet that goal, this document:

1. Summarizes and analyzes data collected prior to and during the ongoing Site Remedial Investigation (RI) to assess whether discharge of contaminants from the upland Site, via the pathways identified in the AO, poses a risk of recontamination to LDW sediments at levels exceeding the remedial action levels (RALs) defined in the LDW Record of Decision (ROD; EPA, 2014). The AO-identified recontamination pathways are: (1) Contaminated groundwater discharging to LDW sediment; (2) Contaminated soils entering the storm drain system and discharging to the LDW; and (3) Erosion of contaminated soil and transport to the LDW via overland flow or riverbank sloughing.
2. Identifies whether data gaps exist with respect to the current understanding of each pathway from the Site
3. Discusses the need for an interim action(s) to control any potential sources or contaminant discharge pathways from the Site

In addition to completion of this source control review, the RI for the Site will be completed to address the nature and extent of, and environmental risk posed by, Site contamination. The RI will address all applicable environmental exposure pathways in accordance with the Washington State Model Toxics Control Act (MTCA), the AO, and the Ecology-approved RI Work Plan (Aspect, 2021). Following completion of this memorandum, the Phase 2 RI sampling and analysis will be conducted, in accordance with an Ecology-approved RI Work Plan Addendum, to refine the understanding of contaminant nature and extent at the Site. The supplemental data collected in that effort will be used to update the source control evaluation for this Site as described in Section 6.

The following sections of this memorandum are organized as follows:

- **Section 1** briefly describes the Site and the planned remediation of offshore LDW sediments as part of the LDW Superfund Site.
- **Section 2** describes the framework for conducting the Site source control review consistent with goals of Ecology's Source Control Strategy for the LDW.
- **Section 3** describes data for the marina basin receiving sediments compared against the LDW ROD RALs.
- **Section 4** describes the upland Site data used to characterize the three contaminant transport pathways defined in the AO by which upland media can potentially recontaminate the LDW sediments adjacent to the Site (within the marina basin area).

- **Section 5** presents a predictive modeling analysis to assess contaminant mass loading from the uplands to the receiving sediments as a secondary line of evidence supporting Ecology's source control sufficiency determination.
- **Section 6** presents the conclusions of this source control review, including whether there are data gaps for completing the review, and presents recommendations for achieving source control for the Site including whether an interim action is warranted.
- **Section 7** includes references cited in this document.

Tables and figures are located at the end of this memorandum followed by three appendices:

- **Appendix A** summarizes information regarding Site stormwater management.
- **Appendix B** is a memorandum presenting the methods and results for estimating annual stormwater runoff from the Site property using the Western Washington Hydrologic Model (WWHM).
- **Appendix C** presents the analytical results for historical surface sediment samples that were excluded from the analysis of current surface sediment conditions for reasons described in Section 3.1.

1 Background for Site

The SPM Property is located on the LDW west bank between river mile (RM) 3.3 and 3.5 (Figure 1). In accordance with the AO, the "Site" is defined as the extent of contamination caused by releases of hazardous substances at or from the South Park Marina (SPM) Property and is not limited by property boundaries. The upland portion of the SPM Property is defined as the portion of SPM Property above mean higher high water (MHHW). This source control review evaluates the upland portion of the SPM Property and the LDW sediments immediately offshore of it.

The SPM Property is located immediately north and downstream of the location where the Terminal 117 (T-117) non-time critical removal action (NTCRA) for upland soils and LDW sediments was completed between May 2013 and January 2015 as part of an Early Action Area (EAA) cleanup (AECOM, 2018). The SPM Property is also bordered to the north[1] by South Thistle Street, a King County stormwater management system, and the South Park Bridge. The Site is bordered to the west by Dallas Avenue South and residential and commercial properties; a dry cleaner historically operated at the corner of Dallas Avenue South and 14th Avenue South. These surrounding properties are described in Section 2.4 of the RI Work Plan for the Site (Aspect, 2021).

The SPM Property is used as a boat marina and includes secured overwater docks and pilings, parking, dry boat storage, a boat ramp, restrooms and laundry facilities, and a boat wash area (Figure 1). In addition to the boatyard area, the Tire Factory and Rick's Master Marine facilities lease northern portions of the SPM Property. Buildings at the south end of the Property have been leased by various tenants for woodworking, boat repairs, and lumber storage uses. The RI Work Plan includes additional detail regarding history and current operations of the SPM Property (Aspect, 2021).

1.1 September 2021 Fire

On September 2, 2021, a fire damaged several vessels in the upland dry storage area and destroyed the woodworking shop, the lumber storage building, and a storage shed in the southern portion of the SPM Property (Figure 1). Following the fire, a containment boom was deployed in the LDW adjacent to the affected area, and sedimentation controls (wattles) were installed along the upland bank, to mitigate the transport of contamination off-site via runoff. The fire occurred after collection of all data that are relied upon in this source control review. After completion of the fire department and insurance investigations of the fire, removal of the fire-generated debris was conducted between March 17 and March 24, 2022. The surfaces exposed by the fire primarily consist of impervious surfaces (concrete slab or asphalt pavement) with limited areas of exposed soil. The southern portion of the SPM Property have reverted to marina boatyard use (dry boat storage).

[1] For purposes of this project, directions are referenced to "project north" which is approximately 45 degrees west of true north and is aligned in the downstream direction of the LDW (see north arrows on the figures in this memorandum).

For purposes of this source control review, the data collected prior to the fire are considered representative of the near-term future conditions. Consequently, the September 2021 fire is not considered further in this source control review. However, during the RI Phase 2 data collection, additional soil, groundwater, and stormwater data will be collected within and downslope/downgradient of the fire area, and those data will be evaluated in the update to this source control review discussed in Section 6.

1.2 Marina Basin Sediments

For purposes of this source control review, the area of LDW sediments immediately offshore of the upland SPM Property is referred to as the "marina basin." It extends from MHHW on the western bank to the federal navigation channel boundary on the east between the north and south SPM Property boundaries as depicted on Figure 1. The marina basin covers approximately 3.1 acres.

The selected remedy in the Environmental Protection Agency's (EPA) LDW ROD for the marina basin sediment area, would entail monitored natural recovery (MNR). However, based on information presented by EPA at their March 31, 2022, LDW Roundtable Meeting, dredging near the southwestern corner of the marina basin is being contemplated based on 2021 sediment sample data collected during the LDW remedial design work. The actual remediation technology to be applied to marina basin sediments will be determined through the remedial design process (currently underway but not yet complete) for the Upper Reach of the LDW sediment site, which includes the marina basin. The marina basin area was designated in the ROD as Recovery Category 3 ("predicted to recover") and there was no designation change recommended in the recent LDW Recovery Category Recommendations Report based on post-ROD information (Integral, 2019). The results of the Pre-Design Investigation Phase I sediment sampling (which is part of the Upper Reach remedial design) conducted within the marina basin (Windward, 2020) are incorporated into this source control review and discussed in Section 3.

2 Framework for Site Source Control Review

This section describes the framework for the Site source control review. An overview of Ecology's Source Control Strategy goals is first provided for context, and then the specific steps comprising the source control review for the Site are described.

2.1 Overview of Ecology's Source Control Strategy Framework

Ecology's 2016 LDW Source Control Strategy represents the coordinated long-term effort to manage source control in the LDW by the agencies that have authorities to regulate sources of contaminants. The Strategy identifies the goals and priorities of source control, the main regulatory mechanisms that may be used, how those will be implemented, and the process and information needed to determine whether contaminant sources have been sufficiently controlled to begin in-waterway remedial actions. The Strategy is implemented through twenty-four area-specific Source Control Action Plans (SCAPs) that are coordinated with sediment cleanups, including cleanups at the T-117 EAA that borders the Site to the south and the Boeing/Jorgenson Forge EAA located across the LDW from the Site.

The SCAPs provide detail regarding how data gaps relevant to source control will be addressed, what source control actions are needed, and how those actions will be implemented. Ecology intends for the Strategy to be the framework for LDW source control until the end of the active in-water sediment remediation. Sediment remediation of the Upper Reach is scheduled to start by the end of 2024 (Anchor QEA, 2019).

The Strategy defines two source control goals with different timeframes as follows:

- **Near-term:** "The near-term goal of source control is to address existing, ongoing sources of contaminants to the LDW so that in-waterway sediment cleanup can begin without the risk of recontamination above [sediment] remedial action levels [RALs], as defined in EPA's Record of Decision (ROD)."
- **Long-term:** "In the long term, after the sediment remedy is in place, the LDW source control goal is to minimize the risk of recontaminating sediments above the sediment cleanup standards established in the ROD."

The Strategy also identifies the concept of "source control sufficiency" as achieving the Strategy's near-term goal. The Strategy also states that "in-water work activities that necessitate sufficiency evaluations include dredging, capping, and enhanced natural recovery (ENR). Because MNR is expected in areas where the sediments already meet the LDW RALs, a source control sufficiency evaluation will not generally be necessary in MNR areas." Nonetheless, the Site's AO requires completion of this source control review to support Ecology's determination of source control sufficiency including identification of data gaps and recommendations for source control action. This memo focuses on the near-term strategy goal as described in Section 2.2.

2.1.1 Principal Criteria for Source Control Sufficiency

In their Source Control Strategy, Ecology has defined five principal criteria as a basis for source control sufficiency evaluations. These five criteria are:

1. Status of identified high- and medium-priority actions from the Source Control Action Plans.
2. Information collected through business inspections and spill investigations/response.
3. Relevant information collected through other studies.
4. Status of permit compliance, where applicable.
5. Status of upland contaminated site cleanups.

Actions conducted in response to criteria numbers 1, 2, and 4 are documented in Appendix A to this memorandum. Additional information regarding criteria number 1 is documented in SAIC (2008 and 2009) and Leidos (2015). Upland contaminated sites include this SPM site as well as the T117 EAA. Remedial actions in the upland portions of the T117 EAA bordering the Site to the south and west were completed from 2013 through 2017 and are summarized in Section 2.4.2 of the RI Work Plan (Aspect, 2021). In addition to the data analysis outlined below, Ecology will use the five principal criteria as a basis for their source control sufficiency evaluation of the Site, in accordance with Ecology (2016).

2.2 Approach for Site Source Control Review

The source control review for this Site encompasses the extent of the upland SPM Property, as evaluated in the RI, as well as the marina basin sediments, as depicted on Figure 1. It addresses the Strategy's near-term goal to control sources sufficiently to allow in-waterway remediation to start, anticipated in 2024 for the Upper Reach. This review therefore assumes the continued use of the Site as a marina, with no substantive changes to Site conditions or operations, during that near-term period.

This source control review focuses on the ROD-defined LDW sediment contaminants of concern (COCs) and their concentrations in marina basin sediments relative to the ROD-defined RALs. Tables 2, 5, and 6 list the 43 LDW COCs with their respective RALs for 0-10 cm of sediment across the LDW site.[2] Consistent with the Strategy's near-term goal, this review evaluates the presence of LDW sediment COCs in Site upland media and the potential for them to recontaminate the marina basin sediments via multiple environmental pathways. While this source control review is limited to the LDW COCs, the Site RI will evaluate a broader list of contaminants in accordance with the RI Work Plan.

Figure 2 shows a flowchart illustrating the general source control review approach for the Site, which is outlined below.

[2] In Tables 5 and 6 (upland catch basin solids and surface soil), all RALs are expressed as dry-weight values from the LDW Preliminary Cleanup Level (PCUL) Workbook (Ecology, 2022).

Step 1: Compare Sediment Concentrations in Receiving Marina Basin to LDW RALs. The empirical data for the marina basin sediments are the most representative measure of whether the upland Site represents a source for sediment recontamination to levels greater than the LDW RALs. Therefore, the empirical data for the marina basin sediments (described in Section 3) constitute the primary line of evidence for assessing source control sufficiency at the Site, and the first step is comparison of the measured COC concentrations in sediment against the ROD-defined RALs.

Step 2: Assessment[3] – Evaluate if Upland Sources Could Recontaminate Sediments. Regardless of the outcome from Step 1, Step 2 assesses the potential for recontamination due to discharge of upland Site contaminants to sediments, divided into the following three substeps:

2A: Compare Upland Concentrations to Pathway-Specific Screening Levels. The first step involves assessing discharges of COCs to marina basin sediments via the three potential recontamination pathways defined in the AO:

1. "Soil leaching to groundwater discharging to the LDW through sediment;
2. Contaminated soils entering the storm drain system and discharging to the LDW; and
3. Erosion of contaminated soil and transport to the LDW via overland flow or bank sloughing."

This step starts with quantitative screening of Site upland data against conservative pathway-specific screening levels. Section 4 describes the datasets and the source-control screening levels for COCs in upland media—groundwater, stormwater (both whole-water and CB solids), and surface soils—that are used to evaluate these three pathways as potential sources for sediment recontamination.

2B: Evaluate if a Transport Pathway is Controlled. For potential pathways where COC concentrations exceed screening levels, the next step includes a qualitative evaluation of whether existing engineering controls on the SPM Property are controlling discharge of COCs to the marina basin sediments via the given pathway. If engineering controls are relied upon to protect sediment, the cleanup will include an environmental covenant and periodic reviews to ensure the controls are maintained; this would be evaluated as a component of the Site Feasibility Study (FS) to be prepared after the RI.

2C: Use Modeling to Assess Whether COC Transport to Sediments Can Create a Sediment RAL Exceedance. If, based on the screening of the Site data and evaluation of engineering control effectiveness, any of the three pathways appears to pose a risk of recontaminating marina basin sediments to concentrations greater than LDW RALs, then a modeling analysis is conducted ("Predict COC mass loading to receiving sediments" in Figure 2 flowchart). The modeling predicts whether contaminant mass loading from the uplands to the receiving sediments would result

[3] In addition to the SPM site, there are other potential upstream sources of contamination to the LDW sediments. Step 2 will be completed to verify the presence or lack of sources from the upland Site.

in sediment COC concentrations exceeding LDW RALs. Section 5 details the predictive modeling approach and results.

Step 3: Assess Uncertainties and Data Gaps and Draw Conclusions. After completion of these steps, uncertainties regarding each pathway's potential to recontaminate marina basin sediments within the near-term timeframe are evaluated to determine whether data gaps exist and additional data collection or modeling analysis is warranted. With that information, a preliminary conclusion is made regarding whether the Site source control review can be completed.

The empirical data for marina basin sediments provide the primary line of evidence, and the steps of pathway-specific upland data screening, engineering control evaluation, and predictive modeling provide the secondary lines of evidence to assess whether each Site pathway for sediment recontamination appears sufficiently controlled or warrants source control action in the near-term timeframe. In either case, the Site RI will proceed following this source control review in accordance with the AO and the RI Work Plan.

3 Screening of Receiving Surface Sediments in Marina Basin

As Step 1 in the source control review approach, this section describes the representative dataset for the marina basin sediments, the applicable screening levels, and the comparison of the data against screening levels.

3.1 Sediment Dataset

As stated in Ecology's Source Control Strategy, a sufficiency evaluation relies upon data for surface sediment (0-to-10 centimeter [cm] depth interval). Subsurface sediment data are not considered in this source control review but may be evaluated as a component of the Site RI.

The available surface sediment data located within and adjacent to the marina basin were compiled from numerous documents and studies going back decades. For purposes of this source control review, the data were screened to best represent "current conditions". As such, the following categories of sediment samples were not considered representative of the current surface sediment within the marina basin and were excluded from the source control sediment dataset:

- Samples older than 20 years (prior to 2002). Ecology typically relies on data collected within the last 10 years to be considered "current conditions". However, as discussed in Section 5.3.2, the assumed minimum net sedimentation rate within the marina basin is 0.5 cm/yr. At this rate, the sediment represented by a 0-10 cm sample would be completely buried in 20 years. Including samples as old as 20 years is considered a conservative assumption in the overall evaluation.
- Older samples located within 10 feet of a newer sample, consistent with LDW data analysis protocols (Windward Environmental, 2010).
- Samples representing sediment removed by dredging.
- Samples no longer at the surface (top 10 cm) because they have been capped or covered by backfill following dredging.[4]

With the exclusion of such samples (Table 1), this source control review incorporates data from the following 47 surface sediment samples collected within the marina basin between 2003 and 2021 as depicted on Figure 3 and presented in Table 2:

- Two samples (SE-73-G and SE-74-G) collected in 2004 as part of the T-117 EAA design investigation with analysis for PCBs (Windward Environmental et al, 2005).

[4] The marina basin was last dredged in 1992 (Aspect, 2021).

- One sample (98-G) collected in 2008 as part of the T-117 EAA design investigation with analyses for PCBs and mercury (Windward Environmental and Integral Consulting, 2009).
- Two samples (LDW-SS2214-A and LDW-SS2214-D) collected in 2011 as part of Ecology's assessment of surface sediment quality near stormwater and combined sewer outfalls, with analyses for the full suite of LDW COCs (SAIC, 2011).
- One sample (PERIM-5-POST) collected in 2014 outside the perimeter of dredge unit 3 and following completion of the dredging performed as part of the T-117 EAA with analyses for the full suite LDW COCs (AECOM, 2016). It should be noted that results for certain analytes were superseded by results from location PERIM-5-LTM collected in 2021 and described below.
- Four samples (SD-PER303, SD-PER305, SD-PER312 and SD-PER313) collected in 2015 on behalf of the Boeing Company outside the perimeter of their remediation activities and following remediation completion, as a component of the Boeing Plant 2 Duwamish Sediment Other Area (DSOA) and Southwest Bank Corrective Measure, with analyses for PCBs and the state Sediment Management Standards metals (AMEC Foster Wheeler et al, 2016).
- Six samples (SG-B1-PreOp, SG-B2-PreOp, SG-B3-PreOp, SG-B1-PreOp, SG-C1-PreOp, SG-C2-PreOp, and SG-C3-PreOp) collected in 2016 on behalf of City of Seattle (City) after installation and prior to operation of the new City stormwater outfall in the T-117 EAA, near the upstream edge of the marina basin, with analyses for PCBs (Integral, 2016).
- Sixteen samples (SC-01 through SC-16) collected in 2016 for characterization purposes on behalf of SPM, with analyses for PCBs (TIG, 2016).
- One sample (SS-130) collected in 2018 on behalf of the Lower Duwamish Waterway Group (LDWG) for pre-design studies in accordance with the third amendment to the Agreed Order on Consent (AOC), with analyses for the full suite of LDW COCs (Windward Environmental, 2019).
- Seven samples (LDW20-SS154, LDW20-SS158, LDW20-SS159, LDW20-SS164, LDW20-SS167, LDW20-SS168, LDW20-SS169[5]) collected in 2020 on behalf of the LDWG for Phase 1 pre-design investigation purposes, six with analyses for the full suite of LDW COCs and one (LDW20-SS164) with PCB congener analyses only (Windward Environmental, 2020).
- One sample (SS-559) collected in 2021 on behalf of LDWG for Phase 2 pre-design investigation purposes, with analysis for PCB Aroclors (Windward Environmental and Anchor QEA, 2022).
- One sample (PERIM-5-LTM) collected in 2021 on behalf of Port of Seattle as part of the Year 6 long-term monitoring for the T-117 removal action, with analyses for PCBs, dioxins/furans, select PAHs, arsenic, and phenol (Anchor QEA, 2021).

[5] Not consecutive sample numbering, refer to Table 1.

In addition, the following five samples, located just outside of the marina basin boundary, are included for purposes of developing Thiessen polygons to calculate surface-weighted average concentrations [SWAC]) of contaminants within the marina basin (discussed in Section 5):

- One sample (SE-07-G) collected in 2003 as part of the T-117 EAA design investigation with analysis for PCBs (AECOM, 2016).
- One sample (SD-PER307) collected in 2015 during the Boeing Plant 2 DSOA and Southwest Bank Corrective Measure, with analyses for PCBs and Sediment Management Standards metals (AMEC Foster Wheeler et al, 2016).
- Three samples (SG-A1-PreOp, SG-A2-PreOp, and SG-A3-PreOp) collected in 2016 after construction but prior to operation of the City stormwater outfall, with analyses for PCBs (Integral, 2016).

A total of 123 surface sediment samples were not considered representative of the current marina basin surface sediment and were thus excluded from the source control evaluation. Data for the excluded surface sediment samples are included in Appendix C.

The RALs in the LDW ROD include both dry-weight and organic carbon (OC)-normalized values depending on the COC (EPA, 2014). The range of total organic carbon (TOC) concentrations in the marina basin sediment samples evaluated was between 77 and 3.64 percent (SS559 and SG-B3-PreOp, respectively; Table 2). Therefore, in accordance with Ecology guidance (Ecology, 2021), the sediment concentrations are presented as organic carbon (OC)-normalized values in Table 2 for organic compounds with OC-normalized RALs based on benthic protection.

3.2 Source Control Screening Levels for Sediment

Consistent with the Strategy's near-term goal, the ROD RALs for surface sediment (0-10 cm) site-wide throughout the LDW site are the sediment screening levels applied in this source control review. The existing sediment data within the marina basin were compared to the LDW ROD RALs (Table 27 in the ROD) which include both OC-normalized and dry-weight values as shown in Table 2. Table 2 includes the 43 LDW COCs and the respective RALs used in this evaluation.

3.3 Sediment Concentrations Relative to LDW RALs

Concentrations of LDW COCs in 44 of the 47 samples representing current marina basin surface sediment used for analysis are less than the LDW ROD RALs. Three samples, collected on or at the base of the armored bank near the southeast corner of the Site, each contained one LDW COC at a concentration greater than its respective RAL (Table 2; Figure 3):

- LDW-SS2214-A (2011): benzyl alcohol was detected at a concentration of 0.28 mg/kg as compared to a RAL of 0.114 mg/kg.
- LDW-SS2214-D (2011): benzyl alcohol was detected at a concentration of 0.28 mg/kg as compared to a RAL of 0.114 mg/kg.

- LDW21-SS559 (2021): total PCBs were detected at a concentration of 0.17 mg/kg as compared to a RAL of 0.13 mg/kg.

3.4 Primary Line of Evidence Regarding Site Source Control

The empirical sediment data are a primary line of evidence regarding whether discharges from the Site are not contaminating the receiving sediments above the LDW ROD RALs. The sediment data indicate that, with the exception of PCBs and possibly benzyl alcohol, the Site is not discharging COCs in sufficient mass to create surface sediment concentrations greater than RALs anywhere in the marina basin. Likewise, the sediment data indicate that discharges of PCBs from the Site are not creating surface sediment concentrations greater than the RAL outside of the marina basin's southwest corner.

The sediment data indicate RAL exceedances of PCBs and benzyl alcohol. It is unknown whether these concentrations indicate ongoing COC discharges from the Site or are from other sources. The three samples that have RAL exceedances are located in the basin's southwest corner—proximal to the area of the marina corner removal action and PCB-contaminated sediment dredging conducted during the T-117 removal action and the Site stormwater outfall UOF-1 described in Section 4.2.1. Based on the location and concentrations of these data, the possibility that discharges of COCs from the southern portion of the Site may be contaminating the marina basin sediment cannot be ruled out and will be evaluated further in the RI (see Section 4). It is also possible that the PCBs in the sediment were derived from upstream sources. SAIC (2008) suggested that upstream sources may be responsible for PCB concentrations detected in samples of intertidal sediment collected at the base of the bank in this same area.[6]

The benzyl alcohol exceedances were flagged as estimated concentrations in the 2011 samples, and benzyl alcohol is known to be a ubiquitous and naturally occurring compound. In a 2016 assessment of benzyl alcohol in marine sediments, the Army Corps of Engineers (Corps) concluded that "Multiple lines of evidence suggest the occurrence of benzyl alcohol is not a significant cause of concern to the DMMP[7] agencies" (Corps, 2016). Benzyl alcohol has not been analyzed during sediment sampling supporting remedial design for the LDW. Therefore, with respect to this source control review, benzyl alcohol is not considered to be a constituent of concern.

[6] SAIC (2008) states: "The source of this limited sediment appears to be from settling of waterway-transported material rather than erosion and transport of bank soil across the rip-rap zone, although a combination of the two sources cannot be ruled out. Higher concentrations of PCBs in the sediment than in the bank soil, and higher arsenic in sediment than in any site soils, also suggest that bank soil may not be the source of the sediment and its contaminants." (SAIC, 2008).

[7] DMMP = Dredged Material Management Program.

4 Upland Recontamination Pathway Assessment

This section presents and evaluates each of the three upland recontamination pathways—(1) groundwater discharge, (2) stormwater drain discharge, and (3) soil erosion and transport via overland flow or bank sloughing—as secondary lines of evidence to corroborate the interpretation drawn from the empirical sediment data for COCs other than PCBs, and to evaluate the Site as a source of PCBs to surface sediments in the southwest corner of the marina basin.

For each pathway, the evaluation describes the available dataset for the Site, the applicable screening levels based on sediment recontamination, the comparison of the data against screening levels, and, if applicable, the assessment of engineering control effectiveness in achieving source control. Based on that collective information, the evaluation then concludes either that the pathway does not pose a risk for sediment recontamination or that predictive modeling of contaminant mass loading to sediments is warranted to further assess the recontamination potential.

4.1 Pathway 1: Groundwater Discharge

At the Site, the shallowest groundwater-bearing unit is referred to as the Fill Unit consisting of variable anthropogenic fill material, typically 8 to 12 feet thick, and containing a saturated thickness of up to 5 feet. Observations in monitoring wells screened in the Fill Unit and located along the shoreline indicate that, at lower-low tidal stages, the Fill Unit along the shoreline fully drains to the LDW (goes dry).

Across most of the Site, the Fill Unit overlies a native soil unit comprised of organic-rich silt and silty sand—termed the Tidal Flat Unit—that is typically 3 to 5 feet thick and is interpreted to serve as a leaky aquitard unit. The depth of the Tidal Flat Unit beneath the former A&B Barrel Co. pond, and whether it is intact, are uncertain. However, the weight of evidence indicates that the Tidal Flat Unit likely is present beneath the pond. The pond historically collected water from pressure-washing drums. This likely would not have been a large volume of water at any one time, and therefore a large pond capacity was likely not needed. In addition, excavating to depth below a tidally influenced water table in loose fill could have resulted in sloughing of the pond sidewalls and loss of ground that would have been counterproductive and dangerous for their operations. Finally, if the Tidal Flat Unit were absent and there was free exchange of groundwater between the Fill and Alluvium Units, the groundwater concentrations measured by SAIC (2008) at Alluvial Unit well MW-3 likely would have been much higher than they were, given the high concentrations currently measured at Fill Unit well MW-5 located a few feet laterally from the former location of MW-3 (see inset map on Figure 5). The Phase 2 RI data collection will better define the depth of the Tidal Flat in the area of the historical pond.

Beneath the Tidal Flat Unit is the Alluvium Unit, a predominantly sand unit that overlies glacially overridden materials (Till Unit) encountered at a depth of approximately 23 feet in the southeastern corner of the Site. SAIC (2008) observed very little saturation in the Fill Unit and therefore installed three monitoring wells, MW-1, MW-2, and MW-3, in the Alluvium Unit along the shoreline in the former A&B Barrel Co. area at the southern end of the Site. These wells were decommissioned in 2009. There are no Alluvium Unit wells currently on the Site to allow measurement of vertical gradients between the Fill and Alluvium Units but, based on conditions at other LDW upland sites a downward gradient is expected. The Phase 2 RI data collection will include installation of Alluvium Unit monitoring wells and measurement of vertical gradients.

Figure 4 is a subsurface cross section, aligned west to east, near the south end of the Site that depicts the geologic units.

As stated in Section 2.2, Pathway 1 is identified in the AO as "Soil leaching to groundwater discharging to the LDW through sediment". Source control for this pathway would likely address Site soils creating groundwater impacts. The empirical groundwater data collected at the Site are a direct and reliable means to characterize Pathway 1 because (1) marina operations have remained generally consistent for many years; and (2) operations at the A&B Barrel Co., a primary historical source of Site contamination, concluded 60 years ago.

Therefore, sufficient time has passed for migration of COCs from soil into groundwater (WAC 173-340-747(9)(b)). Furthermore, the near-term future Site conditions are expected to be consistent with the characteristics of the Site represented by the groundwater data presented here.

Given the source control review's focus on sediment recontamination, the assessment of Pathway 1 relies upon groundwater data collected from upland monitoring wells located along the shoreline of the Site. These monitoring locations are the closest to the point of groundwater discharge to the LDW receiving sediments. Within the Site's tidally influenced groundwater system, considerable attenuation of groundwater contaminant concentrations can occur along a groundwater flow path from a shoreline well location to the point of discharge into the receiving sediments; therefore, data from shoreline wells are a conservative representation of groundwater concentrations that could reach the sediment bioactive zone (upper 10 cm). Concentrations in the shoreline wells in the fill unit are considered conservative estimates of the concentrations that may be present in the alluvial unit, as discussed in Sections 4.1.3.2 and 4.1.3.3. The following sections present the groundwater analytical data, identify groundwater screening levels for source control review, and compare the data to those screening levels.

4.1.1 Groundwater Dataset

The groundwater dataset for this source control review includes all of the groundwater data available for the Site:

- Phase 1 RI data from six shoreline wells (MW-6 through MW-11; Table 3) screened in the Fill Unit (well depths of less than 10 feet bgs). Samples were collected in March 2021[8] for analysis of a broad range of constituents including the full list of LDW COCs. Samples were also collected in May 2021 from selected wells for analysis of PCB congeners only.

[8] PCB congener data (only) were collected from selected wells in May 2021; these data are included with the March 2021 data for the respective wells (one column with all 2021 data per well).

- Data from three historical shoreline wells (MW-1 through MW-3) located downgradient of the former A&B Barrel Co. area and screened in the Alluvium Unit (well depths 17 to 18 feet bgs). Samples were collected and analyzed for the full list of LDW COCs in October 2007 and March 2008 (SAIC, 2008; those wells were decommissioned in 2009).

No groundwater data collected from the Site were excluded from this assessment.

The locations of the Site monitoring wells in the Fill Unit and Alluvium Unit are shown on Figure 4. Although this source control review only uses data from the shoreline monitoring wells as most representative of discharge to LDW sediments, the groundwater dataset presented in Table 3 includes data from all Site monitoring wells for completeness.[9]

As previously noted, the Fill Unit has limited saturated thickness and most Fill Unit shoreline wells go dry during lower low tide stages. During the RI Phase 1 groundwater sampling, which was conducted at lower low tide during wet season conditions, there was insufficient water volume in shoreline wells MW-7, MW-9, and MW-10 to conduct all planned analyses, even after extending the sampling effort into higher tidal stages (analytes noted as “NA” in Table 3). The lack of data from these wells and the implications for a source control determination is discussed in Section 4.1.3.1.

4.1.2 Source Control Screening Levels for Groundwater

Source control screening levels for groundwater were selected using the Ecology’s LDW Preliminary Cleanup Level (PCUL) Workbook (Ecology, 2022). Specifically, the PCULs for groundwater based on sediment protection (GW-3) were selected as the groundwater screening levels.[10] The GW-3 screening levels for the LDW COCs are listed in Table 3. Total PCB results in groundwater monitoring wells are shown on Figure 5.

4.1.3 Groundwater Concentrations Relative to Screening Levels

4.1.3.1 Fill Unit Groundwater

Groundwater samples from four (MW-6, MW-7, MW-8, MW-11) of the six Fill Unit shoreline wells did not have any exceedances of GW-3 screening levels for LDW sediment COCs during the RI Phase 1 sampling. The remaining two shoreline wells MW-9 and MW-10 lacked enough groundwater at low tide to collect a sample for all analyses planned (Table 3). Groundwater samples from MW-9 and MW-10 were analyzed for PAHs and SVOCs and did not exceed GW-3 criteria. The lack of groundwater data from shoreline wells MW-9 and MW-10 may represent a data gap for the RI and this source control memo. The paucity of groundwater at these locations, however, reduces the level of concern for the data gap.

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[9] Field duplicate sample results are used for quality assurance purposes only and, whether containing higher or lower concentrations than their parent sample results, are not included in the data tabulations in this memorandum.

[10] The GW3 PCULs are calculated values using the PCUL workbook’s target sediment concentration which are more stringent than RALs. This approach is a conservative assumption for purposes of this source control review.

Inland from the shoreline, total PCBs and zinc (both dissolved and total) were detected at concentrations exceeding GW-3 screening levels at well MW-5 located approximately 20 feet from the MHHW line on the downgradient edge of the historical A&B Barrel Co. waste disposal pond (Pond) (see inset map on Figure 5). One lower-concentration PCB exceedance was also detected at well MW-4 on the west (upgradient) edge of the sheet pile wall at approximately 30 feet from the MHHW line but behind the sheet pile wall (which provides engineering control).

The sheet pile wall, along the shoreline east of the Pond area, was constructed in 2014 to a depth of approximately 20 feet below grade and fully penetrates the Fill Unit, as depicted on Figure 4 (AECOM, 2014b). The sheet pile wall was not designed with the intent of cutting-off groundwater flow (it was placed for structural support), and some Fill Unit groundwater is expected to flow through seams between the individual steel sheets comprising the wall and through weep holes reportedly drilled through the wall. Nevertheless, groundwater elevation data collected prior to the March 2021 groundwater sampling event confirm that Fill Unit groundwater is slightly mounded upgradient (west) of the sheet pile wall with lower elevations immediately to the north at well MW-6.

The water level data indicate that the sheet pile wall redirects the majority of the Fill Unit groundwater flow in the Pond area northward to the edge of the sheet pile wall (MW-6 location) where it discharges eastward to the LDW. No seeps were observed along the LDW shoreline below the sheet pile wall during extreme low tides in summer 2021 when numerous seeps were observed along most of the rest of the Site shoreline. However, the LDW area immediately offshore of the sheet pile wall is at lower elevation than the rest of the Site shoreline as a result of dredging during the T117 in-water cleanup. That area remained submerged even at extreme low tides, preventing conclusive visual observation of seeps. As such, seeps may be present in that area.

As such, data from shoreline well MW-6 are considered the best measure of the predominant groundwater discharge pathway from the pond area. The PCB and zinc exceedances observed at MW-5 are not present in MW-6 even 60 years after the Pond was filled in. While there is some flow of Fill Unit groundwater through discontinuities in the sheet pile wall, a GAC geocomposite mat was installed along its downgradient side (Figure 4) which should sorb dissolved-phase organic contaminants passing through the wall. Based on a weight of evidence, AECOM (2014a) concluded that the combination of GAC geocomposite and backfill material likely provides adequate protection and isolation of PCB concentrations in the covered bank soils for the next 100 years.

At other Fill Unit monitoring wells located farther inland, no constituent concentrations were detected at concentrations exceeding GW-3 screening levels (Table 3).

The RI Phase 2 field effort will include installation of and sampling of additional monitoring wells, collection of water level data and analysis of the sheet pile wall’s effect on the groundwater flow conditions in that portion of the Site.

4.1.3.2 Alluvium Unit Groundwater

The two rounds of groundwater samples collected in 2007-2008 from the three Alluvium Unit shoreline wells (MW-1, MW-2, MW-3) did not exceed GW-3 screening levels for detected concentrations of the LDW sediment COCs (Figure 5, Table 3). However, the 2007-2008 data had non-detected concentrations with reporting limits for some COCs that were above SLs as discussed below. Monitoring well MW-3 was screened in the Alluvium Unit immediately downgradient of the Pond, prior to installation of the sheet pile wall, and therefore represents a worst-case location for observing groundwater impacts in the Alluvium Unit. The Alluvium Unit is present between depths of roughly 12 to 23 feet below ground surface (bgs) at the MW-5 location. As such, the sheet pile wall partially but likely does not completely penetrate the Alluvium Unit thickness (Figure 4).

Although the groundwater data are 14 years old, the data were collected 46 years after conclusion of the A&B Barrel Co. operations. Given that long duration and the potential for natural attenuation, groundwater quality in that area is expected to be no worse now than that measured in 2008. Alluvium Unit groundwater quality will be further evaluated as part of Phase 2 of the RI.

The analytical reporting limits achieved during the 2008 investigation for PCBs and for carcinogenic polycyclic aromatic hydrocarbons (cPAHs) (both 0.21 µg/L) were higher than current analytical methods (e.g., 0.01 µg/L for both in the 2021 RI analyses). However, there is a considerable weight of evidence to indicate that concentrations of PCBs and cPAHs in the Alluvium Unit groundwater along the shoreline are no higher than those measured in the Fill Unit groundwater along the shoreline, which are below the GW-3 screening levels. First, soil PAH and PCB concentrations in the Alluvial Unit are lower than those in the Fill Unit as measured in borings within the historical Pond area—i.e., the contaminant source is predominantly within the Fill Unit.

Second, groundwater will always flow more readily in the horizontal direction in the sandy Fill Unit rather than vertically down through the underlying lower-permeability Tidal Flat Unit to reach the deeper Alluvium Unit. This is true even with mounded Fill Unit groundwater behind the sheet pile wall (downward gradients across the Tidal Flat unit increase with mounding, but so too do horizontal gradients in the Fill Unit). So, if groundwater at Fill Unit shoreline well MW-6 meets screening levels, it is probable that groundwater in the Alluvium Unit in that same shoreline location also meets screening levels. This is further supported by the fact that the Tidal Flat Unit has a high organic-carbon content (average 0.57 percent, more than double that of the Fill Unit, based on RI sample data), and PCBs and cPAHs are high-molecular-weight, highly hydrophobic classes of organic compounds that sorb readily to organic carbon (i.e., lower mobility of COCs out of the Fill Unit).

Given the Site hydrogeologic conditions, downward flux of groundwater through the Tidal Flat Unit is small and the downward flux of hydrophobic contaminants like PCBs and cPAHs in that groundwater is expected to be negligible. Combined, there is a strong weight of evidence that groundwater discharge from the Alluvium Unit is not a pathway for cPAHs or PCBs to recontaminate marina basin sediments.

The elevated reporting limits for cPAHs and PCBs in the available Alluvium Unit groundwater samples could represent a data gap for the RI; however, with respect to completion of this source control review, the likelihood of recontamination potential from PAHs and PCBs in Alluvial Unit groundwater is low based on the weight of evidence outlined above. Additional characterization of groundwater in the Alluvium Unit will be conducted during the RI, and that additional data will have analytical reporting limits in accordance with the Ecology-approved RI Work Plan.

4.1.4 Conclusion Regarding Pathway 1, Groundwater Discharge to LDW Sediments

The collective Site groundwater data indicate that discharge of Site groundwater (Pathway 1) does not pose a threat for recontamination of LDW sediments within the marina basin. There is a high level of confidence in this conclusion because groundwater does not exceed screening levels protective of sediment at the shoreline. In addition, evaluating groundwater samples from upland shoreline wells against GW-3 screening levels is conservative because natural attenuation of COC concentrations can occur along the groundwater flowpath from these wells to the sediment bioactive zone (where the GW-3 screening levels apply).

The RI Work Plan envisioned that the Phase 1 data collected during the RI would be sufficient to complete this source control review. The complete suite of LDW COCs was not analyzed for at the two Fill Unit shoreline wells MW-9 and MW-10, located in the central portion of the Site shoreline, because sufficient sample volume was not collected due to the well going dry during low tide. This is a limitation in the current groundwater data set that will be further investigated and evaluated in the RI. However, it is not considered a data gap that precludes completion of this source control review.

Based on the current data for the Site, the most highly contaminated soils and groundwater are present in the area of the historical A&B Barrel Co. waste disposal pond near the southeast corner of the Site. Within that area, Fill Unit well MW-05 has the highest groundwater COC concentrations detected on Site, notably higher than detected at other inland wells (Table 3). Fill Unit shoreline well MW-06 is positioned approximately 20 feet downgradient of the Pond area (and MW-05) and can reasonably be assumed to represent the worst-case groundwater quality discharging from the Fill Unit to the LDW.

Therefore, based on the RI groundwater data collected from monitoring wells along the Site shoreline, and current LDW sediment data indicating marina basin sediments are less than LDW ROD RALs with the exception of localized PCBs and benzyl alcohol in the basin’s southwest corner, no groundwater-related data gaps were identified during this source control review. Therefore, no further data collection or modeling analysis is warranted for purposes of evaluating Pathway 1 (groundwater discharge to LDW sediments) as part of this source control review. The RI Phase 2 data collection will include additional characterization of groundwater quality and flow in the Fill Unit (including at wells MW-09 and MW-10) and in the Alluvium Unit, and that additional data will be evaluated in the update to this source control review as discussed in Section 6.

4.2 Pathway 2: Stormwater Drain System Discharge

Stormwater at the SPM Property is managed under SPM’s National Pollution Discharge Elimination System (NPDES) Boatyard General Permit WAG030045. The NPDES permit program regulates surface water quality impacts associated with discharge of SPM Property stormwater to the LDW; therefore, surface water impacts are not addressed in this source control review. A summary of the SPM Property stormwater infrastructure and stormwater management under NPDES, including stormwater compliance inspections performed by Ecology and SPM's actions in response to the inspections completed to date, is presented in Appendix A.

This section presents a brief recap of Site stormwater catchment areas and discharge locations (outfalls) for the SPM Property followed by discussions of data sets for both whole water[11] and CB solids, screening levels established for source control review, and then a comparison of both datasets to screening levels.

4.2.1 Overview of SPM Stormwater Catchments and Outfalls

Approximately 99 percent of the SPM Property is located within the following four stormwater catchment areas shown on Figure 6:

- **OF-2215**: This northern catchment (estimated 9 percent of total property) is entirely paved and drains to catch basin CB-10, which discharges to the LDW downstream of the marina basin via a King County storm drain to Outfall OF-2215 northeast (downstream) of the property.
- **SPM Outfall:** This central catchment (estimated 61 percent of total property) drains to a series of catch basins (CB-02, CB-03, CB-04, CB-05, and CB-06) that discharge to the LDW via the SPM Outfall. Catch basin CB-01, located within this catchment area, was decommissioned in 2019 and is no longer part of the Site stormwater drainage system (however, data collected from it in 2016 and 2017 are included in this evaluation).
- **Unnamed Outfall No. 1**: This southern catchment (estimated 21 percent of total property) drains to a series of catch basins (CB-07, CB-08, and CB-09) that flow to a vault before being pumped into the StormwateRx™ system for treatment of copper and zinc and discharge through Unnamed Outfall No. 1 (UOF-1). SPM samples the discharge to the LDW from the StormwateRx™ system to UOF-1 under the Boatyard General Permit for the facility.
  - Under certain storm conditions when the capacity of the holding tank feeding the StormwateRx™ system is exceeded, untreated stormwater can bypass the treatment system via an overflow pipe and discharge to a separate outfall (OF-2214) adjacent to UOF-1. There are no sample data for outfall OF-2214, but it is assumed that the quality of any water discharging from it is the same as the system's untreated influent, for which sample data are available.
- **Infiltration through gravel surface along shoreline**: Along the shoreline, most of the SPM Property is unpaved gravel approximately 7 to 15 feet wide (estimated 8 percent of total property) immediately inland from the ecology block wall spanning the shoreline. Stormwater is assumed to infiltrate through this pervious surface and discharge as seeps to the riverbank. The top of the ecology block wall is at or above grade, which, combined with the strip of unpaved gravel

[11] The term whole water reflects that fact that samples of stormwater can contain contaminants in both particulate (solids) phase and dissolved phase.

on its inland edge, prevents any substantive sheet flow over the top of the bank into the LDW.

Three smaller drainage areas comprise the remaining 1 percent of the SPM Property:

- Small areas in the northwestern portion of the property (estimated 0.5 percent of total property) drain into unnamed catch basins along Dallas Avenue South and South Thistle Street. The catch basin across South Thistle Street drains to King County outfall OF-2215. The catch basin along Dallas Avenue South near 14th Ave South is connected to a private sanitary sewer that discharges to the City of Seattle's (City) combined sewer system in Dallas Avenue South.
- A sliver of land in the southwest corner of the property (estimated 0.3 percent of total property) appears to drain off-property into the City's green stormwater infrastructure (bioretention/infiltration) in Dallas Avenue South, with overflow discharging to the LDW through the City's 17th Avenue South storm drain outfall located immediately south of the SPM Property.
- The boat ramp in the northeast corner of the SPM Property drains directly to the LDW (estimated 0.1 percent of total property). Based on visual observations during a Spring 2021 storm event reconnaissance and the subsequent unsuccessful attempts to capture enough runoff volume on the boat ramp to sample during a storm event as part of the RI Phase 1 data collection, overland runoff from the SPM Property via the boat ramp is considered to be de minimis.

Table A-1 in Appendix A summarizes the historical uses and current business operations that have and are occurring within each of the catchment areas.

4.2.2 Stormwater

4.2.2.1 Stormwater (Whole-Water) Dataset

The stormwater dataset for this source control review includes 22 samples of untreated stormwater collected from within the central catchment area (CB-01, CB-02, CB-05, and CB-06), and within the southern catchment area (StormwateRx™ pretreatment vault) from 2017 to 2021. Stormwater sample locations are shown on Figure 6. The stormwater dataset including the samples of treated water are presented in Table 4.

The data from catch basins CB-01, CB-02, CB-05, and CB-06 in the central catchment area represents untreated water quality. However, in the fall of 2021, following collection of the stormwater and CB solids data used for this assessment, SPM purchased and installed custom AbTech Technologies brand basket-style catch basin filter inserts in each of the Site catch basins. The manufacturer's documentation for the catch basin inserts is included as Attachment A-2 in Appendix A.

Samples of treated stormwater (effluent) collected from the StormwateRx™ system were evaluated for compliance with the Boatyard General Permit water quality benchmarks in Appendix A. Because the analytes for sample analysis under the General Permit are limited (copper and zinc principally), the treated water data are not evaluated explicitly in this source control review.

Concentrations of samples of untreated stormwater from the Stormwater Rx™ pretreatment vault (SWRX-Pre) were compared to concentrations in samples of the

Stormwater Rx™ system's treated effluent (SWRX-Post) in Table 5. This comparison, conducted only for constituents that were detected in both pre- and post-treatment samples, indicates that the treatment system achieves concentration reductions ranging from 76 to 96 percent depending on the constituent and date of sampling.

4.2.2.2 Source Control Screening Levels for Stormwater

For this source control review, groundwater PCULs based on sediment protection (GW-3) were selected as the screening levels for the stormwater whole-water data (Table 4). The use of GW-3 screening levels is conservative as it assumes that all of the contaminant mass detected in the whole-water samples is present in dissolved phase that, after discharge to the LDW, entirely sorbs to marina basin sediments.

4.2.2.3 Stormwater Sample Concentrations Relative to Screening Levels

Constituents detected in one or more samples of untreated Site stormwater at concentrations greater than GW-3 screening levels include cadmium, copper, zinc, total PCBs, indeno(1,2,3-cd)pyrene, and bis(2-ethylhexyl)phthalate (BEHP) (Table 4). Stormwater sample locations where detected PCB concentrations exceed GW-3 screening levels are shown on Figure 6.[12]

4.2.3 Catch Basin Solids

4.2.3.1 Catch Basin Solids Dataset

The CB solids dataset for this source control review includes 14 samples collected from within the central catchment area (CB-01, CB-02, CB-03, CB-04, CB-05, and CB-06) and within the southern catchment area (CB-07, CB-08, CB-09, and StormwateRx™ pretreatment vault) from 2014 to 2021. Prior to the April 2021 sampling, the catch basins had not been cleaned out for approximately 4 years. Table 6 presents the dataset for CB solids. Figure 7 depicts the CB solids sample locations.

CB solids generally represent coarser-grained materials that are not readily transported via the stormwater drain system. Coarser-grained materials tend to have lower concentrations of PCBs and PAHs. Thus, the CB solids data likely underestimate the concentrations of particle-bound contaminants reaching the LDW. Grain size analysis for the CB solids samples has not been conducted. However, the fact that those solids are retained in the catch basins indicates that the majority of the CB solids are not likely being transported to the LDW.

4.2.3.2 Source Control Screening Levels for CB Solids

For this source control review, dry-weight equivalents of LDW ROD RALs[13] for surface sediment (0-10 cm) were selected as screening levels for CB solids (Table 6). The dry-

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[12] As noted above, PCBs were selected for illustration of spatial distribution relative to screening levels because PCBs are a primary risk-driver COC in LDW sediments and are present in all Site media at concentrations exceeding screening levels based on sediment recontamination.

[13] Obtained from LDW PCUL Workbook (Ecology, 2022). Note that, for compounds with OC-normalized RALs, the dry-weight sediment RALs in the PCUL workbook (Lowest Apparent Effect Threshold; LAETs) are not the same as if the OC-normalized RALs were converted to dry-weight values using total organic carbon data from the marina basin (Site-specific).

weight equivalent RALs were selected for all COCs that have OC-normalized values because all but one of the 14 samples in the CB solids dataset have TOC contents greater than the 0.5 to 3.5 percent range for conducting OC normalization as per Ecology (2017). The TOC contents for the CB solids samples ranged from 1.4 to 23 percent with a median value of 9.8 percent.

4.2.3.3 CB Solids Concentrations Relative to Screening Levels

Constituents detected in one or more samples of Site CB solids at concentrations greater than LDW ROD RALs include arsenic, cadmium, copper, lead, mercury, zinc, total PCBs, total dioxin/furan TEQ[14], several PAHs (2-methylnaphthalene, benzo(g,h,i)perylene, fluoranthene, phenanthrene, pyrene, benz(a)anthracene, benzo(a)pyrene, chrysene, indeno(1,2,3-cd)pyrene, total benzofluoranthenes, and total high-molecular weight PAHs [total HPAHs]), and several SVOCs (4-methylphenol, benzoic acid, benzyl alcohol, benzyl butyl phthalate, BEHP, dimethyl phthalate, pentachlorophenol, and phenol). The CB solids sample locations are shown on Figure 7.

For all exceedances except zinc and 4-methylphenol, the highest concentrations were detected in the 2014 sample collected from the StormwateRx™ pretreatment vault. Concentrations detected in the 2021 sample from that vault were considerably lower than detected in 2014 (Table 6). The substantial difference measured over that 7-year period may be attributed to SPM's improved application of boatyard best management practices (BMPs) and maintenance of the facility's stormwater drain system including clean out of catch basins and the stormwater vault.

4.2.4 Conclusion Regarding Stormwater Drain System Discharge (Pathway 2)

The conservative screening of the stormwater and CB solids data indicates the potential for the Site stormwater system discharge (Pathway 2) to pose a recontamination risk to marina basin sediments at levels greater than the LDW ROD RALs.

The following are uncertainties with respect to quantifying the concentrations of COCs on stormwater solids discharging to the LDW via the Site stormwater drain system:

- The specific pathway by which stormwater in the central catchment area reaches the SPM outfall is uncertain. However, the characterization conducted by SPM over several years, including dye testing, confirms that the water from catch basins CB-05 and CB-06 discharges to that outfall, as described in the RI Work Plan. Based on that information, Ecology agreed during preparation of the RI Work Plan to sample stormwater and CB solids at those catch basins to characterize stormwater discharge from that catchment area.
- While collection of suspended solids from stormwater using sediment traps would provide the best representation of stormwater solids concentrations discharging to the LDW, it is not feasible to install sediment traps to conduct such sampling in the Site stormwater drainage system. This was discussed with Ecology during preparation of the RI Work Plan, and there was agreement to

[14] Total toxic equivalent concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin calculated in accordance with MTCA (WAC 173-340-708(8)(d)).

conduct the whole-water and CB solids sampling outlined in the RI Work Plan to provide data for this source control review.

- There are limited analyses for the full range of COCs in treated water discharging to the LDW from the StormwateRx™ system. However, the source control analysis relies upon data for untreated stormwater, which is a conservative assumption for the analysis, so that lack of data is not a data gap.
- In addition, there are very limited data to characterize dioxins/furan concentrations in Site stormwater solids, but that is not considered a data gap that precludes completion of this source control review for reasons discussed in Section 5.2.2.

Therefore, based on the collective data for Site stormwater and CB solids spanning up to 7 years in time, no data gaps were identified for Pathway 2 with respect to completing this source control review. However, stormwater and solids concentrations can be highly variable, and additional samples representative of post-fire conditions will be collected during the RI Phase 2 investigation. The data collected will be evaluated in the update to this source control review as discussed in Section 6.

Based on the exceedances of source-control screening levels for both stormwater and CB solids, a modeling analysis will be conducted as a secondary line of evidence in this source control review (Step 2C described in Section 2.2) to predict whether contaminant mass loading from the storm drain system would result in marina basin sediment COC concentrations exceeding LDW ROD RALs. Section 5 presents the predicted contaminant mass loading to marina basin sediments via discharge from the stormwater drain system and resulting sediment concentrations resulting from that flux.

4.3 Pathway 3: Discharge of Eroded Soil via Overland Flow or Bank Sloughing

As part of the RI Phase 1, Aspect inspected the shoreline and concluded there are no riverbank soils exposed for erosion along the SPM shoreline because of the marina's ecology block wall and riprap armoring. Photographs 1 and 2 below show segments of the block wall and riprap along its base. Inland from the block wall, the SPM Property includes unpaved areas with gravel surfacing that are exposed to precipitation and thus potential erosion.

Photograph 1. Ecology block wall along SPM riverbank, looking south.

Photograph 2. Ecology block wall and riprap at SPM southeast corner, lower-low tide stage.

4.3.1 Surface Soil Dataset

Because Pathway 3 addresses erosion of soil, this source control review evaluates available data for surface soils located anywhere within the property boundary, both along the shoreline and inland. The RI Work Plan defined surface soil samples as collected between 0 and 1 foot below ground surface, where ground surface is the top of soil below any paving, pavement gravel base course, or gravel surfacing. Samples collected from a depth interval of 0 to 1.6 feet are also included in the surface soil dataset for purposes of this review. The surface soil dataset for this source control review includes:

- 39 samples collected in 2016 and 2017
- 23 samples collected during the RI Phase 1 data collection in 2021

These 62 surface soil sample locations are shown on Figure 8. The data for surface soils samples are presented in Table 7, with the samples grouped based on location (e.g., along shoreline versus inland) and whether it is paved or unpaved soil. In the near-term period considered in this review, the paved soils are not subject to erosion but the data are presented for completeness.

4.3.2 Source Control Screening Levels for Surface Soils

The same screening levels used for CB solids (dry-weight-equivalent LDW ROD RALs for surface sediment (0-10 cm)) were also selected as screening levels for surface soils in this source control review.

Table 8 summarizes COCs that exceed source control screening levels for each of the Site upland media/recontamination pathways, and it lists the maximum exceedance factor[15] for each COC that exceeds screening levels.

4.3.3 Surface Soil Concentrations Relative to Screening Levels

Constituents detected in one or more samples of Site surface soil at concentrations greater than LDW ROD RALs include copper, lead, mercury, total PCBs, total dioxin/furan TEQ, benzyl alcohol, benzyl butyl phthalate, BEHP, and dimethyl phthalate (Table 7).

PCB concentrations greater than the 0.13 mg/kg LDW ROD RAL occur in unpaved and paved soils across much of the Property (Figure 8). PCB concentrations greater than 1 mg/kg are limited to unpaved soils in the historical Pond area, unpaved soils along the south lot line, and paved soils along Dallas Avenue South.

Concentrations of mercury exceeding LDW ROD RALs are limited to the unpaved soils in the historical Pond area and along the south lot line; copper and lead exceedances occurred in only one sample from the Pond area.

The phthalates and benzyl alcohol exceedances are low in concentration (less than 0.6 mg/kg) and are scattered across the property without any clear spatial pattern or paved/unpaved condition (Table 7).

Of the two soil samples analyzed for dioxins/furans, the total dioxin/furan TEQ concentration detected at the unpaved inland SB-32 location only slightly exceeded the 25 nanogram per kilogram dry weight (ng/kg dw) LDW ROD RAL at 25.63 ng/kg, and is less than the 90th percentile concentration (46 ng/kg) determined from 120 samples of soil from residential properties throughout Seattle (Ecology, 2011). However, the total dioxin/furan TEQ concentration in the sample collected from the unpaved historical Pond area (SB-26) exceeded the 25 ng/kg LDW ROD RAL by two orders of magnitude at 2,546 ng/kg. The SB-26 sample also contained the maximum concentrations of metals and near-maximum concentrations of PCBs (Table 7).

4.3.4 Concentrations in Covered Bank Sediment at Marina Southeast Corner

As detailed in Section 5.2.3 of the Site RI Work Plan (Aspect, 2021), during the T-117 EAA removal action in February 2014, a portion of the SPM property bank immediately east of the newly constructed sheet pile wall sloughed (slope failed) from the top of bank down to below the low tide water line (area referred to as the "Marina Corner"). Subsequently, sheen was observed discharging from the exposed bank east and south of the sheet pile wall. A pair of 6-point composite samples of the newly exposed intertidal sediment east of the sheet pile wall were collected for analysis—the first for PCBs and total petroleum hydrocarbons using the hydrocarbon identification (TPH-HCID) method, and the second for gasoline-, diesel-, and oil-range TPH, PCB Aroclors, chlorinated pesticides/herbicides, metals, and VOCs. Total PCB concentrations in the two samples ranged from 3.0 to 5.4 mg/kg dry weight. These samples were excluded from the

[15] Ratio of maximum detected concentration to screening level concentration.

sediment SWAC evaluation (Appendix C) as a result of engineering controls (described below) installed during the T-117 removal action.

Based on the observed sheens discharging from residual materials east and south of the sheet pile wall, the T-117 removal action design was modified to install a high-permeability, approximately 1/4-inch-thick GAC geocomposite layer along the east and south sides of the sheet pile wall. The GAC layer was placed over imported gravel borrow backfill between elevations approximately 0 and 8 feet NAVD88. The GAC layer was covered with additional gravel borrow and then riprap armoring up to mean high water. Above mean high water, an ecology block wall was constructed outside the sheet pile, with crushed rock backfill between the sheet pile wall and ecology block wall (AECOM, 2014b). In March 2015, the Port and SPM drafted a legal agreement that acknowledges the sheet pile will remain in place permanently.

4.3.5 Conclusion Regarding Soil Erosion via Overland Flow/Bank Sloughing Discharge (Pathway 3)

COC concentrations exceeding LDW RALs have been detected in upland surface soils across the Site, and on the shoreline bank along the Site's southeast corner and possibly further north. However, engineering controls are in-place, in the form of an existing ecology block wall and riprap armoring to prevent the erosion and transport of soil to the LDW (Photographs 1 and 2). This control stretches along the entire shoreline from the south end of the SPM property to the north end, just south of the boat ramp (Figure 8). The block wall retains soils in the upper bank while the riprap armoring covers the Site's lower bank.

As noted previously, the block wall prevents substantive overland flow of upland stormwater to the LDW. This was confirmed by Phase 1 field observations. The effectiveness of this engineering control with respect to overland flow will be confirmed by field staff during 2022 Site activities when precipitation is occurring. Overland flow does runoff to the LDW via the boat ramp; however, as noted earlier, the amount of runoff is very small, and its contributing drainage area is principally pavement, such that the boat ramp represents a negligible pathway for transport of Site soil to the LDW.

The existing block wall represents an effective engineering control to prevent the erosion and transport of upland soil, sloughing of riverbank soils and overland flow of site stormwater. The lack of overland flow of site stormwater to the LDW was confirmed visually during three storm events as part of the RI Phase 1 data collection program.

SPM has no plans to remove or otherwise reconfigure the block wall in the near-term. Therefore Pathway 3 is considered to pose negligible risk of recontamination to marina basin sediments for the near-term duration of this source control review. There is a robust data set (62 samples) to characterize surface soil quality across both paved and unpaved portions of the upland Site, and no data gaps were identified with respect to evaluation of recontamination Pathway 3. These conclusions will be further evaluated with additional visual observations during 2022 RI field activities.

No further data collection or modeling analysis is warranted for purposes of evaluating Pathway 3 as part of this source control review.

4.4 Summary of Data for Upland Media Relative to Source Control Screening Levels

Table 8 is a summary of COCs exceeding media-specific source-control screening levels corresponding to the three recontamination pathways within the near-term timeframe considered in this source control review. The pathway-specific results are as follows:

- Pathway 1: There are no COCs exceeding GW-3 screening levels in shoreline groundwater from the Fill Unit and Alluvium Unit representing Pathway 1 (groundwater discharge). Modeling of this pathway is not warranted at this time. However, data from both water-bearing zones will be collected during Phase 2 of the RI and the need for modeling will be revisited after those data are obtained.
- Pathway 2: COCs in samples of both stormwater and CB solids representing Pathway 2 exceed screening levels (GW-3 for stormwater, LDW ROD RALs for CB solids). Modeling of this pathway was conducted as described in Section 5.
- Pathway 3: Surface and riverbank soils across the Site contain COCs exceeding the RAL screening levels, but engineering controls (ecology block wall, riprap) prevents erosion and transport of those soils to the LDW. Modeling of this pathway is not warranted.

5 Sediment Recontamination Model Analysis for Pathway 2

As discussed in Section 4.2.4, the conservative screening of the stormwater and CB solids data indicates a potential recontamination risk for discharge from the Site stormwater drain system (Pathway 2) to marina basin sediments to levels greater than LDW ROD RALs. However, concentrations in upland media do not equate directly to concentrations in marina basin sediments, as indicated by comparison of concentrations in stormwater and CB solids samples (which exceed screening levels based on the GW-3 PCUL and ROD RALs, respectively) versus those in marina basin sediments (which meet the ROD RALs, with the exception of localized PCBs and benzyl alcohol in the basin's southwest corner).

Therefore, as a secondary line of evidence to the empirical sediment data, further technical analysis is warranted to put the Pathway 2 data into proper context for assessing this potential recontamination risk. To do so, a simplified, conservative version of the Bed Composition Model (BCM) was developed. The BCM was used in the LDW Feasibility Study (FS) to estimate medium- and long-term changes in chemistry of the surface sediment bed, expressed as the SWAC, and it formed one basis for the assembly of the remedial alternatives for LDW sediments.

The BCM tool is an Excel-based workbook (AECOM, 2012) that estimates changes in sediment chemistry with time (up to 45 years, at 5 years increments) resulting from the physical processes of sediment burial, resuspension, and mixing estimated from the Sediment Transport Model (STM) prepared for the LDW FS (QEA, 2008). The BCM framework tracks the percentage of three variables (bedded sediment, lateral inflow, and upstream inflow) contributing to each model grid cell over time, using loading output from the STM. Input parameters include assigned chemical concentration values to each of the three variables.

The BCM was simplified for the purposes of this source control review by (1) eliminating sediment resuspension and mixing within the marina basin, (2) not considering the effects of grain-size fractions within the sediment, upstream inputs, or lateral inputs, (3) applying a single model cell instead of a 10-foot by 10-foot model grid, (4) using an average sedimentation rate instead of a detailed dataset representative of sediment loadings calibrated on the trapping efficiency in the LDW upper reach, and (5) considering only stormwater discharges from the Site, thus ignoring stormwater discharges to the marina basin from upgradient City and County storm drains as mentioned in Section 4.2.1.

This simplified version of the BCM conservatively assumes that 100 percent of the COC mass and sediment loading from lateral sources (the Site) and upstream sources is applied to the marina basin bed composition and conserved throughout the period of analysis—i.e., there is no sediment resuspension, degradation of COCs, or mixing of higher concentration lateral sediment with the baseline bed sediment.

The following four sections describe (a) the model used for this source control review ("the model"); (b) the physical and chemical properties used as inputs to the model; (c) the methodology for determining input parameter values, and a range of values for the uncertainty analysis for three cases (or scenarios): the base-case plus less-conservative and more-conservative cases to; and the (d) model results in terms of estimated future marina basin surface sediment concentrations and uncertainties with the model. Like the BCM, this model does not include inputs for the groundwater-to-sediment pathway. Additional monitoring wells in both the Fill and Alluvium Units will be installed as part of Phase 2 of the RI and these data may need to be incorporated into future modeling evaluations.

5.1 Model Development

The model assumes that sediment in the marina basin at some time in the future (t) is determined by the relative contributions from three sources:

- The bed, which is the baseline sediment currently in the marina basin (time = zero).
- The river inflows, which deposit solids in the marina basin from the combined upstream sources.
- The lateral inflow of solids from the upland Site storm drain system (groundwater and surface runoff inputs are considered negligible).

As discussed above, the model was developed using the BCM with simplifying assumptions, reducing the model to the following algorithm (Eq. 1):

$$C_{time} = C_{bed} \times fraction_{bed} + C_{river} \times fraction_{river} + C_{lateral} \times fraction_{lateral} \quad \text{(Eq. 1)}$$

Where:

- C_{time} is the concentration (mg/kg) of an analyte in the marina basin sediment at any specified time = t years
- C_{bed} is the concentration (mg/kg) of an analyte in marina basin sediment at time = 0 years
- C_{river} is the concentration (mg/kg) of an analyte on solids in upstream inflows
- $C_{lateral}$ is the concentration (mg/kg) of an analyte on solids in lateral inflows (estimated from Site stormwater [whole-water] data and/or measured in CB solids)[16]
- $fraction_x$ is the fraction (percentage) of the 0- to 10-cm surface sediment mass in the marina basin at time = t years derived from each sediment source (bed, river, and lateral) (dimensionless)

Net sedimentation rates were used to determine the fractions of original bed, river, or lateral solids that comprise the bed sediment concentration at some future time. Because

[16] Direct measurement of lateral solids concentrations from the end of pipe is not feasible. There is uncertainty associated with using estimated concentrations derived from whole-water data and measured concentrations on CB solids, which likely do not reach the LDW and marina basin sediment. This uncertainty and the approach for calculating $C_{lateral}$ concentrations is further discussed in Section 5.3.4.3.

the marina basin is an area of net sediment deposition, as estimated from the LDW sediment transport model (STM) (QEA, 2008), the bed sediment fraction represents 100 percent at time 0 and decreases over time as lateral and river sediment settles and buries or replaces the baseline/original (Time 0) marina basin sediment. Thus, at model run Time 0, the sediment bed is 100 percent comprised of the original bed sediment, 0 percent lateral, and 0 percent upstream river. At model run Time 10 years, for example, the sediment bed may be comprised of 20 percent original bed, 79 percent upstream river, and 1 percent lateral sourced solids depending on the model input parameter assumptions described in the following sections. Chemical concentrations are assigned to these fractions. The model does not account for mixing, erosion, or redeposition of sediments in the marina basin.

The model was run in a spreadsheet with annual time steps for 25 years; however, irrespective of the assumed net sedimentation rate (described below), the modeled bed (0-10 cm) concentrations reached a steady state, where the sediment concentration depends solely on the lateral and upstream inputs and not on existing sediment concentrations, in 20 years or less.

5.2 Model Input Parameters

This section describes the physical and chemical properties representing input parameters to the model. The input parameter values assigned for three model cases uncertainty are then described in Section 5.3.

5.2.1 Physical Properties

Several physical properties are used to determine the *fraction* of each sediment input source as shown in Table 9. The following sections discuss the development of each physical property for the model.

5.2.1.1 Lateral Sedimentation Rate from the Site

The sedimentation rate from the Site (lateral) was calculated based on estimated annual discharge of stormwater and the measured total suspended solids (TSS) of that stormwater.

To derive this lateral sedimentation rate, the annual lateral runoff quantity (flux) from the Site was first calculated using the Western Washington Hydrology Model (WWHM) to simulate stormwater runoff from the entire 3.71-acre upland area[17] over a 61-year period of available precipitation data for Seattle. Appendix B provides details regarding the WWHM methodology and results for the Site-specific runoff simulation.

The lateral sedimentation rate from the Site was then calculated using the runoff output from the WWHM and measured TSS values for Site stormwater samples using Equation 2:

[17] The annual runoff quantity produced by the WWHM includes the entire SPM Property, which discharges through three outfalls. The chemical concentration data used in the model (Section 5.3.4) come from stormwater samples collected in the SPM Outfall and UOF-1 catchment areas (Section 4.2.1). The 3.71-acre includes some portions of rights-of-way adjacent to the SPM property.

$$S_{lateral} = \frac{Runoff \ \times TSS \ \times unit\ conversion}{dry\ bulk\ density \ \times marina\ basin\ area} \quad \text{(Eq. 2)}$$

Where:

- $S_{lateral}$ is the lateral (Site) sedimentation rate (cm/yr)
- *Runoff* is the annual runoff output from the WWHM (L/yr)
- *TSS* is the measured total suspended solids in whole-water samples (mg/L)
- *Dry bulk density* of the sediments deposited from lateral and upstream sources (lbs/ft^3).
- Marina basin area is 3.1 acres.

$Fraction_{lateral}$ at any future time modeled is then calculated by multiplying the lateral sedimentation rate (cm/yr) by time (years) and dividing by the receiving sediment depth (10 cm, point of compliance depth), providing a dimensionless quantity.

5.2.1.2 Total Net Sedimentation Rate in the Marina Receiving Basin

The total net sedimentation rate in the marina basin was estimated from information generated by the LDW cleanup process. The LDW STM used empirically derived estimated net sedimentation rates to calibrate the model and produce predicted net sedimentation rates. The empirical estimates for outside the navigation channel (i.e., in areas like the Marina Basin) were produced from core data collected between 1963 and 2006. There was no core data collected in the area of the Marina Basin, between RM 3.3 and 3.5 for empirical measurements. In the area of the Marina Basin, between RM 3.3 to 3.5, the LDW STM predicts a net sedimentation rate of 7 to 15 cm/yr (QEA, 2008)[18]. On a larger scale, the LDW STM in Reach 2b (from RM 2.6 to RM 4.0) predicts a net sedimentation rate of 2.4 cm/yr and nearshore shallow areas site-wide were predicted to receive about 0.5 cm/yr of net deposition.

The STM was originally calibrated based on upstream sediment solids load data from USGS studies during 1965 to 1966 and 1996 to 1997. In 2020, as part of a doctoral dissertation at the University of Washington, McKeon analyzed hydrodynamics and sediment transport in the LDW based on more recent data available for sediment loads (McKeon, 2020). McKeon concluded that the STM may overestimate sediment loads by a factor of approximately 2.

LDWG had previously evaluated the effects of a lower upstream sediment load in 2009 as part of the revised STM calibration. When the upstream sediment loads were decreased by 50%, the STM still predicted net deposition fluxes in the benches for Reach 2 that were consistent with the original STM calibration results, and the working group concluded “Based on these findings, model results from the original calibration are

[18] However, the STM model did not account for marina structures, pilings, nor floating docks in the model set-up. In addition, a rigid over-water, public-access walk-way structure was constructed in the waterway as part of the T-117 habitat reconstruction and public access in 2021. These physical features may alter the amount of settling solids in the marina basin.

considered acceptable for the STM's applications in the Feasibility Study and in future remedial design efforts." (Integral, 2019).

In each of the three model cases, the assumed total net sedimentation rate in the Marina Basin (0.5, 2, and 3 cm/yr; see Section 5.3.2) is lower (more conservative) than the STM-predicted net sedimentation rate in the Marina Basin of 7 to 15 cm/yr from 2009 and incorporates a conservativism of reduced sediment loads expected more recently, as described in the 2020 McKeon dissertation.

5.2.1.3 River Sedimentation Rate from Upstream Sources

The river sedimentation rate from upstream sources was calculated as the total net sedimentation rate minus the lateral sedimentation rate from the Site. $Fraction_{river}$ at any future time modeled is calculated by multiplying the river sedimentation rate (cm/yr) by time (years) and dividing by the receiving sediment depth (10 cm).

$Fraction_{bed}$ at any future time modeled is calculated as $1 - fraction_{lateral} - fraction_{river}$.

5.2.2 LDW COCs Modeled

All three of the following criteria were used to determine which LDW COCs should be modeled:

- COCs which exceeded their initial screening levels for stormwater whole-water and CB solids (Sections 4.2.2 and 4.2.3)
- COCs that are potentially associated with the use of the Site as a boatyard
- COCs with the highest magnitude of exceedance within a chemical class based on a comparison of the 90th percentile value of $C_{lateral}$ concentrations (which includes both calculated whole-water suspended solids and measured CB solids, see Section 5.1.4.3) to the (dry-weight-equivalent) LDW ROD RALs

Of the COCs that met all these criteria, the following six COCs were chosen from four distinct chemical groups to be evaluated using the three model cases:

- PCBs: Total PCBs is a primary human-health risk driver COC for LDW sediments and, accordingly, had one of the most comprehensive data sets (all media).
- Metals:
  - Copper and zinc contained the highest relative exceedances at 23 and 26 times LDW ROD RALs, respectively, and are the boatyard NPDES parameters;
  - Arsenic is a primary human-health risk driver COC for LDW sediments and, while it had no exceedances for Site stormwater samples and a minor exceedance in only one CB solids sample, it was included at the request of Ecology.
- PAHs: 2-Methylnaphthalene contained the highest relative exceedance at 6 times the LDW ROD RAL
- SVOCs: Dimethyl phthalate contained the highest relative exceedance at 4,800 times the ROD RAL and is a constituent in resins used for fiberglass repair that may have been/be used in Site boatyard operations.

Dioxins/furans are also a primary human-health risk driver COC for LDW sediments, but they were not modeled for this assessment. There are only two Site CB solids samples, two samples of sediment with dioxins/furans analyses in the Marina Basin, and no Site stormwater (whole-water) sample data, thus greatly limiting the credibility of modeling dioxins/furans. However, we expect that modeling conclusions regarding recontamination risk associated with PCBs discharging to the LDW from the Site stormwater drain system would also reasonably apply for dioxins/furans, because the highest concentrations for both total PCBs and total dioxin/furans (TEQ) were detected in the 2014 sample of CB solids collected from the StormwateRx™ pretreatment vault, and the sample's magnitudes of exceedances were approximately the same (32 for PCBs and 36 for dioxins/furans[19]).

Furthermore, the highest concentration of dioxins/furans (TEQ) in Site surface soils was collocated with the second highest total PCB concentration detected on Site as discussed in Section 4.3.3. Because of their similar concentrations relative to respective LDW ROD RALs at the Site, and because both classes of compounds are highly hydrophobic, dioxins/furans and PCBs are expected to have similar behavior eroding into and then being transported within the stormwater drain system.

Section 5.3.4 describes the model input concentrations for the selected COCs.

5.3 Input Parameter Values and Uncertainty Analysis

To determine the uncertainty of the model in response to changes in input parameters, five of the terms in Equation 1[20] were varied over the following three model cases (three model cases were also used in the LDW-applied BCM in the ROD):

- **Base Case**: The base-case model uses median values for each of the input concentrations, the median stormwater runoff from the Site as estimated by the WWHM, and the median total sedimentation rate for the marina basin.
- **More Conservative:** The more-conservative model uses the 90th percentile values for the lateral and river input concentrations, the 90th percentile stormwater runoff from the Site as determined by the WWHM, and the lowest total sedimentation rate for the marina basin. Using the lowest total sedimentation rate for the marina basin is the more conservative, as it results in a higher relative deposition of lateral, high concentration sediment over lower concentration sediment from upstream.
- **Less Conservative:** The less-conservative model uses the 25th percentile values for the lateral and river input concentrations, the 25th percentile stormwater runoff from the Site as determined by the WWHM, and the highest total sedimentation rate for the marina basin.

[19] Total PCBs: 4.1 mg/kg sample / 0.13 mg/kg RAL = 32. Dioxins/furans (TEQ): 890 ng/kg sample / 25 ng/kg RAL = 36 (CB solids data presented in Table 5).

[20] The $fraction_{lateral}$ term in Equation 1 is derived from Equation 2. The *Runoff* term in Equation 2 was varied over the three model cases. The C_{bed} term in Equation 1 was not varied over the three model cases.

The following sections describe the basis for each model input value.

5.3.1 Lateral Sedimentation Rate from Site

As noted in Equation 2, the annual lateral sedimentation rate is calculated using estimates for annual stormwater runoff (to LDW via storm drain system), the TSS of the stormwater runoff, the dry bulk density of the suspended solids fraction, and the marina basin area across which the suspended solids are distributed. Assumed values for each of those parameters for each of the three model cases are presented in Table 9 and described below.

This approach is similar to the methodology used by the City of Seattle and King County for estimating lateral loads from combined sewer outfalls (CSOs) – estimating the amount of runoff based on surface conditions and amount of urbanization (e.g., agricultural, light urban, heavy urban etc.). However, the studies differ in scale. Those estimations were performed at the watershed-scale and included large areas serviced by municipal storm drains and the effects of combined stormwater-sanitary sewer systems. Based on the City's work, the STM estimated an LDW-wide lateral load of 2 percent (QEA, 2008). The approach outlined here is focused solely on the SPM property and relies on measured TSS for the SPM Property and modeled runoff from the WWHM, which was developed for Ecology for use in the design process for stormwater projects in western Washington.

Annual Lateral Runoff from the Site. The estimated annual total stormwater runoff ranged from 6,215,270 liters per year (L/yr) in Water Year (WY) 1977 to 17,002,693 L/yr in WY 1972, with a median of 11,707,212 L/yr. Details regarding these estimates are presented in Appendix B. The WWHM modeling produced a cumulative distribution function for annual runoff, from which percentiles can be obtained. Because a greater quantity of runoff is more conservative for the modeling analysis, the assumed lateral runoff fluxes for the three model cases are as follows (Table 9):

- More Conservative: WWHM 90th percentile value of 15,118,466 liters per year (L/yr)
- Base Case: WWHM 50th percentile (median) value of 11,707,212 L/yr
- Less Conservative: WWHM 25th percentile value of 10,081,954 L/yr

Stormwater TSS. Because a higher TSS is more conservative for the modeling analysis, the assumed TSS for the three model cases are as follows (Table 9):

- More Conservative: 90th percentile TSS of the 15 Site stormwater samples = 24 mg/L
- Base Case: Median TSS of the 15 Site stormwater samples = 12 mg/L
- Less Conservative: 25th percentile TSS of the 15 Site stormwater samples = 8 mg/L

Dry Bulk Density of Sediment Deposited. Dry bulk density of the sediment deposited from the Site stormwater is assumed to be equal to the receiving sediments and does not vary between the model cases. The LDW FS reported a mean sediment dry density increasing with depth from 60.4 to 67.2 pounds per cubic foot (pcf) (AECOM, 2012).

Because the model considers only the recently deposited upper 10 cm of sediment, the low-end density value (60 pcf) was applied for all sediment sources in the model (Table 9).

Marina Basin Area. The marina basin area was not varied between the model cases and was held constant at 3.1 acres (Table 9).

Resulting Lateral Sedimentation Rate. By input of the case-specific parameter estimates above into Equation 2, the lateral sedimentation rates for the three model cases are as follows (Table 9):

- More Conservative: 0.003 cm/year
- Base Case: 0.0012 cm/year
- Less Conservative: 0.0007 cm/year

5.3.2 Total Net Sedimentation Rate in the Marina Basin

The range of model-estimated and empirically measured net sedimentation rates for the marina basin in this stretch of the LDW (Reach 2B), and LDW-wide are discussed in Section 5.2.1.2. For this model, the base-case total net sedimentation rate in the marina basin was assumed to be 2 cm/year, which is the average net sedimentation rate of 2.4 cm/yr for LDW Reach 2B[21] (QEA, 2008), adjusted down to 2 cm/yr based on empirical data for subtidal bench areas of the LDW (like the marina basin) and excluding the Navigation Channel. The total net sedimentation rate was assumed to be 0.5 cm/year and 3 cm/year for the more-conservative and less-conservative cases, respectively (Table 9). The 0.5 cm/yr value is based on the lower-bound net sedimentation rate for Reach 2B nearshore areas, and the 3 cm/yr value is based on the upper-bound net sedimentation rate for Reach 2 (QEA 2008).

In the Site mixing model, the lateral fraction contributed by the Site stormwater drain system is fixed (based on Site data) for each model scenario, and therefore a higher total sedimentation rate is less conservative because the upstream fraction, consisting of lower-concentration sediment (described below), makes up the difference in the total rate. Ultimately, the net sedimentation rate controls the time required for the model to replace the 0-10 cm sediment bed (the ‘steady-state’ model endpoint), but it does not influence the COC concentrations in the sediment bed at that endpoint.

5.3.3 River Sedimentation Rate from Upstream Sources

By subtracting the lateral sedimentation rate from the total net sedimentation rate, the upstream sedimentation rates for the three model cases are as follows (Table 9):

- More Conservative: 0.5 cm/year
- Base Case: 2.0 cm/year
- Less Conservative: 3.0 cm/year

Steady state in this model is reached when the total net sedimentation in the Marina Basin has replaced the upper 0 to 10 cm of sediment. No resuspension of sediment is evaluated

[21] River mile 2.6 to 4.0, which includes the marina basin.

in this model; if resuspension were incorporated, the model would take longer to reach steady state, but no difference in steady state concentrations would be expected, as the proportion of upstream and lateral sediment rates and concentrations would remain the same.

The more conservative case has the lowest upstream sedimentation rate because this provides the least dilution of higher concentrations coming from lateral sources.

5.3.4 Input Concentrations for COCs Modeled

The methodology for calculating chemical concentrations for each modeled COC in each input source is discussed below. Because the concentration data for Site stormwater whole-water and CB solids and for the (upstream) river solids are on a dry-weight basis for all COCs, dry-weight concentrations for all media were used for purposes of the modeling. Table 10 presents the marina basin surface sediment data used for the modeled COCs. Table 11 presents summary statistics of concentrations for each modeled COC for each input source and the values used as inputs in each of the three model cases. The following rules were used in calculating the summary statistics:

- Total PCBs: If a sample had concentration data for both Aroclors and congeners, the higher of the two total PCB values was used, or the total PCB congener value was used if all Aroclors were non-detect. If only congener or Aroclor data were available, then available data were used. For samples with only non-detect Aroclor concentrations, one-half the highest Aroclor reporting limit was used.
- All other LDW COCs: For samples with non-detect results, one-half the reporting limit was used. Only primary sample results were used (duplicate results were not considered).

5.3.4.1 Baseline Sediment Concentrations in Marina Basin – C_{bed}

The concentration of analytes in the marina basin sediment have been measured; therefore, the concentration of each analyte in the receiving sediment was not varied between the three model cases. The baseline concentration for each analyte in the marina basin was calculated as a SWAC based on the spatial distribution of the chemical analytical data collected between 2003 and 2021. SWACs for each analyte were calculated using Thiessen polygons as discussed with Ecology prior to preparation of this memorandum. Thiessen polygons provide a more conservative estimate over other methods, such as inverse-distance weighting, for calculating SWACs in the Marina Basin. Since the SWACs are only used to establish the Year 0 baseline concentration, and the predicted model concentrations at later time become solely the result of upstream and lateral inputs, no change in predicted model results would occur if a different method (i.e., inverse distance weighting) were used to calculate the SWAC for each analyte.

Six sets of Thiessen polygons were generated based on the available number of sediment samples in or next to the Marina Basin:

- There are 15 samples with arsenic data as shown on Figure 9.
- There are 15 samples with copper data (14 are the same samples as the arsenic data) as shown on Figure 10.

- There are 15 samples with zinc data (14 are the same samples as the arsenic data) as shown on Figure 11.
- There are 10 samples with 2-methylnaphthalene data as shown on Figure 12.
- There are 10 samples with dimethyl phthalate data as shown on Figure 13.
- There are 46 sample locations with PCB data (either Aroclor or congener) as shown on Figure 14.

The SWAC for each of the COCs modeled is shown in Table 11. These SWACs for the existing marina basin surface sediment are below LDW ROD RALs.

5.3.4.2 Upstream Sediment Concentrations in the LDW – C_{river}

Two data sets were used to estimate the concentrations of solids deposited in the marina basin from upstream sources:

(1) The 2020 LDW-wide update to the BCM input parameters presented in the Lower Duwamish Waterway Group's (LDWG) *Pre-Design Studies Data Evaluation Report* (Windward Environmental, 2020); and

(2) A 2018 study produced by the United States Geological Survey (USGS) of *Chemical Concentrations in Water and Suspended Sediment, Green River to Lower Duwamish Waterway* that was specifically generated to support Ecology's source control review process:[22]

The upstream dataset from the Windward (2020) pre-design studies included multiple lines of evidence and a comprehensive data set from nine distinct sources, including the USGS (2018) data set, to determine appropriate concentrations that represent upstream inputs for the model. Each data source has its own bias, but when collectively considered they represent a robust analysis of upstream inputs from upstream suspended solids, outfall samples, bedded sediment, and sediment cores from the Upper Turning Basin that acts as a natural sediment trap for solids entering the LDW.

However, the report presents summary statistics only for the four risk-driver LDW COCs based on human health: arsenic, cPAHs TEQ, total PCBs, and total dioxins/furans TEQ. For this memo, the Windward (2020) values (shown in orange font in Table 11) for arsenic and PCBs were used as the input values for the three model cases.

For the remaining LDW COCs, the USGS (2018) data set was used to generate the 90th percentile, median, and 25th percentile values used as input concentrations in the three model cases. The USGS data set includes suspended solids chemistry data from 13 unique sampling events of differing river conditions (stage, antecedent precipitation, etc.)

[22] "To support implementation of an LDW cleanup plan, Ecology is leading source control activities and a watershed-scale pollutant loading assessment to identify sources of sediment recontamination adjacent to and upstream of the LDW. From 2013 to 2017, the U.S. Geological Survey (USGS), in cooperation with Ecology, collected new data to provide estimates of sediment loading and toxic chemical loading from suspended sediment transported by the Green/Duwamish River to the LDW." (USGS, 2018).

collected during 2016 and 2017 for each of the LDW COCs. The upstream sediment concentration of each analyte for each model case are shown in Table 11.

5.3.4.3 Lateral Sediment Concentrations from the Site – $C_{lateral}$

The analysis considers mobilization and discharge of suspended solids in stormwater (calculated concentrations using data from whole-water samples) and CB solids (measured concentrations). Multiple levels of conservatism are maintained throughout the analysis for all three model cases:

- The analysis assumes the entire stormwater suspended solids load settles out within the marina basin.
- The analysis relies only upon data from untreated stormwater samples because the dataset is much larger - covering a larger spatial area and a greater number of constituents (only the southern portion of the upland Site receives treatment via the StormwateRx™ system prior to discharge).
- The analysis assumes that 100 percent of the measured concentration in the whole-water stormwater samples is attributable to suspended solids and, therefore, is deposited in the marina basin (except for metals; see discussion below). In reality, a portion of these measured whole-water concentrations are due to the dissolved phase, which would mix with and disperse in LDW surface water.

To estimate the suspended solids in whole-water samples, Equation 3 was used:

$$C_{WWSS} = C_{WWM} \div TSS \times unit\ conversion \qquad \text{(Eq. 3)}$$

Where:

- C_{WWSS} is the calculated whole-water suspended solids concentration (mg/kg).
- C_{WWM} is the measured whole-water concentration (ug/L). For metals, where both total and dissolved concentrations are available, the whole-water concentration was calculated as the total concentration minus the dissolved concentration. For samples without dissolved concentration data, the total concentration was used. The two metals analyses where the reported dissolved concentration exceeded the total concentration were not included in the analysis.
- *TSS* is the total suspended solids concentration measured in each sample.

It is important to note that, because the calculation of whole-water suspended solids relies on TSS, only samples with TSS data were included in the evaluation.[23] This estimation of stormwater suspended solids concentrations involves multiple assumptions, such as 100 percent of the detected concentration is attributable to the suspended solids, which amplifies the error from analytical variability and creates a very wide-ranging and conservative data set. The BCM model also used this simplifying approach (AECOM, 2012). The conservatism in this approach is apparent in that $C_{lateral}$ concentrations

[23] Only including samples with TSS data resulted in removing the following number of samples for each analyte: 4 for arsenic; 26 for copper; 27 for zinc; 2 for 2-methylnaphthalene; 2 for dimethyl phthalate; 11 for Total PCBs. The total number of samples used to calculate whole-water suspended solids concentration for each analyte are included in Table 11.

estimated for the more-conservative case far exceed concentrations detected in Site surface soils. At the bottom of Table 11 is a comparison of COC concentrations on stormwater solids as estimated from the whole-water samples (using TSS) versus those measured in samples of CB solids.

The measured CB solids concentrations and the estimated whole-water suspended solids concentrations are both intended, for purposes of the model, to represent solids discharging via the Site storm drain system. Therefore, the calculated suspended solids data set was combined with the measured CB solids data set, and $C_{lateral}$ concentrations were established as the 90th percentile, median, and 25th percentile values of the combined data set. A summary of the number of samples for each analyte and the concentrations of each analyte used for each of the three model cases is presented in Table 11.

5.4 Model Results

Using the input parameters described above and presented in Tables 9 and 11, concentrations of analytes in the receiving sediment were evaluated for each of the model cases on a yearly basis for a period of 25 years.

5.4.1 Relative Contribution of Solids Mass to Sediment by Source

Each model reaches steady-state concentrations in the receiving sediment once the total sedimentation rate has replaced the upper 10 cm of the receiving sediment. For example, in the more-conservative model, the total sedimentation rate is 0.5 cm/yr. In that case, at year 20, the upper 10 centimeters of the sediment has been replaced by a combination of lateral (Site) and river (upstream) sources. The relative contribution of each of the lateral and river sources does not vary within each model case and the concentrations on each fraction are fixed within each model case; therefore, the predicted concentration in sediment no longer changes once the upper 10 centimeters of the marina basin sediment has been replaced. A summary of the relative contribution by source and the length of time it takes to reach steady state is included in inset Table A.

Table A. Relative Contribution of Solids Mass by Source to Sediment

Parameter	More Conservative	Base Case	Less Conservative
$fraction_{lateral}$	0.63%	0.06%	0.02%
$fraction_{river}$	99.37%	99.94%	99.98%
Total Basin Sedimentation Rate	0.5 cm/yr	2 cm/yr	3 cm/yr
Time to Reach Steady State	Year 20	Year 5	Year 4[(1)]

Notes: (1) – The model runs in 1-year increments and, therefore, does not reach steady-state until Year 4, at which point a total of 12 cm has been deposited.

A discussion of the predicted results for each analyte modeled is included below.

5.4.2 Arsenic

The predicted arsenic concentrations in the receiving basin sediment for the three model cases are presented on Figure 15 and Table 12. The baseline SWAC is 10.7 mg/kg and, for all three model cases, the predicted sediment concentration (9 to 14 mg/kg) remains well below the ROD RAL of 57 mg/kg.

In the base-case and less-conservative models, the predicted sediment concentrations (10 and 9 mg/kg, respectively) are nearly equal to the upstream river concentration due to the limited contribution from the upland Site lateral source (Table A). In the more-conservative model, the predicted concentration of arsenic in sediment rises above the upstream river concentration due to the conservatively high estimate of the lateral mass flux and concentration of arsenic from the upland Site (Figure 15).

However, the predicted sediment concentration in the more-conservative case of 14 mg/kg is still well below the ROD RAL of 57 mg/kg. Additionally, it should be noted that resultant concentration from the base case (10 mg/kg) once the model reaches a steady-state condition at Year 5 closely reflects the current SWAC of arsenic in the receiving basin (10.7 mg/kg).

5.4.3 Copper

The predicted copper concentrations in the receiving basin sediment for the three model cases are presented on Figure 16 and Table 12. The baseline SWAC is 39 mg/kg and, for all three model cases, the predicted sediment concentration (38 to 183 mg/kg) remains below the LDW ROD RAL of 780 mg/kg.

Similar to the results for arsenic, in the base-case and less-conservative models, the predicted sediment concentrations (49 and 38 mg/kg, respectively) are nearly equal to the upstream river concentration (46 and 37 mg/kg, respectively) due to the limited contribution from the upland Site lateral source in these scenarios (Table A). In the more-conservative model, the concentration of copper in sediment rises above the upstream river concentration due to the conservatively high estimate of lateral mass flux and concentration of copper from the upland Site (Figure 16). This more-conservative model still predicts a copper concentration (183 mg/kg) in sediment well below the LDW ROD RAL.

Both the base-case and less-conservative models predict copper concentrations in sediment (49 and 38 mg/kg, respectively) once the models reach a steady state at Years 5 and 3, respectively, that are nearly equivalent to the current SWAC for copper in the receiving basin (39 mg/kg).

5.4.4 Zinc

The predicted zinc concentrations in the receiving basin sediment for the three model cases are presented on Figure 17 and Table 12. The baseline SWAC is 77 mg/kg and, for all three model cases, the predicted sediment concentration (179 to 543 mg/kg) remains below the LDW ROD RAL of 820 mg/kg.

Similar to the results for the other two metals, in the base-case and less-conservative models, the predicted sediment concentrations (230 and 180 mg/kg, respectively) are nearly equal to the upstream river concentration due to the limited contribution from the upland Site lateral source in these scenarios (Table A). In the more-conservative model, the predicted concentration of zinc in sediment rises above the upstream river concentration due to the conservatively high estimate of lateral mass flux and concentration of zinc from the upland Site (Figure 17). This more-conservative model still predicts a zinc concentration (543 mg/kg) in sediment below the LDW ROD RAL.

Unlike the other two metals, however, in both the base-case and less-conservative models, the predicted zinc concentrations in sediment (230 and 179 mg/kg, respectively) once the models reach steady-state at Years 3 and 5, respectively, are above the current SWAC of zinc in the receiving basin (77 mg/kg). The upstream river solids concentrations in these two models are approximately 2 to 3 times the current SWAC.

5.4.5 2-Methylnaphthalene

The predicted 2-methylnaphthalene concentrations in the receiving basin sediment for the three model cases are presented on Figure 18 and Table 12. The baseline SWAC is 0.010 mg/kg dw and, for all three model cases, the predicted sediment concentration (0.012 to 0.087 mg/kg dw) is below the dry-weight-equivalent ROD RAL of 1.34 mg/kg dw.

In the base-case and less-conservative models, the predicted sediment concentration (0.019 and 0.012 mg/kg dw, respectively) is nearly equal to the upstream river concentration due to the limited contribution from the upland Site lateral source (Table A). In the more- conservative model, the predicted concentration of 2-methylnaphthalene in sediment rises above the upstream river concentration due to the conservatively high estimate of lateral mass flux and concentration of 2-methylnaphthalene from the upland Site (Figure 18). This more-conservative model still predicts a 2-methylnaphthalene concentration in sediment below the LDW ROD RAL.

All three models predicted 2-methylnaphthalene concentrations in sediment above the current SWAC in the receiving basin sediments. However, it should be noted that 2-methylnaphthalene was not detected in four of the six samples of marina basin sediment and, therefore, one-half of the reporting limit value for these samples was used to calculate the SWAC.

5.4.6 Dimethyl Phthalate

The predicted dimethyl phthalate concentrations in receiving basin sediment for the three model cases are presented on Figure 19 and Table 12. The baseline SWAC is 0.010 mg/kg dw and, for all the base-case and less-conservative models, the predicted sediment concentration remains below the dry-weight-equivalent LDW ROD RAL of 0.142 mg/kg dw. In these two cases, the predicted sediment concentration (0.041 and 0.018 mg/kg dw, respectively) is nearly equal to the upstream river concentration due to the limited contribution from the upland Site lateral source (Table A) in these scenarios.

In the more-conservative model, the concentration of dimethyl phthalate in sediment is predicted to be 4.3 mg/kg, which exceeds the LDW ROD RAL of 0.142 mg/kg dw by an order of magnitude (Figure 19, Table 12). This predicted concentration is due to the significant difference in the 90th percentile lateral source concentration as compared to the median and 25th percentile concentrations for the lateral, upland Site sources (Table 10). Primarily, the 90th percentile of the lateral concentration source is driven by the estimated whole-water suspended solids concentrations, which are 2 to 3 orders of magnitude greater than the measured concentrations in CB solids and 3 orders of magnitude greater than the maximum detection in surface soils. The relatively higher concentrations in the estimated whole-water suspended solids concentrations are due to the higher solubility of dimethyl phthalate; a significant portion of dimethyl phthalate in stormwater is likely in the dissolved-phase, and therefore the whole-water estimate significantly overestimates the mass on the solids.

All three models predicted dimethyl phthalate concentrations in sediment above the current SWAC in the receiving basin sediments. However, it should be noted that dimethyl phthalate was not detected in any of the six samples in the marina basin sediments and, therefore, one-half of the reporting limit value for these samples was used to calculate the SWAC. Additionally, dimethyl phthalate was not detected in four of the six upstream river samples, and one-half of the reporting limit was used for these samples as well. Therefore, the predicted concentration for all three model cases continues to rise even in the absence of detected concentrations in the current bed sediment and upstream river sources.

While the more-conservative model predicts a concentration of dimethyl phthalate in sediment that exceeds the LDW ROD RAL, these results must be taken in the context of the empirical data for both the CB solids and receiving sediment and dimethyl phthalate's fate/transport characteristics:

- The measured CB solids concentrations are significantly lower than the calculated whole-water suspended solids concentrations. Dimethyl phthalate has a high solubility and low partition coefficient for solids; in fact, it had the lowest octanol-water partition coefficient[24] of eight phthalates measured by EPA (1996). Because of its low affinity to sorb to solids, it is likely that the majority of the mass in the whole-water data is in the dissolved phase, and the suspended solids concentration estimated from the whole-water TSS approach is overly conservative.
- Most importantly, dimethyl phthalate was not detected in eight of the ten marina basin sediment samples analyzed. In the remaining two samples, dimethyl phthalate was detected at 1.0 and 0.76 mg/kg (OC-normalized) as compared to the LDW ROD RAL of 106 mg/kg (OC-normalized; Table 2).

Given the weight of evidence, the more-conservative model is considered overly conservative for this LDW COC. The base-case model, which uses the median value for the lateral concentration from the upland Site and ignores the outliers in the calculated whole-water suspended solids concentrations, is considered more representative of the

[24] Surface sediment concentrations were weighted by the spatial area represented by a sample. Interpolations were conducted using Theissen polygons for the newer data and inverse distance weighting (IDW) for the data represented in the LDW FS/ROD. The area-weighted concentration values were then summed and divided by the total area of the pre-defined domain (marina basin) to calculate the SWAC. Theissen polygons are an empirically based interpolation method that preserves analytical values but is not weighted by sample concentrations. IDW is weighted by the magnitude of the sample concentration, surrounding samples, and river flow direction; it was calibrated during the FS.

changes in sediment concentration over time in the receiving marina basin and does not predict an exceedance in surface sediment of the LDW ROD RALs.

5.4.7 Total PCBs

The predicted total PCBs concentration in receiving basin sediment for the three model cases are presented on Figure 20 and Table 12. The baseline SWAC is 0.068 mg/kg dw and, for all three model cases, the predicted sediment concentration (0.006 to 0.075 mg/kg dw) remains below the ROD RAL of 0.13 mg/kg dw.

In both the base-case and the less-conservative models, the predicted sediment concentration (0.020 and 0.006 mg/kg, respectively) is nearly equal to the upstream river concentration due to the limited contribution from the upland Site lateral source (Table A) in these scenarios. In the more-conservative model, the concentration of total PCBs in sediment rises above the upstream river concentration due to the conservatively high estimate of lateral mass flux and concentration of total PCBs from the upland Site (Figure 20). The more-conservative model still predicts a concentration in surface sediment below the LDW ROD RAL.

In the base-case and less-conservative models, the concentration of PCBs in the receiving basin sediment decreases over time from the current SWAC as the sediment bed composition is dominated by lower-concentration upstream river sediments. In the more-conservative model, the concentration of total PCBs in the receiving basin sediment increases above the current SWAC, but the predicted concentration remains below the LDW ROD RAL.

It should be noted that, in this more-conservative model case, the 90th percentile concentration is driven by a single CB solids sample and two calculated whole-water suspended solids estimated from samples collected from the StormwateRx™ pretreatment vault. In reality, solids accumulated in the pretreatment vault never discharge to the LDW, and the StormwateRx™ system, while not specifically designed to remove PCBs, does achieve reductions in whole-water total PCBs concentrations as indicated in Table 5. Likewise, it should be noted that the majority of stormwater runoff from the Site discharges to the SPM Outfall or OF-2215 and does not pass through the StormwateRx™ system.

Even with the layers of conservativism built into the more-conservative model case, it still predicts remaining PCB concentrations below the LDW ROD RAL in the receiving sediments of the marina basin.

5.4.8 Uncertainty Analysis

The predictive model indicates that discharge of Site stormwater will not recontaminate surface sediment above the ROD RALs, and, as such, generally corroborates the existing sediment quality data for the marina basin. However, the uncertainty associated with the results, and limitations in the model and the data set, particularly the CB data, must be acknowledged.

The predictive model used is a highly simplistic mass-mixing model that does not account for the complex hydrodynamics of stormwater outfalls discharging into the tidally influenced LDW, nor does it consider sediment resuspension and deposition processes occurring within the LDW. The model also does not account for effects from the other (City of Seattle) storm drain that discharges immediately upstream of the marina basin. Climate change is another potential uncertainty not considered in the model (e.g., sea level rise, erosive forces on the riverbank); however, within the near-term horizon of this source control review, climate change is expected to have negligible effect on Site conditions and thus on the model predictions.

The modeling also includes conservative assumptions, including assuming that all contaminant mass in both dissolved and particulate phases in Site stormwater is deposited and 100 percent conserved within the marina basin sediment bed. The predicted contaminant concentrations on the stormwater suspended solids fraction (using the simplistic TSS calculation methodology) far exceeded concentrations detected in either CB solids or surface soils anywhere on Site, by orders of magnitude for some COCs (Table 10), which suggests the conservatism in this overall approach. Using data from samples of only untreated stormwater for the southern catchment area as inputs to the model provides an additional measure of conservatism to the assessment.

Ultimately, the cleanup remedy designated in the LDW ROD for the marina basin is monitored natural recovery area and no change to its “predicted to recover” designation was made in the most recent evaluation conducted 5 years after the ROD (Integral, 2019). Indeed, total PCB SWACs for marina basin surface sediments have decreased since the FS/ROD (see inset Table B), providing further empirical evidence of natural recovery (and lack of recontamination).

Table B. Comparison of pre-2012 and post-2012 PCB SWACs in Marina Basin

Dataset	Total PCB SWAC (mg/kg dw)	Notes / Interpolation Method
2014-2021 (current)	0.068	SWAC calculated using Thiessen polygons and the 2014-2021 data included in Table 2.
Pre-2012 (FS/ROD)	0.152	From BCM Workbook Time=0 and inverse-distance area-weighted interpolation map (see Figure 21) filtered for 10-ft grid cells only located in the marina basin (Fitzpatrick, 2021)

Notes: BCM = bed composition model; IDW = inverse distance weighting

Note that the 2014-2021 total PCB SWAC represents a different data set than the SWAC used for the model’s C_{bed} concentration at time zero, which incorporates data back to 2003.

Figure 21 reproduces the pre-2012 empirical and interpolated total PCB concentrations for LDW surface sediments as presented in Appendix A of the LDW FS (AECOM, 2012). The approximate boundary of the marina basin is annotated as a red polygon on that figure for reference. For purposes of this source control review, the City’s consultant Geosyntec calculated the total PCB concentrations for the marina basin based on the interpolated concentrations[25] shown on Figure 21 (Fitzpatrick, 2021). Those concentrations were the starting concentrations (Time = 0) for running the BCM in support of the LDW FS.

Based on that pre-2012 SWAC[26] of 0.152 mg/kg dw, total PCB concentrations have decreased by more than 50 percent (2014 to 2021 SWAC of 0.068 mg/kg dw). Some of this concentration reduction may be due to early source control actions from the adjacent T-117 and marina corner cleanup. Nonetheless, this comparison corroborates both the Integral (2019) conclusion that the marina basin is predicted to recover, as well as the results of modeling for this source control review that indicate the Site does not present a risk of recontaminating LDW sediments above LDW ROD RALs. That conclusion is also consistent with Ecology's prior sediment recontamination assessment for the Site, which concluded "…COC loading from SPM [South Park Marina] is not expected to cause any future SMS exceedances at any locations on either SPM or T-117 that have undergone cleanup" (SAIC, 2009).

In conclusion, the predictive modeling is a supporting line of evidence secondary to the empirical sediment data and, with the conservatism it includes, is considered suitable for use in this source control review.

[25] The interpolated concentrations on Figure 21 are binned into concentration ranges for presentation purposes, but individual interpolated concentration values are available for each 10-foot by 10-foot grid cell used in the BCM.

[26] Because the concentrations are from a uniform grid, each value is weighted equally for the SWAC calculation.

6 Conclusions and Recommendations

Based on this source control review, we conclude that the Site does not present a risk of recontaminating LDW surface sediments above LDW ROD RALs for the near-term timeframe identified in Ecology (2016). Therefore, based on the current data and analysis conducted, it is our opinion that an interim action is not required to achieve source control sufficiency prior to beginning active remediation of the LDW sediments—one of the goals defined in Ecology's Source Control Strategy (Ecology, 2016). Additional data collected during the RI will be discussed in the context of this conclusion.

As outlined in Section 2.2, the primary line of evidence for determining source control sufficiency is the empirical data for the marina basin sediment that is the receiving body of sediment for discharge of COCs via any of the three recontamination pathways discussed above. The LDW ROD identifies monitored natural recovery as the cleanup remedy for the marina basin portion of the LDW. Based on sediment data collected between 2011 and 2020, concentrations of LDW COCs in marina basin sediment are less than the LDW ROD RALs with the exception of PCBs and benzyl alcohol in a small area located at the base of the intertidal bank on the Site's southeast corner.

As a secondary line of evidence, the results of the assessment conducted for each recontamination pathway are as follows:

- Pathway 1, groundwater discharge, does not appear to pose a risk of sediment recontamination based on the empirical data from shoreline wells indicating no COC concentrations exceeding conservative GW-3 screening levels (protection of sediment). The upland data likely overstate COC concentrations reaching the sediment bioactive zone, providing a high level of confidence in the conclusion.
- Pathway 2, discharge of upland soils via the storm drain system, does not pose a risk of sediment recontamination based on conservative predictive modeling. representative of site conditions.
- Pathway 3, discharge of eroded soil, is adequately controlled by the marina's existing block wall along the shoreline that both prevents erosion of riverbank soils and prevents soil entrained in overland flow of stormwater from reaching the LDW.

No data gaps were identified with respect to completion of this source control review for the near-term timeframe. The Phase 1 data collection program established in the Ecology-approved Site RI Work Plan was intended to provide sufficient information to evaluate source control and determine if any areas of the site might require interim actions to mitigate ongoing sources to the LDW prior to start of the in-water cleanup. Those data in combination with prior data collected at the Site are deemed sufficient to evaluate each of three recontamination pathways identified in the AO, as presented in Sections 4.1, 4.2, and 4.3, and to also complete predictive modeling as presented in Section 5. However, we acknowledge that some assumptions had to be made in the analysis because of data limitations (these could be considered data gaps for the RI):

- Limited shoreline groundwater data for some analytes because of limited groundwater volume in the Fill Unit along the shoreline at low tide stages

- Historical groundwater samples from Alluvial Unit wells had elevated PAH and PCB detection limits; no Alluvial wells were installed during the RI Phase 1
- Limited dioxin/furan data (no modeling conducted)

Although we believe that the source control investigation demonstrates that an interim action is not required to achieve source control for the near-term timeframe, we recommend that SPM inspect and maintain the shoreline block wall and the sheet pile wall, continue conducting boatyard BMPs in accordance with the Site stormwater pollution prevention plan (SWPPP), and continue monitoring and maintenance of the StormwateRx™ system in accordance with the Site NPDES permit, to continue achieving source control for the Site.

In addition, supplemental data will be collected during Phase 2 of the Site RI and for remedial design of the LDW sediment cleanup action. The information available at the conclusion of the RI Phase 2 data collection will be incorporated into an update to this source control review. The source control update will be focused on discharge of PCBs from the southern catchment area by the three recontamination pathways, given the PCB sediment exceedances in the southwest portion of the marina basin. Once the RI Phase 2 data are obtained and analyzed, the PLP Group will coordinate with Ecology regarding whether the source control update should be provided as an addendum to this source control review memorandum or as a component of the Site RI.

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8 Limitations

Work for this project was performed for the Port of Seattle, City of Seattle, and South Park Marina (collectively the Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

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TABLES

Table 1. Available Surface Sediment Sampling Locations within Marina Basin

Project No. 190293, Seattle, Washington

Year	Study	EIM Study Name	Sample ID(s)	Used in Evaluation?	Rationale
1990	Duwamish River Maintenance Dredge, Phase 1	DUWO&M90	DU9004X	Excluded	Greater than 20 years old; removed during maintenance dredging
			DU9005X	Excluded	Greater than 20 years old; removed during maintenance dredging
1991	Duwamish River Maintenance Dredge, Phase 2	DUWO&M91	DU9215XX	Excluded	Greater than 20 years old; removed during maintenance dredging
1991	South Park Marina Maintenance Dredge, Phase 1	SOPARK91	SPRK0101	Excluded	Greater than 20 years old; removed during maintenance dredging
1997	NOAA LDW Sediment Characterization	NOAA97	WST322	Excluded	Greater than 20 years old
			WST323	Excluded	Greater than 20 years old; removed during T-117 EAA Dredging
			CH0017	Excluded	Greater than 20 years old; in navigation channel
1998	LDW Site Inspection	LODRIV98	DR205	Excluded	Greater than 20 years old
			DR227	Excluded	Greater than 20 years old
			DR228	Excluded	Greater than 20 years old
			DR234	Excluded	Greater than 20 years old; in navigation channel
1998	USACE Duwamish Maintenance Dredge	DUWA98	S1	Excluded	Greater than 20 years old; removed during maintenance dredging
2003	LDW Source Control, T-117 EAA Non-Time Critical Removal Action	G0800557	SE-08-G	Excluded	Removed during T-117 EAA Dredging
			SE-07-G	Yes	Existing, outside marina basin but to be used for creating Thiessen polygons
			SE-10-G	Excluded	Removed during T-117 EAA Dredging
2004	LDW Source Control, T-117 EAA Non-Time Critical Removal Action	G0800557	SE-73-G	Yes	Existing, within marina basin
			SE-74-G	Yes	Existing, within marina basin
			SE-76-G	Excluded	Removed during T-117 EAA Dredging; outside of marina basin
			SE-84-G	Excluded	Removed as part of the T-117 Marina Bank Removal Area
			SE-85-G	Excluded	Removed during T-117 EAA Dredging
			SE-89-G	Excluded	Removed during T-117 EAA Dredging in DU3
			SE-91-G	Excluded	Removed during T-117 EAA Dredging; outside of marina basin
2005	LDW RI - Surface Sediment Round 2	LDWRRUN2	SS108	Excluded	Superseded by more recent result within 10 feet at location SS-130
2008	SAIC - SPM Site Investigation	AODE16185	TRANS-A-SED	Excluded	Removed as part of the T-117 Marina Bank Removal Area
			TRANS-B-SED	Excluded	Removed as part of the T-117 Additional Marina Bank Removal Area
2008	LDW Source Control, T-117 EAA Non-Time Critical Removal Action	G0800557	98-G	Yes	Existing, within marina basin
			99-G	Excluded	Removed as part of the T-117 Additional Marina Bank Removal Area
			100-G	Excluded	Removed as part of the T-117 Additional Marina Bank Removal Area
			101-G	Excluded	Removed as part of the T-117 Additional Marina Bank Removal Area
			102-G	Excluded	Removed as part of the T-117 Additional Marina Bank Removal Area
2011	Surface Sediment Sampling at Outfalls in the LDW	LDWOFSS	LDW-SS2214-A	Yes	Existing, within marina basin
			LDW-SS2214-D	Yes	Existing, within marina basin
			LDW-SS2214-U	Excluded	Removed during T-117 EAA Dredging in DU3
2013	T-117 EAA Removal Action 2013-2014	T117CA14	PERIM-5-PRE	Excluded	Superseded by more recent result within 10 feet at location PERIM-5-LTM
2014	T-117 EAA Removal Action 2013-2014	T117CA14	SG-07-R2	Excluded	Confirmation sample subsequently buried by clean backfill; outside marina basin
			SG-08-R2	Excluded	Confirmation sample subsequently buried by clean backfill; outside marina basin
			SG-24-R2	Excluded	Confirmation sample subsequently buried by clean backfill; outside marina basin
			PERIM-5-POST	Partially	PCB, PAH, and arsenic data superseded by more recent data within 10 feet at PERIM-5-LT
2014	T-117 DU3 Sheen Memo	N/A	Marina Bank-140306	Excluded	6-point soil composite sample; subsequently buried
			Marina Bank-140317	Excluded	6-point soil composite sample; subsequently buried
2015	Boeing Plant 2 Completion Report	N/A	SD-PER301	Excluded	In navigation channel outside of marina basin
			SD-PER302	Excluded	In navigation channel outside of marina basin
			SD-PER303	Yes	Existing, within marina basin
			SD-PER304	Excluded	In navigation channel outside of marina basin
			SD-PER305	Yes	Existing, within marina basin
			SD-PER306	Excluded	In navigation channel outside of marina basin
			SD-PER307	Yes	Existing, outside marina basin but to be used for creating Thiessen polygons
			SD-PER312	Yes	Existing, within marina basin
			SD-PER313	Yes	Existing, within marina basin
2015	T-117 Outfall Pre-Construction Sediment Sampling	LDWT117OF PreConSed	SG-A1-PreCon	Excluded	Superseded by more recent result within 10 feet at SG-A1-PostCon
			SG-A2-PreCon	Excluded	Superseded by more recent result within 10 feet at SG-A2-PostCon
			SG-A3-PreCon	Excluded	Superseded by more recent result within 10 feet at SG-A3-PostCon
			SG-B1-PreCon	Excluded	Superseded by more recent result within 10 feet at SG-B1-PostCon
			SG-B2-PreCon	Excluded	Superseded by more recent result within 10 feet at SG-B2-PostCon
			SG-B3-PreCon	Excluded	Superseded by more recent result within 10 feet at SG-B3-PostCon
			SG-C1-PreCon	Excluded	Superseded by more recent result within 10 feet at SG-C1-PostCon
			SG-C2-PreCon	Excluded	Superseded by more recent result within 10 feet at SG-C2-PostCon
			SG-C3-PreCon	Excluded	Superseded by more recent result within 10 feet at SG-C3-PostCon
2015	T-117 Outfall Post-Construction Sediment Sampling	LDWT117OF PostConSed	SG-A1-PostCon	Excluded	Superseded by more recent result within 10 feet at SG-A1-PreOp
			SG-A2-PostCon	Excluded	Superseded by more recent result within 10 feet at SG-A2-PreOp
			SG-A3-PostCon	Excluded	Superseded by more recent result within 10 feet at SG-A3-PreOp
			SG-B1-PostCon	Excluded	Superseded by more recent result within 10 feet at SG-B1-PreOp
			SG-B2-PostCon	Excluded	Superseded by more recent result within 10 feet at SG-B2-PreOp
			SG-B3-PostCon	Excluded	Superseded by more recent result within 10 feet at SG-B3-PreOp
			SG-C1-PostCon	Excluded	Superseded by more recent result within 10 feet at SG-C1-PreOp
			SG-C2-PostCon	Excluded	Superseded by more recent result within 10 feet at SG-C2-PreOp
			SG-C3-PostCon	Excluded	Superseded by more recent result within 10 feet at SG-C3-PreOp
2016	T-117 Outfall Pre-Operational Sediment Sampling	LDWT117OF PreOpSed	SG-A1-PreOp	Yes	Existing, outside marina basin but to be used for creating Thiessen polygons
			SG-A2-PreOp	Yes	Existing, outside marina basin but to be used for creating Thiessen polygons
			SG-A3-PreOp	Yes	Existing, outside marina basin but to be used for creating Thiessen polygons
			SG-B1-PreOp	Yes	Existing, within marina basin
			SG-B2-PreOp	Yes	Existing, within marina basin
			SG-B3-PreOp	Yes	Existing, within marina basin
			SG-C1-PreOp	Yes	Existing, within marina basin
			SG-C2-PreOp	Yes	Existing, within marina basin
			SG-C3-PreOp	Yes	Existing, within marina basin
2016	TIG - SPM Site Investigation	AODE16185	SC-01	Yes	Existing, within marina basin
			SC-02	Yes	Existing, within marina basin
			SC-03	Yes	Existing, within marina basin
			SC-04	Yes	Existing, within marina basin
			SC-05	Yes	Existing, within marina basin
			SC-06	Yes	Existing, within marina basin
			SC-07	Yes	Existing, within marina basin
			SC-08	Yes	Existing, within marina basin
			SC-09	Yes	Existing, within marina basin
			SC-10	Yes	Existing, within marina basin
			SC-11	Yes	Existing, within marina basin
			SC-12	Yes	Existing, within marina basin
			SC-13	Yes	Existing, within marina basin
			SC-14	Yes	Existing, within marina basin
			SC-15	Yes	Existing, within marina basin
			SC-16	Yes	Existing, within marina basin
2018	LDW - AOC Amendment 3	LDWAOC3	SS-130	Yes	Existing, within marina basin
2020	LDW Pre-Design Investigation Phase 1	N/A	SS154	Yes	Existing, within marina basin
			SS158	Yes	Existing, within marina basin
			SS159	Yes	Existing, within marina basin
			SS164	Yes	Existing, within marina basin
			SS167	Yes	Existing, within marina basin
			SS168	Yes	Existing, within marina basin
			SS169	Yes	Existing, within marina basin
2021	LDW Pre-Design Investigation Phase 2	N/A	SS559	Yes	Existing, within marina basin
2021	T-117 EAA Year 6 Sediment Monitoring	N/A	PERIM-5-LTM	Yes	Existing, within marina basin

Table 2. 0-10 cm Sediment Analytical Data within Marina Basin Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

		Data Year and Source(1)	2003 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action	2004 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action		2008 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action	2011 - Surface Sediment Sampling at Outfalls in the LDW	
		Location	SE-07-G	SE-73-G	SE-74-G	98-G	LDW-SS2214-A	LDW-SS2214-D
		Date	12/08/2003	03/16/2004	03/16/2004	08/29/2008	03/07/2011	03/07/2011
		Sample ID	T117-SE07-SG	T117-SE73-SG	T117-SE74-SG	T117-98-SG	LDW-SS2214-A	LDW-SS2214-D
		Depth	NR	NR	NR	0 - 0.2 ft	NR	NR
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)						
Metals								
Arsenic	mg/kg	57	--	--	--	--	**20**	**20**
Cadmium	mg/kg	10.2	--	--	--	--	**0.6**	**0.5**
Chromium	mg/kg	520	--	--	--	--	**34**	**34**
Copper	mg/kg	780	--	--	--	--	**66.7**	**67.2**
Lead	mg/kg	900	--	--	--	--	**22**	**22**
Mercury	mg/kg	0.82	--	--	--	**0.14**	**0.11**	**0.12**
Silver	mg/kg	12.2	--	--	--	--	0.8 U	0.7 U
Zinc	mg/kg	820	--	--	--	--	**119**	**115**
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	mg/kg-OC		0.63 U	0.63 U	0.74 U	1.05 U	1.44 U	1.10 U
Aroclor 1221	mg/kg-OC		0.63 U	0.63 U	0.74 U	1.05 U	1.44 U	1.10 U
Aroclor 1232	mg/kg-OC		0.63 U	0.63 U	0.74 U	1.05 U	1.44 U	1.10 U
Aroclor 1242	mg/kg-OC		0.63 U	0.63 U	0.74 U	1.05 U	1.44 U	1.10 U
Aroclor 1248	mg/kg-OC		0.63 U	**0.66 J**	0.74 U	1.05 U	1.44 U	1.10 U
Aroclor 1254	mg/kg-OC		**1.03**	**2.25**	**1.52**	**2.09**	3.63 U	3.37 U
Aroclor 1260	mg/kg-OC		**1.69**	**5.31**	**3.04**	**4.08**	**10.74**	**8.71**
Aroclor 1262	mg/kg-OC		--	--	--	1.05 U	--	--
Aroclor 1268	mg/kg-OC		--	--	--	1.05 U	--	--
Total PCB Aroclors(2)	mg/kg-OC	12	**2.72 A**	**8.22 AJ**	**4.56 A**	**6.2**	**10.74 A**	**8.71 A**
Total PCB Congeners(3)	mg/kg-OC	12	--	--	--	--	--	--
Dioxins/Furans								
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)								
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	**0.37 J**	0.53 U
Acenaphthene	mg/kg-OC	32	--	--	--	--	0.70 U	**0.34 J**
Anthracene	mg/kg-OC	440	--	--	--	--	**0.96**	**1.0**
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	**2.6**	**2.1**
Fluoranthene	mg/kg-OC	320	--	--	--	--	**10**	**7.6**
Fluorene	mg/kg-OC	46	--	--	--	--	**0.48 J**	**0.51 J**
Naphthalene	mg/kg-OC	198	--	--	--	--	**0.52 J**	**0.39 J**
Phenanthrene	mg/kg-OC	200	--	--	--	--	**3.1**	**3.4**
Pyrene	mg/kg-OC	2000	--	--	--	--	**7.8**	**5.9**
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	**3**	**2.8**
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	**3.1**	**2.6**
Chrysene	mg/kg-OC	220	--	--	--	--	**6.3**	**4.5**
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	**0.78**	**0.67**
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	**2.1**	**1.8**
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--
Total LPAHs(5) (ND = 1/2 RDL(4))	mg/kg-OC	740	--	--	--	--	**5.8 J**	**5.9 J**
Total HPAHs(6) (ND = 1/2 RDL(4))	mg/kg-OC	1,920	--	--	--	--	**44**	**34**
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	1	--	--	--	--	**0.126**	**0.138**
Semivolatile Organic Compounds								
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	0.18 U	0.13 U
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	0.18 U	0.13 U
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	0.18 U	0.13 U
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	**0.89 J**	**1.3 J**
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	**6.3**	**3.9**
Dibenzofuran	mg/kg-OC	30	--	--	--	--	**0.56 J**	**0.39 J**
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	**1**	**0.76**
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	0.18 U	0.13 U
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	0.18 U	0.13 U
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	0.0048 U	0.0048 U
4-Methylphenol	mg/kg	1.34	--	--	--	--	**0.16**	**0.4**
Benzoic acid	mg/kg	1.3	--	--	--	--	**0.48**	**0.49**
Benzyl alcohol	mg/kg	0.114	--	--	--	--	**0.28 J**	**0.28 J**
Pentachlorophenol	mg/kg	0.72	--	--	--	--	**0.015 J**	0.024 U
Phenol	mg/kg	0.84	--	--	--	--	**0.048**	**0.079**
Conventionals								
Total Organic Carbon	%		**3.20**	**3.20**	**2.70**	**1.91**	**2.70**	**3.56**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters

mg/kg = milligrams per kilogram - dry weight

mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).

ng/kg = nanograms per kilogram

% = percent

NR = sample depth not reported in Ecology's Environmental Information Management database.

TEQ = total toxicity equivalence

Bold = Analyte detected

Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.

-- = sample not analyzed

A - Incomplete number of Aroclors used in summation

J - Result value estimated

U - Analyte not detected at or above the reporting limit shown

Table 2. 0-10 cm Sediment Analytical Data within Marina Basin Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

		Data Year and Source[1]	2014 - T-117 EAA Removal Action 2013-2014	2015 - Boeing Plant 2 Completion Report				
		Location	PERIM-5-POST	SD-PER303	SD-PER305	SD-PER307	SD-PER312	SD-PER313
		Date	05/12/2014	02/26/2015	02/27/2015	03/09/2015	02/26/2015	02/27/2015
		Sample ID	SG-PERIM-5-POST	SD-PER303-0315	SD-PER305-0315	SD-PER307-0315	SD-PER312-0315	SD-PER313-0315
		Depth	NR	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)						
Metals								
Arsenic	mg/kg	57	**4.26**	**8.3**	**8**	**7.8**	**11.4**	**9.1**
Cadmium	mg/kg	10.2	1 U	**0.5**	**0.4**	**0.4**	**0.6**	**0.5**
Chromium	mg/kg	520	**12.7 J**	**26.3**	**24.9**	**24**	**30**	**27.5**
Copper	mg/kg	780	**21.8**	**32.6**	**31**	**28.8**	**42.1**	**36.2**
Lead	mg/kg	900	**7.02**	**12**	**11**	**9**	**15**	**12**
Mercury	mg/kg	0.82	**0.071**	**0.06**	**0.06**	**0.09**	**0.1**	**0.14**
Silver	mg/kg	12.2	1 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U
Zinc	mg/kg	820	**39.7**	**75**	**69**	**63**	**87**	**75**
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	mg/kg-OC		0.29 UJ	0.17 U	0.23 U	0.11 U	0.21 U	0.17 U
Aroclor 1221	mg/kg-OC		0.29 U	0.17 U	0.23 U	0.11 U	0.21 U	0.17 U
Aroclor 1232	mg/kg-OC		0.29 U	0.17 U	0.23 U	0.11 U	0.21 U	0.17 U
Aroclor 1242	mg/kg-OC		0.29 U	0.17 U	0.23 U	0.11 U	0.21 U	0.17 U
Aroclor 1248	mg/kg-OC		0.29 U	**1.07**	**1.48 J**	**0.45**	**1.4**	**0.82 J**
Aroclor 1254	mg/kg-OC		**1.45**	**1.87**	**2.54**	**0.76 J**	**2.75**	**1.33 J**
Aroclor 1260	mg/kg-OC		**1.16**	**1.29 J**	**2.07 J**	**0.42**	**2.49**	**0.82 J**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**2.61**	**4.24 AJ**	**6.09 AJ**	**1.64 AJ**	**6.63 A**	**2.96 AJ**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--
Dioxins/Furans								
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	**1.3 J**	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)								
2-Methylnaphthalene	mg/kg-OC	76	**0.4**	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	0.36 U	--	--	--	--	--
Anthracene	mg/kg-OC	440	**0.8**	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	**1.09**	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	**3.26**	--	--	--	--	--
Fluorene	mg/kg-OC	46	**0.39**	--	--	--	--	--
Naphthalene	mg/kg-OC	198	0.36 U	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	**2.03**	--	--	--	--	--
Pyrene	mg/kg-OC	2000	**3.12**	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	**1.16**	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	**1.16**	--	--	--	--	--
Chrysene	mg/kg-OC	220	**1.88**	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	0.36 U	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	**1.01**	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	**2.61**	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	**3.8**	--	--	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1,920	**15**	--	--	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	**0.023**	--	--	--	--	--
Semivolatile Organic Compounds								
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	0.14 U	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	0.14 U	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	0.14 U	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	0.72 UJ	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	**8.7 J**	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	**0.37**	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	0.72 U	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	0.14 U	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	0.14 U	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	0.01 U	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	0.1 U	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	0.02 U	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	0.01 U	--	--	--	--	--
Phenol	mg/kg	0.84	0.002 U	--	--	--	--	--
Conventionals								
Total Organic Carbon	%		**1.38**	**2.24 J**	**1.69**	**3.53**	**1.93 J**	**2.33**

Notes:

(1) - Refer to Table 1.
(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any Aroclor.
(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.
(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.
(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.
(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters
mg/kg = milligrams per kilogram - dry weight

mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).

ng/kg = nanograms per kilogram
% = percent

NR = sample depth not reported in Ecology's Environmental Information Management database.

TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in summation
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table 2. 0-10 cm Sediment Analytical Data within Marina Basin Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)	SG-A1-PREOP	SG-A2-PREOP	SG-A3-PREOP	SG-B1-PREOP	SG-B2-PREOP	SG-B3-PREOP
		Data Year and Source(1)	2016 - T-117 Outfall Pre-Operational Sediment Sampling					
		Location	SG-A1-PREOP	SG-A2-PREOP	SG-A3-PREOP	SG-B1-PREOP	SG-B2-PREOP	SG-B3-PREOP
		Date	07/12/2016	07/12/2016	07/12/2016	07/12/2016	07/12/2016	07/12/2016
		Sample ID	SD0127	SD0128	SD0129	SD0123	SD0122	SD0120
		Depth	NR	NR	NR	NR	NR	NR
Metals								
Arsenic	mg/kg	57	--	--	--	--	--	--
Cadmium	mg/kg	10.2	--	--	--	--	--	--
Chromium	mg/kg	520	--	--	--	--	--	--
Copper	mg/kg	780	--	--	--	--	--	--
Lead	mg/kg	900	--	--	--	--	--	--
Mercury	mg/kg	0.82	--	--	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--
Zinc	mg/kg	820	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	mg/kg-OC		0.05 U	0.06 U	0.07 U	0.05 U	0.05 U	0.04 U
Aroclor 1221	mg/kg-OC		0.05 U	0.06 U	0.07 U	0.05 U	0.05 U	0.04 U
Aroclor 1232	mg/kg-OC		0.05 U	0.06 U	0.07 U	0.05 U	0.05 U	0.04 U
Aroclor 1242	mg/kg-OC		0.05 U	0.06 U	0.07 U	0.05 U	0.05 U	0.04 U
Aroclor 1248	mg/kg-OC		**0.51**	**0.57**	**0.69**	**0.47**	**0.49**	**0.41**
Aroclor 1254	mg/kg-OC		**1.05**	**1.34 J**	**1.37**	**0.91**	**0.95**	**0.77**
Aroclor 1260	mg/kg-OC		**0.69 J**	**0.8 J**	**0.98 J**	**0.63 J**	**0.67 J**	**0.49 J**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--
Total PCB Aroclors(2)	mg/kg-OC	12	**2.24 AJ**	**2.72 AJ**	**3.04 AJ**	**2.02 AJ**	**2.12 AJ**	**1.68 AJ**
Total PCB Congeners(3)	mg/kg-OC	12	--	--	--	--	--	--
Dioxins/Furans								
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)								
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--
Total LPAHs(5) (ND = 1/2 RDL(4))	mg/kg-OC	740	--	--	--	--	--	--
Total HPAHs(6) (ND = 1/2 RDL(4))	mg/kg-OC	1,920	--	--	--	--	--	--
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	1	--	--	--	--	--	--
Semivolatile Organic Compounds								
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--
Conventionals								
Total Organic Carbon	%		**2.77**	**2.61**	**2.04**	**3.17**	**3.26**	**3.64**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters

mg/kg = milligrams per kilogram - dry weight

mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).

ng/kg = nanograms per kilogram

% = percent

NR = sample depth not reported in Ecology's Environmental Information Management database.

TEQ = total toxicity equivalence

Bold = Analyte detected

Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.

-- = sample not analyzed

A - Incomplete number of Aroclors used in summation

J - Result value estimated

U - Analyte not detected at or above the reporting limit shown

Table 2. 0-10 cm Sediment Analytical Data within Marina Basin Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

		Data Year and Source[1]	2016 - T-117 Outfall Pre-Operational Sediment Sampling			2016 - TIG - SPM Site Investigation		
		Location	SG-C1-PREOP	SG-C2-PREOP	SG-C3-PREOP	SC-01	SC-02	SC-03
		Date	07/12/2016	07/12/2016	07/12/2016	02/25/2016	02/24/2016	02/25/2016
		Sample ID	SD0126	SD0124	SD0125	SPM-SC-01-02252016-0-0.1	SPM-SC-02-02242016-0-0.1	SPM-SC-03-02252016-0-0.1
		Depth	NR	NR	NR	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	**Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)**						
Metals								
Arsenic	mg/kg	57	--	--	--	--	--	--
Cadmium	mg/kg	10.2	--	--	--	--	--	--
Chromium	mg/kg	520	--	--	--	--	--	--
Copper	mg/kg	780	--	--	--	--	--	--
Lead	mg/kg	900	--	--	--	--	--	--
Mercury	mg/kg	0.82	--	--	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--
Zinc	mg/kg	820	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	mg/kg-OC		0.09 U	0.07 U	0.06 U	0.3 U	0.38 U	0.33 UJ
Aroclor 1221	mg/kg-OC		0.09 U	0.07 U	0.06 U	0.3 U	0.38 U	0.33 U
Aroclor 1232	mg/kg-OC		0.09 U	0.07 U	0.06 U	0.3 U	0.38 U	0.33 U
Aroclor 1242	mg/kg-OC		0.09 U	0.07 U	0.06 U	0.3 U	0.38 U	0.33 U
Aroclor 1248	mg/kg-OC		**0.85**	**0.64**	**0.61**	**0.69**	**0.56**	**0.64**
Aroclor 1254	mg/kg-OC		**1.76**	**1.32**	**1.19**	0.3 U	0.38 U	0.33 U
Aroclor 1260	mg/kg-OC		**1.31 J**	**0.96 J**	**0.88 J**	**1.59**	**1.36**	**0.89 J**
Aroclor 1262	mg/kg-OC		--	--	--	0.3 U	0.38 U	0.33 U
Aroclor 1268	mg/kg-OC		--	--	--	0.3 U	0.38 U	0.33 U
Total PCB Aroclors[2]	mg/kg-OC	12	**3.92 AJ**	**2.92 AJ**	**2.68 AJ**	**2.28**	**1.92**	**1.54**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	**5.1 J**	**0.80 J**	**0.49 J**
Dioxins/Furans								
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)								
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	--	--	--	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1,920	--	--	--	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	--	--	--	--	--
Semivolatile Organic Compounds								
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--
Conventionals								
Total Organic Carbon	%		**1.76**	**2.19**	**2.61**	**1.32**	**2.13**	**1.23**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters

mg/kg = milligrams per kilogram - dry weight

mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).

ng/kg = nanograms per kilogram

% = percent

NR = sample depth not reported in Ecology's Environmental Information Management database.

TEQ = total toxicity equivalence

Bold = Analyte detected

Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.

-- = sample not analyzed

A - Incomplete number of Aroclors used in summation

J - Result value estimated

U - Analyte not detected at or above the reporting limit shown

Table 2. 0-10 cm Sediment Analytical Data within Marina Basin Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

		Data Year and Source[1]	2016 - TIG - SPM Site Investigation					
		Location	SC-04	SC-05	SC-06	SC-07	SC-08	SC-09
		Date	02/26/2016	02/25/2016	02/24/2016	02/25/2016	02/25/2016	02/26/2016
		Sample ID	SPM-SC-04-02262016-0-0.1	SPM-SC-05-02252016-0-0.1	SPM-SC-06-02242016-0-0.1	SPM-SC-07-02252016-0-0.1	SPM-SC-08-02252016-0-0.1	SPM-SC-09-02262016-0-0.1
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	**Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)**						
Metals								
Arsenic	mg/kg	57	--	--	--	--	--	--
Cadmium	mg/kg	10.2	--	--	--	--	--	--
Chromium	mg/kg	520	--	--	--	--	--	--
Copper	mg/kg	780	--	--	--	--	--	--
Lead	mg/kg	900	--	--	--	--	--	--
Mercury	mg/kg	0.82	--	--	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--
Zinc	mg/kg	820	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	mg/kg-OC		0.28 U	2.56 U	0.43 U	4.21 U	0.18 U	0.21 U
Aroclor 1221	mg/kg-OC		0.28 U	2.56 U	0.43 U	4.21 U	0.18 U	0.21 U
Aroclor 1232	mg/kg-OC		0.28 U	2.56 U	0.43 U	4.21 U	0.18 U	0.21 U
Aroclor 1242	mg/kg-OC		0.28 U	2.56 U	0.43 U	4.21 U	0.18 U	0.21 U
Aroclor 1248	mg/kg-OC		**0.48**	2.56 U	**0.7**	4.21 U	**0.21**	**0.49**
Aroclor 1254	mg/kg-OC		0.28 U	2.56 U	0.43 U	4.21 U	0.18 U	0.21 U
Aroclor 1260	mg/kg-OC		**1.03**	2.56 U	**4.3**	4.21 U	**0.26**	**1.45**
Aroclor 1262	mg/kg-OC		0.28 U	2.56 U	0.43 U	4.21 U	0.18 U	0.21 U
Aroclor 1268	mg/kg-OC		0.28 U	2.56 U	0.43 U	4.21 U	0.18 U	0.21 U
Total PCB Aroclors[2]	mg/kg-OC	12	**1.51**	2.56 U	**5**	4.21 U	**0.46**	**1.94**
Total PCB Congeners[3]	mg/kg-OC	12	**2.6 J**	**0.32 J**	**0.99 J**	**2.3 J**	**4.5 J**	**2.7**
Dioxins/Furans								
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)								
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	--	--	--	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1,920	--	--	--	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	--	--	--	--	--
Semivolatile Organic Compounds								
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--
Conventionals								
Total Organic Carbon	%		**1.45**	**1.56**	**1.86**	**1.90**	**2.18**	**1.93**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters

mg/kg = milligrams per kilogram - dry weight

mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).

ng/kg = nanograms per kilogram

% = percent

NR = sample depth not reported in Ecology's Environmental Information Management database.

TEQ = total toxicity equivalence

Bold = Analyte detected

Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.

-- = sample not analyzed

A - Incomplete number of Aroclors used in summation

J - Result value estimated

U - Analyte not detected at or above the reporting limit shown

Table 2. 0-10 cm Sediment Analytical Data within Marina Basin Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

		Data Year and Source(1)	2016 - TIG - SPM Site Investigation						
		Location	SC-10	SC-11	SC-12	SC-13	SC-14	SC-15	SC-16
		Date	02/24/2016	02/25/2016	02/26/2016	02/26/2016	02/25/2016	02/24/2016	02/26/2016
		Sample ID	SPM-SC-10-02242016-0-0.1	SPM-SC-11-02252016-0-0.1	SPM-SC-12-02262016-0-0.1	SPM-SC-13-02262016-0-0.1	SPM-SC-14-02252016-0-0.1	SPM-SC-15-02242016-0-0.1	SPM-SC-16-02262016-0-0.1
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	**Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)**							
Metals									
Arsenic	mg/kg	57	--	--	--	--	--	--	--
Cadmium	mg/kg	10.2	--	--	--	--	--	--	--
Chromium	mg/kg	520	--	--	--	--	--	--	--
Copper	mg/kg	780	--	--	--	--	--	--	--
Lead	mg/kg	900	--	--	--	--	--	--	--
Mercury	mg/kg	0.82	--	--	--	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--	--
Zinc	mg/kg	820	--	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)									
Aroclor 1016	mg/kg-OC		0.35 U	4.04 U	0.42 U	0.35 U	0.42 U	0.48 U	0.41 U
Aroclor 1221	mg/kg-OC		0.35 U	4.04 U	0.42 U	0.35 U	0.42 U	0.48 U	0.41 U
Aroclor 1232	mg/kg-OC		0.35 U	4.04 U	0.42 U	0.35 U	0.42 U	0.48 U	0.41 U
Aroclor 1242	mg/kg-OC		0.35 U	4.04 U	0.42 U	0.35 U	0.42 U	0.48 U	0.41 U
Aroclor 1248	mg/kg-OC		**0.41**	4.04 U	**0.52**	0.35 U	**0.77**	**1.07**	**0.77**
Aroclor 1254	mg/kg-OC		0.35 U	4.04 U	0.42 U	0.35 U	0.42 U	0.48 U	0.41 U
Aroclor 1260	mg/kg-OC		**0.79**	4.04 U	**1.26**	**0.43**	**3.73**	**4.82**	**4.74**
Aroclor 1262	mg/kg-OC		0.35 U	4.04 U	0.42 U	0.35 U	0.42 U	0.48 U	0.41 U
Aroclor 1268	mg/kg-OC		0.35 U	4.04 U	0.42 U	0.35 U	0.42 U	0.48 U	0.41 U
Total PCB Aroclors(2)	mg/kg-OC	12	**1.2**	4.04 U	**1.78**	**0.43**	**4.5**	**5.89**	**5.51**
Total PCB Congeners(3)	mg/kg-OC	12	**2.4 J**	**4.3 J**	**2.9 J**	**1.3 J**	**8.1**	**12 J**	**1.9 J**
Dioxins/Furans									
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)									
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--
Total LPAHs(5) (ND = 1/2 RDL(4))	mg/kg-OC	740	--	--	--	--	--	--	--
Total HPAHs(6) (ND = 1/2 RDL(4))	mg/kg-OC	1,920	--	--	--	--	--	--	--
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	1	--	--	--	--	--	--	--
Semivolatile Organic Compounds									
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--
Conventionals									
Total Organic Carbon	%		**2.29**	**1.98**	**1.91**	**2.30**	**1.88**	**1.68**	**1.96**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters

mg/kg = milligrams per kilogram - dry weight

mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).

ng/kg = nanograms per kilogram

% = percent

NR = sample depth not reported in Ecology's Environmental Information Management database.

TEQ = total toxicity equivalence

Bold = Analyte detected

Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.

-- = sample not analyzed

A - Incomplete number of Aroclors used in summation

J - Result value estimated

U - Analyte not detected at or above the reporting limit shown

Table 2. 0-10 cm Sediment Analytical Data within Marina Basin Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

		Data Year and Source[(1)]	2018 - LDW AOC Amendment 3	2020 - LDW Pre-Design Investigation Phase 1				
		Location	SS-130	LDW20-SS154	LDW20-SS158	LDW20-SS159	LDW20-SS164	LDW20-SS167
		Date	03/01/2018	06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
		Sample ID	LDW18-SS-130	LDW20-SS154	LDW20-SS158	LDW20-SS159	LDW20-SS164	LDW20-SS167
		Depth	NR	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)						
Metals								
Arsenic	mg/kg	57	**13.6**	**11.3**	**11.8**	**8.13**	--	**11.6**
Cadmium	mg/kg	10.2	**0.2 J**	**0.17**	**0.22**	**0.07**	--	**0.18**
Chromium	mg/kg	520	**28.2**	**24.2**	**25.3**	**17.7**	--	**25.1**
Copper	mg/kg	780	**48.4**	**42.6**	**41.5**	**29.1**	--	**42.4**
Lead	mg/kg	900	**15.8**	**13.3**	**13.1**	**8.5**	--	**13.8**
Mercury	mg/kg	0.82	**0.15**	**0.152**	**0.217**	**0.0689**	--	**0.151**
Silver	mg/kg	12.2	**0.19 J**	**0.16**	**0.14**	**0.11**	--	**0.18**
Zinc	mg/kg	820	**102**	**83.4**	**83.5**	**52.7**	--	**86.3**
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	mg/kg-OC		0.68 U	--	--	--	--	--
Aroclor 1221	mg/kg-OC		0.68 U	--	--	--	--	--
Aroclor 1232	mg/kg-OC		0.68 U	--	--	--	--	--
Aroclor 1242	mg/kg-OC		0.68 U	--	--	--	--	--
Aroclor 1248	mg/kg-OC		**0.78 J**	--	--	--	--	--
Aroclor 1254	mg/kg-OC		**0.89**	--	--	--	--	--
Aroclor 1260	mg/kg-OC		**0.75**	--	--	--	--	--
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--
Total PCB Aroclors[(2)]	mg/kg-OC	12	**2.42 AJ**	**1.12**	**1.38**	**3.28**	--	**2.00**
Total PCB Congeners[(3)]	mg/kg-OC	12	--	**0.02**	**0.97**	**2.22**	**1.11**	**1.06**
Dioxins/Furans								
Total Dioxin/Furan TEQ (ND = 1/2 RDL[(4)])	ng/kg	25	--	--	--	**1.79**	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)								
2-Methylnaphthalene	mg/kg-OC	76	**0.29 J**	0.57 U	0.70 U	1.57 U	--	0.70 U
Acenaphthene	mg/kg-OC	32	**0.48 J**	0.57 U	0.70 U	1.57 U	--	0.70 U
Anthracene	mg/kg-OC	440	**1.4**	0.57 U	0.70 U	1.57 U	--	0.70 U
Benzo(g,h,i)perylene	mg/kg-OC	62	**3.0**	**0.59**	**1.01**	**2.11**	--	**0.86**
Fluoranthene	mg/kg-OC	320	**13**	**4.01**	**3.06**	**3.57**	--	**1.87**
Fluorene	mg/kg-OC	46	**0.62 J**	0.57 U	0.70 U	1.57 U	--	0.70 U
Naphthalene	mg/kg-OC	198	**0.30 J**	0.57 U	0.70 U	1.57 U	--	0.70 U
Phenanthrene	mg/kg-OC	200	**5.3**	**2.35**	**1.78**	**1.69**	--	**0.97**
Pyrene	mg/kg-OC	2000	**10**	**2.68**	**2.76**	**3.31**	--	**1.63**
Benzo(a)anthracene	mg/kg-OC	220	**4.2**	**0.56**	**1.05**	**1.86**	--	**0.78**
Benzo(a)pyrene	mg/kg-OC	198	**3.3**	**0.62**	**1.12**	**2.10**	--	**0.85**
Chrysene	mg/kg-OC	220	**7.2**	**1.52**	**2.04**	**3.40**	--	**1.36**
Dibenzo(a,h)anthracene	mg/kg-OC	24	**0.96 J**	0.57 U	0.70 U	1.57 U	--	0.70 U
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	**2.6**	**0.50**	**0.81**	**1.69**	--	**0.61**
Total Benzofluoranthenes	mg/kg-OC	4650	--	**2.39**	**3.11**	**6.20**	--	**2.36**
Total LPAHs[(5)] (ND = 1/2 RDL[(4)])	mg/kg-OC	740	**8.3 J**	**12.88**	**14.95**	**24.24**	--	**10.31**
Total HPAHs[(6)] (ND = 1/2 RDL[(4)])	mg/kg-OC	1,920	**55 J**	**2.35**	**1.78**	**1.69**	--	**0.97**
Total cPAHs[(7)] TEQ (ND = 1/2 RDL[(4)])	mg/kg	1	**0.146 J**	**0.0381**	**0.0507**	**0.0435**	--	**0.0395**
Semivolatile Organic Compounds								
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	0.18 U	0.14 U	0.18 U	0.39 U	--	0.17 U
1,2-Dichlorobenzene	mg/kg-OC	4.6	0.18 U	0.14 U	0.18 U	0.39 U	--	0.17 U
1,4-Dichlorobenzene	mg/kg-OC	6.2	**0.036 J**	0.14 U	0.18 U	0.39 U	--	0.17 U
Benzyl butyl phthalate	mg/kg-OC	9.8	0.71 U	**0.33**	0.70 U	**0.85**	--	0.70 U
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	**6.5**	**1.29**	**3.03**	**5.02**	--	**2.17**
Dibenzofuran	mg/kg-OC	30	**0.33 J**	0.57 U	0.70 U	1.57 U	--	**0.48**
Dimethyl phthalate	mg/kg-OC	106	0.71 U	0.57 U	0.70 U	1.57 U	--	0.70 U
Hexachlorobenzene	mg/kg-OC	0.76	0.18 U	**0.03**	0.018 U	0.039 U	--	0.017 U
N-Nitrosodiphenylamine	mg/kg-OC	22	0.18 U	0.14 U	0.18 U	0.39 U	--	**0.05**
2,4-Dimethylphenol	mg/kg	0.058	0.0249 U	0.0199 U	0.02 U	0.02 U	--	0.02 U
4-Methylphenol	mg/kg	1.34	0.02 U	0.0199 U	0.02 U	0.02 U	--	0.02 U
Benzoic acid	mg/kg	1.3	**0.0251 J**	**0.0875**	**0.126**	**0.114**	--	**0.21**
Benzyl alcohol	mg/kg	0.114	**0.0765**	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	0.02 UJ	0.0199 U	0.02 U	**0.0124**	--	**0.0045**
Phenol	mg/kg	0.84	**0.0173 J**	0.0199 U	0.02 U	0.02 U	--	0.02 U
Conventionals								
Total Organic Carbon	%		**2.8 J**	**3.47**	**2.85**	**1.27**	**3.15**	**2.86**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters

mg/kg = milligrams per kilogram - dry weight

mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).

ng/kg = nanograms per kilogram

% = percent

NR = sample depth not reported in Ecology's Environmental Information Management database.

TEQ = total toxicity equivalence

Bold = Analyte detected

Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.

-- = sample not analyzed

A - Incomplete number of Aroclors used in summation

J - Result value estimated

U - Analyte not detected at or above the reporting limit shown

Table 2. 0-10 cm Sediment Analytical Data within Marina Basin Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

		Data Year and Source(1)	2020 - LDW Pre-Design Investigation Phase 1		2021 - LDW Pre-Design Investigation Phase 2	2021 - T-117 EAA Year 6 Sediment Monitoring
		Location	LDW20-SS168	LDW20-SS169	SS559	PERIM-5-LTM
		Date	06/05/2020	06/11/2020	06/30/2021	03/18/2021
		Sample ID	LDW20-SS168	LDW20-SS169	LDW21-SS559	PERIM-5-LTM-20210318
		Depth	0 - 10 cm	0 - 10 cm	0 - 0.33 ft	0 - 10 cm
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)				
Metals						
Arsenic	mg/kg	57	**10.4**	**10.9**	--	**11.5**
Cadmium	mg/kg	10.2	**0.17**	**0.19**	--	--
Chromium	mg/kg	520	**22.3**	**23.9**	--	--
Copper	mg/kg	780	**37.5**	**37.7**	--	--
Lead	mg/kg	900	**11.4**	**12.6**	--	--
Mercury	mg/kg	0.82	**0.111**	**0.347**	--	--
Silver	mg/kg	12.2	**0.15**	**0.14**	--	--
Zinc	mg/kg	820	**73.9**	**76.1**	--	--
Polychlorinated Biphenyls (PCBs)						
Aroclor 1016	mg/kg-OC		--	--	0.52 U	0.15 U
Aroclor 1221	mg/kg-OC		--	--	0.52 U	0.15 U
Aroclor 1232	mg/kg-OC		--	--	0.52 U	0.15 U
Aroclor 1242	mg/kg-OC		--	--	0.52 U	0.15 U
Aroclor 1248	mg/kg-OC		--	--	0.52 U	**0.24**
Aroclor 1254	mg/kg-OC		--	--	**5.04**	**0.33**
Aroclor 1260	mg/kg-OC		--	--	**17.14 J**	**0.25**
Aroclor 1262	mg/kg-OC		--	--	--	0.15 U
Aroclor 1268	mg/kg-OC		--	--	--	0.15 U
Total PCB Aroclors(2)	mg/kg-OC	12	**1.23**	**1.21**	**22.2 AJ**	**0.82**
Total PCB Congeners(3)	mg/kg-OC	12	**0.96**	**1.03**	--	--
Dioxins/Furans						
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	**3.34245 J**
Polycyclic Aromatic Hydrocarbons (PAHs)						
2-Methylnaphthalene	mg/kg-OC	76	0.73 U	**0.35**	--	**2.07**
Acenaphthene	mg/kg-OC	32	0.73 U	**0.34**	--	**3.73**
Anthracene	mg/kg-OC	440	**0.42**	**0.28**	--	**0.93**
Benzo(g,h,i)perylene	mg/kg-OC	62	**0.98**	**0.68**	--	--
Fluoranthene	mg/kg-OC	320	**2.32**	**2.13**	--	**9.7**
Fluorene	mg/kg-OC	46	0.73 U	**0.33**	--	**3.24**
Naphthalene	mg/kg-OC	198	0.73 U	**0.47**	--	--
Phenanthrene	mg/kg-OC	200	**1.65**	**1.82**	--	**11.99**
Pyrene	mg/kg-OC	2000	**1.92**	**1.76**	--	--
Benzo(a)anthracene	mg/kg-OC	220	**0.99**	**0.66**	--	**2.77**
Benzo(a)pyrene	mg/kg-OC	198	**1.12**	**0.68**	--	**2.08**
Chrysene	mg/kg-OC	220	**2.07**	**1.04**	--	**2.74**
Dibenzo(a,h)anthracene	mg/kg-OC	24	0.73 U	**0.25**	--	**0.29**
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	**0.77**	**0.63**	--	**1.14**
Total Benzofluoranthenes	mg/kg-OC	4650	**2.61**	**1.78**	--	--
Total LPAHs(5) (ND = 1/2 RDL(4))	mg/kg-OC	740	**12.80**	**9.60**	--	--
Total HPAHs(6) (ND = 1/2 RDL(4))	mg/kg-OC	1,920	**2.07**	**3.23**	--	--
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	1	**0.0467**	**0.0302**	--	**0.077**
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	0.18 U	0.18 U	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	0.18 U	0.18 U	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	0.18 U	0.18 U	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	0.73 U	0.72 U	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	**2.01**	**2.07**	--	--
Dibenzofuran	mg/kg-OC	30	0.73 U	**0.0137**	--	**2.43**
Dimethyl phthalate	mg/kg-OC	106	0.73 U	0.72 U	--	--
Hexachlorobenzene	mg/kg-OC	0.76	0.02 U	0.018 U	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	0.18 U	0.18 U	--	--
2,4-Dimethylphenol	mg/kg	0.058	0.0199 U	0.0198 U	--	--
4-Methylphenol	mg/kg	1.34	0.0199 U	0.0198 U	--	--
Benzoic acid	mg/kg	1.3	**0.104**	**0.104**	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--
Pentachlorophenol	mg/kg	0.72	0.0199 U	0.0198 U	--	--
Phenol	mg/kg	0.84	0.0199 U	**0.0161**	--	**0.0156 J**
Conventionals						
Total Organic Carbon	%		**2.71**	**2.75**	**0.77**	**2.66**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters
mg/kg = milligrams per kilogram - dry weight

mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).

ng/kg = nanograms per kilogram
% = percent

NR = sample depth not reported in Ecology's Environmental Information Management database.

TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.

-- = sample not analyzed

A - Incomplete number of Aroclors used in summation
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table 3. Groundwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)[1]	Fill Unit Wells on Shoreline						Alluvium Unit Wells on Shoreline, A&B Barrel Area (SAIC, 20				
				MW-06 03/29/2021	MW-07 03/29/2021	MW-08 03/29/2021	MW-09 03/29/2021	MW-10 03/30/2021	MW-11 03/30/2021	MW-01 10/09/2007	MW-01 03/12/2008	MW-02 10/09/2007	MW-02 03/12/2008	MW-03 10/08/2007
Metals														
Arsenic	D	ug/L	220	**0.288**	NA	**0.592**	NA	NA	**0.552**	**4.46**	--	**8.08**	--	**3.26**
Arsenic	T	ug/L	220	**0.267**	NA	**0.666**	NA	NA	**0.734**	**4.68**	**2.91**	**8.07**	**1.56**	**3.13**
Cadmium	D	ug/L	1.2	0.1 U	NA	0.1 U	NA	NA	0.1 U	**0.026**	--	**0.105**	--	**0.032**
Cadmium	T	ug/L	1.2	0.1 U	NA	0.1 U	NA	NA	**0.036 J**	**0.022**	**0.013**	**0.091**	**0.015**	**0.04**
Chromium	D	ug/L	78	**0.465 J**	NA	**0.443 J**	NA	NA	**0.596**	**1.61**	--	**25.2**	--	**1.25**
Chromium	T	ug/L	78	**0.444 J**	NA	**0.816**	NA	NA	**1.03**	**2.03**	**27.3**	**40.4**	**15.7**	**1.52**
Copper	D	ug/L	14	**2.73**	NA	**2.00**	NA	NA	**1.77**	**2.77**	--	**6.27**	--	**5.11**
Copper	T	ug/L	14	**3.06**	NA	**2.17**	NA	NA	**3.34**	**2.83**	**6.63**	**9.7**	**5.81**	**5.23**
Lead	D	ug/L	19	**0.068 J**	NA	**0.073 J**	NA	NA	**0.115**	**0.057**	--	**0.021**	--	**0.055**
Lead	T	ug/L	19	**0.13**	NA	**0.924**	NA	NA	**0.505**	**0.07**	**0.128**	**0.046**	**0.189**	**0.191**
Mercury	D	ug/L	2	0.02 UJ	NA	0.02 UJ	NA	NA	0.02 UJ	0.2 U	--	0.2 U	--	0.2 U
Mercury	T	ug/L	2	0.02 UJ	NA	0.02 UJ	NA	NA	0.02 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Zinc	D	ug/L	770	**5.71**	NA	5 U	NA	NA	5 U	**2.1**	--	**4.1**	--	**5.2**
Zinc	T	ug/L	770	**6.01**	NA	6 U	NA	NA	6 U	**4.7**	**2.93**	**4.9**	**3.5**	**4.5**
Polychorinated biphenyls (PCBs)														
Total PCB Aroclors[2]	T	ug/L	0.086	**0.02**	**0.01**	**0.003**	NA	NA	**0.006**	0.21 UJ	--	0.21 UJ	--	0.2 UJ
Total PCB Congeners[3]	T	ug/L	0.086	--	--	**0.0029**	--	--	--	--	--	--	--	--
Polycyclic aromatic hydrocarbons (PAHs)														
2-Methylnaphthalene	T	ug/L	14	**0.003 J**	**0.003 J**	**0.003 J**	NA	NA	**0.003 J**	0.21 U	--	0.21 U	--	0.21 U
Acenaphthene	T	ug/L	5.3	0.01 U	0.01 U	0.013 U	NA	NA	0.01 U	0.21 U	--	0.21 U	--	0.21 U
Anthracene	T	ug/L	2.1	0.01 U	0.01 U	0.013 U	NA	NA	0.01 U	0.21 U	--	0.21 U	--	0.21 U
Benzo(g,h,i)perylene	T	ug/L		0.01 U	0.01 U	0.013 U	NA	NA	0.01 U	0.21 U	--	0.21 U	--	0.21 U
Dibenzofuran	T	ug/L	3.1	**0.002 J**	0.01 U	0.013 U	NA	NA	**0.002 J**	0.21 U	--	0.21 U	--	0.21 U
Fluoranthene	T	ug/L	1.8	0.01 U	**0.002 J**	0.013 U	NA	NA	**0.003 J**	0.21 U	--	0.21 U	--	0.21 U
Fluorene	T	ug/L	3.7	0.01 U	0.01 U	0.013 U	NA	NA	0.01 U	0.21 U	--	0.21 U	--	0.21 U
Naphthalene	T	ug/L	90	0.008 U	**0.01**	0.005 U	0.5 U	0.5 U	**0.004 U**	0.21 U	2 U	0.21 U	2 U	0.21 U
Phenanthrene	T	ug/L		0.01 U	**0.002 J**	**0.002 J**	NA	NA	**0.003 J**	0.21 U	--	0.21 U	--	0.21 U
Pyrene	T	ug/L	2	0.01 U	0.002 U	0.013 U	NA	NA	0.003 U	0.21 U	--	0.21 U	--	0.21 U
Benzo(a)anthracene	T	ug/L	0.19	0.01 U	0.01 U	0.013 U	NA	NA	0.01 U	0.21 U	--	0.21 U	--	0.21 U
Benzo(a)pyrene	T	ug/L	0.087	0.01 U	0.01 U	0.013 U	NA	NA	0.01 U	0.21 U	--	0.21 U	--	0.21 U
Chrysene	T	ug/L	0.40	0.01 U	**0.002 J**	0.013 U	NA	NA	**0.002 J**	0.21 U	--	0.21 U	--	0.21 U
Dibenzo(a,h)anthracene	T	ug/L	0.0068	0.01 UJ	0.01 UJ	0.013 UJ	NA	NA	0.01 UJ	0.21 U	--	0.21 U	--	0.21 U
Indeno(1,2,3-cd)pyrene	T	ug/L	0.016	0.01 U	0.01 U	0.013 U	NA	NA	0.01 U	0.21 U	--	0.21 U	--	0.21 U
Total Benzofluoranthenes	T	ug/L		0.01 U	0.01 U	0.013 U	NA	NA	0.01 U	0.21 U	--	0.21 U	--	0.21 U
Total HPAHs[4] (ND = 1/2 RDL[7])	T	ug/L		0.01 UJ	**0.004 J**	0.013 UJ	NA	NA	**0.005 J**	0.21 U	--	0.21 U	--	0.21 U
Total LPAHs[5] (ND = 1/2 RDL[7])	T	ug/L		0.01 U	**0.012 J**	**0.002 J**	NA	NA	**0.003 J**	0.21 U	--	0.21 U	--	0.21 U
Total cPAHs[6] TEQ (ND = 1/2 RDL[7])	T	ug/L	0.032	0.00755 U	**0.00752**	0.009815 U	NA	NA	**0.00752**	0.15855 U	--	0.15855 U	--	0.15855 U

Table 3. Groundwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

				08)	Fill Unit Wells Adjacent to A&B Barrel Pond		Fill Unit Wells Inland			
Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)[1]	MW-03 03/12/2008	MW-04 03/31/2021	MW-05 03/31/2021	MW-12 03/30/2021	MW-13 03/31/2021	MW-14 03/31/2021	MW-15 03/30/2021
Metals										
Arsenic	D	ug/L	220	--	**0.567**	**0.798**	**0.749**	**1.72**	**0.254**	**0.698**
Arsenic	T	ug/L	220	**1.59**	**0.575**	**0.833**	**0.765**	**1.51**	0.262 U	**0.832**
Cadmium	D	ug/L	1.2	--	**0.076 J**	0.1 U	**0.114**	**0.053 J**	0.1 U	**0.076 J**
Cadmium	T	ug/L	1.2	**0.017**	0.085 U	0.1 U	**0.104**	0.056 U	0.1 U	**0.083 J**
Chromium	D	ug/L	78	--	**1.05**	**2.34**	0.5 U	**0.385 J**	0.5 U	**0.289 J**
Chromium	T	ug/L	78	**19.4**	1.11 U	**2.37**	**0.342 J**	0.436 U	0.275 U	**0.769**
Copper	D	ug/L	14	--	**1.84**	**0.297 J**	**10.1**	**4.43**	**3.28**	**6.42**
Copper	T	ug/L	14	**9.83**	2.02 U	0.476 U	**10.4**	5.02 U	**3.79 U**	**9.53**
Lead	D	ug/L	19	--	**0.183**	**0.226**	**0.065 J**	**0.061 J**	**0.052 J**	**1.99**
Lead	T	ug/L	19	**0.519**	0.334 U	**2.44**	**0.163**	0.143 U	0.208 U	**4.67**
Mercury	D	ug/L	2	--	0.02 U	0.02 U	0.02 UJ	0.02 U	0.02 U	0.02 UJ
Mercury	T	ug/L	2	0.2 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.02 U	0.02 UJ
Zinc	D	ug/L	770	--	**26.2**	**1490**	**5.88**	**8.69**	**5.1**	**10.9**
Zinc	T	ug/L	770	**3.84**	26.8 U	**1830**	**5.66 J**	10.5 U	5.24 U	**13.8**
Polychorinated biphenyls (PCBs)										
Total PCB Aroclors[2]	T	ug/L	0.086	--	**0.103 J**	**0.679**	0.01 U	0.01 U	0.01 U	**0.007**
Total PCB Congeners[3]	T	ug/L	0.086	--	**0.153**	**0.304**	--	**0.0000547**	--	**0.00125**
Polycyclic aromatic hydrocarbons (PAHs)										
2-Methylnaphthalene	T	ug/L	14	--	0.004 U	**0.441 J**	**0.003 J**	0.011 U	0.003 U	**0.005 J**
Acenaphthene	T	ug/L	5.3	--	**0.054**	**0.436 J**	0.01 U	**0.003 J**	0.01 U	0.01 U
Anthracene	T	ug/L	2.1	--	**0.01**	**0.182**	0.01 U	0.01 U	0.01 U	0.01 U
Benzo(g,h,i)perylene	T	ug/L		--	**0.002 J**	**0.002 J**	0.01 U	0.01 U	0.01 U	0.01 U
Dibenzofuran	T	ug/L	3.1	--	**0.023 J**	**0.322**	**0.002 J**	**0.003 J**	**0.002 J**	**0.002 J**
Fluoranthene	T	ug/L	1.8	--	**0.021**	**0.06**	0.01 U	**0.003 J**	0.01 U	**0.002 J**
Fluorene	T	ug/L	3.7	--	**0.041**	**0.562**	0.01 U	**0.002 J**	0.01 U	0.01 U
Naphthalene	T	ug/L	90	2 U	0.005 U	**0.036 J**	0.5 U	**0.023**	0.004 U	0.5 U
Phenanthrene	T	ug/L		--	0.01 U	**0.062 J**	0.01 U	**0.01 J**	**0.002 J**	**0.003 J**
Pyrene	T	ug/L	2	--	**0.021**	**0.051**	0.002 U	**0.002 J**	0.01 U	0.003 U
Benzo(a)anthracene	T	ug/L	0.19	--	0.01 U	**0.007 J**	0.01 U	0.01 U	0.01 U	0.01 U
Benzo(a)pyrene	T	ug/L	0.087	--	0.01 U	**0.003 J**	0.01 U	0.01 U	0.01 U	0.01 U
Chrysene	T	ug/L	0.40	--	**0.002 J**	**0.011**	0.01 U	0.01 U	0.01 U	0.01 U
Dibenzo(a,h)anthracene	T	ug/L	0.0068	--	0.01 UJ	0.01 UJ	0.01 UJ	0.01 UJ	0.01 UJ	0.01 UJ
Indeno(1,2,3-cd)pyrene	T	ug/L	0.016	--	0.01 U	**0.001 J**	0.01 U	0.01 U	0.01 U	0.01 U
Total Benzofluoranthenes	T	ug/L		--	0.01 U	**0.006 J**	0.01 U	0.01 U	0.01 U	0.01 U
Total HPAHs[4] (ND = 1/2 RDL[7])	T	ug/L		--	**0.046 J**	**0.144 J**	**0.002**	**0.005 J**	0.01 UJ	**0.002 J**
Total LPAHs[5] (ND = 1/2 RDL[7])	T	ug/L		--	**0.108 J**	**1.302 J**	0.01 U	**0.038 J**	**0.002 J**	**0.003 J**
Total cPAHs[6] TEQ (ND = 1/2 RDL[7])	T	ug/L	0.032	--	**0.00752 J**	**0.00521 J**	0.00755 U	0.00755 U	0.00755 U	0.00755 U

Table 3. Groundwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)(1)	Fill Unit Wells on Shoreline						Alluvium Unit Wells on Shoreline, A&B Barrel Area (SAIC, 20				
				MW-06 03/29/2021	MW-07 03/29/2021	MW-08 03/29/2021	MW-09 03/29/2021	MW-10 03/30/2021	MW-11 03/30/2021	MW-01 10/09/2007	MW-01 03/12/2008	MW-02 10/09/2007	MW-02 03/12/2008	MW-03 10/08/2007
Other semivolatile organic compounds (SVOCs)														
2,4-Dimethylphenol	T	ug/L	2.9	1.1 U	1 U	NA	NA	NA	1.1 U	4.1 U	--	4.1 U	--	4.1 U
4-Methylphenol	T	ug/L	110	0.2 U	0.2 U	NA	NA	NA	0.2 U	0.51 U	--	0.51 U	--	0.51 U
Benzoic acid	T	ug/L	590	2.1 U	2 U	NA	NA	NA	2.1 U	5.1 U	--	5.1 U	--	5.1 U
Benzyl alcohol	T	ug/L	56	0.2 U	0.2 U	NA	NA	NA	0.2 U	5.1 U	--	5.1 U	--	5.1 U
Benzyl butyl phthalate	T	ug/L	0.24	0.2 U	0.2 U	NA	NA	NA	0.2 U	0.21 U	--	0.21 U	--	0.21 U
Bis(2-ethylhexyl) phthalate	T	ug/L	0.62	0.2 U	0.2 U	NA	NA	NA	0.2 U	1.1 U	--	1.1 U	--	1.1 U
Dimethyl phthalate	T	ug/L	59	0.2 U	0.2 U	NA	NA	NA	0.2 U	0.21 U	--	0.21 U	--	0.21 U
Hexachlorobenzene	T	ug/L	0.014	0.0013 U	0.0013 U	0.0013 U	NA	NA	0.0013 U	0.21 U	--	0.21 U	--	0.21 U
N-Nitrosodiphenylamine	T	ug/L	0.55	0.2 U	0.2 U	NA	NA	NA	0.2 U	0.21 U	--	0.21 U	--	0.21 U
Pentachlorophenol	T	ug/L	0.88	0.1 U	0.1 U	NA	NA	NA	0.1 U	1.1 U	--	1.1 U	--	1.1 U
Phenol	T	ug/L	100	0.2 U	0.2 U	NA	NA	NA	0.2 U	0.51 U	--	0.51 U	--	0.51 U
1,2,4-Trichlorobenzene	T	ug/L	0.96	0.2 U	0.2 U	0.5 U	0.5 U	0.5 U	0.2 U	0.21 U	2 U	0.21 U	2 U	0.21 U
1,2-Dichlorobenzene	T	ug/L	4.5	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U	0.5 U	0.21 U	0.5 U	0.21 U
1,4-Dichlorobenzene	T	ug/L	8.9	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U	0.5 U	0.21 U	0.5 U	0.21 U

Notes:

(1) - The screening levels presented are applied for source control review only and are not used for compliance purposes.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(5) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(6) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

(7) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

ug/L - micrograms per liter

D - Dissolved Fraction (filtered) sample result

T - Total Fraction (unfiltered) sample result

TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

NA - Insufficient water in well to allow collection of sample volume to complete this analysis.

"--" - indicates sample not collected

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 3. Groundwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)(1)	08)	Fill Unit Wells Adjacent to A&B Barrel Pond		Fill Unit Wells Inland			
				MW-03 03/12/2008	MW-04 03/31/2021	MW-05 03/31/2021	MW-12 03/30/2021	MW-13 03/31/2021	MW-14 03/31/2021	MW-15 03/30/2021
Other semivolatile organic compounds (SVOCs)										
2,4-Dimethylphenol	T	ug/L	2.9	--	1 U	1 U	--	--	1 U	1 U
4-Methylphenol	T	ug/L	110	--	0.2 U	**0.1 J**	--	--	0.2 U	0.2 U
Benzoic acid	T	ug/L	590	--	**0.4 J**	2 U	--	--	2 U	2 U
Benzyl alcohol	T	ug/L	56	--	0.2 U	0.2 U	--	--	0.2 U	0.2 U
Benzyl butyl phthalate	T	ug/L	0.24	--	0.2 U	0.2 U	--	--	0.2 U	0.2 U
Bis(2-ethylhexyl) phthalate	T	ug/L	0.62	--	**0.6**	**0.6 J**	--	--	0.2 U	0.2 U
Dimethyl phthalate	T	ug/L	59	--	0.2 U	0.2 U	--	--	0.2 U	0.2 U
Hexachlorobenzene	T	ug/L	0.014	--	0.0013 U	0.0013 U	--	--	0.2 U	0.0013 U
N-Nitrosodiphenylamine	T	ug/L	0.55	--	0.2 U	**0.3**	--	--	0.2 U	0.2 U
Pentachlorophenol	T	ug/L	0.88	--	0.1 U	0.1 U	--	--	0.1 U	0.1 U
Phenol	T	ug/L	100	--	0.2 U	**0.1 J**	--	--	0.2 U	0.2 U
1,2,4-Trichlorobenzene	T	ug/L	0.96	2 U	0.2 U	0.2 U	0.5 U	0.5 U	0.2 U	0.2 U
1,2-Dichlorobenzene	T	ug/L	4.5	0.5 U	**0.11 J**	**3.34**	0.2 U	**0.21**	0.2 U	0.2 U
1,4-Dichlorobenzene	T	ug/L	8.9	0.5 U	**0.04 J**	**0.5**	0.2 U	**0.41**	0.2 U	0.2 U

Notes:

(1) - The screening levels presented are applied for source control review only and are not used for compliance purposes.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(5) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(6) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

(7) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

ug/L - micrograms per liter

D - Dissolved Fraction (filtered) sample result

T - Total Fraction (unfiltered) sample result

TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

NA - Insufficient water in well to allow collection of sample volume to complete this analysis.

"--" - indicates sample not collected

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 4. Stormwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

				Central Stormwater Catchment Area (to SPM Outfall)									
				CB-01	**CB-02**						**CB-05**		
Analyte	**Fraction**	**Unit**	**Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)(1)**	**CB-01 09/19/2017**	**CB-02 06/08/2017**	**CB-02 09/19/2017**	**CB-02 03/05/2021**	**SPM-CB-02-SW 04/24/2021**	**CB-02 05/27/2021**	**SPM-CB-02-SW 05/27/2021**	**CB-05 09/19/2017**	**SPM-CB-05-SW 04/24/2021**	**SPM-CB-05-SW 05/27/2021**
Metals													
Arsenic	D	ug/L	220	--	--	--	**13.2 J**	--	**2.37**	--	--	--	--
Arsenic	T	ug/L	220	--	**3.9**	--	**8.81 J**	--	**3.08**	--	--	--	--
Cadmium	D	ug/L	1.2	--	--	--	**0.138 J**	--	**0.796**	--	--	--	--
Cadmium	T	ug/L	1.2	--	4.4 U	--	**0.254**	--	**1.37**	--	--	--	--
Chromium	D	ug/L	78	--	--	--	**0.463 UJ**	--	0.5 U	--	--	--	--
Chromium	T	ug/L	78	--	11 U	--	**0.864**	--	0.5 U	--	--	--	--
Copper	D	ug/L	14	--	--	--	**35.1 J**	**160**	**41.3**	**48**	--	**320**	**77**
Copper	T	ug/L	14	--	**130**	--	**85.7**	**170**	**159**	**67**	--	**300**	**110**
Lead	D	ug/L	19	--	--	--	**0.198 J**	**1.6**	**0.474**	**0.72**	--	**3.9**	**2**
Lead	T	ug/L	19	--	**5.7**	--	**4.8**	**3.9**	**4.2**	**2.3**	--	**7.1**	**6**
Mercury	D	ug/L	2	--	--	--	0.02 UJ	--	**0.00175**	--	--	--	--
Mercury	T	ug/L	2	--	0.5 U	--	0.02 U	--	**0.00359**	--	--	--	--
Zinc	D	ug/L	770	--	--	--	**404 J**	**1800**	**825**	**820**	--	**110**	**100**
Zinc	T	ug/L	770	--	**1800**	--	**528**	**1800**	**1040**	**860**	--	**89**	**130**
Polychlorinated biphenyls (PCBs)													
Total PCB Aroclors(2)	T	ug/L	0.086	0.047 U	0.047 U	0.048 U	0.01 U	--	**0.015 J**	--	0.047 U	--	--
Total PCB Congeners(3)	T	ug/L	0.086	**0.00417**	**0.00682**	**0.0038**	--	--	--	--	**0.0221**	--	--
Polycyclic aromatic hydrocarbons (PAHs)													
2-Methylnaphthalene	T	ug/L	14	--	0.096 U	--	0.1 U	--	**0.822**	--	--	--	--
Acenaphthene	T	ug/L	5.3	--	0.096 U	--	0.1 U	--	**0.032**	--	--	--	--
Anthracene	T	ug/L	2.1	--	0.096 U	--	0.1 U	--	**0.033**	--	--	--	--
Benzo(g,h,i)perylene	T	ug/L		--	0.0096 U	--	0.1 U	--	**0.051**	--	--	--	--
Dibenzofuran	T	ug/L	3.1	--	0.96 U	--	0.1 U	--	**0.01**	--	--	--	--
Fluoranthene	T	ug/L	1.8	--	0.096 U	--	**0.02 J**	--	**0.071**	--	--	--	--
Fluorene	T	ug/L	3.7	--	0.096 U	--	0.1 U	--	**0.071**	--	--	--	--
Naphthalene	T	ug/L	90	--	0.096 U	--	0.02 U	--	**1.73**	--	--	--	--
Phenanthrene	T	ug/L		--	0.096 U	--	0.1 U	--	**0.113**	--	--	--	--
Pyrene	T	ug/L	2	--	0.096 U	--	**0.03 J**	--	**0.11**	--	--	--	--
Benzo(a)anthracene	T	ug/L	0.19	--	0.0096 U	--	0.1 U	--	**0.012**	--	--	--	--
Benzo(a)pyrene	T	ug/L	0.087	--	0.0096 U	--	0.1 U	--	**0.012**	--	--	--	--
Chrysene	T	ug/L	0.40	--	0.0096 U	--	0.1 U	--	**0.021**	--	--	--	--
Dibenzo(a,h)anthracene	T	ug/L	0.0068	--	0.0096 U	--	0.1 U	--	0.01 UJ	--	--	--	--
Indeno(1,2,3-cd)pyrene	T	ug/L	0.016	--	0.0096 U	--	0.1 U	--	**0.009 J**	--	--	--	--
Total Benzofluoranthenes	T	ug/L		--	0.0096 U	--	0.2 U	--	**0.019**	--	--	--	--
Total HPAHs(4) (ND = 1/2 RDL(7))	T	ug/L		--	0.096 U	--	**0.05 J**	--	**0.301 J**	--	--	--	--
Total LPAHs(5) (ND = 1/2 RDL(7))	T	ug/L		--	0.096 U	--	**0.02**	--	**2.378**	--	--	--	--
Total cPAHs(6) TEQ (ND = 1/2 RDL(7))	T	ug/L	0.032	--	0.007248 U	--	0.0805 U	--	**0.0168**	--	--	--	--

Table 4. Stormwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

				Central Stormwater Catchment Area (to SPM Outfall)						Southern Stormwater Catchment Area (to UOF-1 Outfall)					
				CB-06						StormwaterRx Pre-Treatment Vault (Untreated Influent)					
Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)(1)	CB-06 06/08/2017	CB-06 09/19/2017	CB-06 03/04/2021	SPM-CB-06-SW 04/24/2021	CB-06 05/27/2021	SPM-CB-06-SW 05/27/2021	SWRX-PRE 04/12/2017	SWRX-PRE 05/16/2017	SWRX-PRE 06/08/2017	SWRX-PRE 09/19/2017	PRERX 03/04/2021	PRERX 05/27/2021
Metals															
Arsenic	D	ug/L	220	--	--	**1.27 J**	--	**15.7**	--	--	--	--	--	**4.8 J**	**6.46**
Arsenic	T	ug/L	220	3.3 U	--	**1.85**	--	**19**	--	--	--	3.3 U	--	**6.95**	**7.89**
Cadmium	D	ug/L	1.2	--	--	**0.131 J**	--	**0.254**	--	--	--	--	--	**0.944 J**	**0.319**
Cadmium	T	ug/L	1.2	4.4 U	--	**0.237**	--	**0.432**	--	--	--	4.4 U	--	**1.22**	**0.631**
Chromium	D	ug/L	78	--	--	**0.424 UJ**	--	**2.85**	--	--	--	--	--	**1.47 J**	0.5 U
Chromium	T	ug/L	78	11 U	--	**1.45**	--	0.5 U	--	--	--	11 U	--	**2.5**	0.5 U
Copper	D	ug/L	14	--	--	**33.5 J**	**87**	**50.5**	**46**	--	--	--	--	**238 J**	**300**
Copper	T	ug/L	14	**120**	--	**99**	**120**	**77.6**	**300**	--	--	**970**	--	**411**	**455**
Lead	D	ug/L	19	--	--	**0.128 J**	**1.1**	**0.51**	**0.55**	--	--	--	--	**4.65 J**	**0.997**
Lead	T	ug/L	19	**5.9**	--	**5.68**	**5.4**	**3.05**	**19**	--	--	**18**	--	**17**	**4.9**
Mercury	D	ug/L	2	--	--	0.02 UJ	--	**0.0023**	--	--	--	--	--	0.02 UJ	**0.00433**
Mercury	T	ug/L	2	0.5 U	--	**0.013 J**	--	**0.00532**	--	--	--	0.5 U	--	**0.021**	**0.00703**
Zinc	D	ug/L	770	--	--	**64.4 J**	**58**	**95.8**	**78**	--	--	--	--	**345 J**	**183**
Zinc	T	ug/L	770	**92**	--	**93.8**	**85**	**137**	**330**	--	--	**650**	--	**401**	**314**
Polychlorinated biphenyls (PCBs)															
Total PCB Aroclors(2)	T	ug/L	0.086	0.047 U	0.048 U	**0.017 J**	--	0.01 U	--	--	--	--	0.048 U	**0.048**	**0.019 J**
Total PCB Congeners(3)	T	ug/L	0.086	**0.0574**	**0.0267**	--	--	--	--	**0.0137**	**0.00556**	**0.0226**	**0.00849**	**0.0654**	**0.0171**
Polycyclic aromatic hydrocarbons (PAHs)															
2-Methylnaphthalene	T	ug/L	14	0.094 U	--	0.1 U	--	0.01 U	--	--	--	0.096 U	--	0.1 U	0.01 U
Acenaphthene	T	ug/L	5.3	0.094 U	--	0.1 U	--	0.01 U	--	--	--	0.096 U	--	0.1 U	0.01 U
Anthracene	T	ug/L	2.1	0.094 U	--	0.1 U	--	0.01 U	--	--	--	0.096 U	--	0.1 U	0.01 U
Benzo(g,h,i)perylene	T	ug/L		**0.014**	--	0.1 U	--	**0.023**	--	--	--	**0.02**	--	0.1 U	0.01 U
Dibenzofuran	T	ug/L	3.1	0.94 U	--	0.1 U	--	--	--	--	--	0.96 U	--	0.1 U	--
Fluoranthene	T	ug/L	1.8	0.094 U	--	**0.05 J**	--	**0.03**	--	--	--	**0.13**	--	**0.02 J**	**0.022**
Fluorene	T	ug/L	3.7	0.094 U	--	0.1 U	--	**0.004 J**	--	--	--	0.096 U	--	0.1 U	0.01 U
Naphthalene	T	ug/L	90	0.094 U	--	0.1 U	--	0.01 U	--	--	--	0.096 U	--	0.2 U	0.01 U
Phenanthrene	T	ug/L		0.094 U	--	**0.03 J**	--	**0.01**	--	--	--	0.096 U	--	0.1 U	0.01 U
Pyrene	T	ug/L	2	0.094 U	--	**0.05 J**	--	**0.036**	--	--	--	0.096 U	--	0.1 U	**0.016**
Benzo(a)anthracene	T	ug/L	0.19	0.0094 U	--	0.1 U	--	0.01 U	--	--	--	**0.029**	--	0.1 U	0.01 U
Benzo(a)pyrene	T	ug/L	0.087	0.0094 U	--	0.1 U	--	0.01 U	--	--	--	**0.017**	--	0.1 U	0.01 U
Chrysene	T	ug/L	0.40	**0.032**	--	0.1 U	--	**0.029**	--	--	--	**0.072**	--	0.1 U	**0.012**
Dibenzo(a,h)anthracene	T	ug/L	0.0068	0.0094 U	--	0.1 U	--	**0.001 J**	--	--	--	0.0096 U	--	0.1 U	0.01 UJ
Indeno(1,2,3-cd)pyrene	T	ug/L	0.016	0.0094 U	--	0.1 U	--	0.01 U	--	--	--	**0.019**	--	0.1 U	0.01 U
Total Benzofluoranthenes	T	ug/L		0.0094 U	--	0.2 U	--	**0.021**	--	--	--	0.096 U	--	0.2 U	**0.011**
Total HPAHs(4) (ND = 1/2 RDL(7))	T	ug/L		**0.061**	--	**0.1 J**	--	**0.158 J**	--	--	--	0.096 U	--	0.02 J	**0.065 J**
Total LPAHs(5) (ND = 1/2 RDL(7))	T	ug/L		0.094 U	--	**0.03 J**	--	**0.014 J**	--	--	--	**0.044**	--	0.02	**0.011 J**
Total cPAHs(6) TEQ (ND = 1/2 RDL(7))	T	ug/L	0.032	**0.0084**	--	0.0805 U	--	**0.009**	--	--	--	**0.0292**	--	0.0805 U	**0.0152**

Table 4. Stormwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

				Southern Stormwater Catchment Area (to UOF-1 Outfall)											
				StormwaterRx System Discharge (Treated Effluent)											
Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)[1]	SPM-SWRX-POST-SW 01/01/2017	SWRX-POST 04/12/2017	SWRX-POST 05/16/2017	SWRX-POST 06/08/2017	SWRX-POST 09/19/2017	SPM-SWRX-POST-SW 10/18/2017	SPM-SWRX-POST-SW 11/03/2017	SPM-SWRX-POST-SW 01/05/2018	SPM-SWRX-POST-SW 01/23/2018	SPM-SWRX-POST-SW 04/10/2018	SPM-NPDES-SW 10/05/2018	SPM-NPDES-SW 11/02/2018
Metals															
Arsenic	D	ug/L	220	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	T	ug/L	220	--	--	--	3.3 U	--	--	--	--	--	--	--	--
Cadmium	D	ug/L	1.2	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	T	ug/L	1.2	--	--	--	4.4 U	--	--	--	--	--	--	--	--
Chromium	D	ug/L	78	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	T	ug/L	78	--	--	--	11 U	--	--	--	--	--	--	--	--
Copper	D	ug/L	14	--	--	--	--	--	--	--	--	--	--	--	--
Copper	T	ug/L	14	**7.03**	**3.5**	**17**	**42**	--	**20**	**13**	**7**	6.2	**7.3**	**14**	**3.1**
Lead	D	ug/L	19	--	--	--	--	--	--	--	--	--	--	--	--
Lead	T	ug/L	19	**0.202**	--	--	**2.4**	--	--	--	--	--	--	--	--
Mercury	D	ug/L	2	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	T	ug/L	2	--	--	--	0.5 U	--	--	--	--	--	--	--	--
Zinc	D	ug/L	770	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	T	ug/L	770	**62.3**	**20**	**53**	**72**	--	**53**	**72**	**300**	110	**28**	**27**	**9.8**
Polychlorinated biphenyls (PCBs)															
Total PCB Aroclors[2]	T	ug/L	0.086	--	0.05 U	0.047 U	0.048 U	0.048 U	--	--	--	--	--	--	--
Total PCB Congeners[3]	T	ug/L	0.086	--	**0.000814**	**0.00105**	**0.00179**	**0.00154**	**0.00362**	**0.000924**	--	--	--	--	--
Polycyclic aromatic hydrocarbons (PAHs)															
2-Methylnaphthalene	T	ug/L	14	--	--	--	**0.17**	--	--	--	--	--	--	--	--
Acenaphthene	T	ug/L	5.3	--	--	--	0.094 U	--	--	--	--	--	--	--	--
Anthracene	T	ug/L	2.1	--	--	--	0.094 U	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	T	ug/L		--	--	--	0.0094 U	--	--	--	--	--	--	--	--
Dibenzofuran	T	ug/L	3.1	--	--	--	0.94 U	--	--	--	--	--	--	--	--
Fluoranthene	T	ug/L	1.8	--	--	--	0.094 U	--	--	--	--	--	--	--	--
Fluorene	T	ug/L	3.7	--	--	--	0.094 U	--	--	--	--	--	--	--	--
Naphthalene	T	ug/L	90	--	--	--	0.094 U	--	--	--	--	--	--	--	--
Phenanthrene	T	ug/L		--	--	--	0.094 U	--	--	--	--	--	--	--	--
Pyrene	T	ug/L	2	--	--	--	0.094 U	--	--	--	--	--	--	--	--
Benzo(a)anthracene	T	ug/L	0.19	--	--	--	0.0094 U	--	--	--	--	--	--	--	--
Benzo(a)pyrene	T	ug/L	0.087	--	--	--	0.0094 U	--	--	--	--	--	--	--	--
Chrysene	T	ug/L	0.40	--	--	--	0.0094 U	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	T	ug/L	0.0068	--	--	--	0.0094 U	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	T	ug/L	0.016	--	--	--	0.0094 U	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	T	ug/L		--	--	--	0.0094 U	--	--	--	--	--	--	--	--
Total HPAHs[4] (ND = 1/2 RDL[7])	T	ug/L		--	--	--	0.094 U	--	--	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[7])	T	ug/L		--	--	--	0.094 U	--	--	--	--	--	--	--	--
Total cPAHs[6] TEQ (ND = 1/2 RDL[7])	T	ug/L	0.032	--	--	--	0.007097 U	--	--	--	--	--	--	--	--

Table 4. Stormwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

				Southern Stormwater Catchment Area (to UOF-1 Outfall)												
				StormwaterRx System Discharge (Treated Effluent)												
Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)[1]	SPM-NPDES-SW 01/03/2019	SPM-NPDES-SW 04/05/2019	SPM-NPDES-SW 05/14/2019	SPM-NPDES-SW 10/16/2019	SPM-NPDES-SW 12/12/2019	SPM-NPDES-SW 01/10/2020	SPM-NPDES-SW 04/22/2020	SPM-NPDES-SW 05/17/2020	SPM-NPDES-SW 10/10/2020	SPM-NPDES-SW 11/03/2020	SPM-NPDES-SW 01/28/2021	SPM-NPDES-SW 04/24/2021	SPM-NPDES-SW 05/27/2021
Metals																
Arsenic	D	ug/L	220	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	T	ug/L	220	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	D	ug/L	1.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	T	ug/L	1.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	D	ug/L	78	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	T	ug/L	78	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	D	ug/L	14	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	T	ug/L	14	**4.2**	**44**	**150**	**15**	**5.2**	**6.8**	**58**	**8.3**	**9.2**	**18**	**7.4**	**130**	**34**
Lead	D	ug/L	19	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	T	ug/L	19	--	--	--	--	--	--	--	--	--	--	--	**3.4**	**0.86**
Mercury	D	ug/L	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	T	ug/L	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	D	ug/L	770	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	T	ug/L	770	**9.8**	**17**	**36**	**28**	**18**	**18**	**34**	**31**	**27**	**18**	**26**	**98**	**74**
Polychlorinated biphenyls (PCBs)																
Total PCB Aroclors[2]	T	ug/L	0.086	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCB Congeners[3]	T	ug/L	0.086	--	--	--	--	--	--	--	--	--	--	--	--	--
Polycyclic aromatic hydrocarbons (PAHs)																
2-Methylnaphthalene	T	ug/L	14	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	T	ug/L	5.3	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	T	ug/L	2.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	T	ug/L		--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	T	ug/L	3.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	T	ug/L	1.8	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	T	ug/L	3.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	T	ug/L	90	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	T	ug/L		--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	T	ug/L	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	T	ug/L	0.19	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	T	ug/L	0.087	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	T	ug/L	0.40	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	T	ug/L	0.0068	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	T	ug/L	0.016	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	T	ug/L		--	--	--	--	--	--	--	--	--	--	--	--	--
Total HPAHs[4] (ND = 1/2 RDL[7])	T	ug/L		--	--	--	--	--	--	--	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[7])	T	ug/L		--	--	--	--	--	--	--	--	--	--	--	--	--
Total cPAHs[6] TEQ (ND = 1/2 RDL[7])	T	ug/L	0.032	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 4. Stormwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

				Central Stormwater Catchment Area (to SPM Outfall)									
				CB-01	CB-02						CB-05		
Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)(1)	CB-01 09/19/2017	CB-02 06/08/2017	CB-02 09/19/2017	CB-02 03/05/2021	SPM-CB-02-SW 04/24/2021	CB-02 05/27/2021	SPM-CB-02-SW 05/27/2021	CB-05 09/19/2017	SPM-CB-05-SW 04/24/2021	SPM-CB-05-SW 05/27/2021
Other semivolatile organic compounds (SVOCs)													
2,4-Dimethylphenol	T	ug/L	2.9	--	0.96 U	--	1 U	--	**1.7**	--	--	--	--
4-Methylphenol	T	ug/L	110	--	--	--	**0.1 J**	--	**1.8**	--	--	--	--
Benzoic acid	T	ug/L	590	--	--	--	2 U	--	2 U	--	--	--	--
Benzyl alcohol	T	ug/L	56	--	0.96 U	--	0.2 U	--	**1.3**	--	--	--	--
Benzyl butyl phthalate	T	ug/L	0.24	--	0.96 U	--	**0.09 J**	--	**0.08 J**	--	--	--	--
Bis(2-ethylhexyl) phthalate	T	ug/L	0.62	--	**59**	--	**24.7 J**	--	**6.9**	--	--	--	--
Dimethyl phthalate	T	ug/L	59	--	0.96 U	--	**0.2**	--	**0.1 J**	--	--	--	--
Hexachlorobenzene	T	ug/L	0.014	--	0.96 U	--	0.2 U	--	0.2 U	--	--	--	--
N-Nitrosodiphenylamine	T	ug/L	0.55	--	0.96 U	--	0.2 U	--	0.2 U	--	--	--	--
Pentachlorophenol	T	ug/L	0.88	--	4.8 U	--	1 UJ	--	1 U	--	--	--	--
Phenol	T	ug/L	100	--	0.96 U	--	**0.08 J**	--	**1.1**	--	--	--	--
1,2,4-Trichlorobenzene	T	ug/L	0.96	--	0.96 U	--	0.2 U	--	0.2 U	--	--	--	--
1,2-Dichlorobenzene	T	ug/L	4.5	--	0.96 U	--	0.2 U	--	0.2 U	--	--	--	--
1,4-Dichlorobenzene	T	ug/L	8.9	--	0.96 U	--	0.2 U	--	0.2 U	--	--	--	--
Conventionals													
Total Suspended Solids	T	mg/L		--	**8**	--	**6**	**24**	**15**	**4**	--	**8**	**8**

Notes:

(1) - The screening levels presented are applied for source control review only and are not used for compliance purposes.

(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor. Analytical method EPA 8082.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0. Analytical method EPA 1668A.

(4) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(5) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(6) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

(7) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

ug/L - micrograms per liter

D - Dissolved Fraction (filtered) sample result.

T - Total Fraction (unfiltered) sample result.

TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

"--" - indicates sample not analyzed

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 4. Stormwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

				Central Stormwater Catchment Area (to SPM Outfall)						Southern Stormwater Catchment Area (to UOF-1 Outfall)					
				CB-06						StormwaterRx Pre-Treatment Vault (Untreated Influent)					
			Groundwater Preliminary Cleanup Level Protective of	CB-06	CB-06	CB-06	SPM-CB-06-SW	CB-06	SPM-CB-06-SW	SWRX-PRE	SWRX-PRE	SWRX-PRE	SWRX-PRE	PRERX	PRERX
Analyte	Fraction	Unit	Sediment (GW-3)(1)	06/08/2017	09/19/2017	03/04/2021	04/24/2021	05/27/2021	05/27/2021	04/12/2017	05/16/2017	06/08/2017	09/19/2017	03/04/2021	05/27/2021
Other semivolatile organic compounds (SVOCs)															
2,4-Dimethylphenol	T	ug/L	2.9	0.94 U	--	1 U	--	1 UJ	--	--	--	0.96 U	--	1 U	1 U
4-Methylphenol	T	ug/L	110	--	--	0.2 U	--	**0.03 J**	--	--	--	--	--	0.2 U	0.05 J
Benzoic acid	T	ug/L	590	--	--	2 U	--	0.6 J	--	--	--	--	--	2 U	0.4 J
Benzyl alcohol	T	ug/L	56	0.94 U	--	**0.2**	--	0.09 J	--	--	--	0.96 U	--	0.2 U	0.2 J
Benzyl butyl phthalate	T	ug/L	0.24	0.94 U	--	**0.2 J**	--	0.2 J	--	--	--	0.96 U	--	0.2 U	0.2 J
Bis(2-ethylhexyl) phthalate	T	ug/L	0.62	**1.9**	--	**6**	--	**21.7**	--	--	--	**2.5**	--	**2.6**	**3.7**
Dimethyl phthalate	T	ug/L	59	**17**	--	**0.2**	--	**0.2**	--	--	--	0.96 U	--	**0.7**	**16.9**
Hexachlorobenzene	T	ug/L	0.014	0.94 U	--	0.2 U	--	0.2 U	--	--	--	0.96 U	--	0.2 U	0.2 U
N-Nitrosodiphenylamine	T	ug/L	0.55	0.94 U	--	0.2 U	--	0.2 U	--	--	--	0.96 U	--	0.2 U	0.2 U
Pentachlorophenol	T	ug/L	0.88	4.7 U	--	**0.3 J**	--	**0.5 J**	--	--	--	4.8 U	--	1 UJ	0.3 J
Phenol	T	ug/L	100	0.94 U	--	**0.1 J**	--	**0.1 J**	--	--	--	0.96 U	--	**0.1 J**	0.1 J
1,2,4-Trichlorobenzene	T	ug/L	0.96	0.94 U	--	0.2 U	--	0.2 U	--	--	--	0.96 U	--	0.2 U	0.2 U
1,2-Dichlorobenzene	T	ug/L	4.5	0.94 U	--	0.2 U	--	0.2 U	--	--	--	0.96 U	--	0.2 U	0.2 U
1,4-Dichlorobenzene	T	ug/L	8.9	0.94 U	--	0.2 U	--	0.2 U	--	--	--	0.96 U	--	0.2 U	0.2 U
Conventionals															
Total Suspended Solids	T	mg/L		**18**	--	**26**	**24**	**20**	**12**	--	--	**13**	--	**11**	**6**

Notes:

(1) - The screening levels presented are applied for source control review only and are not used for compliance purposes.

(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor. Analytical method EPA 8082.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0. Analytical method EPA 1668A.

(4) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene.

(5) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(6) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

(7) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

ug/L - micrograms per liter

D - Dissolved Fraction (filtered) sample result.

T - Total Fraction (unfiltered) sample result.

TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

"--" - indicates sample not analyzed

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 4. Stormwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

				Southern Stormwater Catchment Area (to UOF-1 Outfall)											
				StormwaterRx System Discharge (Treated Effluent)											
				SPM-SWRX-POST-SW	SWRX-POST	SWRX-POST	SWRX-POST	SWRX-POST	SPM-SWRX-POST-SW	SPM-SWRX-POST-SW	SPM-SWRX-POST-SW	SPM-SWRX-POST-SW	SPM-SWRX-POST-SW	SPM-NPDES-SW	SPM-NPDES-SW
Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)(1)	01/01/2017	04/12/2017	05/16/2017	06/08/2017	09/19/2017	10/18/2017	11/03/2017	01/05/2018	01/23/2018	04/10/2018	10/05/2018	11/02/2018
Other semivolatile organic compounds (SVOCs)															
2,4-Dimethylphenol	T	ug/L	2.9	--	--	--	0.94 U	--	--	--	--	--	--	--	--
4-Methylphenol	T	ug/L	110	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	T	ug/L	590	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	T	ug/L	56	--	--	--	0.94 U	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	T	ug/L	0.24	--	--	--	0.94 U	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	T	ug/L	0.62	--	--	--	0.94 U	--	--	--	--	--	--	--	--
Dimethyl phthalate	T	ug/L	59	--	--	--	0.94 U	--	--	--	--	--	--	--	--
Hexachlorobenzene	T	ug/L	0.014	--	--	--	0.94 U	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	T	ug/L	0.55	--	--	--	0.94 U	--	--	--	--	--	--	--	--
Pentachlorophenol	T	ug/L	0.88	--	--	--	4.7 U	--	--	--	--	--	--	--	--
Phenol	T	ug/L	100	--	--	--	0.94 U	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	T	ug/L	0.96	--	--	--	0.94 U	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	T	ug/L	4.5	--	--	--	0.94 U	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	T	ug/L	8.9	--	--	--	0.94 U	--	--	--	--	--	--	--	--
Conventionals															
Total Suspended Solids	T	mg/L		--	--	**14**	--	--	4 U	--	--	--	--	--	--

Notes:

(1) - The screening levels presented are applied for source control review only and are not used for compliance purposes.

(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor. Analytical method EPA 8082.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0. Analytical method EPA 1668A.

(4) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene.

(5) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(6) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

(7) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

ug/L - micrograms per liter

D - Dissolved Fraction (filtered) sample result.

T - Total Fraction (unfiltered) sample result.

TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

"--" - indicates sample not analyzed

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 4. Stormwater Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

				Southern Stormwater Catchment Area (to UOF-1 Outfall)												
				StormwaterRx System Discharge (Treated Effluent)												
Analyte	Fraction	Unit	Groundwater Preliminary Cleanup Level Protective of Sediment (GW-3)(1)	SPM-NPDES-SW 01/03/2019	SPM-NPDES-SW 04/05/2019	SPM-NPDES-SW 05/14/2019	SPM-NPDES-SW 10/16/2019	SPM-NPDES-SW 12/12/2019	SPM-NPDES-SW 01/10/2020	SPM-NPDES-SW 04/22/2020	SPM-NPDES-SW 05/17/2020	SPM-NPDES-SW 10/10/2020	SPM-NPDES-SW 11/03/2020	SPM-NPDES-SW 01/28/2021	SPM-NPDES-SW 04/24/2021	SPM-NPDES-SW 05/27/2021
Other semivolatile organic compounds (SVOCs)																
2,4-Dimethylphenol	T	ug/L	2.9	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	T	ug/L	110	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	T	ug/L	590	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	T	ug/L	56	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	T	ug/L	0.24	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	T	ug/L	0.62	--	--	--	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	T	ug/L	59	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	T	ug/L	0.014	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	T	ug/L	0.55	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	T	ug/L	0.88	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	T	ug/L	100	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	T	ug/L	0.96	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	T	ug/L	4.5	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	T	ug/L	8.9	--	--	--	--	--	--	--	--	--	--	--	--	--
Conventionals																
Total Suspended Solids	T	mg/L		--	--	--	--	--	--	--	--	--	--	--	4 U	4 U

Notes:

(1) - The screening levels presented are applied for source control review only and are not used for compliance purposes.

(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor. Analytical method EPA 8082.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0. Analytical method EPA 1668A.

(4) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(5) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(6) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

(7) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

ug/L - micrograms per liter

D - Dissolved Fraction (filtered) sample result.

T - Total Fraction (unfiltered) sample result.

TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

"--" - indicates sample not analyzed

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 5. Comparison of Treated vs Untreated Stormwater Quality from StormwateRx System

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Fraction	Unit	GW3 PCUL Protective of Sediment	SWRX-PRE 04/12/2017	SWRX-POST 04/12/2017	Percent Reduction[1]	SWRX-PRE 05/16/2017	SWRX-POST 05/16/2017	Percent Reduction[1]	SWRX-PRE 06/08/2017	SWRX-POST 06/08/2017	Percent Reduction[1]	SWRX-PRE 09/19/2017	SWRX-POST 09/19/2017	Percent Reduction[1]	PRERX 05/27/2021	SPM-NPDES-SW 05/27/2021	Percent Reduction[1]
Metals																		
Copper	T	ug/L	14	--	**3.5**		--	**17**		**970**	**42**	**96%**	--	--		**455**	**34**	**93%**
Lead	T	ug/L	19	--	--		--	--		**18**	**2.4**	**87%**	--	--		**4.9**	**0.86**	**82%**
Zinc	T	ug/L	770	--	**20**		--	**53**		**650**	**72**	**89%**	--	--		**314**	**74**	**76%**
Polychlorinated biphenyls (PCBs)																		
Total PCB Aroclors[2]	T	ug/L	0.022	--	0.05 U		--	0.047 U		--	0.048 U		0.048 U	0.048 U		**0.019 J**	--	
Total PCB Congeners[3]	T	ug/L	0.022	**0.0137**	**0.000814**	**94%**	**0.00556**	**0.00105**	**81%**	**0.0226**	**0.00179**	**92%**	**0.00849**	**0.00154**	**82%**	**0.0171**	--	

Notes:

(1) - The percent reduction in post-treatment vs pre-treatment samples is calculated only for constituents with detectable concentrations in both samples.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

T - Total Fraction (unfiltered) sample result.

ug/L - micrograms per liter

Bold - Analyte detected

Blue Shaded - Detected result exceeded GW3 screening level.

"--" - indicates sample not analyzed.

U - Analyte not detected at or above the

J - Analyte was positively identified, and the reported value is an estimate

Table 6. Catch Basin Solids Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

			Central Stormwater Catchment Area (to SPM Outfall)								Southern Stormwater Catchment Area (to UOF-1 Outfall)					
			CB-01	CB-02		CB-03	CB-04	CB-05	CB-06		CB-07	CB-08	CB-09		StormwaterRx Vault	
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	SPM-CB-01-02112016 02/11/2016	SPM-CB-02-02112016 02/11/2016	CB-02-210420 04/20/2021	SPM-CB-03-02112016 02/11/2016	SPM-CB-04-02112016 02/11/2016	SPM-CB-05-02112016 02/11/2016	SPM-CB-06-02092016 02/09/2016	CB-06-210420 04/20/2021	SPM-CB-07-02112016 02/11/2016	SPM-CB-08-02112016 02/11/2016	SP-CB-09 10/08/2015	SPM-CB-09-02112016 02/11/2016	SP-OWS-01 (SOLID) 10/08/2014	PRERX-210420 04/20/2021
Metals																
Arsenic	mg/kg	57	--	--	**18.4**	--	--	--	--	**13.9**	--	--	**22**	--	**69**	**6.63**
Cadmium	mg/kg	10.2	--	--	**3.85**	--	--	--	--	**1.19**	--	--	**6.5**	--	**16**	**0.96**
Chromium	mg/kg	520	--	--	**116**	--	--	--	--	**26.3**	--	--	**160**	--	**330**	**24.9**
Copper	mg/kg	780	--	--	**1850**	--	--	--	--	**771**	--	--	**1800**	--	**14000**	**1370**
Lead	mg/kg	900	--	--	**396**	--	--	--	--	**64.5**	--	--	**430**	--	**940**	**91.3**
Mercury	mg/kg	0.82	--	--	**0.178 J**	--	--	--	--	**0.06 J**	--	--	**0.19**	--	**1.7**	**0.199 J**
Silver	mg/kg	12.2	--	--	--	--	--	--	--	--	--	--	**2.1**	--	**1.2**	--
Zinc	mg/kg	820	--	--	**7330**	--	--	--	--	**303**	--	--	**5600**	--	**2900**	**383**
Polychlorinated biphenyls (PCBs)																
Total PCB Aroclors(2)	mg/kg	0.13	4 U	**0.57**	**0.464 J**	20 U	0.8 U	**0.78**	10 U	**0.212**	**0.34**	**0.48**	**0.54**	**1.5**	**4.11**	**0.327**
Total PCB Congeners(3)	mg/kg	0.13	**0.158**	**0.403**	--	**0.0507**	**0.0634**	**0.453**	**1.19**	--	**0.289**	**0.138**	**0.896 J**	**0.735**	**3.96 J**	--
Dioxins/Furans																
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	--	--	--	--	--	**59 J**	--	**890 J**	--
Polycyclic aromatic hydrocarbons (PAHs)																
2-Methylnaphthalene	mg/kg	1.34	--	--	**0.385**	--	--	--	--	**0.0716**	--	--	**4.6**	--	**4.7**	**0.0273 J**
Acenaphthene	mg/kg	1	--	--	**0.038 J**	--	--	--	--	**0.0359 J**	--	--	**0.17 J**	--	0.057 U	**0.00995 J**
Anthracene	mg/kg	1.92	--	--	**0.0858**	--	--	--	--	**0.0503**	--	--	**0.19 J**	--	**0.8**	**0.0244 J**
Benzo(g,h,i)perylene	mg/kg	1.34	--	--	**0.775**	--	--	--	--	**0.386**	--	--	**0.36**	--	**1.4**	**0.192**
Dibenzofuran	mg/kg	1.08	--	--	**0.0476 J**	--	--	--	--	**0.054**	--	--	0.44 UJ	--	0.29 U	**0.0154 J**
Fluoranthene	mg/kg	3.4	--	--	**1.6**	--	--	--	--	**1.0**	--	--	**1.6 J**	--	**12**	**0.53**
Fluorene	mg/kg	1.08	--	--	**0.12**	--	--	--	--	**0.112**	--	--	**0.51**	--	**0.95**	**0.0475 J**
Naphthalene	mg/kg	4.2	--	--	**0.471**	--	--	--	--	**0.00974 J**	--	--	**2.2**	--	**2**	**0.00342 J**
Phenanthrene	mg/kg	3	--	--	**0.674**	--	--	--	--	**0.651**	--	--	**0.88 J**	--	**6.3**	**0.208**
Pyrene	mg/kg	5.2	--	--	**1.65**	--	--	--	--	**0.77**	--	--	**2.2 J**	--	**11**	**0.463**
Benzo(a)anthracene	mg/kg	2.6	--	--	**0.372**	--	--	--	--	**0.207**	--	--	**0.27 J**	--	**3.4**	**0.164**
Benzo(a)pyrene	mg/kg	3.2	--	--	**0.399**	--	--	--	--	**0.208**	--	--	**0.37 J**	--	**3.8**	**0.201**
Chrysene	mg/kg	2.8	--	--	**1.08**	--	--	--	--	**0.74**	--	--	**0.96 J**	--	**5.9**	**0.31**
Dibenzo(a,h)anthracene	mg/kg	0.46	--	--	**0.0957**	--	--	--	--	**0.0509**	--	--	0.18 U	--	**0.44**	**0.042 J**
Indeno(1,2,3-cd)pyrene	mg/kg	1.2	--	--	**0.344**	--	--	--	--	**0.184**	--	--	**0.25**	--	**1.8**	**0.166**
Total Benzofluoranthenes	mg/kg	6.4	--	--	**1.43**	--	--	--	--	**0.69**	--	--	**1 J**	--	**11**	**0.54**
Total HPAHs(5) (ND = 1/2 RDL(4))	mg/kg	24	--	--	**7.7457**	--	--	--	--	**4.2359**	--	--	**7**	--	**50**	**2.484 J**
Total LPAHs(6) (ND = 1/2 RDL(4))	mg/kg	10.4	--	--	**1.4631 J**	--	--	--	--	**0.9473 J**	--	--	**4**	--	**10**	**0.31195 J**
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	5.5	--	--	**0.60277**	--	--	--	--	**0.31599**	--	--	**0.54 J**	--	**5.5**	**0.2829 J**
Other semivolatile organic compounds (SVOCs)																
2,4-Dimethylphenol	mg/kg	0.058	--	--	0.999 U	--	--	--	--	0.997 U	--	--	0.44 U	--	0.29 U	0.998 U
4-Methylphenol	mg/kg	1.34	--	--	**12.4**	--	--	--	--	**1.44**	--	--	**0.33 J**	--	**6.4**	0.2 U
Benzoic acid	mg/kg	1.3	--	--	**0.68 J**	--	--	--	--	1.99 UJ	--	--	11 U	--	**9.7**	2 UJ
Benzyl alcohol	mg/kg	0.114	--	--	**5.89**	--	--	--	--	**0.38**	--	--	**3.6 J**	--	**63**	**3.53**
Benzyl butyl phthalate	mg/kg	0.126	--	--	**0.7 J**	--	--	--	--	**2.99 J**	--	--	**1.8**	--	**4.3**	**0.228 J**
Bis(2-ethylhexyl) phthalate	mg/kg	2.6	--	--	**89.1**	--	--	--	--	**33.2**	--	--	**37**	--	**110**	**8.2 J**
Dimethyl phthalate	mg/kg	0.142	--	--	**11.2 J**	--	--	--	--	**1.42**	--	--	**3.9 J**	--	**70**	**2.34**
Hexachlorobenzene	mg/kg	0.014	--	--	0.00199 UJ	--	--	--	--	0.00197 U	--	--	0.22 U	--	0.14 U	0.00198 U
N-Nitrosodiphenylamine	mg/kg	0.056	--	--	0.2 U	--	--	--	--	0.199 U	--	--	0.22 UJ	--	0.14 U	0.2 U
Pentachlorophenol	mg/kg	0.72	--	--	0.999 U	--	--	--	--	**0.341 J**	--	--	0.88 U	--	**1.5**	0.998 U
Phenol	mg/kg	0.84	--	--	**1.62**	--	--	--	--	0.198 J	--	--	**0.37 J**	--	**2.2**	0.2 U
1,2,4-Trichlorobenzene	mg/kg	0.062	--	--	0.0198 U	--	--	--	--	0.012 U	--	--	0.22 UJ	--	0.14 U	0.0052 U
1,2-Dichlorobenzene	mg/kg	0.07	--	--	0.00395 U	--	--	--	--	0.00241 U	--	--	0.24 UJ	--	0.16 U	0.00104 U
1,4-Dichlorobenzene	mg/kg	0.22	--	--	0.00395 UJ	--	--	--	--	0.00241 UJ	--	--	0.22 UJ	--	0.14 U	0.00104 U
Conventionals																
Total Organic Carbon (TOC)	%		**7**	**7.735**	**18.1**	**5.84**	**12.1**	**11.9**	**8.54**	**11.5**	**11**	**4.11**	**11**	**5.85**	**23**	**1.42**

Notes:

(1) The screening levels presented are applied for source control review only and are not used for compliance purposes. The screening levels are shown as dry-weight equivalent based on the values presented in LDW Preliminary Cleanup Level Workbook.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor. Analytical method EPA 8082.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0. Analytical method EPA 1668A.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

mg/kg - milligrams per kilogram, ng/kg - nangram per kilogram, % - percent

TEQ - total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

"--" - indicates sample not analyzed.

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 7. Surface Soil Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

			A&B Barrel Pond (Unpaved)								South Lot Line (Unpaved)	
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	B-03 11/17/2017 0 - 1 ft	B-04 11/17/2017 0 - 1 ft	MW-04 03/04/2021 0 - 1 ft	MW-05 03/05/2021 0 - 1 ft	MW-06 03/05/2021 0 - 1 ft	SB-26 03/04/2021 0 - 1 ft	SS-31 11/17/2017 0 - 1.5 ft	SS-39 11/17/2017 0 - 1.25 ft	HA-01 03/11/2021 0 - 1 ft	HA-02 03/11/2021 0 - 1 ft
Metals												
Arsenic	mg/kg	57	--	--	5.03	20.7	6.81	4.77	--	--	7.4 J	6.57 J
Cadmium	mg/kg	10.2	--	--	0.86	2.09	0.35	5.09 J	--	--	3.25	3.4
Chromium	mg/kg	520	--	--	33.1	50.2	17.9	150 J	--	--	65.4	71.3
Copper	mg/kg	780	--	--	66.3	135	99.9	2470 J	--	--	135	148
Lead	mg/kg	900	--	--	587 J	313 J	64.8	1490 J	--	--	426 J	512 J
Mercury	mg/kg	0.82	--	--	0.997	0.392	0.0668	11.5 J	--	--	1.96 J	2.42 J
Silver	mg/kg	12.2	--	--	--	--	--	--	--	--	--	--
Zinc	mg/kg	820	--	--	124	337	127	771	--	--	338	471
Polychlorinated biphenyls (PCBs)												
Total PCB Aroclors(2)	mg/kg	0.13	20.1	1.34	4.19	3.75	0.23	43.47	0.064	10	7.24	8.31
Total PCB Congeners(3)	mg/kg	0.13	14.4	--	5.65	--	--	66.8 J	--	6.04	--	--
Dioxins/Furans												
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	2546 J	--	--	--	--
Polycyclic aromatic hydrocarbons (PAHs)												
2-Methylnaphthalene	mg/kg	1.34	--	--	0.0111 J	0.005 U	0.00345	0.0555 J	--	--	0.028	0.0278
Acenaphthene	mg/kg	1	--	--	0.015 U	0.00143 J	0.00498 U	0.0125 J	--	--	0.0057 J	0.00496 J
Anthracene	mg/kg	1.92	--	--	0.00935 J	0.00755	0.00275	0.127 J	--	--	0.00908 J	0.00793 J
Benzo(g,h,i)perylene	mg/kg	1.34	--	--	0.0358	0.0281	0.0199	0.516 J	--	--	0.0985	0.0726
Dibenzofuran	mg/kg	1.08	--	--	0.015 U	0.00245 J	--	0.0199	--	--	0.0111 J	0.00626 J
Fluoranthene	mg/kg	3.4	--	--	0.0356	0.0419	0.0158	0.283 J	--	--	0.11	0.10
Fluorene	mg/kg	1.08	--	--	0.015 U	0.005 U	0.00067	0.0285	--	--	0.0104 J	0.00625 J
Naphthalene	mg/kg	4.2	--	--	0.00633 U	0.00804 U	0.00226	0.00524 UJ	--	--	0.0412	0.0286
Phenanthrene	mg/kg	3	--	--	0.0289	0.0251	0.00623	0.199 J	--	--	0.0656	0.246
Pyrene	mg/kg	5.2	--	--	0.0362	0.0388	0.0166	0.211 J	--	--	0.106	0.103
Benzo(a)anthracene	mg/kg	2.6	--	--	0.0186	0.0145	0.00827	0.178 J	--	--	0.0469	0.0359
Benzo(a)pyrene	mg/kg	3.2	--	--	0.0252	0.0191	0.0124	0.276 J	--	--	0.0723	0.0528
Chrysene	mg/kg	2.8	--	--	0.0331	0.0368	0.0215	0.252 J	--	--	0.0825	0.071
Dibenzo(a,h)anthracene	mg/kg	0.46	--	--	0.00688 J	0.00598	0.00392	0.0657	--	--	0.0168	0.0131 J
Indeno(1,2,3-cd)pyrene	mg/kg	1.2	--	--	0.0226	0.0207	0.0151	0.373 J	--	--	0.0681	0.0516
Total Benzofluoranthenes	mg/kg	6.4	--	--	0.0584	0.0522	0.0454	0.489 J	--	--	0.164	0.117
Total HPAHs(5) (ND = 1/2 RDL(4))	mg/kg	24	--	--	0.27238 J	0.25808	0.0920	2.6437 J	--	--	0.7235	0.5856 J
Total LPAHs(6) (ND = 1/2 RDL(4))	mg/kg	10.4	--	--	0.04164 J	0.0366 J	0.0454	0.4302 J	--	--	0.13198 J	0.30363 J
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	5.5	--	--	0.034712 J	0.028486	0.01988	0.39079	--	--	0.102815	0.07213 J

Table 7. Surface Soil Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	Unpaved Soils Along Shoreline											
			MW-07 03/09/2021 0 - 1 ft	MW-08 03/09/2021 0 - 1 ft	MW-09 03/09/2021 0 - 1 ft	MW-10 03/08/2021 0 - 1 ft	MW-11 03/08/2021 0 - 1 ft	SB-27 03/09/2021 0 - 1 ft	SS-03 02/09/2016 0 - 1.6 ft	SS-08 02/09/2016 0 - 1.6 ft	SS-12 02/09/2016 0 - 1.6 ft	SS-16 02/09/2016 0 - 1.6 ft	SS-20 02/10/2016 0 - 1.6 ft	SS-24 02/10/2016 0 - 1.6 ft
Metals														
Arsenic	mg/kg	57	3.71 J	5.42 J	1.84 J	5.08	5.75	5.43 J	--	--	--	--	--	--
Cadmium	mg/kg	10.2	0.25	0.48	--	0.26	0.66	0.25	--	--	--	--	--	--
Chromium	mg/kg	520	14.6 J	10.3 J	14.3 J	12.4	15.1	10.9	--	--	--	--	--	--
Copper	mg/kg	780	65.3	45.7	12.6	31.5	71.3	111	--	--	--	--	--	--
Lead	mg/kg	900	40 J	206 J	1.81 J	34.4	23.4	57.6 J	--	--	--	--	--	--
Mercury	mg/kg	0.82	0.0469 J	0.174 J	0.0103 J	0.0382	0.0339	0.0796 J	--	--	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	mg/kg	820	71.7	90.2	24.6	60.5	104	77.9	--	--	--	--	--	--
Polychlorinated biphenyls (PCBs)														
Total PCB Aroclors(2)	mg/kg	0.13	0.0925	0.0801	0.0009 J	0.0527	0.0799	0.2552	0.094	0.0715	0.017	0.36	0.08 U	0.074
Total PCB Congeners(3)	mg/kg	0.13	--	0.216	--	0.0363	--	--	--	--	--	--	--	--
Dioxins/Furans														
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	--	--	--	--	--	--	--
Polycyclic aromatic hydrocarbons (PAHs)														
2-Methylnaphthalene	mg/kg	1.34	0.00498 U	0.005 U	0.005 U	0.005 U	0.0249 U	0.0125 J	--	--	--	--	--	--
Acenaphthene	mg/kg	1	0.00498 U	0.005 U	0.005 U	0.005 U	0.0249 U	0.00433 J	--	--	--	--	--	--
Anthracene	mg/kg	1.92	0.00467 J	0.00761	0.005 U	0.00521	0.00689 J	0.00743 J	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg	1.34	0.017	0.0594	0.005 U	0.065	0.14	0.0766	--	--	--	--	--	--
Dibenzofuran	mg/kg	1.08	0.00498 U	0.005 U	0.005 U	0.005 U	0.0249 U	0.0248 U	--	--	--	--	--	--
Fluoranthene	mg/kg	3.4	0.0181	0.0263	0.005 U	0.0136	0.0299	0.104	--	--	--	--	--	--
Fluorene	mg/kg	1.08	0.00092 J	0.00094 J	0.005 U	0.005 U	0.0249 U	0.0039 J	--	--	--	--	--	--
Naphthalene	mg/kg	4.2	0.00153 J	0.00198 J	0.005 U	0.00132 J	0.00552 U	0.00665 U	--	--	--	--	--	--
Phenanthrene	mg/kg	3	0.0101	0.00793	0.005 U	0.00366 J	0.0117 J	0.0433	--	--	--	--	--	--
Pyrene	mg/kg	5.2	0.0206	0.0303	0.005 U	0.0172	0.0399	0.0905	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg	2.6	0.00996	0.0165	0.005 U	0.0126	0.0181 J	0.0363	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg	3.2	0.0163	0.04	0.005 U	0.0627	0.0404	0.0593	--	--	--	--	--	--
Chrysene	mg/kg	2.8	0.0172	0.0391	0.005 U	0.0423	0.0568	0.107	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg	0.46	0.00355 J	0.0103	0.005 U	0.012	0.0171 J	0.0107 J	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg	1.2	0.0119	0.049	0.005 U	0.0557	0.0703	0.0504	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg	6.4	0.0376	0.115	0.00999 U	0.194	0.089	0.143	--	--	--	--	--	--
Total HPAHs(5) (ND = 1/2 RDL(4))	mg/kg	24	0.14177 J	0.3859	0.005 U	0.4751	0.4804 J	0.6432 J						
Total LPAHs(6) (ND = 1/2 RDL(4))	mg/kg	10.4	0.02086 J	0.02395 J	0.005 U	0.01446 J	0.02418 J	0.05896 J						
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	5.5	0.021729 J	0.059601	0.003775 U	0.090573	0.058308 J	0.08095 J	--	--	--	--	--	--

Table 7. Surface Soil Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	Unpaved Areas Inland												
			MW-14A 03/10/2021 0 - 1 ft	SB-28 03/01/2021 0 - 1 ft	SB-29 03/01/2021 0 - 1 ft	SB-32 03/08/2021 0 - 1 ft	SB-33 03/03/2021 0 - 1 ft	SB-34 03/01/2021 0 - 1 ft	SB-34R 03/23/2021 0 - 1 ft	SS-04 02/10/2016 0 - 1.6 ft	SS-05 02/10/2016 0 - 1.6 ft	SS-06 02/10/2016 0 - 1.6 ft	SS-09 02/10/2016 0 - 1.6 ft	SS-10 02/10/2016 0 - 1.6 ft	SS-11 02/10/2016 0 - 1.6 ft
Metals															
Arsenic	mg/kg	57	**27.4 J**	**4.68 J**	**4.28 J**	**7.47**	**4.09**	**4.43**	--	--	--	--	--	--	--
Cadmium	mg/kg	10.2	**0.3**	**0.32**	**0.27**	**0.49**	**0.46**	**0.62**	--	--	--	--	--	--	--
Chromium	mg/kg	520	**34.3**	**13.2**	**14.6**	**12.2 J**	**9.99**	**11.3**	--	--	--	--	--	--	--
Copper	mg/kg	780	**292**	**35.8 J**	**25.8 J**	**50.2 J**	**51.5**	**25.5 J**	--	--	--	--	--	--	--
Lead	mg/kg	900	**42 J**	**54.6 J**	**33.5 J**	**30.7 J**	**41.3 J**	**47.7 J**	--	--	--	--	--	--	--
Mercury	mg/kg	0.82	**0.187 J**	**0.0472**	**0.025**	**0.0482**	**0.0213 J**	--	--	--	--	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	mg/kg	820	**145**	**75.5**	**60.8**	**73.8 J**	**83.7**	**106**	--	--	--	--	--	--	--
Polychlorinated biphenyls (PCBs)															
Total PCB Aroclors(2)	mg/kg	0.13	**0.0515**	**0.0521**	**0.0199**	**0.746 J**	**0.738**	**0.0937**	--	**0.21**	**0.82**	0.08 U	**0.05**	0.004 U	**0.019**
Total PCB Congeners(3)	mg/kg	0.13	--	--	--	**0.277**	--	**0.027**	--	--	--	--	--	--	--
Dioxins/Furans															
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	**25.63**	--	--	--	--	--	--	--	--	--
Polycyclic aromatic hydrocarbons (PAHs)															
2-Methylnaphthalene	mg/kg	1.34	0.00498 U	0.005 U	0.005 U	**0.0114**	0.015 U	**0.0207**	--	--	--	--	--	--	--
Acenaphthene	mg/kg	1	**0.00433 J**	0.005 U	0.005 U	**0.00183 J**	**0.0031 J**	**0.00564**	--	--	--	--	--	--	--
Anthracene	mg/kg	1.92	**0.00827**	**0.00262 J**	**0.00232 J**	**0.00241 J**	**0.00265 J**	**0.0167**	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg	1.34	**0.027**	**0.0298**	**0.0408**	**0.0236 J**	**0.0422**	**0.0603**	--	--	--	--	--	--	--
Dibenzofuran	mg/kg	1.08	**0.00298 J**	0.005 U	0.005 U	**0.0023 J**	0.015 U	**0.00531**	--	--	--	--	--	--	--
Fluoranthene	mg/kg	3.4	**0.061**	**0.0161**	**0.0213**	**0.0201 J**	**0.0207**	**0.115**	--	--	--	--	--	--	--
Fluorene	mg/kg	1.08	**0.00521**	0.005 U	0.005 U	**0.00276 J**	**0.00369 J**	**0.0109**	--	--	--	--	--	--	--
Naphthalene	mg/kg	4.2	**0.00307 J**	0.005 U	0.005 U	**0.00822**	0.005 U	**0.021**	0.005 U	--	--	--	--	--	--
Phenanthrene	mg/kg	3	**0.0394**	**0.0154**	**0.0101**	**0.0182 J**	**0.0362**	**0.13**	--	--	--	--	--	--	--
Pyrene	mg/kg	5.2	**0.0533**	**0.0214**	**0.0284**	**0.022**	**0.0226**	**0.156**	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg	2.6	**0.0277**	**0.0123**	**0.0136**	**0.00936 J**	**0.0127 J**	**0.0507**	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg	3.2	**0.0307**	**0.0243**	**0.0259**	**0.0128 J**	**0.0207**	**0.0678**	--	--	--	--	--	--	--
Chrysene	mg/kg	2.8	**0.0413**	**0.0329**	**0.0245**	**0.0185 J**	**0.0667**	**0.0731**	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg	0.46	**0.00565**	**0.00566**	**0.00542**	**0.00365 J**	**0.00715 J**	**0.0103**	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg	1.2	**0.0211**	**0.0201**	**0.0214**	**0.0131 J**	**0.0165**	**0.0451**	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg	6.4	**0.0687**	**0.0603**	**0.0529**	**0.0391 J**	**0.0508**	**0.102**	--	--	--	--	--	--	--
Total HPAHs(5) (ND = 1/2 RDL(4))	mg/kg	24	**0.33645**	**0.22286**	**0.23422**	**0.16221 J**	**0.26005 J**	**0.6803**	--						
Total LPAHs(6) (ND = 1/2 RDL(4))	mg/kg	10.4	**0.06267 J**	**0.02639 J**	**0.01399 J**	**0.03641 J**	**0.04564 J**	**0.19644**	--						
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	5.5	**0.043208**	**0.034595**	**0.035357**	**0.01927 J**	**0.030086 J**	**0.089391**	--	--	--	--	--	--	--

Table 7. Surface Soil Data Screened for Source Control Review
Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	Unpaved Areas Inland													
			SS-13	SS-14	SS-15	SS-18	SS-19	MW-12	MW-13	MW-15	SB-30	SB-31	SS-01	SS-02	SS-07	SS-17
			02/10/2016	02/10/2016	02/09/2016	02/10/2016	02/10/2016	03/03/2021	03/01/2021	03/03/2021	03/01/2021	03/01/2021	02/09/2016	02/09/2016	02/09/2016	02/10/2016
			0 - 1.6 ft	0 - 1.6 ft	0 - 1.6 ft	0 - 1.6 ft	0 - 1.6 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1.6 ft	0 - 1.6 ft	0 - 1.6 ft	0 - 1.6 ft
Metals																
Arsenic	mg/kg	57	--	--	--	--	--	**3.59**	**3.77 J**	**3.24**	**2.9 J**	**6.42 J**	--	--	--	--
Cadmium	mg/kg	10.2	--	--	--	--	--	**0.15**	--	**0.2**	**0.12**	--	--	--	--	--
Chromium	mg/kg	520	--	--	--	--	--	**23.1**	**7.88**	**8.27**	**25.1**	**16.2**	--	--	--	--
Copper	mg/kg	780	--	--	--	--	--	**22.9**	**9.65 J**	**20**	**19.9 J**	**37.4 J**	--	--	--	--
Lead	mg/kg	900	--	--	--	--	--	**39.4 J**	**9.53 J**	**24.2 J**	**3.75 J**	**6.25 J**	--	--	--	--
Mercury	mg/kg	0.82	--	--	--	--	--	**0.0276**	--	**0.0183 J**	**0.278**	**0.0268**	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	mg/kg	820	--	--	--	--	--	**48.7**	**21.7**	**93.1**	**37.3**	**40.9**	--	--	--	--
Polychlorinated biphenyls (PCBs)																
Total PCB Aroclors(2)	mg/kg	0.13	**0.061**	**0.027**	**0.052**	**0.25**	**0.77**	**0.0226**	0.004 U	**0.1232**	**0.0033 J**	**0.0291**	**0.0075**	**0.014**	**0.0048**	0.004 U
Total PCB Congeners(3)	mg/kg	0.13	--	--	--	--	--	--	--	--	--	**0.0226 J**	--	--	--	--
Dioxins/Furans																
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polycyclic aromatic hydrocarbons (PAHs)																
2-Methylnaphthalene	mg/kg	1.34	--	--	--	--	--	0.00498 U	**0.00497 U**	0.00499 U	0.00498 U	0.00499 U	--	--	--	--
Acenaphthene	mg/kg	1	--	--	--	--	--	**0.00068 J**	0.00497 U	**0.00071 J**	0.00498 U	0.00499 U	--	--	--	--
Anthracene	mg/kg	1.92	--	--	--	--	--	**0.00105 J**	0.00497 U	**0.00182 J**	**0.00093 J**	**0.00129 J**	--	--	--	--
Benzo(g,h,i)perylene	mg/kg	1.34	--	--	--	--	--	**0.0067**	**0.00935**	**0.0146**	**0.0129**	**0.00805**	--	--	--	--
Dibenzofuran	mg/kg	1.08	--	--	--	--	--	0.00498 U	0.00497 U	0.00499 U	0.00498 U	0.00499 U	--	--	--	--
Fluoranthene	mg/kg	3.4	--	--	--	--	--	**0.00864**	**0.0102**	**0.0181**	**0.00658**	**0.0023 J**	--	--	--	--
Fluorene	mg/kg	1.08	--	--	--	--	--	0.00498 U	0.00497 U	0.00499 U	0.00498 U	0.00499 U	--	--	--	--
Naphthalene	mg/kg	4.2	--	--	--	--	--	0.00474 U	0.00497 U	0.00769 U	0.00498 U	0.00499 U	--	--	--	--
Phenanthrene	mg/kg	3	--	--	--	--	--	0.00498 U	**0.00351 J**	**0.00793**	**0.0127**	**0.0031 J**	--	--	--	--
Pyrene	mg/kg	5.2	--	--	--	--	--	**0.0119**	**0.0132**	**0.0177**	**0.0337**	**0.00328 J**	--	--	--	--
Benzo(a)anthracene	mg/kg	2.6	--	--	--	--	--	**0.00356 J**	**0.00469 J**	**0.00895**	**0.00556**	**0.00134 J**	--	--	--	--
Benzo(a)pyrene	mg/kg	3.2	--	--	--	--	--	**0.00587**	**0.0077**	**0.0134**	**0.00518**	**0.00217 J**	--	--	--	--
Chrysene	mg/kg	2.8	--	--	--	--	--	**0.00663**	**0.0067**	**0.0136**	**0.0137**	**0.003 J**	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg	0.46	--	--	--	--	--	**0.0019 J**	**0.00174 J**	**0.00322 J**	**0.00205 J**	**0.00123 J**	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg	1.2	--	--	--	--	--	**0.00467 J**	**0.00638**	**0.0125**	**0.00287 J**	**0.00319 J**	--	--	--	--
Total Benzofluoranthenes	mg/kg	6.4	--	--	--	--	--	**0.0128**	**0.0154**	**0.0309**	**0.012**	**0.00631 J**	--	--	--	--
Total HPAHs(5) (ND = 1/2 RDL(4))	mg/kg	24						**0.06267 J**	**0.07003 J**	**0.13297 J**	**0.09208 J**	**0.02962 J**	--	--	--	--
Total LPAHs(6) (ND = 1/2 RDL(4))	mg/kg	10.4						**0.00173 J**	**0.00351 J**	**0.01214 J**	**0.01363 J**	**0.00439 J**	--	--	--	--
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	5.5	--	--	--	--	--	**0.0082303 J**	**0.010055 J**	**0.019161 J**	**0.007319 J**	**0.003282 J**	--	--	--	--

Table 7. Surface Soil Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	Paved Areas Inland												
			SS-21 02/08/2016 0 - 1.6 ft	SS-22 02/08/2016 0 - 1.6 ft	SS-23 02/08/2016 0 - 1.6 ft	SS-25 02/08/2016 0 - 1.6 ft	SS-26 02/08/2016 0 - 1.6 ft	SS-27 02/08/2016 0 - 1.6 ft	SS-32 11/17/2017 0 - 1.5 ft	SS-33 11/17/2017 0 - 1.5 ft	SS-34 11/17/2017 0 - 1.5 ft	SS-35 11/17/2017 0 - 1.5 ft	SS-36 11/17/2017 0 - 1.5 ft	SS-37 11/17/2017 0 - 1.5 ft	SS-38 11/17/2017 0 - 1 ft
Metals															
Arsenic	mg/kg	57	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	mg/kg	10.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	mg/kg	520	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	mg/kg	780	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	mg/kg	900	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	mg/kg	0.82	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	mg/kg	820	--	--	--	--	--	--	--	--	--	--	--	--	--
Polychlorinated biphenyls (PCBs)															
Total PCB Aroclors(2)	mg/kg	0.13	**16**	**0.22**	**0.083**	**0.6**	**0.61**	**0.041**	**0.2**	**29**	0.053 U	0.052 U	**5.6**	0.053 U	**66**
Total PCB Congeners(3)	mg/kg	0.13	--	--	--	--	--	--	--	**76.5**	--	--	--	--	**49.2**
Dioxins/Furans															
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	--	--	--	--	--	--	--	--
Polycyclic aromatic hydrocarbons (PAHs)															
2-Methylnaphthalene	mg/kg	1.34	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg	1	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg	1.92	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg	1.34	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg	1.08	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg	3.4	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg	1.08	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	4.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg	3	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg	5.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg	2.6	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg	3.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	mg/kg	2.8	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg	0.46	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg	1.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg	6.4	--	--	--	--	--	--	--	--	--	--	--	--	--
Total HPAHs(5) (ND = 1/2 RDL(4))	mg/kg	24	--	--	--	--	--	--	--	--	--	--	--	--	--
Total LPAHs(6) (ND = 1/2 RDL(4))	mg/kg	10.4	--	--	--	--	--	--	--	--	--	--	--	--	--
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	5.5	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7. Surface Soil Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	A&B Barrel Pond (Unpaved)								South Lot Line (Unpaved)	
			B-03	**B-04**	**MW-04**	**MW-05**	**MW-06**	**SB-26**	**SS-31**	**SS-39**	**HA-01**	**HA-02**
			11/17/2017	**11/17/2017**	**03/04/2021**	**03/05/2021**	**03/05/2021**	**03/04/2021**	**11/17/2017**	**11/17/2017**	**03/11/2021**	**03/11/2021**
			0 - 1 ft	**0 - 1 ft**	**0 - 1 ft**	**0 - 1 ft**	**0 - 1 ft**	**0 - 1 ft**	**0 - 1.5 ft**	**0 - 1.25 ft**	**0 - 1 ft**	**0 - 1 ft**
Other semivolatile organic compounds (SVOCs)												
2,4-Dimethylphenol	mg/kg	0.058	--	--	0.1 U	0.998 U	0.1 U	0.1 U	--	--	0.0999 U	0.0998 U
4-Methylphenol	mg/kg	1.34	--	--	0.02 U	0.2 U	0.0200 U	0.02 U	--	--	**0.021**	0.02 U
Benzoic acid	mg/kg	1.3	--	--	0.2 UJ	2 UJ	0.2 U	**0.0896 J**	--	--	**0.112 J**	**0.067 J**
Benzyl alcohol	mg/kg	0.114	--	--	0.02 U	0.2 U	0.0200 U	0.02 U	--	--	**0.034**	**0.531**
Benzyl butyl phthalate	mg/kg	0.126	--	--	**0.0913**	0.2 U	0.0200 U	0.02 UJ	--	--	**0.0616 J**	**0.0919 J**
Bis(2-ethylhexyl) phthalate	mg/kg	2.6	--	--	**0.258**	0.499 U	0.0500 U	0.5 UJ	--	--	**0.475**	**0.264**
Dimethyl phthalate	mg/kg	0.142	--	--	**0.0095 J**	**0.292**	0.0200 U	0.02 UJ	--	--	**0.543**	**0.0792**
Hexachlorobenzene	mg/kg	0.014	--	--	0.00996 U	0.00998 U	0.00050 U	0.00998 U	--	--	0.00998 U	0.01 U
N-Nitrosodiphenylamine	mg/kg	0.056	--	--	0.02 U	0.2 U	0.0200 U	**0.0506 J**	--	--	0.02 U	0.02 U
Pentachlorophenol	mg/kg	0.72	--	--	**0.118 J**	0.998 UJ	0.1 U	**0.429 J**	--	--	**0.473 J**	**0.385 J**
Phenol	mg/kg	0.84	--	--	**0.0798**	0.2 U	0.0200 U	**0.0149 J**	--	--	**0.0302**	**0.0311**
1,2,4-Trichlorobenzene	mg/kg	0.062	--	--	0.00633 U	0.00804 U	0.00598 U	0.00524 UJ	--	--	0.00533 U	0.00828 U
1,2-Dichlorobenzene	mg/kg	0.07	--	--	**0.016 J**	0.00161 U	0.0012 U	**0.0123 J**	--	--	0.00107 U	0.00166 U
1,4-Dichlorobenzene	mg/kg	0.22	--	--	0.00127 U	0.00161 U	0.0012 U	**0.0204 J**	--	--	0.00107 U	0.00166 U
Conventionals												
Total Organic Carbon (TOC)	%		--	--	**0.95**	**0.74**	--	**2.98**	--	--	**1.76**	**2.75**

Notes:

(1) The screening levels presented are applied for source control review only and are not used for compliance purposes. The screening levels are shown as dry-weight equivalent values presented in the LDW Preliminary Cleanup Level Workbook.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

mg/kg - milligrams per kilogram, ng/kg - nanograms per kilogram, ft - feet.

% - percent

TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

"--" - indicates samples not analyzed.

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 7. Surface Soil Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	Unpaved Soils Along Shoreline											
			MW-07 03/09/2021 0 - 1 ft	MW-08 03/09/2021 0 - 1 ft	MW-09 03/09/2021 0 - 1 ft	MW-10 03/08/2021 0 - 1 ft	MW-11 03/08/2021 0 - 1 ft	SB-27 03/09/2021 0 - 1 ft	SS-03 02/09/2016 0 - 1.6 ft	SS-08 02/09/2016 0 - 1.6 ft	SS-12 02/09/2016 0 - 1.6 ft	SS-16 02/09/2016 0 - 1.6 ft	SS-20 02/10/2016 0 - 1.6 ft	SS-24 02/10/2016 0 - 1.6 ft
Other semivolatile organic compounds (SVOCs)														
2,4-Dimethylphenol	mg/kg	0.058	0.0995 U	0.1 U	0.1 U	0.0999 U	0.0997 U	0.0996 U	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	0.0199 U	0.02 UJ	0.02 U	0.02 UJ	0.0199 UJ	0.0199 U	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	0.199 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.199 UJ	0.199 UJ	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	0.0199 U	0.02 U	0.02 U	0.02 U	0.0199 U	**0.0149 J**	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg	0.126	0.0199 U	0.0126 J	0.02 U	0.02 U	**0.0303**	**0.122**	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg	2.6	**0.0671**	**0.0665**	0.05 U	0.0499 U	**0.0811**	**0.981**	--	--	--	--	--	--
Dimethyl phthalate	mg/kg	0.142	**0.0262**	**0.114**	0.02 U	0.02 U	**0.0178 J**	**0.197**	--	--	--	--	--	--
Hexachlorobenzene	mg/kg	0.014	0.0005 U	0.0005 U	0.0005 U	0.02 U	0.0199 U	0.0199 U	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg	0.056	0.0199 U	0.02 U	0.02 U	0.02 U	0.0199 U	0.0199 U	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	0.0995 UJ	0.1 UJ	0.1 UJ	0.0999 UJ	0.0997 UJ	0.0996 UJ	--	--	--	--	--	--
Phenol	mg/kg	0.84	0.0199 U	0.02 U	0.02 U	0.02 U	0.0199 U	**0.0097 J**	--	--	--	--	--	--
1,2,4-Trichlorobenzene	mg/kg	0.062	0.00654 U	0.00789 U	0.00587 U	0.00517 U	0.00552 U	0.00665 U	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg	0.07	0.00131 U	0.00158 U	0.00117 U	0.00103 U	0.0011 U	0.00133 U	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg	0.22	0.00131 U	0.00158 U	0.00117 U	0.00103 U	0.0011 U	0.00133 U	--	--	--	--	--	--
Conventionals														
Total Organic Carbon (TOC)	%		**0.21**	**0.22**	**0.04**	**0.24**	**1.23**	**0.34**	--	--	--	--	--	--

Notes:

(1) The screening levels presented are applied for source control review only and are not used for compliance purposes. The screening levels are shown as dry-weight equivalent values presented in the LDW Preliminary Cleanup Level Workbook.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

mg/kg - milligrams per kilogram, ng/kg - nanograms per kilogram, ft - feet.

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TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

"--" - indicates samples not analyzed.

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 7. Surface Soil Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	Unpaved Areas Inland												
			MW-14A 03/10/2021 0 - 1 ft	SB-28 03/01/2021 0 - 1 ft	SB-29 03/01/2021 0 - 1 ft	SB-32 03/08/2021 0 - 1 ft	SB-33 03/03/2021 0 - 1 ft	SB-34 03/01/2021 0 - 1 ft	SB-34R 03/23/2021 0 - 1 ft	SS-04 02/10/2016 0 - 1.6 ft	SS-05 02/10/2016 0 - 1.6 ft	SS-06 02/10/2016 0 - 1.6 ft	SS-09 02/10/2016 0 - 1.6 ft	SS-10 02/10/2016 0 - 1.6 ft	SS-11 02/10/2016 0 - 1.6 ft
Other semivolatile organic compounds (SVOCs)															
2,4-Dimethylphenol	mg/kg	0.058	0.0997 U	0.0997 U	0.0998 U	0.0994 U	0.0997 U	--	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	0.0199 U	0.0199 UJ	0.02 UJ	0.0199 UJ	0.0199 U	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	0.199 UJ	0.199 U	0.2 U	**0.0623 J**	0.199 U	--	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	**0.138**	0.0199 UJ	0.02 UJ	0.0199 U	0.0199 U	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg	0.126	0.0199 U	0.0199 U	0.02 U	**0.0412**	**0.0096 J**	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg	2.6	**0.0521**	0.0466 J	0.0499 U	**0.255 J**	**0.067**	--	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg	0.142	**0.271**	0.0199 U	0.02 U	**0.254 J**	0.0199 U	--	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg	0.014	0.0199 U	0.0199 U	0.0005 U	0.0199 U	0.0199 U	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg	0.056	0.0199 U	0.0199 U	0.02 U	0.0199 U	0.0199 U	--	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	0.0997 UJ	0.0997 UJ	0.0998 UJ	0.0994 UJ	0.0997 U	--	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	0.0199 U	0.0199 U	0.02 U	0.0199 U	0.0199 U	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	mg/kg	0.062	0.00465 U	0.00499 UJ	0.0058 U	0.00858 U	0.005 U	0.0068 UJ	0.005 U	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg	0.07	0.00093 U	0.001 UJ	0.00116 U	0.00172 U	0.001 U	0.00136 UJ	0.001 U	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg	0.22	0.00093 U	0.001 UJ	0.00116 U	0.00172 U	0.001 U	0.00136 UJ	0.001 U	--	--	--	--	--	--
Conventionals															
Total Organic Carbon (TOC)	%		**0.26**	**0.75**	**0.25**	**1.08**	**0.09**	**0.14**	--	--	--	--	--	--	--

Notes:

(1) The screening levels presented are applied for source control review only and are not used for compliance purposes. The screening levels are shown as dry-weight equivalent values presented in the LDW Preliminary Cleanup Level Workbook.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

mg/kg - milligrams per kilogram, ng/kg - nanograms per kilogram, ft - feet.

% - percent

TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

"--" - indicates samples not analyzed.

U - Analyte not detected at or above the reporting limit shown

J - Analyte was positively identified, and the reported value is an estimate

UJ - Analyte was not detected at or above the reported limit, and the value shown is an estimate

Table 7. Surface Soil Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	Unpaved Areas Inland													
			SS-13 02/10/2016 0 - 1.6 ft	SS-14 02/10/2016 0 - 1.6 ft	SS-15 02/09/2016 0 - 1.6 ft	SS-18 02/10/2016 0 - 1.6 ft	SS-19 02/10/2016 0 - 1.6 ft	MW-12 03/03/2021 0 - 1 ft	MW-13 03/01/2021 0 - 1 ft	MW-15 03/03/2021 0 - 1 ft	SB-30 03/01/2021 0 - 1 ft	SB-31 03/01/2021 0 - 1 ft	SS-01 02/09/2016 0 - 1.6 ft	SS-02 02/09/2016 0 - 1.6 ft	SS-07 02/09/2016 0 - 1.6 ft	SS-17 02/10/2016 0 - 1.6 ft
Other semivolatile organic compounds (SVOCs)																
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	0.0994 U	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	0.0199 U	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	0.199 U	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	0.0199 U	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg	0.126	--	--	--	--	--	--	--	0.0199 U	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg	2.6	--	--	--	--	--	--	--	0.0497 U	--	--	--	--	--	--
Dimethyl phthalate	mg/kg	0.142	--	--	--	--	--	--	--	0.0199 U	--	--	--	--	--	--
Hexachlorobenzene	mg/kg	0.014	--	--	--	--	--	--	--	0.0005 U	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg	0.056	--	--	--	--	--	--	--	0.0199 U	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	0.0994 U	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	0.0199 U	--	--	--	--	--	--
1,2,4-Trichlorobenzene	mg/kg	0.062	--	--	--	--	--	0.00474 U	--	0.00769 U	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg	0.07	--	--	--	--	--	0.00095 U	--	0.00154 U	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg	0.22	--	--	--	--	--	0.00095 U	--	0.00154 U	--	--	--	--	--	--
Conventionals																
Total Organic Carbon (TOC)	%		--	--	--	--	--	**0.19**	**0.07 U**	**0.15**	--	**0.26**	**0.1**	--	--	--

Notes:

(1) The screening levels presented are applied for source control review only and are not used for compliance purposes. The screening levels are shown as dry-weight equivalent values presented in the LDW Preliminary Cleanup Level Workbook.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

mg/kg - milligrams per kilogram, ng/kg - nanograms per kilogram, ft - feet.

% - percent

TEQ = total toxicity equivalence

Bold - detected

Blue Shaded - Detected result exceeded screening level

"--" - indicates samples not analyzed.

U - Analyte not detected at or above the reporting limit shown

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Table 7. Surface Soil Data Screened for Source Control Review

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm sitewide)(1)	Paved Areas Inland												
			SS-21 02/08/2016 0 - 1.6 ft	SS-22 02/08/2016 0 - 1.6 ft	SS-23 02/08/2016 0 - 1.6 ft	SS-25 02/08/2016 0 - 1.6 ft	SS-26 02/08/2016 0 - 1.6 ft	SS-27 02/08/2016 0 - 1.6 ft	SS-32 11/17/2017 0 - 1.5 ft	SS-33 11/17/2017 0 - 1.5 ft	SS-34 11/17/2017 0 - 1.5 ft	SS-35 11/17/2017 0 - 1.5 ft	SS-36 11/17/2017 0 - 1.5 ft	SS-37 11/17/2017 0 - 1.5 ft	SS-38 11/17/2017 0 - 1 ft
Other semivolatile organic compounds (SVOCs)															
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg	0.126	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg	2.6	--	--	--	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg	0.142	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg	0.014	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg	0.056	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	mg/kg	0.062	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg	0.07	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg	0.22	--	--	--	--	--	--	--	--	--	--	--	--	--
Conventionals															
Total Organic Carbon (TOC)	%		--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

(1) The screening levels presented are applied for source control review only and are not used for compliance purposes. The screening levels are shown as dry-weight equivalent values presented in the LDW Preliminary Cleanup Level Workbook.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

mg/kg - milligrams per kilogram, ng/kg - nanograms per kilogram, ft - feet.

% - percent

TEQ = total toxicity equivalence

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Blue Shaded - Detected result exceeded screening level

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Table 8. Summary of Data Screening for Source Control by Media, with Exceedance Factors

Project No. 190293, South Park Marina, Seattle, Washington

			Marina Basin Receiving Sediment (0-10 cm)(1)	Upland Pathways for Potential Sediment Recontamination			
				Pathway 1: Groundwater Discharge	Pathway 2: Stormwater Drain System Discharge		Pathway 3: Discharge of Eroded Soil via Overland Flow or Bank Sloughing
		Media:	Sediment	Groundwater at Shoreline(2)	Stormwater(3)	CB Solids	Surface Soil
		Screening Level(4):	LDW RALs(5)	GW3 PCULs(6)	GW3 PCULs(6)	LDW RALs(5)	LDW RALs(5)
Exceedance Factors for LDW COCs(7)	Metals	Arsenic				1.2	
		Cadmium			1.1 (T)	1.6	
		Copper			23 (D) 33 (T)	18	3.2
		Lead				1.0	1.7
		Mercury				2.1	14.0
		Zinc			2.3 (D) 2.3 (T)	8.9	
	PCBs	Total PCBs(8)	1.9			32	588
	Dioxins	Total Dioxin/Furan TEQ				36	102
	PAHs	2-Methylnaphthahlene				3.5	
		Benzo(g,h,i)perylene				1.0	
		Fluoranthene				3.5	
		Phenanthrene				2.1	
		Pyrene				2.1	
		Benz(a)anthracene				1.3	
		Benzo(a)pyrene				1.2	
		Chrysene				2.1	
		Indeno(1,2,3-cd)pyrene			1.2	1.5	
		Total Benzofluoranthenes				1.7	
		Total HPAHs(9)				2.1	
	Other SVOCs	4-Methylphenol				9.3	
		Benzoic acid				7.5	
		Benzyl alcohol	2.5			553	4.7
		Benzyl butyl phthalate				34	
		Bis (2-ethylhexyl) phthalate			95	42	
		Dimethyl phthalate				493	3.8
		Pentachlorophenol				2.1	
		Phenol				2.6	

Notes:

(1) - The empirical sediment data for the marina basin are the primary line of evidence with respect to sediment recontamination.

(2) - Inland from the shoreline, total PCBs and zinc were detected at concentrations exceeding GW-3 screening levels at well MW-5 on the downgradient edge of the historical A&B Barrel Co. waste disposal pond. As discussed in the text, data from shoreline well MW-6, which does not have exceedances, are considered the best measure of groundwater discharge from the pond area.

(3) - Concentrations in stormwater whole-water samples must be converted to estimated concentrations on suspended solids phase for use in the sediment recontamination assessment (refer to text).

(4) - A contaminant of concern (COC) exceedance of a screening level in upland media does not by itself indicate the upland media is a risk for sediment recontamination. Rather, it indicates the need for further analysis of the mass loading of that COC to LDW sediment (refer to text).

(5) - LDW RAL - Lower Duwamish Waterway Remedial Action Level for 0-10 centimeter sediment, sitewide (or dry-weight equivalent per the LDW PCUL Workbook).

(6) - GW3 PCUL - LDW Groundwater Preliminary Cleanup Level based on protection of sediment.

(7) - Includes only LDW sediment COCs that exceeded one or more source-control screening level in upland media. Exceedance factors shown are the maximum detected concentration divided by the media-specific screening level.

(8) - Total PCB concentrations are the sum of Aroclors or sum of congeners, calculated with non-detects = 0.

(9) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

Other SVOCs - other semivolatile organic compounds

PAHs - polycyclic aromatic hydrocarbons

PCBs - polychlorinated biphenyls

TEQ = total toxicity equivalence

D - Maximum detection of metal in dissolved phase exceeds source control screening level

T - Maximum detection of metal in total phase exceeds source control screening level

Table 9. Predictive Model Formulas and Input Parameters

Project No. 190293, South Park Marina, Seattle, Washington

Model Formula:

$C_{(time)} = C_{bed}*fraction_{bed} + C_{river}*fraction_{river} + C_{lateral}*fraction_{lateral}$
where the fractions are percent of sediment mass contribution within the receiving sediment mixed layer at any time.

Additional Model Formulas:

$fraction_{lateral}$	(Runoff rate from upland * TSS value * time) / (density * basin area * receiving sediment depth)
$fraction_{river}$	[(Total sedimentation rate - lateral sedimentation rate) * time] / receiving sediment depth
$fraction_{bed}$	$1 - fraction_{lateral} - fraction_{river}$

Model Parameter Assumptions that Do Not Vary:

Input	Value
Density of lateral and river sediment = bedded baseline sediment	60 pounds per cubic foot, based on LDW FS
Receiving sediment depth	0 - 10 centimeters
Receiving basin area	3.1 acres
Model time step	1 year (annual)
Time of simulation	25 years

Variable Model Parameter Assumptions for Sensitivity Analysis:

Inputs		Model Cases		
		More Conservative Value	Base Case	Less Conservative Value
Physical Properties	Runoff rate from Site upland (L/yr)	90th percentile value of the distribution produced by WWHM	Median value of the distribution produced by WWHM	25th percentile value of the distribution produced by WWHM
		15,118,466	11,707,212	10,081,954
	Lateral sedimentation rate from Site to marina basin (cm/yr)	Calculated using modeled 90th percentile runoff from Site and 90th percentile TSS	Calculated using modeled median runoff from Site and median TSS	Calculated using modeled 25th percentile runoff from Site and 25th percentile TSS
		0.003	0.001	0.0007
	Total sedimentation rate to receiving basin (cm/yr)	Based on LDW Sediment Transport Model (QEA, 2008). Refer to memorandum Section 5.3.2 for discussion of assumed sedimentation		
		0.5	2.0	3
	River sedimentation rate from upstream (cm/yr)	More conservative total sedimentation rate minus lateral sedimentation rate	Base case total sedimentation rate minus lateral sedimentation rate	Less conservative total sedimentation rate minus lateral sedimentation rate
		0.497	1.999	2.999
Chemical Properties for COCs modeled (see Table 11)	COC concentrations in Site stormwater solids ($C_{lateral}$)	90th percentile value from both the calculated whole-water estimation and measured CB Solids data sets	Median concentration from both the calculated whole-water estimation and measured CB Solids data sets	25th percentile value from both the calculated whole-water estimation and measured CB Solids data sets
	COC concentrations in receiving sediments (C_{bed})	Measured surface-weighted average concentration (SWAC)		
	COC concentrations in upstream sediment load (C_{river})	Windward (2020) 90th percentile for arsenic and PCBs; USGS (2018) 90th percentile for other LDW COCs modeled	Windward (2020) median for arsenic and PCBs; USGS (2018) median for other LDW COCs modeled	Windward (2020) 25th percentile for arsenic and PCBs; USGS (2018) 25th percentile for other LDW COCs modeled

Whole-Water Total Suspended Solids (TSS) Concentrations (mg/L):

Number of Samples	Range of TSS Concentrations (mg/L)				
	Maximum	More Conservative 90th Percentile	Base Case Median	Less Conservative 25th Percentile	Minimum
15	26	24	12	8	4

Notes:

LDW = Lower Duwamish Waterway
FS = Feasibility Study
WWHM = Western Washington Hydrologic Model
COC = Contaminant of Concern
CB = Catch Basin
PCBs = polycholorinated biphenyls
L/yr = liters per year, cm/yr = centimeters per year

QEA, 2008, Lower Duwamish Waterway Sediment Transport Modeling Report, Final, prepared for USEPA and Department of Ecology, October 2008.

United States Geological Survey (USGS), 2018, Chemical Concentration in Water and Suspended Sediment, Green River to Lower Duwamish Waterway near Seattle, Washington, 2016-17, Data Series 1073, Conn, K.E., Black, R.W., Peterson, N.T., Senter, C.A., and Chapman, E.A., https://doi.org/10.3133/ds1073.

Windward Environmental, 2020, Lower Duwamish Waterway Pre-Design Studies Data Evaluation Report (Task 6), prepared for the LDWG, Final, June 26, 2020.

Table 10. Marina Basin Surface Sediment Data (Dry-Weight) for Modeled COCs

Project No. 190293, South Park Marina, Seattle, Washington

Data Year and Source[1]		2003 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action	2004 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action		2008 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action	2011 - Surface Sediment Sampling at Outfalls in the LDW		2014 - T-117 EAA Removal Action 2013-2014
	Location	SE-07-G	SE-73-G	SE-74-G	98-G	LDW-SS2214-A	LDW-SS2214-D	PERIM-5-POST
	Date	12/08/2003	03/16/2004	03/16/2004	08/29/2008	03/07/2011	03/07/2011	05/12/2014
	Sample ID	T117-SE07-SG	T117-SE73-SG	T117-SE74-SG	T117-98-SG	LDW-SS2214-A	LDW-SS2214-D	SG-PERIM-5-POST
	Depth	0 - 0 ft	0 - 0 ft	0 - 0 ft	0 - 0.2 ft	0 - 0 cm	0 - 0 cm	0 - 0 cm
Analyte	Unit							
Metals								
Arsenic	mg/kg	--	--	--	--	**20**	**20**	**4.26**
Copper	mg/kg	--	--	--	--	**66.7**	**67.2**	**21.8**
Zinc	mg/kg	--	--	--	--	**119**	**115**	**39.7**
Polychlorinated Biphenyls (PCBs)								
Total PCB Aroclors[2]	mg/kg	**0.087**	**0.263**	**0.123**	**0.118**	**0.29**	**0.31**	**0.036**
Total PCB Congeners[3]	mg/kg	--	--	--	--	--	--	--
Total PCB Concentration Used in Model[4]	mg/kg	**0.087**	**0.263**	**0.123**	**0.118**	**0.29**	**0.31**	**0.036**
Polycyclic Aromatic Hydrocarbons (PAHs)								
2-Methylnaphthalene	mg/kg	--	--	--	--	**0.01**	0.019 U	**0.0055**
Semivolatile Organic Compounds (SVOCs)								
Dimethyl Phthalate	mg/kg	--	--	--	--	**0.027**	**0.027**	0.01 U

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - Total PCB value is shown as reported in Ecology's Environmental Information Management database. Summing rules, and individual Aroclors included, are unknown.

(5) - Total PCB Concentrations Used in Model - If a sample had concentration data for both Aroclors and congeners, the higher of the two total PCB values was used, or the total PCB congener value was used if all Aroclors were non-detect. If only congener or Aroclor data were available, then available data were used.

mg/kg = milligrams per kilogram, all values are dry-weight equivalent

Bold - detected

U - Analyte not detected at Reporting Limit (RL) shown

Table 10. Marina Basin Surface Sediment Data (Dry-Weight) for Modeled COCs

Project No. 190293, South Park Marina, Seattle, Washington

	Data Year and Source[(1)]	2015 - Boeing Plant 2 Completion Report					2016 - T-117 Outfall Pre-Operational Sediment Sampling				
	Location	SD-PER303	SD-PER305	SD-PER307	SD-PER312	SD-PER313	SG-A1-PREOP	SG-A2-PREOP	SG-A3-PREOP	SG-B1-PREOP	SG-B2-PREOP
	Date	02/26/2015	02/27/2015	03/09/2015	02/26/2015	02/27/2015	07/12/2016	07/12/2016	07/12/2016	07/12/2016	07/12/2016
	Sample ID	SD-PER303-0315	SD-PER305-0315	SD-PER327-0315	SD-PER312-0315	SD-PER313-0315	SD0127	SD0128	SD0129	SD0123	SD0122
	Depth	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0 cm	0 - 0 cm	0 - 0 cm	0 - 0 cm	0 - 0 cm
Analyte	Unit										
Metals											
Arsenic	mg/kg	**8.3**	**8**	**8**	**11.4**	**9.1**	--	--	--	--	--
Copper	mg/kg	**32.6**	**31**	**32.6**	**42.1**	**36.2**	--	--	--	--	--
Zinc	mg/kg	**75**	**69**	**70**	**87**	**75**	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)											
Total PCB Aroclors[(2)]	mg/kg	**0.095**	**0.103**	**0.061**	**0.128**	**0.069**	**0.062**	**0.071**	**0.062**	**0.064**	**0.069**
Total PCB Congeners[(3)]	mg/kg	--	--	--	--	--	--	--	--	--	--
Total PCB Concentration Used in Model[(4)]	mg/kg	**0.095**	**0.103**	**0.061**	**0.128**	**0.069**	**0.062**	**0.071**	**0.062**	**0.064**	**0.069**
Polycyclic Aromatic Hydrocarbons (PAHs)											
2-Methylnaphthalene	mg/kg	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds (SVOCs)											
Dimethyl Phthalate	mg/kg	--	--	--	--	--	--	--	--	--	--

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - Total PCB value is shown as reported in Ecology's Environmental Information Management database. Summing rules, and individual Aroclors included, are unknown.

(5) - Total PCB Concentrations Used in Model - If a sample had concentration data for both Aroclors and congeners, the higher of the two total PCB values was used, or the total PCB congener value was used if all Aroclors were non-detect. If only congener or Aroclor data were available, then available data were used.

mg/kg = milligrams per kilogram, all values are dry-weight equivalent

Bold - detected

U - Analyte not detected at Reporting Limit (RL) shown

Table 10. Marina Basin Surface Sediment Data (Dry-Weight) for Modeled COCs

Project No. 190293, South Park Marina, Seattle, Washington

Data Year and Source(1)		2016 - T-117 Outfall Pre-Operational Sediment Sampling				2016 - TIG - SPM Site Investigation				
	Location	SG-B3-PREOP	SG-C1-PREOP	SG-C2-PREOP	SG-C3-PREOP	SC-01	SC-02	SC-03	SC-04	SC-05
	Date	07/12/2016	07/12/2016	07/12/2016	07/12/2016	02/25/2016	02/24/2016	02/25/2016	02/26/2016	02/25/2016
	Sample ID	SD0120	SD0126	SD0124	SD0125	SPM-SC-01-02252016-0-0.1	SPM-SC-02-02242016-0-0.1	SPM-SC-03-02252016-0-0.1	SPM-SC-04-02262016-0-0.1	SPM-SC-05-02252016-0-0.1
	Depth	0 - 0 cm	0 - 0 cm	0 - 0 cm	0 - 0 cm	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft
Analyte	Unit									
Metals										
Arsenic	mg/kg	--	--	--	--	--	--	--	--	--
Copper	mg/kg	--	--	--	--	--	--	--	--	--
Zinc	mg/kg	--	--	--	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)										
Total PCB Aroclors(2)	mg/kg	**0.061**	**0.069**	**0.064**	**0.07**	**0.0301**	**0.041**	**0.0189**	**0.0219**	< 0.04 U
Total PCB Congeners(3)	mg/kg	--	--	--	--	**0.0672**	**0.0171**	**0.0060**	**0.0382**	**0.0049**
Total PCB Concentration Used in Model(4)	mg/kg	**0.061**	**0.069**	**0.064**	**0.07**	**0.0672**	**0.0410**	**0.0189**	**0.0382**	**0.0049**
Polycyclic Aromatic Hydrocarbons (PAHs)										
2-Methylnaphthalene	mg/kg	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds (SVOCs)										
Dimethyl Phthalate	mg/kg	--	--	--	--	--	--	--	--	--

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - Total PCB value is shown as reported in Ecology's Environmental Information Management database. Summing rules, and individual Aroclors included, are unknown.

(5) - Total PCB Concentrations Used in Model - If a sample had concentration data for both Aroclors and congeners, the higher of the two total PCB values was used, or the total PCB congener value was used if all Aroclors were non-detect. If only congener or Aroclor data were available, then available data were used.

mg/kg = milligrams per kilogram, all values are dry-weight equivalent

Bold - detected

U - Analyte not detected at Reporting Limit (RL) shown

Table 10. Marina Basin Surface Sediment Data (Dry-Weight) for Modeled COCs

Project No. 190293, South Park Marina, Seattle, Washington

Data Year and Source[1]		2016 - TIG - SPM Site Investigation								
	Location	SC-06	SC-07	SC-08	SC-09	SC-10	SC-11	SC-12	SC-13	SC-14
	Date	02/24/2016	02/25/2016	02/25/2016	02/26/2016	02/24/2016	02/25/2016	02/26/2016	02/26/2016	02/25/2016
	Sample ID	SPM-SC-06-02242016-0-0.1	SPM-SC-07-02252016-0-0.1	SPM-SC-08-02252016-0-0.1	SPM-SC-09-02262016-0-0.1	SPM-SC-10-02242016-0-0.1	SPM-SC-11-02252016-0-0.1	SPM-SC-12-02262016-0-0.1	SPM-SC-13-02262016-0-0.1	SPM-SC-14-02252016-0-0.1
	Depth	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft	0 - 0.33 ft
Analyte	Unit									
Metals										
Arsenic	mg/kg	--	--	--	--	--	--	--	--	--
Copper	mg/kg	--	--	--	--	--	--	--	--	--
Zinc	mg/kg	--	--	--	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)										
Total PCB Aroclors[2]	mg/kg	**0.093**	< 0.08	0.0101	0.03745	**0.0275**	< 0.08	**0.034**	**0.01**	**0.0845**
Total PCB Congeners[3]	mg/kg	**0.0183**	**0.0429**	**0.0974**	**0.0512**	**0.0548**	**0.0843**	**0.0558**	**0.0291**	**0.1530**
Total PCB Concentration Used in Model[4]	mg/kg	**0.0930**	**0.0429**	**0.0974**	**0.0512**	**0.0548**	**0.0843**	**0.0558**	**0.0291**	**0.1530**
Polycyclic Aromatic Hydrocarbons (PAHs)										
2-Methylnaphthalene	mg/kg	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds (SVOCs)										
Dimethyl Phthalate	mg/kg	--	--	--	--	--	--	--	--	--

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - Total PCB value is shown as reported in Ecology's Environmental Information Management database. Summing rules, and individual Aroclors included, are unknown.

(5) - Total PCB Concentrations Used in Model - If a sample had concentration data for both Aroclors and congeners, the higher of the two total PCB values was used, or the total PCB congener value was used if all Aroclors were non-detect. If only congener or Aroclor data were available, then available data were used.

mg/kg = milligrams per kilogram, all values are dry-weight equivalent

Bold - detected

U - Analyte not detected at Reporting Limit (RL) shown

Table 10. Marina Basin Surface Sediment Data (Dry-Weight) for Modeled COCs

Project No. 190293, South Park Marina, Seattle, Washington

Data Year and Source (1)		2016 - TIG - SPM Site Investigation		2018 - LDW AOC Amendment 3	2020 - LDW Pre-Design Investigation Phase 1						
	Location	SC-15	SC-16	SS-130	LDW20-SS154	LDW20-SS158	LDW20-SS159	LDW20-SS164	LDW20-SS167	LDW20-SS168	LDW20-SS169
	Date	02/24/2016	02/26/2016	03/01/2018	06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/11/2020
	Sample ID	SPM-SC-15-02242016-0-0.1	SPM-SC-16-02262016-0-0.1	LDW18-SS-130	LDW20-SS154	LDW20-SS158	LDW20-SS159	LDW20-SS164	LDW20-SS167	LDW20-SS168	LDW20-SS169
	Depth	0 - 0.33 ft	0 - 0.33 ft	0 - 0 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit										
Metals											
Arsenic	mg/kg	--	--	**13.6**	**11.3**	**11.8**	**8.13**	--	**11.6**	**10.4**	**10.9**
Copper	mg/kg	--	--	**48.4**	**42.6**	**41.5**	**29.1**	--	**42.4**	**37.5**	**37.7**
Zinc	mg/kg	--	--	**102**	**83.4**	**83.5**	**52.7**	--	**86.3**	**73.9**	**76.1**
Polychlorinated Biphenyls (PCBs)											
Total PCB Aroclors (2)	mg/kg	**0.099**	**0.108**	**0.0677**	**0.039**	**0.0392**	**0.0416**	--	**0.0573**	**0.0334**	**0.0333**
Total PCB Congeners (3)	mg/kg	**0.1973**	**0.0381**	--	--	--	--	**0.0350**	--	--	--
Total PCB Concentration Used in Model (4)	mg/kg	**0.1973**	**0.1080**	**0.0677**	**0.0390**	**0.0392**	**0.0416**	**0.0350**	**0.0573**	**0.0334**	**0.0333**
Polycyclic Aromatic Hydrocarbons (PAHs)											
2-Methylnaphthalene	mg/kg	--	--	**0.008**	0.0199 U	0.02 U	0.02 U	--	0.02 U	0.0199 U	**0.0096**
Semivolatile Organic Compounds (SVOCs)											
Dimethyl Phthalate	mg/kg	--	--	0.02 U	0.0199 U	0.02 U	0.02 U	--	0.02 U	0.0199 U	0.0198 U

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - Total PCB value is shown as reported in Ecology's Environmental Information Management database. Summing rules, and individual Aroclors included, are unknown.

(5) - Total PCB Concentrations Used in Model - If a sample had concentration data for both Aroclors and congeners, the higher of the two total PCB values was used, or the total PCB congener value was used if all Aroclors were non-detect. If only congener or Aroclor data were available, then available data were used.

mg/kg = milligrams per kilogram, all values are dry-weight equivalent

Bold - detected

U - Analyte not detected at Reporting Limit (RL) shown

Table 10. Marina Basin Surface Sediment Data (Dry-Weight) for Modeled COCs

Project No. 190293, South Park Marina, Seattle, Washington

	Data Year and Source[1]	2021 - LDW Pre-Design Investigation Phase 2	2021 - T-117 EAA Year 6 Sediment Monitoring
	Location	SS559	PERIM-5-LTM
	Date	06/30/2021	03/18/2021
	Sample ID	LDW21-SS559	PERIM-5-LTM-20210318
	Depth	0 - 0.33 ft	0 - 10 cm
Analyte	Unit		
Metals			
Arsenic	mg/kg	--	**11.5**
Copper	mg/kg	--	--
Zinc	mg/kg	--	--
Polychlorinated Biphenyls (PCBs)			
Total PCB Aroclors[2]	mg/kg	**0.1708**	**0.0219**
Total PCB Congeners[3]	mg/kg	--	--
Total PCB Concentration Used in Model[4]	mg/kg	**0.1708**	**0.0219**
Polycyclic Aromatic Hydrocarbons (PAHs)			
2-Methylnaphthalene	mg/kg	--	**0.0551**
Semivolatile Organic Compounds (SVOCs)			
Dimethyl Phthalate	mg/kg	--	**--**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Arolclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclors concentration is shown as non-detect at the maximum reporting limit for any individual Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - Total PCB value is shown as reported in Ecology's Environmental Information Management database. Summing rules, and individual Aroclors included, are unknown.

(5) - Total PCB Concentrations Used in Model - If a sample had concentration data for both Aroclors and congeners, the higher of the two total PCB values was used, or the total PCB congener value was used if all Aroclors were non-detect. If only congener or Aroclor data were available, then available data were used.

mg/kg = milligrams per kilogram, all values are dry-weight equvalent

Bold - detected

U - Analyte not detected at Reporting Limit (RL) shown

Table 11. Range of Input Concentration Values for Modeled COCs

Project No. 190293, South Park Marina, Seattle, Washington

C_{bed} - Summary of Predictive Model Input Concentration Data

Analyte	Number of Samples	Range of C_{bed} Concentrations (mg/kg)				
		Maximum	90th Percentile	C_{bed} SWAC Concentration	25th Percentile	Minimum
Arsenic	15	20.0	17.4	**11.4**	8.7	7.8
Copper	15	67.2	59.4	**40.9**	31.8	21.8
Zinc	15	119	110	**82.0**	71.5	39.7
2-Methylnaphthalene	10	0.055	0.015	**0.011**	0.010	0.008
Dimethyl Phthalate	10	0.027	0.027	**0.011**	0.010	0.005
Total PCBs	46	0.310	0.162	**0.080**	0.042	0.005

C_{river} - Summary of Predictive Model Input Concentration Data

Analyte	Number of Samples (USGS, 2018)	Range of C_{river} Concentrations (mg/kg)				
			More Conservative	Base Case	Less Conservative	
		Maximum	90th Percentile	Median	25th Percentile	Minimum
Arsenic	11	27	**12**	**10**	**9**	8
Copper	11	70	**69.1**	**46.3**	**37.4**	27
Zinc	11	1,470	**355**	**227**	**178**	96
2-Methylnaphthalene	10	0.073	**0.039**	**0.017**	**0.012**	0.008
Dimethyl Phthalate	6	0.052	**0.046**	**0.026**	**0.016**	0.002
Total PCBs	10	0.051	**0.055**	**0.020**	**0.006**	0.002

$C_{lateral}$ - Summary of Predictive Model Input Concentration Data

Analyte	Measured Catch Basin Solids Samples	Calculated Whole-Water Suspended Solids Samples	Total Number of Samples	Range of $C_{lateral}$ Concentrations (mg/kg)				
					More Conservative	Base Case	Less Conservative	
				Maximum	90th Percentile	Median	25th Percentile	Minimum
Arsenic	5	8	13	488	**268**	**69**	**22**	6.6
Copper	5	14	19	74,615	**18,167**	**4,750**	**1,825**	417
Zinc	5	13	18	225,000	**30,283**	**5,356**	**3,033**	303
2-Methylnaphthalene	5	9	14	55	**7.6**	**3.2**	**0.52**	0.03
Dimethyl phthalate	5	9	14	2,817	**682**	**25.0**	**6.92**	1.42
Total PCBs	14	9	23	5.95	**3.2**	**0.78**	**0.38**	0.05

Comparison of $C_{lateral}$ Concentrations By Data Source

Range of Measured Catch Basin Solids Concentrations (mg/kg)

Analyte	Number of Measured Catch Basin Solids Samples	Maximum	90th Percentile	Median	25th Percentile	Minimum
Arsenic	5	69	50	18	14	6.6
Copper	5	14,000	9,140	1,800	1,370	771
Zinc	5	7,330	6,638	2,900	383	303
2-Methylnaphthalene	5	4.7	4.7	0.39	0.07	0.03
Dimethyl phthalate	5	70	46	3.9	2.3	1.4
Total PCBs	14	4.1	1.4	0.47	0.24	0.05

Range of Calculated Whole-Water Suspended Solids Concentrations (mg/kg)

Analyte	No. of Calculated Whole-Water Suspended Solids Samples	Maximum	90th Percentile	Median	25th Percentile	Minimum
Arsenic	8	488	339	157	81	22
Copper	14	74,615	22,958	7,257	2,921	417
Zinc	13	225,000	44,367	10,000	3,750	1,125
2-Methylnaphthalene	9	54.8	17.6	3.69	1.92	0.417
Dimethyl phthalate	9	2,817	1,319	37	17	6.7
Total PCBs	9	5.9	3.7	1.0	0.83	0.42

Notes:

Grey shaded and bold values represent values used as input concentrations for C_{river}, C_{bed}, and $C_{lateral}$ for sensitivity analysis.

Orange values indicate values used directly from Windward (2020), Table 8-5.

mg/L = milligrams per liter; mg/kg = milligrams per kilogram

PCBs = polychlorinated biphenyls

Total PCBs: If a sample had concentration data for both Aroclors and congeners, the higher of the two total PCB values was used, or the total PCB congener value was used if all Aroclors were non-detect. If only congener or Aroclor data are available, that data were used. For samples with only non-detect Aroclor concentrations, one-half the highest Aroclor reporting limit was used.

United States Geological Survey (USGS), 2018, Chemical Concentration in Water and Suspended Sediment, Green River to Lower Duwamish Waterway near Seattle, Washington, 2016-17, Data Series 1073, Conn, K.E., Black, R.W., Peterson, N.T., Senter, C.A., and Chapman, E.A., https://doi.org/10.3133/ds1073.

Windward Environmental (Windward), 2020, Lower Duwamish Waterway Pre-Design Studies Data Evaluation Report (Task 6), prepared for the LDWG, Final, June 26, 2020.

Table 12. Model-Predicted Concentrations in Surface Sediment

Project No. 190293, South Park Marina, Seattle, Washington

Summary of Model-Predicted Concentrations in Sediment (mg/kg dw)					
	Lower Duwamish Waterway Record of Decision Remedial Action Levels	Current Surface-Weighted Average Concentration	Model Cases		
Analyte	(0-10 cm sitewide)(1)	(SWAC) in Sediment	More Conservative	Base Case	Less Conservative
Arsenic	57	11.4	14	10	9.0
Copper	780	41	183	49	38
Zinc	820	82	543	230	179
2-Methylnaphthalene	1.34	0.011	0.087	0.019	0.012
Dimethyl Phthalate	0.142	0.011	**4.32**	0.041	0.018
Total PCBs	0.130	0.080	0.075	0.020	0.006

Notes:

(1) The LDW Record of Decision Remedial Actions for 0-10 centimeters are shown as dry-weight equivalent concentrations based on the values presented in the LDW Preliminary Cleanup Level Workbook.

Blue shaded and bold values indicate predicted sediment concentrations exceeding LDW Record of Decision Remedial Action Levels.

mg/kg - milligrams per kilogram

Total PCBs = total polychlorinated biphenyls

Refer to text for uncertainty analysis.

FIGURES

Site Features

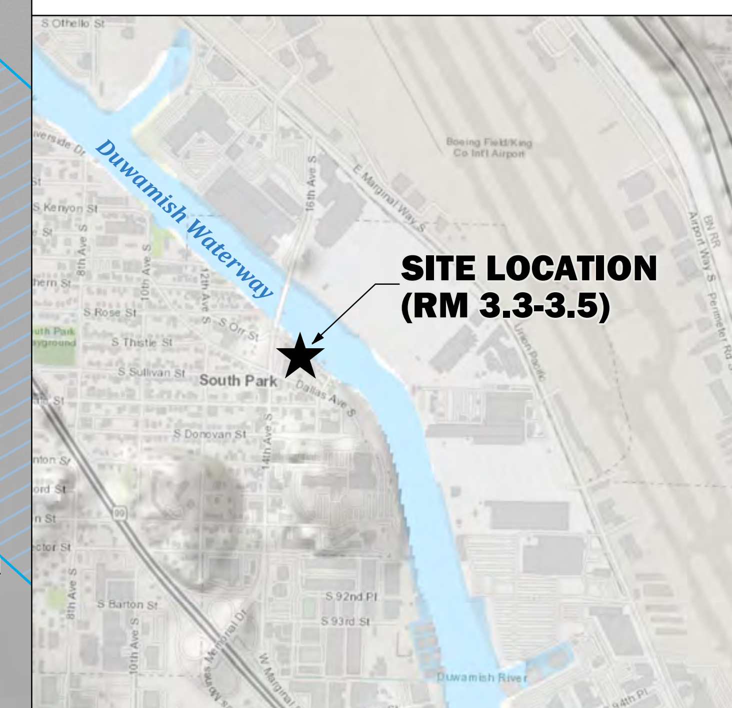
- Site Boundary
- Marina Basin
- Navigation Channel (sourced from Lower Duwamish Waterway Group)
- Outfall (Existing and Decommissioned)
- Pervious Surface (gravel)
- Approximately Extent of GAC Geocomposite Mat
- Washwater and Stormwater Treatment Areas
- 2021 Fire Area
- Cross Section alignment (see Figure 4)
- King County Tax Parcel

Note:

- Site features are approximate.

0 80 160
Feet

N
True North
Project North



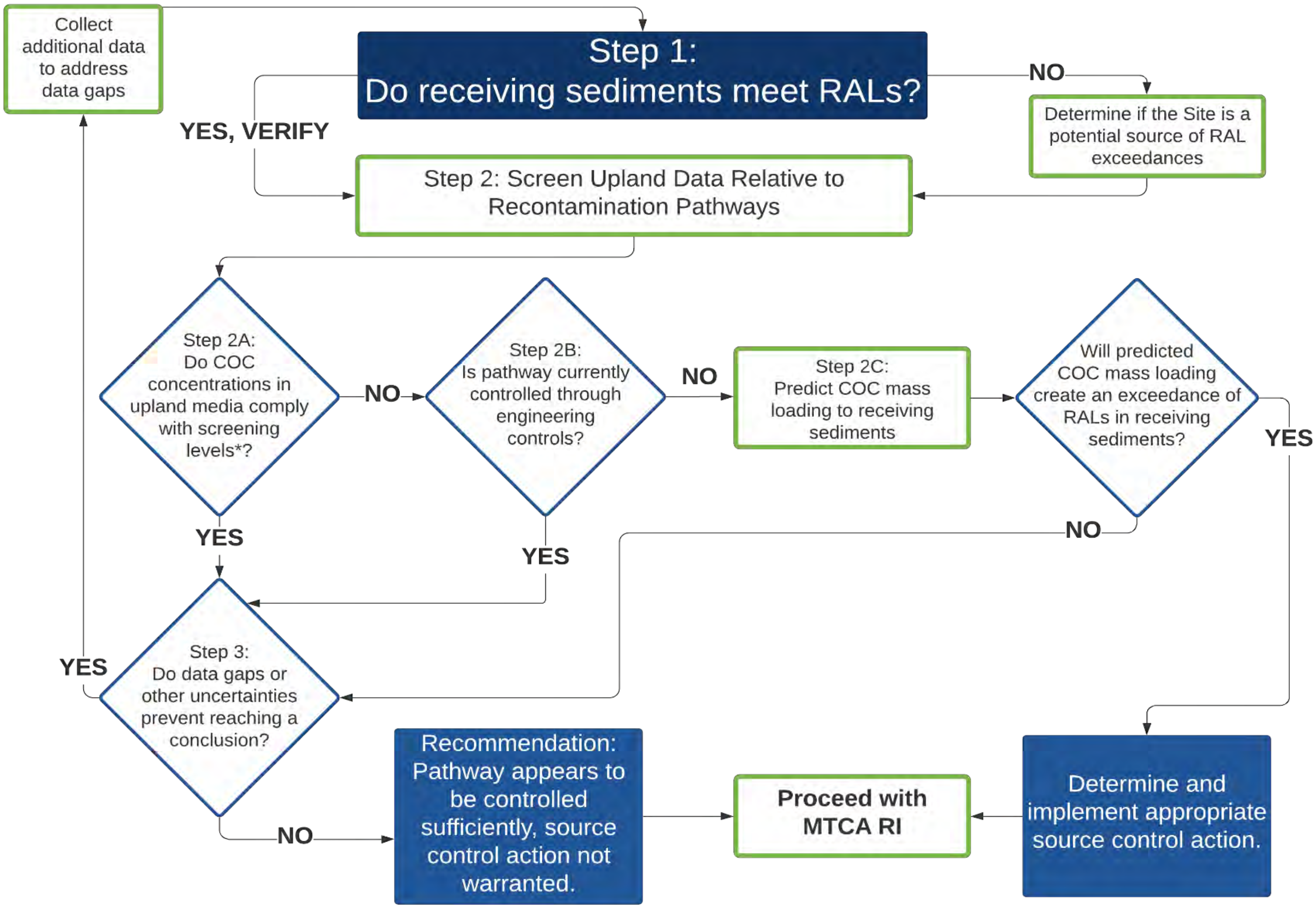
South Park Marina Site and Marina Basin

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING	JUN-2022	BY: AY / TDR	FIGURE NO.
	PROJECT NO. 190293	REVISED BY: NLK	1

Basemap Layer Credits || Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\Source Control Eval Memo\01 South Park Marina Site and Marina Basin.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/2/2022 || User: nkochie || Print Date: 6/2/2022

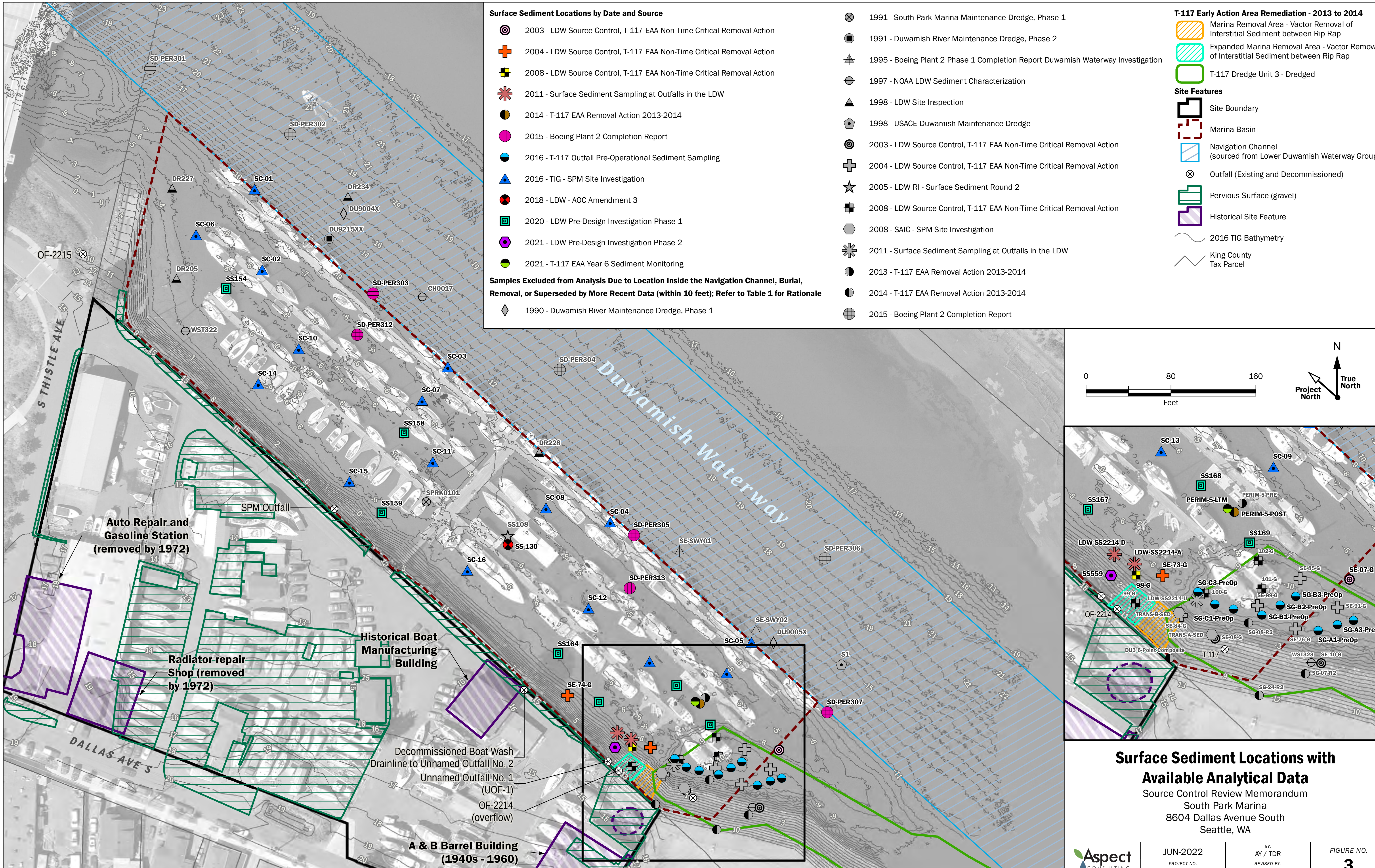


• - Screening levels for assessment of sediment recontamination

Figure 2

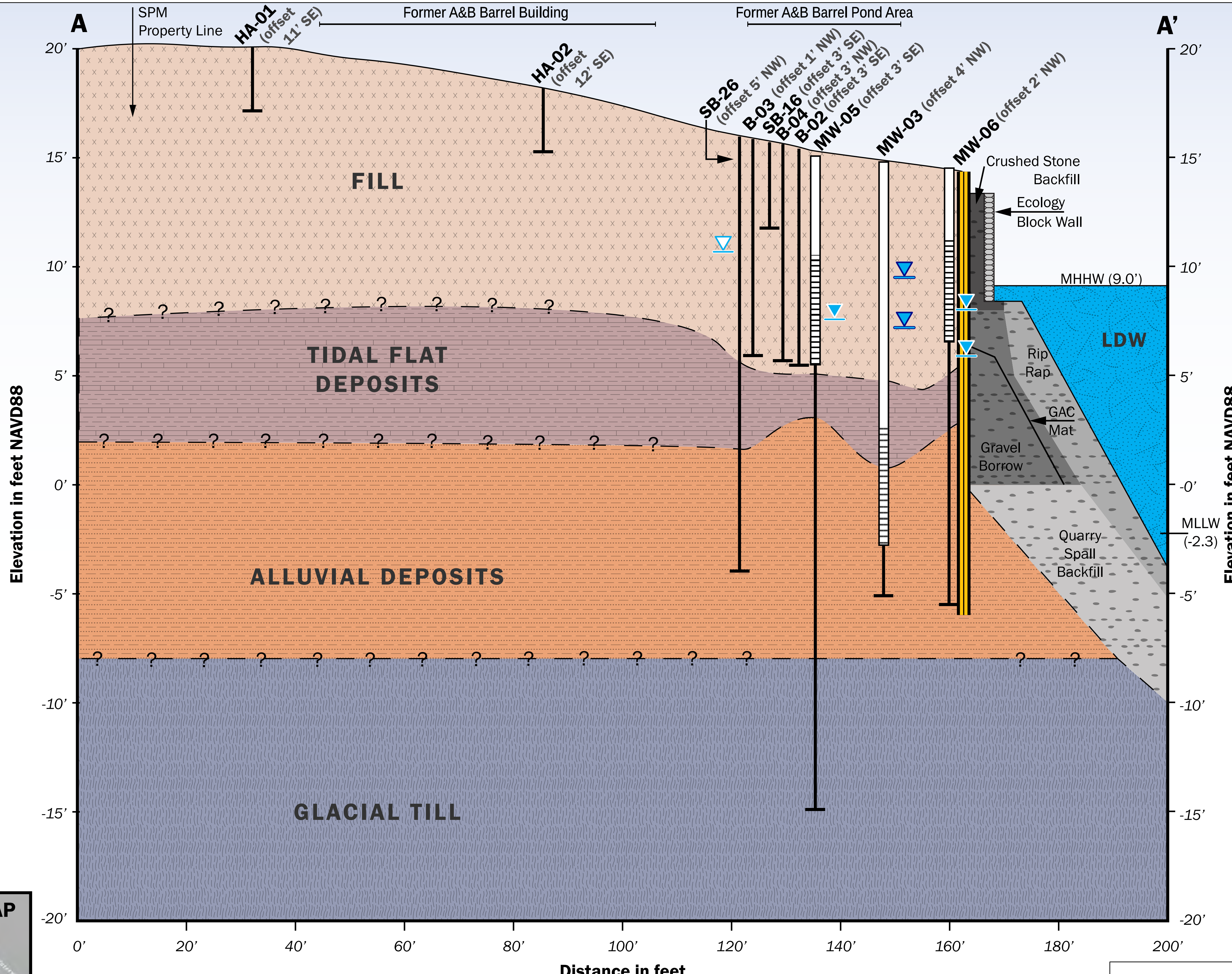
Flowchart Illustrating Source Control Review Approach

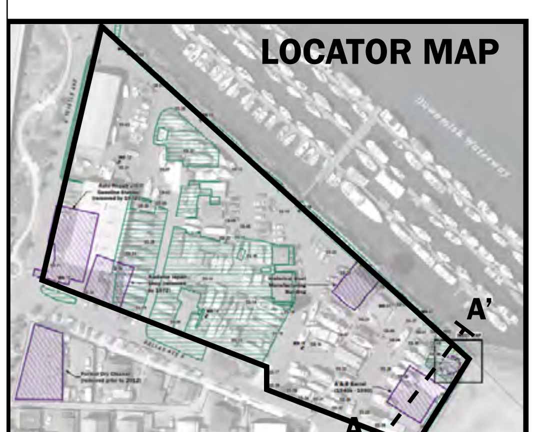
Source Control Review Memorandum
South Park Marina Site, Seattle, WA



Surface Sediment Locations with Available Analytical Data

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA





MW-3 ← Monitoring Well Name

← Blank PVC Casing

← Well Screen

← Approximate Depth

SB-9 ← Soil Boring Name

← Groundwater at Time of Drilling

← Range of Observed Groundwater Elevations

← Alluvial Unit Water Levels (Measured Oct. 2007, SAIC 2008)

← Boring Depth

Sheet Pile Wall

Ecology Block Retaining Wall

Notes:
- Cross section transect line shown on Figure 2.
- Configuration of sheet pile wall, GAC mat, and shoreline armoring from AECOM (2014).
- Grade elevations are approximate.
- Alluvial Unit Monitoring Wells Decomissioned

Vertical Exaggeration =4X

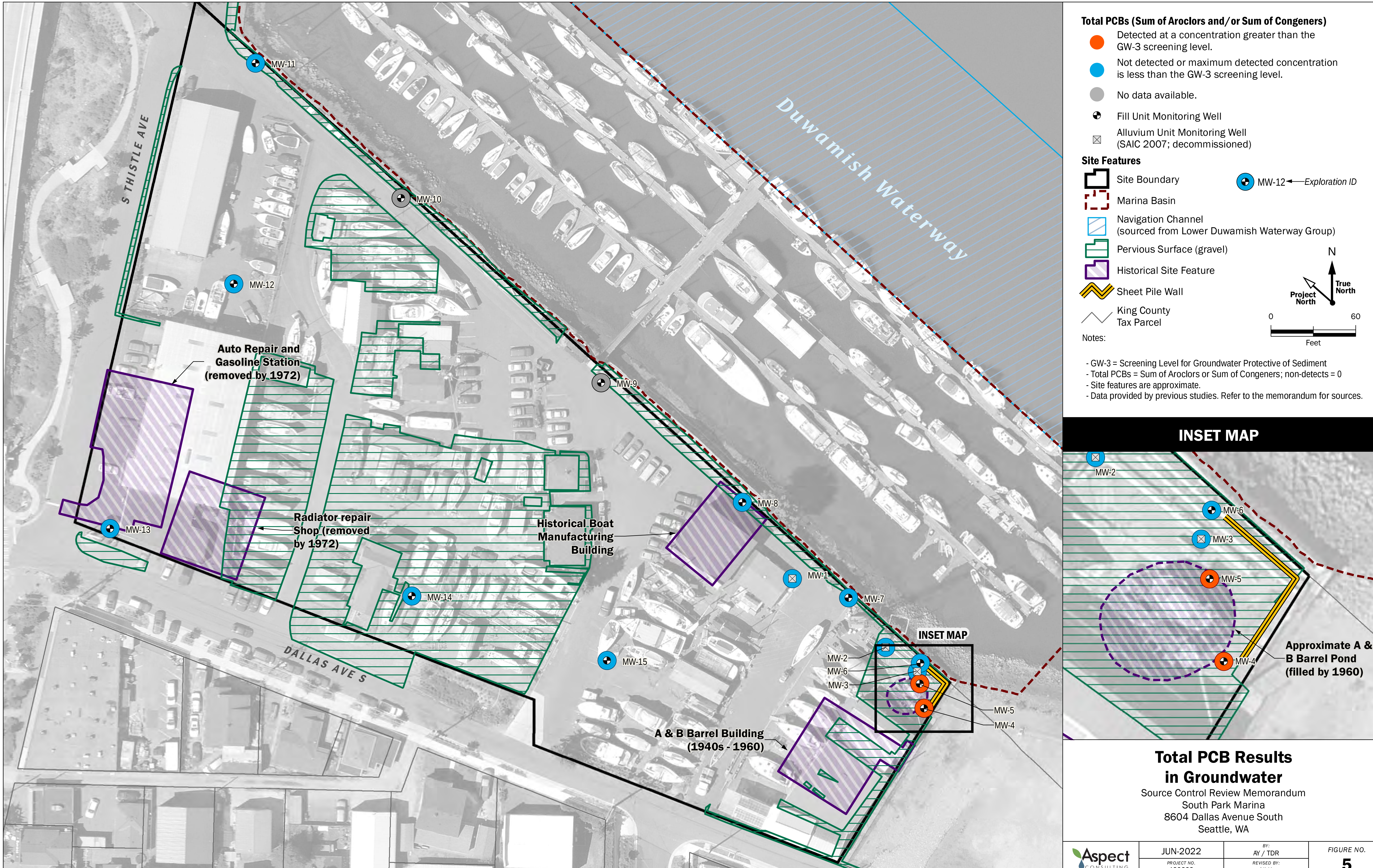
0 20 40 ft

SCALE IS APPROXIMATE

Cross Section A-A'

Source Control Review Memorandum
South Park Marina
Seattle, Washington

Aspect CONSULTING	DEC-2021	BY: AY / RAC / AWP	FIGURE NO.
	PROJECT NO. 190293	REV BY: - - -	4

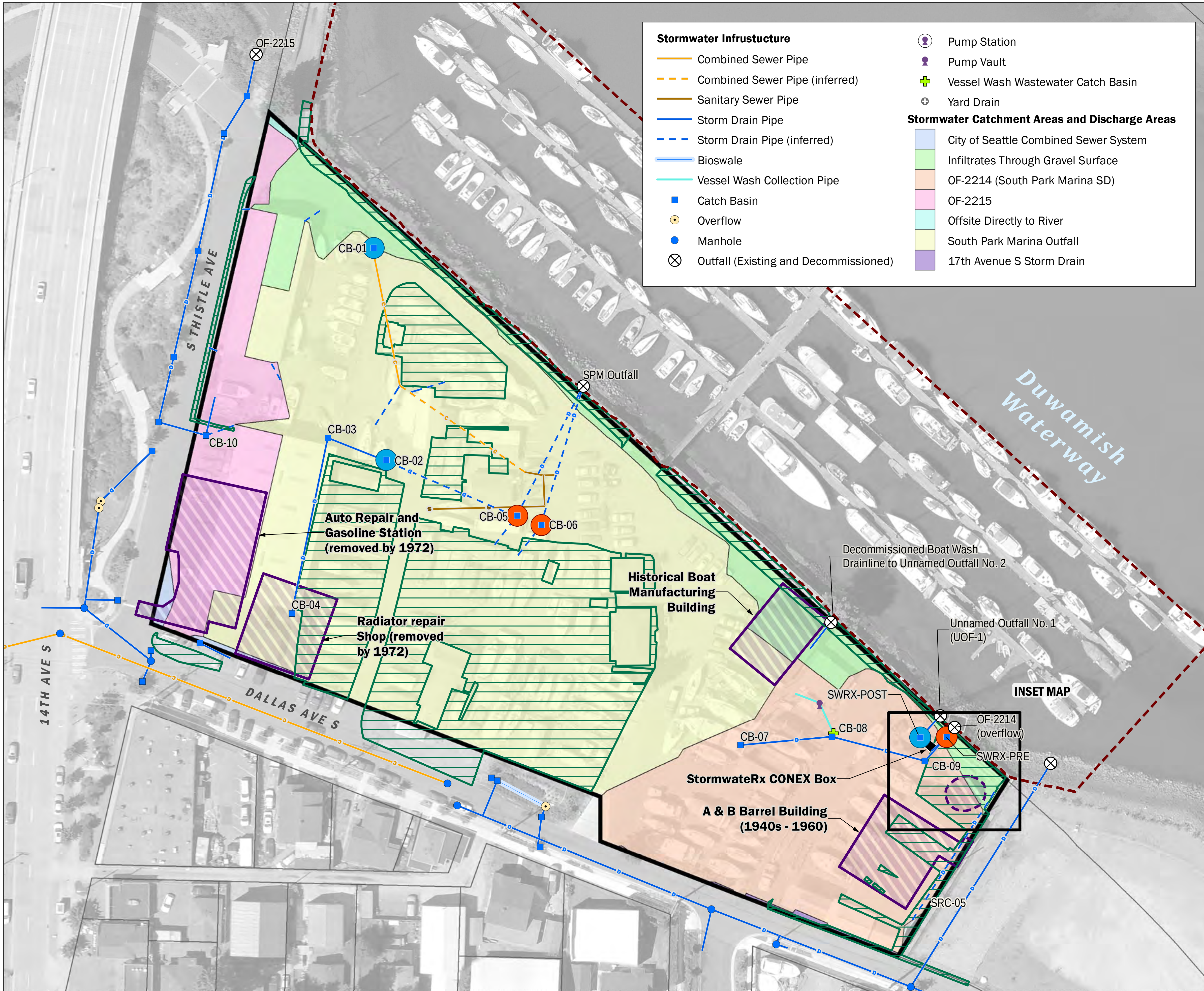


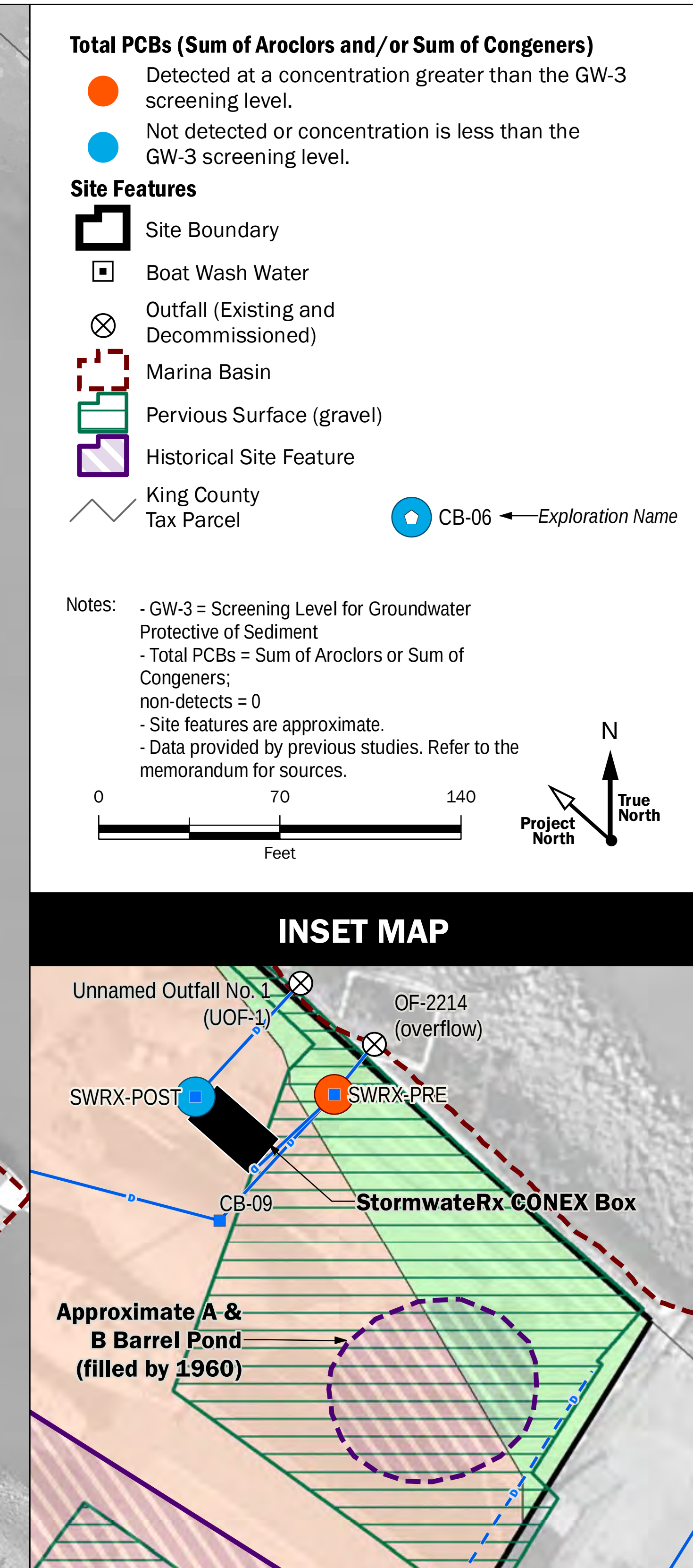
Total PCB Results in Groundwater

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING

JUN-2022	BY: AY / TDR	FIGURE NO.
PROJECT NO. 190293	REVISED BY: NLK	5

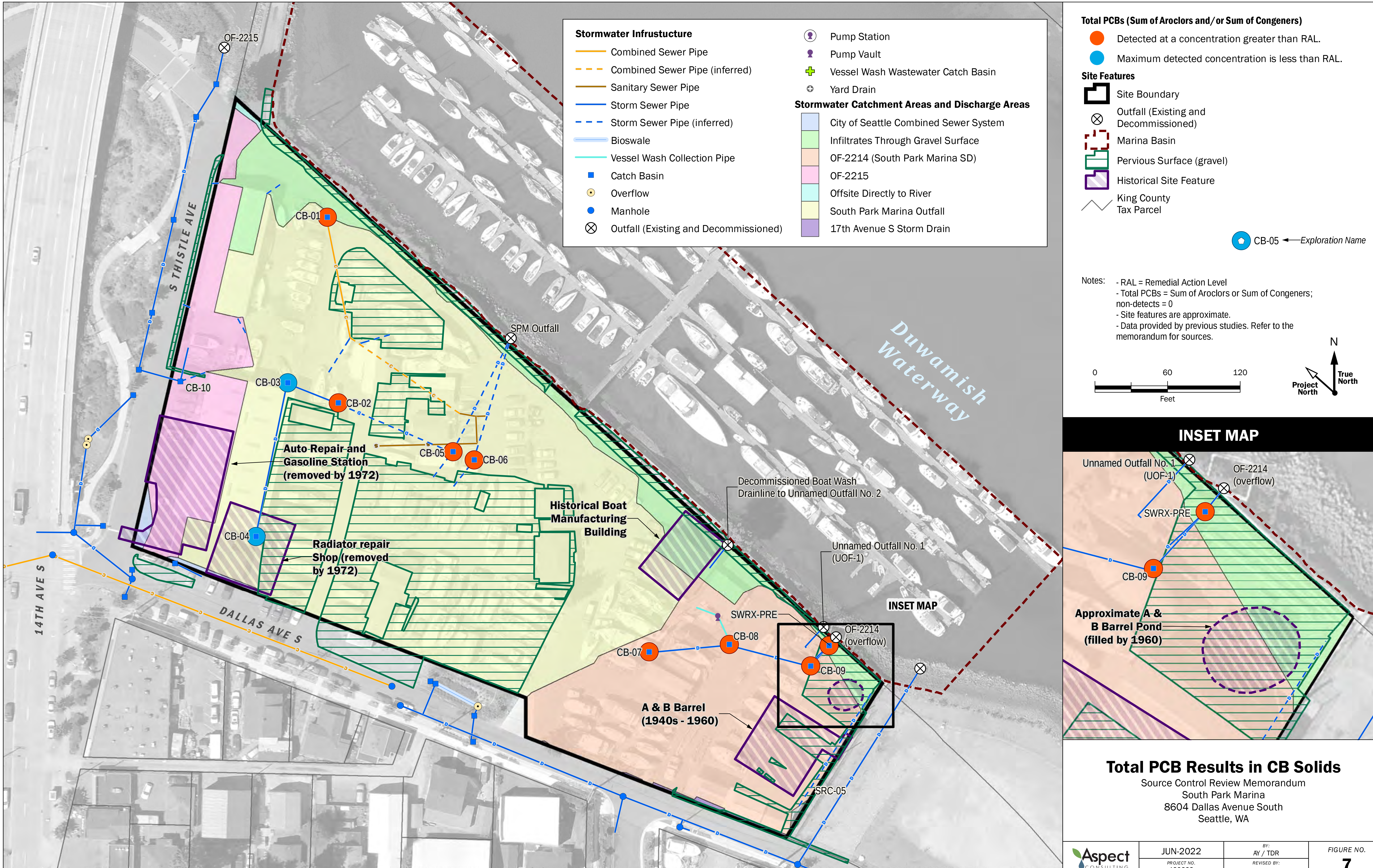




Total PCB Results in Stormwater (Whole-Water Samples)

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING | JUN-2022 | BY: AY / TDR | FIGURE NO. 6
PROJECT NO. 190293 | REVISED BY: NLK



Total PCB Results in CB Solids

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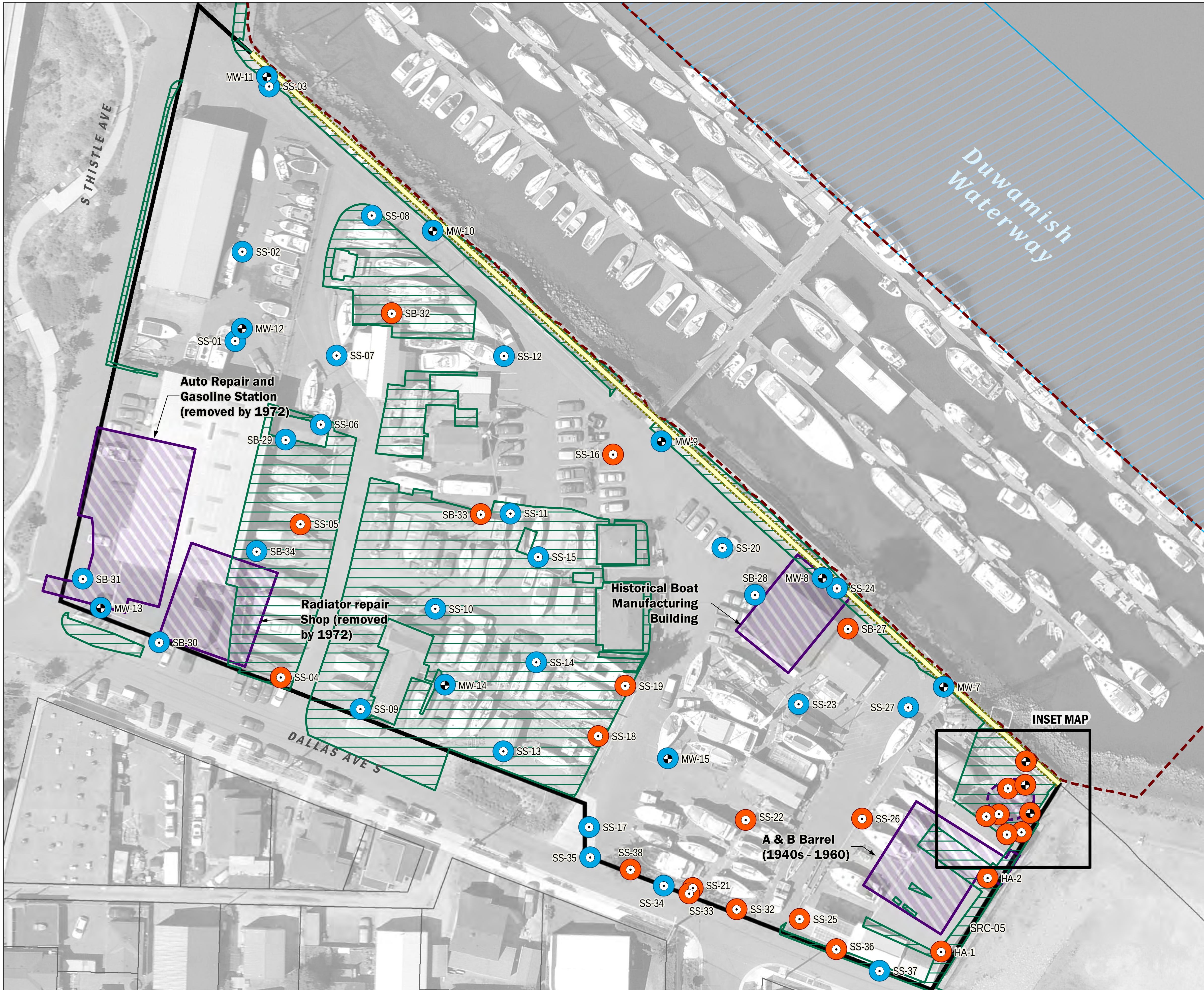
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect Consulting	JUN-2022	BY: AY / TDR	FIGURE NO.
	PROJECT NO. 190293	REVISED BY: ---	7



Total PCBs (Sum of Aroclors and/or Sum of Congeners)

- Detected at concentration greater than RAL.
- Not detected or maximum detected concentration is less than the RAL.
- Soil Boring / Surface Soil / Hand Auger Boring
- Monitoring Well

Site Features

- Site Boundary
- Marina Basin
- Navigation Channel (sourced from Lower Duwamish Waterway Group)
- Pervious Surface (gravel)
- Historical Site Feature
- Lateral Extent of Ecology Block Wall
- King County Tax Parcel

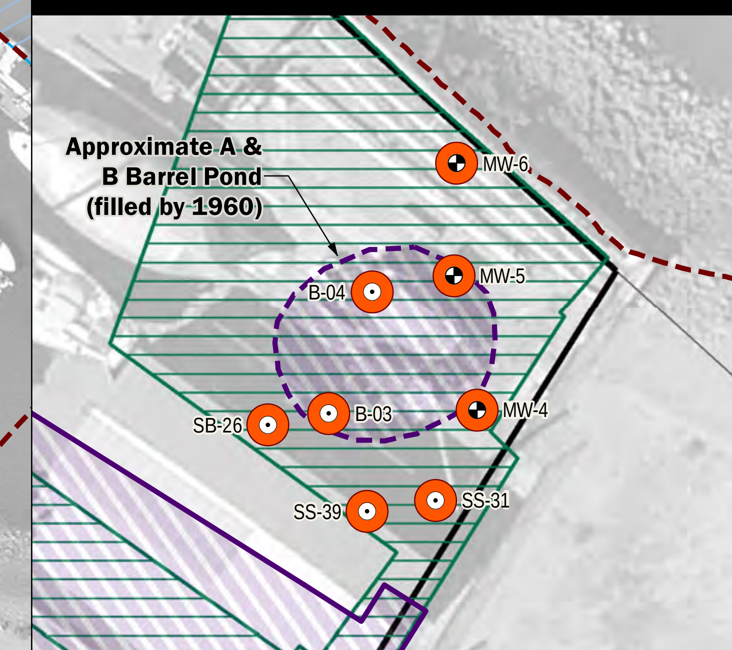
CB-05 ← *Exploration Name*

Notes:
- Total PCBs = Sum of Aroclors or Sum of Congeners; non-detects = 0
- RAL = Remedial Action Level
- Site features are approximate.
- Data provided by previous studies. Refer to the memorandum for sources.

0 60 120
Feet

N
True North
Project North

INSET MAP



Total PCB Results in Surface Soil

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING

JUN-2022	BY: AY / TDR	FIGURE NO.
PROJECT NO. 190293	REVISED BY: NLK	8

Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/2/2022 || User: nkochie || Print Date: 6/2/2022

Thiessen Polygons Used to Calculate Surface - Weighted Average Concentration of Arsenic

Analyte detected at a concentration less than the RAL

Sediment Sample Location Used to Create Thiessen Polygon

Site Features

Site Boundary

Marina Basin

Navigation Channel (sourced from Lower Duwamish Waterway Group)

Outfall (Existing and Decommissioned)

Pervious Surface (gravel)

Historical Site Feature

King County Tax Parcel

Notes:

- RAL = Remedial Action Level
- Data provided by previous studies. Refer to the memorandum for sources.
- Site features are approximate.

0 80 160
Feet

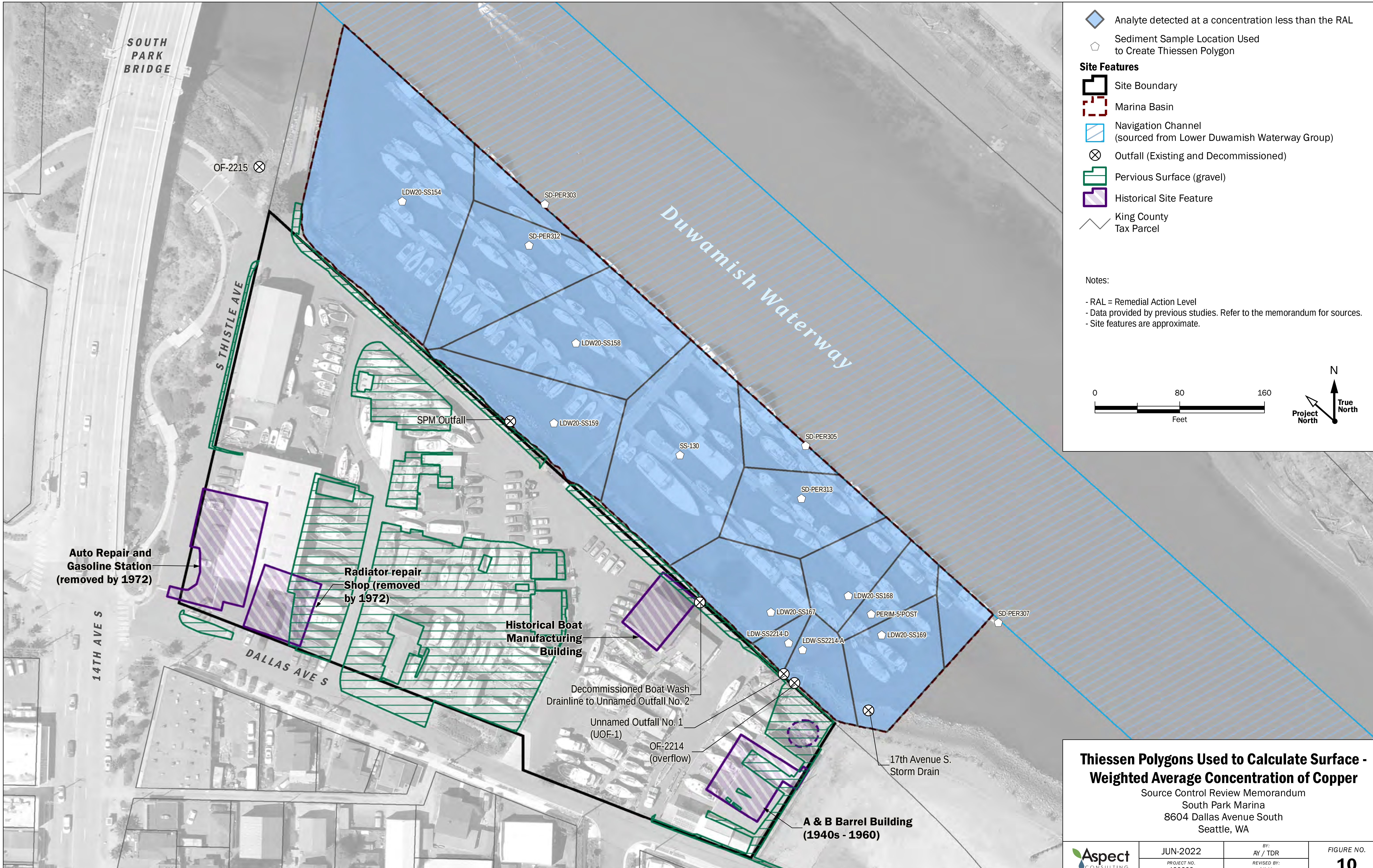
N
True North
Project North

Thiessen Polygons Used to Calculate Surface - Weighted Average Concentration of Arsenic

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING

JUN-2022	BY: AY / TDR	FIGURE NO.	9
PROJECT NO. 190293	REVISED BY: NLK		



Notes:

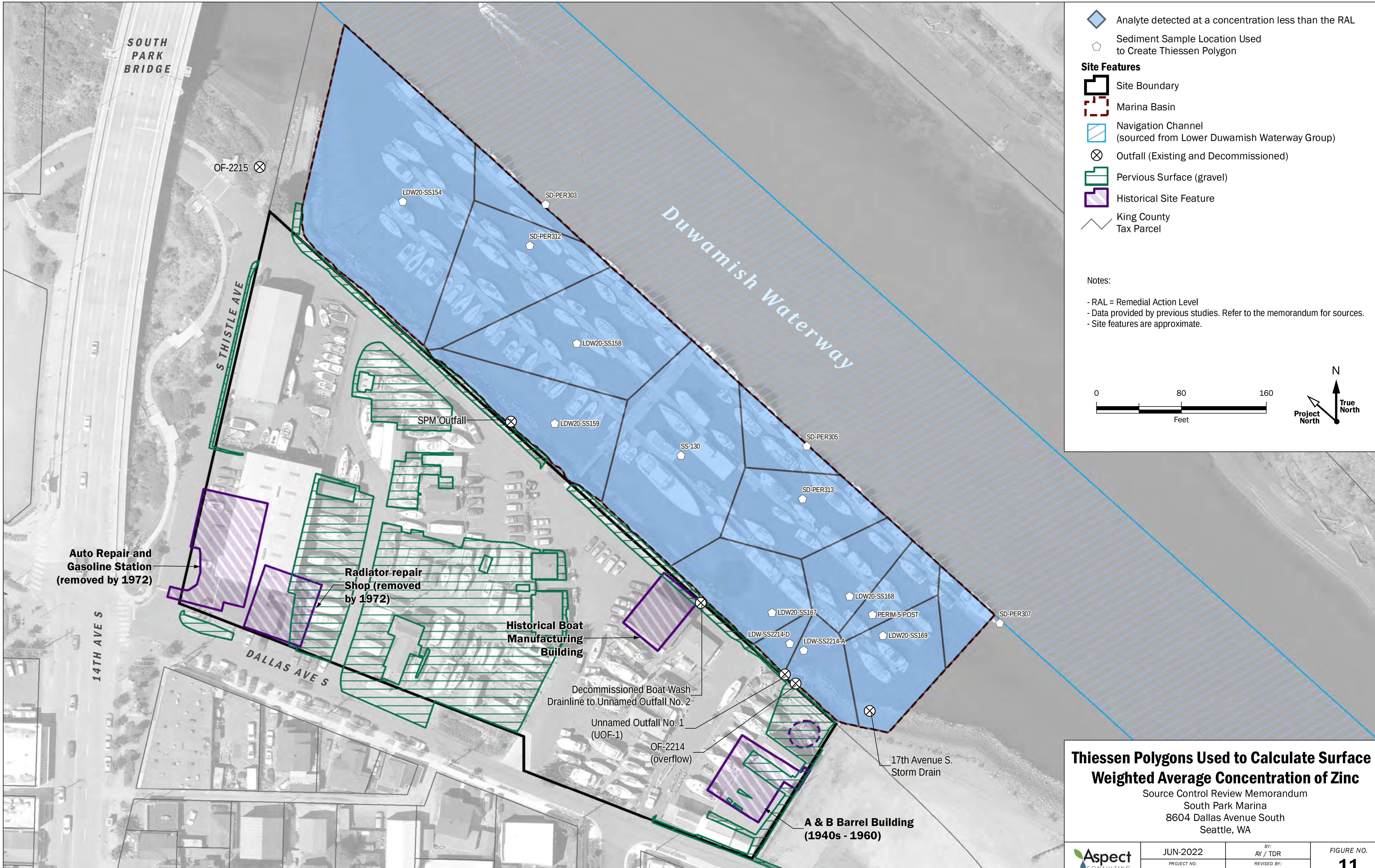
- RAL = Remedial Action Level
- Data provided by previous studies. Refer to the memorandum for sources.
- Site features are approximate.

Thiessen Polygons Used to Calculate Surface - Weighted Average Concentration of Copper

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING	JUN-2022	BY: AY / TDR	FIGURE NO.
	PROJECT NO. 190293	REVISED BY: NLK	10

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\Source Control Eval Memo\10 Thiessen Polygons Used to Calculate Surface-Weighted Average Concentration of Copper.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/2/2022 || User: nkochie || Print Date: 6/2/2022



Thiessen Polygons Used to Calculate Surface - Weighted Average Concentration of Zinc

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING

JUN-2022 | BY: AY / TDR | FIGURE NO. 11
PROJECT NO. 190293 | REVISED BY: NLK

Thiessen Polygons Used to Calculate Surface - Weighted Average Concentration of 2-Methylnaphthalene
Analyte detected at a concentration less than the RAL
Analyte not detected at a concentration less than the RAL
Sediment Sample Location Used to Create Thiessen Polygon

Site Features

Site Boundary
Marina Basin
Navigation Channel (sourced from Lower Duwamish Waterway Group)
Outfall (Existing and Decommissioned)
Pervious Surface (gravel)
Historical Site Feature
King County Tax Parcel

Notes:

- RAL = Remedial Action Level
- Data provided by previous studies. Refer to the memorandum for sources.
- Site features are approximate.

0 80 160
Feet

N
True North
Project North

Thiessen Polygons Used to Calculate Surface - Weighted Average Concentration of 2-Methylnaphthalene

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING

JUN-2022	BY: AY / TDR	FIGURE NO.
PROJECT NO. 190293	REVISED BY: NLK	12

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\Source Control Eval Memo\12 Thiessen Polygons Used to Calculate Surface-Weighted Average Concentration of 2Methylnaphthalene.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/2/2022 || User: nkochie || Print Da

Thiessen Polygons Used to Calculate Surface - Weighted Average Concentration of Dimethyl Phthalate

Analyte detected at a concentration less than the RAL

Analyte not detected at a concentration less than the RAL

Sediment Sample Location Used to Create Thiessen Polygon

Site Features

Site Boundary

Marina Basin

Navigation Channel (sourced from Lower Duwamish Waterway Group)

Outfall (Existing and Decommissioned)

Pervious Surface (gravel)

Historical Site Feature

King County Tax Parcel

Notes:

- RAL = Remedial Action Level
- Data provided by previous studies. Refer to the memorandum for sources.
- Site features are approximate.

0 80 160

Feet

N

True North

Project North

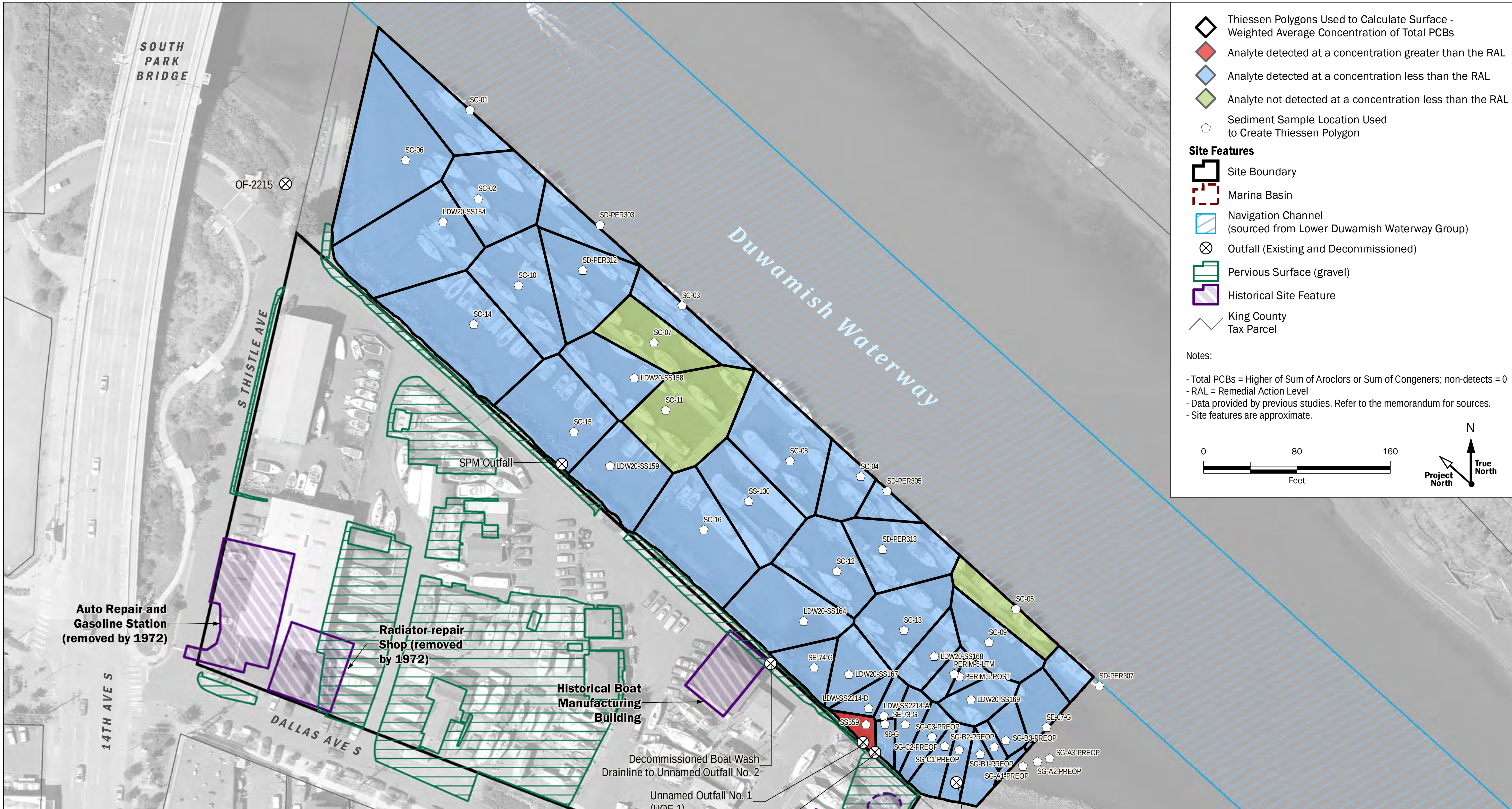
Thiessen Polygons Used to Calculate Surface - Weighted Average Concentration of Dimethyl Phthalate

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING

JUN-2022	BY: AY / TDR	FIGURE NO.	
PROJECT NO. 190293	REVISED BY: NLK	13	

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\Source Control Eval Memo\14 Thiessen Polygons Used to Calculate Surface Weighted Average Concentration of Dimethyl Phthalate.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/2/2022 || User: nkochie || Print Date



Thiessen Polygons Used to Calculate Surface - Weighted Average Concentration of Total PCBs

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING | JUN-2022 | BY: AY / TDR | FIGURE NO. 14
PROJECT NO. 190293 | REVISED BY: NLK

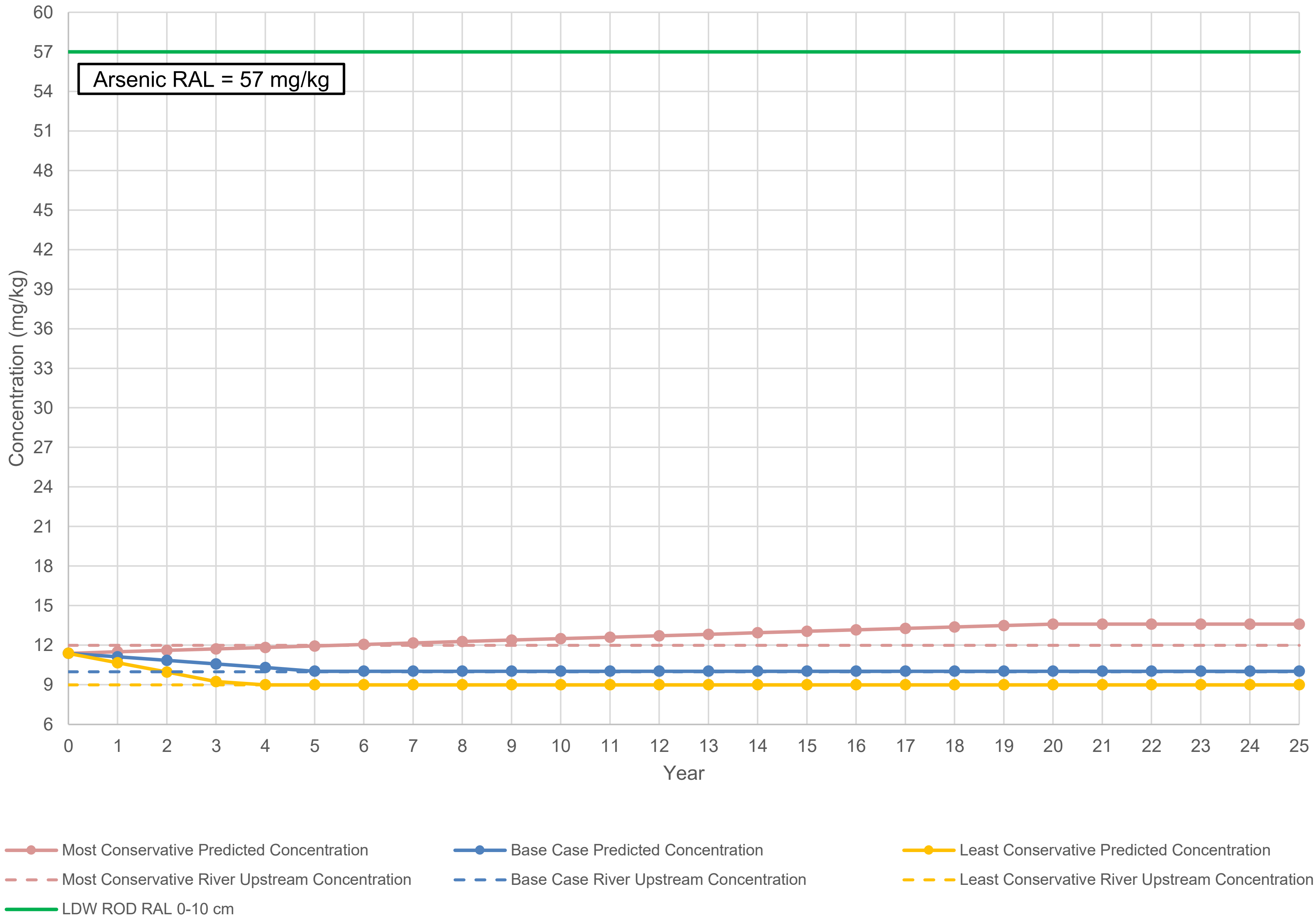


Figure 15

Model-Predicted Arsenic Concentrations in Sediment

Source Control Review Memo

Project No. 190293

Aspect Consulting

9/6/2022

V:\190293 South Park Marina\Deliverables\Source Control Review Memo\Final\Tables\Files\Tables 9 to 12 - Models

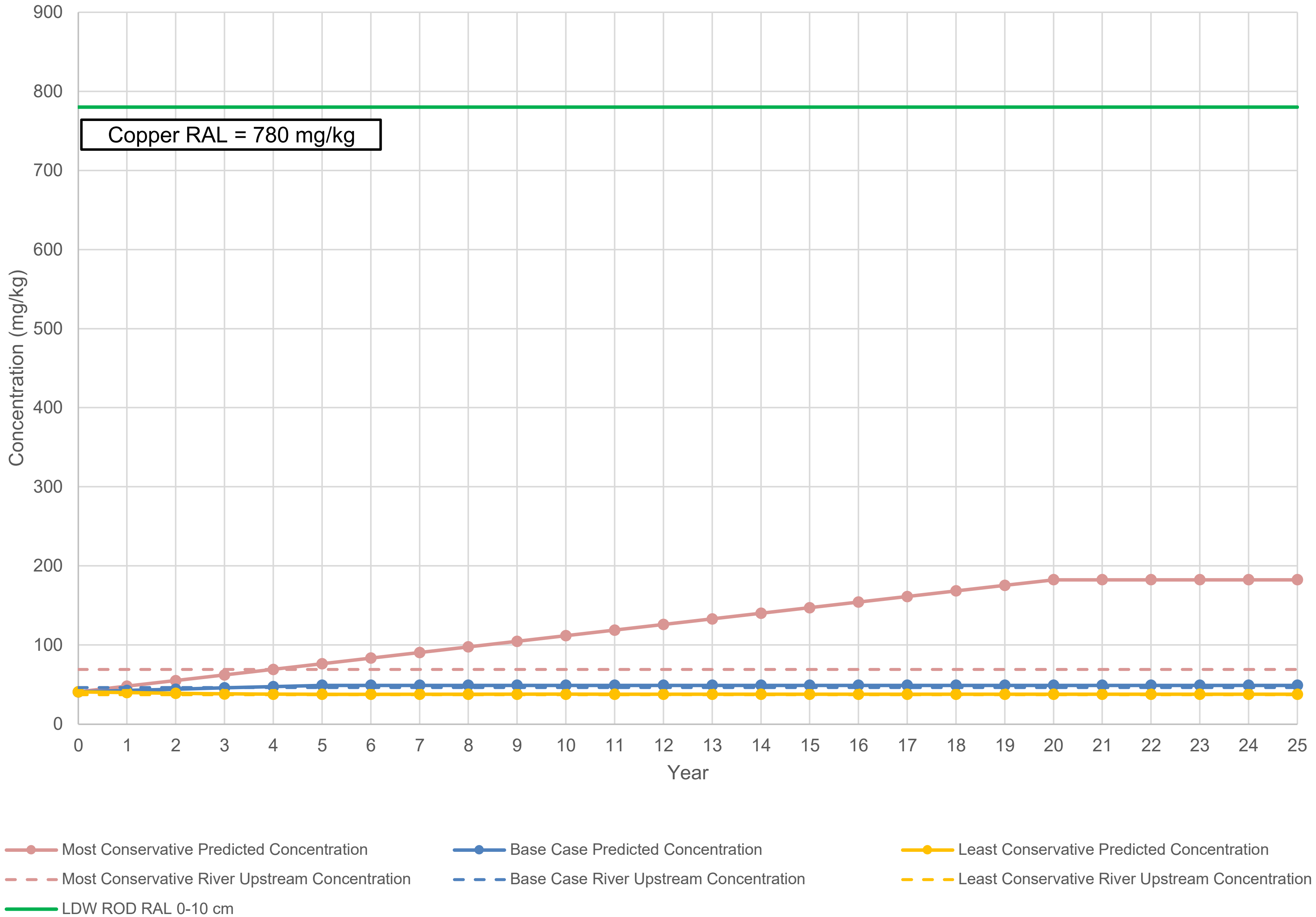
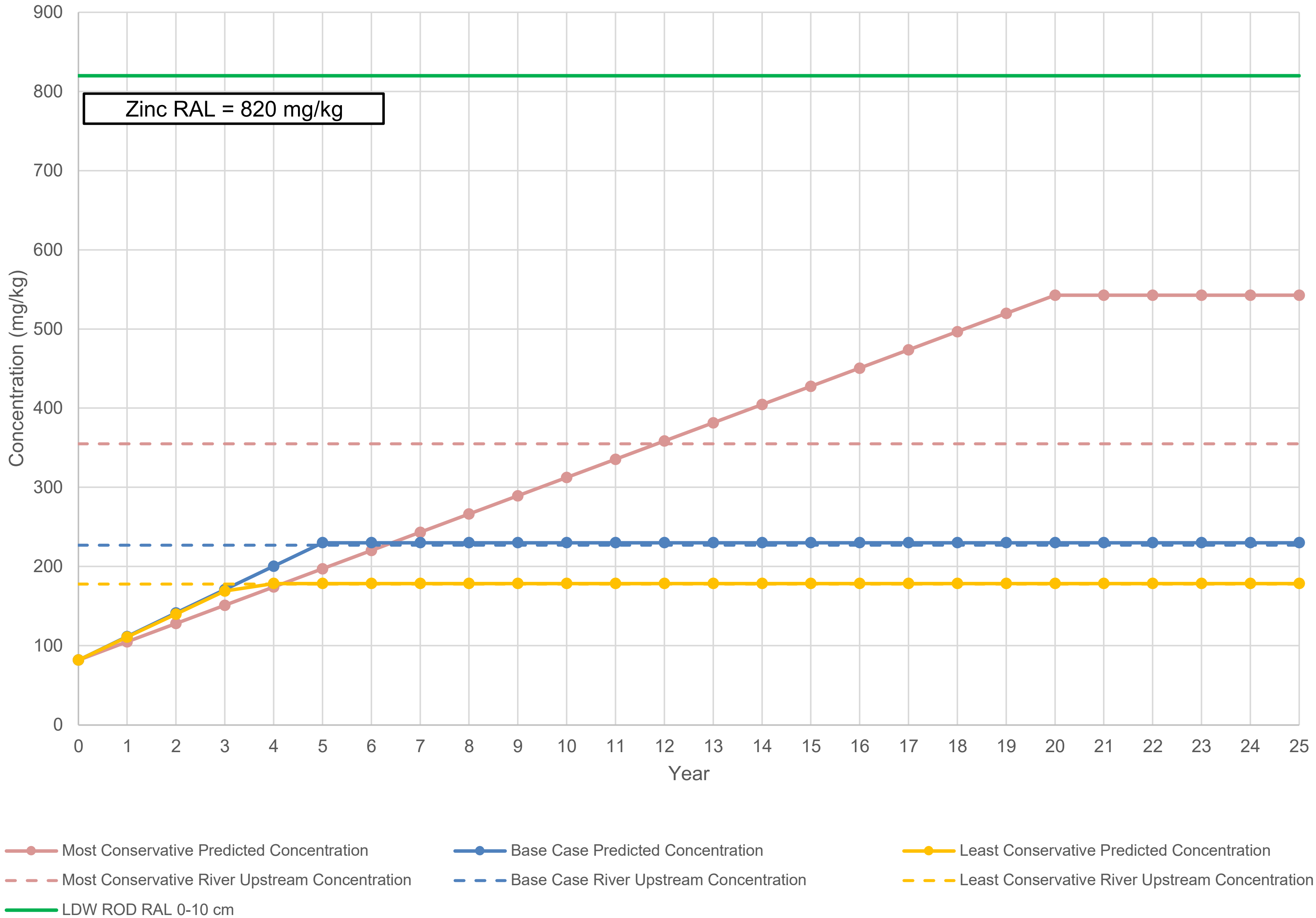


Figure 16

Model-Predicted Copper Concentrations in Sediment

Source Control Review Memo
Project No. 190293

Aspect Consulting
9/6/2022
V:\190293 South Park Marina\Deliverables\Source Control Review Memo\Final\Tables\Files\Tables 9 to 12 - Models



Aspect Consulting
9/6/2022
V:\190293 South Park Marina\Deliverables\Source Control Review Memo\Final\Tables\Files\Tables 9 to 12 - Models

Figure 17
Model-Predicted Zinc Concentrations in Sediment
Source Control Review Memo
Project No. 190293

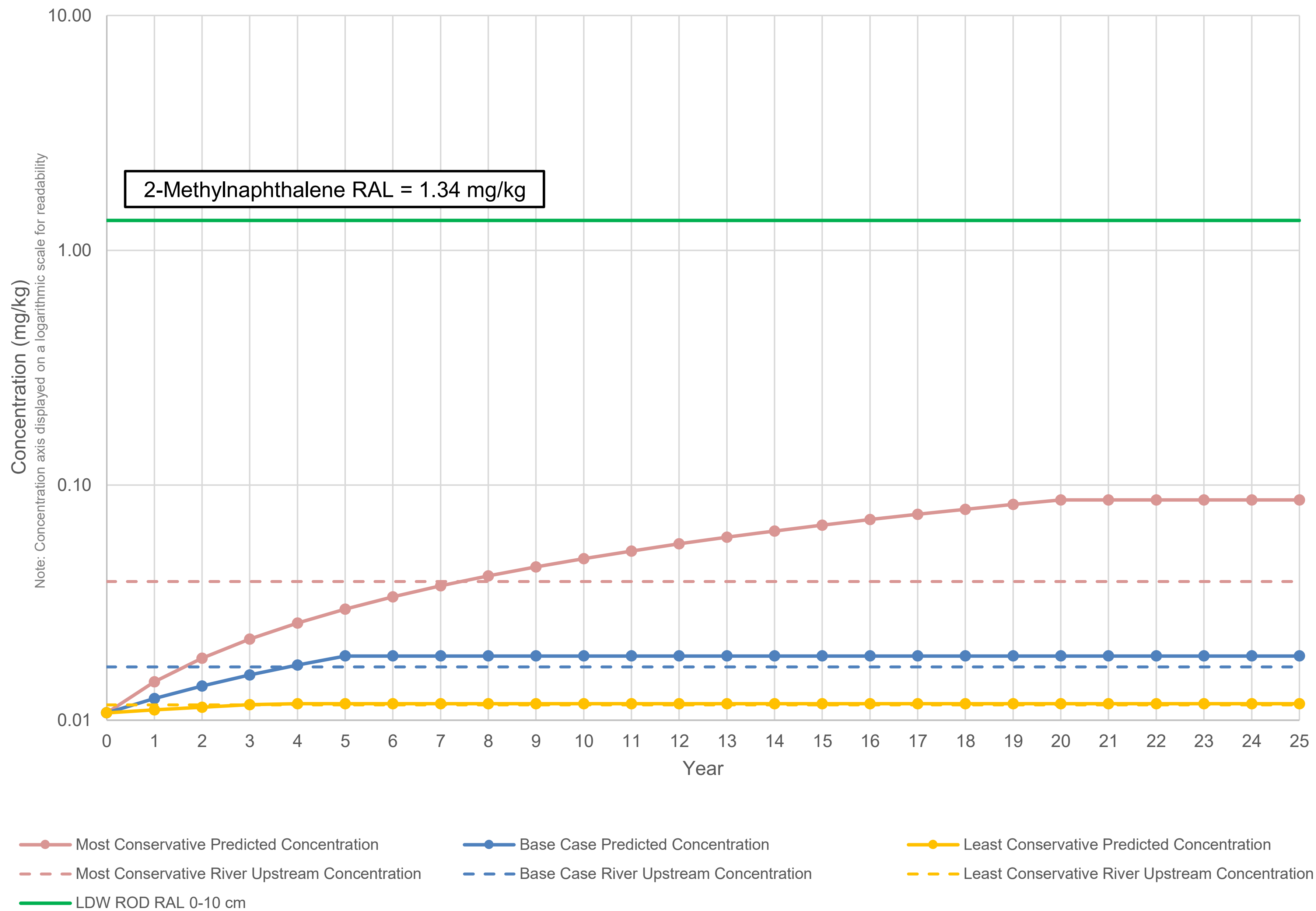


Figure 18

Model-Predicted 2-Methylnaphthalene Concentrations in Sediment

Source Control Review Memo

Project No. 190293

Aspect Consulting

9/6/2022

V:\190293 South Park Marina\Deliverables\Source Control Review Memo\Final\Tables\Files\Tables 9 to 12 - Models

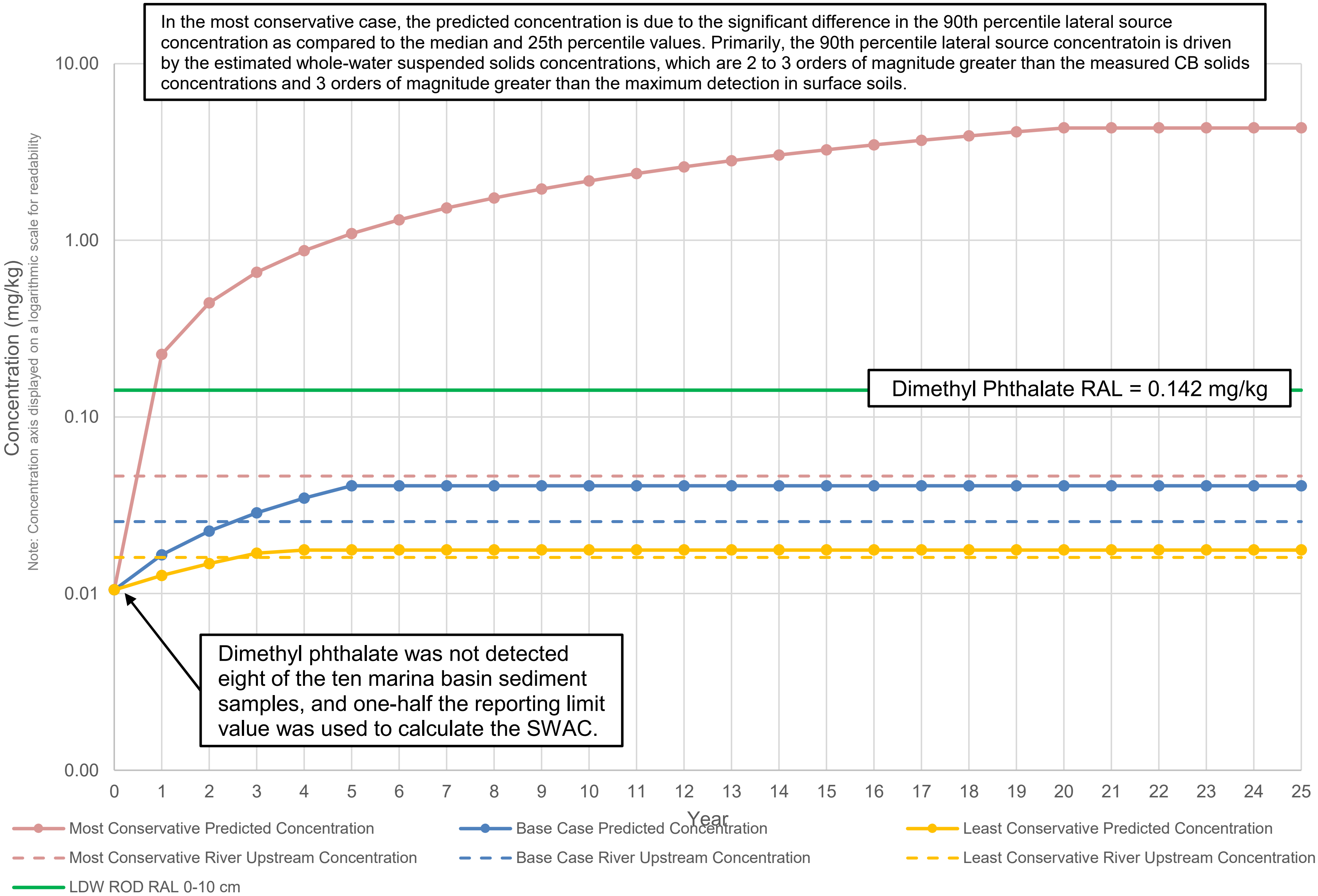


Figure 19

Model-Predicted Dimethyl Phthalate Concentrations in Sediment

Source Control Review Memo
Project No. 190293

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9/6/2022
V:\190293 South Park Marina\Deliverables\Source Control Review Memo\Final\Tables\Files\Tables 9 to 12 - Models

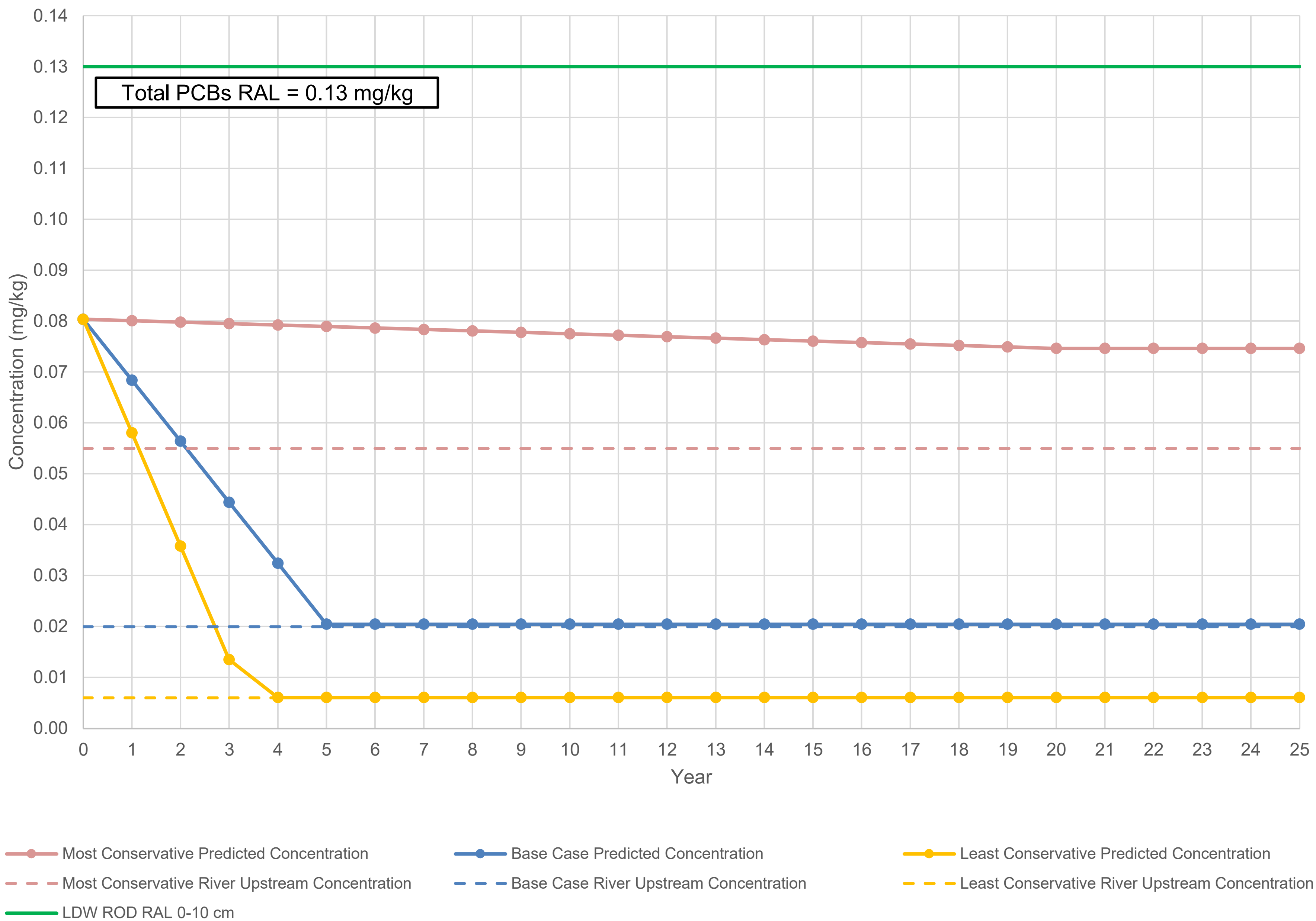


Figure 20

Model-Predicted Total PCBs Concentrations in Sediment (mg/kg)

Source Control Review Memo
Project No. 190293

Aspect Consulting
9/6/2022
V:\190293 South Park Marina\Deliverables\Source Control Review Memo\Final\Tables\Files\Tables 9 to 12 - Models

Top portion of Figure A-2 is truncated to improve legibility for the area encompassing the marina basin.

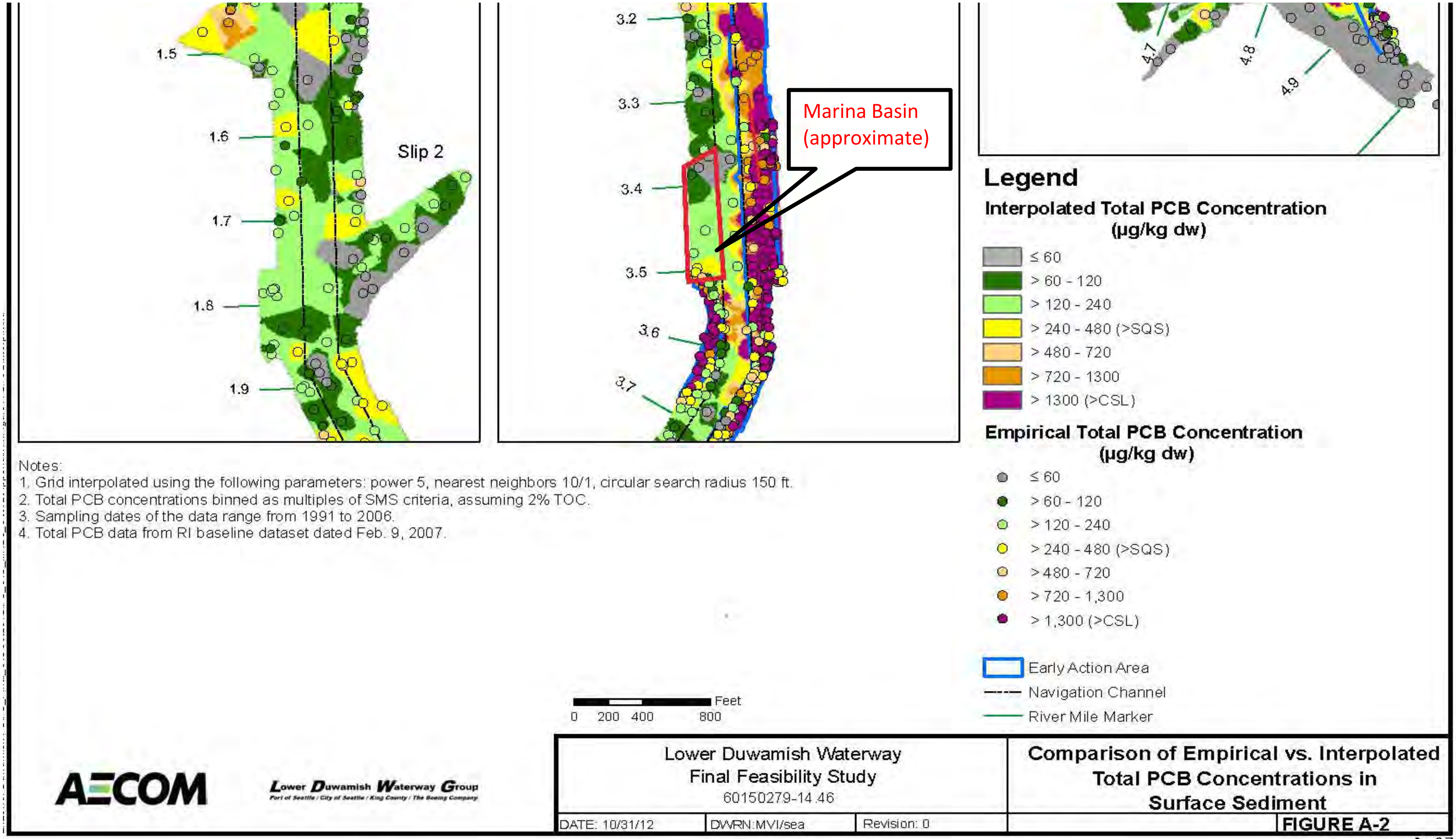


Figure A-2 (partial) reproduced from Appendix A to Feasibility Study for the LDW (AECOM, 2012)

Figure 21

Pre-2012 Total PCB Concentrations in LDW Surface Sediments

9/6/2022

Source Control Review Memo
Project No. 190293

APPENDIX A

NPDES Stormwater Management for South Park Marina

A. NPDES Stormwater Management for South Park Marina

This appendix briefly summarizes the South Park Marina (SPM) facility stormwater infrastructure and stormwater management under the National Pollution Discharge Elimination System (NPDES) Boatyard General Permit. Additional detail regarding SPM's stormwater management is provided in the RI Work Plan (Aspect, 2021)

A.1. Stormwater Catchment Areas and Infrastructure

Figure A-1 illustrates the SPM Property stormwater drainage system infrastructure and catchment areas determined based on methods detailed in the RI Work Plan (Aspect, 2021). SPM Property's stormwater system is divided into four main catchment areas and three smaller areas, as follows:

- The majority of the central portion of the SPM Property, constituting approximately 61 percent of the total property, drains to the SPM Outfall. Stormwater on this portion of the SPM Property flows overland to a series of catch basins (CB-04, CB-03, CB-02, CB-05, and CB-06) that then discharge to the SPM Outfall. The subsurface configuration of drainage connections that remain unknown are depicted in dashed lines on Figure A-1, but the connection of CB-02, CB-05, and CB-06 to the SPM Outfall has been confirmed using dye testing as described in the RI Work Plan and a recent ground penetrating radar survey. The catch basin CB-01 located within this catchment area was decommissioned in 2019; based on the topography, stormwater from CB-01 now flows overland to CB-05. The concrete SPM Outfall is located within the shoreline bank riprap and is submerged during high tide.
- Most of the southern portion of the SPM Property, constituting approximately 21 percent of the total SPM Property area, drains to one of three basins: CB-07 is located upslope of the boat wash pad, CB-08 is located in the boat wash pad, and CB-09 is located near the StormwateRx™ system (Figure A-1). These three catch basins drain into a stormwater vault, where solids are settled, before water is pumped into the StormwateRx™ system for treatment. The StormwateRx™ AquipTM 50SBE treatment system was installed in 2009 to remove heavy metals from stormwater in accordance with the Boatyard General Permit and has been modified and upgraded since (additional details provided in RI Work Plan). The StormwateRx™ system's treated water discharges through Unnamed Outfall No. 1 (UOF-1) to the LDW. Under certain storm conditions when the capacity of the holding tank feeding the StormwateRx™ filtration system is exceeded[27], untreated stormwater can bypass the

[27] The number and frequency of StormwateRx bypass events occurring at this discharge point are unknown; however, no bypass events have occurred since TIG's involvement at the Site began in 2014.

treatment system via an overflow pipe and discharge to a separate outfall (OF-2214) adjacent to UOF-1.

- The northernmost portion, constituting approximately 9 percent of the total SPM Property area, drains to catch basin CB-10, which is connected to a stormwater system operated by King County (County) that flows north down South Thistle Street before discharging through the County's Outfall OF-2215.
- The shoreline portion of the SPM Property abutting the LDW is generally unpaved gravel, and stormwater is assumed to infiltrate through this pervious surface; no overland flow was observed during the field visits conducted as part of the Phase 1 RI. The roof drains from the large structure near the northeast corner of the SPM Property (Rick's Master Marine) discharge to the subsurface, where water is allowed to infiltrate; during high intensity rain events, some of this discharge may daylight at the ground surface before flowing overland and reinfiltrating at the gravel shoreline area. Approximately 8 percent of the total SPM Property infiltrates through this pervious surface.
- Approximately 0.5 percent of the total SPM Property along Dallas Avenue South and South Thistle Street flows into an unnamed catch basin on the SPM Property line (southwest of CB-04), which is connected to the private sanitary sewer and discharges to the City of Seattle's (City) combined sewer system in Dallas Avenue South.
- A sliver of land in the southwest corner of the SPM Property along Dallas Avenue South (approximately 0.3 percent of the total SPM Property) appears to drain off the property and into the City's 17th Avenue storm drain that discharges to the LDW just south of the SPM Property (Figure A-1). No overland flow was observed in this area during the field visits conducted as part of the Phase 1 RI.

The boat ramp in the northeast corner of the North Parcel drains directly to the LDW and represents approximately 0.1 percent of the total SPM Property (Figure A-1).

A.2. SPM Boatyard General Permit (NPDES)

The SPM facility discharges stormwater under a Boatyard General Permit (Permit No. WAG030045), which is both a NPDES Permit and State Waste Discharge General Permit. The Boatyard General Permit sets forth the requirements for stormwater runoff monitoring, boat washwater monitoring, discharge limits, reporting, and best management practices (BMPs). The current version of Boatyard General Permit was issued on July 6, 2016; it became effective August 8, 2016, and expired on July 31, 2021. However, Ecology is currently revising the Boatyard General Permit. The SPM facility submitted their Notice of Intent to reapply for coverage before February 2, 2021, and, therefore, until Ecology reissues the upcoming permit, continues to have coverage for their operations under the existing permit.

A.2.1. Boatyard Best Management Practices

The facility's Boatyard General Permit stipulates a number of BMPs for meeting Washington State water quality standards. Tenants of the marina are provided a copy of Puget Soundkeeper Alliance's *Best Management Practices (BMPs) for Boaters and*

Marinas pamphlet, which is based on BMPs set forth by Ecology and EPA. In accordance with SPM's May 2020 stormwater pollution prevention plan (SWPPP), the mandatory BMPs implemented at the facility are posted on signs around the facility. In general, the facility's BMPs include the following:

- Vacuum sander use
- Solids management
- Oils and bilge water management
- Sacrificial anode (zincs) management
- Chemical management
- Wash pad decontamination
- Sewage and gray water discharges
- Good housekeeping BMPs
- Preventative maintenance activities
- Spill response preparedness including employee training and stocking of spill kits
- Structural source control BMPs
- Treatment BMPs (e.g., StormwateRx™ treatment system)

A description of the StormwateRx™ treatment system is included below, and the manual and equipment specifications are included as Attachment A-1, and documentation related to the catch basin filtration inserts is included as attachment A-2.

Stormwater Treatment System Process

The StormwateRx™ Aquip™ 50SBE stormwater treatment system is an enhanced media filtration system designed to remove suspended solids and heavy metals from stormwater using a combination of inert and adsorptive filtration media.

The StormwateRx™ Aquip™ 50SBE treatment system consists of an above-ground steel tank with two chambers. The first pretreatment chamber allows water to flow upward through conditioning media that increase adsorption of metals from the water in the next stage. Water overflows from this chamber into a perforated distributor pipe that runs horizontally along the length of the second treatment chamber. This perforated pipe distributes water evenly across the top of the gravity flow media in the treatment chamber, which is comprised of the following five layers:

- Coarse inert media
- Fine inert media
- Coarse adsorptive treatment media
- Fine adsorptive treatment media
- Gravel underdrain layer

The adsorptive treatment media is separated from the layers above and below by layers of geofabric. Geofabric can also cover the upper surface of the media, but it must be removed frequently to allow raking or shoveling to maintain the permeability of the upper surface. This upper layer of geofabric has been removed at the Site and replaced with a straw mat.

Water flows through the layered media by gravity, exiting through a pipe at the bottom of the tank, which connects directly to Unnamed Outfall No. 1. The treatment chamber also has an overflow near the top of the tank, which discharges directly to Unnamed Outfall No. 1 in the event the inflow to the treatment system exceeds the gravity flow rate of the media and the additional storage capacity of the treatment chamber above the elevation of the media.

SPM’s May 2020 SWPPP provides further detail on all of these BMPs.

A.2.2. NPDES-Related Inspections and Investigations

This section summarizes Ecology’s NPDES inspections and SPM’s investigations related to the facility’s stormwater and washwater-related systems. Sample data referenced in this section is presented in Appendix D of the RI Work Plan.

June 2015 NPDES Inspection Sampling Support on behalf of Ecology (Leidos, 2015)

- On behalf of Ecology, Leidos conducted an inspection of select stormwater conveyance structures on October 8, 2014, at catch basins CB-02, CB-04, CB-05, and CB-09, manhole 5, and a feature referred to as an oil/water separator[28].
- Stormwater and solids samples were collected from the StormwateRx™ pump vault (mis-identified as an oil/water separator by Leidos), and a solids sample was collected from catch basin CB-09. The stormwater sample was analyzed for metals, mercury, PCB congeners, SVOCs, dioxin/furans, alkalinity, pH, specific conductance, anions, total organic carbon (TOC), dissolved organic carbon (DOC), total suspended solids (TSS), turbidity, and oil and grease. Solids samples were analyzed for the same analytes as the stormwater sample, plus PCB Aroclors, gasoline- , diesel- , motor oil-range, and gasoline-range total petroleum hydrocarbons, grain size, and volatile organic compounds (VOCs).

February 2018 Stormwater and Boat Wash Water Systems Evaluation (TIG Environmental, 2018).

- On behalf of SPM, TIG Environmental conducted an investigation into potential sources of chemicals in stormwater discharging to the LDW and resulting in non-compliance with SPM’s Boatyard General Permit. The investigation reported:
  - Approximately 69 percent of the SPM Property’s stormwater runoff is untreated and contains detectable concentrations of metals and PCBs.

[28] TIG Environmental’s 2018 and 2019 stormwater investigations did not verify the location of manhole 5. It is also presumed that the oil/water separator identified by Leidos (2015) was in fact the StormwateRx™ pump vault because there are no oil/water separators on the SPM Property.

- The StormwateRx™ treatment system currently receives approximately 21 percent[29] of the SPM Property's stormwater. This stormwater is treated for metals in accordance with the Boatyard General Permit. Reportedly, PCBs and other chemicals are removed with moderate success.
- Currently, untreated stormwater can overflow the pump vault and bypass the treatment system to discharge directly to the LDW if the pump fails or the capacity of the vault is exceeded.
- Some comingling of boat washwater with stormwater may occur prior to getting pumped to the StormwateRx™ treatment system.
- Two catch basin samples (CB-02 and CB-06), one roof drain water sample (SRC-01), three samples from the boat washwater closed-loop treatment system samples (pre , mid , and posttreatment), and three samples from the StormwateRx™ treatment system (pre , mid , and posttreatment) were collected and analyzed for metals, PCB congeners, semivolatile organic compounds (SVOCs), alkalinity, hardness, pH, conductivity, TOC, total dissolved solids (TDS), TSS, and turbidity.

2018 Drainage Pathway Investigation (TIG Environmental, 2019)

- In 2018, TIG conducted a stormwater drainage investigation to address data gaps for the stormwater drainage system pathways resulting from the previous historical drainage investigation[30] in order to identify discharge points. The data gaps included locating the SPM outfall discharge point; tracing the network of piping connected to catch basin CB-01; trace downgradient piping pathway from catch basins CB-02 and CB-05; tracing the connection between CB-05 and CB-06; tracing subsurface piping from roof drains on Rick's Master Marine shop; and identifying the discharge path for roof drains from the Tire Factory and the woodworking shop.
- Five roof drain water samples (SRC-01 through SRC-05) were collected on October 25, 2018, for copper and zinc analysis.
- Dye tracer studies were conducted in February, November, and December 2018 to trace the drainage pathways from catch basins CB-01, CB-02, CB-05, and CB-06, and from roof drains attached to Rick's Master Marine shop, Tire Factory, and the woodworking shop in the northern portion of the SPM Property.

Following the investigation work, some components of the drainage system, such as precise pipe connections and discharge points, remain unknown, but findings from these investigations helped refine the stormwater drainage pathway understanding as depicted on Figure A-1.

March 2021 NPDES Inspection (Ecology, 2021)

[29] Area based on TIG Environmental's drainage pathway investigation (2019).

[30] Previous drainage investigations included ground-penetrating radar survey in February 2016, developing a topographic survey in March 2017, and camera surveys within stormwater and sewer pipes in September 2017.

On March 11, 2021, Ecology conducted an announced stormwater compliance inspection of the SPM Property to review site conditions and documentation with respect to the Boatyard General Permit. On behalf of SPM, TIG accompanied Ecology and SPM for the inspection.

Regarding SPM's documentation for stormwater management, Ecology's 2021 inspection concluded that:

- The Site map needs to be revised to meet current requirements.
- The SPM SWPPP must be updated and include the gated storage area south of Dallas Avenue South from the south end of the SPM Property, unless the storm drain in that southern storage area discharges to the combined sewer.
- SPM needs to begin sampling the SPM outfall and, if it drains to the SPM stormwater system, the gated storage area south of Dallas Avenue South.

Regarding SPM's operations, Ecology's inspection concluded that SPM:

- Must begin sampling at each unique sample point as described in the permit conditions.
- Must sample both the outlet of the Stormwater Rx™ system and the overflow or move the sample port to after the overflow.
- Should conduct cleanup and general housekeeping to remove paints and other debris from pavement.
- Must maintain tarps under vessels to keep them in better condition.
- Must correct secondary containment issues throughout the Site.

Following receipt of Ecology's inspection report, SPM has been conducting management activities in accordance with the SWPPP and addressing action items identified in Ecology's inspection report. These activities have included:

- Contracting with Applied Professional Services (APS) in March 2021 to conduct additional investigation of the stormwater infrastructure configuration. This included tracing the drain line from CB-02 southward toward the CB-05/CB-06 area, uncovering the SPM Outfall within the shoreline riprap, and documenting that the catch basin within the gated storage area south of Dallas Avenue South drains northward to the combined sewer line at the intersection of 16th Avenue South and South Cloverdale Street.
- Reconfiguration of the Stormwater Rx™ system overflow piping in April 2021 to prevent river intrusion into the system while maintaining overflow functionality.
- Contracting with MarVac in June 2021 to vacuum accumulated solids from the catch basins and cleaned and replaced THE screen baskets used to capture solids in the catch basins.
- Installation of custom-manufactured catch basin treatment inserts in basins CB-02, CB-03, CB-04, CB-06, CB-07, CB-08, CB-09 in November 2021.

- Additional BMPs including restricting any boat maintenance work to the area of the Site that drains to the Stormwater Rx™ treatment system and more stringent vacuum sander requirements.
- Full replacement of the treatment media within the Stormwater Rx™ system in October 2021.

February 2022 NPDES Inspection (Ecology, 2022)

On February 25, 2022, Ecology conducted an announced stormwater compliance inspection of the SPM Property to review site conditions and documentation with respect to the Boatyard General Permit. On behalf of SPM, TIG accompanied Ecology and SPM for the inspection. SPM and Ecology began the inspection by discussing documentation and changes made since the March 2021 Site inspection. Regarding documentation, the Ecology site inspector concluded that SPM needed to complete the following:

- Update the site map and SWPPP to include two new sampling points at CB-02 and either CB-05 or CB-06.

Regarding operations, the Ecology site inspector concluded that SPM needed to complete the following:

- Begin sampling stormwater in CB-02 and either CB-05 or CB-06 to characterize rainfall reaching the South Park Marina outfall.
- Correct secondary containment issues identified (the one noted location was within the yard that drains to the sanitary sewer).
- Conduct a Level 2 response for copper and a Level 3 response for zinc based on catch basin stormwater results collected in April and May, 2021.

The inspection served to provide South Park Marina with clarification on Ecology's expectations and requirements for site operations governed by the site NPDES permit, as well as technical assistance in meeting these expectations and requirements. Following the inspection, SPM is conducting the following actions:

- Level 2 response for copper: Evaluation of source control and proposed alternatives, including the technical benefits and economic considerations for each. This evaluation may be coupled with the Level 3 response for zinc, as the zinc evaluation will cover the same content but will do so in a more robust manner.
- Level 3 response for zinc: Evaluation of source control and proposal of engineering alternatives for improvement of zinc source control. This document will also propose a preferred alternative and will include sufficient detail to implement the preferred alternative pending Ecology's approval.
- Sampling and reporting of stormwater analytical results for samples taken from CB-12 and either CB-05 or CB-06.

A.2.3. SPM Stormwater Monitoring under Boatyard General Permit

In accordance with the Boatyard General Permit, SPM samples the discharge of treated water from the Stormwater Rx™ system for analysis of total copper and total zinc during wet-season months January, April, May, October, and November, and submits the discharge monitoring reports (DMRs) to Ecology. Table A-1 presents the sample data collected for this purpose. The Boatyard General Permit establishes maximum daily benchmarks (147 µg/L copper and 90 µg/L zinc) and seasonal average water quality benchmarks (50 µg/L copper and 85 µg/L zinc). The seasonal average concentration for each year is calculated as the arithmetic average of all the daily discharge concentrations determined during the wet season monitoring period (October through May). The daily maximum is the concentration measured on any day or, if multiple measurements are collected during a day, the arithmetic average of those measurements. Table A-1 provides SPM's monitoring data compared against both the maximum daily and seasonal average benchmarks.

During the 2017-2018 wet season, discharge from the Stormwater Rx™ system exceeded both sets of benchmarks for zinc and complied with both for copper. During the next wet season, 2018-2019, copper exceeded the maximum daily benchmark in one of five sampling events, zinc complied with the maximum daily benchmark in all events, and copper and zinc met the seasonal average benchmark values. During the 2019-2020 wet season all benchmarks were achieved, and in the 2020-2021 wet season one zinc exceedance was detected (Table A-1).

A.3. References for Appendix A

Leidos, 2015, NPDES Inspection Sampling Support 2014/2015, Prepared for Washington State Department of Ecology, June 2015.

TIG Environmental, 2018, Stormwater and Boat Wash Water Systems Evaluation South Park Marina, Prepared for South Park Marina Limited Partnership, February 2018.

TIG Environmental, 2019, Results of Drainage Pathway Investigation Memorandum, January 16, 2019.

Washington State Department of Ecology (Ecology), 2005, Stormwater Compliance Inspection Report, NPDES Permit WAG30045B, South Park Marina, dated July 11, 2005.

Washington State Department of Ecology (Ecology), 2021, Stormwater Compliance Inspection Report, NPDES Permit WAG30045B, South Park Marina, dated March 24, 2021.

Table A-1. Operations in Stormwater Catchment Areas

Project No. 190293, South Park Marina, Seattle, Washington

Stormwater Catchment Area (and Outfall)	Catchment Area (Acres)	% of Total Property Area	Historical Uses in Catchment Area*	Current Operations in Catchment Area*
Catchment Area Comprising 99% of Site Property				
Central Catchment Area (South Park Marina Outfall)	2.26	61	Radiator repair shop (removed by 1972); auto repair and gasoline station (removed by 1972); boat manufacturing building; mobile homes; 1,000-gallon UST (removed 1991)	Boat storage; South Park Marina office, shop, and parking; Rick's Master Marine; Tire Factory Shop; residential structures.
Southern Catchment Area (UOF-1 Outfall)	0.78	21	A&B Barrel operations (1940s-1960); boat maintenance; storage shed (until 2021); woodworking shop (until 2021); lumber storage building (until 2021)	Boat maintenance with washwater treatment system; StormwateRx system; 35-ton crane; harbormaster shop.
Northern Catchment Area (King County Outfall OF-2215)	0.33	9	Auto repair and gasoline station (removed by 1972); mobile homes.	Tire Factory Shop; Rick's Master Marine.
Shoreline Gravel Area (infiltration area)	0.30	8	Boat manufacturing building; A&B Barrel operations (1940s-1960); mobile homes; 1,000-gallon UST (removed 1981)	South Park Marina shop; harbormaster shop.
Catchment Area Comprising 1% of Site Property				
Northwestern Portion of Site (to City combined sewer)	0.02	0.5	Auto repair and gasoline station (removed by 1972).	Tire Factory Shop.
Southwestern Corner of Site (City 17th Avenue S storm drain)	0.01	0.3	A&B Barrel operations (1940s-1960).	Boat storage.
Top of Boat Ramp (overland flow)	0.004	0.1	Boat ramp access.	Boat ramp access.

Notes:

*: Partially or completely within catchment area. Vehicle traffic occurs to varying degress in all catchment areas.

See Figure A-1 for stormwater catchment area and outfall locations.

UST = underground storage tank

Table A-2. Treated Stormwater Data Comparison to Boatyard Permit Benchmarks, 2017-2021

Project No. 190293, South Park Marina, Seattle, Washington

				StormwaterRx System (Treated Effluent)																			
				Daily Maximum Comparison																			
				2017-2018					2018-2019					2019-2020					2020-2021				
				SPM-SWRX-POST-SW	SPM-SWRX-POST-SW	SPM-SWRX-POST-SW	SPM-SWRX-POST-SW	SPM-SWRX-POST-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW	SPM-NPDES-SW
Analyte	Fraction	Unit	Daily Max Benchmark	10/18/17	11/03/17	01/05/18	01/23/18	04/10/18	10/05/18	11/02/18	01/03/19	04/05/19	05/14/19	10/16/19	12/12/19	01/10/20	04/22/20	05/17/20	10/10/20	11/03/20	01/28/21	04/24/21	05/27/21
Metals																							
Copper	T	ug/L	147	21	13	7	6.6	7.3	14	3.1	4.4	44	150	17	5.2	6.8	58	8.3	9.2	18	7.4	130	34
Zinc	T	ug/L	90	53	72	300	120	28	27	9.8	9.8	17	36	28	18	18	34	31	27	18	26	98	74

				Seasonal Average Comparison (Oct-May wet season)			
Analyte	Fraction	Unit	Seasonal Average Benchmark	2017-18	2018-19	2019-2020	2020-2021
Metals							
Copper	T	ug/L	50	11	43	19	40
Zinc	T	ug/L	85	115	20	26	49

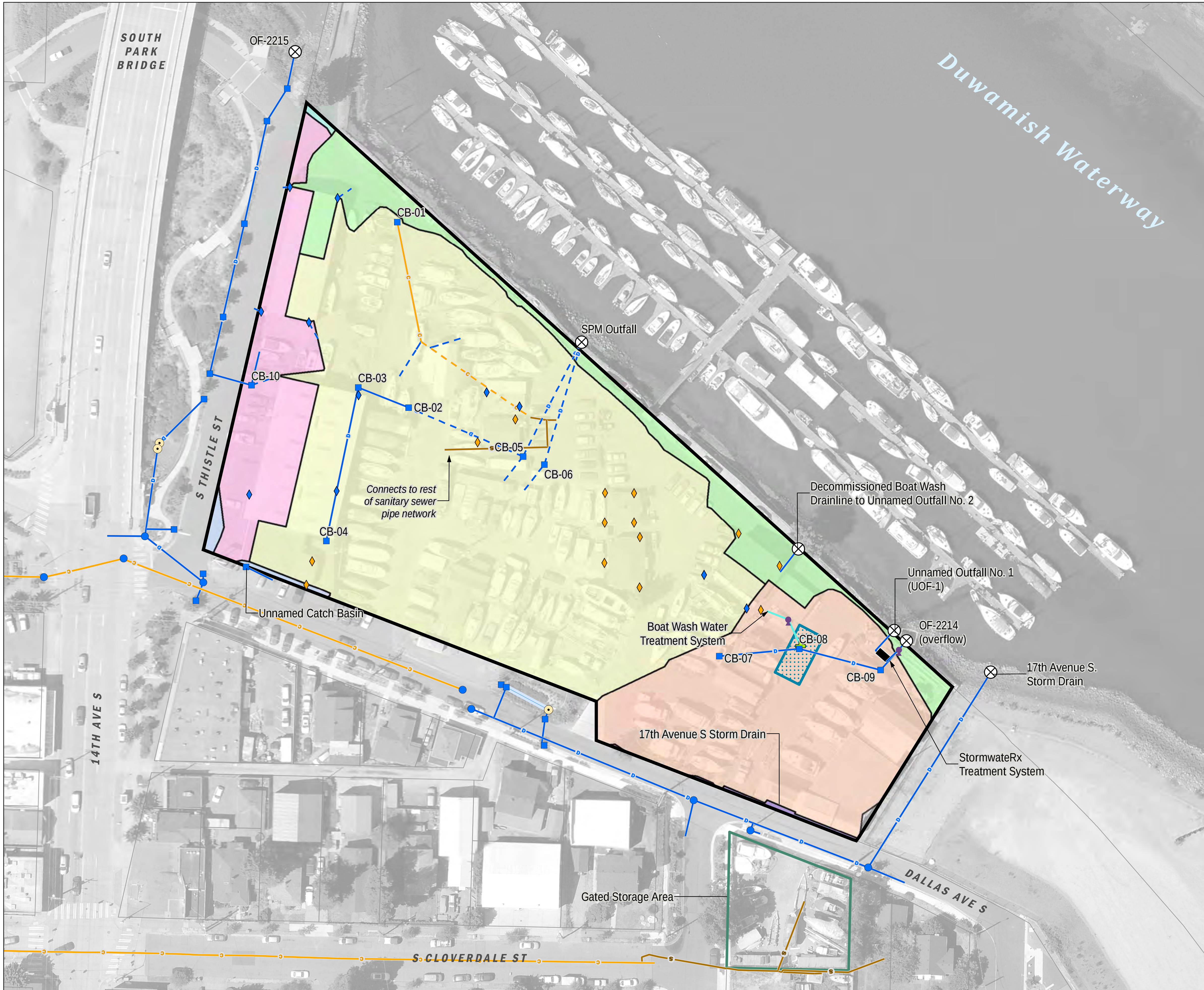
Notes:

For samples with field duplicate results, the higher concentration reported from the parent sample or duplicate sample is used in this analysis, consistent with South Park Marina's NPDES Discharge Monitoring Reports.

Blue Shaded - Result exceeds boatyard permit benchmark

ug/L = micrograms per liter

T - Total Fraction (unfiltered) sample result



Site Boundary
King County Tax Parcel

Stormwater Infrustucture

- Catch Basin
- Overflow
- Manhole
- Metal Roof Drain
- Non Metal Roof Drain
- Outfall (Existing and Decommissioned)
- Pump Station
- Pump Vault
- Vessel Wash Wastewater Catch Basin
- Yard Drain
- Combined Sewer Pipe
- Combined Sewer Pipe (inferred)
- Sanitary Sewer Pipe
- Storm Drain Pipe
- Storm Drain Pipe (inferred)
- Bioswale
- Vessel Wash Collection Pipe

Stormwater Catchment Areas and Discharge Areas

- City of Seattle Combined Sewer System
- Infiltrates Through Gravel Surface
- OF-2214 (South Park Marina SD)
- OF-2215
- Offsite Directly to River
- South Park Marina Outfall
- 17th Avenue S Storm Drain
- Boat Wash Pad

Note:

- Site features are approximate.

0 80 160
Feet

N
Project North
True North

Stormwater Catchment Areas and Infrastructure

Source Control Review Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect CONSULTING

JUN-2022	BY: TDR	FIGURE NO.
PROJECT NO. 190293	REVISED BY: NLK / AJY / WEG	A-1

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\Source Control Eval Memo\A-1 Stormwater Catchment Areas and Infrastructure.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/14/2022 || User: nkochie || Print Date: 6/14/2022

ATTACHMENT A-1

StormwateRx™ Manual and Equipment Specifications

aquip®

stormwateRx®
Reclaiming the world's water.®

Aquip® Stormwater Filtration System: A Technical Description

ver017

aquip® Fundamentals

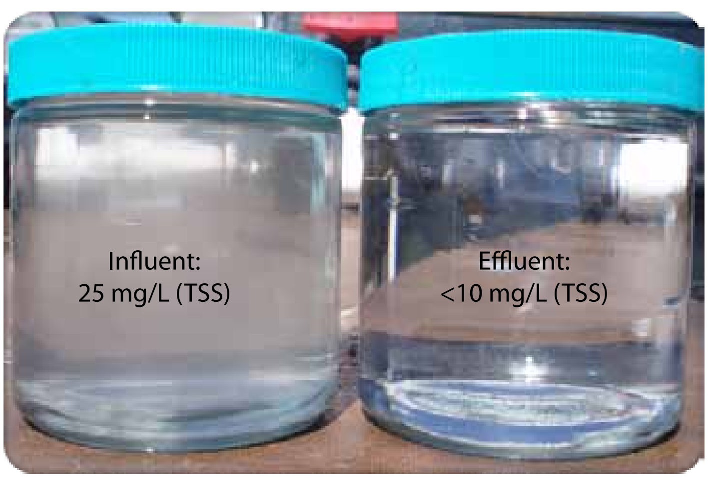
Aquip® (uh-kwip) is a patented, multi-media filtration system for stormwater applications. This robust stormwater treatment Best Management Practice (BMP) produces good stand-alone stormwater quality for a wide range of industries, is easy to retrofit to existing stormwater collection and conveyance infrastructure, and requires no operator attention during rain events.[1]

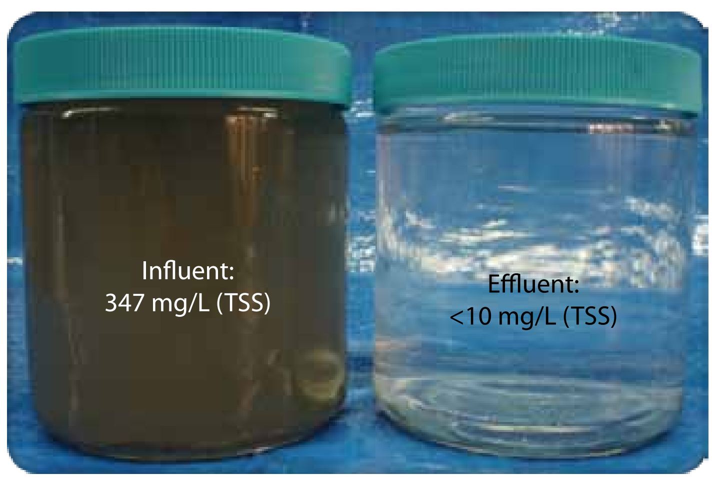
Aquip uses passive adsorptive filtration technology designed specifically for reduction of stormwater pollutants such as suspended solids, turbidity, heavy metals, nutrients, and organics from runoff. The passive system uses no chemicals and has no moving parts so operation is simple and safe. Aquip includes a pre-treatment chamber followed by inert and adsorptive filtration media to effectively trap pollutants in a package that is flexible and reliable. Aquip has received a coveted third party regulatory approval[2] for removal of particulates, dissolved metals and phosphorus from stormwater. Compliance samples are collected from a sample port at the outlet of the filter.

Installation of an Aquip 50 system

View of Aquip inlet distributor

Below are photographs of samples taken before and after the Aquip filtration system. Aquip is an effective filter producing good quality effluent under a range of influent stormwater quality conditions.





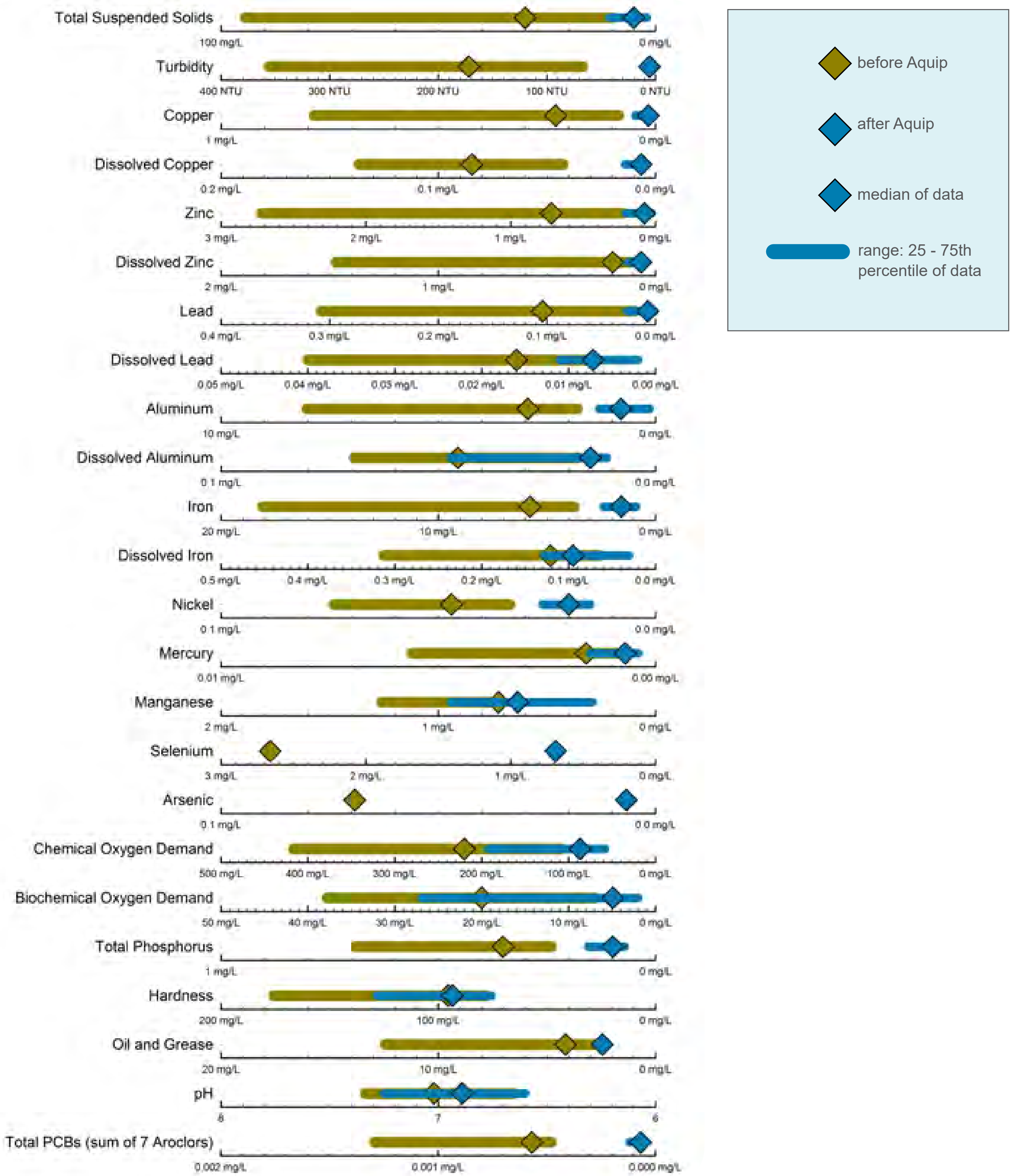
Actual full-scale Aquip influent and effluent samples

1 When properly maintained.

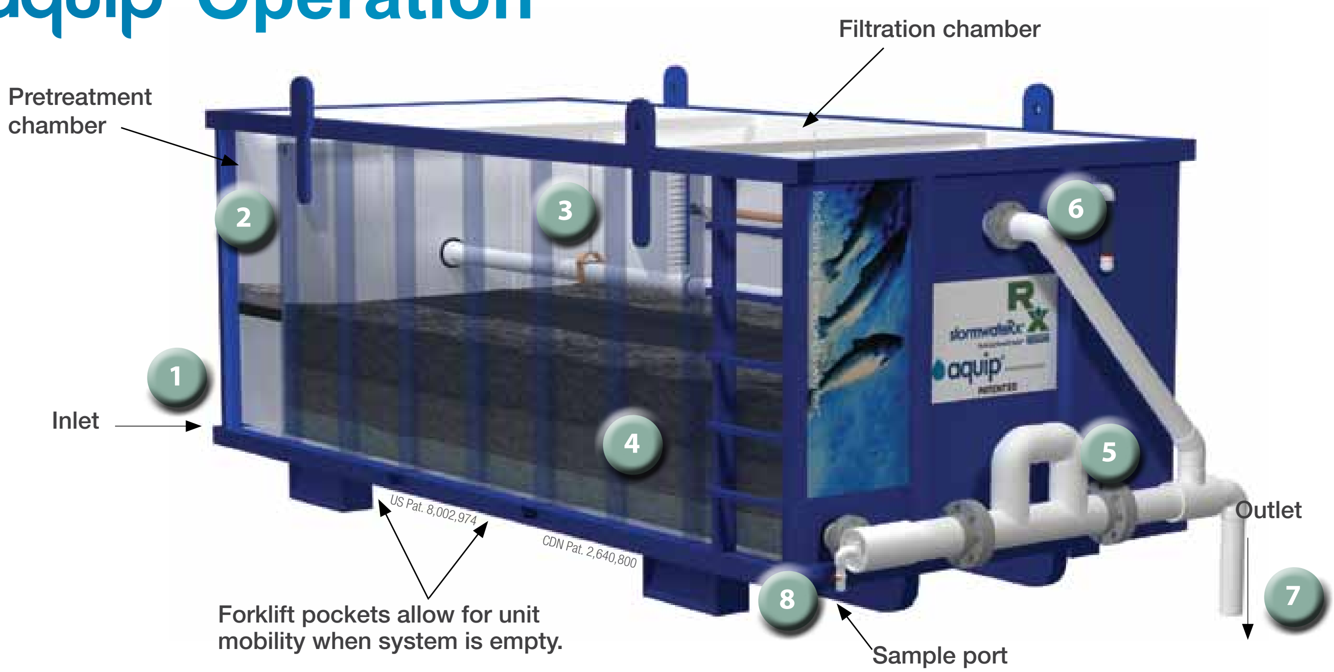
2 The Washington Department of Ecology has conditionally approved (CULD) the Aquip enhanced stormwater filtration system for use for basic, enhanced and phosphorus treatment. The CULD was granted as a part of the Technology Assessment Protocol Ecology (TAPE) process upon review by a Board of External Reviewers consisting of stormwater experts from across the United States. According to Ecology, "...several other states, counties, and cities use TAPE certification to determine whether a technology can be installed within their jurisdiction, including Sacramento CA, Denver CO, St. Louis MO, the State of New Hampshire, Portland OR, the Oregon Department of Transportation, and the State of Rhode Island. Aquip is arguably the first and only industrial stormwater treatment BMP approved for the treatment of solids, metals, and nutrients." The CULD approval means that Aquip can be specified and is approved for use on new and redevelopment projects in Washington as well as retrofits without additional review.

aquip® Performance

Aquip performance has been demonstrated at a wide range of industrial sites including scrap and recycling, galvanizing, metal fabrication, wood treating, automobile salvage, transportation equipment, food processing, power generation, marine and a host of others. Representative performance data from Aquip are presented in the figure below. As the data show, Aquip produces good quality stormwater effluent for the regulated stormwater pollutants as well as for many that are not currently, but may be regulated in the future.



aquip® Operation



1 **Inlet:** Polluted stormwater flows into Aquip via the inlet pipe, then into the pretreatment chamber. In most cases stormwater is pumped to Aquip using a simple float actuated stormwater pump. A totalizing flow meter on the system lets owners track the rate and total amount of stormwater treated to assist with predictive maintenance.

2 **Pretreatment Chamber:** This chamber is customized to naturally balance the water chemistry and improve the quality of the stormwater. The pretreatment chamber can be configured to settle solids, remove oil, or with buffering media for enhanced dissolved metals removal. The buffering process works synchronously with Aquip's adsorptive filtration media, coagulating particulates, adsorbing dissolved metals and creating metal complexes that are more easily removed in the filtration chamber. A mosquito barrier layer is provided to prevent breeding in the pretreatment chamber.

3 **Inlet Distributor:** Water from the pretreatment chamber flows by gravity into the inlet distributor and is dispersed along the full length of the filter media bed, optimizing the contact area of stormwater with filtration media. Energy dissipation fabric lies beneath the distributor to prevent scouring of the media bed.

4 **Filtration Chamber:** Layers of inert and adsorptive media remove stormwater pollutants such as metals, particulates, oil, organics and nutrients. Within the filtration chamber, pollutant removal occurs through a combination of straining, filtration, complexing, adsorption, absorption, micro-sedimentation, and biological degradation, producing excellent water quality. Once passed through the media bed, clean stormwater flows into the underdrain and out of the system, and the pollutants are permanently trapped in the filter bed. The filter bed drains down between storm events. Integrated ladders, filter maintenance tools and an external filter bed drain-down are provided allowing facility personnel to perform routine maintenance without special equipment.

5 **Adjustable Head Control:** Clean stormwater leaving the system passes through the adjustable head controller. This device can be adjusted in the field and assures optimal water/filter media contact under a range of operating conditions.

6 **Emergency Overflow:** This outlet provides a means for stormwater to bypass the filter in case the filter becomes plugged during a rain event. Filter bed plugging is avoided by maintaining the system per StormwateRx recommendations.

7 **Outlet:** Clean stormwater discharges by gravity from the Aquip structure through the outlet.

8 **Outlet Sample Port:** This port provides safe and easy access to system effluent for stormwater compliance sampling.

aquip® Configurations

Aquip is available in a number of configurations. Whether the structure is steel, plastic, concrete, fiberglass, earthen, or owner-supplied, Aquip owners can expect the same high level of performance and reliability. Available upgrades for Aquip include freeze protection, soft or rigid covers, and seismic tie-downs.

Aquip above-grade

Our most popular Aquip configuration, Aquip in a steel configuration for above-ground applications can be moved into place quickly and can be operational in as few as two days.

- Easy to install with a forklift
- Open-top for easy access
- Built-in ladders allow simple maintenance
- Eight sizes available for flow rates up to 600 gpm

Aquip below-grade

This Aquip configuration is designed in a pre-cast concrete vault or panel-vault and is suitable for buried applications.The below ground configuration can be supplied with a solid lid for traffic rated applications or with an open top for easy inspection and maintenance.

- Ideal for large sites such as ports and marine facilities
- Often used for new or redeveloped industrial sites
- Flexible layout to accommodate varying site orientations
- Flow rate virtually unlimited

Aquip portable

Aquip Portable is available in both downspout and wash rack configurations. The downspout configuration uses our advanced media configuration and provides the highest and longest lasting zinc reduction from rooftops in the industry.

- Treats up to ¼ acre, with flow rates up to 15 gpm
- 95-98% zinc reduction for downspout model
- Easy Do-It-Yourself installation
- Used for wash rack applications too!

Aquip green / Aquip user-build

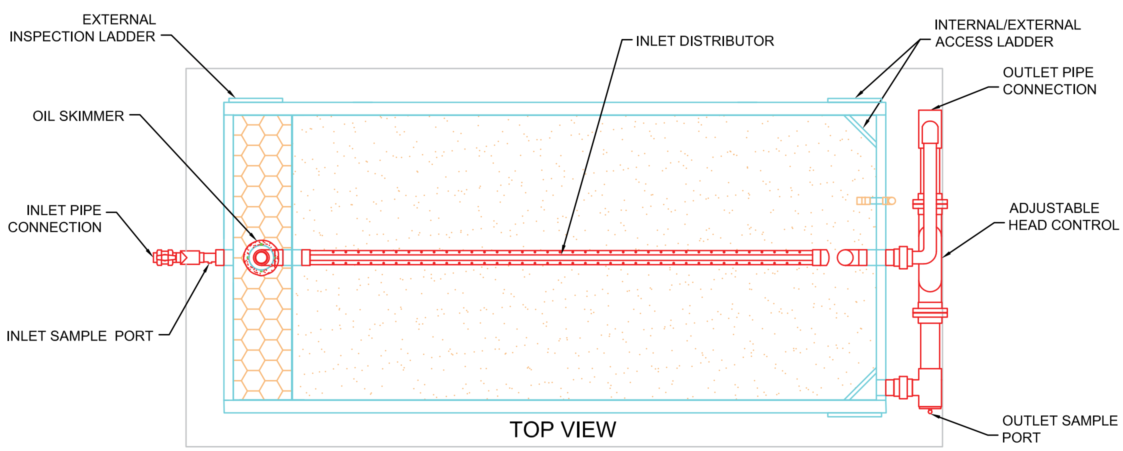
The Aquip filtration system can be supplied in a user-build configuration for applications where the customer desires to supply or build their own Aquip housing. User-supplied Aquip filters have been fabricated from steel, concrete and fiberglass and, in certain cases, StormwateRx can design the filtration technology to fit existing sub-terrain structures or vaults.

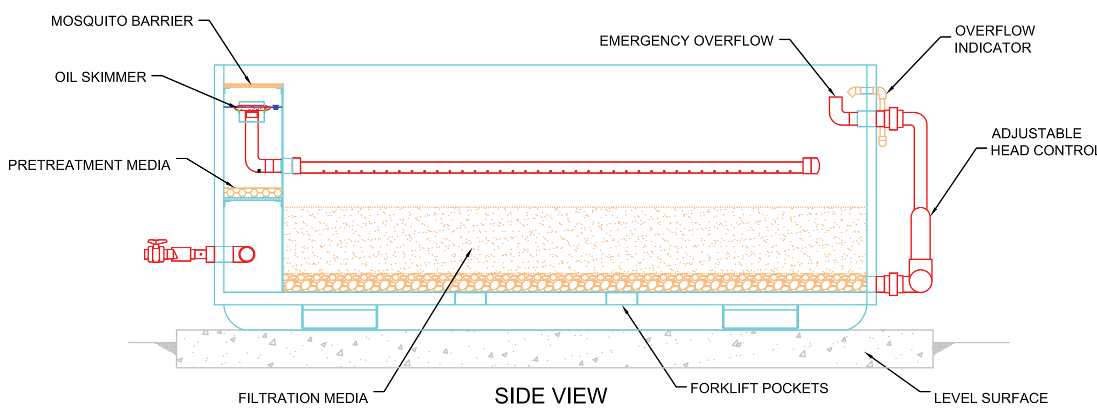
The Aquip green configuration is ideal for jurisdictions where Low Impact Development (LID) or Green Infrastructure designs are encouraged for stormwater volume reduction and where soil properties, groundwater levels and the regulatory framework will allow for stormwater infiltration.

aquip® Sizing

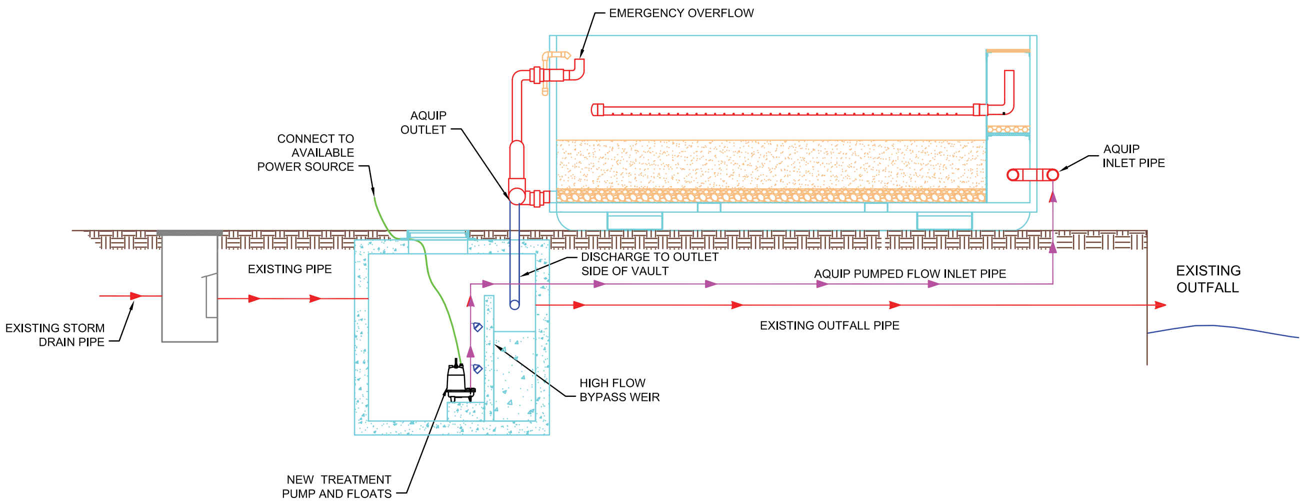
Aquip Model	Treatment Rate (gpm)	Sizing Guideline (acres)*	Footprint (feet)
10	5 – 15	< 0.25	3’ x 9’
25	12 – 40	0.25 – 0.5	5’ x 9’
50	25 – 75	0.5 – 1	7’ x 12’
80	40 – 120	1 – 2	7’ x 16’
110	60 – 170	2 – 3	8’ x 18’
160	80 – 240	3 – 4	8’ x 27’
210	100 – 320	4 – 5	8’ x 32’
300	150 – 450	5 – 8	13’ x 36’
400	200 – 600	6 – 10	13’ x 47’

* Varies by region

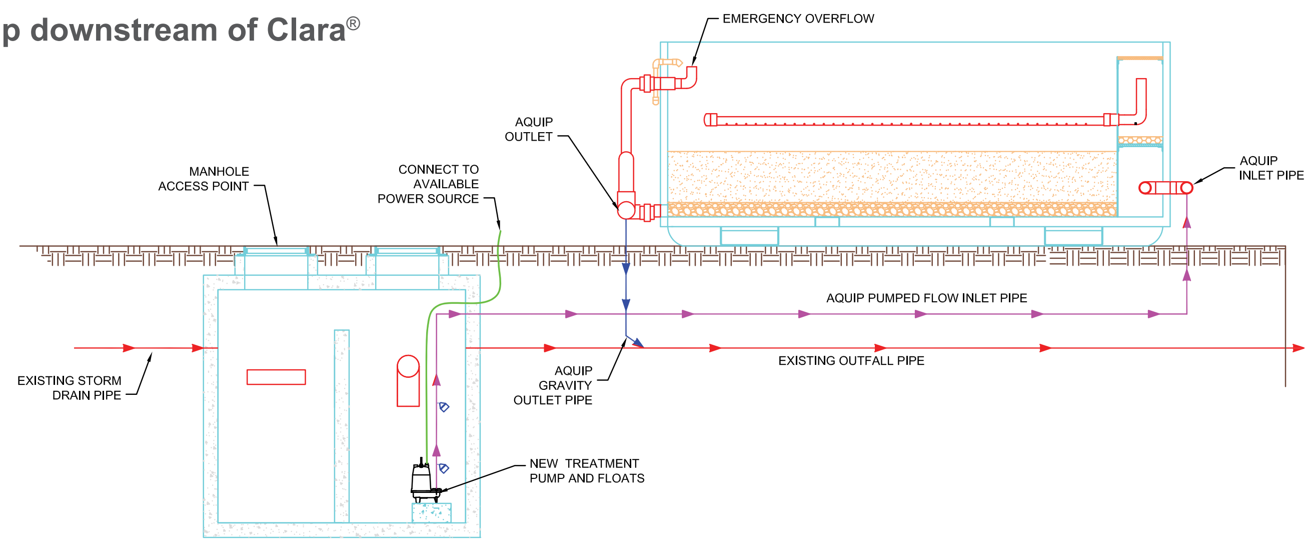




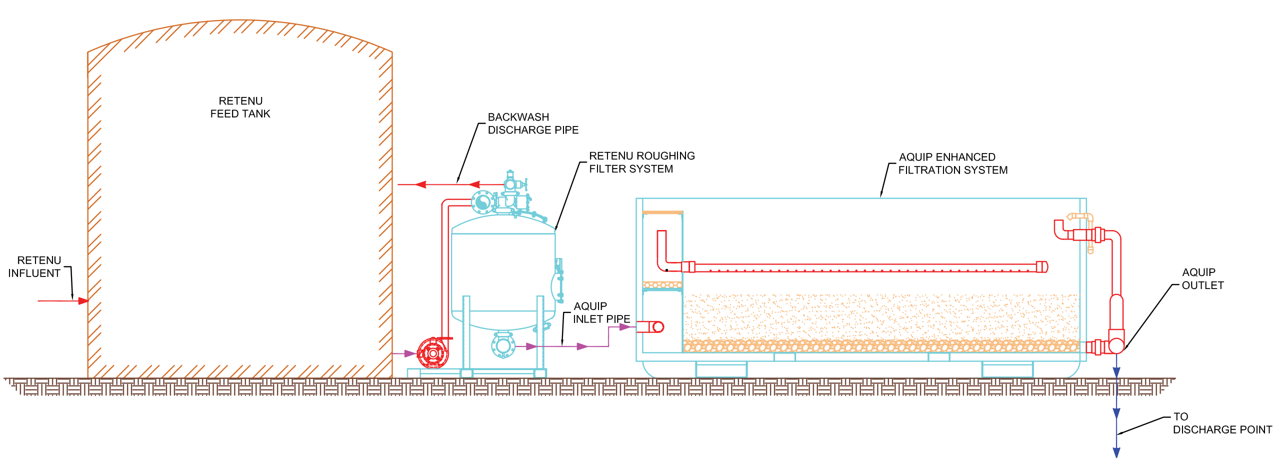
Aquip downstream of bypass pump vault



Aquip downstream of Clara®



Aquip downstream of Retenu®



Testimonials

“As a locally-owned company in a part of the world that is known for its beautiful, clean environment, we are acutely aware that we all share in the responsibility to protect and preserve its health and beauty. At SSC, we take this responsibility seriously and our installation of an environmentally-protective StormwateRx stormwater treatment system is one of the ways we are helping to ensure that our local waterways are clean and healthy for recreation and wildlife for generations to come.”
- Paul Razore, President, Sanitary Service Co., Bellingham, Washington

“After years of struggling to stay below permit benchmarks, despite consistent effort and all the right BMPs, we didn’t quite believe StormwateRx was going to get us there -- until we saw our first sampling results. The Aquip filter has vastly outperformed our previous filter system and brought us into full compliance.”
- Greg Will, Calbag Metals Co., Operations Manager, Portland, Oregon

“Canal Boatyard has always been known as one of the cleanest facilities on the waterfront. We are proud to be at the forefront of the effort to keep runoff pollution to a minimum. The 2009 installation of the StormwateRx system filters runoff water from the entire yard; ensuring contaminants don’t make it into the waterway.”
- Ivaylo Minkov , Manager, Canal Boatyard, Seattle, Washington

“StormwateRx represents best of class solutions that provide a ROI every manger will appreciate. Given the choice to proactively make a capital investment versus being subject to third party lawsuits I will always choose to invest in the future of our business. This is why we partnered with StormwaterRx.”
- Edward Kangeter IV, CEO, CASS, Inc., Oakland, California

“We are always looking for ways to improve the efficiency and sustainability of our operations, and making sure we have the best stormwater treatment equipment is part of that commitment. The StormwateRx treatment train has put Davis Industries at the forefront of environmental technology for the scrap metal recycling industry and we are proud to own one of the most environmentally protective systems on the East Coast.”
- Bill Bukevicz, Executive Vice President, Davis Industries, Lorton, Virginia

stormwateRx®
Reclaiming the world’s water.®

Contact StormwateRx LLC: 800.680.3543 | www.stormwaterx.com

ATTACHMENT A-2

Documentation for Catch Basin Filtration Inserts

Operation, Inspection, and Maintenance Guide
Rev A
December 2020

Table of Contents

1.0 Description

The Ultra-Urban® Filter (UUF) Chester series is a passive, flow-through, stainless-steel, stormwater filtration, and optional purification system designed as an insert sleeve for catch basins. There are two types of models: the UUF "Drop-In" (UUF DI) and the UUF "Curb Opening" (UUF CO). This Guide is specific for the UUF Chester CO models.

The UUF Chester CO filters are comprised of all stainless-steel parts. Figure 1 is a rendered image showing the key components: flow diverter (if applicable), mounting bracket, filter enclosure, and media (if applicable). As an insert sleeve that is positioned in catch basins lower than street level, it is a gravity operated filter that does not require mechanical parts or power. The unit utilizes a filter screen with orifices of less than 5mm in size to reduce trash, debris, and sediment. In addition to TSS reduction, inclusion of AbTech's Smart Sponge® media to the filter enclosure can reduce both particulate and dissolved contaminants.

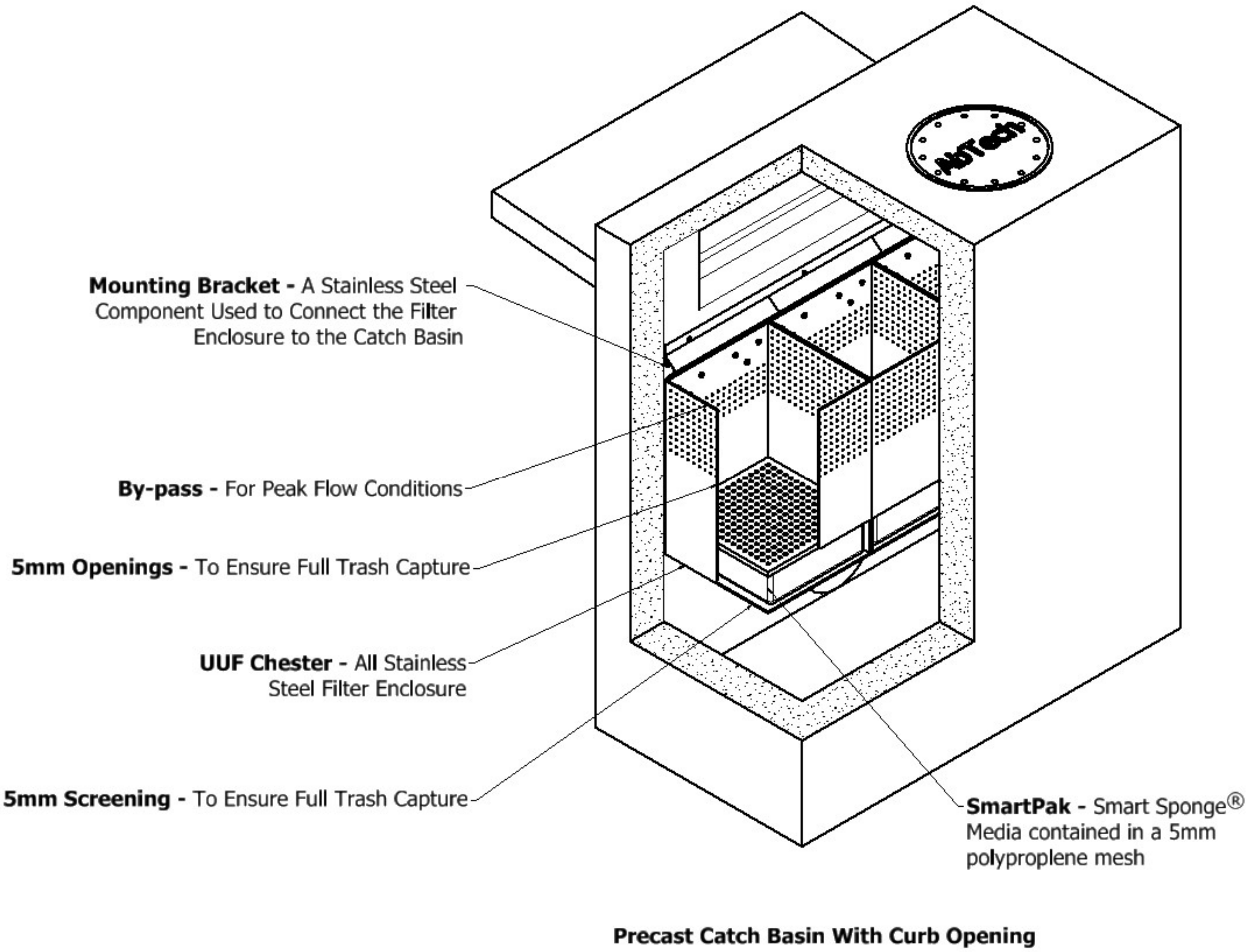


Figure 1: Ultra-Urban® Chester Curb-Opening

2.0 Operation

The UUF Chester CO is positioned beneath the curb opening of catch basin structures used to intercept stormwater runoff from roadways. Untreated stormwater will enter from the curb opening and fall via gravity into the top of the filter insert sleeve(s) positioned beneath the curb opening. Depending on the curb opening size, a flow diverter may be used to ensure that flow entering the curb opening does not short-circuit the filters. This untreated stormwater continues into the face of the filter screen at the bottom of the unit and, subsequently, will be filtered to less than 5mm in particle size. If media is added at the bottom of the filter enclosure, the media and wrap used to restrain the media will provide additional filtration.

Media may be installed as a Smart Pak® at the bottom of the filter enclosure to ensure 100% of water flow is treated. The filtered and purified water will flow out of the unit to be discharged or re-used. The UUF Chester CO is designed with a bypass feature to allow flows exceeding the maximum filtration rate to leave the filter enclosure. Screened bypass initiates when the water levels in the filter enclosure rise above the solid portion of the sides. Full bypass occurs when the water levels rise above the top of the filter insert. A UUF Chester CO is installed in a typical curb opening catch basin and its operation is illustrated in Figure 2.

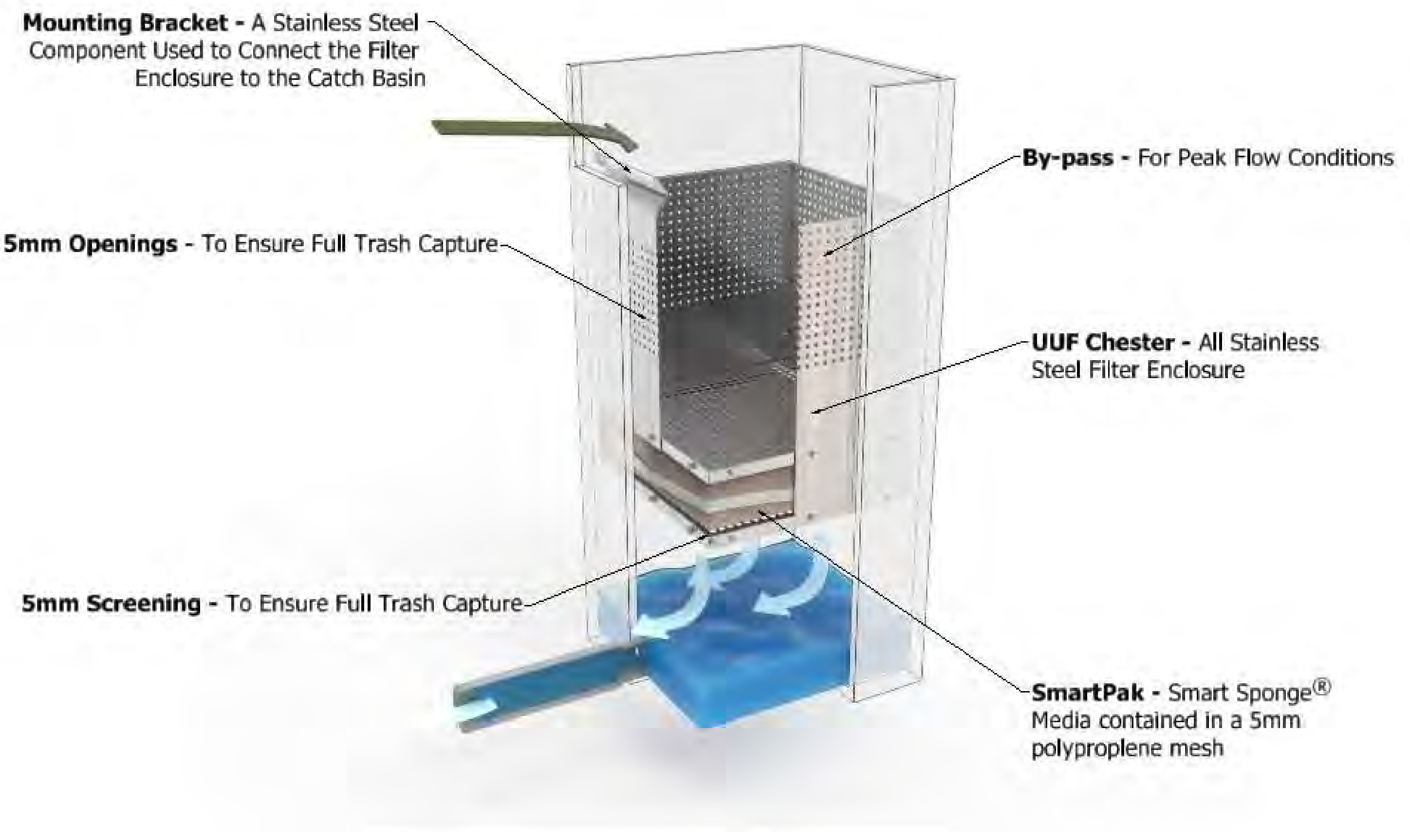


Figure 2: UUF Chester Flow Curb-Opening

3.0 Inspection

3.1 General

Catch basin inspection, maintenance and historic documentation is an integral part of any comprehensive stormwater management plan. A thorough inspection program is necessary to ensure the treatment filter is operating as designed and to provide the necessary pollutant removal. Actively reviewing and updating inspection and monitoring plans will minimize unnecessary maintenance and provide insight to the status of the receiving water bodies. The frequency in which catch basins are cleaned should be based on site-specific factors such as: weather, rainfall events, and expected debris accumulation. It is important to closely monitor and document the first year of operation after initial installation to develop a long-term maintenance plan for the filter that is consistent with actual pollutants loadings.

3.2 Inspection Frequency and Timing

In general, all treatment systems need to be inspected on a routine and recurring basis. The frequency and timing of the inspections will vary based on the configuration of the filter, its location within the drainage system, and the geographic region. During the first year of operation, after initial installation, the UUF Chester should be inspected more frequently to create a baseline of understanding for operation of the filter. Subsequent years of operation can have the inspection frequency adjusted based on working experience provided no irregular events occur during the year.

- First-Year Inspection – Quarterly inspections in the first year are recommended. The first inspection should occur on, or near, the start of the heaviest rainfall season with the last inspection occurring on or around the end of the season. If the location of installation has no definitive rainy season, inspections should be spaced evenly throughout the year. Maintenance visits may coincide with inspection visits.

- Second-Year and Subsequent Year Inspections – Semi-annual inspections are recommended. The first inspection should occur on, or near, the start of the heaviest rainfall season with the last inspection occurring on or around the end of the season. If the location of installation has no definitive rainy season, inspections should be spaced evenly throughout the year. If during the first-year inspection the Filter and/or location is determined have high pollutant loadings or irregular loadings of sediment, trash, and debris, additional inspections may be necessary. Maintenance visits may coincide with inspection visits.

3.3 Inspection Safety and Equipment Considerations

Safety is the most important consideration before inspecting and removing pollutants from the UUF Chester CO. Always employ proper traffic management and handling procedures for all inspections/maintenance where vehicles and pedestrians have access. Disposing of waste liquids and solids may be regulated and should be understood before removing waste products from the treatment system. Urban stormwater drainage structures are often installed along roadside curbs or in parking lots with limited space.

Consider plans for:

- Personal Protective Equipment (PPE) – reflective vests, glasses, steel-toed shoes, gloves
- Allowing personnel space to remove and temporarily store surface grates
- Maneuvering and parking maintenance vehicles
- Equipment for directing traffic and pedestrians - safety cones or barriers and use of appropriate signage
- Equipment for removing the manway/grate (i.e., crowbar, manhole hook, jib crane)
- Tools to loosen consolidated sediment and debris covering the manway/grate
- Storing and disposal of pollutants
- Inspection Data Sheet

In the event of accidental or chemical spill, contact emergency services and follow standard hazmat procedures.

3.4 Inspection Procedures

The UUF Chester CO is typically inspected without entry into the catch basin. The inspection should begin by preparing and installing all safety measures followed by inspection and then documentation. Specific procedures for the inspection are detailed below:

1. Wear all PPE and prepare documentation equipment.

2. Install all work zone safety equipment and conduct a brief safety meeting. Work zone safety equipment should protect the inspector(s) from vehicular traffic and should also isolate and protect pedestrians and vehicles from the work zone.

3. Remove the manhole cover utilizing the manhole puller/remover and safely set aside out of the way of the inspection operations and pedestrians or vehicles.

4. Inspect the grate and catch basin lip. The areas outside of the curb opening should be free from debris, obstructions, and standing water. The presence of any of these conditions outside of the catch basin are potential indicators for a maintenance event. If any of these maintenance indicators are encountered, they should be documented and, depending on severity, should be rectified through recommended maintenance.

Maintenance may occur simultaneously with inspection provided the maintenance indicators have already been documented.

5. Inspect the inside of the catch basin. A flashlight may be needed depending on outside lighting. The interior of the catch basin and pipe outlet(s) should be free from debris, obstructions, and standing water. The presence of any of these conditions in the interior of the catch basin are potential indicators for a maintenance event. If any of these maintenance indicators are encountered, they should be documented and depending on the severity, should be rectified through recommended maintenance. Maintenance may occur simultaneously with inspection provided the maintenance indicators have already been documented.

6. Inspect the mounting bracket and filter enclosure for physical or structural damage. The mounting bracket should be firmly mounted to the catch basin sidewall and there should be no loose or missing hardware. The filter should be supported by the mounting bracket. Bent, broken, or otherwise damaged structural components should be documented and recommended for replacement as needed.

7. Inspect the filter screen for pollutants. Pollutants such as trash and debris, and sediment are expected to be captured inside of the treatment system. The presence of such pollutants are indicators the filter is operating as intended. Conversely, the lack or low quantity of such pollutants present in the filter may be an indicator that the filter is not functioning as intended. The quantities of pollutants should be documented and compared with the maximum capacities for the filter. Maintenance to be scheduled as needed.

8. Inspect the media (if included). When equipped with media, the UUF Chester CO should be inspected to determine the condition of the media wrapping. Smart Sponge® media material darkens in color as it collects pollutants, but with the media wrapping in a Smart Pak, it may be difficult to observe. Observe if a black or oily film has accumulated on top of the media wrapping. If so, its useful life has ended, and replacement is necessary. Alternatively, replacement of the filter media may be necessary after fine sediment has accumulated in the media pack. After dry cleaning the Smart Pak, the media will need to be changed when the increase in weight of a dry Smart Pak equals two times its initial product weight except for sediment, trash, and debris. The condition of the media should be documented, and recommended for maintenance, as needed.

9. Inspect the flow divertor (if installed) for physical damage. The flow diverter should be firmly mounted to the sidewall of the curb opening to direct water into the filter enclosure without short-circuiting the filter(s).

10. Finalize the Inspection Data Sheet. Photograph the conditions of interior and exterior of the catch basin and filter unit. Document the inspection event utilizing the Inspection Data Sheet included with this manual or similar. The presence of standing water or mosquitos should be highlighted per vector control procedures. The local vector control

agency should be notified if mosquitos are present in the catch basin or filter unit.

11. Replace the manhole cover and remove all work zone safety equipment.

4.0 Maintenance and Media Replacement

4.1 General

Catch basin inspection and maintenance is an integral part of any comprehensive stormwater management plan. A thorough maintenance plan is necessary to ensure the treatment filter is operating as designed and is providing the intended pollutant removal. A maintenance plan should be structured based on the type of treatment filter, location, and function of the treatment filter. The frequency in which catch basins are cleaned should be based on site-specific factors such as: weather, rainfall events, and expected debris accumulation. It is important to closely inspect and document the first year of operation after initial installation to develop a long-term maintenance plan for the filter that is consistent with the effluent requirements of the installation.

4.2 Maintenance Frequency and Timing

The UUF Chester CO requires recurring maintenance that is scheduled based on observations made during routine inspections. The frequency and timing of the maintenance visits can be variable based on the configuration of the filter, location of the filter within the drainage system, and the geographic region of installation. During the first year of operation, after initial installation, the UUF Chester should be inspected more frequently to create a baseline of understanding for operation of the filter and servicing needs. Subsequent years of operation can have reduced inspection/maintenance provided no irregular events occur during the year.

- First and Subsequent Year Maintenance – Refer to Section 3.2: Inspection Frequency and Timing. Quarterly inspection visits in the first year are recommended and depending on inspection findings will determine if maintenance is required. A maintenance event will be scheduled following inspections or should occur on or near the start of the heaviest rainfall season with the last inspection occurring on or around the end of the that season. If the location of installation has no definitive rainy season, maintenance visits should be spaced evenly throughout the year. Maintenance visits may coincide with inspection visits.

- Second-Year and Subsequent Year Maintenance – Semi-annual maintenance visits are recommended. The first maintenance visit should occur on or near the start of the heaviest rainfall season with the last visit occurring on or around the end of the that season. If the location of installation has no definitive rainy season, maintenance should be spaced evenly throughout the year to align with inspection visits. If during the first-year inspection/maintenance visit the filter and/or location is determined have high pollutant loadings or irregular loadings of sediment, trash, and debris, additional maintenance visits may be necessary. Maintenance visits may coincide with inspection visits.

4.3 Maintenance Safety and Planning Considerations

Safety is the most important consideration before maintaining and removing pollutants from the UUF Chester CO unit. Always employ proper traffic management and handling procedures for all inspections/maintenance where vehicles and pedestrians have access. Disposing of waste liquids and solids may be regulated and should be understood before removing waste products from the treatment system. Urban stormwater drainage structures are often installed along roadside curbs or in parking lots with limited space.

Consider plans for:

- Personal Protective Equipment (PPE) – reflective vests, glasses, steel-toed shoes, gloves
- Allowing personnel space to remove and temporarily store surface grates
- Maneuvering and parking maintenance vehicles
- Equipment for directing traffic and pedestrians - safety cones or barriers and use of appropriate signage
- Equipment for removing the manway/grate (i.e., crowbar, manhole hook, jib crane)
- Tools to loosen consolidated sediment and debris covering the manway/grate
- Tools for removal of Smart Pak® media
- Storing and disposal of pollutants
- Maintenance Report

In the event of accidental or chemical spill, contact emergency services and follow standard hazmat procedures.

4.4 Maintenance Procedures

The UUF Chester CO is typically maintained without entry into the catch basin and requires very little time. Maintenance should begin by preparing and installing all safety measures followed by the maintenance and documentation. Specific procedures for the maintenance are detailed below:

1. Wear all PPE and prepare documentation equipment.

2. Install all work zone safety equipment and conduct a brief safety meeting. Work zone safety equipment should protect the inspector(s) from vehicular traffic and should also isolate and protect pedestrians and vehicles from the work zone.

3. Remove the manhole grate utilizing the manhole puller/remover and safely set aside out of the way from maintenance operations and pedestrians or vehicles.

4. If during inspection it is determined the accumulated trash, debris, and sediment requires removal, an industrial vacuum should be utilized to remove the material. Using a reduced diameter suction hose, vacuum the trash, debris, and sediment from the catch basin filter. The suction hose may be inserted into the filter through curb opening as illustrated in Figure 3a or through the manway opening as illustrated in Figure 3b. A pressure washing wand may be utilized to assist this process by freeing clogged material from the enclosure screen or media fabric. The suction hose should remain inside the filter while the filter is being washed down. It is also possible to remove sediment by hand by removing the filter enclosure from the catch basin.

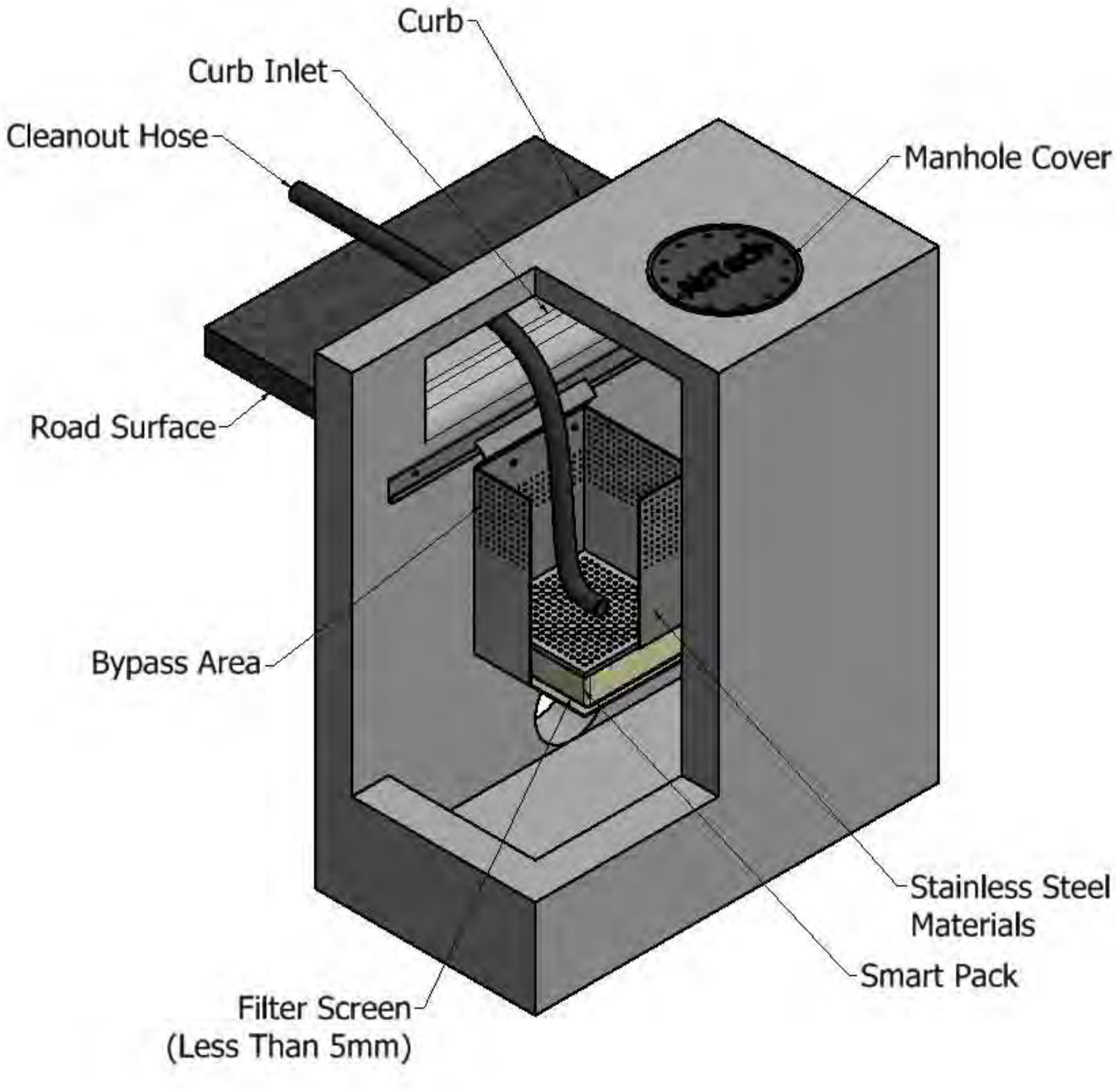


Figure 3a: Maintenance Hose Through the Curb Opening

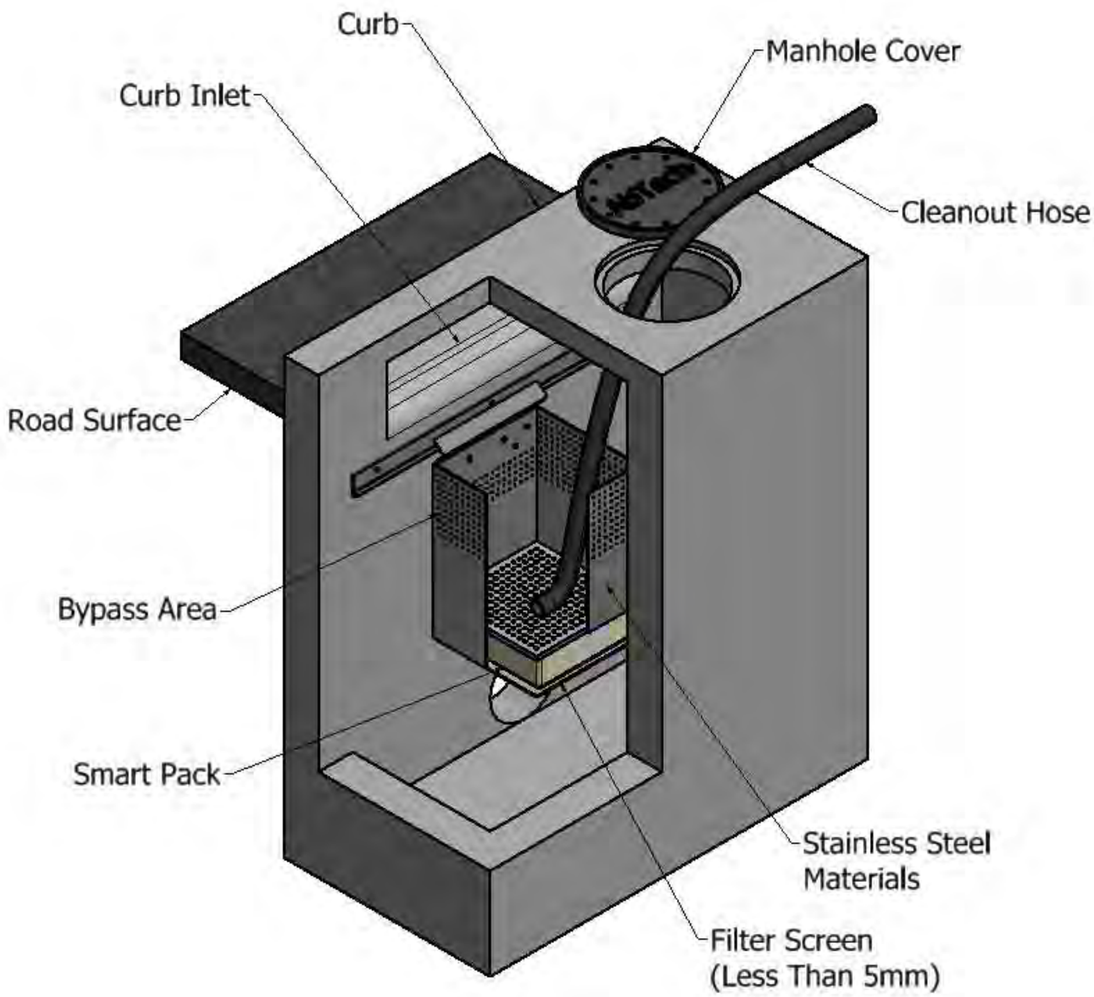


Figure 3b: Maintenance Hose Through the Manway Opening

5. If during inspection it is determined the media requires replacement, the following replacement procedures should be implemented.
   - Replacement media should be pre-ordered in advance of the maintenance visit.
   - After removal of sediment, remove the Smart Pak® from the filter enclosure. The Smart Pak may be removed by hand or using a media removal tool. Additional cleaning may be needed under the Smart Pak where sediment may have accumulated on the filter screen.
   - Once cleaned, place a new Smart Pak into the bottom of the filter enclosure. Ensure the Smart Pak fit tightly and is placed flat into the filter enclosure.

6. Removed trash, debris, and sediment should be disposed of following local, state, and federal guidelines. Media should likewise be disposed of following local, state, and

federal guidelines. Material disposal is discussed in section 5.0.

7. Finalize the Maintenance Report. Photograph the conditions of interior and exterior of the catch basin and filter unit. Document the maintenance event using the Maintenance Report included with this manual or similar. The presence of standing water or mosquitos should be highlighted per vector control procedures. The local vector control agency should be notified if mosquitos are present in the catch basin or filter unit.

8. Replace the manhole cover and remove all work zone safety equipment.

4.5 Related Maintenance Activities

UUF Chester CO’s are often just one of many treatment practices in a comprehensive stormwater drainage treatment system. To maximize the performance of the filter, it is imperative that all upstream infrastructure and treatment practices also be properly maintained. The inspection, maintenance, and repair of upstream facilities should be carried out as part of a comprehensive stormwater management plan. In addition to considering upstream facilities, it is also important to correct any problems identified in the runoff area. Runoff area concerns may include erosion problems, infrastructure damage or failure, and discharges or releases of inappropriate materials.

5.0 Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal several options are available including a municipal vacuum truck decant facility, local wastewater treatment plant or on-site treatment and discharge.

Collected, retired Smart Sponge® filtration media used in standard stormwater applications is classified as a non-hazardous substance. Also, Smart Sponge filtration media saturated with hydrocarbons, both in the lab and field settings, have been tested according to the EPA’s Toxicity Characteristic Leaching Procedure (TCLP). These tests have indicated that Smart Sponge® filtration media is a non-leaching product. For the reasons noted, many cost effective and environmentally friendly disposal options are available as follows:

- Subtitle D Landfills
- Waste-to-Energy Facilities
- Thermal Conversion Process Facilities
- Cement Kilns

6.0 Inspection Data Sheet

Date______________________________ **Personnel**____________________________

Location___________________________ **System Size**_____________________________

No.	Inspection Item	
1	Is settled trash, debris, and/or sediment on the surrounding area? Is the curb opening occluded?	☐ Yes ☐ No
2	Is standing water surrounding the curb opening of the catch basin?	☐ Yes ☐ No
3	Check the flow diverter for structural integrity. Are there any abnormalities?	☐ Yes ☐ No
4	Check the mounting bracket for any physical damage. Is there any damage?	☐ Yes ☐ No
5	Check the filter enclosure for structural integrity. Is there any damage to the enclosure?	☐ Yes ☐ No
6	Is there any damage to the filter screen?	☐ Yes ☐ No
7	Is there trash and debris, and sediment accumulated in the filter? If so, document the qty. If yes, then must be removed as part of the maintenance plan.	☐ Yes ☐ No

8	**Is there a black or oily sheen on top of the Smart Pak®? (if included). If yes, then media must be replaced as part of maintenance plan.**	☐ Yes ☐ No
9	**Is there standing water inside the catch basin?**	☐ Yes ☐ No
10	**Do you observe any mosquitos? If yes, contact vector control as per local guidelines.**	☐ Yes ☐ No

7.0 Maintenance Report

No.	Maintenance Activity	Date
1	Set up appropriate safety equipment and put on safety gear.	
2	Collect and remove trash, debris, etc. surrounding the catch basin and on the grate.	
3	Remove the trash, debris, and sediment from the filter using a vacuum hose, or by hand	
4	Repair or replace damaged or deteriorated structural components such as flow diverter, mounting bracket, or enclosure.	
5	Remove obstructions from filter screen	
6	Remove the spent media and replace with new media.	
7	Conduct O+M procedures as needed for any instrumentation, valves, and other devices. Repair or replace as needed.	
8	Notify agency or owner representative.	

8.0 Warranty

AbTech Industries, Inc. (AbTech) warrants to buyer that the Ultra-Urban Filter Chester Stainless Steel Infrastructure Sleeve (the “Infrastructure Sleeve”) shall materially conform to the description in AbTech’s product documentation as of sale date and shall be free from defects in material and workmanship for twenty (20) years from the date of purchase. This warranty is non-transferable and is conditioned on: (a) the Infrastructure Sleeve being properly installed by a documented authorized service provider of AbTech,(b) buyer’s delivery to AbTech of annual certifications evidencing that buyer has inspected and maintained the Infrastructure Sleeve at least annually from the time of installation, (c) no unauthorized repairs or alterations having been made to the Infrastructure Sleeve, (d) buyer not being in default on any contractual obligation for the Infrastructure Sleeve, (e) buyer registering the Infrastructure Sleeve with AbTech within thirty (30) days of delivery, and (f) any warranty claim being provided to AbTech in writing within thirty (30) days of buyer’s identification of the suspected defect. This warranty specifically excludes coverage of any damage caused by circumstances beyond the control of the party affected, including without limitation acts of God, fire, vandalism, natural disaster, chemical action, abrasive material, misuse, explosion, war, action or demand of governmental authority, injunction or labor strikes, or improper or unauthorized installation or repairs.

This warranty does not apply to (i) any consumable or wearable parts used in conjunction with the Infrastructure Sleeve, or other parts which are designed to diminish or wear over time; or (ii) damage caused by use with a third-party component or product that is not provided by AbTech. The warranties set forth herein are AbTech’s sole and exclusive warranties and are in lieu of all other warranties, remedies and conditions, whether oral, written statutory, express or implied. AbTech disclaims all statutory and implied warranties, including without limitation, warranties of merchantability, fitness for a particular purpose and non-infringement.

If AbTech responds to a claim from buyer under this warranty, and it is later determined that the claim is not, in fact, covered by this warranty, buyer shall pay AbTech its then customary charges for any repair or replacement made by AbTech. IN NO EVENT WILL ABTECH BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES, SUCH AS, BY WAY OF EXAMPLE AND NOT LIMITATION, LOSS OF REVENUES, BUSINESS OPPORTUNITIES OR GOODWILL, ARISING OUT OF OR IN CONNECTION WITH THE INFRASTRUCTURE SLEEVE, HOWSOEVER CAUSED, WHETHER OR NOT BUYER HAS BEEN ADVISED, KNEW OR SHOULD HAVE KNOWN OF THE POSSIBILITY OF SUCH DAMAGES.

APPENDIX B

Western Washington Hydrologic Model Methods and Results

MEMORANDUM

Project No.: 190293-A-002-2.4

June 14, 2022

To: Priscilla Tomlinson, Rick Thomas, and Anthony Wenke
Washington State Department of Ecology Northwest Regional Office

cc: Allison Crowley, Seattle City Light
Roy Kuroiwa, Port of Seattle
Philip Spadaro, TIG Environmental

From:

OWEN GLYNDWR REESE III
STATE OF WASHINGTON
38380
REGISTERED PROFESSIONAL ENGINEER

6/14/2022

Owen G. Reese, PE
Principal Water Resources Engineer
oreese@aspectconsulting.com

Bailey Rockwell
Staff Water Resources Engineer
brockwell@aspectconsulting.com

Re: **Annual Stormwater Discharge Calculations**
South Park Marina Site, Seattle, Washington

Aspect Consulting, LLC (Aspect) prepared this memorandum to summarize the results of hydrologic modeling conducted to estimate the annual stormwater discharge under existing conditions at the South Park Marina Site (Site) located at 8604 Dallas Avenue South in Seattle, Washington. This analysis was performed in accordance with the Scope of Work in Task 2a in Agreed Order No. DE 16185 (AO) for the Site, and the results are used in modeling contaminant loading from the Site's stormwater drainage system to sediments in the Lower Duwamish Waterway (LDW).

Hydrologic Model Description

The existing Site hydrology was simulated with the Western Washington Hydrology Model 2012 version 4.2.17 (WWHM2012; Clear Creek Solutions, 2016). WWHM2012 is a continuous time series hydrologic model based on the US Environmental Protection Agency's (EPA) Hydrologic Simulation Program – Fortran (HSPF). It was developed by Clear Creek Solutions for the Washington State Department of Ecology (Ecology), specifically for stormwater evaluations in Western Washington.

The primary inputs to WWHM2012 include:

- Time series of precipitation and pan evaporation.
- Land characteristics of the drainage basins being simulated, such as slope, soil type, vegetative cover, and whether the land surface is pervious or impervious.

The precipitation and pan evaporation time series are selected by the model based on the site location. The modeler provides the input on land characteristics in the drainage basin.

The primary output from WWHM2012 is a time series of stormwater runoff on an hourly timestep over the 50+ year period of record. The time series can then be post-processed to calculate statistics of interest, in this case the annual stormwater discharge.

Hydrologic Model Input

This section describes the key inputs to WWHM2012: precipitation, evaporation, and land characteristics.

Based on the Site location, WWHM2012 selected precipitation data from the Seattle-Tacoma International Airport weather station and pan evaporation data from the Puyallup 2 W Experimental Station. WWHM2012 applied a scaling factor of 1.0 (i.e., no change) to the precipitation time series. The pan evaporation data was converted to potential evaporation by applying a pan coefficient of 0.76, consistent with the National Oceanic and Atmospheric Administration (NOAA) *Technical Report NWS 33: Evaporation Atlas for the Contiguous 48 United States* (NOAA, 1982). These are both standard assumptions in WWHM2012 based on the Site location.

WWHM2012 uses historical precipitation and evaporation data to represent an expected range of weather conditions at a given location. WWHM2012 does not include the ability to change land characteristics over time, so the results should not be interpreted as a prediction of the actual amount of stormwater runoff that occurred during a specific year in the past, unless the land characteristics for that year are the same as the scenario being modeled. In other words, model results for a specific year (say, water year [WY] 1986) represent what would happen if the actual weather conditions of WY 1986 were to occur to the land use scenario being modeled (in this case, current site conditions at the Site).

Surfaces at the Site consist of building roofs, paved areas, and areas of compacted gravel subject to vehicle traffic or commercial use, as shown on Figure B-1. Consistent with Ecology's *Stormwater Management Manual for Western Washington* (SWMMWW; Ecology, 2019) and the City of Seattle's Stormwater Manual (Table F.8; City of Seattle, 2021), areas of compacted gravel were modeled as an impervious surface. This assumption likely overstates runoff (discharge) to some degree given that these areas are generally flat and many are currently covered with plastic tarps from which captured precipitation would evaporate rather than run off.

The Site drains to the LDW through three primary outfalls[1]: OF-2215, SPM Outfall, and Unnamed Outfall 1 (UOF-1), as described in Section 4.2.1 of the "Source Control Review Memorandum".

[1] As described in Section 4.2.1 of Appendix A to the Source Control Review Memorandum, a small portion of the Site, including the shoreline portion along the concrete block wall, does not drain to these three outfalls.

The SPM Outfall and UOF-1 receive stormwater solely from onsite sources. OF-2215 receives stormwater from South Thistle Street and other offsite areas. The total onsite basin area draining to the three main outfalls is 3.71 acres. Areas of roof and parking/roads (which includes gravel areas and other impervious surfaces) are shown in Table B-1 by basin. In the remainder of this memorandum, results are focused on the total discharge from the Site.

Hydrologic Model Results

Total annual stormwater runoff was calculated from the hourly runoff timeseries by summing discharge occurring within WY, which begins on October 1 and ends on September 30 of the subsequent calendar year. The WYs are numbered by the calendar year in which they end (e.g., WY 1948 includes October 1, 1947, to September 30, 1948). The period of record for WWHM2012, when using the SeaTac airport precipitation gauge, is 61 WYs from October 1, 1948, to September 30, 2009.

Annual stormwater discharge totals from South Park Marina calculated by WWHM2012 for the 61-year period of record are shown in Table B-2 (attached) and plotted on Figure B-2. Annual total stormwater discharge ranged from 6,215,270 liters per year (L/yr) in WY 1977 to 17,002,693 L/yr in WY 1972. Summary statistics for annual stormwater discharge are presented in Table B-3 and a cumulative distribution plot for the discharge is shown on Figure B-3. The median annual stormwater discharge is 11,707,212 L/yr.

Annual precipitation ranged from 22.42 inches per year in WY 1977 to 51.8 inches per year in WY 1972. Median precipitation is 37.49 inches per year (Table B-3). There is good correlation between annual stormwater discharge and precipitation, as illustrated on Figures B-2 and B-3; however, there is slight variability depending on the precipitation pattern. A year with slightly lower precipitation can result in relatively more stormwater discharge if the precipitation falls in fewer, more intense storms compared to a year with more total precipitation but more evenly distributed rainfall.

Uncertainty and Technical Limitations

WWHM is a widely accepted hydrologic model and is used throughout Western Washington for stormwater hydrologic calculations and the design of stormwater facilities. However, it is a model and, as such, model results from WWHM are approximations of runoff volumes that occurred historically rather than accurate calculations. When using the standard assumptions in WWHM, the primary areas of uncertainty are in the drainage basin and land use characteristics, particularly the selection of vegetation and soil types.

For SPM, there is little uncertainty in the appropriate land use characteristics given that the highly impervious nature of the site eliminates the need to interpret soil types or vegetation characteristics. However, as mentioned previously, the standard approach of treating compacted gravel areas as impervious likely results in an over-estimate of runoff from the site, particularly from flat areas where puddles form.

Use of WWHM to estimate future stormwater runoff quantities assumes climate stationarity, meaning that past climate conditions are appropriate for representing the future. In the near-term context of evaluating the potential for recontamination of interim actions in the LDW, stationarity is an appropriate assumption, especially if a conservatively high estimate of annual runoff is used.

References

City of Seattle, 2021, Stormwater Manual, https://www.seattle.gov/Documents/Departments/SDCI/Codes/ChangesToCodes/UpdatingStormwaterRegulations/2021SWFullManualFinalClean.pdf, July 2021.

Clear Creek Solutions, Inc., 2016, Western Washington Hydrology Model 2012, User Manual, https://data.wa.gov/views/5sqj-8rp7/files/1e1744f8-916a-4208-8477-9607c73dcde4, February 2016.

Washington State Department of Ecology (Ecology), 2019, Stormwater Management Manual for Western Washington, https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMWW/2019SWMMWW.htm, Pub. No. 19-10-021, July 2019.

National Oceanic and Atmospheric Administration (NOAA), 1982, Evaporation Atlas for the Contiguous 48 United States, NOAA Technical Report NWS 33, Washington, DC, June 1982.

Attachments:

Table B-1 – Hydrologic Model Input
Table B-2 – Modeled Annual Stormwater Discharge from SPM
Table B-3 – Summary Statistics for Modeled Annual Stormwater Discharge from SPM
Figure B-1 – Basin Outlines
Figure B-2 – Modeled Annual Stormwater Discharge By Year
Figure B-3 – Cumulative Distribution Plot of Annual Stormwater Discharge from SPM
Attachment B-1 – WWHM2012 Model Output

TABLES

Table B-1. Hydrologic Model Input

Project No. 190293, South Park Marina, Seattle, Washington

Land Use	Area by Basin in Acres			
	OF-2215	SPM Outfall	UOF-1	Total
Impervious Surfaces				
Roof	0.13	0.41	0.18	0.72
Parking and Roads, Flat	0.22	2.09	0.68	2.99
Total Impervious Surfaces	0.35	2.5	0.86	3.71
Pervious Surfaces				
None	0	0	0	0
Total Pervious Surfaces	0	0	0	0
Total	0.35	2.50	0.86	3.71

Notes:

OF-2215 = Outfall 2215

SPM Outfall = South Park Marina Outfall

UOF-1 = Unnamed Outfall 1

Table B-2. Modeled Annual Stormwater Discharge from SPM

Project No. 190293, South Park Marina, Seattle, Washington

Water Year	Annual Stormwater Discharge in liters per year
1949	9,251,466
1950	15,600,686
1951	15,422,086
1952	9,331,835
1953	11,287,502
1954	14,332,628
1955	10,796,353
1956	15,609,616
1957	10,948,163
1958	10,903,513
1959	14,984,517
1960	12,519,840
1961	14,520,157
1962	8,626,367
1963	11,707,212
1964	14,154,028
1965	11,260,712
1966	11,055,323
1967	12,814,530
1968	14,654,107
1969	13,671,809
1970	9,814,055
1971	13,144,939
1972	17,002,693
1973	8,688,876
1974	14,448,717
1975	11,903,671
1976	13,403,909
1977	6,215,270
1978	12,314,451
1979	6,902,879

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Water Year	Annual Stormwater Discharge in liters per year
1980	11,582,192
1981	10,287,344
1982	12,939,550
1983	13,725,389
1984	10,814,213
1985	8,706,736
1986	10,019,444
1987	12,296,591
1988	8,313,817
1989	10,983,883
1990	12,019,761
1991	14,859,497
1992	9,144,306
1993	10,081,954
1994	7,251,149
1995	12,305,521
1996	16,636,564
1997	15,118,466
1998	10,903,513
1999	15,689,985
2000	10,948,163
2001	7,590,488
2002	12,787,740
2003	9,590,805
2004	12,073,341
2005	8,697,806
2006	11,859,021
2007	14,823,777
2008	10,331,994
2009	10,314,134

Note: Results presented for a given water year represent model predictions of what would happen if the historical weather conditions from that year were to occur to the land use scenario being modeled. They do not represent a prediction of the actual stormwater discharge that occurred in the past, unless land use conditions have not changed over time.

Table B-3. Summary Statistics for Modeled Annual Stormwater Discharge from SPM

Project No. 190293, South Park Marina, Seattle, Washington

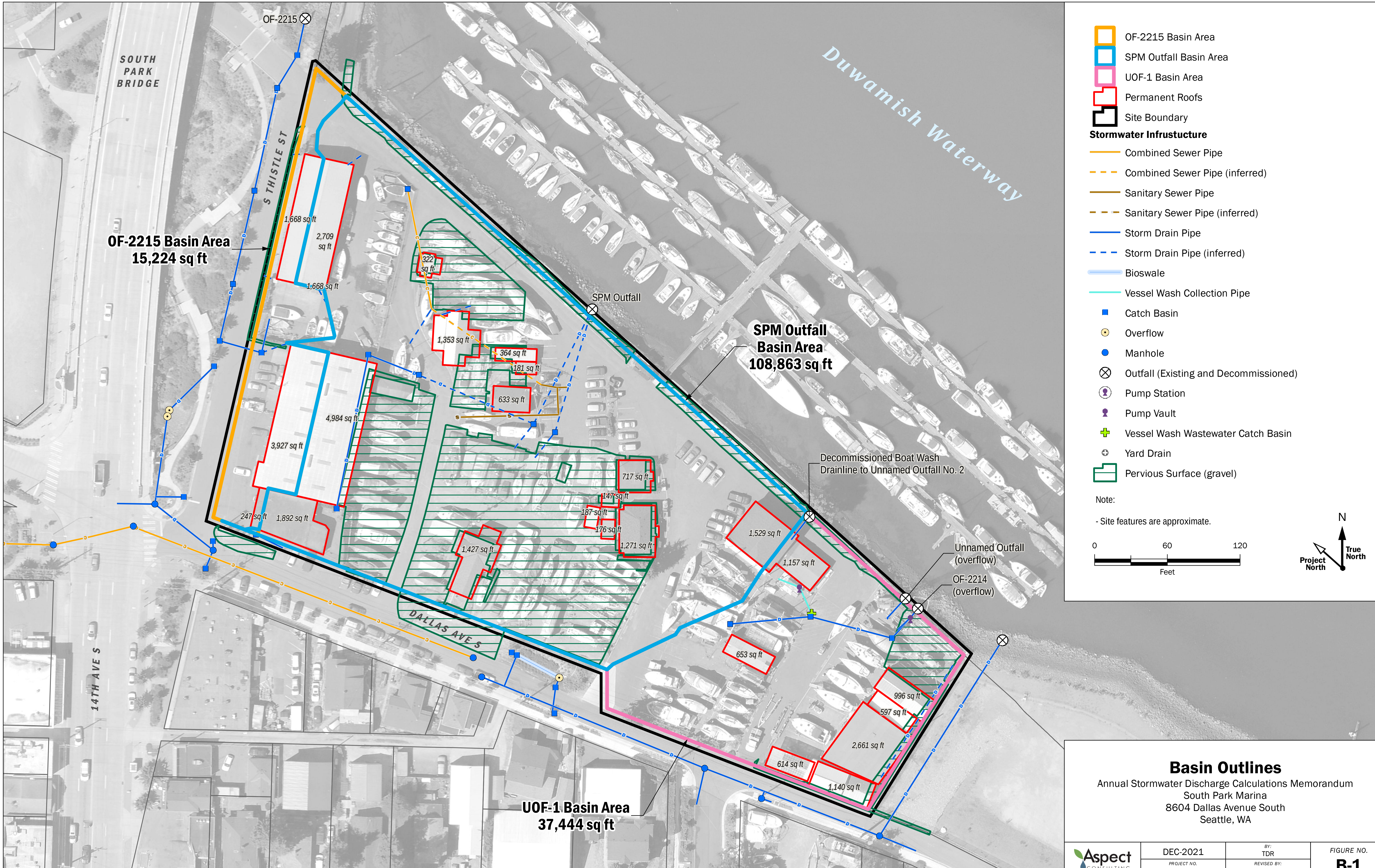
Statistic	Annual Precipitation in inches	Annual Stormwater Discharge in liters/year
Minimum	22.42	6,215,270
25th Percentile	33.04	10,081,954
Median	37.49	11,707,212
Average	37.91	11,803,099
90th Percentile	46.87	15,118,466
Maximum	51.80	17,002,693
St. Dev.	7.01	2,552,599

Notes:

1) Summary statistics are based on WWHM output for the 3.71-acre basin draining to outfalls Outfall 2215 (OF-2215), South Park Marina Outfall (SPM Outfall), and Unnamed Outfall 1 (UOF-1).

2) Statistics are based on annual runoff totals for the full period of record in WWHM of 61 water years from October 1, 1948 to September 30, 2009.

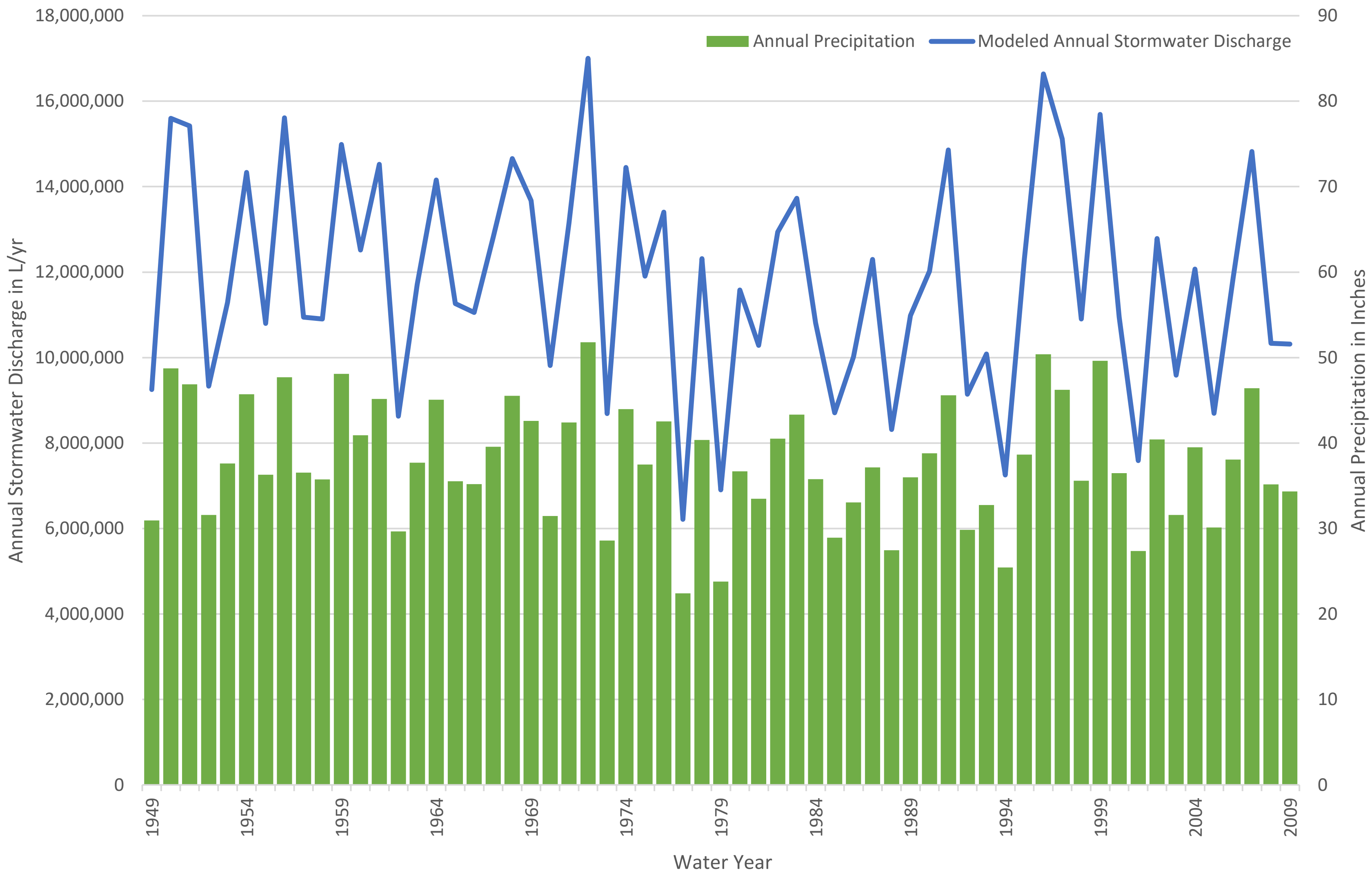
FIGURES



Basin Outlines

Annual Stormwater Discharge Calculations Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, WA

Aspect Consulting	DEC-2021	BY: TDR	FIGURE NO.
	PROJECT NO. 190293	REVISED BY: ---	B-1



Note: Annual stormwater discharge is the total discharge from the 3.71-acre basin on SPM draining to outfalls Outfall 2215 (OF-2215), South Park Marina Outfall (SPM Outfall), and Unnamed Outfall 1 (UOF-1).

Figure B-2
Modeled Annual Stormwater Discharge By Year
Stormwater Discharge Calculation Memo
South Park Marina, Seattle, WA

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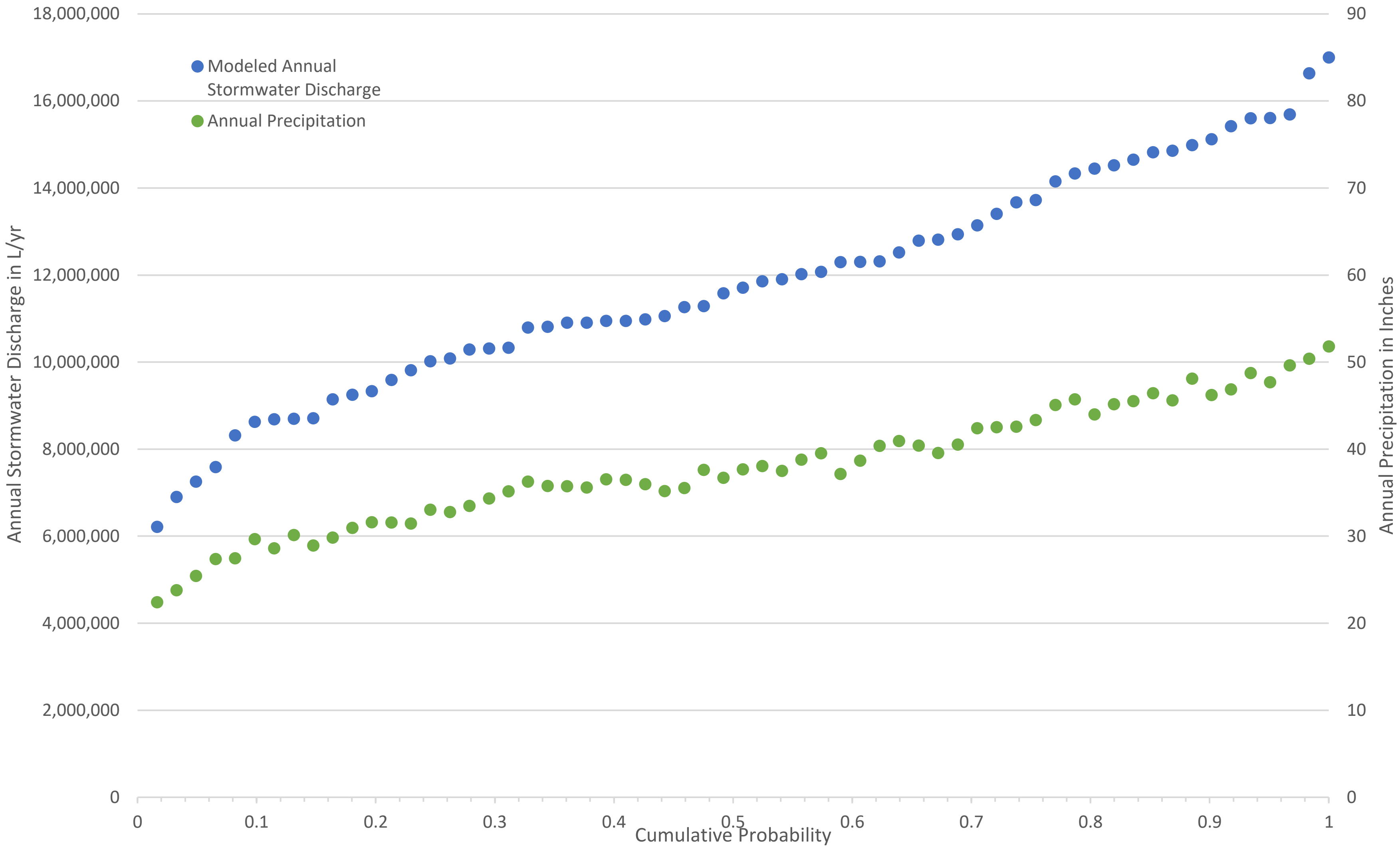

Note: Annual stormwater discharge is the total discharge from the 3.71-acre basin on SPM draining to outfalls Outfall 2215 (OF-2215), South Park Marina Outfall (SPM Outfall), and Unnamed Outfall 1 (UOF-1).

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Figure B-3
Cumulative Distribution Plot of Annual Stormwater Discharge from SPM
South Park Marina, Seattle, WA

APPENDIX B-1

WWHM2012 Model Output

WWHM2012
PROJECT REPORT

Project Name: South Park Marina
Site Name: South Park Marina
Site Address: 8604 Dallas Avenue South
City : Seattle
Report Date: 11/3/2021
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.00
Version Date: 2019/09/13
Version : 4.2.17

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

Low Flow Threshold for POC 2 : 50 Percent of the 2 Year

High Flow Threshold for POC 2: 50 year

Low Flow Threshold for POC 3 : 50 Percent of the 2 Year

High Flow Threshold for POC 3: 50 year

PREDEVELOPED LAND USE

Name : OF-2215
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	**0**

Impervious Land Use	acre
ROADS FLAT	0.22
ROOF TOPS FLAT	0.13
Impervious Total	**0.35**
Basin Total	**0.35**

Element Flows To:
Surface **Interflow** **Groundwater**

Name : SPM Outfall
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	**0**

Impervious Land Use	acre
ROADS FLAT	2.09
ROOF TOPS FLAT	0.41
Impervious Total	**2.5**
Basin Total	**2.5**

Element Flows To:
Surface **Interflow** **Groundwater**

Name : UOF-1
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	**0**

Impervious Land Use	acre
ROADS FLAT	0.68
ROOF TOPS FLAT	0.18
Impervious Total	**0.86**
Basin Total	**0.86**

Element Flows To:
Surface **Interflow** **Groundwater**

MITIGATED LAND USE

**Name : ** OF-2215
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	**0**

Impervious Land Use	acre
ROADS FLAT	0.22
ROOF TOPS FLAT	0.13
Impervious Total	**0.35**
Basin Total	**0.35**

Element Flows To:

Surface	Interflow	Groundwater

**Name : ** SPM Outfall
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	**0**

Impervious Land Use	acre
ROADS FLAT	2.09
ROOF TOPS FLAT	0.41
Impervious Total	**2.5**
Basin Total	**2.5**

Element Flows To:

Surface	Interflow	Groundwater

**Name : ** UOF-1
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
Pervious Total	**0**

Impervious Land Use	**acre**
ROADS FLAT	**0.68**
ROOF TOPS FLAT	**0.18**
Impervious Total	**0.86**
Basin Total	**0.86**

Element Flows To:

Surface	**Interflow**	**Groundwater**

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:0.35

Mitigated Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:0.35

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.089504
5 year	0.112301
10 year	0.128025
25 year	0.148664
50 year	0.164625
100 year	0.18111

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.089504
5 year	0.112301
10 year	0.128025
25 year	0.148664

50 year	0.164625
100 year	0.18111

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.089	0.089
1950	0.127	0.127
1951	0.086	0.086
1952	0.078	0.078
1953	0.070	0.070
1954	0.083	0.083
1955	0.089	0.089
1956	0.086	0.086
1957	0.097	0.097
1958	0.089	0.089
1959	0.068	0.068
1960	0.084	0.084
1961	0.074	0.074
1962	0.077	0.077
1963	0.072	0.072
1964	0.086	0.086
1965	0.077	0.077
1966	0.076	0.076
1967	0.115	0.115
1968	0.130	0.130
1969	0.070	0.070
1970	0.076	0.076
1971	0.075	0.075
1972	0.106	0.106
1973	0.070	0.070
1974	0.076	0.076
1975	0.100	0.100
1976	0.069	0.069
1977	0.089	0.089
1978	0.116	0.116
1979	0.115	0.115
1980	0.094	0.094
1981	0.105	0.105
1982	0.143	0.143
1983	0.106	0.106
1984	0.079	0.079
1985	0.076	0.076
1986	0.092	0.092
1987	0.133	0.133
1988	0.064	0.064
1989	0.080	0.080
1990	0.143	0.143
1991	0.134	0.134
1992	0.079	0.079
1993	0.055	0.055
1994	0.066	0.066
1995	0.082	0.082
1996	0.094	0.094
1997	0.091	0.091
1998	0.100	0.100

1999	0.188	0.188
2000	0.097	0.097
2001	0.085	0.085
2002	0.096	0.096
2003	0.087	0.087
2004	0.167	0.167
2005	0.079	0.079
2006	0.065	0.065
2007	0.145	0.145
2008	0.132	0.132
2009	0.096	0.096

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1875	0.1875
2	0.1666	0.1666
3	0.1445	0.1445
4	0.1431	0.1431
5	0.1429	0.1429
6	0.1342	0.1342
7	0.1326	0.1326
8	0.1324	0.1324
9	0.1301	0.1301
10	0.1273	0.1273
11	0.1159	0.1159
12	0.1150	0.1150
13	0.1146	0.1146
14	0.1061	0.1061
15	0.1060	0.1060
16	0.1051	0.1051
17	0.1005	0.1005
18	0.0999	0.0999
19	0.0973	0.0973
20	0.0966	0.0966
21	0.0961	0.0961
22	0.0957	0.0957
23	0.0943	0.0943
24	0.0939	0.0939
25	0.0918	0.0918
26	0.0913	0.0913
27	0.0895	0.0895
28	0.0894	0.0894
29	0.0892	0.0892
30	0.0886	0.0886
31	0.0869	0.0869
32	0.0862	0.0862
33	0.0861	0.0861
34	0.0860	0.0860
35	0.0845	0.0845
36	0.0844	0.0844
37	0.0832	0.0832
38	0.0816	0.0816
39	0.0801	0.0801
40	0.0794	0.0794
41	0.0794	0.0794

42	0.0791	0.0791
43	0.0781	0.0781
44	0.0771	0.0771
45	0.0765	0.0765
46	0.0765	0.0765
47	0.0764	0.0764
48	0.0764	0.0764
49	0.0759	0.0759
50	0.0746	0.0746
51	0.0740	0.0740
52	0.0725	0.0725
53	0.0702	0.0702
54	0.0697	0.0697
55	0.0695	0.0695
56	0.0692	0.0692
57	0.0680	0.0680
58	0.0655	0.0655
59	0.0646	0.0646
60	0.0638	0.0638
61	0.0548	0.0548

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0448	1345	1345	100	Pass
0.0460	1231	1231	100	Pass
0.0472	1118	1118	100	Pass
0.0484	1033	1033	100	Pass
0.0496	953	953	100	Pass
0.0508	873	873	100	Pass
0.0520	805	805	100	Pass
0.0532	746	746	100	Pass
0.0544	697	697	100	Pass
0.0556	634	634	100	Pass
0.0569	583	583	100	Pass
0.0581	548	548	100	Pass
0.0593	515	515	100	Pass
0.0605	473	473	100	Pass
0.0617	434	434	100	Pass
0.0629	401	401	100	Pass
0.0641	373	373	100	Pass
0.0653	338	338	100	Pass
0.0665	318	318	100	Pass
0.0678	294	294	100	Pass
0.0690	275	275	100	Pass
0.0702	264	264	100	Pass
0.0714	243	243	100	Pass
0.0726	225	225	100	Pass
0.0738	214	214	100	Pass
0.0750	203	203	100	Pass
0.0762	191	191	100	Pass
0.0774	173	173	100	Pass

0.0787	164	164	100	Pass
0.0799	153	153	100	Pass
0.0811	148	148	100	Pass
0.0823	141	141	100	Pass
0.0835	134	134	100	Pass
0.0847	124	124	100	Pass
0.0859	114	114	100	Pass
0.0871	106	106	100	Pass
0.0883	98	98	100	Pass
0.0896	90	90	100	Pass
0.0908	84	84	100	Pass
0.0920	79	79	100	Pass
0.0932	79	79	100	Pass
0.0944	71	71	100	Pass
0.0956	69	69	100	Pass
0.0968	62	62	100	Pass
0.0980	58	58	100	Pass
0.0992	57	57	100	Pass
0.1005	54	54	100	Pass
0.1017	52	52	100	Pass
0.1029	52	52	100	Pass
0.1041	50	50	100	Pass
0.1053	49	49	100	Pass
0.1065	44	44	100	Pass
0.1077	44	44	100	Pass
0.1089	43	43	100	Pass
0.1101	40	40	100	Pass
0.1113	37	37	100	Pass
0.1126	35	35	100	Pass
0.1138	35	35	100	Pass
0.1150	31	31	100	Pass
0.1162	27	27	100	Pass
0.1174	27	27	100	Pass
0.1186	26	26	100	Pass
0.1198	25	25	100	Pass
0.1210	25	25	100	Pass
0.1222	24	24	100	Pass
0.1235	23	23	100	Pass
0.1247	22	22	100	Pass
0.1259	21	21	100	Pass
0.1271	20	20	100	Pass
0.1283	17	17	100	Pass
0.1295	16	16	100	Pass
0.1307	14	14	100	Pass
0.1319	14	14	100	Pass
0.1331	11	11	100	Pass
0.1344	9	9	100	Pass
0.1356	9	9	100	Pass
0.1368	9	9	100	Pass
0.1380	9	9	100	Pass
0.1392	9	9	100	Pass
0.1404	9	9	100	Pass
0.1416	9	9	100	Pass
0.1428	8	8	100	Pass
0.1440	6	6	100	Pass
0.1453	5	5	100	Pass
0.1465	4	4	100	Pass

0.1477	4	4	100	Pass
0.1489	4	4	100	Pass
0.1501	4	4	100	Pass
0.1513	4	4	100	Pass
0.1525	4	4	100	Pass
0.1537	4	4	100	Pass
0.1549	4	4	100	Pass
0.1561	4	4	100	Pass
0.1574	3	3	100	Pass
0.1586	3	3	100	Pass
0.1598	3	3	100	Pass
0.1610	3	3	100	Pass
0.1622	3	3	100	Pass
0.1634	3	3	100	Pass
0.1646	2	2	100	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.043 **acre-feet**
On-line facility target flow: 0.0568 **cfs.**
Adjusted for 15 min: 0.0568 **cfs.**
Off-line facility target flow: 0.0321 **cfs.**
Adjusted for 15 min: 0.0321 **cfs.**

LID Report

LID Technique	Used for Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

Stream Protection Duration

Predeveloped Landuse Totals for POC #2
Total Pervious Area:0
Total Impervious Area:2.5

Mitigated Landuse Totals for POC #2
Total Pervious Area:0
Total Impervious Area:2.5

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	Flow(cfs)
2 year	0.639315

5 year	0.802147
10 year	0.914466
25 year	1.061885
50 year	1.175894
100 year	1.293639

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	Flow(cfs)
2 year	0.639315
5 year	0.802147
10 year	0.914466
25 year	1.061885
50 year	1.175894
100 year	1.293639

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #2

Year	Predeveloped	Mitigated
1949	0.638	0.638
1950	0.909	0.909
1951	0.616	0.616
1952	0.558	0.558
1953	0.501	0.501
1954	0.594	0.594
1955	0.637	0.637
1956	0.615	0.615
1957	0.695	0.695
1958	0.633	0.633
1959	0.486	0.486
1960	0.603	0.603
1961	0.529	0.529
1962	0.547	0.547
1963	0.518	0.518
1964	0.614	0.614
1965	0.551	0.551
1966	0.546	0.546
1967	0.822	0.822
1968	0.930	0.930
1969	0.497	0.497
1970	0.546	0.546
1971	0.533	0.533
1972	0.757	0.757
1973	0.498	0.498
1974	0.546	0.546
1975	0.718	0.718
1976	0.494	0.494
1977	0.639	0.639
1978	0.828	0.828
1979	0.818	0.818
1980	0.673	0.673
1981	0.751	0.751
1982	1.022	1.022
1983	0.758	0.758
1984	0.567	0.567
1985	0.542	0.542
1986	0.656	0.656

1987	0.947	0.947
1988	0.456	0.456
1989	0.572	0.572
1990	1.020	1.020
1991	0.959	0.959
1992	0.565	0.565
1993	0.391	0.391
1994	0.468	0.468
1995	0.583	0.583
1996	0.671	0.671
1997	0.652	0.652
1998	0.713	0.713
1999	1.340	1.340
2000	0.690	0.690
2001	0.604	0.604
2002	0.686	0.686
2003	0.621	0.621
2004	1.190	1.190
2005	0.567	0.567
2006	0.462	0.462
2007	1.032	1.032
2008	0.945	0.945
2009	0.683	0.683

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated
1	1.3396	1.3396
2	1.1900	1.1900
3	1.0325	1.0325
4	1.0220	1.0220
5	1.0204	1.0204
6	0.9586	0.9586
7	0.9469	0.9469
8	0.9454	0.9454
9	0.9296	0.9296
10	0.9093	0.9093
11	0.8281	0.8281
12	0.8218	0.8218
13	0.8184	0.8184
14	0.7581	0.7581
15	0.7571	0.7571
16	0.7506	0.7506
17	0.7178	0.7178
18	0.7133	0.7133
19	0.6952	0.6952
20	0.6900	0.6900
21	0.6861	0.6861
22	0.6835	0.6835
23	0.6732	0.6732
24	0.6709	0.6709
25	0.6555	0.6555
26	0.6522	0.6522
27	0.6390	0.6390
28	0.6383	0.6383
29	0.6372	0.6372

30	0.6326	0.6326
31	0.6207	0.6207
32	0.6156	0.6156
33	0.6148	0.6148
34	0.6143	0.6143
35	0.6036	0.6036
36	0.6027	0.6027
37	0.5942	0.5942
38	0.5829	0.5829
39	0.5721	0.5721
40	0.5673	0.5673
41	0.5673	0.5673
42	0.5649	0.5649
43	0.5578	0.5578
44	0.5511	0.5511
45	0.5466	0.5466
46	0.5463	0.5463
47	0.5460	0.5460
48	0.5456	0.5456
49	0.5423	0.5423
50	0.5328	0.5328
51	0.5286	0.5286
52	0.5175	0.5175
53	0.5013	0.5013
54	0.4976	0.4976
55	0.4967	0.4967
56	0.4940	0.4940
57	0.4858	0.4858
58	0.4682	0.4682
59	0.4616	0.4616
60	0.4558	0.4558
61	0.3912	0.3912

Stream Protection Duration
POC #2
The Facility PASSED

The Facility PASSED.

Flow(cfs)	**Predev**	**Mit**	**Percentage**	**Pass/Fail**
0.3197	1351	1351	100	Pass
0.3283	1236	1236	100	Pass
0.3370	1131	1131	100	Pass
0.3456	1037	1037	100	Pass
0.3543	953	953	100	Pass
0.3629	883	883	100	Pass
0.3716	808	808	100	Pass
0.3802	747	747	100	Pass
0.3888	704	704	100	Pass
0.3975	637	637	100	Pass
0.4061	584	584	100	Pass
0.4148	552	552	100	Pass
0.4234	515	515	100	Pass
0.4321	474	474	100	Pass
0.4407	437	437	100	Pass
0.4494	404	404	100	Pass

0.4580	373	373	100	Pass
0.4667	340	340	100	Pass
0.4753	319	319	100	Pass
0.4840	296	296	100	Pass
0.4926	278	278	100	Pass
0.5013	265	265	100	Pass
0.5099	245	245	100	Pass
0.5186	226	226	100	Pass
0.5272	214	214	100	Pass
0.5359	205	205	100	Pass
0.5445	191	191	100	Pass
0.5532	173	173	100	Pass
0.5618	165	165	100	Pass
0.5705	154	154	100	Pass
0.5791	148	148	100	Pass
0.5878	142	142	100	Pass
0.5964	134	134	100	Pass
0.6051	124	124	100	Pass
0.6137	115	115	100	Pass
0.6224	106	106	100	Pass
0.6310	98	98	100	Pass
0.6397	91	91	100	Pass
0.6483	84	84	100	Pass
0.6570	80	80	100	Pass
0.6656	79	79	100	Pass
0.6743	71	71	100	Pass
0.6829	69	69	100	Pass
0.6916	62	62	100	Pass
0.7002	58	58	100	Pass
0.7089	57	57	100	Pass
0.7175	54	54	100	Pass
0.7262	52	52	100	Pass
0.7348	52	52	100	Pass
0.7435	50	50	100	Pass
0.7521	49	49	100	Pass
0.7607	44	44	100	Pass
0.7694	44	44	100	Pass
0.7780	43	43	100	Pass
0.7867	40	40	100	Pass
0.7953	37	37	100	Pass
0.8040	35	35	100	Pass
0.8126	35	35	100	Pass
0.8213	31	31	100	Pass
0.8299	27	27	100	Pass
0.8386	27	27	100	Pass
0.8472	26	26	100	Pass
0.8559	25	25	100	Pass
0.8645	25	25	100	Pass
0.8732	24	24	100	Pass
0.8818	23	23	100	Pass
0.8905	22	22	100	Pass
0.8991	21	21	100	Pass
0.9078	20	20	100	Pass
0.9164	17	17	100	Pass
0.9251	16	16	100	Pass
0.9337	14	14	100	Pass
0.9424	14	14	100	Pass

0.9510	11	11	100	Pass
0.9597	9	9	100	Pass
0.9683	9	9	100	Pass
0.9770	9	9	100	Pass
0.9856	9	9	100	Pass
0.9943	9	9	100	Pass
1.0029	9	9	100	Pass
1.0116	9	9	100	Pass
1.0202	8	8	100	Pass
1.0289	6	6	100	Pass
1.0375	5	5	100	Pass
1.0462	4	4	100	Pass
1.0548	4	4	100	Pass
1.0635	4	4	100	Pass
1.0721	4	4	100	Pass
1.0808	4	4	100	Pass
1.0894	4	4	100	Pass
1.0981	4	4	100	Pass
1.1067	4	4	100	Pass
1.1154	4	4	100	Pass
1.1240	3	3	100	Pass
1.1326	3	3	100	Pass
1.1413	3	3	100	Pass
1.1499	3	3	100	Pass
1.1586	3	3	100	Pass
1.1672	3	3	100	Pass
1.1759	2	2	100	Pass

Water Quality BMP Flow and Volume for POC #2
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

LID Report

LID Technique	Used for Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

Stream Protection Duration

Predeveloped Landuse Totals for POC #3

Total Pervious Area:0
Total Impervious Area:0.86

Mitigated Landuse Totals for POC #3
Total Pervious Area:0
Total Impervious Area:0.86

Flow Frequency Return Periods for Predeveloped. POC #3

Return Period	Flow(cfs)
2 year	0.219924
5 year	0.275938
10 year	0.314576
25 year	0.365289
50 year	0.404508
100 year	0.445012

Flow Frequency Return Periods for Mitigated. POC #3

Return Period	Flow(cfs)
2 year	0.219924
5 year	0.275938
10 year	0.314576
25 year	0.365289
50 year	0.404508
100 year	0.445012

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #3

Year	Predeveloped	Mitigated
1949	0.220	0.220
1950	0.313	0.313
1951	0.212	0.212
1952	0.192	0.192
1953	0.172	0.172
1954	0.204	0.204
1955	0.219	0.219
1956	0.211	0.211
1957	0.239	0.239
1958	0.218	0.218
1959	0.167	0.167
1960	0.207	0.207
1961	0.182	0.182
1962	0.188	0.188
1963	0.178	0.178
1964	0.211	0.211
1965	0.190	0.190
1966	0.188	0.188
1967	0.283	0.283
1968	0.320	0.320
1969	0.171	0.171
1970	0.188	0.188
1971	0.183	0.183
1972	0.260	0.260
1973	0.171	0.171
1974	0.188	0.188

1975	0.247	0.247
1976	0.170	0.170
1977	0.220	0.220
1978	0.285	0.285
1979	0.282	0.282
1980	0.232	0.232
1981	0.258	0.258
1982	0.352	0.352
1983	0.261	0.261
1984	0.195	0.195
1985	0.187	0.187
1986	0.225	0.225
1987	0.326	0.326
1988	0.157	0.157
1989	0.197	0.197
1990	0.351	0.351
1991	0.330	0.330
1992	0.194	0.194
1993	0.135	0.135
1994	0.161	0.161
1995	0.201	0.201
1996	0.231	0.231
1997	0.224	0.224
1998	0.245	0.245
1999	0.461	0.461
2000	0.237	0.237
2001	0.208	0.208
2002	0.236	0.236
2003	0.214	0.214
2004	0.409	0.409
2005	0.195	0.195
2006	0.159	0.159
2007	0.355	0.355
2008	0.325	0.325
2009	0.235	0.235

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #3

Rank	Predeveloped	Mitigated
1	0.4608	0.4608
2	0.4094	0.4094
3	0.3552	0.3552
4	0.3516	0.3516
5	0.3510	0.3510
6	0.3297	0.3297
7	0.3257	0.3257
8	0.3252	0.3252
9	0.3198	0.3198
10	0.3128	0.3128
11	0.2849	0.2849
12	0.2827	0.2827
13	0.2815	0.2815
14	0.2608	0.2608
15	0.2604	0.2604
16	0.2582	0.2582
17	0.2469	0.2469

18	0.2454	0.2454
19	0.2392	0.2392
20	0.2374	0.2374
21	0.2360	0.2360
22	0.2351	0.2351
23	0.2316	0.2316
24	0.2308	0.2308
25	0.2255	0.2255
26	0.2244	0.2244
27	0.2198	0.2198
28	0.2196	0.2196
29	0.2192	0.2192
30	0.2176	0.2176
31	0.2135	0.2135
32	0.2118	0.2118
33	0.2115	0.2115
34	0.2113	0.2113
35	0.2076	0.2076
36	0.2073	0.2073
37	0.2044	0.2044
38	0.2005	0.2005
39	0.1968	0.1968
40	0.1952	0.1952
41	0.1951	0.1951
42	0.1943	0.1943
43	0.1919	0.1919
44	0.1896	0.1896
45	0.1880	0.1880
46	0.1879	0.1879
47	0.1878	0.1878
48	0.1877	0.1877
49	0.1865	0.1865
50	0.1833	0.1833
51	0.1818	0.1818
52	0.1780	0.1780
53	0.1724	0.1724
54	0.1712	0.1712
55	0.1709	0.1709
56	0.1699	0.1699
57	0.1671	0.1671
58	0.1610	0.1610
59	0.1588	0.1588
60	0.1568	0.1568
61	0.1346	0.1346

Stream Protection Duration
POC #3
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1100	1345	1345	100	Pass
0.1129	1232	1232	100	Pass
0.1159	1118	1118	100	Pass
0.1189	1036	1036	100	Pass

0.1219	953	953	100	Pass
0.1248	873	873	100	Pass
0.1278	805	805	100	Pass
0.1308	747	747	100	Pass
0.1338	697	697	100	Pass
0.1367	634	634	100	Pass
0.1397	583	583	100	Pass
0.1427	550	550	100	Pass
0.1457	515	515	100	Pass
0.1486	474	474	100	Pass
0.1516	434	434	100	Pass
0.1546	402	402	100	Pass
0.1576	374	374	100	Pass
0.1605	338	338	100	Pass
0.1635	318	318	100	Pass
0.1665	294	294	100	Pass
0.1695	276	276	100	Pass
0.1724	264	264	100	Pass
0.1754	245	245	100	Pass
0.1784	226	226	100	Pass
0.1814	214	214	100	Pass
0.1843	203	203	100	Pass
0.1873	191	191	100	Pass
0.1903	173	173	100	Pass
0.1933	164	164	100	Pass
0.1962	153	153	100	Pass
0.1992	148	148	100	Pass
0.2022	141	141	100	Pass
0.2052	134	134	100	Pass
0.2081	124	124	100	Pass
0.2111	114	114	100	Pass
0.2141	106	106	100	Pass
0.2171	98	98	100	Pass
0.2200	90	90	100	Pass
0.2230	84	84	100	Pass
0.2260	79	79	100	Pass
0.2290	79	79	100	Pass
0.2319	71	71	100	Pass
0.2349	69	69	100	Pass
0.2379	62	62	100	Pass
0.2409	58	58	100	Pass
0.2438	57	57	100	Pass
0.2468	54	54	100	Pass
0.2498	52	52	100	Pass
0.2528	52	52	100	Pass
0.2557	50	50	100	Pass
0.2587	49	49	100	Pass
0.2617	44	44	100	Pass
0.2647	44	44	100	Pass
0.2676	43	43	100	Pass
0.2706	40	40	100	Pass
0.2736	36	36	100	Pass
0.2766	35	35	100	Pass
0.2795	35	35	100	Pass
0.2825	31	31	100	Pass
0.2855	27	27	100	Pass
0.2885	27	27	100	Pass

0.2914	26	26	100	Pass
0.2944	25	25	100	Pass
0.2974	25	25	100	Pass
0.3004	24	24	100	Pass
0.3034	23	23	100	Pass
0.3063	22	22	100	Pass
0.3093	21	21	100	Pass
0.3123	19	19	100	Pass
0.3153	17	17	100	Pass
0.3182	16	16	100	Pass
0.3212	14	14	100	Pass
0.3242	14	14	100	Pass
0.3272	11	11	100	Pass
0.3301	9	9	100	Pass
0.3331	9	9	100	Pass
0.3361	9	9	100	Pass
0.3391	9	9	100	Pass
0.3420	9	9	100	Pass
0.3450	9	9	100	Pass
0.3480	9	9	100	Pass
0.3510	8	8	100	Pass
0.3539	6	6	100	Pass
0.3569	5	5	100	Pass
0.3599	4	4	100	Pass
0.3629	4	4	100	Pass
0.3658	4	4	100	Pass
0.3688	4	4	100	Pass
0.3718	4	4	100	Pass
0.3748	4	4	100	Pass
0.3777	4	4	100	Pass
0.3807	4	4	100	Pass
0.3837	4	4	100	Pass
0.3867	3	3	100	Pass
0.3896	3	3	100	Pass
0.3926	3	3	100	Pass
0.3956	3	3	100	Pass
0.3986	3	3	100	Pass
0.4015	3	3	100	Pass
0.4045	2	2	100	Pass

Water Quality BMP Flow and Volume for POC #3
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

LID Report

LID Technique Used for Total Volume Volume Infiltration Cumulative
Percent Water Quality Percent Comment
Treatment? Needs Through Volume Volume
Volume Water Quality
Treatment Facility (ac-ft.) Infiltration
Infiltrated Treated

	(ac-ft)	(ac-ft)		Credit	
Total Volume Infiltrated	0.00	0.00	0.00		0.00
0.00 0% No Treat. Credit					

Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

APPENDIX C

Tabulation of Sediment Data Excluded from Analysis in Source Control Review

This Appendix includes analytical data tables for samples of surface sediment not considered representative of the current marina basin surface sediment and thus excluded from the source control evaluation. The samples are as follows:

- Fourteen samples older than 20 years (collected 1990-1998).
- Fourteen samples collected in 2003, 2004, 2007, 2008, and 2011 representing sediment subsequently removed during the T-117 EAA removal action.
- Five samples representing surface sediment exposed but then covered during the T-117 EAA removal action:
  - Three confirmation samples collected following dredging upstream of the marina basin (SG-07-R2, SG-08-R2, and SG-24-R2) and then covered by clean backfill; and
  - Two composite samples of intertidal bank sediment collected during the T-117 EAA marina corner removal action (Marina Bank-140306 and Marina Bank-140317), and subsequently covered by several feet of materials including a layer of gravel borrow, a granular activated carbon (GAC) geocomposite layer, an additional layer of gravel borrow, and then riprap at the surface.
- Sixty-six samples superseded by newer samples located within 10 feet:
  - One sample (PERIM-5-PRE) collected downstream of the T-117 EAA dredging in 2013 (pre-dredging) that is superseded by the 2014 sample PERIM-5-POST and 2021 sample PERIM-5-LTM collected within 10 feet of that station;
  - A single 2005 sample (SS108) located within 10 feet of the 2018 sample SS-130;
  - Twenty-eight samples collected during multiple rounds of 2015 sampling at the same nine stations where the ”PreOp” samples near the City stormwater outfall were subsequently collected in 2016 as described above; and.
  - Thirty-six samples collected during multiple rounds of pre- and during construction monitoring as part of the 2015 Boeing Plant 2 DSOA and Southwest Bank Corrective Measure that were collected at the same five stations (SD-PER303, SD-PER305, SD-PER307, SD-PER312, and SD-PER313) that are superseded by more recent data.
- Twenty-four samples at four stations (SD-PER301, SD-PER302, SD-PER304, SD-PER306) collected within the federal navigation channel east of the marina basin as part of the 2015 Boeing Plant 2 DSOA and Southwest Bank Corrective Measure.

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	1990 - Duwamish River Maintenance Dredge, Phase 1		1991 - Duwamish River Maintenance Dredge, Phase 2	1991 - South Park Marina Maintenance Dredge, Phase 1	1997 - NOAA LDW Sediment Characterization		
		Location	DU9004XX	DU9005XX	DU9125XX	SPRK0101	WST322	WST323	CH0017
		Date	08/28/1990	08/28/1990	08/06/1991	09/14/1991	10/21/1997	10/21/1997	11/13/1997
		Sample	DUWO&M90S004	DUWO&M90S005	DUWO&M91S017	C1	WST09-01	WST09-02	CH04-04
		Depth	NR	NR	NR	NR	NR	NR	NR
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)							
Metals									
Arsenic	mg/kg	57	**8.5 J**	**8.3**	--	**16**	--	--	--
Cadmium	mg/kg	10.2	**0.54**	**0.66**	--	**1.6**	--	--	--
Chromium	mg/kg	520	--	--	--	--	--	--	--
Copper	mg/kg	780	**36**	**36**	--	**49**	--	--	--
Lead	mg/kg	900	**3.3**	**25**	--	**36**	--	--	--
Mercury	mg/kg	0.82	**0.13**	**0.17**	--	**0.21**	--	--	--
Silver	mg/kg	12.2	**0.39**	**0.26**	--	**1.1**	--	--	--
Zinc	mg/kg	820	**100**	**140**	--	**100**	--	--	--
Polychlorinated Biphenyls (PCBs)									
Aroclor 1016	mg/kg-OC		0.17 U	0.08 U	0.60 SU	3.70 U	--	--	--
Aroclor 1221	mg/kg-OC		0.17 U	0.08 U	2.50 SU	3.7 U	--	--	--
Aroclor 1232	mg/kg-OC		0.17 U	0.08 U	0.60 SU	3.70 U	--	--	--
Aroclor 1242	mg/kg-OC		0.17 U	0.08 U	**1.2 S**	3.70 U	--	--	--
Aroclor 1248	mg/kg-OC		0.17 U	0.08 U	0.60 SU	3.70 U	--	--	--
Aroclor 1254	mg/kg-OC		**10.83**	**12.08**	0.60 SU	**20.74**	--	--	--
Aroclor 1260	mg/kg-OC		0.17 U	0.08 U	**2.2 S**	3.7 U	--	--	--
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**10.83 A**	**12.08 A**	**3.4 SA**	**20**	--	--	--
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--	--
Dioxins/Furans									
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)									
2-Methylnaphthalene	mg/kg-OC	76	0.42 U	0.42 U	--	25 U	--	--	--
Acenaphthene	mg/kg-OC	32	0.42 U	0.42 U	--	23 U	--	--	--
Anthracene	mg/kg-OC	440	0.42 U	0.42 U	--	48 U	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	0.83 U	0.83 U	--	200 U	--	--	--
Fluoranthene	mg/kg-OC	320	**1.1**	0.42 U	--	233 U	--	--	--
Fluorene	mg/kg-OC	46	0.42 U	0.42 U	--	24 U	--	--	--
Naphthalene	mg/kg-OC	198	0.42 U	0.42 U	--	78 U	--	--	--
Phenanthrene	mg/kg-OC	200	0.42 U	0.42 U	--	119 U	--	--	--
Pyrene	mg/kg-OC	2000	**1.2**	0.42 U	--	159 U	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	0.42 U	0.42 U	--	167 U	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	0.42 U	0.42 U	--	252 U	--	--	--
Chrysene	mg/kg-OC	220	0.42 U	0.42 U	--	248 U	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	0.83 U	0.83 U	--	44 U	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	0.83 U	0.83 U	--	26 U	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	296 U	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	0.42 U	0.42 U	--	119 U	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1920	--	--	--	296 U	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	--	--	0.415 U	--	--	--

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	1998 - LDW Site Inspection				1998 - USACE Duwamish Maintenance Dredge	2003 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action		2004 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action				
		Location	DR205	DR227	DR228	DR234	S1	SE-08-G	SE-10-G	SE-76-G	SE-84-G	SE-85-G	SE-89-G	SE-91-G
		Date	08/27/1998	08/27/1998	09/01/1998	08/19/1998	10/05/1998	12/08/2003	12/08/2003	06/04/2004	09/14/2004	09/14/2004	09/14/2004	09/14/2004
		Sample	SD-205-0000	SD-227-0000	SD-228-0000	SD-234-0000	S1	T117-SE08-SG	T117-SE10-SG	T117-SE76-SG	T117-SE84-SG	T117-SE85-SG	T117-SE89-SG	T117-SE91-SG
		Depth	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)												
Metals														
Arsenic	mg/kg	57	**9.6**	**7.9**	**11**	**7.1**	**9**	7 U	--	--	--	--	--	--
Cadmium	mg/kg	10.2	**0.26**	**0.21**	0.3 UJ	**0.4**	**0.4**	0.3 U	--	--	--	--	--	--
Chromium	mg/kg	520	**30**	**27**	**31**	**20**	**25**	**16.9**	--	--	--	--	--	--
Copper	mg/kg	780	**40**	**37**	**47**	**36**	**32**	**28**	--	--	--	--	--	--
Lead	mg/kg	900	**15**	**13**	**24 J**	**16**	**16**	**53**	--	--	--	--	--	--
Mercury	mg/kg	0.82	**0.14**	**0.09**	**0.15**	**0.1**	**0.12**	**0.07**	--	--	--	--	--	--
Silver	mg/kg	12.2	**0.16**	**0.13**	**0.19**	**0.23**	**0.3**	0.4 U	--	--	--	--	--	--
Zinc	mg/kg	820	**81**	**74**	**100**	**77**	**75.2**	**68.8**	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)														
Aroclor 1016	mg/kg-OC		0.91 U	1.00 U	0.80 UJ	1.11 UJ	1.00 SU	0.91 U	1 U	1.1 U	1.64 U	0.62 U	5.39 U	0.66 U
Aroclor 1221	mg/kg-OC		1.82 U	2.00 U	1.60 U	2.22 U	2.00 SU	0.91 U	1 U	1.1 U	1.64 U	0.62 U	5.39 U	0.66 U
Aroclor 1232	mg/kg-OC		0.91 U	1.00 U	0.80 U	1.11 U	1.00 SU	0.91 U	1 U	1.1 U	1.64 U	1.24 U	5.39 U	1.32 U
Aroclor 1242	mg/kg-OC		0.91 U	1.00 U	0.80 U	1.11 U	1.00 SU	0.91 U	1 U	1.1 U	1.64 U	0.62 U	5.39 U	0.66 U
Aroclor 1248	mg/kg-OC		0.91 U	1.00 U	0.80 U	1.11 U	1.00 SU	0.91 U	1 U	1.1 U	1.64 U	0.62 U	--	0.66 U
Aroclor 1254	mg/kg-OC		0.91 U	1.00 U	**2.56**	**1.61**	**0.65 SJ**	**25.91**	1 U	1.1 U	3.2 U	**1.42**	53.95 U	**1.51**
Aroclor 1260	mg/kg-OC		**1.59**	**1.25**	**3.88 J**	**1.39 J**	**1.1 S**	**19.55**	**60**	**77.35 J**	**7.21**	**2.2**	**92.11**	**2.7**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--	--	--	--	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**1.59 A**	**1.25 A**	**6.44 AJ**	**3 AJ**	**1.8 S**	**45.45 A**	**60 A**	**77.35 AJ**	**7.21 A**	**3.62 A**	**92.11 A**	**4.21 A**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--	--	--	--	--	--	--
Dioxins/Furans														
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)														
2-Methylnaphthalene	mg/kg-OC	76	0.91 U	1 U	0.80 U	1.1 U	1 SU	**4.09**	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	0.91 U	1 U	**1.2**	1.1 U	1 SU	0.91 U	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	0.91 U	1 U	**1.6**	**1.1**	1 SU	0.91 U	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	**1.8**	**2.5**	**4.4**	**4.4**	1 SU	0.91 UJ	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	**5.9**	**7.5**	**21**	**13**	**8 S**	**4.18**	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	0.91 U	1 U	**1.6**	1.1 U	1 SU	**1.27**	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	0.91 U	1 U	0.80 U	1.1 U	1 SU	**3.27**	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	**2.7**	**2.5**	**9.6**	**5**	**3.8 S**	**3.18**	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	**5**	**8.5**	**18**	**12**	**1.5 S**	**3.95**	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	**2.3**	**3**	**6.4**	**5**	**3.1 S**	**1.73**	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	**2.3**	**2.5**	**5.6**	**6.1**	1 SU	**2 J**	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	**4.5**	**4.5**	**9.2**	**7.2**	**3.5 S**	**3.23**	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	0.91 U	1 U	**0.8**	**1.1**	1 SU	**1 J**	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	**2.3**	**2.5**	**4.4**	**5.6**	1 SU	**3**	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	**5.6 S**	--	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	**5.0**	**5.0**	**15**	**8.3**	**6.3 S**	**9.1**	--	--	--	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1920	**30**	**40**	**83**	**68**	**24 S**	**26 J**	--	--	--	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	**0.075**	**0.079**	**0.205**	**0.156**	**0.03**	**0.07 J**	--	--	--	--	--	--

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2005 - LDW RI - Surface Sediment Round 2	2008 - SAIC - SPM Site Investigation		2008 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action				2011 - Surface Sediment Sampling at Outfalls in the LDW	2013 - T-117 EAA Removal Action 2013-2014
		Location	SS108	TRANS-A-SED	TRANS-B-SED	99-G	100-G	101-G	102-G	LDW-SS2214-U	PERIM-5-PRE
		Date	03/10/2005	03/12/2008	03/12/2008	08/29/2008	08/29/2008	08/29/2008	08/29/2008	03/07/2011	11/22/2013
		Sample	LDW-SS108-01	TRANS-A-SED	TRANS-B-SED	T117-99-SG	T117-100-SG	T117-101-SG	T117-102-SG	LDW-SS2214-U	SG-PERIM-5-PRE
		Depth	NR	0 - 10 cm	0 - 10 cm	0 - 0.2 ft	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	**Unit**	**Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)**									
Metals											
Arsenic	mg/kg	57	**11.4**	**13 J**	**18.5 J**	--	--	--	--	**20**	**15.8**
Cadmium	mg/kg	10.2	0.5 U	**0.201**	**0.311**	--	--	--	--	**0.6**	1 U
Chromium	mg/kg	520	**29**	**25.5**	**28.7**	--	--	--	--	**33**	**16.6**
Copper	mg/kg	780	**61.4**	**42.5 J**	**66.9 J**	--	--	--	--	**64**	**41.2**
Lead	mg/kg	900	**26**	**50**	**37.7**	--	--	--	--	**24**	**17**
Mercury	mg/kg	0.82	**0.2**	**0.303**	**0.154**	**0.07**	--	--	--	**0.12**	**0.15 J**
Silver	mg/kg	12.2	0.7 U	**0.306**	**0.447**	--	--	--	--	0.7 U	1 U
Zinc	mg/kg	820	**109**	**83.8 J**	**104 J**	--	--	--	--	**117**	**79.4 J**
Polychlorinated Biphenyls (PCBs)											
Aroclor 1016	mg/kg-OC		0.72 U	2.95 SU	0.70 SU	5.41 U	0.63 U	3.64 U	0.57 U	1.45 U	1.74 U
Aroclor 1221	mg/kg-OC		0.72 U	--	--	5.41 U	0.63 U	3.64 U	0.57 U	1.45 U	1.74 U
Aroclor 1232	mg/kg-OC		0.72 U	--	--	5.41 U	0.63 U	3.64 U	0.57 U	1.45 U	1.74 U
Aroclor 1242	mg/kg-OC		0.72 U	--	--	5.41 U	0.63 U	3.64 U	0.57 U	1.45 U	1.74 U
Aroclor 1248	mg/kg-OC		0.72 U	4.35 SU	**1.65 S**	5.41 U	0.63 U	3.64 U	0.57 U	1.45 U	1.74 U
Aroclor 1254	mg/kg-OC		**1.67**	2.95 SU	0.70 SU	5.41 U	0.63 U	--	**1.6**	5.95 U	1.74 U
Aroclor 1260	mg/kg-OC		**2.97**	**85 S**	**32.5 S**	**15.3**	**1.85**	**21.19**	**4.3**	**15.24**	**6.96**
Aroclor 1262	mg/kg-OC		--	--	--	5.41 U	0.63 U	3.64 U	0.57 U	--	--
Aroclor 1268	mg/kg-OC		--	--	--	5.41 U	0.63 U	3.64 U	0.57 U	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**4.64 A**	**2167.5**	**830.4**	**15**	**1.8**	**21**	**5.9**	**15.24 A**	**6.96**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--	--	--	--
Dioxins/Furans											
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	**9.35906 J**	--	**6.53651 J**	--	**6.55 J**
Polycyclic Aromatic Hydrocarbons (PAHs)											
2-Methylnaphthalene	mg/kg-OC	76	2.1 U	**0.46 S**	**0.24 S**	--	--	--	--	0.74 U	**0.18 J**
Acenaphthene	mg/kg-OC	32	2.1 U	**0.2 S**	**0.35 S**	--	--	--	--	0.74 U	1.74 U
Anthracene	mg/kg-OC	440	**1.3 J**	**1.6 S**	**1.7 S**	--	--	--	--	**0.97**	**4.17 J**
Benzo(g,h,i)perylene	mg/kg-OC	62	**2.6**	**3.2 S**	**4.1 S**	--	--	--	--	**2.0**	**7.39**
Fluoranthene	mg/kg-OC	320	**13**	**9 S**	**12 S**	--	--	--	--	**8.6**	**56.52**
Fluorene	mg/kg-OC	46	2.1 U	**0.34 S**	**0.55 S**	--	--	--	--	**0.41 J**	**2.22**
Naphthalene	mg/kg-OC	198	2.1 U	**0.55 S**	**0.3 S**	--	--	--	--	**0.45 J**	1.74 U
Phenanthrene	mg/kg-OC	200	**3.6**	**3.2 S**	**6 S**	--	--	--	--	**3.2**	**26.96 J**
Pyrene	mg/kg-OC	2000	**11**	**7.5 S**	**10 S**	--	--	--	--	**6.3**	**40.87**
Benzo(a)anthracene	mg/kg-OC	220	--	**4.2 S**	**4.8 S**	--	--	--	--	**3.2**	**18.7**
Benzo(a)pyrene	mg/kg-OC	198	**5.4**	**4.7 S**	**5 S**	--	--	--	--	**2.8**	**14.35**
Chrysene	mg/kg-OC	220	**8.7**	**8 S**	**9.5 S**	--	--	--	--	**5.6**	**16.52**
Dibenzo(a,h)anthracene	mg/kg-OC	24	2.1 U	**0.75 S**	**1 S**	--	--	--	--	**0.67**	**1.87**
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	**3.6**	**3.5 S**	**4.7 S**	--	--	--	--	**1.9**	**8.26**
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--	--	**35.22**
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	**9.2 J**	**6.4 S**	**9.5 S**	--	--	--	--	**5.7 J**	**36 J**
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1920	--	**51 SJ**	**62 SJ**	--	--	--	--	**38**	**200**
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	**0.133 J**	**0.146 J**	--	--	--	--	**0.113**	**0.48**

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 - Boeing Plant 2 Completion Report									
		Location	SD-PER301	SD-PER301	SD-PER301	SD-PER301	SD-PER301	SD-PER301	SD-PER302	SD-PER302	SD-PER302	SD-PER302
		Date	12/11/2012	12/13/2013	03/14/2014	07/14/2014	09/12/2014	03/09/2015	12/10/2012	12/16/2013	03/13/2014	07/14/2014
		Sample	SD-PER301-1212	SD-PER301-1213	SD-PER301-0314	SD-PER301-0714	SD-PER301-0914	SD-PER301-0315	SD-PER302-1212	SD-PER302-1213	SD-PER302-0314	SD-PER302-0714
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	**Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)**										
Metals												
Arsenic	mg/kg	57	**8.5**	**6.2**	**4.1**	**7**	**10.2**	**9.3**	**8.3**	**6.5**	**5.6**	6.6 UJ
Cadmium	mg/kg	10.2	**0.5**	0.4 U	**0.5**	**0.5**	0.4 U	**0.4**	**0.4**	0.3 U	**0.5**	**0.4**
Chromium	mg/kg	520	**23.8**	**23**	**31.5**	**28.3**	**29.1**	**27**	**21.2**	**26.1**	**25.1**	**24**
Copper	mg/kg	780	**29.3**	**32.6**	**30**	**34.1**	**40**	**31.2**	**24**	**29.4**	**27.1**	**26.7**
Lead	mg/kg	900	**10**	**13**	**9**	**9**	**19**	**11**	**9**	**12**	**11**	**10**
Mercury	mg/kg	0.82	**0.06**	**0.06**	**0.045 J**	**0.075**	**0.07**	**0.24**	**0.065**	**0.1**	**0.06**	**0.07**
Silver	mg/kg	12.2	0.5 U	0.6 U	0.4 U	0.5 U	0.5 U	0.6 U	0.5 U	0.5 U	0.5 U	0.5 U
Zinc	mg/kg	820	**68**	**66**	**52**	**70**	**99**	**75**	**64**	**74**	**67**	**68**
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	mg/kg-OC		0.22 U	1.07 U	0.24 U	0.35 U	0.23 U	0.21 U	0.21 U	0.24 U	0.25 U	0.14 U
Aroclor 1221	mg/kg-OC		0.22 U	1.07 U	0.24 U	0.35 U	0.23 U	0.21 U	0.21 U	0.24 U	0.25 U	0.14 U
Aroclor 1232	mg/kg-OC		0.22 U	1.07 U	0.24 U	0.35 U	0.23 U	0.21 U	0.21 U	0.24 U	0.25 U	0.14 U
Aroclor 1242	mg/kg-OC		0.22 U	1.07 U	0.24 U	0.35 U	0.23 U	0.21 U	0.21 U	0.24 U	0.25 U	0.14 U
Aroclor 1248	mg/kg-OC		**0.57**	**1.71**	**0.48**	**0.79**	**1.97**	**1.31**	**0.39**	0.74 U	**0.88**	**0.56**
Aroclor 1254	mg/kg-OC		**1.22**	**2.94**	**0.98**	**2.09 J**	**3.99**	**2.13**	**0.71**	**1.48**	**1.57**	**1.27**
Aroclor 1260	mg/kg-OC		**0.99**	**2.73**	**1.28**	**1.45**	**2.08**	**1.58**	**0.47**	**0.99**	**2.08**	**1.01**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--	--	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**2.78 A**	**7.38 A**	**2.74 A**	**4.34 AJ**	**8.03 A**	**5.03 A**	**1.57 A**	**2.47 A**	**4.53 A**	**2.85 A**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--	--	--	--	--
Dioxins/Furans												
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)												
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	--	--	--	--	--	--	--	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1920	--	--	--	--	--	--	--	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	--	--	--	--	--	--	--	--	--

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 - Boeing Plant 2 Completion Report								
		Location	SD-PER302	SD-PER302	SD-PER303	SD-PER303	SD-PER303	SD-PER303	SD-PER303	SD-PER304	SD-PER304
		Date	09/12/2014	03/09/2015	12/07/2012	12/16/2013	03/13/2014	07/14/2014	09/11/2014	12/06/2012	12/20/2013
		Sample	SD-PER302-0914	SD-PER302-0315	SD-PER303-1212	SD-PER303-1213	SD-PER303-0314	SD-PER303-0714	SD-PER303-0914	SD-PER304-1212	SD-PER304-1213
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)									
Metals											
Arsenic	mg/kg	57	**5.5**	**6.5**	**10.9**	**9.1**	**7.4**	8 UJ	**8.4**	**7.6**	**5.7**
Cadmium	mg/kg	10.2	0.3 U	**0.5**	**0.5**	0.4 U	**0.5**	**0.4**	0.4 U	**0.4**	0.3 U
Chromium	mg/kg	520	**24.9**	**26.3**	**20**	**25**	**28.3**	**25.5**	**28.4**	**24**	**24.5**
Copper	mg/kg	780	**27.3**	**33.6**	**27.2**	**36.2**	**31.9**	**30.5**	**36.4**	**27.2**	**28.8**
Lead	mg/kg	900	**10**	**13**	**9**	**13**	**13**	**10**	**13**	**8**	**10**
Mercury	mg/kg	0.82	**0.06**	**0.07**	**0.09**	**0.08**	**0.07**	**0.08**	**0.07**	**0.06**	**0.08**
Silver	mg/kg	12.2	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.6 U	0.5 U	0.5 U
Zinc	mg/kg	820	**72**	**79**	**62**	**76**	**74**	**72**	**83**	**68 J**	**71**
Polychlorinated Biphenyls (PCBs)											
Aroclor 1016	mg/kg-OC		0.51 U	0.24 U	0.18 U	0.20 U	0.26 U	0.34 U	0.30 U	0.28 U	1.48 U
Aroclor 1221	mg/kg-OC		0.51 U	0.24 U	0.18 U	0.20 U	0.26 U	0.34 U	0.30 U	0.28 U	1.48 U
Aroclor 1232	mg/kg-OC		0.51 U	0.24 U	0.18 U	0.20 U	0.26 U	0.34 U	0.30 U	0.28 U	2.22 U
Aroclor 1242	mg/kg-OC		0.51 U	0.24 U	0.18 U	0.20 U	0.26 U	0.34 U	0.30 U	0.28 U	1.48 U
Aroclor 1248	mg/kg-OC		**3.04**	**1.78**	0.45 U	0.97 U	**0.9**	**1.22**	**1.82**	**0.58**	1.48 U
Aroclor 1254	mg/kg-OC		**4.94**	**3.18**	**1.06**	**2.67**	**1.93**	**3.13**	**4.24**	**1.01 J**	**3.04**
Aroclor 1260	mg/kg-OC		**3.93**	**2.99**	**1.01**	**5.13**	**2.83**	**2.43**	**3.11**	**0.72**	**8.89 J**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**11.91 A**	**7.96 A**	**2.07 A**	**7.79 A**	**5.66 A**	**6.78 A**	**9.17 A**	**2.32 AJ**	**11.93 AJ**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--	--	--	--
Dioxins/Furans											
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)											
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	--	--	--	--	--	--	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1920	--	--	--	--	--	--	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	--	--	--	--	--	--	--	--

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 - Boeing Plant 2 Completion Report								
		Location	SD-PER304	SD-PER304	SD-PER304	SD-PER304	SD-PER305	SD-PER305	SD-PER305	SD-PER305	SD-PER305
		Date	03/17/2014	07/14/2014	09/12/2014	02/27/2015	12/07/2012	12/16/2013	03/11/2014	07/14/2014	09/11/2014
		Sample	SD-PER304-0314	SD-PER304-0714	SD-PER304-0914	SD-PER304-0315	SD-PER305-1212	SD-PER305-1213	SD-PER305-0314	SD-PER305-0714	SD-PER305-0914
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)									
Metals											
Arsenic	mg/kg	57	**7**	5.8 UJ	**7.4**	**6.6**	**9.7**	**10.2**	**7.8**	8.7 UJ	**7.7**
Cadmium	mg/kg	10.2	**0.6**	**0.3**	0.3 U	**0.4**	**0.4**	0.4 U	**0.6**	**0.4**	0.3 U
Chromium	mg/kg	520	**26.1**	**22.5**	**25.6**	**27.4**	**21**	**27**	**26.2**	**25.2**	**27**
Copper	mg/kg	780	**29.5**	**22.8**	**29.1**	**30.1**	**26.7**	**38.7**	**33.4**	**30.7**	**31.2**
Lead	mg/kg	900	**14**	**7**	**12**	**11**	**9**	**13**	**13**	**10**	**11**
Mercury	mg/kg	0.82	**0.1 J**	**0.06**	**0.04**	**0.08**	**0.08**	**0.08**	**0.09**	**0.08**	**0.07**
Silver	mg/kg	12.2	0.5 U	0.5 U	0.4 U	0.5 U	0.6 U	0.7 U	0.5 U	0.5 U	0.5 U
Zinc	mg/kg	820	**73**	**60**	**75**	**71**	**63**	**81**	**74**	**71**	**74**
Polychlorinated Biphenyls (PCBs)											
Aroclor 1016	mg/kg-OC		0.27 U	0.86 U	0.59 U	0.17 U	0.18 U	0.17 U	0.20 U	0.37 U	0.29 U
Aroclor 1221	mg/kg-OC		0.27 U	0.86 U	0.59 U	0.17 U	0.18 U	0.17 U	0.20 U	0.37 U	0.29 U
Aroclor 1232	mg/kg-OC		0.27 U	0.86 U	0.59 U	0.17 U	0.18 U	0.17 U	0.20 U	0.37 U	0.29 U
Aroclor 1242	mg/kg-OC		0.27 U	0.86 U	0.59 U	0.17 U	0.18 U	0.17 U	0.20 U	0.37 U	0.29 U
Aroclor 1248	mg/kg-OC		**1.34**	**1.31**	**2.94**	**1.4**	0.55 U	0.76 U	0.50 U	**0.96**	**1.27**
Aroclor 1254	mg/kg-OC		**2.46**	**3.1 J**	**6.19**	**2.11**	**1.15**	**1.78**	**1.4**	**2.4**	**2.84**
Aroclor 1260	mg/kg-OC		**2.82**	**1.84**	**3.1**	**2.81**	**0.92**	**3.11**	**1.45**	**2.21**	**1.72**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**6.62 A**	**6.24 AJ**	**12.23 A**	**6.32 A**	**2.06 A**	**4.89 A**	**2.85 A**	**5.58 A**	**5.82 A**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--	--	--	--
Dioxins/Furans											
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)											
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	--	--	--	--	--	--	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1920	--	--	--	--	--	--	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	--	--	--	--	--	--	--	--

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source(1)	2015 - Boeing Plant 2 Completion Report									
		Location	SD-PER306	SD-PER306	SD-PER306	SD-PER306	SD-PER306	SD-PER306	SD-PER307	SD-PER307	SD-PER307	SD-PER307
		Date	12/10/2012	12/19/2013	03/11/2014	07/14/2014	09/15/2014	02/27/2015	12/07/2012	12/07/2012	12/16/2013	12/16/2013
		Sample	SD-PER306-1212	SD-PER306-1213	SD-PER306-0314	SD-PER306-0714	SD-PER306-0914	SD-PER306-0315	SD-PER307-1212	SD-PER327-1212	SD-PER307-1213	SD-PER327-1213
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)										
Metals												
Arsenic	mg/kg	57	**10.9**	**8.6**	**7.7**	8.9 UJ	**9.2**	**8.7**	**9**	**8.6**	**13.3 J**	**9.8**
Cadmium	mg/kg	10.2	**0.5**	0.4 U	**0.6**	**0.5**	**0.3**	**0.5**	**0.4**	**0.4**	0.4 U	0.4 U
Chromium	mg/kg	520	**25**	**31.2**	**25**	**29.7**	**25.9**	**29.5**	**22.4**	**22**	**28**	**31**
Copper	mg/kg	780	**36.9**	**44.7**	**31.8**	**31.5**	**30.5**	**38.3**	**29.3**	**29**	**39.2**	**34.7**
Lead	mg/kg	900	**13**	**17**	**17**	**11**	**18**	**16**	**11**	**9**	**14**	**10**
Mercury	mg/kg	0.82	**0.13**	**0.1**	**0.09**	**0.1**	**0.075**	**0.14**	**0.06**	**0.09**	**0.07**	**0.08**
Silver	mg/kg	12.2	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U	0.7 U	0.6 U
Zinc	mg/kg	820	**84**	**103**	**77**	**75**	**79**	**85**	**65**	**63**	**83**	**72**
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	mg/kg-OC		0.13 U	1.07 U	0.26 U	0.43 U	0.23 UJ	0.17 U	0.18 U	0.19 U	0.13 U	0.14 U
Aroclor 1221	mg/kg-OC		0.13 U	1.07 U	0.26 U	0.43 U	0.23 UJ	0.17 U	0.18 U	0.19 U	0.13 U	0.14 U
Aroclor 1232	mg/kg-OC		0.13 U	1.07 U	0.26 U	0.43 U	0.23 UJ	0.17 U	0.18 U	0.19 U	0.13 U	0.14 U
Aroclor 1242	mg/kg-OC		0.13 U	1.07 U	0.26 U	0.43 U	0.23 UJ	0.17 U	0.18 U	0.19 U	0.13 U	0.14 U
Aroclor 1248	mg/kg-OC		**0.7**	**1.98**	**2.12**	**3.19**	**1.98 J**	**1.75**	0.44 U	0.48 U	0.58 U	0.59 U
Aroclor 1254	mg/kg-OC		**1.17**	**3.8**	**4.18**	**7.41**	**4.94 J**	**2.78**	**0.89**	**0.98**	**1.8 J**	**1.53**
Aroclor 1260	mg/kg-OC		**0.74**	**2.78**	**4.52**	**5.7**	**2.21 J**	**2.65**	**0.84**	**1.07**	**1.87**	**1.94**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--	--	--	--
Total PCB Aroclors(2)	mg/kg-OC	12	**2.62 A**	**8.56 A**	**10.82 A**	**16.31 A**	**9.13 AJ**	**7.17 A**	**1.73 A**	**2.05 A**	**3.67 AJ**	**3.47 A**
Total PCB Congeners(3)	mg/kg-OC	12	--	--	--	--	--	--	--	--	--	--
Dioxins/Furans												
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)												
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--	--	--	--
Total LPAHs(5) (ND = 1/2 RDL(4))	mg/kg-OC	740	--	--	--	--	--	--	--	--	--	--
Total HPAHs(6) (ND = 1/2 RDL(4))	mg/kg-OC	1920	--	--	--	--	--	--	--	--	--	--
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	1	--	--	--	--	--	--	--	--	--	--

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source(1)	2015 - Boeing Plant 2 Completion Report							
		Location	SD-PER307	SD-PER307	SD-PER307	SD-PER307	SD-PER307	SD-PER307	SD-PER312	SD-PER312
		Date	03/11/2014	03/11/2014	07/15/2014	07/15/2014	09/15/2014	09/15/2014	12/07/2012	12/16/2013
		Sample	SD-PER307-0314	SD-PER327-0314	SD-PER307-0714	SD-PER327-0714	SD-PER307-0914	SD-PER327-0914	SD-PER312-1212	SD-PER312-1213
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	**Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)**								
Metals										
Arsenic	mg/kg	57	**6.5 J**	**8.1**	8.1 UJ	**7**	**6.9 J**	**10.2 J**	**10**	**9.3**
Cadmium	mg/kg	10.2	**0.6**	**0.6**	**0.5**	**0.5**	0.4 U	0.4 U	**0.5**	0.4 U
Chromium	mg/kg	520	**27**	**26**	**26.7**	**26.8**	**26.4**	**31**	**25**	**26**
Copper	mg/kg	780	**116 J**	**35.2**	**35.1**	**35.6**	**33.2 J**	**43.6 J**	**37.8**	**39**
Lead	mg/kg	900	**13**	**15**	**11**	**9**	**11**	**18**	**11**	**12**
Mercury	mg/kg	0.82	**0.09**	**0.09**	**0.09**	**0.12**	**0.07**	**0.09**	**0.07**	**0.11**
Silver	mg/kg	12.2	0.6 U	0.6 U	0.6 U	0.5 U	0.6 U	0.6 U	0.7 U	0.6 U
Zinc	mg/kg	820	**73**	**74**	**77**	**72**	**75 J**	**98 J**	**79**	**78**
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	mg/kg-OC		0.25 U	0.16 U	0.25 U	0.43 U	0.22 U	0.16 U	0.18 U	0.16 U
Aroclor 1221	mg/kg-OC		0.25 U	0.16 U	0.25 U	0.43 U	0.22 U	0.16 U	0.18 U	0.16 U
Aroclor 1232	mg/kg-OC		0.25 U	0.16 U	0.25 U	0.43 U	0.22 U	0.16 U	0.18 U	0.16 U
Aroclor 1242	mg/kg-OC		0.25 U	0.16 U	0.25 U	0.43 U	0.22 U	0.16 U	0.18 U	0.16 U
Aroclor 1248	mg/kg-OC		0.63 U	0.41 U	**0.66**	**0.96**	**0.65 J**	**1.31 J**	0.44 U	0.51 U
Aroclor 1254	mg/kg-OC		**1.61**	**0.83**	**1.26**	**2.71 J**	**1.36 J**	**2.61 J**	**1.23**	**1.23**
Aroclor 1260	mg/kg-OC		**2.19**	**1.24**	**0.79**	**2.03**	**0.82 J**	**1.14 J**	**1.23**	**1.19**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--	--
Total PCB Aroclors(2)	mg/kg-OC	12	**3.81 A**	**2.07 A**	**2.72 A**	**5.7 AJ**	**2.83 AJ**	**5.06 AJ**	**2.47 A**	**2.42 A**
Total PCB Congeners(3)	mg/kg-OC	12	--	--	--	--	--	--	--	--
Dioxins/Furans										
Total Dioxin/Furan TEQ (ND = 1/2 RDL(4))	ng/kg	25	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)										
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--	--
Total LPAHs(5) (ND = 1/2 RDL(4))	mg/kg-OC	740	--	--	--	--	--	--	--	--
Total HPAHs(6) (ND = 1/2 RDL(4))	mg/kg-OC	1920	--	--	--	--	--	--	--	--
Total cPAHs(7) TEQ (ND = 1/2 RDL(4))	mg/kg	1	--	--	--	--	--	--	--	--

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 - Boeing Plant 2 Completion Report								2014 - T-117 EAA Removal Action
		Location	SD-PER312	SD-PER312	SD-PER312	SD-PER313	SD-PER313	SD-PER313	SD-PER313	SD-PER313	PERIM-5-POST
		Date	03/12/2014	07/14/2014	09/11/2014	12/07/2012	12/16/2013	03/12/2014	07/14/2014	09/11/2014	05/12/2014
		Sample	SD-PER312-0314	SD-PER312-0714	SD-PER312-0914	SD-PER313-1212	SD-PER313-1213	SD-PER313-0314	SD-PER313-0714	SD-PER313-0914	SG-PERIM-5-POST
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Analyte	Unit	**Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)**									
Metals											
Arsenic	mg/kg	57	**8.9**	9.8 UJ	**9.6**	**12**	**9.5**	**8.2**	10 UJ	**8.3**	**4.26**
Cadmium	mg/kg	10.2	**0.6**	**0.5**	0.4 U	**0.5**	0.5 U	**0.5**	**0.6**	0.4 U	1 U
Chromium	mg/kg	520	**26.5**	**29**	**28**	**26**	**28**	**26.3**	**31**	**28.2**	**12.7 J**
Copper	mg/kg	780	**34.9**	**37.7**	**37.8**	**37.8**	**41.1**	**32.7**	**42.6**	**36**	**21.8**
Lead	mg/kg	900	**14**	**12**	**13**	**12**	**12**	**13**	**24**	**11**	**7.02**
Mercury	mg/kg	0.82	**0.095**	**0.09**	**0.08**	**0.1**	**0.07**	**0.09**	**0.11**	**0.06**	**0.071**
Silver	mg/kg	12.2	0.6 U	0.6 U	0.6 U	0.7 U	0.7 U	0.6 U	0.6 U	0.5 U	1 U
Zinc	mg/kg	820	**73**	**82**	**82**	**80**	**83**	**70**	**91**	**77**	**39.7**
Polychlorinated Biphenyls (PCBs)											
Aroclor 1016	mg/kg-OC		0.18 U	0.21 U	0.21 U	0.18 U	0.14 U	0.18 U	0.30 U	0.19 U	0.29 UJ
Aroclor 1221	mg/kg-OC		0.18 U	0.21 U	0.21 U	0.18 U	0.14 U	0.18 U	0.30 U	0.19 U	0.29 U
Aroclor 1232	mg/kg-OC		0.18 U	0.21 U	0.21 U	0.18 U	0.14 U	0.18 U	0.30 U	0.19 U	0.29 U
Aroclor 1242	mg/kg-OC		0.18 U	0.21 U	0.21 U	0.18 U	0.14 U	0.18 U	0.30 U	0.19 U	0.29 U
Aroclor 1248	mg/kg-OC		**0.65**	**0.6**	**0.8**	0.45 U	0.57 U	**0.7**	**1.06**	**1**	0.29 U
Aroclor 1254	mg/kg-OC		**2.03**	**1.79**	**2.19**	**1.12**	**1.71**	**1.96**	**3.56**	**2.49**	**1.45**
Aroclor 1260	mg/kg-OC		**3.04**	**1.58**	**1.66**	**1.35**	**2.66**	**2.9**	**3.71**	**1.94**	**1.16**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**5.71 A**	**3.97 A**	**4.65 A**	**2.47 A**	**4.37 A**	**5.56 A**	**8.33 A**	**5.42 A**	**2.61**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--	--	--	--
Dioxins/Furans											
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--	--	--	**1.3 J**
Polycyclic Aromatic Hydrocarbons (PAHs)											
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--	--	--	**0.4**
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--	--	--	0.36 U
Anthracene	mg/kg-OC	440	--	--	--	--	--	--	--	--	**0.8**
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--	--	--	**1.09**
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--	--	--	**3.26**
Fluorene	mg/kg-OC	46	--	--	--	--	--	--	--	--	**0.39**
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--	--	--	0.36 U
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--	--	--	**2.03**
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--	--	--	**3.12**
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--	--	--	**1.16**
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--	--	--	**1.16**
Chrysene	mg/kg-OC	220	--	--	--	--	--	--	--	--	**1.88**
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--	--	--	0.36 U
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--	--	--	**1.01**
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--	--	**2.61**
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	--	--	--	--	--	--	--	--	**3.8**
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1920	--	--	--	--	--	--	--	--	**15**
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	--	--	--	--	--	--	--	**0.023**

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 T-117 Outfall Pre-Construction, Post-Construction Sediment Sampling								
		Location	SG-A1-POSTCON	SG-A1-PRECON	SG-A2-POSTCON	SG-A2-PRECON	SG-A3-POSTCON	SG-A3-PRECON	SG-B1-POSTCON	SG-B1-PRECON	SG-B2-POSTCON
		Date	08/10/2015	07/15/2015	08/10/2015	07/15/2015	08/10/2015	07/15/2015	08/10/2015	07/15/2015	08/10/2015
		Sample	SD0110	SD0100	SD0111	SD0101	SD0112	SD0102	SD0113	SD0103	SD0114
		Depth	NR	NR	NR	NR	NR	NR	NR	NR	NR
Analyte	Unit	Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)									
Metals											
Arsenic	mg/kg	57	--	--	--	--	--	--	--	--	--
Cadmium	mg/kg	10.2	--	--	--	--	--	--	--	--	--
Chromium	mg/kg	520	--	--	--	--	--	--	--	--	--
Copper	mg/kg	780	--	--	--	--	--	--	--	--	--
Lead	mg/kg	900	--	--	--	--	--	--	--	--	--
Mercury	mg/kg	0.82	--	--	--	--	--	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--	--	--	--
Zinc	mg/kg	820	--	--	--	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)											
Aroclor 1016	mg/kg-OC		0.05 U	0.05 U	0.05 U	0.06 U	0.05 U	0.04 U	0.05 U	0.05 U	0.05 U
Aroclor 1221	mg/kg-OC		0.05 U	0.05 U	0.05 U	0.06 U	0.05 U	0.04 U	0.05 U	0.05 U	0.05 U
Aroclor 1232	mg/kg-OC		0.05 U	0.05 U	0.05 U	0.06 U	0.05 U	0.04 U	0.05 U	0.05 U	0.05 U
Aroclor 1242	mg/kg-OC		0.05 U	0.05 U	0.05 U	0.06 U	0.05 U	0.04 U	0.05 U	0.05 U	0.05 U
Aroclor 1248	mg/kg-OC		**0.84**	**0.91**	**0.87**	**0.7**	**0.62**	**0.65**	**1.02**	**0.9**	**0.72**
Aroclor 1254	mg/kg-OC		**1.64**	**1.67**	**1.6**	**1.32**	**1.35**	**1.36**	**1.77**	**1.79**	**1.5**
Aroclor 1260	mg/kg-OC		**1.02**	**0.94**	**1.13 J**	**0.74**	**0.98**	**0.74**	**1.26**	**1.43**	**1.13**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**3.5 A**	**3.51 A**	**3.6 AJ**	**2.76 A**	**2.95 A**	**2.75 A**	**4.05 A**	**4.12 A**	**3.35 A**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--	--	--	--
Dioxins/Furans											
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)											
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	--	--	--	--	--	--	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1920	--	--	--	--	--	--	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	--	--	--	--	--	--	--	--

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 T-117 Outfall Pre-Construction, Post-Construction Sediment Sampling									
		Location	SG-B2-PRECON	SG-B3-POSTCON	SG-B3-POSTCON	SG-B3-PRECON	SG-C1-POSTCON	SG-C2-POSTCON	SG-C2-PRECON	SG-C3-POSTCON	SG-C3-PRECON	SG-C3-PRECON
		Date	07/15/2015	08/10/2015	08/10/2015	07/15/2015	08/10/2015	08/10/2015	07/15/2015	08/10/2015	07/15/2015	07/15/2015
		Sample	SD0104	SD0115	SD0119	SD0105	SD0116	SD0117	SD0107	SD0118	SD0108	SD0109
		Depth	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Analyte	Unit	**Lower Duwamish Waterway Record of Decision Remedial Action Levels (0-10 cm, Sitewide)**										
Metals												
Arsenic	mg/kg	57	--	--	--	--	--	--	--	--	--	--
Cadmium	mg/kg	10.2	--	--	--	--	--	--	--	--	--	--
Chromium	mg/kg	520	--	--	--	--	--	--	--	--	--	--
Copper	mg/kg	780	--	--	--	--	--	--	--	--	--	--
Lead	mg/kg	900	--	--	--	--	--	--	--	--	--	--
Mercury	mg/kg	0.82	--	--	--	--	--	--	--	--	--	--
Silver	mg/kg	12.2	--	--	--	--	--	--	--	--	--	--
Zinc	mg/kg	820	--	--	--	--	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	mg/kg-OC		0.06 U	0.05 U	0.05 U	0.05 U	0.06 U	0.06 U	0.04 U	0.08 U	0.06 U	0.06 U
Aroclor 1221	mg/kg-OC		0.06 U	0.05 U	0.05 U	0.05 U	0.06 U	0.06 U	0.04 U	0.08 U	0.06 U	0.06 U
Aroclor 1232	mg/kg-OC		0.06 U	0.05 U	0.05 U	0.05 U	0.06 U	0.06 U	0.04 U	0.08 U	0.06 U	0.06 U
Aroclor 1242	mg/kg-OC		0.06 U	0.05 U	0.05 U	0.05 U	0.06 U	0.06 U	0.04 U	0.08 U	0.06 U	0.06 U
Aroclor 1248	mg/kg-OC		**0.78**	**0.84**	**0.98**	**0.67**	**0.74**	**0.86**	**0.64**	**1.19**	**1.04**	**1.09**
Aroclor 1254	mg/kg-OC		**1.52**	**1.56**	**1.74**	**1.43**	**1.44**	**1.67**	**1.29**	**2.15**	**2.16**	**2.09**
Aroclor 1260	mg/kg-OC		**0.96**	**0.99**	**1.18**	**0.79**	**1**	**1.34**	**0.82**	**1.58**	**1.4**	**1.46**
Aroclor 1262	mg/kg-OC		--	--	--	--	--	--	--	--	--	--
Aroclor 1268	mg/kg-OC		--	--	--	--	--	--	--	--	--	--
Total PCB Aroclors[2]	mg/kg-OC	12	**3.26 A**	**3.38 A**	**3.9 A**	**2.89 A**	**3.17 A**	**3.87 A**	**2.75 A**	**4.92 A**	**4.6 A**	**4.64 A**
Total PCB Congeners[3]	mg/kg-OC	12	--	--	--	--	--	--	--	--	--	--
Dioxins/Furans												
Total Dioxin/Furan TEQ (ND = 1/2 RDL[4])	ng/kg	25	--	--	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)												
2-Methylnaphthalene	mg/kg-OC	76	--	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg-OC	32	--	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg-OC	440	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC	62	--	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg-OC	320	--	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg-OC	46	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg-OC	200	--	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg-OC	2000	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC	198	--	--	--	--	--	--	--	--	--	--
Chrysene	mg/kg-OC	220	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC	24	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	68	--	--	--	--	--	--	--	--	--	--
Total Benzofluoranthenes	mg/kg-OC	4650	--	--	--	--	--	--	--	--	--	--
Total LPAHs[5] (ND = 1/2 RDL[4])	mg/kg-OC	740	--	--	--	--	--	--	--	--	--	--
Total HPAHs[6] (ND = 1/2 RDL[4])	mg/kg-OC	1920	--	--	--	--	--	--	--	--	--	--
Total cPAHs[7] TEQ (ND = 1/2 RDL[4])	mg/kg	1	--	--	--	--	--	--	--	--	--	--

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	1990 - Duwamish River Maintenance Dredge, Phase 1		1991 - Duwamish River Maintenance Dredge, Phase 2	1991 - South Park Marina Maintenance Dredge, Phase 1	1997 - NOAA LDW Sediment Characterization		
		Location	DU9004XX	DU9005XX	DU9125XX	SPRK0101	WST322	WST323	CH0017
		Date	08/28/1990	08/28/1990	08/06/1991	09/14/1991	10/21/1997	10/21/1997	11/13/1997
		Sample	DUWO&M90S004	DUWO&M90S005	DUWO&M91S017	C1	WST09-01	WST09-02	CH04-04
		Depth	NR	NR	NR	NR	NR	NR	NR
Semivolatile Organic Compounds									
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	0.42 U	0.42 U	--	4.8 U	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	0.42 U	0.42 U	--	7.0 U	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	0.42 U	0.42 U	--	9.6 U	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	0.42 U	0.42 U	--	174 U	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	**1.7**	0.42 U	--	1148 U	--	--	--
Dibenzofuran	mg/kg-OC	30	0.42 U	0.42 U	--	20 U	--	--	--
Dimethyl phthalate	mg/kg-OC	106	0.42 U	0.42 U	--	59 U	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	0.42 U	0.42 U	--	8.5 U	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	0.83 U	0.83 U	--	10 U	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	0.01 U	0.01 U	--	0.029 U	--	--	--
4-Methylphenol	mg/kg	1.34	0.01 U	0.01 U	--	0.12 U	--	--	--
Benzoic acid	mg/kg	1.3	0.01 U	0.01 U	--	0.4 U	--	--	--
Benzyl alcohol	mg/kg	0.114	0.01 U	0.01 U	--	0.025 U	--	--	--
Pentachlorophenol	mg/kg	0.72	0.01 U	0.01 U	--	0.1 U	--	--	--
Phenol	mg/kg	0.84	0.01 U	0.01 U	--	0.12 U	--	--	--
Conventionals									
Total Organic Carbon	%		**2.4**	**2.4**	--	**0.27**	**2.34**	**1.93**	**1.24**

Notes:

(1) - Refer to Table 1.
(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.
(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.
(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.
(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene.
(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters
mg/kg = milligrams per kilogram - dry weight
mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).
ng/kg = nanograms per kilogram
% = percent
NR = sample depth not reported in Ecology's Environmental Information Management database.
TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in sum
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source(1)	1998 - LDW Site Inspection				1998 - USACE Duwamish Maintenance Dredge	2003 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action		2004 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action				
		Location	DR205	DR227	DR228	DR234	S1	SE-08-G	SE-10-G	SE-76-G	SE-84-G	SE-85-G	SE-89-G	SE-91-G
		Date	08/27/1998	08/27/1998	09/01/1998	08/19/1998	10/05/1998	12/08/2003	12/08/2003	06/04/2004	09/14/2004	09/14/2004	09/14/2004	09/14/2004
		Sample	SD-205-0000	SD-227-0000	SD-228-0000	SD-234-0000	S1	T117-SE08-SG	T117-SE10-SG	T117-SE76-SG	T117-SE84-SG	T117-SE85-SG	T117-SE89-SG	T117-SE91-SG
		Depth	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Semivolatile Organic Compounds														
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	0.91 U	1 U	0.80 U	1.1 U	0.36 SU	0.25 UJ	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	0.91 U	1 U	0.80 U	1.1 U	0.070 SU	0.05 U	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	0.91 U	1 U	0.80 U	1.1 U	0.070 SU	0.05 U	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	0.91 U	**1**	**1.2**	1.1 U	1 SU	**1.68**	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	**6.8**	**7**	**16**	13 U	9.0 SU	**6.36**	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	0.91 U	1 U	**1.2**	1.1 U	1 SU	0.91 U	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	0.91 U	1 U	**0.8**	1.1 U	1 SU	0.91 U	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	0.91 U	1 U	0.80 U	1.1 U	--	0.04 U	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	1.8 U	2.0 U	1.6 U	2.2 U	1 SU	0.91 U	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	0.02 U	0.02 U	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	0.05 U	0.05 U	0.05 U	0.05 U	0.02 U	**0.072**	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.099 U	--	--	--	--	--	--
Phenol	mg/kg	0.84	**0.25**	**0.41**	0.02 U	**0.07**	0.02 U	0.02 U	--	--	--	--	--	--
Conventionals														
Total Organic Carbon	%		**2.2**	**2**	**2.5**	**1.8**	--	**2.2**	**2**	**1.81**	**1.22**	**3.23**	**0.76**	**3.04**

Notes:

(1) - Refer to Table 1.
(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.
(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.
(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.
(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.
(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters
mg/kg = milligrams per kilogram - dry weight
mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).
ng/kg = nanograms per kilogram
% = percent
NR = sample depth not reported in Ecology's Environmental Information Management database.
TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in sum
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2005 - LDW RI - Surface Sediment Round 2	2008 - SAIC - SPM Site Investigation		2008 - LDW Source Control, T-117 EAA Non-Time Critical Removal Action				2011 - Surface Sediment Sampling at Outfalls in the LDW	2013 - T-117 EAA Removal Action 2013-2014
		Location	SS108	TRANS-A-SED	TRANS-B-SED	99-G	100-G	101-G	102-G	LDW-SS2214-U	PERIM-5-PRE
		Date	03/10/2005	03/12/2008	03/12/2008	08/29/2008	08/29/2008	08/29/2008	08/29/2008	03/07/2011	11/22/2013
		Sample	LDW-SS108-01	TRANS-A-SED	TRANS-B-SED	T117-99-SG	T117-100-SG	T117-101-SG	T117-102-SG	LDW-SS2214-U	SG-PERIM-5-PRE
		Depth	NR	0 - 10 cm	0 - 10 cm	0 - 0.2 ft	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Semivolatile Organic Compounds											
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	0.24 U	0.60 SU	0.70 SU	--	--	--	--	0.19 U	**0.39**
1,2-Dichlorobenzene	mg/kg-OC	4.6	0.24 U	0.60 SU	0.70 SU	--	--	--	--	0.19 U	**0.22**
1,4-Dichlorobenzene	mg/kg-OC	6.2	0.24 U	0.60 SU	0.70 SU	--	--	--	--	0.19 U	**0.13**
Benzyl butyl phthalate	mg/kg-OC	9.8	0.24 U	**1.8 S**	**2.5 S**	--	--	--	--	**1.0**	**0.65 J**
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	**5.8**	**6**	**10**	--	--	--	--	**3.5**	**4.78**
Dibenzofuran	mg/kg-OC	30	2.1 U	**0.25 S**	**0.22 S**	--	--	--	--	0.74 U	**0.39 J**
Dimethyl phthalate	mg/kg-OC	106	0.24 U	**2.4 S**	**8 S**	--	--	--	--	**0.36**	**0.57**
Hexachlorobenzene	mg/kg-OC	0.76	0.036 U	0.60 SU	0.70 SU	--	--	--	--	0.19 U	0.04 UJ
N-Nitrosodiphenylamine	mg/kg-OC	22	0.24 U	0.60 SU	0.70 SU	--	--	--	--	0.19 U	0.04 UJ
2,4-Dimethylphenol	mg/kg	0.058	0.0065 U	0.059 U	0.069 U	--	--	--	--	0.005 U	0.019 U
4-Methylphenol	mg/kg	1.34	0.059 U	**0.007**	**0.0071**	--	--	--	--	**4.9**	--
Benzoic acid	mg/kg	1.3	0.065 UJ	0.24 U	0.28 U	--	--	--	--	**0.44**	0.054 U
Benzyl alcohol	mg/kg	0.114	0.033 U	0.03 U	**0.087**	--	--	--	--	**0.19 J**	**0.035 J**
Pentachlorophenol	mg/kg	0.72	0.033 U	0.12 U	0.14 U	--	--	--	--	0.025 U	0.0062 UJ
Phenol	mg/kg	0.84	0.059 U	**0.018**	**0.016**	--	--	--	--	**0.48**	**0.007**
Conventionals											
Total Organic Carbon	%		**2.76**	--	--	**1.83**	**3.19**	**2.69**	**3.49**	**2.69**	**2.3**

Notes:
(1) - Refer to Table 1.
(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.
(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.
(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.
(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.
(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.
cm = centimeters
mg/kg = milligrams per kilogram - dry weight
mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).
ng/kg = nanograms per kilogram
% = percent
NR = sample depth not reported in Ecology's Environmental Information Management database.
TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in sum
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 - Boeing Plant 2 Completion Report									
		Location	SD-PER301	SD-PER301	SD-PER301	SD-PER301	SD-PER301	SD-PER301	SD-PER302	SD-PER302	SD-PER302	SD-PER302
		Date	12/11/2012	12/13/2013	03/14/2014	07/14/2014	09/12/2014	03/09/2015	12/10/2012	12/16/2013	03/13/2014	07/14/2014
		Sample	SD-PER301-1212	SD-PER301-1213	SD-PER301-0314	SD-PER301-0714	SD-PER301-0914	SD-PER301-0315	SD-PER302-1212	SD-PER302-1213	SD-PER302-0314	SD-PER302-0714
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	--	--	--
Conventionals												
Total Organic Carbon	%		**1.72**	**1.87**	**1.64 J**	**1.1**	**1.73**	**1.83 J**	**1.83**	**1.62**	**1.59**	**2.67**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters
mg/kg = milligrams per kilogram - dry weight
mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).
ng/kg = nanograms per kilogram
% = percent
NR = sample depth not reported in Ecology's Environmental Information Management database.
TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in sum
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 - Boeing Plant 2 Completion Report								
		Location	SD-PER302	SD-PER302	SD-PER303	SD-PER303	SD-PER303	SD-PER303	SD-PER303	SD-PER304	SD-PER304
		Date	09/12/2014	03/09/2015	12/07/2012	12/16/2013	03/13/2014	07/14/2014	09/11/2014	12/06/2012	12/20/2013
		Sample	SD-PER302-0914	SD-PER302-0315	SD-PER303-1212	SD-PER303-1213	SD-PER303-0314	SD-PER303-0714	SD-PER303-0914	SD-PER304-1212	SD-PER304-1213
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Semivolatile Organic Compounds											
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	--	--
Conventionals											
Total Organic Carbon	%		**0.789**	**1.57 J**	**2.17**	**1.95**	**1.45**	**1.15**	**1.32**	**1.38**	**1.35**

Notes:
(1) - Refer to Table 1.
(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.
(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.
(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.
(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.
(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.
cm = centimeters
mg/kg = milligrams per kilogram - dry weight
mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).
ng/kg = nanograms per kilogram
% = percent
NR = sample depth not reported in Ecology's Environmental Information Management database.
TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in sum
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

Data Year and Source[(1)]			2015 - Boeing Plant 2 Completion Report								
		Location	SD-PER304	SD-PER304	SD-PER304	SD-PER304	SD-PER305	SD-PER305	SD-PER305	SD-PER305	SD-PER305
		Date	03/17/2014	07/14/2014	09/12/2014	02/27/2015	12/07/2012	12/16/2013	03/11/2014	07/14/2014	09/11/2014
		Sample	SD-PER304-0314	SD-PER304-0714	SD-PER304-0914	SD-PER304-0315	SD-PER305-1212	SD-PER305-1213	SD-PER305-0314	SD-PER305-0714	SD-PER305-0914
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Semivolatile Organic Compounds											
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	--	--
Conventionals											
Total Organic Carbon	%		**1.42**	**0.452**	**0.646**	**2.28**	**2.18**	**2.25**	**1.93**	**1.04**	**1.34**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters

mg/kg = milligrams per kilogram - dry weight

mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).

ng/kg = nanograms per kilogram

% = percent

NR = sample depth not reported in Ecology's Environmental Information Management database.

TEQ = total toxicity equivalence

Bold = Analyte detected

Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.

-- = sample not analyzed

A - Incomplete number of Aroclors used in sum

J - Result value estimated

U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

Data Year and Source(1)			2015 - Boeing Plant 2 Completion Report									
		Location	SD-PER306	SD-PER306	SD-PER306	SD-PER306	SD-PER306	SD-PER306	SD-PER307	SD-PER307	SD-PER307	SD-PER307
		Date	12/10/2012	12/19/2013	03/11/2014	07/14/2014	09/15/2014	02/27/2015	12/07/2012	12/07/2012	12/16/2013	12/16/2013
		Sample	SD-PER306-1212	SD-PER306-1213	SD-PER306-0314	SD-PER306-0714	SD-PER306-0914	SD-PER306-0315	SD-PER307-1212	SD-PER327-1212	SD-PER307-1213	SD-PER327-1213
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	--	--	--
Conventionals												
Total Organic Carbon	%		**2.98**	**1.87**	**1.46**	**0.877**	**1.72**	**2.23**	**2.25**	**2.05**	**2.94**	**2.88**

Notes:

(1) - Refer to Table 1.
(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.
(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.
(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.
(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.
(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.
cm = centimeters
mg/kg = milligrams per kilogram - dry weight
mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).
ng/kg = nanograms per kilogram
% = percent
NR = sample depth not reported in Ecology's Environmental Information Management database.
TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in sum
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 - Boeing Plant 2 Completion Report							
		Location	SD-PER307	SD-PER307	SD-PER307	SD-PER307	SD-PER307	SD-PER307	SD-PER312	SD-PER312
		Date	03/11/2014	03/11/2014	07/15/2014	07/15/2014	09/15/2014	09/15/2014	12/07/2012	12/16/2013
		Sample	SD-PER307-0314	SD-PER327-0314	SD-PER307-0714	SD-PER327-0714	SD-PER307-0914	SD-PER327-0914	SD-PER312-1212	SD-PER312-1213
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Semivolatile Organic Compounds										
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	--
Conventionals										
Total Organic Carbon	%		**1.55 J**	**2.41**	**1.51 J**	**0.886 J**	**1.84 J**	**2.45 J**	**2.19**	**2.36**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters
mg/kg = milligrams per kilogram - dry weight
mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).
ng/kg = nanograms per kilogram
% = percent
NR = sample depth not reported in Ecology's Environmental Information Management database.
TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in sum
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

		Data Year and Source[1]	2015 - Boeing Plant 2 Completion Report								2014 - T-117 EAA Removal Action
		Location	SD-PER312	SD-PER312	SD-PER312	SD-PER313	SD-PER313	SD-PER313	SD-PER313	SD-PER313	PERIM-5-POST
		Date	03/12/2014	07/14/2014	09/11/2014	12/07/2012	12/16/2013	03/12/2014	07/14/2014	09/11/2014	05/12/2014
		Sample	SD-PER312-0314	SD-PER312-0714	SD-PER312-0914	SD-PER313-1212	SD-PER313-1213	SD-PER313-0314	SD-PER313-0714	SD-PER313-0914	SG-PERIM-5-POST
		Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Semivolatile Organic Compounds											
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--	--	--	0.14 U
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--	--	--	0.14 U
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--	--	--	0.14 U
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--	--	--	0.72 UJ
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--	--	--	**8.7 J**
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--	--	--	**0.37**
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--	--	--	0.72 U
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--	--	--	0.14 U
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--	--	--	0.14 U
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	--	0.01 U
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	--	0.1 U
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	--	0.02 U
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	--	0.01 U
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	--	0.002 U
Conventionals											
Total Organic Carbon	%		**2.17 J**	**1.84**	**1.87 J**	**2.15**	**2.63**	**2.14**	**1.32**	**2.01**	**1.38**

Notes:

(1) - Refer to Table 1.
(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.
(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.
(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.
(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.
(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.
cm = centimeters
mg/kg = milligrams per kilogram - dry weight
mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).
ng/kg = nanograms per kilogram
% = percent
NR = sample depth not reported in Ecology's Environmental Information Management database.
TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in sum
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

Data Year and Source(1)			2015 T-117 Outfall Pre-Construction, Post-Construction Sediment Sampling								
Location			SG-A1-POSTCON	SG-A1-PRECON	SG-A2-POSTCON	SG-A2-PRECON	SG-A3-POSTCON	SG-A3-PRECON	SG-B1-POSTCON	SG-B1-PRECON	SG-B2-POSTCON
Date			08/10/2015	07/15/2015	08/10/2015	07/15/2015	08/10/2015	07/15/2015	08/10/2015	07/15/2015	08/10/2015
Sample			SD0110	SD0100	SD0111	SD0101	SD0112	SD0102	SD0113	SD0103	SD0114
Depth			NR	NR	NR	NR	NR	NR	NR	NR	NR
Semivolatile Organic Compounds											
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	--	--
Conventionals											
Total Organic Carbon	%		**2.74 J**	**2.76**	**3 J**	**2.72**	**3.25 J**	**3.53**	**2.94 J**	**3.01**	**3.19 J**

Notes:

(1) - Refer to Table 1.

(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.

(3) - Total PCB Congeners are the sum of congeners, with non-detects = 0.

(4) - ND = 1/2 RDL - calculated using 1/2 the reporting limit for non-detected components.

(5) - LPAHs (low molecular weight polycyclic aromatic hydrocarbons): naphthalene, acenaphthylene, acenaphethene, fluorene, phenanthrene, and anthracene.

(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters
mg/kg = milligrams per kilogram - dry weight
mg/kg-OC = organic-carbon-normalized (dry weight divided by the fraction of organic carbon).
ng/kg = nanograms per kilogram
% = percent
NR = sample depth not reported in Ecology's Environmental Information Management database.
TEQ = total toxicity equivalence
Bold = Analyte detected
Blue Shaded = Reported concentration exceeds the Remedial Action Level shown.
-- = sample not analyzed
A - Incomplete number of Aroclors used in sum
J - Result value estimated
U - Analyte not detected at or above the reporting limit shown

Table C-1. Historical Surface Sediment Analytical Data Excluded from Surface-Weighted Average Concentration Analysis

Project No. 190293, Seattle, Washington

Data Year and Source (1)			2015 T-117 Outfall Pre-Construction, Post-Construction Sediment Sampling									
		Location	SG-B2-PRECON	SG-B3-POSTCON	SG-B3-POSTCON	SG-B3-PRECON	SG-C1-POSTCON	SG-C2-POSTCON	SG-C2-PRECON	SG-C3-POSTCON	SG-C3-PRECON	SG-C3-PRECON
		Date	07/15/2015	08/10/2015	08/10/2015	07/15/2015	08/10/2015	08/10/2015	07/15/2015	08/10/2015	07/15/2015	07/15/2015
		Sample	SD0104	SD0115	SD0119	SD0105	SD0116	SD0117	SD0107	SD0118	SD0108	SD0109
		Depth	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	mg/kg-OC	1.62	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC	4.6	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC	6.2	--	--	--	--	--	--	--	--	--	--
Benzyl butyl phthalate	mg/kg-OC	9.8	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	mg/kg-OC	94	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC	30	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	mg/kg-OC	106	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC	0.76	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	mg/kg-OC	22	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	mg/kg	0.058	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	mg/kg	1.34	--	--	--	--	--	--	--	--	--	--
Benzoic acid	mg/kg	1.3	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	mg/kg	0.114	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	mg/kg	0.72	--	--	--	--	--	--	--	--	--	--
Phenol	mg/kg	0.84	--	--	--	--	--	--	--	--	--	--
Conventionals												
Total Organic Carbon	%		**2.7**	**3.34 J**	**2.87 J**	**3.29**	**2.71 J**	**2.69 J**	**3.42**	**1.77 J**	**2.5**	**2.39**

Notes:

(1) - Refer to Table 1.
(2) - Total PCB Aroclors Concentrations are the sum of Aroclors, with non-detects = 0, unless all Aroclors were not detected, in which case the Total PCB Aroclor concentration is shown as non-detect at the maximum reporting limit for any Aroclor.
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(6) - HPAHs (high molecular weight polycyclic aromatic hydrocarbons): fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
(7) - cPAHs (carcinogenic polycyclic aromatic hydrocarbons): benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

cm = centimeters
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