

DRAFT FINAL
Pre-Remedial Design Data Gaps Memorandum

**Budd Inlet Sub-Area 1 (East Bay, Log Pond, Upland Confined
Disposal Facility, and West Bay Park)
Budd Inlet Sediment Site
Olympia, Washington**

November 3, 2023

Prepared for

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EXECUTIVE SUMMARY

As shown on Figure 1-1, the potential Budd Inlet Sediment Remediation Site, the boundaries of which are yet to be defined, has been divided into three Sub-Areas for sequential investigation, evaluation, design, and remedy implementation. This Pre-Remedial Design Data Gaps Memorandum covers Budd Inlet Sub-Area 1 and discusses existing available data and data anticipated to be needed for design of the Port of Olympia's (Port's) proposed remedy for Sediment Management Areas within Sub-Area 1, as presented in the Draft for Ecology review *Revised Identification and Evaluation of Interim Action Alternatives Memorandum, Budd Inlet Sediment Site, Olympia, Washington* (DOF et al. 2023).

Various types of physical and environmental data are needed for the evaluation of source control and remedial design of the Port's proposed sediment remedy within Sub-Area 1. Data necessary for remedial design within the overall Budd Inlet Site include the following for each of the Budd Inlet Sub-Areas.

- Site Maps
 - Accurate, up-to-date topographic and bathymetric data are needed to begin the design process within each Sub-Area.
- Source Control Data
 - Data are needed to evaluate potential ongoing chemical inputs to Budd Inlet for each Sub-Area. This includes data on the numerous outfalls that drain into each Budd Inlet Sub-Area and other potential historical and ongoing sources to each Sub-Area in Budd Inlet. Outfalls to be considered include City of Olympia (City) stormwater outfalls; Port Stormwater outfalls; and Lacey, Olympia, Tumwater, and Thurston County Clean Water Alliance (LOTT) outfalls as shown on Figure 4-12.
- Sediment Data
 - Nature and extent of chemical contamination throughout each Sub-Area within Budd Inlet, including identification of "hot spots."
 - Surface sediment chemistry, at 0-10 centimeter (cm) depth in subtidal areas and 0-45 cm depth in intertidal areas, for recalculation of site-wide and intertidal surface-weighted average concentrations (SWACs).
 - Chemical concentrations in sediment, both horizontally and vertically, to support design, confirm potential chemicals of concern in the Z-layer (the surface exposed by dredging), and potential capping of contamination below the Z-layer if necessary.
 - Sediment chemistry in the vicinity of existing and former outfalls for identification of potential current or historical sources.
 - Sediment chemistry for the development and evaluation of potential dredged material management options, including onsite confined disposal facilities (CDFs) either upland or in-water.
 - Sediment physical parameters such as grain size and density to evaluate dredgeability, dredged material management, and sediment management approaches other than dredging, including capping or enhanced natural recovery (ENR).

- Existing Structures in Remediation Area
 - Data on the location, type, construction materials, and condition of existing structures within or adjacent to the potential remedial areas and sediment management areas is needed to evaluate potential impacts and management approaches to the existing structures.
- Existing Habitat Conditions
 - Data are needed to sequentially document existing habitat and environmental conditions within and adjacent to each Budd Inlet Sub-Area in order to evaluate potential project impacts and the potential for habitat restoration and to prepare required permitting applications.

Much of the necessary data are not currently available, and data that is available may be older, such that its applicability to remedial design is limited.

- Site Maps
 - Existing bathymetry and topographic data are not contiguous across the project area, the result of various surveys performed at various times for other purposes. With the exception of the US Army Corps of Engineers (USACE) 2023 survey data for the federal navigation channels and Swantown Marina, the existing data are several years old and may not represent current conditions. As a result, up-to-date mapping must be performed so that current data are available for all remedial design and action areas.
- Source Control Data
 - Limited data are available on the multiple potential contaminant inputs to each Sub Area within Budd Inlet. Up-to-date data are needed to evaluate existing surface and subsurface sediment conditions and the potential for recontamination. Existing surface sediment will provide insight into potential ongoing conditions, and subsurface sediment into potential historical sources.
- Sediment Data
 - Although several previous studies of sediment contamination have been performed in Budd Inlet, most of the available sediment data are greater than 10 years old, much of it greater than 20 years old. Owing to ongoing source control efforts and other factors, surface sediment conditions may have changed since the last data were collected. Although subsurface conditions are not expected to have changed significantly, the existing subsurface data are insufficient for remedial design because they do not exist at an adequate coverage density for the required chemicals of concern (COCs) throughout the Budd Inlet Site. These ongoing source control efforts include comprehensive stormwater management programs maintained by the Port and City to reduce potential contaminant loading to Budd Inlet (Port of Olympia 2022; City of Olympia 2021a).
- Existing Structures in Budd Inlet Sub-Area 1
 - Several structures, including Swantown Marina, are within or adjacent to the sediment management areas and have the potential to be impacted by the project. Up-to-date data on the condition of those structures is necessary to evaluate potential project impacts and prepare the remedial design.

- Existing Habitat Conditions
 - Although existing habitat conditions within Budd Inlet are generally considered impaired, detailed data on existing habitat and biological conditions across the project area are not available, including:
 - Fine-scale, location-specific substrate, slope, and vegetation data throughout the remedial area.
 - Detailed bathymetry of the remediation area.
 - A draft Shoreline and Intertidal Habitat Technical Memorandum has been prepared by Grette Associates, and it provides a qualitative characterization of the potential project area.
 - A detailed shoreline habitat conditions survey is planned, and it will collect habitat data sufficient to characterize the entire remedial area for the purpose of evaluating remedial alternatives for potential habitat impacts.

To begin the remedial design of the project, collection of new data documenting existing conditions is required. The timely collection of the necessary data will be a significant driver on overall project schedule and when remedial construction can be implemented.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADA	Americans with Disabilities Act
AO	Agreed Order
Cascade Pole	Cascade Pole Cleanup Site
CDF	confined disposal facility
cm	centimeter
COC	chemical of concern
COPC	chemical of potential concern
cPAH.....	carcinogenic polycyclic aromatic hydrocarbon
CPT	cone penetration test
CSM.....	conceptual Site model
CSO.....	combined sewer overflow
D/F	dioxin and furan
DL	detection limit
DNR	Washington Department of Natural Resources
Draft Alternatives Memorandum	Draft <i>Revised Identification and Evaluation of Interim Action Alternatives Memorandum, Budd Inlet Sediment Site, Olympia, Washington</i>
µg/kg.....	micrograms per kilogram
Ecology.....	Washington State Department of Ecology
ENR.....	enhanced natural recovery
ft	feet, foot
GIS.....	Geographic Information System
HTL	High Tide Line
IAP.....	Interim Action Plan
LiDAR.....	light detection and ranging
Log Pond CDF	in-water CDF within the former Log Pond area
LOTT	Lacey, Olympia, Tumwater, and Thurston County Clean Water Alliance
MLLW	mean lower low water
ng/kg.....	nanograms per kilogram
No.	Number
PAH	polycyclic aromatic hydrocarbon
PCB.....	polychlorinated biphenyl
Port	Port of Olympia
PRD Memo	Pre-Remedial Design Data Gaps Memorandum
PRD.....	pre-remedial design
RAL	remedial action level
SCL.....	sediment cleanup level
SLR	sea level rise

LIST OF ABBREVIATIONS AND ACRONYMS (CONTINUED)

SMA.....	Sediment Management Area
SPT	standard penetration test
Study Area.....	Port of Olympia Budd Inlet Sediment Site Study Area
SVOC	semivolatile organic compound
SWAA	Southwest Washington Regional Airport Authority
SWAC	surface-weighted average concentration
TEQ.....	toxicity equivalency quotient
Upland CDF	upland CDF within the Marine Terminal area
USACE.....	US Army Corps of Engineers

1.0 INTRODUCTION AND PURPOSE

This Pre-Remedial Design (PRD) Data Gaps Memorandum (PRD Memo) has been prepared as required by Amendment No. 2 (June 2023) to Agreed Order (AO) No. DE 6083, entered into by the State of Washington, Department of Ecology (Ecology) and the Port of Olympia (Port) on December 5, 2008. This memorandum has been prepared consistent with the requirement of “Task 7: Pre-Remedial Design Data Gaps Memorandum” of AO Amendment No. 2, effective June 9, 2023.

As required by Task 7 of Amendment No. 2, this PRD Memo presents:

“data gaps primarily focused on remedial dredging within the navigational areas (channels, marinas, and adjacent areas). The PRD Memo will present compiled existing data and a summary of data needs for design of dredging and dredging-related portions of the remedial action and be consistent with the Identification and Evaluation of Interim Action Alternatives Memorandum, including source control and remedy protection. In addition, the PRD Memo will address dredged material management considerations including data that will support evaluations of sediment reuse and disposal options. The PRD Memo will identify existing nearshore, shoreline, and overwater structures that could be impacted by an interim action and the data needed to evaluate remedial actions near these structures.”

As such, this PRD Memo is focused on the implementation of the Port’s proposed remedy presented in the Draft *Revised Identification and Evaluation of Interim Action Alternatives Memorandum, Budd Inlet Sediment Site, Olympia, Washington* dated May 19, 2023 (Draft Alternatives Memorandum) currently under review by Ecology.

This PRD Memo is focused on the first phase of the project, which includes East Bay and related areas needed for sediment management, as detailed in the following sections.

The Budd Inlet Sediment Site is in South Puget Sound (Figure 1-1), in the southern portion of Budd Inlet. The full extent of the site is not yet defined and extends beyond the Project Area shown on Figure 1-1.

1.1 Project Areas Included in This Memorandum

This PRD Memo covers Budd Inlet Sub-Area 1 (Figure 1-2), which includes the Sediment Management Areas (SMAs); Sub-Area 1 is a portion of the overall Budd Inlet Site:

- East Bay, from the junction of the federal navigation channels to the southern limit of East Bay. This includes the following SMAs: Moxlie Creek, Boatworks, Swantown Marina, Open Water East, Cascade Pole, and Navigational Channel East.
- Log Pond SMA, which is a potential sediment remediation area and also an area for potential in-water confined disposal facility (CDF) construction.
- West Bay Park SMA, located on the southern shoreline of West Bay near the 5th Avenue Bridge. This is a potential mitigation area for the Log Pond CDF construction, pending discussion with the City of Olympia (City).

- Port Peninsula upland areas for potential CDF construction or beneficial reuse of dredged sediment.

2.0 SITE HISTORY AND BACKGROUND

The history of Budd Inlet, the Port Peninsula, previous operations, and site investigations are fully described in multiple site documents (Anchor 2012, Anchor 2016b) and are not repeated here. There are several other known contaminated sites, in addition to the Budd Inlet Sediment Site, within Budd Inlet (Figure 2-1).

3.0 PORT OF OLYMPIA'S PROPOSED REMEDY

The Draft Alternatives Memorandum (DOF et al. 2023) presents approaches for sediment remediation and related dredged material management within the Port of Olympia Budd Inlet Sediment Site Study Area (Study Area) and adjacent areas of both East and West Bays based on multiple factors, including existing sediment data, remedial action levels (RALs) developed in the Draft Alternatives Memorandum, and current and future use of the site. Within that document, the Study Area and adjacent areas of both East and West Bays are divided into specific SMAs based on functional and environmental characteristics. The Port's proposed remedial approach for each SMA is developed in the Draft Alternatives Memorandum and summarized below. Data gap identification is based on data needed to design the Port's proposed remedy, where a remedy is identified in the Draft Alternatives Memorandum, and on data needed to evaluate potential remedies within areas where a specific remedy was not proposed in the Draft Alternatives Memorandum.

Existing sediment data used in this document and in development of the regional background exceedance areas presented is generally 10 to 20 years old. As such, the areas exceeding regional background are likely to be modified as a result of future data collection.

3.1 Sediment Remediation

The Port's proposed alternative for sediment remediation within Budd Inlet Sub-Area 1 is stated in the Draft Alternatives Memorandum and summarized as follows and depicted on Figure 3-1. Figure 3-2 depicts areas where surface sediments exceed the regional background concentration for dioxin/furans, cPAHs, or both, based on existing data.

- Removal of impacted sediments (dredging) in all current navigational areas, including the Navigation Channel SMA, Swantown SMA, and Boatworks SMA.
- Removal of impacted sediments (dredging) in areas of significantly elevated chemicals of concern (COCs) with the potential to cause recontamination and in erosional areas of the non-navigational areas of the Moxlie Creek, Open Water East, and Open Water North SMAs.
- Capping/enhanced natural recovery (ENR) in the remaining non-navigational areas of the Moxlie Creek, Open Water East, and Open Water North SMAs.
- Potential use of combined dredging and capping if areas of deep sediment contamination are identified within all SMAs.
 - Within navigational areas, capping may be considered if the depth of contamination is such that a cap could be installed below the depth of future dredging, including a two foot over-dredge allowance and a 2-foot buffer below the overdredge depth and the top of any cap.
 - Within non-navigational areas, capping may be considered if the depth of contamination is greater than 3 feet, such that dredging of 3 feet of sediment and cap construction could be completed without changing the elevation from the existing elevation within that area.

3.2 Dredged Material Management

The cost-effective and environmentally protective management of dredged material is a core concept to cost-effective remediation by dredging within Budd Inlet. Conventional landfill disposal of the dredged material would significantly increase not only costs and potential impacts on neighboring communities through which the dredged material would be transported but also the carbon footprint of the project due to impacts of sediment transportation from Budd Inlet to a landfill in Eastern Washington or Eastern Oregon. By using alternatives to landfill disposal, dredged material management costs can be reduced, ancillary environmental impacts such as carbon footprint reduced, and pending sea level rise (SLR) impacts on the Port Peninsula mitigated by the selective onsite placement of the dredged material.

Several types of onsite placement and beneficial reuse are included in the Port's proposed alternative, including an in-water CDF within the former Log Pond area (Log Pond CDF); an upland CDF within the Marine Terminal area or adjacent Port property (Upland CDF), including upland portions of the Cascade Pole Cleanup Site (Cascade Pole); and select placement on the Port Peninsula to address SLR, including potentially raising future development sites and the Billy Frank Jr. Trail, which could provide a barrier along the length of the East side of the Peninsula (Figure 3-3). It is anticipated that significant quantities of debris may be encountered during the implementation of the remedy. Debris would be separated from the dredged material as practicable and disposed of at an approved upland offsite landfill along with any sediments unsuitable for onsite placement owing to contamination, physical properties, overall project volume, or other unanticipated factors.

4.0 DATA REQUIRED FOR DESIGN, COMPARISON OF REQUIRED DATA TO EXISTING DATA, AND RESULTING DATA GAPS FOR DESIGN OF THE PORT OF OLYMPIA'S PROPOSED REMEDY

This section summarizes the data required for preparation of the remedial design, whether those data types exist, and the resulting data gaps for design of the Port's proposed remedy for either the project area as a whole or for specific areas or SMAs. Although several previous sediment studies have been performed within Budd Inlet, the existing sediment chemistry data are limited in geographic area; limited in analytes, which is inconsistent with project requirements; or were for previously completed remedial activities, such as Cascade Pole inside the "Multiple Benefits Line," and are no longer representative of existing conditions. In some cases, the data required for design and the data gaps are virtually identical because little to none of the existing data are suitable, cover only a small area, or don't exist, such that **all of the data needed for remedial design are currently a data gap.**

4.1 Project Area Base Map

4.1.1 Required Base Map Content and Mapping Data for Remedial Design

An up-to-date, accurate base map covering the extent of the project area and depicting current site bathymetry, topographic contours, and topographic features such as buildings, shoreline features, roads, paved area, utilities, etc. is needed for the design of the remedy and corresponding sediment management.

4.1.2 Existing Base Map Content and Mapping Data Suitable for Remedial Design

The existing project base map data consists of a mix of publicly available Geographic Information System (GIS) data, federal and local government topographic and hydrographic surveys, and a Port of Olympia hydrographic condition survey. The data ranges in age from 2023 to 2017 or older, with the majority of upland and nearshore information originating from 2017 or earlier. Attempting to perform design-level activities from a mix of older surveys will impact the accuracies necessary to carry through a long-term project, especially in the nearshore and upland areas. Existing locations and vertical elevations of shoreline features such as structures, piling, shoreline protection, outfalls, seeps, and vertical walls is either limited or non-existent. The US Army Corps of Engineers (USACE) 2023 multibeam hydrographic channel condition survey is sufficient for design-level work but limited in its extent of coverage. The 2017 Southwest Washington Regional Airport Authority (SWAA) light detection and ranging (LiDAR) upland/nearshore coverage and accuracy quickly diminishes in the tidal flats area at the north end of the project area and in the Moxlie Creek area at the south end. The Log Pond area has limited, older survey coverage from 2019, Swantown Marina has limited coverage under the floats and near the shoreline, and Boatworks has no survey coverage (Figure 4-1).

4.1.3 Base Map Data Gaps for Remedial Design

With the exception of the USACE 2023 bathymetry survey data within the East Bay Navigation Channel and Swantown Marina, none of the existing topographic or bathymetric survey data are of design-level quality or recency. As such, data gaps for bathymetric and topographic survey data exist throughout all potential remedial design areas outside the East Bay Navigation Channel and Swantown Marina. Additional bathymetric and topographic surveying will be required within identified remedial action areas, except in the East Bay Navigation Channel and at Swantown Marina, prior to design.

4.2 Nature and Extent of Sediment Contamination

4.2.1 Required Data on the Nature and the Extent of Sediment Contamination for Delineation of Remedial Areas and Remedial Design

Data on the nature and extent of sediment contamination in surface, near-surface, and subsurface sediment is required for multiple purposes, including:

- Nature and extent of chemical contamination throughout each Sub-Area within Budd Inlet, including identification of “hot spots.”
- Surface sediment chemistry, at 0-10 centimeter (cm) depth in subtidal areas and 0-45 cm depth in intertidal areas, for recalculation of sitewide and intertidal surface-weighted average concentrations (SWACs).
- Chemical concentrations in sediment, both horizontally and vertically, to support design, confirm potential chemicals of concern in the Z-layer (the surface exposed by dredging, if dredging is performed), and potential capping of contaminated sediments within areas where capping is a selected remedy and below the Z-layer if necessary, based on a proposed dredging remedy within that SMA.
 - Sufficient data density is required to define an accurate dredge prism, horizontally and vertically, to remove the impacted sediments.
- Sediment chemistry in the vicinity of existing and former outfalls for identification of potential current or historical sources.
- Sediment chemistry for the development and evaluation of potential dredged material management options, including onsite CDFs either upland or in-water.
- Sediment physical parameters, such as grain size and density, to evaluate dredgeability, dredged material management, and sediment management approaches other than dredging, including capping or ENR.

Within each of the SMAs shown on Figure 3-1, the following data are required to address the purposes listed above.

Navigation Channel East SMA—The Port’s proposed remedy for contamination within the Navigation Channel East is removal by dredging. The horizontal and vertical extent of contaminated sediment is

required to design a dredge prism to remove contaminated sediment, restore navigation depth, and allow USACE to resume maintenance dredging as needed.

Swantown SMA—The Port’s proposed remedy for contamination within the Swantown SMA is removal by dredging. The horizontal and vertical extent of contaminated sediment is required to design a dredge prism to remove contaminated sediment, restore navigation depth, and allow the Port to resume maintenance dredging as needed.

Boatworks SMA—The Port’s proposed remedy for contamination within the Boatworks SMA is removal by dredging. The horizontal and vertical extent of contaminated sediment is required to design a dredge prism to remove contaminated sediment, restore navigation depth, and allow the Port to resume maintenance dredging as needed.

Moxlie Creek SMA—The horizontal and vertical extent of contaminated sediment is required to design a dredge prism to remove contaminated sediment from potential erosion areas and to design cap or ENR as appropriate for non-erosional areas.

Open Water North SMA, and Open Water East SMA—The horizontal and vertical extent of contaminated sediment is required to design a dredge prism to remove contaminated sediment from potential erosion areas or “hot spots” and to design a cap or ENR as appropriate for non-erosional areas. These areas are anticipated to include those adjacent to outfalls with previously identified elevated COCs in nearby sediment or stormwater monitoring, consistent with source control efforts, and other areas with substantially elevated concentrations of COCs. The forthcoming source control evaluation will inform sampling with regard to all potential pathways to these SMAs, including but not limited to an evaluation of erosive shoreline embankments, groundwater seeps, bulkhead drains, and direct overwater or overland flow discharges.

Log Pond SMA—The Port’s proposed remedy for the Log Pond is to construct a CDF that would include remediation of Log Pond sediments. However, if the CDF is not constructed, Log Pond sediments would be remediated by dredging, capping, or ENR, to be determined based on data collection and evaluation. To evaluate remedial options other than dredging, surface and subsurface sediment chemistry data will be required to delineate the nature and extent of contamination.

Limited surface and subsurface data are available for remedial design of the Port’s proposed remedy within the project area. Much of the existing sediment data are 10 to 20 years old and are generally considered suitable to inform the design but should not be solely relied upon as basis for design. It is anticipated that surface sediment chemistry may have changed over time owing to erosion or deposition. Additionally, the positioning and sampling methods used may not have provided the accuracy of current methods.

Stormwater Outfall areas within any SMA—Localized areas around outfalls may have different sediment impacts, due to COCs, than the larger SMAs in which they are located. The horizontal and vertical extent of contamination in sediment associated with municipal stormwater outfalls is not

complete. These data are necessary to evaluate contaminant contributions from stormwater and develop effective source control measures.

Cascade Pole—Previous Remedial Actions at Cascade Pole remediated sediments from the shoreline, extending offshore to the Multiple Benefits Line, as shown on various figures. Areas outside the Multiple Benefits Line are part of the Open Water North SMA or the Navigation Channel East SMA.

West Bay Park Segment—The West Bay Park segment of Budd Inlet Sub-Area 1 is located on the west shoreline of West Bay and includes intertidal and subtidal sediments and a former railroad embankment. This embankment creates an inner “lagoon” area cutoff from West Bay except for a small inlet area. Data on the nature and extent of sediment contamination is needed to evaluate need for sediment remediation and potential remedial options, as needed. Additionally, removal of the former railroad embankment could be performed as a habitat enhancement related to overall project permitting.

4.2.2 Existing Data on the Nature and Extent of Sediment Contamination

The existing sediment chemistry data within each SMA is outlined below and summarized on Table 4-1, Table 4-2, and Table 4-3 (surface, near-surface, and subsurface lab results, respectively).

4.2.3 Navigation Channel East Sediment Management Area

The Navigation Channel East SMA covers approximately 1.0 million square feet of the project area. There are five surface (0 to 10 centimeter [cm]) data locations (Figure 4-2), two near-surface (10 to 45 cm) data locations (Figure 4-3), and eight subsurface (>45 cm) data locations (Figure 4-4) for dioxin furans; there are six surface (0-10cm) data locations (Figure 4-5), no near-surface (10-45 cm) data locations (Figure 4-6), and three subsurface (>45 cm) data locations (Figure 4-7) for carcinogenic polycyclic aromatic hydrocarbon (cPAHs) within the Navigation Channel East SMA.

Based on existing data, half of the surface/near-surface sediment samples collected within the East Navigation Channel area exceed regional background concentrations for dioxins and furans (D/Fs; 10 nanograms per kilogram [ng/kg]), cPAHs (78 micrograms per kilogram [μg/kg]), or both (Figure 4-8).

From eight subsurface core locations, a total of 18 subsurface samples were collected and analyzed for D/Fs and five were analyzed for cPAHs. Six samples exceeded regional background concentrations for D/Fs, with a range of 0.34 to 78.2 ng/kg. The four cPAH samples exceeded regional background concentrations, with a range of 72.8 to 142 μg/kg. The maximum depth below mudline for D/F exceedances was 11 feet; the maximum depth below mudline for cPAH exceedances was 8 feet. Mudline elevation was not available for the determination of exceedance elevations.

4.2.4 Swantown Sediment Management Area

The Swantown SMA covers approximately 1.0 million square feet of the project area. There are six surface (0 to 10 cm, Figure 4-2), no near-surface (10 to 45 cm, Figure 4-3), and five subsurface (>45 cm,

Figure 4-4) data locations for D/Fs; there are six surface (0 to 10 cm) data locations (Figure 4-5), no near-surface (10 to 45 cm) data locations (Figure 4-6), and one subsurface (>45 cm) data location (Figure 4-7) for cPAHs within the Swantown SMA.

Based on existing data, all of the surface sediment within the Swantown SMA exceeds regional background for D/Fs (19 ng/kg), cPAHs 78 (µg/kg) or both (Figure 4-8).

From five subsurface core locations, a total of 11 subsurface samples were collected and analyzed for D/Fs and one sample was analyzed for cPAHs. One sample exceeded regional background concentrations for D/Fs, with a range of 0.113 to 16.1 ng/kg. The one cPAH sample exceeded regional background concentrations at 88.9 µg/kg. Both exceedances occurred at the same location and depth of 4 feet below mudline. The mudline elevation was not available for the determination of exceedance elevations.

4.2.5 Boatworks Sediment Management Area

The Boatworks SMA covers approximately 0.4 million square feet of the project area. There are four surface (0 to 10 cm) data locations (Figure 4-2), no near-surface (10 to 45 cm) data locations (Figure 4-3), and four subsurface (>45 cm) data locations (Figure 4-4) for D/Fs; there are six surface (0 to 10 cm) data locations (Figure 4-5), no near-surface (10 to 45 cm) data locations (Figure 4-6), and one subsurface (>45cm) data location (Figure 4-7) for cPAHs within the Boatworks SMA.

Based on existing data, all of the surface sediment within the Boatworks area exceeds regional background concentrations for D/Fs (10 ng/kg), cPAHs (78 µg/kg), or both (Figure 4-8).

From four subsurface core locations, a total of 10 subsurface samples were collected and analyzed for D/Fs, and one sample was analyzed for cPAHs. Six samples exceeded regional background concentrations for D/Fs, with a range of 1.18 to 58.6 ng/kg. The lowest elevation of exceedance was recorded at -13.1 feet MLLW. The cPAH sample did not exceed regional background concentrations for cPAHs.

4.2.6 Moxlie Creek Sediment Management Area

The Moxlie Creek SMA covers approximately 0.9 million square feet of the project area. There are 11 surface (0 to 10 cm) data locations (Figure 4-2), 3 near-surface (10 to 45 cm) data locations (Figure 4-3), and 5 subsurface (>45 cm) data locations (Figure 4-4) for dioxin furans; there are 11 surface (0 to 10 cm) data locations (Figure 4-5), 2 near-surface (10-45 cm) data locations (Figure 4-6), and 3 subsurface (>45cm) data locations (Figure 4-7) for cPAHs within the Moxlie Creek SMA.

Based on existing data, all but two of the surface/near-surface sediment samples within the Moxlie Creek area exceed regional background concentrations for D/Fs (10 ng/kg), cPAHs 78 (µg/kg) or both (Figure 4-8).

From 7 subsurface core locations, a total of 20 subsurface samples were collected and analyzed for D/Fs and 17 were analyzed for cPAHs. All but five exceed regional background concentrations for D/Fs, with a range of 0.184 to 1,280 ng/kg. The lowest elevation of exceedance was recorded at -10.6 feet MLLW. All but seven samples exceed regional background for cPAHs, with the lowest elevation of exceedance recorded at -7.60 feet MLLW.

4.2.7 Open Water East and Open Water North Sediment Management Areas

The Open Water East and Open Water North SMAs cover approximately 6.8 million square feet of the project area. There are 17 surface (0 to 10 cm) data locations (Figure 4-2), 6 near-surface (10 to 45 cm) data locations (Figure 4-3), and 7 subsurface (>45 cm) data locations (Figure 4-4) for dioxin furans; there are 22 surface (0 to 10 cm) data locations (Figure 4-5), no near-surface (10 to 45 cm) data locations (Figure 4-6), and 2 subsurface (>45 cm) data locations (Figure 4-7) for cPAHs within the East Bay Channel SMA.

Based on existing data, significant areas of the surface and near-surface sediment within the East Bay SMA exceed regional background concentrations for D/Fs (10 ng/kg), cPAHs (78 µg/kg), or both (Figure 4-8), with potential areas of significantly elevated chemistry near outfalls.

From seven subsurface core locations, a total nine subsurface samples were collected and analyzed for D/Fs and two were analyzed for cPAHs. There were no exceedances for D/Fs, with a range of 0.579 to 7.76 ng/kg. There was one **RAL exceedance** for cPAHs (133 µg/kg) that extended to 2 feet below mudline to an elevation of approximately +9.5 MLLW.

Log Pond SMA. The Log Pond SMA covers approximately 300,500 square feet at the northwest end of the Port Peninsula. This area had previously been used as a recreational marina and then for log storage after the marina was removed. There are five surface (0-10 cm), five near-subsurface (0-45 cm), and three subsurface (below 45 cm) sample locations for D/F in the Log Pond SMA (Figures 4-2, 4-3, and 4-4). There are four surface (0-10 CM), four near-subsurface (0-45 cm), and 0 subsurface (below 45 cm) sample locations for cPAHs in the Log Pond SMA (Figures 4-5, 4-6, and 4-7).

West Bay Park Segment. Very little sediment chemistry data exist for the West Bay Park segment and are limited to six previous shallow borings on the side of the embankment, which were analyzed for both D/Fs and cPAHs as shown on Figures 4-2, 4-3, 4-5, and 4-6.

4.2.8 Sediment Contamination Data Gaps

Sediment contamination data gaps, based on differences between data needed for remedial design and available existing data, within each Sediment Management Area are outlined below. Existing outfalls discharge into several of these SMAs and areas around outfalls will be investigated accordingly to identify potential sediment impacts.

Navigation Channel East SMA—Surface sediment data are needed to delineate the extent of contamination and delineate the required remedial area. The existing subsurface sample locations alone do not provide enough detail for delineation of areas requiring remediation or remedial design within this SMA. Additional borings are needed to confirm the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface.

Swantown SMA—Existing surface data indicate that the entire surface area within this SMA exceeds regional background for both D/Fs and cPAHs. The existing subsurface sample locations do not provide enough detail for remedial design within this SMA. Additional borings are needed to confirm the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface.

Boatworks SMA—The existing subsurface sample locations alone do not provide enough detail for remedial design within this SMA. Additional borings are needed to confirm the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z layer) surface.

Moxlie Creek SMA—The existing surface and subsurface sample locations alone do not provide enough detail for remedial design within this SMA. Existing data indicate contamination to depths exceeding 10 feet in several areas. Additional borings are needed to confirm the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface for potential dredge areas. Additional surface samples are needed to accurately define limits of surficial contamination.

Open Water East and Open Water North SMAs—The existing surface and subsurface sample locations alone do not provide enough detail for delineation of remedial areas, evaluation of remedial alternatives, or remedial design within these SMAs. Additional borings are needed to confirm the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface for potential dredged areas, if dredging is to be performed. Additional surface samples are needed to accurately define the limits of surficial contamination. This will include focused sampling near outfalls of potential concern.

Log Pond SMA—Data are needed to support design of the proposed CDF and to evaluate remedial options and design the selected remedy if a CDF is not constructed. To support CDF design, geotechnical data will be needed along the alignment of the potential CDF construction to evaluate subsurface conditions for containment wall design and construction. Data may be needed on potential confining layers beneath the proposed CDF. Sediment chemistry data are needed to evaluate the nature and extent of sediment contamination within the Log Pond to evaluate potential remedial options and design the selected remedy if a CDF is not constructed.

4.3 Dredged Material Management Data

4.3.1 Sediment Properties for Sediment Management

Various data are required to support design of the proposed dredged material management options identified in the Draft Alternatives Memorandum (DOF et al. 2023) and include:

- Offsite disposal at an approved Subtitle D landfill.
- Several onsite **beneficial reuse** options as shown conceptually on Figure 3-3, including:
 - Placement in a nearshore CDF to be constructed in the area of the former Log Pond at the northwest corner of the Port Peninsula,
 - Placement in an upland CDF to be constructed within the Port Terminal area, adjacent to the existing Cascade Pole CDF, and
 - Incorporation as fill into other SLR and shoreline resiliency improvements throughout the Port property.

Each dredged material management option has both unique and overlapping design data needs. A thorough understanding of the sediment chemical characteristics (chemicals of concern, leaching properties, etc.) is required for offsite disposal profiling and to develop safe containment strategies for onsite placement. The sediment physical properties are required to evaluate dewatering and material handling requirements during dredging, transfer, and processing of the sediment, and to determine potential amendment requirements (e.g., stabilization/solidification using cement, fly ash, or other materials) for offsite transport and onsite placement.

As summarized in Section **4.1**, numerous investigations have been performed within Budd Inlet to identify COCs. In addition, multiple geotechnical investigations have been completed within selected portions of Budd Inlet and upland Port Peninsula property (Figures 4-9 and 4-15). Data from these investigations are summarized in the *Budd Inlet Sediment Site Existing Information Summary and Data Gaps Memorandum* (Anchor QEA 2012a) and the *Final Investigation Report, Port of Olympia Budd Inlet Sediment Site* (Anchor QEA 2016b).

While the existing data are sufficient for feasibility evaluations, the age and spatial distribution of the data limits its use for higher resolution analyses and design of the dredged material management options listed above. Additionally, previous studies did not focus on the dredged material management options currently under consideration. To facilitate design of the dredged material management options identified above, representative sediment samples will be needed from throughout the areas proposed for remediation by dredging to supplement existing data (Table 4-4). Sample collection details, including locations, spatial distribution/density, analytes, and testing methods will be developed in the **Pre-Design Investigation Work Plan** as required by AO Amendment No. 2.

To assess sediment characteristics and associated sediment processing requirements, it is anticipated that selected samples will be composited to represent the various SMAs defined in the Draft

Alternatives Memorandum (DOF et al. 2023). Compositing samples will allow adjustments to be made to the sediment processing design and to operations as the dredging progresses throughout Sub-Area 1. The composite samples will also be used for bench scale treatability testing to determine appropriate amendment materials (e.g., cement, bentonite, aggregate) and mixing ratios to achieve the properties required for both offsite transport and onsite placement of the sediment. The anticipated sediment properties required for design of the sediment management project elements are summarized in Table 4-5.

Table 4-5. Sediment Management Design Data Needs

Data Need	Purpose				
	Sediment Dewatering/ Handling	Offsite Landfill Disposal	Nearshore CDF Placement	Upland CDF/SLR Placement	Effluent Treatment
Chemical Properties (Budd Inlet COCs)		✓	✓	✓	✓
Physical Properties (bulk density, grain size, plasticity, water content, total organic carbon, total solids)	✓	✓	✓	✓	
Strength Properties (compressibility and shear strength)			✓	✓	
Elutriate Properties	✓		✓	✓	✓
Settling/Consolidation Properties			✓	✓	
Leaching Properties			✓	✓	

4.3.2 In-Water Confined Disposal Facility Design

The recommended nearshore CDF would be constructed in the area of the former Log Pond, located in West Bay at the northwest end of the Port Peninsula (Figure 3-3). The CDF would be designed to provide permanent containment for the dredged sediment in addition to existing contaminated sediment within the nearshore CDF footprint. Containment of the dredged material would be provided by enclosing the Log Pond area within a steel sheet pile cutoff wall. Dredged material would be placed in the CDF until filled to the approximate surrounding upland grades, then covered with a low-permeability cap. Similar to the Cascade Pole nearshore CDF (Figure 4-11), the sheet pile wall joints would be designed to control leakage, and groundwater pumping wells could be installed within the CDF and pumped, as required, to maintain an inward hydraulic gradient. Decant water generated (displaced) during placement of sediment into the CDF would be monitored and treated as required to meet applicable water quality standards. Following capping, the CDF would be developed to incorporate SLR protection features.

Construction of the CDF would require removal of the large, derelict, creosote-treated timber dock structure bordering the west side of the Log Pond (partially located on Washington Department of Natural Resources (DNR) property), eliminating a potential ongoing source of contaminants to the sediment, while also providing potential mitigation for the CDF construction. Additional derelict

structures and debris would also need to be removed along the east shoreline of the Log Pond, including the piling-supported former marina building. Once filled, the CDF structure would need to be integrated with existing shoreline features and infrastructure, including possible rerouting of existing outfalls at the south end of the Log Pond and relocation of the floating dock at the northwest corner of the peninsula.

Data needs to complete design of the nearshore CDF include the Log Pond area bathymetry/topography; condition and details of existing derelict structures, infrastructure, and utilities; sediment chemical, geotechnical, and hydrogeologic characteristics; and future property development considerations.

Limited bathymetric/topographic data are available for the Log Pond area and are composed of partial surveys of selected areas between 2017 and 2023 (DOF et al. 2023). There is no known available survey information or structural assessments of the derelict structures within the Log Pond area. The Port's storm sewer network system and outfall locations have been mapped based on available-record drawings and other historical information (Anchor QEA 2012a), although verification and updated information will be required to capture current conditions.

Surface and subsurface sediment conditions have been characterized at selected locations within and adjacent to the Log Pond, as discussed in detail in the Budd Inlet Sediment Investigation Report (Anchor QEA 2016). Some wood waste and debris were observed in a few test borings, but the nature and extent of debris has not been mapped. In addition, geotechnical explorations have been completed at several locations within the Log Pond and adjacent upland area to support the evaluation of remedial alternatives (Figures 4-9 and 4-15). These explorations included hollow-stem auger borings, cone penetration tests (CPTs), and vane shear tests (Anchor QEA 2016b). It is anticipated that the existing geotechnical borings will provide sufficient information for preliminary design of the nearshore CDF, but additional explorations may be required to support geotechnical and hydrogeologic analyses for final design.

There are currently no other planned uses for the Log Pond property; future development plans will need to be explored in coordination with the Port during design.

Based on preliminary review of existing information, it is anticipated that the following additional data will be required to supplement existing data for design of the nearshore CDF (Table 4-6). The rationale and objectives for, and details regarding, these investigation activities will be developed in the Pre-Design Investigation Work Plan, based a comprehensive review of existing data and the recommended alternative contained in the Interim Action Plan.

Table 4-6. Nearshore Confined Disposal Facility Design Data Needs

Data Need	Purpose
Bathymetry/upland topography conditions	Support CDF siting, sizing and capacity analysis, and construction layout and control.
Derelict structure information	Support assessment of structure materials, condition, and waste disposal quantities for construction planning.
Upland infrastructure and utility information	Verify work completed in 2012 and evaluate if additional structures have been placed since that time, and support design of CDF integration with upland shoreline structures, storm water outfalls, public access features.
Sediment physical/chemical characteristics	Assess contaminant leaching/migration potential and hydraulic containment requirements.
Geotechnical/hydrogeologic characteristics	Support design of CDF sheet pile structure and hydraulic containment features.
Site development plans	Inform design of CDF cap and cover system, SLR improvements, and operation and monitoring features.

4.3.3 Upland Placement Design

As previously noted, multiple upland beneficial reuse options will be evaluated during design for the placement of dredged sediment. These options include placement in an upland CDF, incorporation as fill into SLR resiliency features, and other shoreline improvements throughout the Port property (Figure 3-3).

The proposed upland CDF would be developed within the northern portion of the Port peninsula, adjacent to the upland CDF constructed for the Cascade Pole sediment cleanup in 2002 (Figure 4-11). Building on the Cascade Pole CDF, dredged sediment would be placed in adjoining cell(s) constructed of earthen berms to the west and north of the existing Cascade Pole upland CDF, identified as the “Potential Upland CDF Areas to be Evaluated” on Figure 3-3. The new CDF cell(s) would expand the area of elevated grade at the north end of the Port Peninsula. The footprint and elevation of the expanded upland CDF will be determined in coordination with the Port during design, based on future site use plans and constraints. The upland CDF could likely be constructed in stages over the multiyear dredging effort, as needed to accommodate construction sequencing plans and Port operations.

Following initial dewatering on the dredge barge, dredged sediment would be transferred to the upland CDF via clamshell, hydraulic excavators, trucks, or other methods. Similar to the Cascade Pole CDF, the expanded CDF would include features to capture surface drainage and accelerate further dewatering and consolidation of the sediment. Alternatively, amendments such as Portland cement and other admixtures may be mixed with the sediment during placement into the CDF to stabilize and solidify the material, eliminating the need for post-placement dewatering. Upon curing, the stabilized/solidified CDF sediment would provide structurally competent foundation conditions for future site use. Once filled, the CDF would be covered with an impermeable cover and appropriate grading and paving materials to

prevent stormwater infiltration and to prepare the area for future use (e.g., Port Terminal operations, public use).

Similar to the upland CDF, sediments designated for SLR and shoreline resiliency improvements would be stabilized and solidified with amendments to produce chemically stable structural fill, designed to satisfy anticipated loading requirements for proposed site uses (e.g., roadways, building foundations, public spaces). As indicated on Figure 3-3, candidate placement opportunities include raising grades in selected Port property parcels and road segments to improve SLR resiliency, improvements to the Billy Frank Jr. Trail, and shoreline enhancement fills.

Data required to complete design and construction of the proposed upland CDF and SLR/shoreline resiliency improvements includes detailed mapping of existing site topography, utilities (surface and subsurface), structures, and paved/unpaved surfaces. Subsurface geotechnical conditions within the proposed CDF and SLR/shoreline improvement areas will also be required for design of fill placements. Because a portion of the proposed CDF is anticipated to be constructed within the footprint of the existing Cascade Pole slurry wall and groundwater collection and treatment system, features of this system will be compiled and evaluated to facilitate integration into the proposed expanded CDF structure. Any proposed modifications to these features will be developed in close coordination with the Port, Ecology, and CPC consultant team. In addition, current and future property use and site-development planning information will be needed to inform siting and completion details for the upland CDF and SLR improvements.

Additional review of existing upland data will be completed during development of the pre-design investigation plan. Based on review to date, it appears that current topographic data exists for selected portions of the Port property. Similarly, geotechnical data for the proposed upland sediment management areas identified on Figure 3-3 are limited to isolated investigation areas (Figures 4-9 and 4-10). The Cascade Pole groundwater collection and treatment infrastructure details are well documented and are shown conceptually on Figure 4-11. Future Port property development planning is ongoing through the Port Vision 2050 Action Plan, Port of

4.3.4 Dredged Material Management Data Gaps

Based on preliminary review of existing information, it is anticipated that the following additional data will be required to supplement existing data for design of the upland CDF and SLR/shoreline resiliency improvements (Table 4-7). The rationale, objectives, and details of these additional investigation activities will be developed as part of a future pre-design work plan to support focused investigations (if required) and bench scale testing for onsite placement activities. This work plan will be prepared following initial pre-design sediment chemistry investigation activities for Sub-Area 1 and identification of preliminary dredge limits and quantities within Sub-Area 1.

Table 4-7. Upland CDF Design Data Needs

Data Need	Purpose
Upland topography conditions	Support siting, sizing, and capacity analysis of proposed upland placement areas, integration with existing upland features, and construction layout and control.
Upland infrastructure and utility information	Verify work completed in 2012 (Anchor QEA 2012a) and evaluate if additional structures have been placed since that time, and support integration with existing upland structures and utilities, including Port operation and tenant facilities, stormwater conveyance and treatment infrastructure, other buried and overhead utilities, Cascade Pole groundwater treatment infrastructure, and public access features
Geotechnical	Support geotechnical design and analysis of fill placement.
Site development plans	Support siting of proposed upland placement areas and integration with existing site features.
Future Port operational plans	Design location and final configuration of sediment placement areas consistent with future operations.

4.4 Sources of Contamination—Source Control and Remedy Protection

Source control is an essential element of the recommended remedial action for the East Bay. Multiple transport pathways to the Site have the potential to contribute contamination. Source control will limit the potential for sediment recontamination and ensure that the remedy remains protective. This section presents the data required for remedial design, currently existing data, and data gaps specific to source control and remedy protection for East Bay.

4.4.1 Required Data for Source Control Evaluation

As presented in the Draft Alternatives Memorandum, the COCs for East Bay are D/Fs, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), cadmium, and select semivolatile organic compounds (DOF et al. 2023). As will be discussed in the forthcoming Interim Action Plan, a source control framework will define the source control approach, roles and responsibilities, and timing and deliverables associated with implementation of a source control evaluation for East Bay.

Initially, sediment data will be collected in areas with potential sources of COCs (e.g., outfalls, marinas, cleanup sites, etc.) during the PRD data collection. This sampling program is designed to address known data gaps such as outdated data or low data density. Based on the PRD results, additional data needs will be identified to further inform the source control investigation. The proposed PRD data collection scope is expected to be implemented in winter 2024. Following receipt and analysis of results from that sampling effort, a **Source Control Assessment Memo** will be prepared to describe the source control approach, for Ecology review, in advance of additional data gap sampling.

For the purpose of identifying data gaps as part of this PRD Memo, it is anticipated that the source control evaluation will focus on identification of potential sources of COCs and potential pathways to

East Bay. Anticipated pathways to East Bay include stormwater, shoreline erosion, groundwater, in-water structures, overwater activities, and in-water sediment resuspension and release (e.g., from other cleanup sites with a nexus to East Bay).

For example, stormwater discharges will be evaluated to identify any potential for an ongoing source of COCs to East Bay, which would require implementation of source control measures. The evaluation will likely involve reviewing whether stormwater permit thresholds are being met and recent stormwater and catch basin solids data. Sediment data collected near outfalls discharging to East Bay may be evaluated to support identification of sources that may result in an ongoing source of contamination.

A broader assessment of other potential transport pathways will be required to develop a comprehensive conceptual site model (CSM) for potential ongoing sources of COCs to sediments within East Bay. The CSM will inform other potential assessment needs along potentially complete pathways to East Bay, possibly including erosive shoreline embankments, groundwater seeps, bulkhead drains, and direct overwater or overland flow discharges.

Elevated D/F, cPAHs, and cadmium concentrations throughout East Bay also suggest ongoing contributions from diffuse sources. Diffuse sources may include local and regional background sources that potentially contribute to chemical concentrations in sediments within Budd Inlet. Background concentrations of chemicals such as D/F, cPAHs and metals occur either naturally or can be found in surficial soils and sediments through much of the state due to global use of these chemicals. The potential contributions from these ubiquitous sources and the development of background concentrations for some widespread and/or naturally occurring chemicals are considered data gaps that will be further assessed in the forthcoming Source Control Assessment Memo.

4.4.2 Existing Source Control Data

Multiple studies offer regional- and site-specific information relevant to East Bay source characterization (SAIC 2008; Anchor QEA 2012a, 2012b, 2014, 2016b, 2017; Ecology 2018). These investigations included evaluation of stormwater, catch basin solids, and stormwater sediments, focusing on discharges associated with drainage areas for Moxlie Creek and the Eastbay Redevelopment Site. Additionally, the investigations identified that stormwater discharges potentially contribute to widespread input of COCs to East Bay, particularly D/F and cPAHs. Outfalls discharging to East Bay are shown on Figure 4-12. Further, as shown on Figure 4-13, concentrations of cPAHs in surface sediments requiring remediation are present near some outfalls. As discussed in the Draft Alternatives Memorandum, COCs in sediment are elevated near several of the outfalls, with concentrations decreasing beyond the immediate outfall location. This indicates the significance of evaluating the need for source control measures for the stormwater pathway.

Further, the studies mentioned above and the Draft Alternatives Memorandum identify several historical and ongoing sources that likely contribute to elevated COC concentrations in East Bay sediments. These studies have generally categorized potential historical and ongoing sources to Budd

Inlet as follows: atmospheric deposition, a historical waste pit located at the north end of the Port terminal, other cleanup sites along Budd Inlet, and stormwater and combined sewer overflow (CSO) discharges to East Bay. These potential sources will be further evaluated and discussed in the Source Control Assessment Memo. A comprehensive assessment of these potential sources to East Bay and any potential effect on sediment quality will supplement existing data to determine recontamination potential.

4.4.3 Data Gaps for Source Control Evaluation

It is anticipated that based on the forthcoming preliminary source control strategy framework in the Interim Action Plan, the source control evaluation will primarily focus on sources discharging to East Bay via the stormwater pathway. Specifically, discharges from Moxlie Creek, the Eastbay Redevelopment Site, and other private and public outfalls discharging to East Bay (Figure 4-12). A current evaluation of stormwater discharges to East Bay will need to be completed to fully characterize stormwater sources to East Bay. This evaluation will inform the scope of source control measures that may be required to ensure that the remedy for East Bay remains protective.

Additionally, the recontamination CSM will identify additional sources and pathways to East Bay for further evaluation. This could include additional public and private outfalls not previously investigated, erosive shoreline embankments, groundwater seeps, bulkhead drains, and direct overwater or overland flow discharges.

A refinement of data gaps will be completed based on a comprehensive review of available data following completion of **proposed** sediment chemistry investigation to determine areas of potential impacts. Once specific data gaps have been identified, a sampling and investigation approach will be developed and presented in the Pre-Design Investigation Work Plan. Sampling will require coordination and data collection by multiple parties and landowners, and it will generally target stormwater and catch basin solids from outfalls discharging to East Bay.

4.5 Existing Structures

The project areas covered by this PRD Memo include several existing structures that could potentially affect or be impacted by the remedy construction and that need to be evaluated and addressed during the design process. Because the extents of sediment contamination and required remediation are not fully known, potential impacts on structures cannot be fully quantified or evaluated at this time but will be during remedial design as needed. As such, information on existing structures and potential impacts due to remediation, and existing data needs, are presented. It is anticipated that future studies of structures to be potentially impacted will be performed following additional sediment investigation and remedy development, in coordination with Ecology.

Existing structures within Sub-Area 1 that could be impacted by the remedial action (or have impacts on the remedial action) include the following:

- **Swantown Marina docks, ramps, piling, and marina tenants in the Swantown SMA.** In order to perform the Port's proposed remedy of removing contaminated sediment by dredging, it is anticipated that the existing marina will need to be temporarily relocated. This would require disassembly of the floating docks and removal of existing dock piling. It may be possible to work around the existing shoreline ramp attachment piers. This would be determined during remedial design.
- **Boatworks docks, piers, and piling in the Boatworks SMA.** The Boatworks SMA includes both floating docks and fixed piers. Similar to the Swantown SMA, it is anticipated that the floating docks may need to be relocated to perform the proposed remedial dredging. Dredging would likely be performed around the pile-supported fixed piers, combined with capping as required based on upcoming sampling.
- **Old marina building, including creosote timber piling on east shore of Log Pond SMA.** If the Log Pond CDF is constructed, it is anticipated that this dilapidated, pile-supported structure would be removed.
- **Moxlie Creek Outfall at south end of the Moxlie Creek SMA.** Depending upon the extent of sediment remediation required and the selected remedial alternative, structural or hydrodynamic (discharge) data may be needed regarding the Moxlie Creek Outfall.
- **Other existing outfalls on shorelines of Sub-Area 1.** Several other outfalls are located on the shorelines of Budd Inlet Sub-Area 1. Depending upon the extent of sediment contamination identified during proposed sediment sampling and upon the resulting required remediation and remedial approach in the vicinity of these outfalls, structural data may be required to complete the remedial design in the vicinity of one or more outfalls. Data needs and existing data investigations and evaluations will be performed during design as needed based on remediation requirements.
- **Former Port Berth 4 on the west side of the Log Pond SMA, including remnant piling and dock timbers.** The remnant piling and timber structure that served as Berth 4 may need to be removed to accommodate CDF construction, allow the performance of required sediment remediation, or to satisfy permitting or habitat considerations.
- **Upland structures.** Several existing upland structures, including buildings, roads, and rail tracks, are within the area of potential upland CDF construction. Specific structures that could be impacted will be determined as the size and location of the potential upland CDF are determined. Evaluation of data needs and existing data investigations will be performed during design as needed based on CDF location and sizing.
- **Former railroad embankment and trestle bridge within the West Bay Park segment of Sub-Area 1.** This structure may be removed as part of the remediation project. If the structure is to be removed, data on its construction, including fill type and potential chemical contamination, will be needed for both the portion that would be removed and the remaining surface post removal.

4.5.1 Existing Data on Potentially Impacted Structures

A preliminary review of the existing site conditions and available records was conducted to inform the data gap analysis work. The data required on various structures within Sub-Area 1 depends upon the areas requiring remediation and the remedial method (dredging, capping, etc.). In upland areas, the

location and layout of the potential upland CDF will determine data needs for existing upland structures. The Port is currently planning to demolish and replace the Ports maintenance building, which is located within the area of the Cascade Pole Slurry Wall. The Port is still evaluating the plan for reconstruction of that building, including location.

The following was conducted to support these data review efforts.

- Site condition visual review during a summer, daylight site visit at low tide (July 2022).
- Preliminary-level compilation of readily available historical Port records.
- Interview with Port Staff.
- Publicly available data.

4.5.1.1 Swantown Marina

Records. Compiling a comprehensive collection of available historical records and documentation related to the existing marina infrastructure's age and the marina's construction-material types is ongoing. Records important to the next phase of analysis include information on the concrete floating docks and utilities, and geotechnical data. Additional records are likely available to be acquired for review to help frame a good basis of knowledge for the next phase of assessment work.

Marina Infrastructure Condition. A condition assessment of the marina infrastructure with sufficient recency for evaluating impacts of the planned remedial action was not available at the time of this work. A condition assessment of the marina by dock designation to determine reuse versus replacement for purposes of dock removal to conduct remedy for dredging technology will be required. Condition assessment would include the moorage float concrete pontoons, gangway, utilities, fire suppression, and other infrastructure. Data with respect to current condition and relative to codes and standards under a remove-and-reinstall situation is required.

Geotechnical Conditions. Review of all existing geotechnical records to determine if supplemental borings are needed for locations of pile replacement.

4.5.1.2 Boatworks

Depending upon the extent of remediation, particularly dredging, data will be needed on the dock and pier structures at Boatworks. Research for available existing data, including design drawings and construction records, is ongoing.

4.5.1.3 Shoreline Stability—East Bay

The shoreline slope in many areas (east side of Port Peninsula, western East Bay shoreline) is over-steepened and, in some areas, the upper bank is eroding. Stability of over-steepened slope relative to planned dredge cut and hydrodynamic conditions will be evaluated during design phase based on remediation requirements and methods.

4.5.1.4 Stormwater Outfalls

A condition assessment is needed of outfalls within the site and Sub-Area 1 relative to any remedy; type, size, and age need to be documented.

4.5.1.5 Moxlie Creek

A hydrologic assessment may be needed to evaluate the hydrodynamics of the Moxlie Creek outlet and the corresponding effect on the East Bay bottom tidal channel condition, depending upon the selected remedy and future sediment sampling in the area adjacent to the outfall. If capping or another remedy with the potential for erosion is constructed, information on discharge flow volumes and velocities will be needed to evaluate remedy stability.

4.5.1.6 Log Pond Potential Confined Disposal Facility

The shoreline condition adjacent to the proposed Log Pond CDF needs to be evaluated. The presence of armoring, habitat, and physical processes that currently exist (intertidal substrate and nearshore geomorphologic processes) is not currently documented.

4.5.2 Data Gaps Regarding Existing Structures

A data gap analysis was conducted based on a review of available existing information and was supplemented with a site visit. The focus of the data gap analysis is on implementation of the Port's proposed remedy from the Draft Alternatives Memorandum (DOF et al. 2023), within the East Bay and the proposed nearshore CDF in the former Log Pond area, and does not include West Bay or the commercial Marine Terminal berthing areas.

- **Swantown Marina.** Dredging for remediation of contaminated sediments within the marina is anticipated to require temporary removal of existing moorage float facilities. The removal and reinstallation may require moorage float infrastructure replacement for some portions of the marina, depending on the age and condition of existing structures. Creosote timber piles will require replacement with steel or concrete piles as required by regulatory agencies (Washington Department of Fish & Wildlife and USACE). Electrical, fire suppression, and Americans with Disabilities Act (ADA) code and regulatory compliance considerations could be a factor for reinstallation of moorage floats, because they could constitute a non-conforming structure relative to current codes and standards. The infrastructure within the marina will require evaluation and assessment relative to the planned sediment remediation by dredging and to the work sequencing plan to determine a comprehensive understanding of the scope of improvements needed to implement the Port's proposed remedy.
- **Boatworks.** Data on the existing structures, including pile embedments, will be required to evaluate the potential impacts of any remedial action.
- **Moxlie Creek.** Moxlie Creek discharges through a large culvert at the southern boundary of East Bay. If sediment remediation with the potential to impact the outfall structure is determined necessary based on future sediment sampling, data on the existing structural integrity of the outfall may be needed. This will be evaluated during remedial design.

- **Nearshore CDF.** The former Log Pond area located at the northwest corner of the Port Peninsula and adjacent to the commercial-berth Marine Terminal is a potential CDF for placement of dredged material. The CDF will require the construction of a containment structure and shoreline stabilization. The former Log Pond area is bordered by derelict structures to the west (portions of the old Marine Terminal) and east (former marina building).

4.6 Geotechnical Data

Geotechnical data are required to support several elements of the remedial design, including In-Water and Upland CDF construction, Swantown Marina removal and reconstruction, and dredging within the Boatworks area. Determining the geotechnical properties of the dredged material is also required.

This PRD Memo presents a summary of geotechnical data needs for design of dredging and dredging-related portions of the remedial action in East Bay. The data gaps discussed herein assume that dredging for East Bay is the Port's proposed remedy and that data will be collected to support evaluations of sediment reuse and disposal options. The geotechnical data gaps summarized in this PRD Memo are also specific to support of the evaluation and ultimate design of both in-water and upland CDFs and of other upland sediment reuse scenarios to address SLR concerns. Table 4-8 presents a summary of relevant historical geotechnical explorations; relevant historical geotechnical explorations and geotechnical data gaps are presented in the sections below.

4.6.1 Historical Geotechnical Explorations

Numerous previous investigations have advanced geotechnical explorations in and around the Port of Olympia. Although CPTs have been advanced for some studies, historical geotechnical explorations include primarily conventional geotechnical borings with standard penetration test data and laboratory index tests (i.e., specific gravity, water content, grain size, in situ density, and Atterberg Limits). Some investigations have included advanced laboratory tests to determine the strength or compressibility characteristics of soils; however, the number of such tests is limited, and most of these investigations were completed in the 1970s and 1980s.

Historical geotechnical explorations for pre-remedial design have been identified for sediment properties relative to general sediment management, nearshore CDF design, and upland CDF design. Historical geotechnical explorations reviewed and determined to be related to these remedial and design elements are listed in Table 4-9. Figure 4-15 illustrates locations of relevant historical geotechnical explorations identified during the historical data-review process. Historical geotechnical data are summarized as follows:

- Sediment properties for sediment management.
 - As shown on Figure 4-15, numerous subsurface investigations were advanced in the late 1960s, 1970s, and early 1980s in the East Bay sediment management area. Owing to the age of these explorations, subsequent changes in site geometry, and relatively low confidence in the position accuracy of many of these explorations, their utility for current geotechnical design is limited. Of the numerous explorations advanced in the

sediment management area, only one was advanced more recently than 1982. Of these explorations, 15 were advanced to depths greater than 50 feet (ft) below ground surface (BGS) at the time of exploration. While historical explorations in the sediment management area may be useful for understanding the distribution of various soil units within the subsurface, owing to their age and changing site conditions they will not be reliable for determining the engineering parameters (such as density, compressibility, or strength) of these soils.

- Nearshore CDF design.
 - As shown on Figure 4-15, eight (8) explorations have been advanced previously within or immediately adjacent to the Nearshore CDF project component. Six (6) of these explorations were advanced in 2013; two (2) were advanced in the mid-1980s. Four (4) of the explorations extend 100 ft or more BGS. Four (4) of the explorations extend between 48 and 60 ft BGS. Explorations consisted of conventional geotechnical borings with standard penetration test (SPT) blow counts supplemented with geotechnical index tests. A limited amount of laboratory strength and compressibility testing was conducted for these historical explorations.
- Upland CDF design and SLR/shoreline resiliency placement design
 - As shown on Figure 4-15, historical explorations are absent from the Upland CDF area, except for two 2013-era explorations at the far western margin of this project area.

4.6.2 Geotechnical Data Gaps

Geotechnical data gaps for pre-remedial design have been identified for sediment properties relative to general sediment management, nearshore CDF design, upland CDF design, and SLR/shoreline resiliency placement design. Geotechnical data gaps related to these remedial and design elements are as follows:

- Sediment properties for sediment management.
 - Additional in-water exploration will be required to characterize the physical and strength properties of the sediment and to support design of replacement float piles within the marina. Borings will generally extend 50 ft below the mudline. To support float pile design, one-dimensional consolidation tests and consolidated, undrained triaxial tests will also be completed.
 - To support dredge spoils characterization, samples collected within the anticipated dredging depths will be tested for bulk density, grain size, plasticity, and moisture content.
 - Geophysical surveys will be completed across the dredge area to determine sediment thickness.
- Nearshore CDF design.
 - Additional in-water and upland explorations will be required to characterize seismic characteristics, soil compressibility, and shear strength for use in designing sheet piles and lateral restraint systems. In-water explorations will likely extend 150 ft below the mudline, and upland explorations will likely extend 100 ft below the mudline. Samples collected from geotechnical explorations will be tested for grain size, plasticity, and

moisture content. One-dimensional consolidation tests and consolidated, undrained triaxial tests will also be completed on the samples collected.

- Geophysical surveys will be completed at the site to determine the average shear wave velocity of the soils present at the site.
- Upland CDF design and SLR/shoreline resiliency placement design.
 - Upland explorations will be required to characterize soil compressibility, for use in evaluating settlement resulting from the proposed fill placement. Explorations will extend until non-compressible material is encountered, anticipated to be 100 ft or less below ground surface. One-dimensional consolidation tests will be completed on samples collected from the explorations.

4.7 Permitting and Habitat Data

4.7.1 Required Permitting Data

High Tide Line (HTL): The jurisdictional line for Section 10/404 permitting is the HTL. This line is field-located, site-specific, and is not correlated to any site-wide elevation. This line must be delineated in the field and included in the figure set.

Salt marsh coverage: Salt marsh—a type of coastal wetland—is present along much of the Budd Inlet shoreline, and much of the remedial area. Owing to the potential for remedial design to affect saltmarsh, the extent of salt marsh must be known for permitting in order to track any impacts.

Salt marsh elevation: The elevation at which salt marsh begins and ends would need to be established with confidence. This information would drive remedial design alternatives, as well as mitigation needs.

Shoreline habitat conditions survey work plan: A shoreline habitat survey would characterize shoreline habitat conditions for the purpose of informing remedial design. Prior to the survey, a habitat survey work plan must be developed by the Port and approved by Ecology, which describes the data to be collected and the format in which it would be reported.

Shoreline habitat conditions survey: The shoreline habitat survey described in the work plan above would need to be conducted to collect data necessary for permitting. Habitat conditions include slope, substrate, and vegetation coverage. These data are necessary to characterize the habitat that may be affected by remediation.

Select sampling locations: The permitting process may require location-specific chemical contamination data. Specific locations are not determined, but the habitat and permitting team would need the opportunity to direct the location of some samples, as applicable.

Bathymetry: Bottom depths of areas to be remediated would need to be known with a high degree of certainty and precision. This information would drive the calculations of the changes in aquatic habitat by elevation zone.

Benthic debris: The presence of debris on the benthic surface of the areas to be affected by remediation would affect the valuation of this habitat, and thus would need to be known for permitting in order to account for habitat impacts.

Overwater structures: If any overwater structures would be affected by the remedial action (i.e., removed or altered), these would need to be described in detail, including square footage, composition materials, pile counts, pile diameter, and whether the structures would be rebuilt.

Areas and volumes of removal and fill: Any sediment that would be removed or placed below the HTL would need to be quantified. This would include any contaminated sediment removed as part of remedial actions, any backfill or capping material, any armoring material, and any other aggregate material placed or removed.

Presence/absence of contaminants in potential habitat areas: For all areas in the West Bay that would be excavated to create habitat, the sediment must be sampled for chemical contamination. Characterization must be sufficient to both confirm that the leave surface will meet sediment chemical standards and to inform proper disposal of the removed material. The habitat permitting team would provide input into sample locations.

4.7.2 Existing Permitting and Habitat Data

There is limited up-to-date data available to support project permitting or habitat evaluations. Previously the project completed limited initial evaluations of existing benthic debris and overwater structures. Up to date data will be needed to evaluate habitat conditions. Areas where data are needed depend upon area requiring remediation, remedial approach and related permitting, mitigation of habitat restoration needs.

General natural resource information can be found in the following:

- Coast & Harbor Engineering's *City of Olympia West Bay Environmental Restoration Assessment* (Coast & Harbor Engineering 2016)
- JA Brennan Associates' *West Bay Park Recreation, Trail & Restoration Analysis Report* (JA Brennan Associates 2019)
- JA Brennan Associates' *City of Olympia West Bay Restoration & Park Master Plan Alternatives 1, 2 & 5 Comparison Memorandum* (Brennan 2022).
- Additionally, Grette Associates has prepared a draft *Shoreline and Intertidal Habitat Technical Memorandum*, which provides qualitative shoreline habitat data for the remedial area. A more detailed shoreline habitat conditions survey will be conducted prior to remedial design.

4.7.3 Permitting and Habitat Data Gaps

High Tide Line: The HTL has not been delineated at the site. A site visit to delineate the HTL per USACE guidance along the entirety of the remedial area will be necessary for permitting.

Salt marsh elevation: The precise elevation bounds of salt marsh have not been determined at the site. This will be needed during consideration of design alternatives in order to quantify habitat effects.

Salt marsh coverage: Total coverage and extent of salt marsh has not been mapped. This would be done by conducting a site visit to record the extent of salt marsh using a sub-meter global positioning system (GPS).

Shoreline habitat conditions survey work plan: A habitat conditions survey work plan has not yet been prepared; a work plan must be prepared by the Port and approved by Ecology prior to conducting the survey.

Shoreline habitat conditions survey: Data on habitat conditions have not been collected. Following approval of the work plan described above, the habitat conditions survey must be conducted prior to beginning the permitting process.

Select sampling locations: As stated above, the permitting team would need the opportunity to provide input into the specific locations of sediment contaminant samples. Any specific sampling locations will be identified through the permitting process and will coincide with other sampling work.

Areas and volumes of removal and fill: Removal/fill volumes would be calculated as part of the remedial design process.

Presence/absence of contaminants in potential habitat areas: Chemical contamination data are sparse along the west shore of West Bay, where potential mitigation actions could be implemented. Additional sampling in this area is necessary. The habitat permitting team would need to provide input into the sample locations.

5.0 NEXT STEPS

This Pre-Remedial Design Data Gaps Memorandum is for Sub-Area 1 of three Sub-Areas within the overall Budd Inlet Sediment Site. Sub-Area 1 is the focus of current work, and future submittals will also be appropriately focused on Sub-Area 1. As work related to Sub-Area 1 is advanced, work will be continued throughout Sub-Areas 2 and 3 to encompass the overall Budd Inlet Site.

Consistent with that focus on Budd Inlet Sub-Area 1, the next AO-required submittal is anticipated to be the Pre-Remedial Design Investigation Work Plan for Sub-Area 1, focused on sediment chemistry data collection. Collection and evaluation of that sediment chemistry data will allow for refinement of the nature and extent of sediment contamination within Sub-Area 1 and subsequent reevaluation of proposed remedial alternatives. Additional work plans will then be prepared and submitted for source control, upland investigations, and additional structural investigations based on revised remedial alternatives based on the proposed sediment chemistry investigation.

Subsequent similar work plans will then be prepared for Budd Inlet Sub-Areas 2 and 3.

Based on the deliverables required by the AO and the AO-required schedule, assuming 60 days for Ecology review of each submittal results in the Pre-Remedial Design Field Investigation starting around August or September 2024, less than a year from now. To expedite the project, the Port would like to work with Ecology to move forward with performance of initial Pre-Remedial Design Field Investigation in Fall-Winter 2023.

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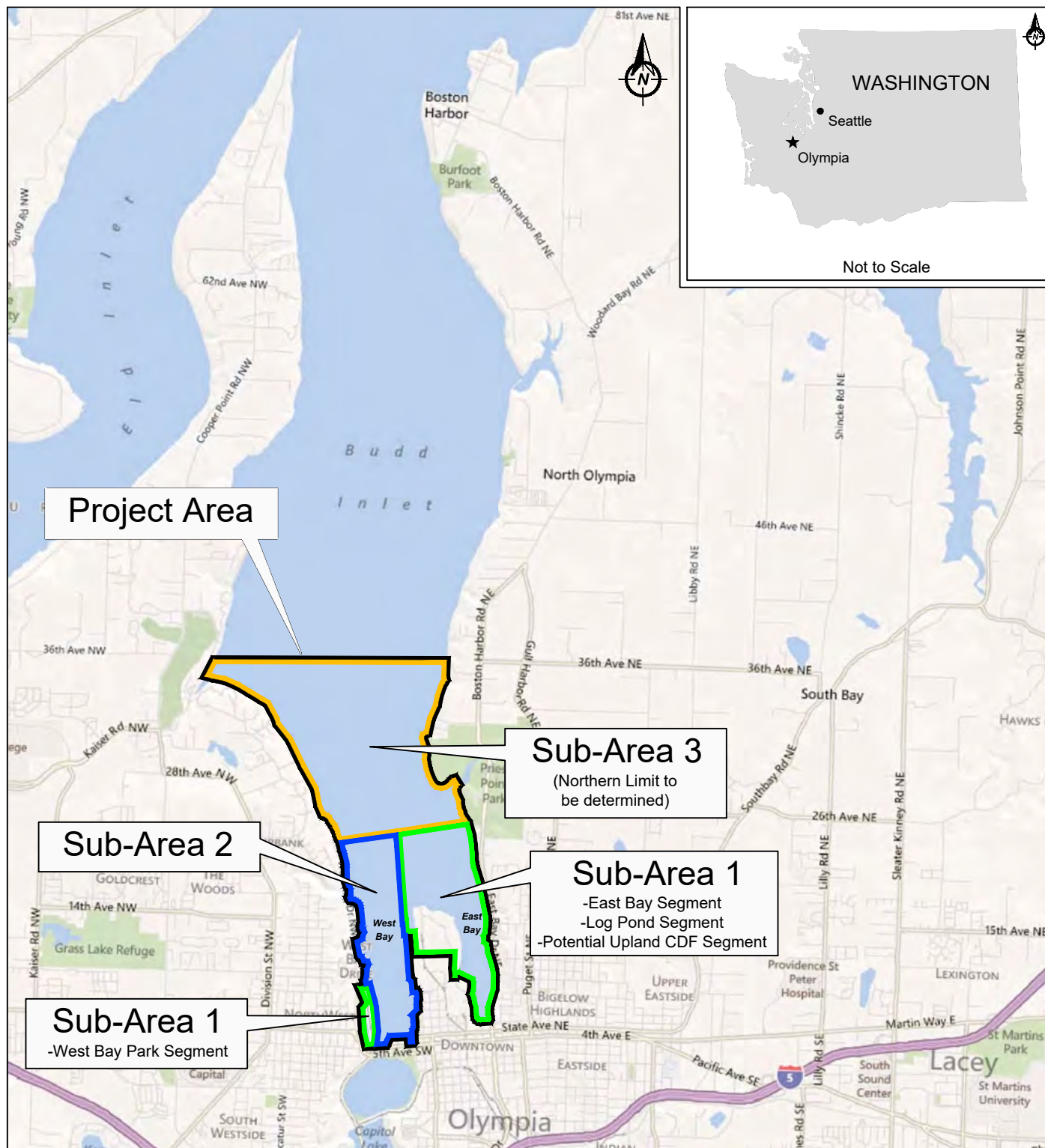
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Note

1. Background imagery: Bing Maps
2. All boundaries are approximate.

Legend

- Project Area (Northern Limit to be determined)
- Sub-Area 1
- Sub-Area 2
- Sub-Area 3 (Northern Limit to be determined)

0 0.5 1
Scale in Miles

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**Vicinity Map &
Budd Inlet Project Sub-Areas**

**Figure
1-1**

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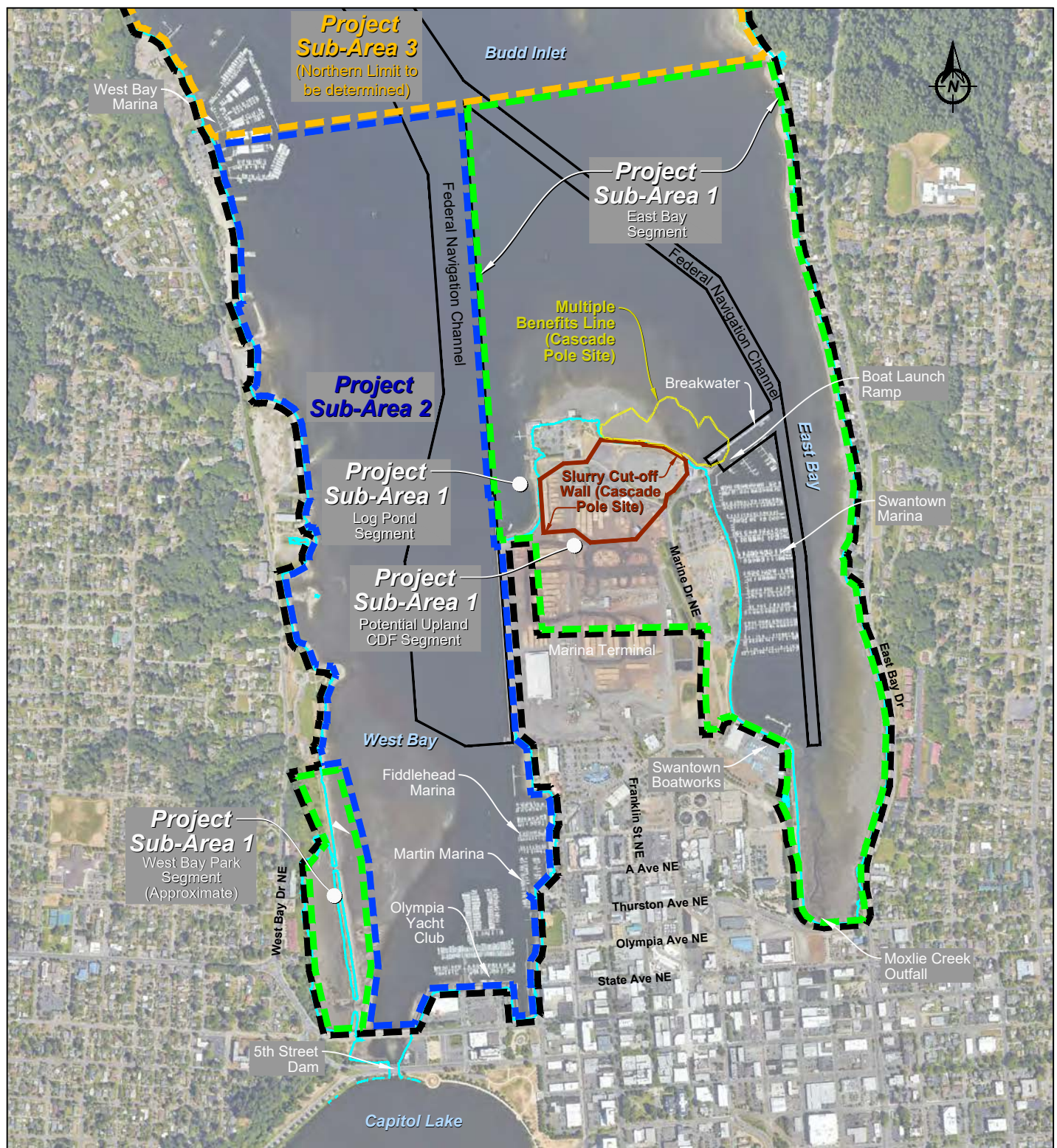
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Notes

1. Horizontal Datum: Washington State Plane South, NAD83.
2. Background imagery: Google Earth Pro, 07/25/2022.
3. All boundaries are approximate.

Legend

- | | |
|----------------|--|
| — Project Area | — Multiple Benefits Line (Cascade Pole Site) |
| — Sub-Area 1 | — Slurry Cut-off Wall (Cascade Pole Site) |
| — Sub-Area 2 | — Federal Navigation Channel |
| — Sub-Area 3 | — Mean Higher High Waterline (MHHW) |

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**Project Areas & Site Features
in South Budd Inlet**

**Figure
1-2**

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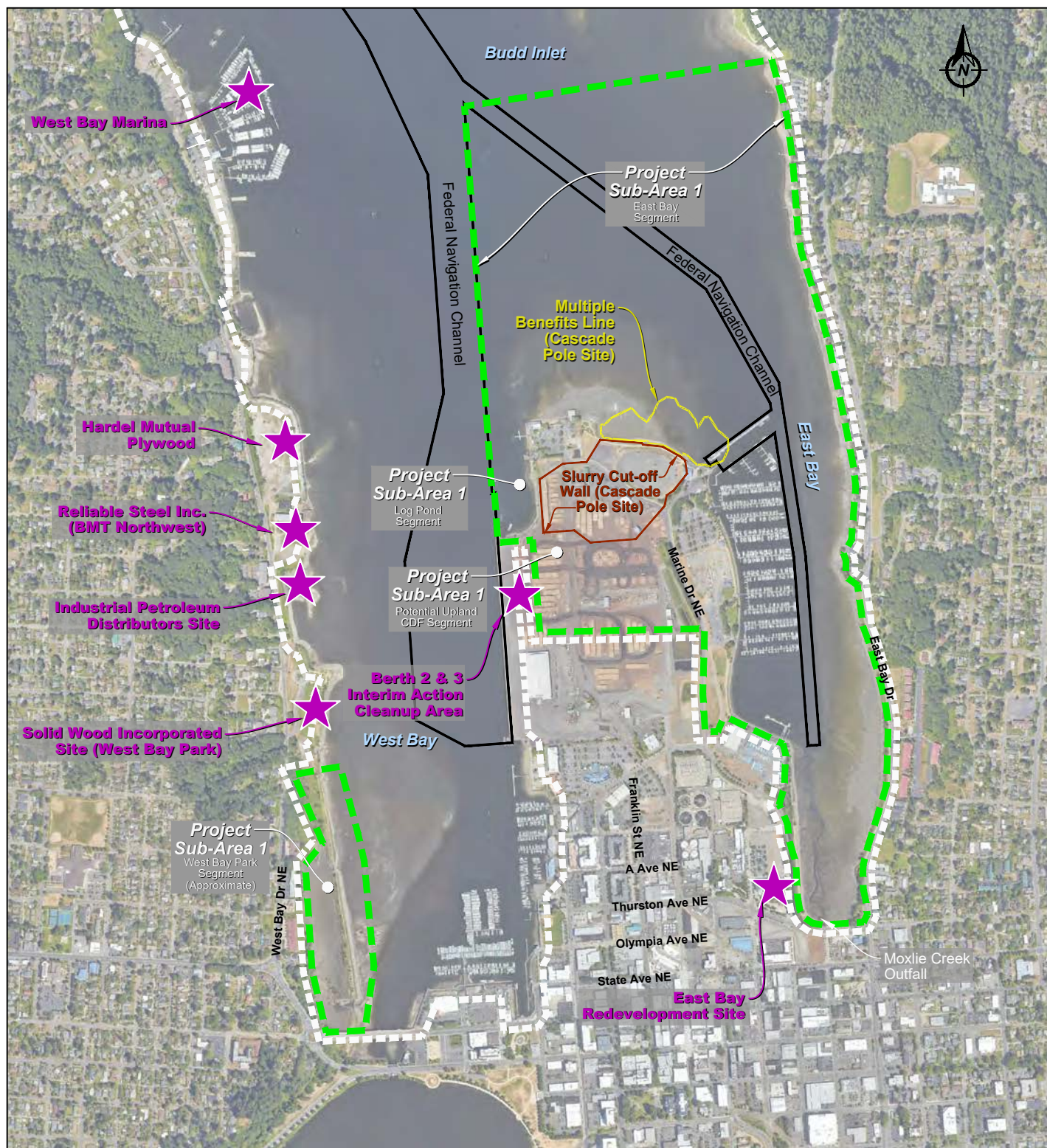
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Notes

1. Background imagery:
Google Earth Pro, 07/25/2022.
2. Source: Department of Ecology Website

Legend

- Known Contaminated Site
- Project Area
- Sub-Area 1
- Multiple Benefits Line (Cascade Pole Site)
- Slurry Cut-off Wall (Cascade Pole Site)
- Federal Navigation Channel

0 600 1200
Scale in Feet

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**Locations of
Other Known Contaminated Sites**

**Figure
2-1**

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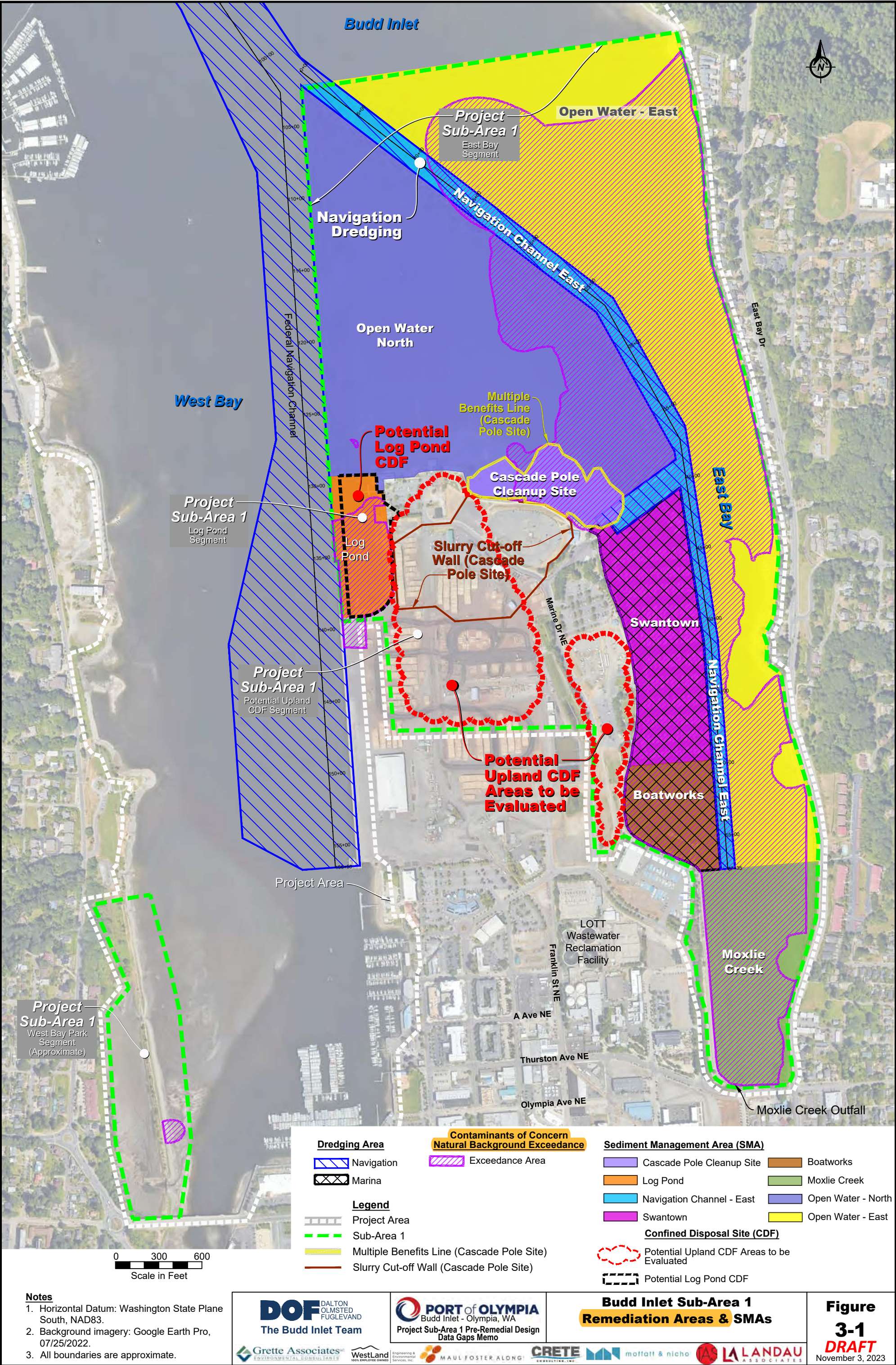
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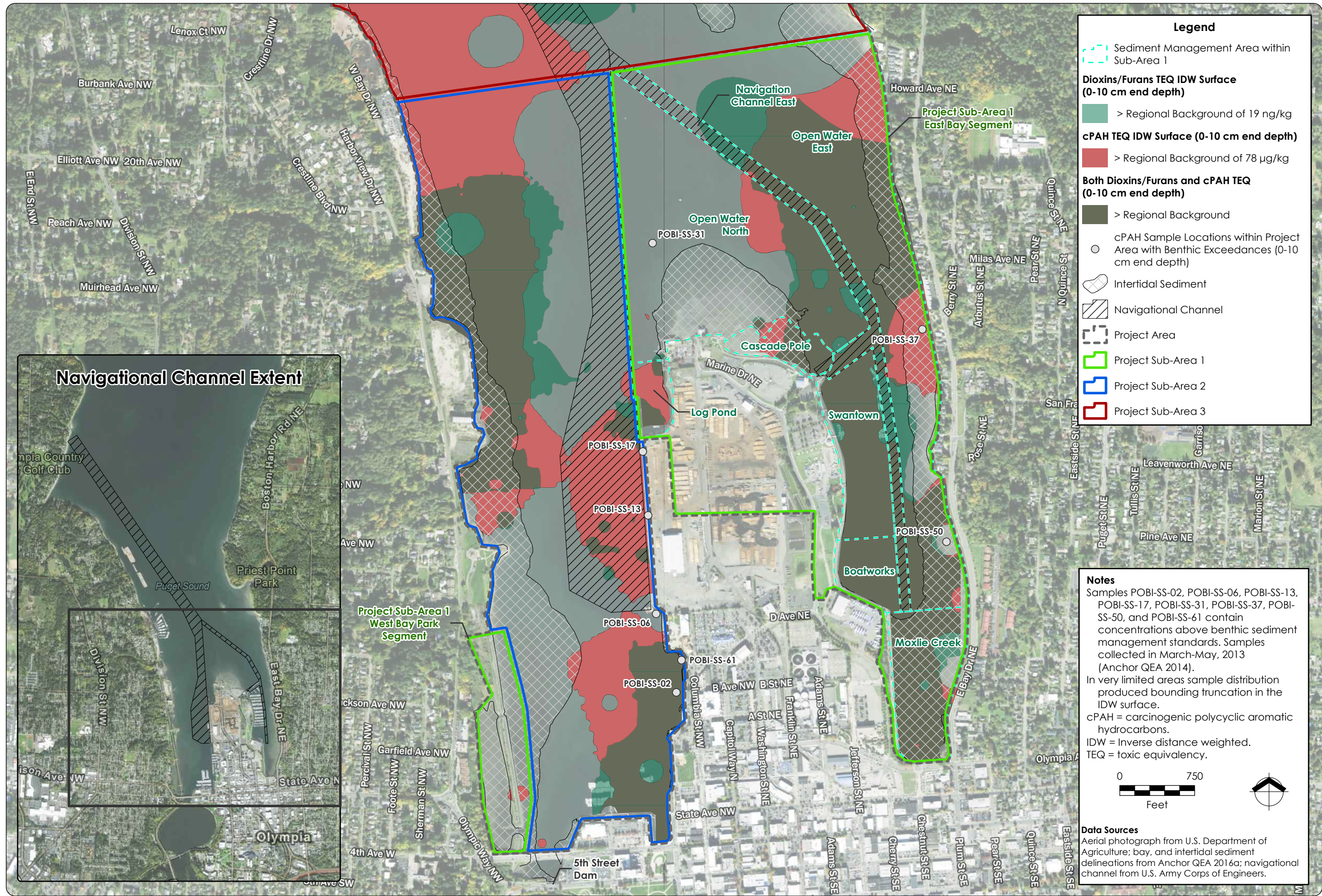


Figure 3-2

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Regional Background and Sediment Management Context

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Legend

- Potential Billy Frank Jr. Trail Improvements
- Potential Log Pond CDF
- Potential Shoreline Enhancement
- Potential Upland CDF Areas

Notes

1. Upland beneficial reuse options are conceptual. Final options and associated footprints will be determined during design.
2. Upland CDF construction would be phased as required to accommodate dredge timeline and Port property operational needs.
3. Beach Enhancement Area would be constructed utilizing clean sediment or import fill materials.
4. CDF=Confined Disposal Facility
5. All boundaries are approximate.
6. Background imagery: Google Earth Pro, 07/25/2022.

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**Sediment Management
Beneficial Reuse Options**

**Figure
3-3
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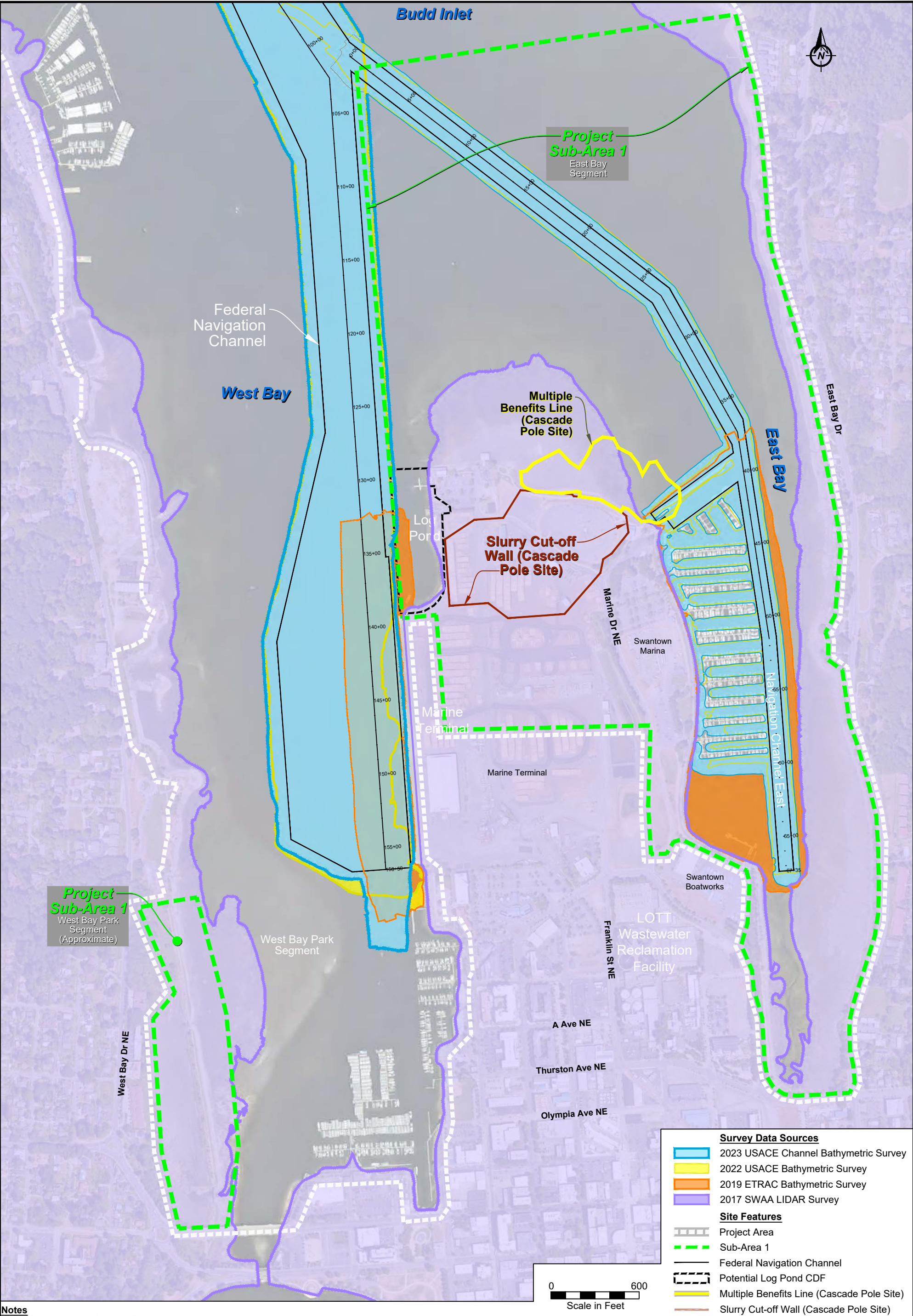
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Notes

1. Surface generated from the following surveys: 2017 SWAA LIDAR uplands, 2019 Etrac Condition Survey, 2023 USACE Condition Survey.
2. Data sets earlier than 2017 not included due to obsolescence.
3. Horizontal Datum: Washington State Plane South, NAD83.
4. Background imagery: Google Earth Pro, 07/25/2022.

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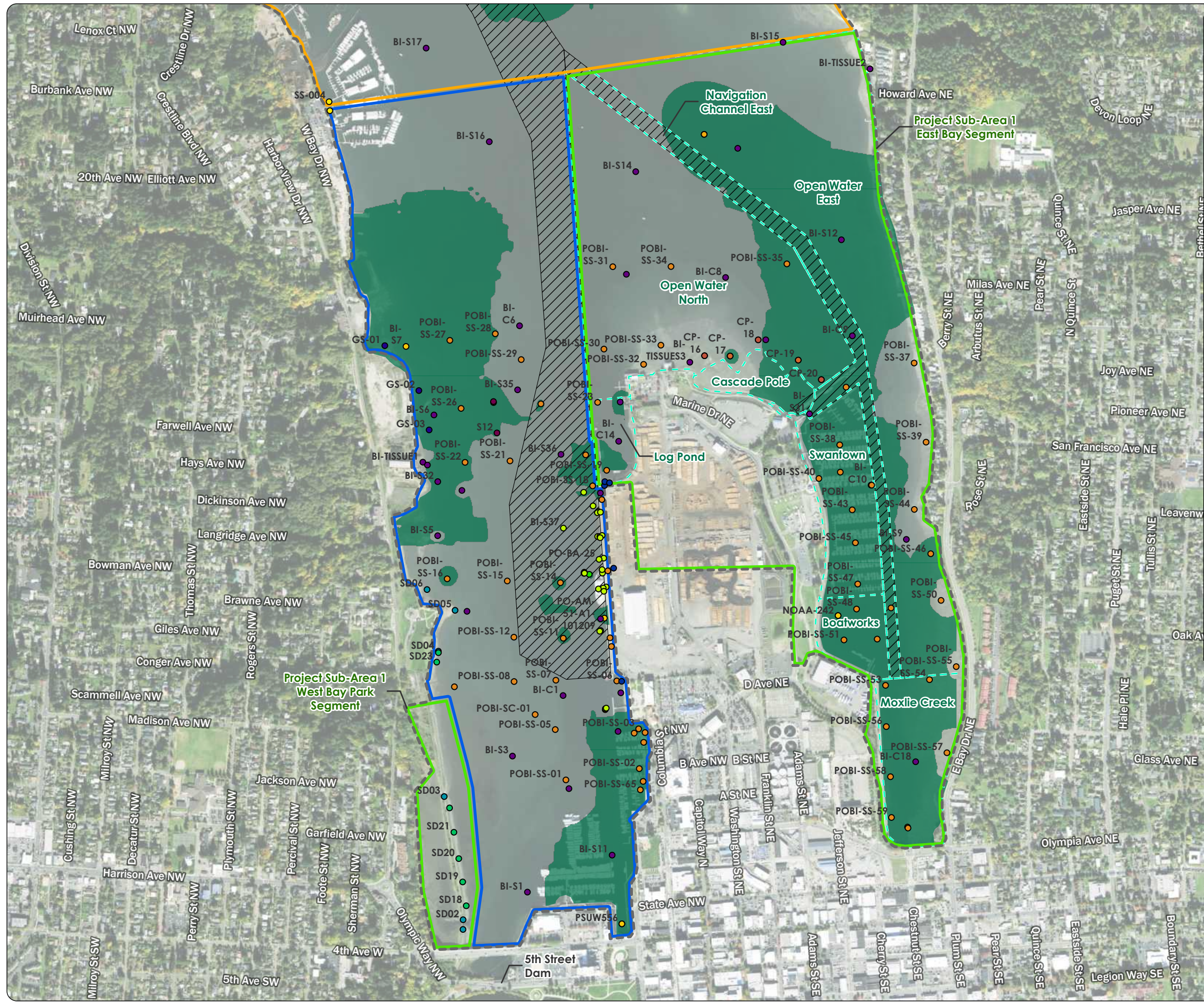
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Existing Survey Coverage

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Legend

Dioxin/Furan Sample Locations within Project Area (0-10 cm end depth)

EIM Study Name, Year Sampled

- OHPSD06, 2006
- BUDD07, 2007
- Budd Inlet Hardel 07, 2007
- Budd Inlet W Bay 07, 2007
- FS94656838Ph2, 2007
- WB1577RIFS, 2008
- Marine Terminal, 2009
- Marine Terminal, 2010
- AODE5272, 2011
- BuddOakDioxins, 2011
- UWI2011, 2011
- POBI2013, 2013
- FS1385, 2017
- FS1385, 2022

Dioxins/Furans TEQ IDW Surface (0-10 cm end depth)

- > Regional Background of 19 ng/kg
- Sediment Management Area within Sub-Area 1
- Navigation Channel
- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3

Notes

See Table X-X for complete sample data source information.
Not all sample locations labeled due map scale limitations.
In very limited areas sample distribution produced bounding truncation in the IDW surface.
EIM = Washington State Department of Ecology's Environmental Information Management database.
IDW = Inverse distance weighted.
TEQ = toxic equivalency.

Data Sources

Aerial photograph from U.S. Department of Agriculture; navigational channel from U.S. Army Corps of Engineers.

0 750 Feet

Figure 4-2

Dioxins/Furans Sediment Surface (0-10 cm end depth) Sample Density

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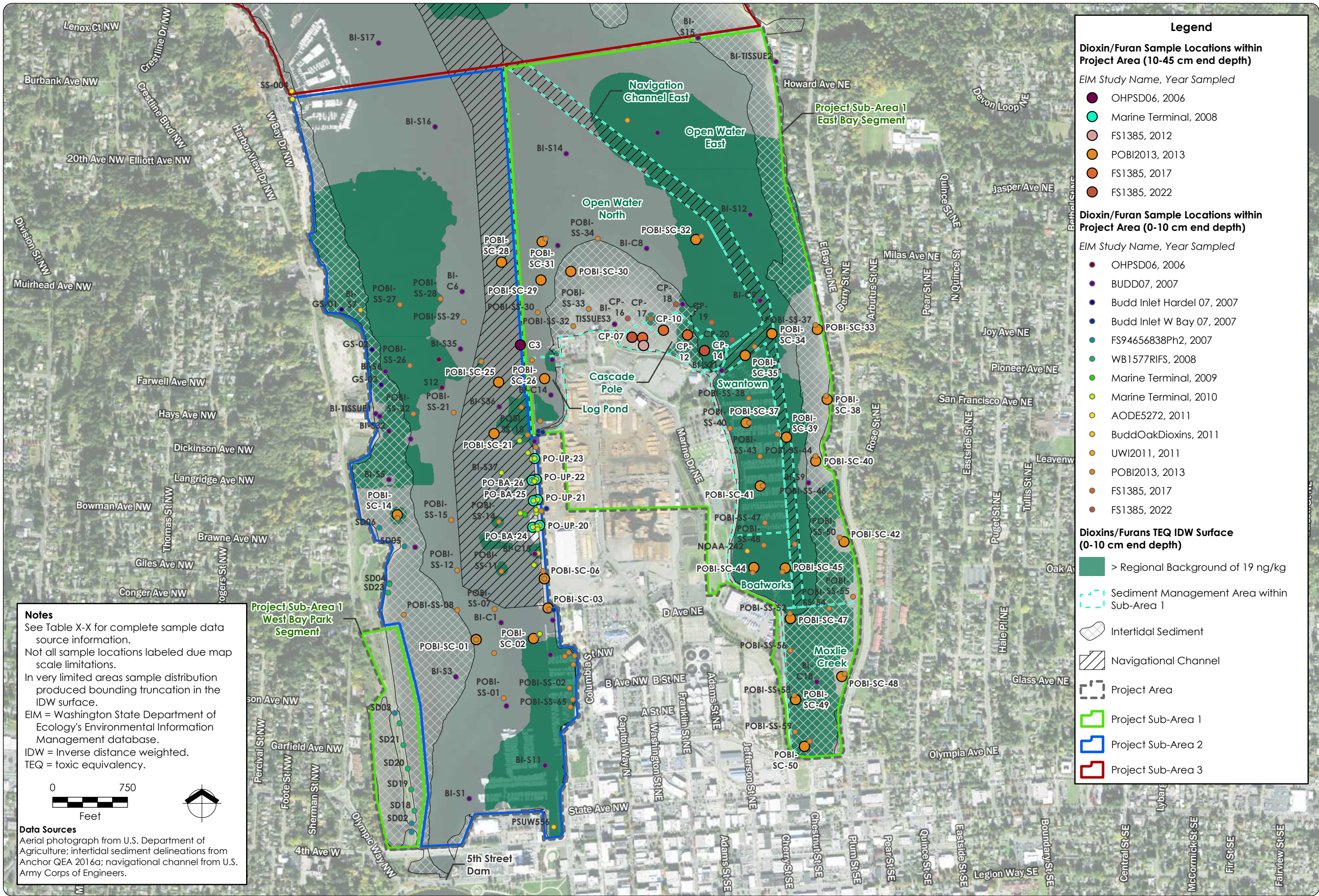


Figure 4-3

Dioxins/Furans Sediment Near-Surface (0-45 cm end depth) Sample Density

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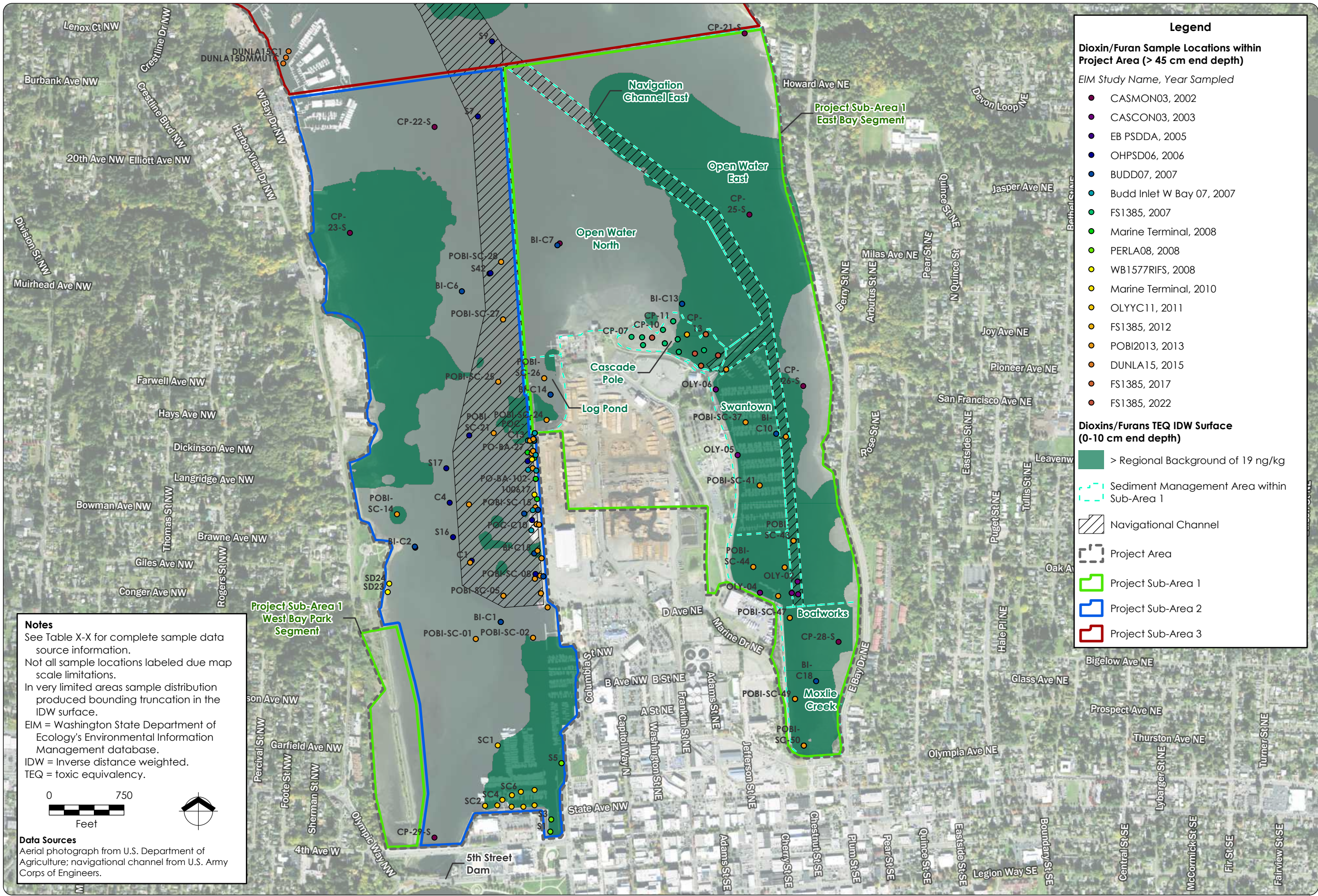


Figure 4-4
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Dioxins/Furans Sediment Subsurface (> 45 cm end depth) Sample Density

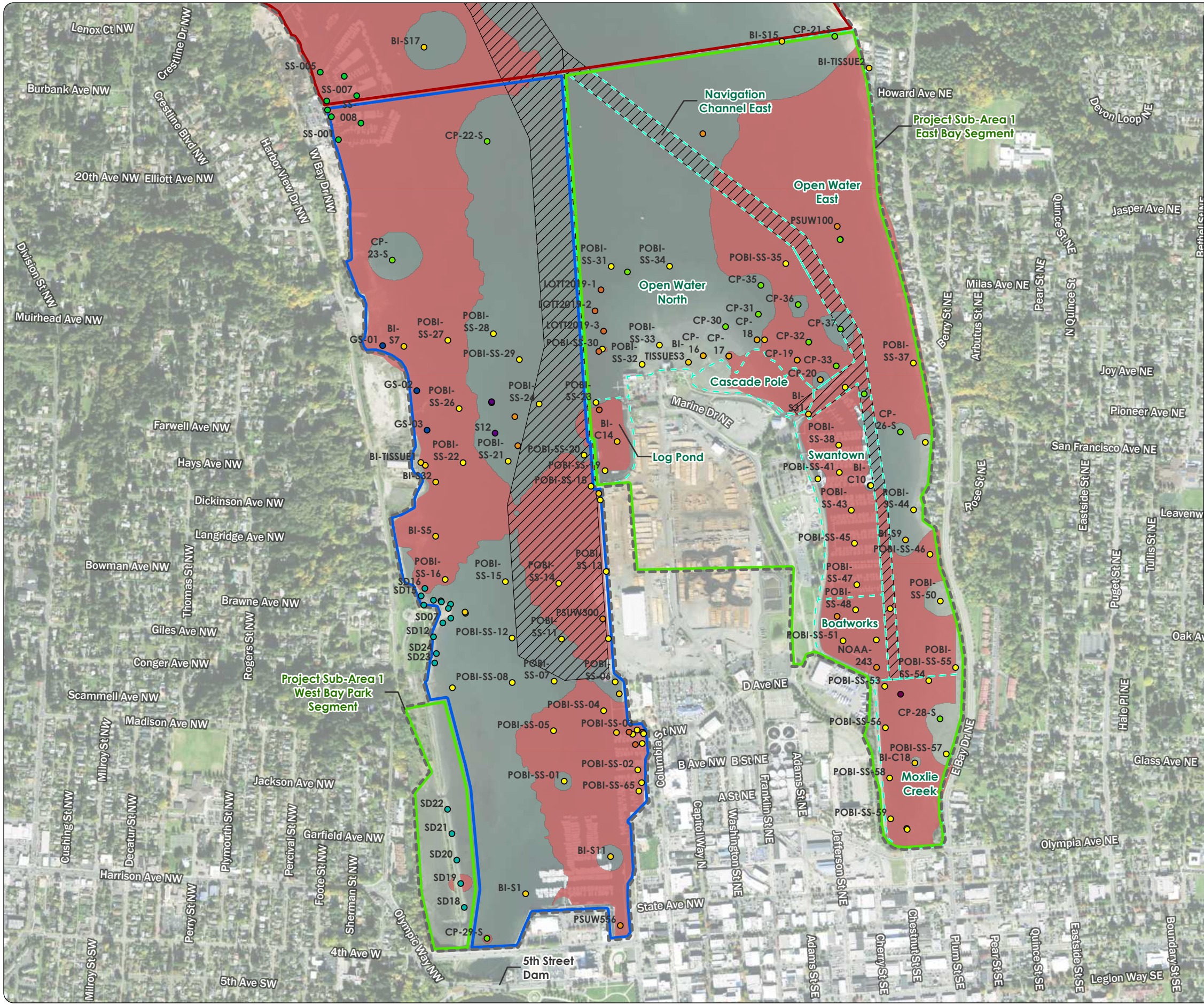
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Legend

cPAH Sample Locations within Project Area (0-10 cm end depth)

EIM Study Name, Year Sampled

- AJOH0049, 2006
- OHPSD06, 2006
- Budd Inlet Hardel 07, 2007
- WB1577RIFS, 2008
- AODE5272, 2011
- FS1385, 2013
- POBI2013, 2013
- PSEMP_LT, 2016
- FS1385, 2017
- UWI, 2018
- LOTT2019, 2019
- FS1385, 2022

cPAH TEQ IDW Surface (0-10 cm end depth)

- > Regional Background of 78 µg/kg
- Sediment Management Area within Sub-Area 1
- Navigation Channel
- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3

Notes

See Table X-X for complete sample data source information.
Not all sample locations labeled due map scale limitations.
In very limited areas sample distribution produced bounding truncation in the IDW surface.
cPAH = carcinogenic polycyclic aromatic hydrocarbons.
EIM = Washington State Department of Ecology's Environmental Information Management database.
IDW = Inverse distance weighted.
TEQ = toxic equivalency.

Data Sources

Aerial photograph from U.S. Department of Agriculture; navigational channel from U.S. Army Corps of Engineers.

0 750 Feet

Figure 4-5

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CPAH Sediment Surface (0-10 cm end depth) Sample Density

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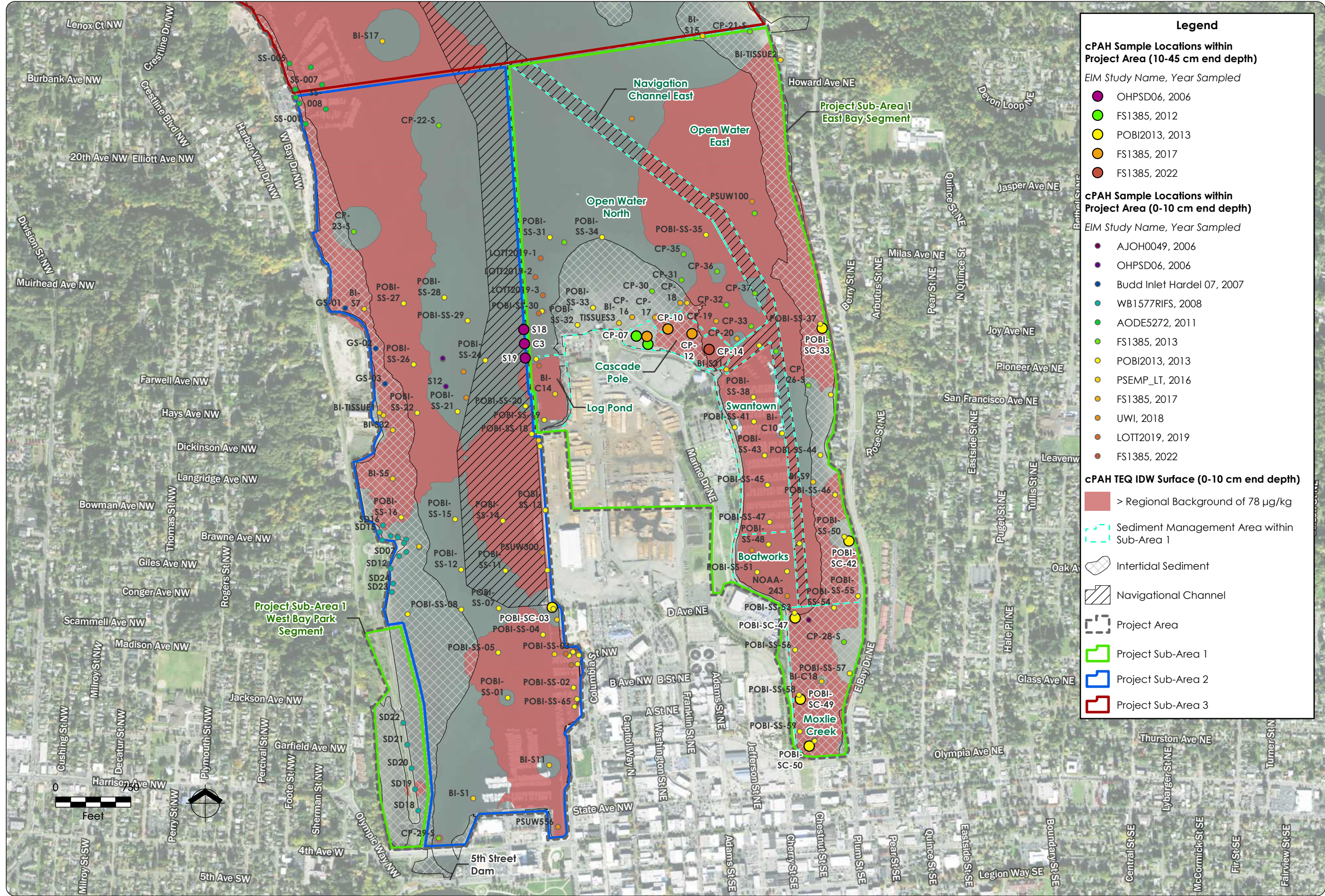


Figure 4-6

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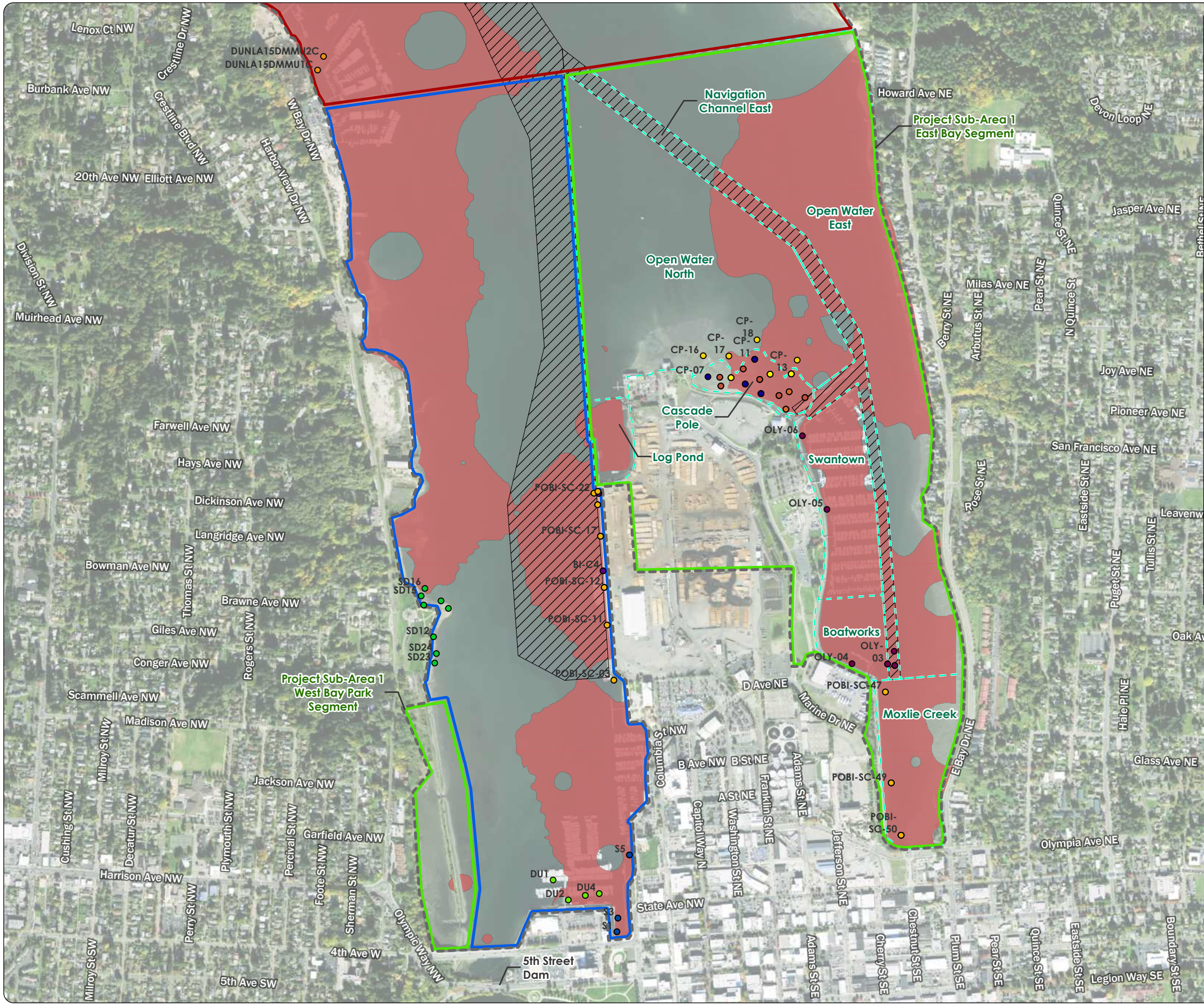
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cPAH Sample Locations within Project Area (> 45 cm end depth)

EIM Study Name, Year Sampled

- EB PSDDA, 2005
- BUDD07, 2007
- FS1385, 2007
- PERLA08, 2008
- WB1577RIFS, 2008
- OLY11, 2011
- FS1385, 2012
- FS1385, 2013
- POBI2013, 2013
- DUNLA15, 2015
- FS1385, 2017
- FS1385, 2022

cPAH TEQ IDW Surface (0-10 cm end depth)

- > Regional Background of 78 µg/kg
- Sediment Management Area within Sub-Area 1
- Navigation Channel
- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3

Notes

See Table X-X for complete sample data source information.
Not all sample locations labeled due map scale limitations.
In very limited areas sample distribution produced bounding truncation in the IDW surface.
cPAH = carcinogenic polycyclic aromatic hydrocarbons.
EIM = Washington State Department of Ecology's Environmental Information Management database.
IDW = Inverse distance weighted.
TEQ = toxic equivalency.

Data Sources

Aerial photograph from U.S. Department of Agriculture; navigational channel from U.S. Army Corps of Engineers.

0 750
Feet

Figure 4-7

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CPAH Sediment Subsurface (> 45 cm end depth) Sample Density

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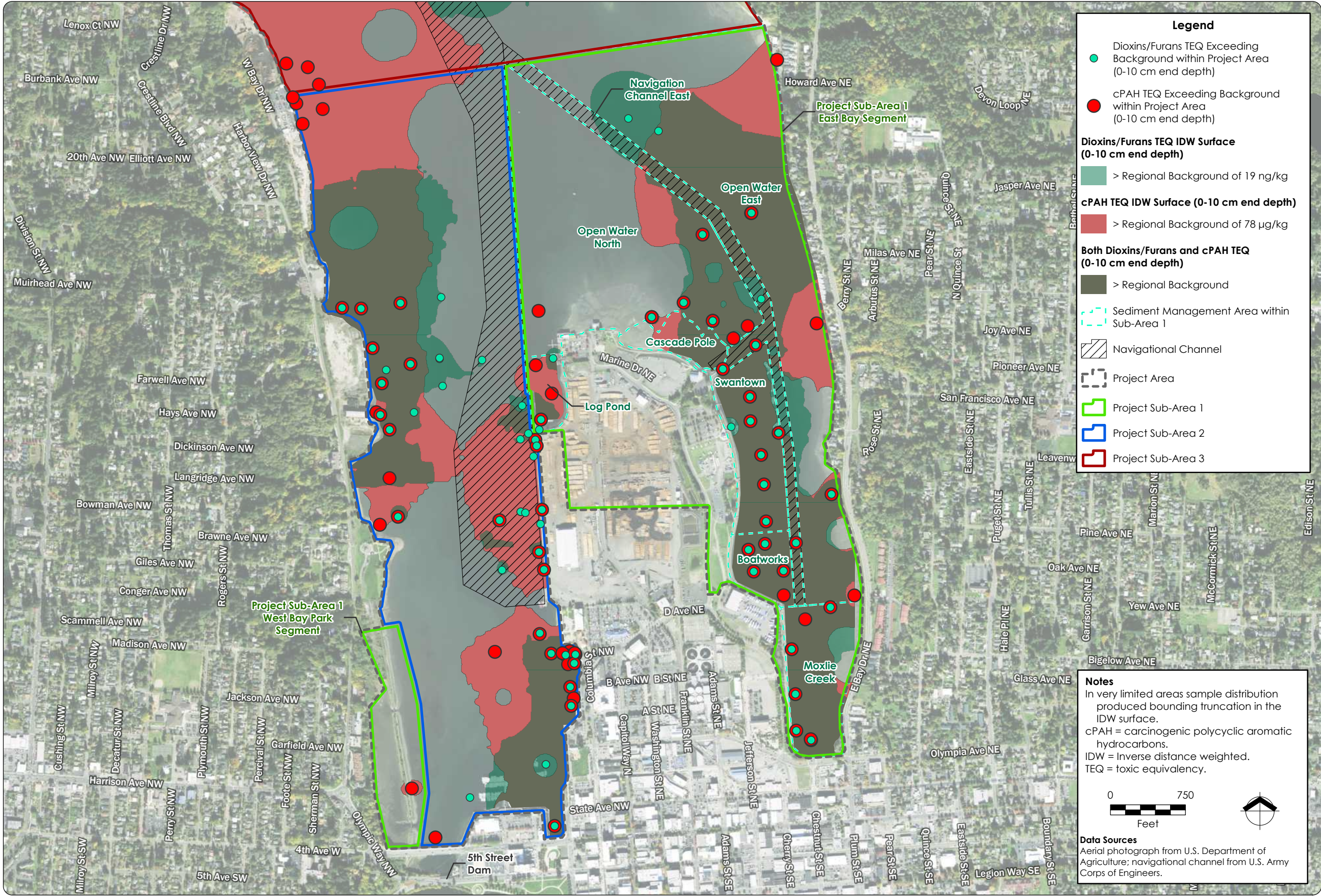


Figure 4-8

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Dioxin/Furans and cPAH TEQ Sediment Surface (0-10 cm end depth) Regional Background Exceedance

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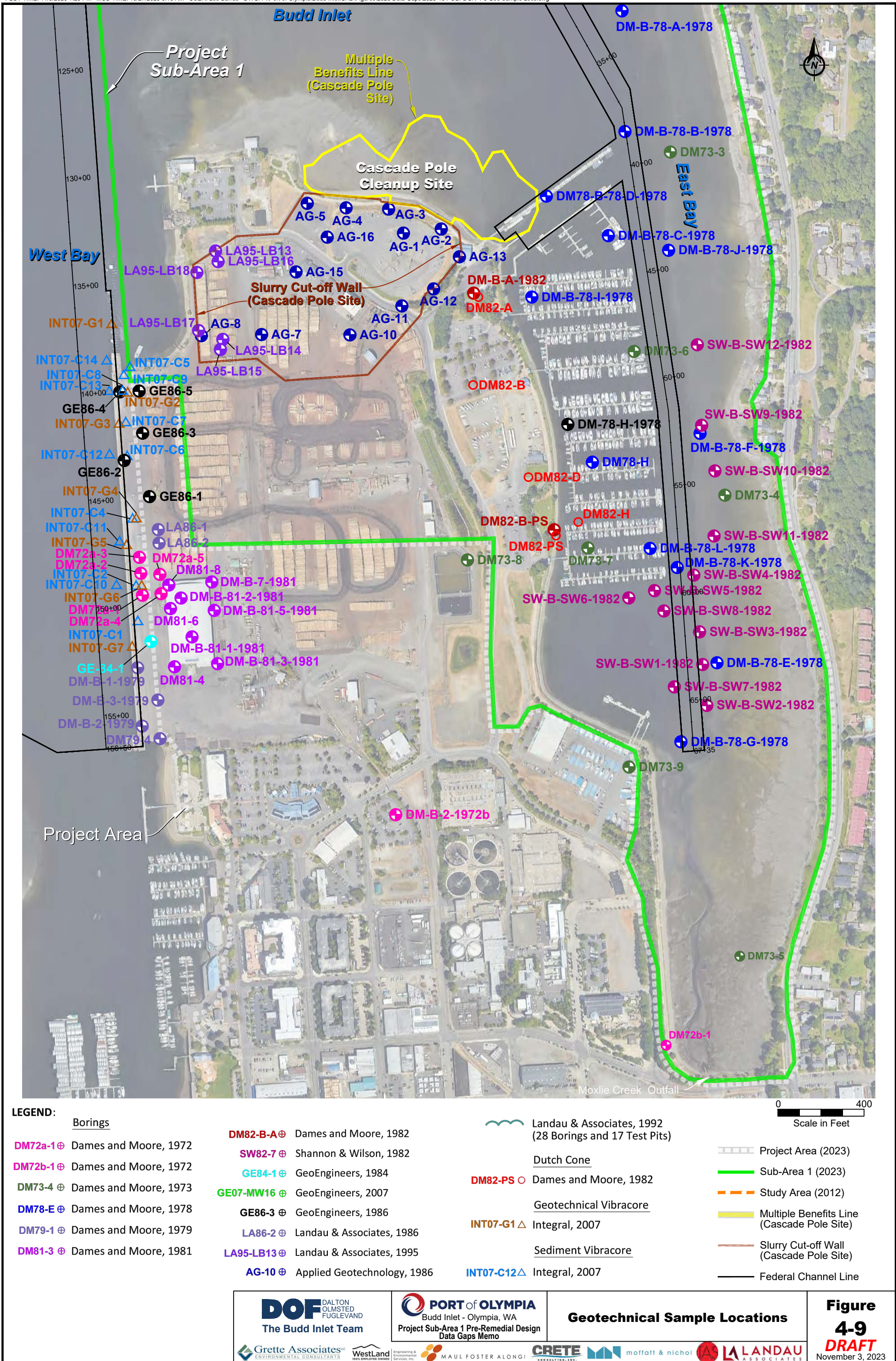
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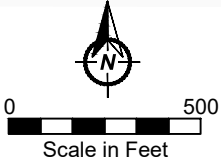




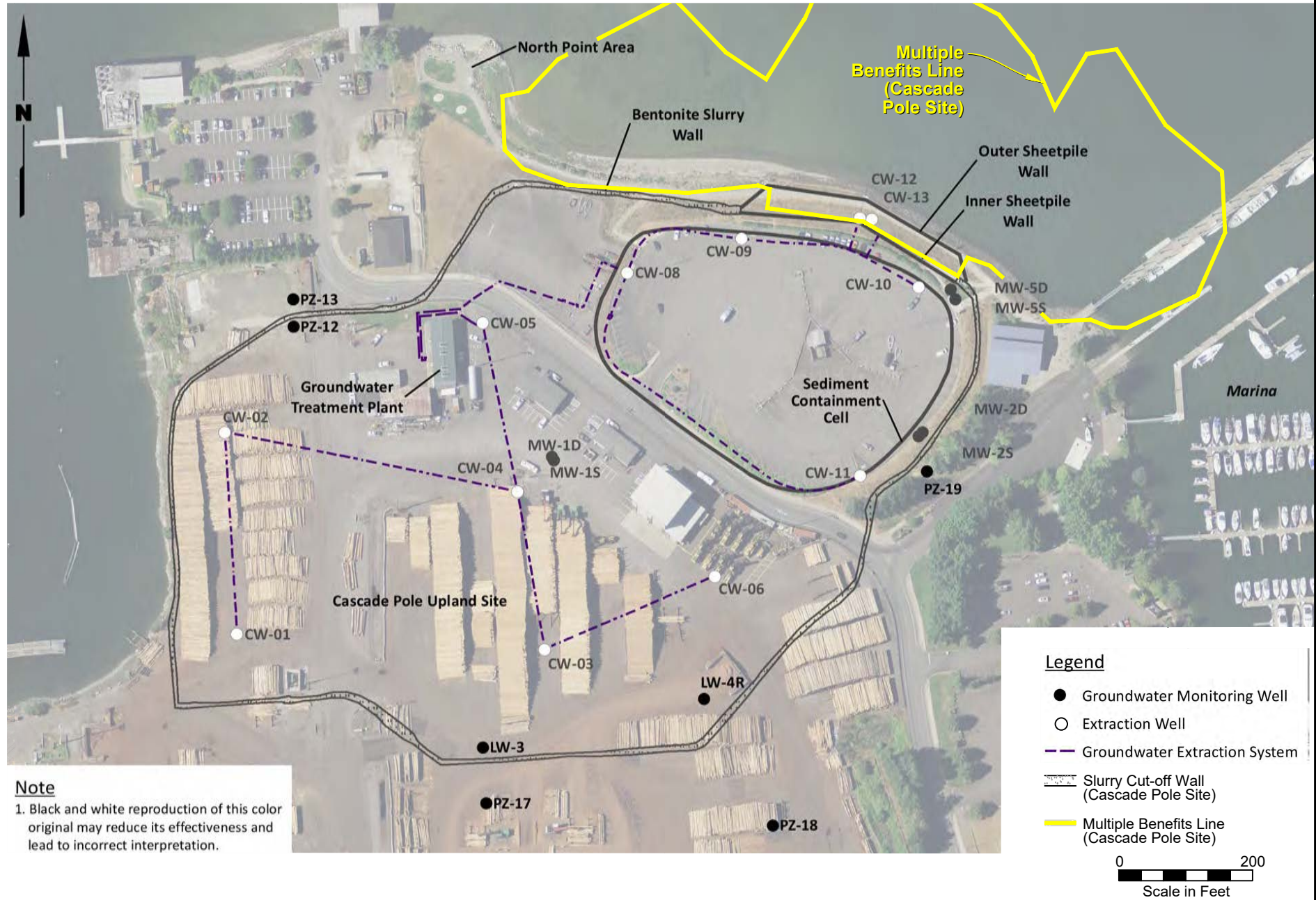
- Cone Penetration Test
- Soil Boring
- Vane Shear Test
- Jet Probe and Debris Observation Only
- Debris Observation Transect

- Project Area
- Sub-Area 1
- Multiple Benefits Line (Cascade Pole Site)
- Slurry Cut-off Wall (Cascade Pole Site)

NOTES:
1. Transects depicted for debris observation transects (DT) and jet probe transects (JT) are an approximation of the actual length. The results for debris observations and jet probing are presented in Appendix A.
2. Locations shown for debris observation transects (DT) and jet probe transects (JT) represent the starting point of the transect. The full length of transects performed varies and are not shown graphically on the figure.



- Notes**
- Horizontal Datum: Washington State Plane South, NAD83.
 - Source: Anchor QEA, Figure 2-2.
 - All boundaries are approximate.



Note

1. Source: Landau, Figure 1.

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**Cascade Pole Groundwater
 Treatment System**

**Figure
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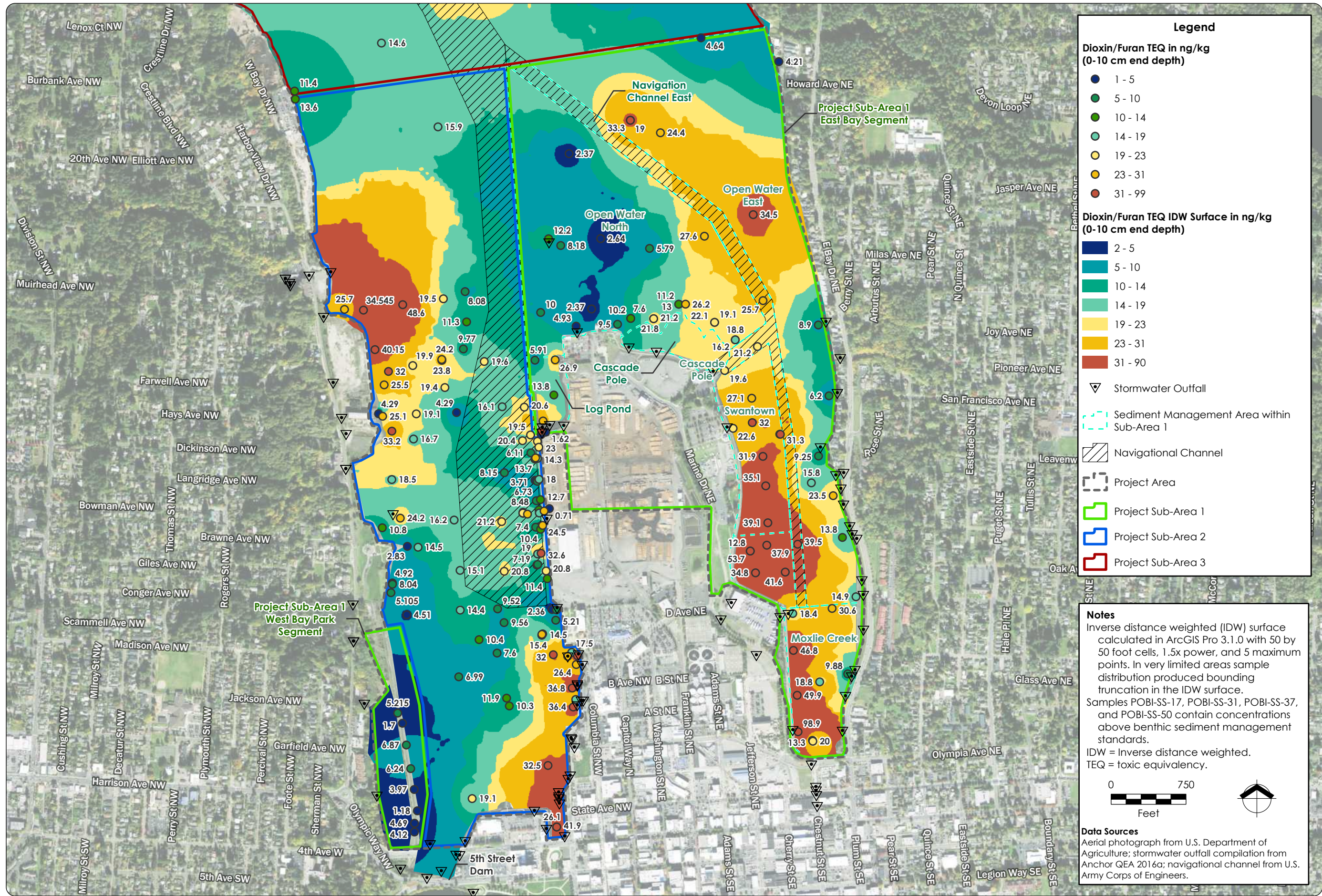


Figure 4-13

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Dioxins/Furans Sediment Surface (0-10 cm end depth) Interpolation

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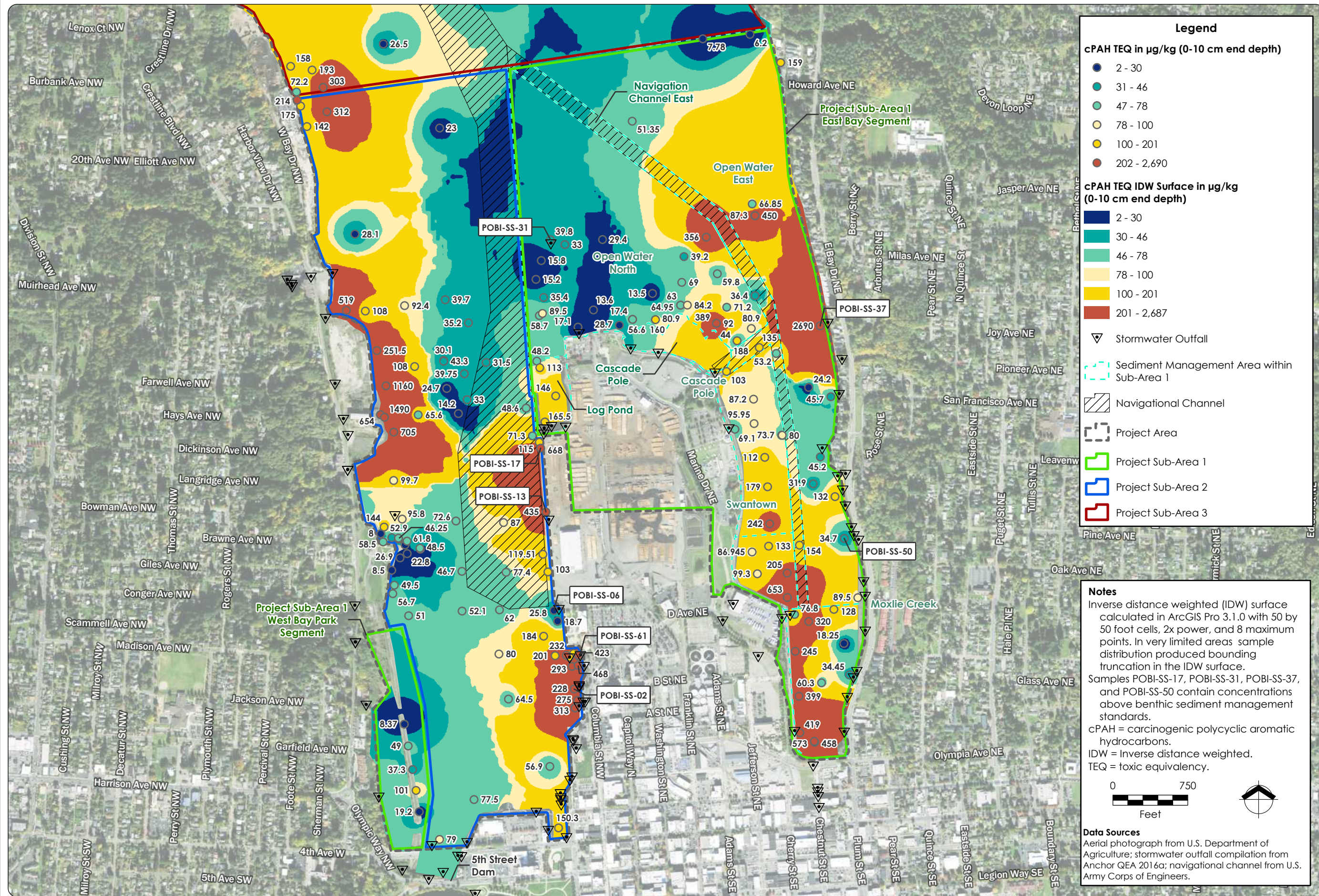


Figure 4-14

**cPAH Sediment Surface
(0-10 cm end depth) Interpolation**

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**Historical Geotechnical
Exploration Locations**

**Figure
4-15
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Table 4-1

Sediment Management Area and Depth Summary - Surface Lab Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Year	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Boatworks Sediment Management Unit						
NOAA-242	2011	BuddOakDioxins	0	10	--	12.8 JT
NOAA-242	2011	UWI2011	0	3	272 T	53.7 JT
NOAA-243	2011	UWI2011	0	3	623 T	--
NOAA-243	2011	UWI2011	0	3	502 T	--
POBI-SS-48	2013	G1300053	0	10	133 T	37.9 JT
POBI-SS-51	2013	G1300053	0	10	99.3 JT	34.8 KJT
POBI-SS-52	2013	G1300053	0	10	205 T	41.6 KJT
NOAA-242	2018	UWI	0	3	3.89 JT	--
NOAA-242	2018	UWI	0	3	170 T	--
NOAA-243	2018	UWI	0	3	653 T	--
Log Pond Sediment Management Area						
BI-C14	2007	BUDD07	0	10	146 T	13.8 T
BI-S38	2007	BUDD07	0	10	--	26.9 T
POC-S4	2007	Budd Inlet W Bay 07	0	7.62	--	44.7 JT
POC-S5	2007	Budd Inlet W Bay 07	0	10.16	--	1.62 JT
POBI-SS-19	2013	G1300053	0	10	97 JT	24.7 KJT
POBI-SS-19-DUP	2013	G1300053	0	10	234 T	31 JT
POBI-SS-23	2013	G1300053	0	10	48.2 T	5.91 KJT
LOTT2019-5	2019	LOTT2019	0	10	113 T	--
Moxlie Creek Sediment Management Area						
SWANTOWN2	2006	AJOH0049	0	2	320 T	--
BI-C18	2007	BUDD07	0	10	60.3 T	18.8 T
BI-S30	2007	BUDD07	0	10	573 T	60.3 T
BI-S30	2011	BuddOakDioxins	0	10	--	13.3 JT
CP-28-S	2013	FS1385	0	10	12.4 T	--
POBI-SS-53	2013	POBI2013	0	10	76.8 JT	18.4 JT
POBI-SS-54	2013	POBI2013	0	10	128 JT	30.6 JT
POBI-SS-56	2013	POBI2013	0	10	245 T	46.8 JT
POBI-SS-57	2013	POBI2013	0	10	32.5 JT	9.94 KJT
POBI-SS-57-DUP	2013	POBI2013	0	10	36.4 T	9.82 KJT
POBI-SS-58	2013	POBI2013	0	10	399 T	49.9 JT
POBI-SS-59	2013	POBI2013	0	10	419 T	98.9 KJT
POBI-SS-60	2013	POBI2013	0	10	458 T	20 KJT

Table 4-1

Sediment Management Area and Depth Summary - Surface Lab Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Year	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Navigation Channel East Sediment Management Area						
BI-C9	2007	BUDD07	0	10	--	25.7 T
BI-S31	2007	BUDD07	0	10	103 T	19.6 T
CP-34	2013	FS1385	0	10	53.2 T	--
CP-37	2013	FS1385	0	10	36.4 T	--
POBI-SS-36	2013	POBI2013	0	10	135 JT	21.2 KJT
POBI-SS-49	2013	POBI2013	0	10	154 T	39.5 JT
Open Water East Sediment Management Area						
BI-S9	2007	BUDD07	0	10	31.9 T	15.8 T
BI-S12	2007	BUDD07	0	10	450 T	34.5 T
BI-S13	2007	BUDD07	0	10	--	24.4 T
BI-S15	2007	BUDD07	0	10	7.78 T	4.64 T
PSUW100	2011	UWI2011	0	3	268 T	--
UW40056	2011	UWI2011	0	3	188 T	33.3 JT
UW40056	2011	BuddOakDioxins	0	10	--	19 JT
CP-21-S	2013	FS1385	0	10	6.2 JT	--
CP-25-S	2013	FS1385	0	10	87.3 T	--
CP-26-S	2013	FS1385	0	10	24.2 JT	--
POBI-SS-37	2013	G1300053	0	10	2690 T	8.9 KJT
POBI-SS-39	2013	G1300053	0	10	45.7 T	6.2 KJT
POBI-SS-44	2013	G1300053	0	10	45.2 T	9.25 KJT
POBI-SS-46	2013	G1300053	0	10	132 T	23.5 KJT
POBI-SS-50	2013	G1300053	0	10	34.7 JT	13.8 KJT
POBI-SS-55	2013	G1300053	0	10	89.5 T	14.9 KJT
PSUW100	2018	UWI	0	3	15.7 T	--
PSUW100	2018	UWI	0	3	118 T	--
UW40056	2018	UWI	0	3	83.4 T	--
UW40056	2018	UWI	0	3	19.3 T	--

Table 4-1
Sediment Management Area and Depth Summary - Surface Lab Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Year	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Open Water North Sediment Management Area						
BI-C7	2007	BUDD07	0	10	--	8.18 T
BI-C8	2007	BUDD07	0	10	--	5.79 T
BI-C13	2007	BUDD07	0	10	84.2 T	26.2 T
BI-S14	2007	BUDD07	0	10	--	2.37 JT
BI-TISSUES3 SBI	2007	BUDD07	0	10	28.7 T	9.5 T
CP-16	2007	FS1385	0	10	0.0601 T	13.9 JT
CP-17	2007	FS1385	0	10	0.0171 T	34.7 T
CP-18	2007	FS1385	0	10	0.0128 T	16.5 JT
CP-19	2007	FS1385	0	10	0.286 T	23.3 T
CP-20	2007	FS1385	0	10	0.0465 T	15.5 JT
CP-16	2012	FS1385	0	10	60.8 T	13.1 JT
CP-17	2012	FS1385	0	10	896 T	11.2 JT
CP-18	2012	FS1385	0	10	91.5 T	18.4 JT
CP-19	2012	FS1385	0	10	342 T	1.71 JT
CP-20	2012	FS1385	0	10	251 JT	19.2 JT
CP-24-S	2013	FS1385	0	10	33 JT	--
CP-30	2013	FS1385	0	10	13.5 T	--
CP-31	2013	FS1385	0	10	69 T	--
CP-32	2013	FS1385	0	10	71.2 T	--
CP-33	2013	FS1385	0	10	80.9 T	--
CP-35	2013	FS1385	0	10	39.2 T	--
CP-36	2013	FS1385	0	10	59.8 T	--
POBI-SS-30	2013	G1300053	0	10	89.5 JT	10 KJT
POBI-SS-31	2013	G1300053	0	10	39.8 JT	12.2 KJT
POBI-SS-32	2013	G1300053	0	10	17.1 JT	4.93 KJT
POBI-SS-33	2013	G1300053	0	10	13.6 JT	2.37 KJT
POBI-SS-34	2013	G1300053	0	10	29.4 JT	2.64 KJT
POBI-SS-35	2013	G1300053	0	10	356 T	27.6 JT
CP-16	2017	FS1385	0	10	56.6 T	10.2 T
CP-17	2017	FS1385	0	10	160 T	21.8 T
CP-18	2017	FS1385	0	10	60.2 T	10.9 JT
CP-19	2017	FS1385	0	10	389 T	22.1 T
CP-20	2017	FS1385	0	10	188 T	16.2 T
LOTT2019-1	2019	LOTT2019	0	10	15.8 JT	--
LOTT2019-2	2019	LOTT2019	0	10	15.2 JT	--
LOTT2019-3	2019	LOTT2019	0	10	35.4 JT	--
LOTT2019-4	2019	LOTT2019	0	10	58.7 T	--
CP-16	2022	FS1385	10	10	17.4 JT	7.6 JT
CP-17	2022	FS1385	10	10	80.9 JT	21.2 JT
CP-18	2022	FS1385	10	10	63 JT	11.2 JT
CP-19	2022	FS1385	10	10	92 JT	19.1 JT
CP-20	2022	FS1385	10	10	44 JT	18.8 JT

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Sample Location ID	Sample Year	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Swantown Sediment Management Area						
BI-C10	2007	BUDD07	0	10	73.7 JT	30.6 T
POBI-SS-38	2013	G1300053	0	10	87.2 JT	27.1 KJT
POBI-SS-40	2013	G1300053	0	10	69.1 T	22.6 KJT
POBI-SS-41	2013	G1300053	0	10	108 JT	32.4 KJT
POBI-SS-41-DUP	2013	G1300053	0	10	83.9 T	31.6 KJT
POBI-SS-42	2013	G1300053	0	10	80 JT	31.3 KJT
POBI-SS-43	2013	G1300053	0	10	112 JT	31.9 KJT
POBI-SS-45	2013	G1300053	0	10	179 JT	35.1 KJT
POBI-SS-47	2013	G1300053	0	10	242 T	39.1 KJT

Notes:

J = Estimated value.

K = Reported value from laboratory is an estimated maximum potential concentration.

T = Result is based on calculation.

U = Analyte not detected.

*Not documented in EIM. Cited in Anchor QEA 2016b.

† = Specific depths not documented in EIM; determined to be subsurface from Anchor 2016b.

Bold results exceed regional background.

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Abbreviations and Acronyms:

cm = centimeters

cPAH = carcinogenic polycyclic aromatic hydrocarbons

EIM = Ecology's Environmental Information Management database (<https://apps.ecology.wa.gov/eim/search/default.aspx>)

ID = identification

µg/kg = micrograms per kilogram

ng/kg = nanograms per kilogram

TEQ = toxic equivalency

Sediment Management Area and Depth Summary - Near-Surface Lab Results
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Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Year	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Boatworks Sediment Management Area						
POBI-SC-44	2013	G1300053	30	60	--	15.1 JT
POBI-SC-45	2013	G1300053	30	60	--	58.6 KJT
Cascade Pole Sediment Management Area						
CP-01	2012	FS1385	20	30	3.7 UT	2 JT
CP-07	2012	FS1385	20	30	3.7 UT	1.67 JT
CP-08	2012	FS1385	6	20	18 JT	0.886 JT
CP-10	2012	FS1385	20	37	3.7 UT	1.38 JT
CP-14	2012	FS1385	30	43	3.6 UT	0.489 JT
CP-01	2017	FS1385	20	34	0.952 UT	0.782 JT
CP-07	2017	FS1385	30	43	0.971 UT	0.825 JT
CP-08	2017	FS1385	30	43	0.919 UT	1.15 JT
CP-10	2017	FS1385	20	40	0.984 UT	0.556 JT
CP-12	2017	FS1385	30	43	0.986 UT	0.919 JT
CP-07	2022	FS1385	3	20	2.59 JT	7.54 JT
CP-14	2022	FS1385	20	30	6.42 JT	1.05 JT
Log Pond Sediment Management Area						
POBI-SC-26	2013	G1300053	30	60	--	5.48 KJT
Moxlie Creek Sediment Management Area						
POBI-SC-47	2013	G1300053	0	30	101 T	16.1 KJT
POBI-SC-47	2013	G1300053	30	60	106 T	10.1 KJT
POBI-SC-48	2013	G1300053	30	60	--	2.36 KJT
POBI-SC-49	2013	G1300053	0	30	51.9 T	319 JT
POBI-SC-49	2013	G1300053	30	60	76.9 T	1280 JT
POBI-SC-50	2013	G1300053	0	30	81.6 T	10 KJT
POBI-SC-50	2013	G1300053	30	60	375 T	28.4 JT
Navigation Channel East Sediment Management Area						
POBI-SC-34	2013	G1300053	0	30	--	8.02 KJT
POBI-SC-34	2013	G1300053	30	60	--	1.05 KJT
POBI-SC-35	2013	G1300053	0	30	--	5.71 KJT
POBI-SC-35	2013	G1300053	30	60	--	2.95 KJT
POBI-SC-39	2013	G1300053	30	60	--	3.95 KJT
Open Water East Sediment Management Area						
POBI-SC-33	2013	G1300053	30	60	133 JT	7.76 KJT
POBI-SC-38	2013	G1300053	30	60	--	1.36 KJT
POBI-SC-38	2013	G1300053	30	60	--	1.46 KJT
POBI-SC-40	2013	G1300053	30	60	--	1.55 KJT
POBI-SC-42	2013	G1300053	30	60	16.5 JT	5.73 KJT

Sediment Management Area and Depth Summary - Near-Surface Lab Results
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Open Water North Sediment Management Area						
POBI-SC-29	2013	G1300053	0	30	--	2.56 KJT
POBI-SC-30	2013	G1300053	0	30	--	2.66 KJT
POBI-SC-31	2013	G1300053	30	60	--	1.82 KJT
POBI-SC-32	2013	G1300053	0	30	--	20.5 JT
POBI-SC-32	2013	G1300053	30	60	--	5.67 KJT
Swantown Sediment Management Area						
POBI-SC-37	2013	G1300053	30	60	--	1.9 KJT
POBI-SC-41	2013	G1300053	30	60	--	1.41 KJT

Notes:

J = Estimated value.

K = Reported value from laboratory is an estimated maximum potential concentration.

T = Result is based on calculation.

U = Analyte not detected.

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† = Specific depths not documented in EIM; determined to be subsurface from Anchor 2016b.

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Pre-Remedial Design Data Gaps Memorandum
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Sample Location ID	Sample Year	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Boatworks Sediment Management Area						
OLY-03	2005	EB PSDDA*	0	100	121 T	38.5 T
OLY-03	2005	EB PSDDA*	100	200	88.9 T	25.6 JT
OLY-03	2005	EB PSDDA*	200	300	--	78.2 T
OLY-04	2005	EB PSDDA*	0	100	38.1 JT	44.2 T
OLY-04	2005	EB PSDDA*	100	200	--	18.3 JT
OLY-04	2005	EB PSDDA*	100	200	--	26.1 JT
POBI-SC-44	2013	G1300053	60	90	--	9.16 KJT
POBI-SC-44	2013	G1300053	90	100	--	12.1 KJT
POBI-SC-45	2013	G1300053	60	90	--	1.72 KJT
POBI-SC-45	2013	G1300053	90	100	--	1.18 KJT
POBI-SC-46	2013	G1300053	250	314	--	1.3 KJT
Cascade Pole Sediment Management Area						
CP-15	2003	CASCON03	0	130	--	0.44 JT
CP-01	2007	FS1385	†	†	0.5 UT	0.817 JT
CP-02	2007	FS1385	†	†	0.5 UT	0.39 JT
CP-03	2007	FS1385	†	†	4.9 UT	0.78 JT
CP-04-B	2007	FS1385	†	†	0.49 UT	3.08 JT
CP-04-C	2007	FS1385	†	†	3.39 T	2.47 JT
CP-05	2007	FS1385	†	†	0.0048 UT	0.319 JT
CP-06-B	2007	FS1385	†	†	0.005 UT	0.347 JT
CP-07	2007	FS1385	†	†	0.005 UT	0.489 JT
CP-08	2007	FS1385	†	†	0.00048 UT	0.629 JT
CP-09	2007	FS1385	†	†	0.0048 UT	0.412 JT
CP-10	2007	FS1385	†	†	0.00362 T	4.52 JT
CP-11	2007	FS1385	†	†	0.00048 UT	0.44 JT
CP-12	2007	FS1385	†	†	0.000048 UT	0.385 JT
CP-13	2007	FS1385	†	†	0.005 UT	0.322 JT
CP-14	2007	FS1385	†	†	0.005 UT	0.454 JT
CP-15	2007	FS1385	†	†	0.0049 UT	0.341 JT
CP-02	2012	FS1385	30	46	3.6 UT	2.06 JT
CP-03	2012	FS1385	34	49	3.6 UT	1.07 JT
CP-04-B	2012	FS1385	49	64	3.9 UT	0.974 JT
CP-04-B	2012	FS1385	49	64	3.7 UT	0.877 JT
CP-05	2012	FS1385	46	60	3.6 UT	0.362 JT
CP-06-B	2012	FS1385	46	60	3.6 UT	0.566 JT
CP-09	2012	FS1385	49	64	3.7 UT	0.494 JT
CP-11	2012	FS1385	40	55	3.7 UT	0.666 JT

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Sample Location ID	Sample Year	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Cascade Pole Sediment Management Area						
CP-12	2012	FS1385	34	49	3.6 UT	0.866 JT
CP-13	2012	FS1385	43	58	3.6 UT	0.632 JT
CP-15	2012	FS1385	52	67	3.6 UT	0.888 JT
CP-02	2017	FS1385	58	73	0.983 UT	0.715 JT
CP-03	2017	FS1385	64	79	0.977 UT	0.469 JT
CP-04-B	2017	FS1385	110	100	0.973 UT	0.805 JT
CP-05	2017	FS1385	160	175	0.935 UT	0.759 JT
CP-06-B	2017	FS1385	76	90	0.981 UT	0.462 JT
CP-09	2017	FS1385	37	52	3.51 T	2.05 JT
CP-11	2017	FS1385	49	64	0.983 UT	0.407 JT
CP-13	2017	FS1385	52	67	0.971 UT	0.447 JT
CP-14	2017	FS1385	130	145	0.986 UT	0.722 JT
CP-15	2017	FS1385	90	110	0.977 UT	0.768 JT
CP-01	2022	FS1385	76	90	1.42 JT	1.32 JT
CP-02	2022	FS1385	46	60	3.5 JT	4.19 JT
CP-03	2022	FS1385	90	110	1.53 JT	0.329 JT
CP-04-B	2022	FS1385	53.3	68.6	2.06 JT	2.26 JT
CP-05	2022	FS1385	46	60	6.1 JT	9.82 JT
CP-06-B	2022	FS1385	46	60	14.3 JT	14 JT
CP-08	2022	FS1385	58	64	4.56 JT	0.679 JT
CP-08	2022	FS1385	58	64	5.21 JT	0.726 JT
CP-09	2022	FS1385	38.1	53.3	2.32 JT	0.456 JT
CP-10	2022	FS1385	52	67	6.2 JT	1.6 JT
CP-11	2022	FS1385	52	67	0.301 UT	0.365 JT
CP-12	2022	FS1385	30	46	8.28 JT	3.71 JT
CP-13	2022	FS1385	82	98	8.94 JT	1.81 JT
CP-15	2022	FS1385	90	110	12.7 JT	0.64 JT

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Sample Location ID	Sample Year	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Log Pond Sediment Management Area						
BI-C14	2007	BUDD07	90	100	--	6.62 T
BI-C14	2007	BUDD07	200	200	--	0.147 JT
BI-C14	2007	BUDD07	300	300	--	0.171 T
POBI-SC-24	2013	G1300053	60	90	--	77.1 KJT
POBI-SC-24	2013	G1300053	90	100	--	0.506 KJT
POBI-SC-26	2013	G1300053	60	90	--	1.13 KJT
POBI-SC-26	2013	G1300053	90	100	--	1.05 KJT
Moxlie Creek Sediment Management Area						
CP-28-S	2002	CASMON03	0	25	--	5.54 T
BI-C18	2007	BUDD07	30	60	--	1.36 T
BI-C18	2007	BUDD07	60	90	--	0.184 JT
POBI-SC-47	2013	G1300053	60	90	103 T	6.33 KJT
POBI-SC-47	2013	G1300053	90	100	127 T	2.11 KJT
POBI-SC-49	2013	G1300053	60	90	195 T	144 KJT
POBI-SC-49	2013	G1300053	90	100	174 T	99.8 JT
POBI-SC-49	2013	G1300053	100	200	169 T	26.8 JT
POBI-SC-49	2013	G1300053	200	200	188 T	52.1 KJT
POBI-SC-49	2013	G1300053	320	347	131 T	212 JT
POBI-SC-50	2013	G1300053	60	90	15.1 JT	22.3 KJT
POBI-SC-50	2013	G1300053	90	100	52.8 JT	37 JT
POBI-SC-50	2013	G1300053	100	200	75.6 T	225 JT
POBI-SC-50	2013	G1300053	200	200	48.2 T	122 JT
POBI-SC-50	2013	G1300053	200	280	134 T	167 JT
POBI-SC-50	2013	G1300053	378	400	46 JT	13.1 KJT
Navigation Channel East Sediment Management Area						
OLY-01	2005	EB PSDDA*	0	100	123 T	52.5 T
OLY-01	2005	EB PSDDA*	100	340	72.8 T	28.8 JT
OLY-01	2005	EB PSDDA*	340	370	--	0.34 JT
OLY-02	2005	EB PSDDA*	0	200	142 T	43.7 JT
OLY-02	2005	EB PSDDA*	200	200	--	2.72 JT
POBI-SC-36	2013	G1300053	90	100	--	5.97 KJT
POBI-SC-36	2013	G1300053	100	200	--	3.09 KJT
POBI-SC-39	2013	G1300053	90	100	--	1.66 KJT
POBI-SC-39	2013	G1300053	100	200	--	1.35 KJT
POBI-SC-43	2013	G1300053	60	90	--	1.61 KJT
POBI-SC-43	2013	G1300053	90	100	--	1.08 KJT
POBI-SC-43	2013	G1300053	100	200	--	0.814 KJT

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Sample Location ID	Sample Year	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Open Water East Sediment Management Area						
CP-21-S	2002	CASMON03	0	18	--	3.45 T
CP-25-S	2002	CASMON03	0	28	--	20.9 JT
CP-26-S	2002	CASMON03	0	26	--	8.58 JT
Open Water North Sediment Management Area						
CP-24-S	2002	CASMON03	0	25	--	4.52 T
BI-C7	2007	BUDD07	30	60	--	4.73 T
BI-C7	2007	BUDD07	60	90	--	0.579 JT
BI-C13	2007	BUDD07	30	60	--	14.8 T
BI-C13	2007	BUDD07	60	90	--	12.1 T
BI-C13	2007	BUDD07	100	200	--	0.333 T
BI-C13	2007	BUDD07	200	200	--	0.345 T
CP-16	2013	FS1385	30	60	27.3 T	--
CP-17	2013	FS1385	30	60	24.3 T	--
CP-18	2013	FS1385	30	60	29.1 T	--
CP-19	2013	FS1385	30	60	56.9 T	--
CP-20	2013	FS1385	30	60	19.8 T	--
CP-20	2013	FS1385	30	60	25.5 T	--
Swantown Sediment Management Area						
OLY-05	2005	EB PSDDA*	0	100	13.6 T	5.39 JT
OLY-05	2005	EB PSDDA*	100	200	--	1.62 JT
OLY-05	2005	EB PSDDA*	100	200	--	0.326 JT
OLY-06	2005	EB PSDDA*	0	100	88.9 T	16.1 JT
OLY-06	2005	EB PSDDA*	100	200	--	1.97 JT
BI-C10	2007	BUDD07	60	90	--	1.64 JT
BI-C10	2007	BUDD07	100	200	--	0.113 JT
POBI-SC-37	2013	G1300053	60	90	--	1.08 KJT
POBI-SC-41	2013	G1300053	60	90	--	1.58 KT
POBI-SC-41	2013	G1300053	90	100	--	1.11 KJT

**Sediment Management Area and Depth Summary - Subsurface Lab Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington**

Notes:

J = Estimated value.

K = Reported value from laboratory is an estimated maximum potential concentration.

T = Result is based on calculation.

U = Analyte not detected.

*Not documented in EIM. Cited in Anchor QEA 2016b.

† = Specific depths not documented in EIM; determined to be subsurface from Anchor 2016b.

Bold results exceed regional background.

-- = No result or value reported.

Abbreviations and Acronyms:

cm = centimeters

cPAH = carcinogenic polycyclic aromatic hydrocarbons

EIM = Ecology's Environmental Information Management database
(<https://apps.ecology.wa.gov/eim/search/default.aspx>)

ID = identification

µg/kg = micrograms per kilogram

ng/kg = nanograms per kilogram

TEQ = toxic equivalency

Table 4-4
Sediment Study Summary
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

EIM Study Name	Study Description	Submitting Organization	Number of Discrete Sample Results	Year	Chemicals of Concern	Depth Intervals
CASMON03	Budd Inlet Dioxin & Tissue Mon-Post Sediment Remediation - Cascade Pole Company (CPC)	Unknown	9	2002	Dioxins/Furans	Subsurface
CASCON03	Cascade Pole Sed Confirm Monitoring 2003	Unknown	1	2003	Dioxins/Furans	Subsurface
EB PSDDA*	East Bay PSDDA Characterization*	Unknown	30	2005	Cadmium, cPAHs, Dioxins/Furans	Subsurface
AJOH0049	Toxics in stormwater runoff from PS boatyards	Ecology	2	2006	Cadmium, cPAHs	Surface
NOAA-Mussel-1986-08	NOAA Mussel Watch Program	Hart Crowser	2	2006	Cadmium, cPAHs	Near-Surface
OHPSD06	Olympia Harbor - Supplemental Dioxin Study, DY07	USACE	25	2006	Cadmium, cPAHs, Dioxins/Furans	Surface, Near-Surface, Subsurface
Budd Inlet Hardel 07	C396_Hardel EIM Results	Integral	9	2007	Cadmium, cPAHs, Dioxins/Furans	Surface
Budd Inlet W Bay 07	West Bay of Budd Inlet - Sediment Characterization Study: Berths 2 and 3 Interim Action Project.	Integral	23	2007	Dioxins/Furans	Surface, Subsurface
BUDD07	Budd Inlet Sediment Characterization	SAIC	147	2007	Cadmium, cPAHs, Dioxins/Furans	Surface, Subsurface
FS94656838Ph2	Solid Wood Inc. (West Bay Park) Rail Spur Phase II Environmental Site Assessment, Olympia, WA. Agreed Order # DE-08-TCP SR-5415	Parametrix	6	2007	Dioxins/Furans	Surface
PERLA08	Percival Landing Redevelopment Project - Antidegradation Evaluation, DY10	USACE	18	2008	Cadmium, cPAHs, Dioxins/Furans	Subsurface
VCSW0762	Washington Department of Natural Resources (DNR) Marine Station, Olympia, WA (Federal ID Number: WAD337696)	Landau	32	2008	Cadmium, cPAHs	Subsurface
WB1577RIFS	Solid Wood Inc. (West Bay Park) RI/FS, Olympia, WA. Agreed Order # DE-08-TCP SR-5415	Parametrix	49	2008	Cadmium, cPAHs, Dioxins/Furans	Surface, Subsurface
UWI	Urban Waters Initiative	Ecology	60	2008	Cadmium, cPAHs	Surface
BuddOakDioxins	Budd Inlet and Oakland Bay Dioxin Study	Ecology	32	2011	Dioxins/Furans	Surface
OLYYC11	Olympia Yacht Club, DY13	USACE	18	2011	Cadmium, cPAHs, Dioxins/Furans	Subsurface
UWI2011	Urban Waters Initiative	Ecology	3	2011	Dioxins/Furans	Surface
AODE5272	West Bay Marina Remedial Investigation, Olympia, WA	Hart Crowser	18	2011	Cadmium, cPAHs, Dioxins/Furans	Surface
G1300053	Port of Olympia Budd Inlet Sediment Site 2013	Anchor QEA	359	2013	Cadmium, cPAHs, Dioxins/Furans	Surface, Near-Surface, Subsurface
DUNLA15	Dunlap Towing, Olympia, WA, DY15	USACE	7	2015	Cadmium, cPAHs, Dioxins/Furans	Subsurface
PSEMP_LT	Puget Sound Ecosystem Monitoring Program Long Term Sediment Component	Ecology	2	2016	Cadmium, cPAHs	Surface
LOTT2019	LOTT CWA 2019 Sediment Monitoring NPDES Permit No. WA0037061	Herrera Environmental Consultants	16	2019	Cadmium, cPAHs	Surface
FS1385	Cascade Pole Longterm Groundwater Compliance Monitoring and Sediment Sampling, Olympia, WA	Landau	157	2007-2022	cPAHs, Dioxins/Furans	Surface, Near-Surface, Subsurface
OlyMarineTerminal08	Port of Olympia: Berth 2 & 3 Interim Action Cleanup Sampling to Characterize Pre-Dredge, Post-Dredge, and Post-Cover Conditions	Anchor QEA	42	2008-2010	Dioxins/Furans	Surface, Near-Surface, Subsurface

Table 4-4
Sediment Study Summary
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Notes:

*Not documented in EIM. Cited in Anchor QEA 2016b.
Depth intervals are 0-10 cm for surface, 10-45 cm for near-surface, and >45 cm for subsurface.

Abbreviations and Acronyms:

- cPAH = carcinogenic polycyclic aromatic hydrocarbons.
- CPC = Cascade Pole Company
- DNR = Washington State Department of Natural Resources
- Ecology = Washington State Department of Ecology
- EIM = Ecology's Environmental Information Management database (<https://apps.ecology.wa.gov/eim/search/default.aspx>)
- ID = Identification
- Integral = Integral Consulting, Inc.
- Landau = Landau Associates, Inc.
- LOTT = Thurston County Clean Water Alliance
- NOAA = National Oceanic and Atmospheric Administration
- PSDDA = Puget Sound Dredged Disposal Analysis
- SAIC = Science Applications International Corporation
- USACE = US Army Corps of Engineers
- WA = Washington

Table 4-8
Geotechnical Data Summary Table Review (through February 23, 2023)
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
Incorporation of Fine-Grained Sediment Erodibility Measurements into Sediment Transport Modeling, Capitol Lake, Washington	US Department of the Interior US Geological Survey	Capitol Lake Study	15 Sediment cores	10/31/2007	47.03537	-122.90839	N/A	Between 41 and 54 meters	From <0.5 to 3.6 meters
The Laurana Geotechnical Engineering Report	Landau Associates	The Laurana	4 CPT borings	12/21/2016	47.045829	-122.903645	15	Between 21.5 and 121.5 ft	7 ft
Geotechnical Engineering Report 320 Columbia Street Development 320 Columbia Street NW Olympia, Washington	Landau Associates	320 Columbia Street	2 SPT borings	10/23/2017	47.046938	-122.902806	N/A	121.5 ft	5 ft
Geotechnical Engineering Services Proposed Warehouse B Port of Olympia, Olympia, Washington	Landau Associates	Port Oly Warehouse	5 SPT borings	1/23/2023	47.053092	-122.904559	10 to 11 ft	Between 26.5 and 31.5 ft	4-9 ft
Geotechnical Report Marine Fueling Station Project Swantown Marina Olympia, Washingto	Landau Associates	Port of Olympia Fuel Dock (Olympia Area Rowing)	1 SPT boring	4/20/2016	47.057149	-122.899533	19.5	51.5 ft	10 ft
Supplementary Geotechnical Investigation East Bay Marina Olympia, Washington	Shannon and Wilson	East Bay Marina	12 borings	Mar-82	47.057149	-122.899533	2.6 to 16.8	Between 6 and 18.5 ft	N/A
Supplementary Geotechnical Investigation East Bay Marina Olympia, Washington	Canonie Engineers	East Bay Marina	5 borings	Jun-82	47.057149	-122.899533	N/A	Between 18 and 32 ft	N/A

Table 4-8
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Port of Olympia, Budd Inlet, Olympia Washington

Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
Proposed Roadway Olympia, Washington	Dames and Moore	East Bay Marina	2 borings	May-72	47.057149	-122.899533	20 to 20.4	Between 60 and 91 ft	N/A
Proposed East Bay Development Program Port of Olympia Olympia, Washington	Dames and Moore	East Bay Marina	11 borings	Apr-73	47.057149	-122.899533	-5 to -18	Between 23 and 160 ft	N/A
East Bay Drive Project 25-X259	Dames and Moore	East Bay Marina	15 borings	Jul-68	47.057149	-122.899533	N/A	Between 45 and 75 ft	N/A
Proposed East Bay Development Program Port of Olympia Olympia, Washington	Dames and Moore	East Bay Marina	13 borings	Aug-78	N9367	E1572	N/A	Between 25 and 75 ft	N/A
Supplementary Geotechnical Investigation, East Bay Marina, Olympia WA	Dames and Moore	East Bay Marina	8 boring, 8 CPT	9/9/1982	N/A	N/A	N/A	Between 15 and 60 ft	N/A
Brian Kolb-State Street Site	Bradley-Noble Geotechnical, Inc	Moxlie Creek	2 borings	May-89	N/A	N/A	N/A	Between 45 and 55 ft	~8ft
Olympia City Hall, Olympia, Washington	Landau Associates	Moxlie Creek	3 borings, 3 CPT	5/1/2007	N/A	N/A	N/A	Between 11.5 to 76.5 ft	4 to 5 ft

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Port of Olympia, Budd Inlet, Olympia Washington

Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
West Bay Yards Project	Landau Associates	West Bay Mixed Use Development	7 test pits, 2 borings	5/6/2020	47.057917	-122.913673	N/A	Test pits: between 5 and 16 ft Borings: 41.5 ft	2 ft
Geotechnical Report Hands on Children’s Museum Olympia, Washington	Landau Associates	Hands On Children's Museum	3 borings, 3 CPT	1/8/2009	47.04830006	-122.8967249	N/A	Between 19 to 81.5 ft	6 ft
East Bay Flats and Townhomes Olympia, Washington	Landau Associates	Westman Mill	3 borings, 3 CPT	4/30/2007	47.046959	-122.896589	N/A	Between 11.5 to 76.5 ft	3 to 4 ft
Port Storm Diversion Project Olympia, Washington	Landau Associates	Olympia Avenue (East and West Bays)	3 borings	5/23/2016	47.049944	-122.902907	13 to 14 ft	Between 21.5 and 31.5 ft	7 to 9 ft
Soil Treatability Study Cascade Pole Site Port of Olympia, Washington	Landau Associates	Cascade Pole	10 borings	1/1/1991	47.057831	-122.901408	N/A	Between 15 and 25 ft	N/A
HWA	HWA Geoscience Inc	HWA	8 borings	N/A	N/A	N/A	N/A	Between 40 and 100.5 ft	N/A
Berth2	Port of Olympia Commission	Berth2	5 Borings	12/30/1971	N/A	N/A	16.4 to 20.8 ft	Between 105 and 155 ft	~ 22 ft (tidal fluctuation)
Evaluation of Differing Site Condition Claim East Bay Marina Dredging Project, Olympia, WA	Canonie Pacific Company	East Bay Marina Dredging	12 borings	May-82	N/A	N/A	19 to 23 ft	Between 6 and 18.5 ft	N/A

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Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
Evaluation of subsurface conditions East Bay Marina Dredging Small Boat Basin Olympia, WA	Canonie Pacific Company	East Bay Marina Dredging	9 borings	Feb-83	N/A	N/A	N/A	Between 16 and 33 ft	N/A
Report of preliminary soil investigation proposed roadway, Olympia, WA	Dames and Moore	Proposed Roadway in Olympia	2 borings	May-72	N/A	N/A	N/A	Between 25 and 40 ft	N/A
Report of Soil Investigation Proposed East Bay Development Program Port of Olympia, Olympia, WA	Dames and Moore	Proposed Roadway in Olympia	11 borings	Apr-73	N/A	N/A	5 to 20.4	Between 15 and 100 ft	N/A
Report of Soil Investigation Proposed East Bay Development Program Port of Olympia, Olympia, WA	Dames and Moore	Proposed Roadway in Olympia	9 borings	Jul-68	N/A	N/A	+7 to -14	Between 45 and 90 ft	N/A
Report of Soil Investigation Proposed East Bay Development Program Port of Olympia, Olympia, WA	Dames and Moore	Proposed Roadway in Olympia	2 borings 5 CPTs	Aug-82	N/A	N/A	+20 to+28	Borings: Between 20 and 55 ft CPT: Between 20 and 55 ft	4-14 ft (tidal fluctuation)
Report of Soil Investigation Proposed East Bay Development Program Port of Olympia, Olympia, WA	Dames and Moore	Proposed Roadway in Olympia	12 offshore borings	Aug-78	N/A	N/A	N/A	Between 20 and 70 ft	N/A
Slope Stability at the Port of Olympia Main Berth	PND, Inc	Port of Olympia Main Berth	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Proposed Cold Storage Warehouse Port of Olympia, Olympia, WA	Dames and Moore	Proposed Cold Storage Warehouse	5 boring logs	Mar-81	N/A	N/A	N/A	Between 2 to 66 ft, and 6 to 25-30 ft	~ 10 ft

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Port of Olympia, Budd Inlet, Olympia Washington

Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
Report of Phase II Geotechnical Engineering Service, Berth 3 Reconstruction, Olympia, WA	GeoEngineers	Berth 3 Reconstruction	5 boring logs	Aug-86	N/A	N/A	N/A	21 ft	N/A
Proposed Pier Reconstruction-Berth 1 Olympia, WA	Dames and Moore	Berth 1- Reconstruction	4 boring logs	Apr-79	N/A	N/A	19.7 to 20.8	Between 75 and 155 ft	Between 109 and 125
Proposed Warehouse B Port of Olympia, Olympia, WA	Landau Associates	Proposed Warehouse B	3 boring logs	4/19/2012	47.052954	-122.904664	N/A	Between 2 to 122 ft	~ 8 ft
Final Investigation Report -- Port of Olympia Budd Inlet Sediment Site	Anchor QEA	AN-3 through AN-8	6 boring logs	Feb/Mar-2013	47.057268	-122.905442		48 to 102 ft	

Abbreviations and Acronyms:

- Apr = April
- Aug = August
- CPT = cone penetration test
- Feb = February
- ft = feet
- Landau = Landau Associates, Inc.
- Mar = March
- N/A = not applicable
- pg = page
- SPT = standard penetration test
- WA = Washington