Remedial Investigation/Feasibility Study Report

East Bay Redevelopment Site
Olympia, Washington

Agreed Order No. DE7830
Facility/Site No. 5785176

Prepared for:

Port of Olympia
915 Washington Street NE
Olympia, WA 98501

And

City of Olympia
P.O. Box 1967
Olympia, WA 98507-1967

LOTT Clean Water Alliance
500 Adams Street NE
Olympia, WA 98501

In Coordination with:

Prepared by:

Pioneer Technologies Corporation
5205 Corporate Center Ct. SE, Suite A
Olympia, Washington 98503
Phone: 360.570.1700
Fax: 360.570.1777
www.uspioneer.com

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EXECUTIVE SUMMARY

The purpose of this Remedial Investigation (RI)/Feasibility Study (FS) Report is to (1) summarize the nature and extent of impacts (RI) at the East Bay Redevelopment Site (Site) from historical Site operations, and (2) develop and evaluate cleanup action alternatives for addressing those Site impacts (FS). The primary historical operations of interest for this Model Toxics Control Act (MTCA) Site are the former lumber milling activities and related operations that occurred from the late 1800s to 1972, including lumber sawing, lumber milling, veneer manufacturing, and plywood manufacturing. This RI/FS Report was prepared in accordance with MTCA regulations in Washington Administrative Code 173-340-350 and Agreed Order DE7830.

A variety of soil and groundwater RI activities were conducted between 2006 and 2015 in order to characterize the nature and extent of Site impacts. Based on these RI activities, seven soil constituents of potential concern were identified: arsenic, lead, total petroleum hydrocarbons (TPH) in the gasoline range (TPH-G), total naphthalenes, TPH in the diesel range (TPH-D) and TPH in the heavy oil range (TPH-HO) combined, total carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and total chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans (dioxins/furans). There were only a few isolated soil screening level (SL) exceedances for arsenic, lead, TPH-G, total naphthalenes, and TPH-D and TPH-HO combined compared with a more widespread distribution of soil SL exceedances for total cPAHs and total dioxins/furans. Total cPAHs were likely released via spills or buried refuse in historic operation areas although there could also be some contribution from urban background conditions. Total dioxins/furans exceedances were primarily associated with wood debris (e.g., treated wood) although there could also be some contribution from former Budd Inlet surface sediment used as historical fill material. Further action is necessary for Site soil. The only replicated exceedance of a groundwater SL was a slight dissolved arsenic exceedance in monitoring well (MW) 24S. This slight exceedance was likely attributable to a localized release of arsenic (i.e., a treated wood piling encountered while drilling MW24S), which will be removed as part of the recommended cleanup action alternative. In addition, the localized dissolved arsenic impact at MW24S did not cause groundwater SL exceedances at the conditional point of compliance MWs, which were located downgradient of MW24S. As a result, no further action is necessary for Site groundwater.

Based on the nature and extent of soil impacts, three cleanup action alternatives were developed and evaluated in the FS. The three cleanup action alternatives were:

- Alternative 1 – Institutional Controls and Engineering Controls
- Alternative 2 – Targeted Soil Removal, Cover, and Controls
- Alternative 3 – Total Soil Removal

The recommended cleanup action alternative is Alternative 2 – Targeted Soil Removal, Cover, and Controls. The principal remedial components of Alternative 2 are:

- Excavating soil remediation level exceedances and disposing the excavated soil off-site;

- Covering all portions of the Site that are not already covered by 1982 fill (the 1982 fill is not impacted);
- Implementing engineering controls during construction activities;
- Implementing Institutional controls (ICs) and maintaining the ICs for perpetuity; and
- Conducting long-term inspections of the soil cover, and ICs.

Alternative 2 satisfies all of the MTCA threshold criteria and has the highest overall ranking when considering the MTCA balancing criteria and the sustainability criterion. Alternative 2 protects human health and the environment, employs reliable and proven technologies, and can be completed quickly. Alternative 2 is consistent with the remedy implemented for the two previous Interim Actions.

Figure ES-1 shows the completed and remaining soil removal locations as well as the completed and remaining cover locations for the recommended cleanup action alternative (i.e., Alternative 2). Remaining components of Alternative 2 will be implemented in accordance with the Cleanup Action Plan (CAP) once the CAP is approved. It should be noted that most of the remaining areas that will receive a soil cover (consisting of a permeable geotextile fabric and at least 12 inches of clean soil) pursuant to the CAP will eventually be redeveloped. Any future development at a parcel which may disturb the soil cover will require Washington State Department of Ecology approval prior to development.

PIONEER
TECHNOLOGIES CORPORATION

Recommended Cleanup Action Alternative
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure ES-1

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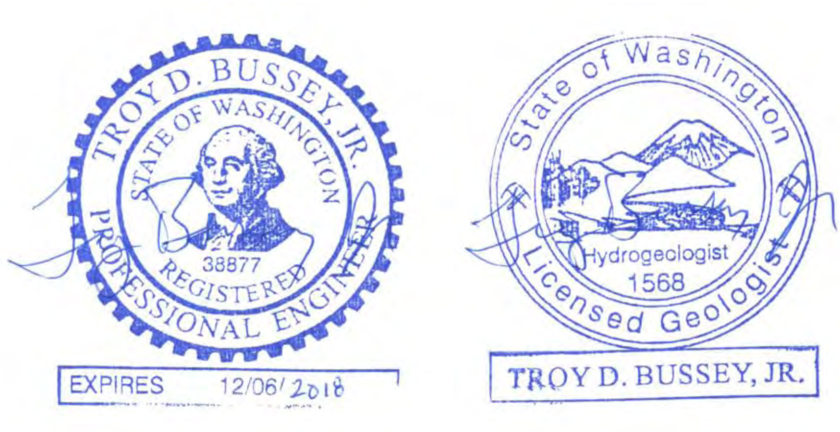
CERTIFICATION

This document was prepared under my direction. The information submitted is, to the best of my knowledge and belief, true, accurate, and complete.



Troy D. Bussey Jr., P.E., L.G., L.HG.
Senior Professional Engineer
PIONEER Technologies Corporation
Washington P.E. Registration No. 38877
Washington L.G. and L.HG. Registration No. 1568

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List of Acronyms

Acronym	Explanation
AO	Agreed Order
AOC	Area of Concern
ASTM	American Society of Testing and Materials
bgs	Below Ground Surface
CAP	Cleanup Action Plan
CITY	City of Olympia
CL	Cleanup Level
CLARC	Cleanup Levels and Risk Calculations
COC	Constituent of Concern
COI	Constituent of Interest
COPC	Constituent of Potential Concern
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
CSEM	Conceptual Site Exposure Model
CY	Cubic Yards
Dioxins/Furans	Chlorinated Dibenzo-p-dioxins and Chlorinated Dibenzofurans
Ecology	Washington State Department of Ecology
ECs	Engineering Controls
FS	Feasibility Study
GPS	Global Positioning System
GWM	Groundwater Monitoring
IA	Interim Action
IAWP	Interim Action Work Plan
ICs	Institutional Controls
LNAPL	Light Non-Aqueous Phase Liquid
LOTT	Lacey, Olympia, Tumwater, and Thurston County Clean Water Alliance
MTCA	Model Toxics Control Act
MW	Monitoring Well
NAVD88	North American Vertical Datum of 1988
NGVD29	National Geodetic Vertical Datum of 1929
NPDES	National Pollutant Discharge Elimination System

Acronym	Explanation
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PIONEER	PIONEER Technologies Corporation
POC	Point of Compliance
Port	Port of Olympia
RI	Remedial Investigation
RIWP	Remedial Investigation Work Plan
RL	Remediation Level
SEPA	State Environmental Policy Act
Site	East Bay Redevelopment Site
SL	Screening Level
TCP	Toxics Cleanup Program
TEFs	Toxicity Equivalency Factors
TPH	Total Petroleum Hydrocarbons
TPH-D	Total Petroleum Hydrocarbons in the Diesel Range
TPH-G	Total Petroleum Hydrocarbons in the Gasoline Range
TPH-HO	Total Petroleum Hydrocarbons in the Heavy Oil Range
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WAC	Washington Administrative Code

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SECTION 1: INTRODUCTION

1.1 East Bay Redevelopment Project

The Port of Olympia (Port), in conjunction with its partners (e.g., City of Olympia [City], Lacey, Olympia, Tumwater, and Thurston County Clean Water Alliance [LOTT], Hands On Children's Museum, State of Washington), is redeveloping the downtown Olympia, Washington property known as the East Bay Redevelopment Project. Cleanup activities, pursuant to Model Toxics Control Act (MTCA) regulations, are being conducted in conjunction with redevelopment. This Brownfield redevelopment project is very important to the Port, its partners, and the Olympia community due to the project's role in helping to revitalize downtown Olympia. The location of the project, which is on the southeast corner of the peninsula (often referred to as the Port Peninsula) that extends from downtown Olympia into Budd Inlet, adjacent to the southwest corner of the East Bay of Budd Inlet is presented in Figure 1-1.

The East Bay Redevelopment Project consists of nine parcels (see Figure 1-2). The Port currently owns six of the nine parcels (Parcels 1, 2, 3, 6, 7, and 9) within the East Bay Redevelopment Project boundary.[1] LOTT and the City purchased Parcel 4 and Parcel 5, respectively, from the Port in June 2010.[2] LOTT purchased Parcel 8 from the Port in 2009.[3]

In 2010, the Port completed installation of utilities, roads, sidewalks, and associated infrastructure within the public right-of-ways of the East Bay Redevelopment Project in order to facilitate redevelopment of the surrounding parcels. In 2010, LOTT completed construction of the LOTT Administrative Building and Water Education and Technology Center on the southern portion of Parcel 8 (and LOTT property west of Parcel 8). In 2012, construction of the Hands On Children's Museum on Parcel 5 and a public plaza on Parcel 4 were completed. In 2013, LOTT completed construction of new wastewater facilities on the northern portion of Parcel 8.

The Port's redevelopment plan for its six parcels (Parcels 1, 2, 3, 6, 7, and 9) includes construction of mixed-use, urban buildings (e.g., uses could include commercial office space, retail/restaurants, a hotel, parking, and urban housing such as condominiums above ground-level retail space). The Port is actively working to attract developers who might be interested in redeveloping the Port-owned parcels in the near future.

1.2 Site Boundary

In accordance with the MTCA definition of a site in Washington Administrative Code (WAC) 173-340-200, the boundary for the East Bay Redevelopment Site (Site) was determined based on the extent of

[1] The addresses for Port properties known as Parcels 1, 2, 3, 6, 7, and 9 are 715 Olympia Avenue NE/724 State Avenue NE, 625 Olympia Avenue NE, 510 State Avenue NE, 427 Marine Drive NE, 517 Marine Drive NE, and 323 Jefferson Street NE, respectively.

[2] The address for Parcel 4 is 325 Marine Drive NE. The address for Parcel 5 is 410 Jefferson Street NE.

[3] The address for Parcel 8 is 421 Jefferson Street NE.

Site impacts (PIONEER Technologies Corporation [PIONEER] 2011c; Washington State Department of Ecology [Ecology] 2011d). The Ecology-approved MTCA Site boundary is shown on Figure 1-3 relative to the East Bay Redevelopment Project boundary. Although the Site boundary and East Bay Redevelopment Project boundary are similar, they are not the same. The Site size is approximately 14.8 acres. Appendix A presents the key documentation and correspondence associated with the Site boundary determination.

The 3.4-acre LOTT Expansion Site, which is located northwest of the East Bay Redevelopment Site (see Figure 1-3), is a separate Voluntary Cleanup Program site being addressed by LOTT. Note that although Parcel 8 is now part of the LOTT Expansion Site, some historical documentation included as appendices in this report includes Parcel 8 data since Parcel 8 was originally part of the East Bay Redevelopment Site prior to creation of the LOTT Expansion Site.

1.3 Report Purpose

The purpose of this Remedial Investigation (RI)/Feasibility Study (FS) Report is to (1) summarize the nature and extent of Site impacts (RI) from historical Site operations, and (2) develop and evaluate cleanup action alternatives for addressing Site impacts (FS). This RI/FS Report was prepared in accordance with MTCA regulations in WAC 173-340-350.

1.4 Report Organization

The remaining portions of this document are organized as follows:

- **Section 2** – Site Background. This section summarizes background information about the Site to support the RI/FS.
- **Section 3** – Remedial Investigation. This section summarizes the RI activities completed at the Site and presents the nature and extent of Site contamination.
- **Section 4** – Feasibility Study. This section establishes the cleanup action objectives and cleanup standards that will be used in the FS, screens remedial technologies, assembles the retained technologies into cleanup action alternatives, and evaluates the assembled cleanup action alternatives.
- **Section 5** – Recommended Cleanup Action Alternative. This section summarizes the recommended cleanup action alternative and the basis for the recommendation.
- **Section 6** – References. This section presents the references used in this document.

Section 2: SITE BACKGROUND

The purpose of this section is to summarize background information about the Site to support the RI/FS.

2.1 Fill History

The original predevelopment shoreline near the Site, as shown in Figure 2-1, was significantly different than the current shoreline (Thurston Regional Planning Council 2010). The entire Port peninsula, a significant portion of downtown Olympia, and most of the Site are situated on land that was reclaimed using fill material beginning in the late 1800s (PIONEER 2010b). Most of this fill consists of sediment that was dredged from Budd Inlet as part of civic improvement projects to expand shipping channels and increase urban land (Stevenson 1982). The largest dredging event, in which over 2 million cubic yards (CY) of sediment was dredged and used as fill, adding 29 blocks of land north of Olympia Avenue, took place from 1909 to 1911 (Stevenson 1982). Smaller scale projects to dredge Budd Inlet and create reclaimed land with the dredge spoils continued from 1924 into the 1970s (Stevenson 1982). The last fill event that created the current shoreline occurred in 1982 (Stevenson 1982; PIONEER 2010b). The approximate shoreline location over time as the area was filled is presented in Figure 2-2.

For the purposes of this report, the fill material was divided into the following two categories:

- **Pre-1982 Fill**: The pre-1982 fill primarily consists of material dredged from Budd Inlet (Stevenson 1982). The primary soil type for pre-1982 fill is light or dark sand, with some woody debris from historic lumber milling operations and construction debris. Most of the Site contains pre-1982 fill (see Figure 2-2). Site contamination is present in pre-1982 fill (PIONEER 2010b; data presented in Section 3).
- **1982 Fill**: The 1982 fill consists of clean, light-colored gravel that was imported from an off-site, upland rock quarry subsequent to co-located historical operations discussed in Section 2.3 (PIONEER 2010b). Field observations and analytical data have confirmed that the 1982 gravel fill is visually, lithologically, and chemically distinct from pre-1982 fill. The 1982 fill is only located on the eastern portion of the Site (see Figure 2-2)[4]. Contamination is not present in 1982 fill (PIONEER 2010b; data presented in Section 3).

2.2 Site Setting

2.2.1 Climatological Setting

The Site is located within Western Washington, which is typified by relatively mild temperatures and a marine-influenced climate (Western Regional Climate Center 2015). The average annual precipitation for Olympia is approximately 50 inches, with most precipitation falling between October and April

[4] The pre-1982 shoreline and fill event locations were determined by evaluating historical records (e.g., aerial photographs, Sanborn maps) presented in previous site reports (GeoEngineers 2007b, GeoEngineers and PIONEER 2008). The 1982 shoreline and fill event locations were determined by evaluating a 1979 aerial photograph (GeoEngineers 2007b), 1979 ground surface elevation contours (Eric Egge, personal communication) (see Appendix B), and boring logs (GeoEngineers 2007c, PIONEER 2009).

(Thurston County 2013). As shown on Figure 2-3, the predominant wind direction is from the south/southwest (Office of the Washington State Climatologist 2005).

2.2.2 Topography and Drainage

As a result of the historic filling activities described in Section 2.1, the Site is relatively flat. Ground surface elevations range from approximately nine to 12 feet using the North Geodetic Vertical Datum of 1929 (NGVD29).

Parcel 4, Parcel 5, and the infrastructure corridors (i.e., portions of the Site with roads and sidewalks) have been redeveloped (see Section 1.1) and are covered with pavement, buildings, landscaped features, et cetera. The remaining portions of the Site (i.e., Parcels 2, 3, 6, 7, and 9, and the portion of the Site northwest of Parcel 7) are covered with crushed rock, pavement, and/or grass.

As part of the 2009 to 2010 infrastructure construction activities, historic stormwater features were decommissioned and a new stormwater collection and conveyance system was installed within the infrastructure corridors. Rainwater that falls on Parcels 4 and 5, and the infrastructure corridors either infiltrates or goes to this new stormwater system. Rainwater that falls on the remaining portions of the Site (i.e., Parcels 2, 3, 6, 7, and 9, and the portion of the Site northwest of Parcel 7) infiltrates. The Port has implemented interim stormwater stabilization measures (e.g., installation of temporary infiltration galleries in Parcels 2 and 3) to help ensure that all rainwater infiltrates in Parcels 2, 3, 6, 7, and 9, and the portion of the Site northwest of Parcel 7, while those areas await redevelopment (ESM Consulting Engineers 2010).

Ponded water has been present near the boundary between Parcels 2 and 3 since at least 2006. Since other investigation activities have ruled out the most plausible explanations for this ponded water (e.g., artesian well, leaking water main), it is speculated that this ponded water may represent natural artesian flow resulting from a previous breach of the regional confining layer (GeoEngineers 2007c, PIONEER 2011a). The extent of this ponded water has expanded since the infrastructure construction project was completed in 2010. As a result, this area was assessed for the presence of a jurisdictional wetland as documented in a wetland assessment report (ACERA 2013; Appendix B). The site assessment resulted in the delineation of a wetland in the western portion of Parcel 2 and the eastern portion of Parcel 3 that contained indicators of wetland hydrology, hydric soils, and a predominance of hydrophytic vegetation. However, this wetland developed as the result of a recent infrastructure development project and associated stormwater management activities. Thus, the wetland assessment report concluded that this wetland satisfies the City's definition of a non-regulated wetland per City Municipal Code 18.32.505.

2.2.3 Geologic Setting

The primary lithologic unit of interest is the fill material described in Section 2.1. Fill thicknesses under the Site are typically on the order of five to 20 feet (GeoEngineers and PIONEER 2008; Landau Associates 2009; PIONEER 2010b; RI lithologic logs presented in Section 3). As discussed in Section 2.1, the fill material can be divided into two categories: pre-1982 fill and 1982 fill. The primary soil type for the pre-1982 fill is light or dark sand, with some woody debris from historic lumber milling operations and construction debris. The 1982 fill is located on the eastern portion of the Site and consists of clean, light-colored gravel that was imported from an off-site, upland rock quarry. Native fine sands are the predominant soil type underneath both types of fill material (GeoEngineers and PIONEER 2008; Landau Associates 2009; PIONEER 2010b). Underneath the native fine sands is a low-permeability silt and clay aquitard. This aquitard, which is the regional confining layer that creates artesian groundwater conditions in Olympia, is estimated to be at least 30 feet thick under the Site (GeoEngineers and PIONEER 2008; Landau Associates 2009). Geologic cross-sections that illustrate the spatial relationship of the aforementioned soil types are presented in Figures 2-4 and 2-5.

2.2.4 Hydrogeologic Setting

A detailed discussion of the hydrogeologic setting of the Site is presented in the *Empirical Evaluation of the Potential for Soil Constituents to Migrate to Surface Water Via Groundwater at the East Bay Redevelopment Site* (PIONEER 2011a), which is included in Appendix C. In summary, the uppermost groundwater-bearing zone is encountered at depths ranging from ground surface to approximately 11 feet below ground surface (bgs), depending on location and tidal fluctuation (PIONEER 2011a). Tidal fluctuation is present in monitoring wells (MWs) located proximate to the East Bay of Budd Inlet. The direction of groundwater flow is generally to the northeast towards the East Bay of Budd Inlet, although localized variations do exist. Most notably, a groundwater mound, which is suspected to be associated with natural artesian flow conditions as mentioned in Section 2.2.2, is present in Parcel 3. Further discussion of Site groundwater data is included in Section 3.

2.3 Operational History

Detailed information about the operational history of the Site has been presented in previous Site documents (GeoEngineers 2007b, 2007c, 2007d; GeoEngineers and PIONEER 2008; PIONEER 2010b). In general, the operational history consisted of three primary periods:

- Late 1800s to 1972: Lumber milling and related operations by a variety of owner/operators.
- 1972 to 2008: Warehouses and commercial storage by the Port and its tenants.
- 2008 to present: Vacant land being redeveloped, or awaiting redevelopment.

Former lumber milling activities and related operations prior to 1972 included lumber sawing, lumber milling, veneer manufacturing, and plywood manufacturing. Over time, as more reclaimed land was created with the dredge-fill activities, operations expanded. An estimate of the maximum known extent of these historic operational footprints is presented in Figure 2-6. The greatest extent and longest duration of the operations was the plywood/veneer manufacturing by the St. Paul and Tacoma Lumber Company and its predecessor (Olympia Veneer Company) from 1921 to 1972. Other historic operations related to lumber milling activities were H.G. Richardson's Shingle Mill, Olympia Planing Mill and Saw Mill, National Wood Pipe Company, and Olympia Door Company Sash and Door Factory. In addition to the lumber milling operations, a small Union Pacific rail spur, which served the former lumber milling operations, was located on the western edge of the Site from circa 1908 until it was removed in 2009.

2.4 Potential Contaminant Sources

Historical maps were used to identify features associated with the aforementioned operations that may be areas of concern (AOCs) for potential contamination (GeoEngineers 2007b, 2007c, 2007d; GeoEngineers and PIONEER 2008; PIONEER 2010b). Lumber milling operations included various support facilities that may be AOCs such as shops (e.g., machine shops, blacksmith shops, repair shop, welding shop, electronic shop), power/boiler houses, oil houses, tar dipping tanks, and transformers. The AOC locations are shown on Figure 2-7. For investigation purposes, AOCs were grouped into historic operation areas in order to characterize potential source areas. Historic operation area boundaries were assumed to extend 25 feet beyond the boundary of the AOC (or group of AOCs) to account for any spills or localized transport associated with the AOC(s), and to account for any uncertainty in the AOC location(s). The historic operation areas, and the associated constituent of interest (COI) categories is presented in Figure 2-8. The primary release mechanisms associated with these historic operation areas were likely spills and refuse buried during subsequent fill events.

Other miscellaneous potential contaminant sources include:

- Historic treated wood pilings.
- The pre-1982 fill material dredged from Budd Inlet.
- Airborne deposition of emissions from the three on-property combustion sources (i.e., boiler house, power house, and refuse fire area).
- Airborne deposition of emissions from off-property and upwind combustion sources.
- Rail operations along a small Union Pacific rail spur.

A conceptual release model to illustrate the potential contaminant sources associated with the historic operation areas and the other miscellaneous potential sources is presented in Figure 2-9. COI categories associated with the potential sources include:

- Metals
- Total petroleum hydrocarbons (TPH)
- Polycyclic aromatic hydrocarbons (PAHs)
- Volatile organic compounds (VOCs)
- Chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans (dioxins/furans)
- Polychlorinated biphenyls (PCBs)

2.5 Regulatory Context

The Port originally entered the Site into Ecology's Voluntary Cleanup Program per WAC 173-340-515 in 2007 when the East Bay Redevelopment Project began. In October 2008, the Port and Ecology entered into Agreed Order (AO) DE5471 for the Site (Ecology 2008). In September 2010, the Port, City, LOTT, and Ecology entered into AO DE7830, which superseded AO DE5471 (Ecology 2010b). This RI/FS Report was prepared pursuant to AO DE7830.

2.6 Site Chronology

A significant number of RI/FS-related activities have been completed and approved for this Site. A Site chronology that summarizes the key activities to date, which include work plans, field investigations, Interim Actions (IAs), reports, and Ecology approvals is presented in Table 2-1. Additional details about the two completed IAs and the conclusions from two completed site-specific pathway evaluations are summarized in the following subsections.

2.6.1 Infrastructure IA

The Infrastructure IA was conducted within the infrastructure corridors from 2009 to 2010 in accordance with the Ecology-approved IA Work Plan (IAWP; PIONEER 2009; Ecology 2009a). The location of the Infrastructure IA is presented in Figure 2-10. The Infrastructure IA was conducted in conjunction with, and added cleanup requirements to, the infrastructure construction activities (e.g., actions and controls were required for soil that was excavated during the construction of utilities and roads). As documented in the Ecology-approved Infrastructure IA Report (PIONEER 2010a; Ecology 2010a), the Infrastructure IA included:

- Implementing engineering controls (ECs) during the infrastructure construction project to prevent exposures to potential receptors during construction activities (e.g., site control, dust control, stormwater control, health and safety requirements);
- Implementing a compliance monitoring plan (e.g., sampling and analysis);
- Disposing of approximately 10,000 CY of excavated material at a permitted off-site landfill that (1) was geotechnically unsuitable for on-site reuse or (2) had a constituent concentration exceeding a soil remediation level (RL) established in the Infrastructure IAWP[5];
- Reusing approximately 12,000 CY of excavated soil on-site that (1) had constituent concentrations that did not exceed the soil RLs established in the Infrastructure IAWP, (2) was reused under pavement, and (3) was geotechnically suitable for reuse; and
- Installing pavement (e.g., roads and sidewalks) over the entire IA area.

The Infrastructure IA Report is included in Appendix D.

2.6.2 Parcel 4/5 IA

The Parcel 4/5 IA was conducted in Parcels 4 and 5 from 2010 to 2012 in accordance with the Ecology-approved IAWP (Brown and Caldwell 2010; Ecology 2010b).[6] The location of the Parcel 4/5 IA is presented in Figure 2-10. The Parcel 4/5 IA was conducted prior to the redevelopment of each parcel. As documented in the Parcel 4/5 IA Report (Brown and Caldwell 2015), actions completed during the IA included:

- Implementing ECs during IA activities to prevent exposures to potential receptors;
- Implementing a compliance monitoring plan (e.g., sampling and analysis);

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[5] Of the 36 soil samples that were collected from soil stockpiles, the only IA RL exceedance was a total cPAHs concentration in one sample.

[6] The Parcel 4/5 IAWP was included as an exhibit to AO DE7830.

- Removing soil at and surrounding sample locations DP11, DP17, DP18, DP21, and TP02 due to an exceedance of a soil RL established in the Parcel 4/5 IAWP at those sample locations;
- Disposing of approximately 7,600 CY of excavated material at a permitted off-site landfill that (1) was associated with the excavations of the DP11, DP17, DP18, DP21, and TP02 soil RL exceedances, (2) was geotechnically unsuitable for on-site reuse, (3) could not be reused due to a lack of on-site space, or (4) had a constituent concentration exceeding a soil RL established in the Parcel 4/5 IAWP[7];
- Reusing approximately 4,300 CY of excavated soil on-site that (1) had constituent concentrations that did not exceed soil RLs established in the Parcel 4/5 IAWP, (2) was reused under pavement, and (3) was geotechnically suitable for reuse; and
- Installing buildings, hardscape, or a soil cover over the entire IA area.

The Parcel 4/5 IA Report is included in Appendix E.

2.6.3 Evaluation of the Potential Soil-to-Surface Water Pathway

The soil-to-surface water (via groundwater transport) pathway is a potentially complete pathway for this Site. A site-specific empirical evaluation of the potential for constituents in soil to impact downgradient surface water via groundwater transport was completed in accordance with WAC 173-340-747(9) and WAC 173-340-747(10). Key conclusions from this Ecology-approved report (PIONEER 2011a; Ecology 2011a) were:

- The only constituents with a groundwater screening level (SL) exceedance that were potentially attributable to a Site release were dissolved arsenic, TPH in the diesel range (TPH-D), and TPH in the heavy oil range (TPH-HO).[8] Thus, dissolved arsenic, TPH-D, and TPH-HO are the only groundwater constituents of potential concern (COPCs).
- Since arsenic, TPH-D, and TPH-HO were identified as a potential concern for the soil-to-surface water pathway, soil SLs, cleanup levels (CLs), and RLs that are protective of the soil-to-surface water pathway will need to be established for arsenic, TPH-D, and TPH-HO.
- Soil SLs, CLs, and RLs for all other soil constituents (besides dissolved arsenic, TPH-D, TPH-HO) do not need to account for the soil-to-surface water pathway since groundwater data empirically demonstrated that these other constituents had not impacted groundwater, and therefore will not impact surface water.

The 2011 soil-to-surface water evaluation report is included in Appendix C.

As a follow-up to the 2011 soil-to-surface water evaluation report, additional activities were conducted to further evaluate the potential for arsenic, TPH-D, and TPH-HO in soil and groundwater to impact downgradient surface water via groundwater transport (PIONEER 2014b). Specifically, a conditional point of compliance (POC) network of MWs along the eastern Site boundary was established (i.e.,

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[7] Of the 134 soil samples that were collected from soil stockpiles, the only IA RL exceedances were lead concentrations in three of the samples and TPH-HO concentrations in four of the samples.

[8] As allowed by WAC 173-340-720(9)(b), dissolved concentrations were used to evaluate arsenic compliance for the reasons discussed in Section 6.2.1 of Appendix C (PIONEER 2011a). Most notably, the surface water criteria in the federal and state surface water laws and regulations that form the basis for the SLs (i.e., Chapter 173-201A WAC, Section 304 of the Clean Water Act , 40 Code of Federal Regulations 131) are explicitly intended for use with dissolved arsenic data.

MW12, MW18, MW26, MW27), and four groundwater monitoring (GWM) events at these POC MWs were conducted between September 2014 and June 2015. The investigation activities and results associated with the POC GWM events are discussed in Section 3.

2.6.4 Evaluation of the Potential Soil-to-Indoor Air Pathway

The soil-to-indoor air pathway is a potentially complete pathway for this Site. A site-specific evaluation of the pathway was completed. Key conclusions from this Ecology-approved report (PIONEER 2014a; Ecology 2015a) were:

- The only constituents with a soil-to-indoor air SL exceedance attributable to a Site release were TPH in the gasoline range (TPH-G) and total naphthalenes. Thus, TPH-G and total naphthalenes are the only COPCs for the soil-to-indoor air pathway.
- MTCA Method A soil CLs (i.e., 100 mg/kg for TPH-G and 5 mg/kg for total naphthalenes) will be used as the soil SLs, CLs, and RLs for TPH-G and total naphthalenes in order to address the potential soil-to-indoor air pathway.
- The only soil sample locations where TPH-G and total naphthalenes concentrations exceeded SLs were DP06 and SVP-2SO.
- In accordance with WAC 173-340-740(6)(c), the POC for TPH-G and total naphthalenes in soil will extend from ground surface to the deepest measured groundwater elevation proximate to DP06 and SVP-2SO. Thus, the POC elevation is 6.8 feet NGVD29 (Ecology 2013d), which corresponds to a depth of approximately 4.5 feet bgs.

The soil-to-indoor air evaluation summary memorandum is included in Appendix F.

2.7 Current and Future Land Use

The current land use for the Infrastructure IA area is an infrastructure corridor (e.g., roads and sidewalks). The current land use of Parcel 4 is a developed public plaza. The current land use of Parcel 5 is the Hands On Children's Museum. The current land use for the remainder of the Site is vacant land awaiting redevelopment, with the exception of a landscaped area located east of Parcels 4 through 7. A temporary perimeter fence currently surrounds the undeveloped and uncovered portions of the Site. Representative photographs showing the current land use are shown in Figure 2-11.

The anticipated future land use for the Infrastructure IA area, Parcel 4, Parcel 5, and the landscaped area east of Parcels 4 through 7 is expected to remain the same as current land use for the foreseeable future. The current zoning for the Site is urban waterfront (City of Olympia 2012). Consistent with that zoning, the Port's redevelopment plan for the remainder of the Site (i.e., Parcels 2, 3, 6, 7, and 9, and the portion of the Site northwest of Parcel 7) includes construction of mixed-use, urban buildings that are consistent with the nature of Olympia's urban core. Once redeveloped, future land use in these areas could include commercial office space, retail/restaurants, a hotel, parking, and urban housing (e.g., condominiums above ground-level retail space). A conceptual site plan for future development within the East Bay Redevelopment Project boundary is presented in Figure 2-12.

For the purposes of the RI/FS and consistent with MTCA requirements, land use was assumed to be unrestricted (i.e., single-family residential) in order to develop more protective SLs, even though there is no current residential land use and zoning does not allow future single-family residential land use.

2.8 Conceptual Site Exposure Model

A conceptual site exposure model (CSEM) has been developed for the Site in order to provide a framework for understanding potential Site exposures based on current and anticipated future land use. In addition to exposure scenarios based on current and anticipated future land use, the CSEM also includes two baseline no action scenarios (i.e., single-family residents and commercial workers in a situation where the Site is allowed to be developed without any controls or further remedial action) in order to provide the basis for establishing more protective SLs, CLs, and RLs consistent with MTCA default exposure scenarios (see Appendix G). The most recent CSEM has been updated to provide additional clarity and address Ecology comments (PIONEER 2013b; Ecology 2013c). The updated CSEM is presented in Figure 2-13. An overview of the CSEM is presented in Appendix G.

As shown in Figure 2-13 and Appendix G, the only complete exposure pathways at the Site are:

- Incidental ingestion of soil, dermal contact with soil, and inhalation of particulates by on-site construction/utility workers during the remediation and redevelopment construction phase.
- Incidental ingestion of soil, dermal contact with soil, and inhalation of particulates by on-site utility maintenance workers during the post-remediation and post-redevelopment phase.

In addition, the following baseline no action pathways were considered complete for the purposes of this RI/FS:

- Incidental ingestion of soil, dermal contact with soil, and inhalation of particulates by single-family residents and commercial workers.
- Inhalation of vapors by single-family residents and commercial workers. This pathway is only complete for TPH-G and total naphthalenes (PIONEER 2014a).

These complete exposure pathways provided the basis for establishing soil and groundwater SLs (see Section 3). All of the potentially complete pathways were considered insignificant compared to the complete exposure pathways in the determination of soil and groundwater SLs, with the following exception. Incidental ingestion of East Bay surface water and sediment, dermal contact with East Bay surface water and sediment, and consumption of seafood from the East Bay by recreators, subsistence fishers, and aquatic organisms are potentially complete pathways that were incorporated in the determination of SLs for arsenic, TPH-D, and TPH-HO to ensure protection of human health and the environment.

It should be noted that the Site is excluded from a terrestrial ecological evaluation per WAC 173-340-7491(1)(b) because of the soil cover being installed as part of remediation/redevelopment activities.

Section 3: Remedial Investigation

The purpose of this section is to (1) summarize the RI activities conducted at the Site, and (2) present the nature and extent of Site contamination in accordance with WAC 173-340-350(7).

3.1 Summary of RI Sampling and Analysis Activities

The RI sampling and analysis activities were completed in the following phases (see also Table 2-1)[9]:

- Pre-AO: Soil samples were collected from 48 locations (DP01 through DP25, MW01 through MW06, MW08 through MW20, and TP01 through TP04), 20 MWs were installed (MW01 through MW20), and two GWM events were conducted (January 2007, and June to August 2007).
- Phase 1 RI: Soil samples were collected from eight locations (DP27, DP30, DP32, DP33, DP34, DP36, DP38, and DP40).
- Phase 2 RI: Soil samples were collected from 14 locations (DP26, DP28, DP29, DP31, DP35, DP37, DP39, DP41, DP42, and MW21S through MW25S), six MWs were installed (MW02R, MW21S through MW25S), and six GWM events were conducted (June 2008, September 2009, November 2009, December 2009, March 2010, August 2010).
- Parcel 4/5 Pre-IA: Soil samples were collected from three locations (DP43 through DP45).
- Parcel 4/5 IA: IA excavation sidewall/bottom soil samples were collected from 36 locations (DP11-1 through DP11-5, DP17-1 through DP17-5, DP18-1 through DP18-5, DP21-1 through DP21-10, and TP02-1 through TP02-11).
- Data gap investigation regarding the Site boundary determination and P-1 geophysical anomaly: Soil samples were collected from 14 locations (DP46 through DP49, DP52 through DP56, P-1-N, P-1-W, P-1-S, P-1-E, and P-1-B).
- Data gap investigation regarding the soil-to-indoor air pathway: Soil samples were collected from two locations (SVP-1SO and SVP-2SO).[10]
- Data gap investigation regarding POC GWM: Soil samples were collected from two locations (DP57 and DP58), two MWs were installed (MW26 and MW27), and four GWM events for the POC MWs were conducted (September 2014, December 2014, March 2015, June 2015).[11]
- Data gap investigation regarding methane in indoor air and soil gas: Indoor air samples were collected from the Hands on Children's Museum and the East Bay Port Plaza restrooms, and soil gas samples were collected from 22 locations in September 2016.

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[9] In addition, data from soil samples collected in 2007 and 2008 from four locations (BC_DP-07 through BC_DP-09, and BC_TP02) as part of the investigation of the adjacent LOTT Expansion Site (Brown and Caldwell 2007, 2009a) are included in this report since these sample locations are now within the East Bay Redevelopment Site boundary.

[10] Two co-located soil gas samples were also collected, but are not discussed further in this report since it was subsequently decided that soil results would be used to evaluate the soil-to-indoor air pathway (PIONEER 2014a).

[11] In addition, MW12 was re-sampled in February 2015 due to an anomalous TPH-HO detection during the December 2014 GWM event.

In total, 292 RI-related soil samples were collected at varying depths from 130 locations (see Figure 3-1).[12,13] A total of 28 MWs (MW01 through MW27, and MW02R) were installed and developed as part of the RI (see Figure 3-2).[14] Groundwater samples were collected using low-flow sampling procedures during the GWM events that were conducted between January 2007 and June 2015.

Soil and groundwater samples were analyzed for a wide variety of COIs, depending on the location of the sample and the nature of the investigation activity. In general, the following analytical methods were used when soil and groundwater samples were analyzed for the following constituents:

- Metals were analyzed using United States Environmental Protection Agency (USEPA) Methods SW846-6010B (7471 for mercury), SW846-6020A (7470A for mercury), or 200.8.
- TPH-G was analyzed using Ecology Method NWTPH-G.
- TPH-D and TPH-HO were analyzed using Ecology Method NWTPH-Dx.
- PAHs and other semivolatile organic compounds were analyzed using USEPA Method SW846-8270C.
- VOCs were analyzed using USEPA Method SW846-8260B.
- Dioxins/furans were analyzed using USEPA Method SW846-8290.
- PCBs were analyzed using USEPA Method SW846-8082.

The Ecology-approved RI Work Plan (RIWP; GeoEngineers and PIONEER 2008; Ecology 2009b) and the Ecology-approved data gap investigation work plans (PIONEER 2011b, 2013a, 2014b, 2016a; Ecology 2011b, 2013b, 2014) prepared pursuant to the AO are included in Appendix H. Field notes and analytical laboratory reports are included in the following appendices:

- Field notes and analytical laboratory reports for the GWM events conducted between January 2007 and August 2010 are included in Appendix C.
- The field notes and analytical laboratory reports for the excavation sidewall and bottom samples collected during the Parcel 4/5 IA are included in Appendix E.
- Field notes for the remainder of the RI-related activities that are not already included in Appendices C and E are included in Appendix I.
- The analytical laboratory reports for the remainder of the RI-related activities that are not already included in Appendices C and E are included in Appendix J.

Lithologic logs for all soil borings and test pits, and MW construction diagrams for all MWs are included in Appendix K. A summary of the MW construction details is presented in Table 3-1. A tabular summary of all RI-related analytical laboratory results is presented in Appendix L.

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[12] Some of the samples associated with sample locations DP11, DP17, DP18, DP21, and TP02 are no longer in place due to the Parcel 4/5 IA excavations.

[13] In addition, 36 soil samples were collected from soil stockpiles during the Infrastructure IA (PIONEER 2010a, Appendix D), and 134 soil samples were collected from soil stockpiles during the Parcel 4/5 IA (Brown and Caldwell 2015, Appendix E). Although these soil stockpile results were not used to define the nature and extent of contamination, these results were used in the determination of soil COPCs (see Section 3.2).

[14] MW02R, MW11, and MW17 are not located within the Site boundary.

3.2 Determination of Soil SLs and Soil COPCs

The determination of soil SLs and soil COPCs is presented in detail in Appendix M and summarized in this section. Soil SLs were developed for COIs detected in any on-site RI soil sample. The SLs were based on single-family residential land use (i.e., unrestricted land use) in order to develop more protective SLs consistent with MTCA requirements even though there is no current residential land use and zoning does not allow future single-family residential land use. Soil COIs were identified as soil COPCs if:

- The maximum detected COI concentration in on-site RI soil samples exceeded the soil SL;
- The maximum detected COI concentration in Infrastructure IA soil stockpile samples exceeded its soil SL (PIONEER 2010a); or
- The maximum detected COI concentration in Parcel 4/5 IA soil stockpile samples exceeded its soil SL (Brown and Caldwell 2015).

As presented in Appendix M, the resulting soil COPCs are:

- Arsenic
- Lead
- TPH-G
- Total naphthalenes
- TPH-D and TPH-HO Combined
- Total carcinogenic PAHs (cPAHs)[15]
- Total dioxins/furans[16]

As presented in Appendix M, the resulting soil SLs for the eight soil COPCs are:

Soil COPC	Soil SL	Basis
Arsenic	20 mg/kg	Unrestricted land use scenario
Lead	250 mg/kg	Unrestricted land use scenario
TPH-G	100 mg/kg	Unrestricted land use scenario
Total Naphthalenes	5.0 mg/kg	Unrestricted land use scenario
TPH-D and TPH-HO Combined	4,700 mg/kg	Unrestricted land use scenario
Total cPAHs	0.095 mg/kg	Unrestricted land use scenario
Total Dioxins/Furans	11 ng/kg[17]	Unrestricted land use scenario

[15] Total cPAHs concentrations were calculated based on toxicity equivalency factors (TEFs) for benzo(a)pyrene in accordance with WAC 173-340-708(8)(e).

[16] Total dioxins/furans concentrations were calculated based on TEFs for 2,3,7,8-tetrachlorodibenzo-p-dioxin in accordance with WAC 173-340-708(8)(d).

[17] The total dioxins/furans soil SL is slightly higher than the total dioxins/furans soil SL/CL of 9.8 ng/kg in previous Site documents (e.g., PIONEER 2009) due to an updated oral cancer potency factor in the current version of Ecology's Cleanup Levels and Risk Calculations (CLARC) database (Ecology 2015b).

3.3 Nature and Extent of Soil COPC Impacts

Soil concentrations are presented in Tables 3-2 through 3-8 by sample location and depth for arsenic, lead, TPH-G, total naphthalenes, TPH-D and TPH-HO combined, total cPAHs, and total dioxins/furans, respectively, relative to the soil SLs. Soil concentrations are presented in Figures 3-3 through 3-9 for arsenic, lead, TPH-G, total naphthalenes, TPH-D and TPH-HO combined, total cPAHs, and total dioxins/furans, respectively, relative to the soil SLs (as well as the soil RLs, which were calculated and presented in Appendix M). In summary, there were few soil SL exceedances for arsenic, lead, TPH-G, total naphthalenes, TPH-D and TPH-HO combined. There were significantly more soil SL exceedances for total cPAHs and total dioxins/furans at locations throughout the Site.

The delineation of the soil SL exceedances is presented by COPC in Figures 3-3 through 3-9. The nature and extent of each soil COPC and the delineation of soil SL exceedances is discussed in more detail in the following subsections.

3.3.1 Arsenic, Lead, TPH-G, Total Naphthalenes, and TPH-D and TPH-HO Combined in Soil

Figures 3-10 through 3-14 show the soil concentrations for arsenic, lead, TPH-G, total naphthalenes, and TPH-D and TPH-HO combined, respectively, relative to historic operation areas identified in Figure 2-8 for these COPCs. As shown in Figures 3-10 through 3-14, all of the arsenic, lead, TPH-G, total naphthalenes, TPH-D and TPH-HO combined soil SL exceedances were located within historic operation areas in which these particular COPCs could have been released to soil via a spill or buried refuse, with the following possible exceptions. The soil SL exceedances for arsenic at DP17 and lead at DP11 were not within historic operation areas assumed to be associated with lead or arsenic. However, DP11 was located within the oil house area, and it is possible that lead was released within the oil house area or was associated with lead-based paint. In addition, it is possible that the surface material impacted with arsenic and lead was buried during subsequent fill events at the DP17 and DP11 locations, respectively. The arsenic impacted soil at DP17 and lead impacted soil at DP11 were removed as part of the Parcel 4/5 IA (Brown and Caldwell 2015).

Figure 3-15 shows the soil concentrations for arsenic, lead, TPH-G, total naphthalenes, TPH-D and TPH-HO combined relative to the historic fill events shown on Figure 2-2. As shown on Figure 3-15, soil SL exceedances for these COPCs were not correlated with a particular fill event. As a result, it does not appear that a particular fill event was the source of the soil SL exceedances for these COPCs.

Each of the COPC SL exceedances shown on Figures 3-3 through 3-7 is relatively isolated and is expected to have a minimal lateral extent since (1) the distribution of soil concentrations does not suggest the releases for these COPCs were widespread, (2) the COPCs were not associated with combustion releases, (3) any leaching from soil to groundwater was localized (PIONEER 2011a), and (4) erosion is not expected to be a significant transport pathway given the data distribution, flat topography, and infiltration capacity of Site soil.[18] As a result, the extents of the arsenic, lead, TPH-G, total naphthalenes, TPH-D and TPH-HO combined soil SL exceedances were assumed to extend halfway to surrounding soil samples with concentrations less than the respective soil SL, or to a distance of 25 feet if another sample was not located within 100 feet of an exceedance.[19] The resulting COPC delineations are shown on Figures 3-3 through 3-8.

3.3.2 Total cPAHs in Soil

The soil concentrations for total cPAHs relative to historic operation areas identified in Figure 2-8 for total cPAHs are presented in Figure 3-16. As shown in Figure 3-16, all of the total cPAHs soil SL exceedances were located within or adjacent to historic operation areas in which cPAHs could have been released to soil via a spill or buried refuse. Although the number of SL exceedances in samples deeper than six feet bgs is unusual for a typical spill scenario, these deep exceedances could have been associated with impacted surface material that was buried during subsequent fill events.

As discussed in more detail in the *Site Boundary Technical Memorandum for the East Bay Redevelopment Site* (PIONEER 2010b, Appendix A)[20], it is unlikely that airborne deposition of emissions from the three on-property combustion sources (i.e., boiler house, power house, and refuse fire area) was responsible for the total cPAHs exceedances for the following reasons:

- In an airborne deposition scenario, the highest concentrations would be in surface soil. By contrast, most of the total cPAHs exceedances in the boiler house area, power house area, and refuse fire area were deeper than six feet bgs. In addition, total cPAHs concentrations in samples deeper than six feet bgs were similar to concentrations in samples collected in the top two feet of soil.
- In an airborne deposition scenario, the highest concentrations would be expected in the areas immediately surrounding the combustion source, where particulates primarily settle. By contrast, total cPAHs concentrations were relatively consistent across the Site.
- A significant number of total cPAHs exceedances were located upwind of the on-property combustion sources given the predominant wind direction for Olympia (south-southwest) as shown in Figure 2-3.
- The deep exceedances cannot be explained by airborne deposition followed by subsequent fill events. As shown in Figure 3-17, the land where most of the total cPAHs exceedances were located was created prior to 1908. The refuse fire area operated after 1908, and the boiler house and the power house operated after 1924 (GeoEngineers 2007a, 2007c).

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[18] In addition to the general lack of soil SL exceedances in the RI data, there were few exceedances of soil SLs for these COPCs in 170 soil samples collected from IA stockpiles (PIONEER 2010a; Brown and Caldwell 2015). The only soil SL exceedances for these COPCs in the 170 IA soil stockpile samples were lead concentrations in three samples collected from two Parcel 4/5 IA stockpiles. These two stockpiles may have been associated with the DP11 excavation, which had elevated lead concentrations.

[19] A distance of 25 feet was a conservative estimate since (1) the distribution of soil concentrations indicates the exceedances were isolated, (2) a significant lateral distribution for the fate and transport is not expected for the reasons described in this subsection, and (3) the extent of the DP11, DP17, DP18, and DP21 exceedances was limited (Brown and Caldwell 2015).

[20] See Figure 3-16 for an updated version of the concentration data presented in the *Site Boundary Technical Memorandum*.

The total cPAHs soil concentrations relative to the historic fill events shown on Figure 2-2 are presented on Figure 3-17. As shown on Figure 3-17, the total cPAHs soil SL exceedances were not correlated with a particular fill event. As a result, it does not appear that a particular fill event was the source of the total cPAHs soil SL exceedances.

A factor that complicates the evaluation of total cPAHs impacts is that total cPAHs are likely present in downtown Olympia soil at concentrations exceeding the soil SL due to urban background. The site, adjacent property, and upwind property have been used for urban and commercial/industrial purposes for approximately 150 years. As discussed in more detail in the *Site Boundary Technical Memorandum for the East Bay Redevelopment Site* (PIONEER 2010b, Appendix A):

- There were numerous off-site, stationary combustion sources on the Port peninsula, the western shore of West Bay, and downtown Olympia that could have impacted Site soil and/or the Budd Inlet sediments used as Site fill;
- Mobile combustion sources such as ship smokestacks and automobile/truck traffic in downtown Olympia could have contributed to cPAHs in Site soil or the Budd Inlet sediments used as Site fill;
- USEPA, Ecology, and regulatory agencies in other states have acknowledged that concentrations of total cPAHs are significantly higher in urban soil and fill material than in pristine soil; and
- The total cPAHs soil exceedances at the Site appear to be within the concentration range of what is typically attributable to urban background.

Regardless of the exact urban background contribution relative to on-site releases from spills and buried refuse, the on-site releases of total cPAHs are not expected to extend significantly beyond the known soil SL exceedances since (1) the distribution of soil concentrations did not indicate that there was a single large source (e.g., large spill) that could have impacted a large area, (2) airborne deposition was not a significant transport pathway, (3) cPAHs bind strongly to soil and have limited mobility once deposited due to a high soil organic carbon-water partitioning coefficient (Ecology 2001, 2015b), (4) any leaching from soil to groundwater was localized (PIONEER 2011a), and (5) erosion is not expected to be a significant transport pathway given the data distribution, flat topography, and infiltration capacity of Site soil. As a result, the extent of each total cPAHs soil SL exceedance was assumed to extend halfway to surrounding soil samples with concentrations less than the soil SL, or to a distance of 25 feet if another sample was not located within 100 feet of an exceedance, as bounded to the east by the 1982 fill.[21] The resulting SL delineations for total cPAHs are shown on Figure 3-8.

3.3.3 Total Dioxins/Furans in Soil

The soil concentrations for total dioxins/furans relative to historic operation areas identified in Figure 2-8 for total dioxins/furans is presented in Figure 3-18. As shown in Figure 3-18, the three highest total dioxins/furans concentrations (the three soil RL exceedances) were located within the boiler house area and power house area. If the boiler house and power house burned salt-laden hog fuel (i.e., wood

[21] The exceedances associated with one MW20 sample and one DP27 sample in the northwestern corner of the property were delineated at the property boundary based on results from nearby samples on the LOTT Expansion Site.

waste from logs rafted in salt water), dioxins/furans could have been produced (Ecology 1998). However, as discussed in more detail in the *Site Boundary Technical Memorandum for the East Bay Redevelopment Site* (PIONEER 2010b, Appendix A)[22], it is unlikely that airborne deposition of emissions from the boiler house or power house was responsible for the total dioxins/furans SL exceedances for the following reasons:

- In an airborne deposition scenario, the highest concentrations would be in surface soil. By contrast, few of the total dioxins/furans exceedances in the boiler house area or power house area were in the top two feet of soil. In addition, total dioxins/furans concentrations in samples deeper than six feet bgs were similar to concentrations in samples collected in the top two feet of soil.
- In an airborne deposition scenario, the highest concentrations would be expected in the areas immediately surrounding the combustion source, where particulates primarily settle. By contrast, most of the samples collected in the top two feet of soil within or immediately adjacent to the boiler house area and power house area did not have total dioxins/furans SL exceedances (e.g., DP33, DP39, DP40, DP45, MW24S, TP02-3, TP02-4, TP02-5, TP02-7, TP02-11).
- Two of the total dioxins/furans SL exceedances (DP30 and TP04) were located upwind or crosswind of the on-property combustion sources given the predominant wind direction for Olympia (south-southwest) as shown in Figure 2-3.
- The deep exceedances cannot be explained by airborne deposition followed by subsequent fill events. As shown in Figure 3-19, the land where a significant number of the total dioxins/furans exceedances were located was created prior to 1908. The boiler house and the power house operated after 1924 (GeoEngineers 2007a, 2007c).

The total dioxins/furans soil concentrations relative to the historic fill events shown on Figure 2-2 are presented in Figure 3-19. As shown on Figure 3-19, the total dioxins/furans soil SL exceedances were not correlated with a particular fill event. As a result, it does not appear that a particular fill event was the source of the total dioxins/furans soil SL exceedances.

As discussed in more detail in the *Site Boundary Technical Memorandum for the East Bay Redevelopment Site* (PIONEER 2010b, Appendix A), the total dioxins/furans exceedances were primarily associated with wood debris. With the possible exception of the soil sample collected from TP03, the significantly elevated total dioxins/furans concentrations (i.e., those exceeding 50 ng/kg) were associated with a sample interval that contained wood debris or was located immediately adjacent to an interval that contained wood debris.[23,24] Moreover, the three samples with total dioxins/furans RL

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[22] See Figure 3-18 for an updated version of the concentration data presented in the *Site Boundary Technical Memorandum for the East Bay Redevelopment Site*.

[23] See the field notes in Appendix I and boring logs in Appendix K for the lithology associated with the DP30 sample at 7 to 7.5 feet bgs, the DP42 sample at 7 to 8 feet bgs, the DP52 sample at 12 to 13.5 feet bgs, the MW24S samples at 6.5 to 8 bgs and 9 to 10 feet bgs, the TP01 sample at 2-2.5 feet bgs, and the TP04 sample at 1.5 to 2 feet bgs. A significant amount of wood pilings, wood features, and wood debris were encountered in the Parcel 4/5 IA excavation of the TP02 sample (Brown and Caldwell 2015, field observations by the author).

[24] The TP03 log noted a significant amount of debris (e.g., concrete, brick, and glass) in the test pit. Amongst this debris, it is possible that wood debris was present in the test pit, but not specifically called out on the log. The TP03 situation may be

exceedances (MW24S, TP02, and TP02-3) were all associated with intact wood features that were likely treated.[25] Specifically, the MW24S sample was collected from an intact wood piling that appeared to be treated, and the TP02 and TP02-3 samples were collected from an area where intact wood features that appeared to be treated (e.g., pilings and a suspected seawall) were encountered during the Parcel 4/5 IA excavation (PIONEER 2010b; Brown and Caldwell 2015; field observations by the author). The location and depth of these historic wood features correlate with the location of historic shoreline buildings prior to fill events.

A factor that complicates the evaluation of total dioxins/furans impacts is that historic total dioxins/furans concentrations in Budd Inlet surface sediment were likely elevated (i.e., exceeding the SL of 11 ng/kg) due to historic, regional anthropogenic activities since "inner Budd Inlet has historically supported wood product industries, recreational marinas, and boat construction/repair facilities" (Science Applications International Corporation 2008). The pre-1982 fill is primarily comprised of material dredged from Budd Inlet. Although the range of historic total dioxins/furans concentrations in former native surface sediment is unknown, and most of the pre-1982 fill likely contained minimal amounts of surface sediment due to the volume and soil types needed for fill activities, it is possible that pockets of the pre-1982 fill contained historic surface sediment that was impacted with total dioxins/furans.

Regardless of the exact historic surface sediment contribution relative to on-site releases associated with treated wood, the on-site releases of total dioxins/furans are not expected to extend significantly beyond the known soil SL exceedances since (1) the distribution of soil concentrations did not indicate that there was a single large source (e.g., large spill) that could have impacted a large area, (2) airborne deposition was not a significant transport pathway, (3) dioxins/furans bind strongly to soil/wood and are essentially immobile once deposited (Agency for Toxic Substances and Disease Registry 1998), (4) any leaching from soil/wood to groundwater was localized (PIONEER 2011a), and (5) erosion is not expected to be a significant transport pathway given the data distribution, flat topography, and infiltration capacity of Site soil. As a result, the extent of each total dioxins/furans soil SL exceedance was assumed to extend halfway to surrounding soil samples with concentrations less than the soil SL, or to a distance of 25 feet if another sample was not located within 100 feet of an exceedance, as bounded to the east by the 1982 fill. The resulting SL delineations for total dioxins/furans are shown on Figure 3-9.

3.4 Overview of Fate and Transport Properties for Soil COPCs

A detailed discussion about constituent fate and transport is not necessary for this Site given the general lack of significant source areas or observed transport from the locations with soil SL exceedances. As a result, this section will instead provide a brief overview of the relevant fate and transport properties for

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analogous to TP02, in which wood debris was not noted in the TP02 lithologic log, but was encountered in the Parcel 4/5 IA excavation of the TP02 sample (Brown and Caldwell 2015, field observations by the author).

[25] The three total dioxins/furans RL exceedances were collected from MW24S at 6.5 to 8 bgs, TP02 at 2 to 2.5 feet bgs, and TP02-3 at 3.5 feet bgs.

the seven soil COPCs. For the purposes of this RI/FS, the relevant fate and transport properties for the seven COPCs are:

- Soil adsorption: Arsenic and lead bind strongly to soil and have limited mobility due to high soil-water distribution coefficients (Ecology 2001, 2015b). Likewise, total naphthalenes, TPH-D and TPH-HO combined, total cPAHs, and total dioxins/furans bind strongly to soil and have limited mobility due to their high soil organic carbon-water partitioning coefficients (Ecology 2001, 2015b). In other words, it is expected that there would be limited transport of these COPCs to groundwater or stormwater, but these COPCs could be present in Site dust and areas with soil erosion deposits. By contrast, TPH-G is typically much more likely than the other COPCs to be transported from soil to water, although Site empirical data have demonstrated that the limited TPH-G impacts in Site soil have not impacted groundwater (PIONEER 2011a).
- Volatilization: The only soil COPC with a significant volatilization potential is TPH-G, and perhaps total naphthalenes and the TPH-D portion of TPH-D and TPH-HO combined (Ecology 2001, 2015b).
- Natural biodegradation: The only soil COPC that would be expected to be amenable to natural biodegradation in a reasonable restoration timeframe is TPH-G, and perhaps total naphthalenes, TPH-D and TPH-HO combined, and total cPAHs.

3.5 Groundwater Measurement Results

3.5.1 Groundwater Elevation Measurements

Groundwater elevation measurements were obtained during the GWM events conducted between January 2007 and June 2015, and during a July 2008 tidal study (PIONEER 2011a).[26] During these GWM events, the static depth to groundwater in a given MW was measured to the nearest 0.01-foot from a consistent reference point (e.g., mark on the top of casing). The measurements were obtained using an electronic water level indicator or interface probe. The measured depths to groundwater and groundwater elevations for these GWM events are presented in Table 3-9.

The uppermost groundwater-bearing zone is encountered at depths ranging from ground surface to approximately 11 feet bgs, depending on location and tidal fluctuation. The variability of groundwater depths across the Site for a typical GWM event (i.e., September 2009) is presented on Figure 3-20.

The direction of flow for the uppermost groundwater-bearing zone is consistently to the northeast towards the East Bay of Budd Inlet, although localized variations in the flow pattern do exist. Most notably, a groundwater mound, which is suspected to be associated with natural artesian flow conditions as mentioned in Section 2.2.2, is present in Parcel 3. Groundwater elevation contours for a typical GWM event (i.e., September 2009) are presented on Figure 3-21.[27] A hydrograph of groundwater elevations for MWs that have a groundwater elevation data record greater than 1.5 years, and are not located adjacent to surface water, where tidal influence is typically greatest is presented on

[26] During the June to August 2007 GWM event, static depth to groundwater measurements were obtained in June, July, and August.

[27] Additional groundwater elevation contour maps are included in Appendix C.

Figure 3-22. Based on the data presented in Table 3-9, Appendix C, and Figure 3-22, there does not appear to be significant seasonal fluctuation within the uppermost groundwater-bearing zone in terms of groundwater elevations or flow direction.

3.5.2 LNAPL Thickness Measurements

Light non-aqueous phase liquid (LNAPL) thickness measurements were obtained during the GWM events conducted between June 2009 and June 2015. During these GWM events, the thickness of LNAPL in a given MW was measured to the nearest 0.01-foot from a consistent reference point (e.g., mark on the top of casing). The measurements were obtained using an interface probe. The measured LNAPL thicknesses during these GWM events are presented in Table 3-10.

As shown in Table 3-10, a measurable thickness of LNAPL was not detected in any MW. In addition, although it was assumed in Table 3-11 that LNAPL thickness measurements were not obtained during the January 2007 and the June to August 2007 GWM events, it is unlikely that LNAPL was present in the MWs sampled during those GWM events given the dissolved-phase concentrations of TPH-G, TPH-D and TPH-HO combined during those GWM events and the likelihood that the investigation reports (GeoEngineers 2006, 2007a, 2007c, 2007d) would have mentioned the presence of a significant petroleum sheen on purge water if it was encountered.

3.6 Determination of Groundwater SLs for the Groundwater COPCs

As discussed in Section 2.6.3, the following two constituents are the groundwater COPCs based on the conclusions of the *Empirical Evaluation of the Potential for Soil Constituents to Migrate to Surface Water Via Groundwater at the East Bay Redevelopment Site* (PIONEER 2011a), which is included in Appendix C:

- Dissolved Arsenic
- TPH-D and TPH-HO combined

Groundwater SLs for these two groundwater COPCs were quantified to be protective of potential receptors in downgradient surface water (see Section 2.8). Calculations for the groundwater SLs are presented in Appendix M. The resulting groundwater SLs for the groundwater COPCs are:

Groundwater COPCs	Groundwater SLs (ug/L)	Basis
Dissolved Arsenic	5.0	Protection of potential surface water receptors
TPH-D and TPH-HO combined	720	Protection of potential surface water receptors

3.7 Nature and Extent of Groundwater COPC Impacts

Groundwater concentration results for arsenic (total and dissolved) and TPH-D and TPH-HO combined are presented in Tables 3-11 and 3-12, respectively. The groundwater concentration data for dissolved arsenic, and TPH-D and TPH-HO combined are summarized on Figures 3-23 through 3-24, respectively, relative to the groundwater SLs. In summary, there were very few groundwater SL exceedances. The only replicated groundwater SL exceedance was dissolved arsenic in MW24S. The groundwater SL exceedances are discussed in the following subsections.

3.7.1 Arsenic in Groundwater

The only on-site MW with an unqualified exceedance of the dissolved arsenic SL of 5.0 ug/L was MW24S.[28,29] The maximum dissolved arsenic concentration in MW24S was 12 ug/L. The slight exceedance for dissolved arsenic in MW24S was likely attributable to a localized release of arsenic (i.e., the treated wood piling encountered while drilling MW24S). As shown in Figure 3-23, the arsenic groundwater exceedance in MW24S was poorly correlated with elevated arsenic concentrations in soil. Specifically, there were no soil SL exceedances in the MW24S soil samples and MW24S was not located immediately downgradient of any location with a soil SL exceedance. In addition, the few locations with soil SL exceedances (i.e., DP04, DP17, DP21, DP21-2) did not cause elevated groundwater concentrations in MWs located immediately downgradient of the soil SL exceedances. It should be noted that the treated wood piling encountered in MW24S will be remediated due to a total dioxins/furans soil RL exceedance at that location.

No dissolved arsenic concentrations exceeded the 5.0 ug/L SL in the POC MWs (i.e., MW12, MW18, MW26, and MW27), which were located downgradient of MW24S. Therefore, the localized dissolved arsenic impact at MW24S did not cause groundwater SL exceedances at the conditional POC along the eastern Site boundary and will not impact potential surface water receptors.

3.7.2 TPH-D and TPH-HO Combined in Groundwater

Only two on-site groundwater samples had a groundwater SL exceedance for TPH-D and TPH-HO combined.[30] During the December 2009 GWM event, TPH-D and TPH-HO combined was detected in MW18 at a concentration of 1,800 ug/L, which exceeded the groundwater SL of 720 ug/L. During the December 2009 GWM event, TPH-D and TPH-HO combined was detected in MW03 at a concentration of 1,100 ug/L, which exceeded the groundwater SL of 720 ug/L. TPH-D and TPH-HO combined was not detected in the nine other samples collected from MW18 and the six other samples collected from MW03.

The unreplicated TPH-D and TPH-HO combined exceedances in MW18 and MW03 were anomalous and were not associated with a Site release. These exceedances were most likely caused by interferences associated with non-petroleum organic matter. The silica gel laboratory preparation procedure, which would have minimized interferences associated with non-petroleum organic matter (Ecology 2011c), was not used for TPH-D and TPH-HO groundwater samples during the December 2009 GWM event. In addition, the unreplicated MW18 and MW03 exceedances were not correlated with the few locations with elevated TPH-D and TPH-HO combined concentrations in soil (see Figure 3-24).

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[28] There was also a dissolved arsenic exceedance in MW02R during the August 2010 GWM event, but MW02R is associated with the upgradient LOTT Expansion Site.

[29] As discussed in Section 5.5 of Appendix C, the dissolved arsenic concentrations from the June 2009 and September 2009 GWM events were qualified with a "BJ" flag, were biased high, and were not considered exceedances.

[30] There was also a TPH-D and TPH-HO combined exceedance in MW02R during the August 2010 GWM event, but MW02R is associated with the upgradient LOTT Expansion Site.

3.7.3 Delineation of Groundwater SL Exceedance

As discussed in the previous subsections, MW24S was the only on-site MW with a replicated exceedance of a groundwater SL. The dissolved arsenic exceedance in MW24S was delineated by assuming the SL exceedance extended halfway between MW24S and the surrounding MWs (see Figure 3-25).

3.8 Methane Investigation

Per Ecology request, a methane investigation was conducted due to 1) a newly-published American Society of Testing and Materials (ASTM) methane investigation document (ASTM Designation E-2996-13; ASTM 2016) and 2) elevated methane in soil gas detected during 2013 soil gas sampling at the Site. Investigation activities were conducted on September 12th and September 28 – 30, 2016 in accordance with the Ecology approved Work Plan (PIONEER 2016a). Methane, carbon dioxide, oxygen and hydrogen soil gas concentrations, and differential pressure were measured at 22 locations (see Figure 3-26). Methane concentrations in indoor air at the Hands On Children's Museum, in nearby stormwater drains, and the Parcel 4 restrooms were also measured.

Site methane concentrations were evaluated using ASTM Designation E2993-16 criteria (soil gas concentrations, indoor air concentrations and pressure differentials) to determine if methane poses a safety concern at the Site. The methane concentrations for all samples except SVP-12 and SVP-13 met the ASTM Designation E2993-16 criteria for no further action (i.e., methane soil gas concentrations were less than 30%, indoor air concentrations were less than 0.010%, and pressure differential measurements were less than 500 Pascals). The methane concentrations at SVP-12 and SVP-13 were greater than 30%; however, the pressure differential measurements were 7.5 Pascals or below which indicates that methane is not a concern. No buildings are present at these locations so indoor air could not be measured. In conclusion, methane does not pose a safety concern at the Site (Appendix N;PIONEER 2016b).

3.9 RI Summary

The RI identified seven soil COPCs based on exceedances of soil SLs: arsenic, lead, TPH-G, total naphthalenes, TPH-D and TPH-HO combined, total cPAHs, and total dioxins/furans. The locations at which at least one soil COPC exceeded its soil SL are presented on Figure 3-27. The nature and extent of the COPCs in Site soil has been well characterized. The few isolated soil SL exceedances for arsenic, lead, TPH-G, total naphthalenes, TPH-D and TPH-HO combined were co-located with historic operation areas that could have released these COPCs via a spill or buried refuse. There were significantly more soil SL exceedances for total cPAHs and total dioxins/furans at locations throughout the Site compared to the other COPCs. It appears that total cPAHs were released via spills or buried refuse in historic operation areas, although there could have been some contribution from urban background conditions. The total dioxins/furans exceedances were primarily associated with wood debris (e.g., treated wood) although there could have been some contribution from former Budd Inlet surface sediment within the pre-1982 fill.

The only replicated exceedance of a groundwater SL was a slight dissolved arsenic exceedance in MW24S. This slight exceedance was likely attributable to a localized release of arsenic (i.e., the treated wood piling encountered while drilling MW24S), which will be remediated due to a total dioxins/furans soil RL exceedance at that location. In addition, the localized dissolved arsenic impact at MW24S did not cause groundwater SL exceedances at the conditional POC MWs (i.e., MW12, MW18, MW26, and MW27), which were located downgradient of MW24S. Enough time has passed since the original releases occurred and a large enough data record has been obtained to conclude that existing groundwater conditions are indicative of future groundwater conditions. As a result, no further action is necessary for Site groundwater in order to protect human health and the environment. The only remaining recommended action for Site groundwater is to ensure that all remaining MWs are decommissioned in accordance with Chapter 173-160 of the WAC.

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SECTION 4: FEASIBILITY STUDY

The purpose of this section is to (1) establish the cleanup action objectives and cleanup standards that will be used in the FS, (2) screen remedial technologies, (3) assemble the retained technologies into cleanup action alternatives, and (4) evaluate the assembled cleanup action alternatives using MTCA criteria.

4.1 Cleanup Action Objectives

Based on the CSEM (see Section 2.8) and the RI (see Section 3), the primary cleanup action objective for the Site is to protect human health and the environment by eliminating unacceptable soil exposures for hypothetical single-family residents and commercial workers (which were used as surrogate pathways for the complete exposure pathways as discussed in Section 2.8, Appendix G, and Appendix M). Other key cleanup action objectives are:

- Comply with cleanup standards;
- Comply with applicable state and federal laws and regulations;
- Provide for compliance monitoring;
- Complete the cleanup action prior to Site redevelopment and consistent with anticipated future land use;
- Consider public concerns; and
- Consider cost-effectiveness and sustainability criteria.

4.2 Cleanup Standards

In accordance with WAC 173-340-700(3), cleanup standards "consist of the following: (a) cleanup levels for hazardous substances present at the site; (b) the location where these cleanup levels must be met (point of compliance); and (c) other regulatory requirements that apply to the site because of the type of action and/or location of the site ('applicable state and federal laws')."

4.2.1 Soil COCs

All soil COPCs identified in Section 3 were considered soil constituents of concern (COCs). Thus, the soil COCs are:

- Arsenic
- Lead
- TPH-G
- Total naphthalenes
- TPH-D and TPH-HO combined
- Total cPAHs
- Total dioxins/furans

4.2.2 Soil CLs and RLs

Table 4-1 presents the CLs and RLs for the soil COCs. The soil CLs are equal to the soil SLs, which were calculated as presented in Appendix M. The CLs were based on single-family residential land use (i.e., unrestricted land use) in order to develop more protective CLs consistent with MTCA requirements even though there is no current residential land use and zoning does not allow future single-family residential land use. The RLs were calculated as presented in Appendix M. The RLs were based on default exposure assumptions for commercial workers in order to develop protective RLs for the complete exposure pathways (i.e., construction/utility workers and utility maintenance workers).

4.2.3 Soil POC

The soil POC applies everywhere within the Site boundary. Since the CLs and RLs are primarily based on the direct contact pathway, the soil POC depth will be from ground surface to 15 feet bgs in accordance with WAC 173-340-740(6)(d), with the following exception. In accordance with WAC 173-340-740(6)(c), the POC for the TPH-G and total naphthalenes soil CL and RL exceedances proximate to DP06 and SVP-2SO will be from ground surface to 4.5 feet bgs (see Section 2.6.4). Compliance with CLs and/or RLs may be evaluated using statistical tools in accordance with WAC 173-340-740(7)(d) – (f), as appropriate.

4.2.4 Other Regulatory Requirements

No other applicable state and federal laws or regulations have been identified at this time that would modify the cleanup standards given the type of cleanup action alternatives being considered for the Site and the location of the Site.

Potentially applicable or potentially relevant and appropriate requirements associated with non-MTCA environmental laws and regulations to be considered for remedy implementation include:

- State Environmental Policy Act (SEPA) as authorized by the RCW 43.21C and WAC 197-11
- Occupational Safety and Health Act and Washington Industrial Safety and Health Act regulations (e.g., 29 Code of Federal Regulations 1910.120, Chapter 296-843 WAC).
- Washington Industrial Safety and Health Act, Chapter 49.17 RCW, Safety Standards for Construction Work (WAC 296-155).
- Underground Utilities, RCW 19.122.010, General Protection Requirements (WAC 296-155-655).
- Coverage under the general construction stormwater National Pollutant Discharge Elimination System (NPDES) permit.
- City permit requirements (e.g., grading permit, shoreline management permit).
- LOTT discharge authorization permit to dispose of wastewater generated during the cleanup action (e.g., from dewatering).
- Chapter 173-160 WAC requirements to decommission all remaining Site MWs prior to any remediation construction activities.
- Resource Conservation and Recovery Act regulations for waste generation, hauling, and disposal (e.g., Chapter 173-303 WAC, Chapter 173-350 WAC).

- Solid Waste Management Chapter 43.21 RCW, Minimum Functional Standards for Solid Waste Handling (WAC 173-304).

4.2.5 *Summary of Soil Cleanup Standard Exceedances*

During the IAs, the RL exceedances within the IA areas were removed and the CL exceedances within the IA areas were capped or covered. The locations of the remaining RL exceedances and the delineated CL exceedance areas that have not been capped or covered are presented on Figure 4-1. Table 4-2 presents the CL and RL exceedance frequencies for samples that are still in place. There are very few remaining soil RL exceedances. The only remaining soil exceedances are (1) the DP04 arsenic RL exceedance at 4-6 feet bgs, (2) the MW24S total dioxins/furans RL exceedance at 6.5-8 feet bgs, (3) the DP06 TPH-G and total naphthalenes RL exceedances at 3-5 feet bgs, and (4) the SVP-2SO TPH-G and total naphthalenes RL exceedances at 4-6 feet bgs (see table below). In contrast, there are a relatively large number of remaining CL exceedances, particularly for total cPAHs and total dioxins/furans.

RL Exceedance Location	Depth (ft bgs)	Constituent(s)	Concentration	RL
DP04	4 – 6	Arsenic	52 mg/kg	20 mg/kg
MW24S	6.5 – 8	Total Dioxins/Furans	979 ng/kg	590 ng/kg
DP06	3 – 5	TPH-G Total Naphthalenes	290 mg/kg 142 mg/kg	100 mg/kg 5.0 mg/kg
SVP-2SO	4 – 6	TPH-G Total Naphthalenes	1,100 mg/kg 150 mg/kg	100 mg/kg 5.0 mg/kg

4.3 Screening of Remedial Technologies

In accordance with WAC 173-340-350(8)(b), the potentially applicable soil remedial technologies were reduced via a screening process to determine the most promising and feasible remedial technologies. The number of viable remedial technologies for this Site is limited due to the type and distribution of the soil COCs. A screening of remedial technologies for this Site was performed and documented in the Parcel 4/5 IAWP (Brown and Caldwell 2010). The same remedial technologies that were retained for further evaluation in the Parcel 4/5 IAWP screening process were also retained for this FS, with one exception. In-situ solidification/stabilization was not retained as a feasible remedial technology for the FS since it was the lowest rated remedial technology in the detailed evaluation of alternatives in the Parcel 4/5 IAWP (Brown and Caldwell 2010). Thus, the retained remedial technologies for the FS were:

- Institutional controls (ICs)
- ECs
- Soil cover
- Excavation
- On-site reuse
- Off-site disposal

4.4 Description of the Assembled Cleanup Action Alternatives

Three cleanup action alternatives were assembled from the retained remedial technologies. These alternatives represent a range of potential remedial approaches for addressing Site contamination.[31] The purpose of this section is to provide an introductory description and conceptual overview of each cleanup action alternative.

4.4.1 Alternative 1 – Institutional Controls and Engineering Controls

Alternative 1 includes implementing ICs and ECs to minimize exposures for potential receptors (i.e., on-site workers and trespassers). During redevelopment construction activities, the Port would require Site developers and construction contractors to implement ECs (e.g., Site control measures, dust control measures, implementation of a health and safety plan, use of appropriately-trained workers, require any new building or enclosed structure that would be located over sample locations DP06 and SVP-2SO to be constructed with a sealed foundation and with a vapor control system installed and maintained to prevent mitigation of vapors into the building or structure). In order to minimize exposures following redevelopment construction activities, the Port, City, and LOTT would also implement and maintain ICs for perpetuity using an environmental covenant developed in accordance with Ecology's Toxics Cleanup Program (TCP) Procedure 440A. Specifically, the environmental covenant would:

- Prohibit any activity at the property which may result in the release of residual contamination contained as part of the remedial action, exacerbate or create a new exposure to residual contamination remaining on the Site, or disturb the soil cover without prior written approval by Ecology.
- Prohibit installation of a well for water supply purposes within the Site boundary.
- Restrict extraction of groundwater within the Site boundary for any purpose other than temporary construction dewatering, investigation, monitoring or remediation.
- Require that any groundwater extracted for any purpose within the Site boundary be considered potentially contaminated and any discharge of this water be done in accordance with state and federal law.
- Restrict construction of stormwater infiltration facilities or ponds within the contaminant delineation areas presented in Figures 3-3 through 3-9 where the depth of these exceedances are shallower than the historical lowest measured groundwater depths for that location.[32]
- Require that all stormwater catch basins, conveyance systems, and other appurtenances be of water-tight construction within the contaminant delineation areas presented in Figures 3-3 through 3-9 where the depth of these exceedances are shallower than the historical lowest measured groundwater depths for that location.[33]
- Require any new building or enclosed structure that would be located over sample locations DP06 and SVP-2SO to be constructed with a sealed foundation and with a vapor control system installed and maintained to prevent mitigation of vapors into the building or structure.

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[31] A no action alternative was not considered since two IAs were already conducted.
[32] Unless the soil associated with the exceedance is removed as part of the cleanup.
[33] Unless the soil associated with the exceedance is removed as part of the cleanup.

Compliance monitoring would include dust monitoring and qualitative EC assessments during redevelopment construction activities, and long-term inspections of the ICs.

4.4.2 Alternative 2 – Targeted Soil Removal, Cover, and Controls

Alternative 2 includes the following remedial components:

- Soil RL exceedances would be excavated and disposed of at an off-site facility permitted to receive such waste (e.g., Weyerhaeuser Regional Landfill in Castle Rock, Washington). These excavations would be backfilled using clean soil from an off-site upland borrow source.
- A soil cover would be installed and maintained for all portions of the Site (Parcels 2, 3, 6, 7, 9; the portion of the Site northwest of Parcel 7; any areas east of Parcels 4 through 7) not already covered by 1982 fill at the required thickness (12 inches). Actual field measurements of cover thickness and a field global positioning system (GPS) will be used to determine and mark the boundary of the 1982 fill. The soil cover would consist of a permeable geotextile fabric and at least 12 inches of clean soil from an off-site upland borrow source. Note that a suitable cap or soil cover already exists in Parcel 4, Parcel 5, the infrastructure corridor, and the existing landscaped area located between the Marine Drive sidewalk and Marine Drive (east of Parcels 4 through 7).
- Soil that is excavated for redevelopment or construction purposes (e.g., to construct a building or parking lot or to install the soil cover) and is geotechnically suitable for possible on-site reuse would be stockpiled on-site (on an impervious surface and covered with a plastic liner when not in use), and sampled to determine the final disposition for the excavated soil. If any COC concentration in the stockpile characterization sample exceeded its RL, then that stockpile would be disposed of off-site.[34] However, if all COC concentrations in the stockpile characterization sample were less than or equal to RLs, then that stockpile could be reused on-site underneath the soil cover.
- ICs and ECs would be implemented as described in Alternative 1, with the following modifications:
  - The EC and IC to require a sealed foundation and a vapor control system in buildings or enclosed structures would not be necessary since the soil associated with the TPH-G and total naphthalenes CL/RL exceedances at DP06/SVP2-SO would be removed.
  - The ECs described in Alternative 1 for redevelopment construction activities would also be required for remediation construction activities.
- Compliance monitoring would include dust monitoring and qualitative EC assessments during remediation and redevelopment construction activities, excavation sidewall and bottom sampling, and long-term inspections of the soil cover, and ICs.

A conceptual schematic for how the excavation, off-site disposal, on-site reuse, backfill, and soil cover cleanup action components would be implemented under this alternative is presented on Figure 4-2. The locations of the RL exceedances that would be removed for this alternative, as well as the areas that

[34] Soil that is geotechnically and chemically suitable for on-site reuse, but for which there is no remaining reuse capacity, would also be disposed of off-site. In addition, material that is excavated for redevelopment purposes, but is geotechnically unsuitable for any on-site reuse (e.g., due to moisture content or wood debris) would be disposed of off-site.

would receive a soil cover are presented on Figure 4-3. Note that the only remaining RL exceedances that would need to be removed would be the RL exceedances at sample locations DP04, MW24S, and DP06/SVP2-SO. This alternative was the remedy selected and implemented for the two previous Ecology-approved IAs at the Site (PIONEER 2009, 2010a; Brown and Caldwell 2010, 2015; Ecology 2009a, 2010a, 2010b).

4.4.3 Alternative 3 – Total Soil Removal

Alternative 3 includes the following remedial components:

- Soil CL exceedances within the portions of the Site that were not remediated during a previous IA would be excavated and disposed of off-site at a facility permitted to receive such waste (e.g., Weyerhaeuser Regional Landfill in Castle Rock, Washington).[35] It was assumed that all of the pre-1982 fill soil would need to be excavated to a depth of 15 feet bgs and disposed of off-site due to the relatively heterogeneous nature and extent of CL exceedances at the Site. Since Alternative 3 would include a significant amount of excavation work within the saturated zone, a significant amount of dewatering work would also be needed in order to complete excavation activities. Excavated areas would be backfilled using clean soil from an off-site upland borrow source.
- ECs would be implemented as described in Alternative 1, with the following modifications:
    - The EC and IC to require a sealed foundation and a vapor control system in buildings or enclosed structureswould not be necessary since the soil associated with the TPH-G and total naphthalenes CL/RL exceedances at sample locations DP06/SVP2-SO would be removed.
    - The ECs described in Alternative 1 for redevelopment construction activities would also be required for remediation construction activities.
- Compliance monitoring would include dust monitoring and qualitative EC assessments during remediation and redevelopment construction activities, and excavation sidewall and bottom sampling.

A conceptual schematic for how soil would be excavated and backfilled is presented on Figure 4-4. The areas where soil would be excavated and disposed of off-site under this alternative are presented on Figure 4-5.

4.5 Evaluation of the Cleanup Action Alternatives

4.5.1 Evaluation Criteria

The cleanup action alternatives were evaluated using the seven MTCA FS criteria in WAC 173-340-360(2). The four threshold criteria are:

- "Protect human health and the environment"
- "Comply with cleanup standards"

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[35] For the purposes of this FS, it was assumed that further excavations would not occur where the Infrastructure IA and Parcel 4/5 IA were conducted since those IAs were Ecology-approved actions.

- "Comply with applicable state and federal laws"
- "Provide for compliance monitoring"

The three "other" or balancing criteria are:

- "Use permanent solutions to the maximum extent practicable"
- "Provide for a reasonable restoration time frame"
- "Consider public concerns"

Although not part of the official MTCA evaluation criteria, a sustainability criterion was also included as an evaluation criterion since it is now recognized that the secondary environmental impacts (e.g., carbon footprint) of a cleanup action alternative can outweigh environmental cleanup benefits achieved by that cleanup action alternative.

4.5.2 Evaluation Process

The seven MTCA FS criteria were evaluated qualitatively by considering Site characteristics, constituent characteristics, technology capabilities, and professional judgment. The sustainability criterion was evaluated qualitatively by considering air emissions, solid waste production, traffic, and resource usage. An explanation of how numerical rankings were used in the qualitative evaluations is presented in Table 4-3. Individual criterion rankings were summed to provide a total score for each alternative. The criteria were equally weighted.

The disproportionate cost analysis, which was used to determine the qualitative evaluation results in Table 4-3 for the "use permanent solutions to the maximum extent practicable" criterion in accordance with WAC 173-340-360 is presented in Table 4-4. Appendix O presents the order of magnitude, and net present value cost estimates for each cleanup action alternative used in the disproportionate cost analysis.

4.5.3 Evaluation Results

The results of the evaluation process are presented in Table 4-3. The overall ranking of the alternatives from most desirable to least desirable is:

- Alternative 2 – Targeted Soil Removal, Cover, and Controls
- Alternative 3 – Total Soil Removal
- Alternative 1 – Institutional Controls and Engineering Controls

Alternative 2 is the most desirable alternative and is the recommended cleanup action alternative. Alternative 2 satisfies all of the MTCA threshold criteria and has the highest overall score when considering the MTCA balancing criteria and the sustainability criterion. It is also consistent with the remedy selected and implemented for the two previous Ecology-approved IAs at the Site (PIONEER 2009, 2010a; Brown and Caldwell 2010, 2015; Ecology 2009a, 2010a, 2010b).

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SECTION 5: RECOMMENDED CLEANUP ACTION ALTERNATIVE

The recommended cleanup action alternative is Alternative 2 – Targeted Soil Removal, Cover, and Controls. In summary, the principal remedial components of Alternative 2 (see Section 4.4 for additional details) are:

- Soil RL exceedances will be excavated and disposed of at an off-site facility permitted to receive such waste.
- A soil cover will be installed and maintained for all portions of the Site not already covered by 1982 fill. The soil cover will consist of a permeable geotextile fabric and at least 12 inches of clean soil.
- ECs will be required for implementation of remediation and redevelopment construction activities.
- ICs will be implemented and maintained for perpetuity using an environmental covenant.
- Long-term inspections will be conducted to ensure that the soil cover and ICs are performing as intended.
- Long-term maintenance will be performed on the following areas where remedial actions have been implemented as part of interim actions at the site: (1) the soil cap and/or soil cover installed on Parcel 4 and 5, (2) the infrastructure corridor, and (3) the existing landscaped area located between the Marine Drive sidewalk and Marine Drive (located east of Parcels 4 through 7).

Alternative 2 satisfies all of the MTCA threshold criteria and has the highest overall score when considering the MTCA balancing criteria and the sustainability criterion. Alternative 2 protects human health and the environment, employs reliable and proven technologies, and can be completed quickly. There are no significant negative aspects or tradeoffs associated with Alternative 2. Alternative 2 is also consistent with the remedy selected and implemented for the two previous Ecology-approved IAs at the Site (PIONEER 2009, 2010a; Brown and Caldwell 2010, 2015; Ecology 2009a, 2010a, 2010b).

Approval of this recommended cleanup action alternative is subject to a pending public review of this RI/FS Report and a Cleanup Action Plan. The recommended cleanup action alternative will be implemented in accordance with the Cleanup Action Plan once the Cleanup Action Plan is approved.

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——— 2011b. Letter from Steve Teel to Alexandra Smith with title of "Ecology Approval of the Data Gap Investigation Work Plan and Schedule," East Bay Redevelopment Site, October 10. See Appendix H.

——— 2011c. Guidance for Remediation of Petroleum Contaminated Sites, September.

——— 2011d. Letter from Steve Teel to Alexandra Smith with title of "Site Boundary Determination and Request to Prepare Draft Remedial Investigation/Feasibility Study Report," East Bay Redevelopment Site, December 12. See Appendix A.

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——— 2013c. Letter from Steve Teel to Alexandra Smith, Jay Burney, and Eric Hielema with title of "Ecology Comments on the Interim Action Work Plan for the Remaining Portions of the East Bay Redevelopment Site, and the Evaluation of the Potential Soil-to-Indoor Air Pathway for TPH-G," East Bay Redevelopment Site, October 14.

——— 2013d. Letter from Steve Teel to Alexandra Smith, Jay Burney, and Eric Hielema with title of "Ecology Comments on the Response to Comments on (1) Interim Action Work Plan for the Remaining Portions of the East Bay Redevelopment Site, and (2) Evaluation of the Potential Soil-to-Indoor Air Pathway for TPH-G," East Bay Redevelopment Site, December 16.

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——— 2007b. Phase I Environmental Site Assessment, East Bay Redevelopment Project, March 14.

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——— 2010a. Infrastructure Interim Action Report for East Bay Redevelopment Site, June. See Appendix D.

——— 2010b. Site Boundary Technical Memorandum for the East Bay Redevelopment Site, November. See Appendix A.

——— 2011a. Empirical Evaluation of the Potential for Soil Constituents to Migrate to Surface Water Via Groundwater at the East Bay Redevelopment Site, May. See Appendix C.

——— 2011b. Letter from Troy Bussey to Steve Teel with title of "Data Gap Investigation Work Plan and Schedule," East Bay Redevelopment Site, October 7. See Appendix H.

——— 2011c. Letter from Troy Bussey to Steve Teel with title of "Site Boundary, East Bay Redevelopment Site," December 2. See Appendix A.

——— 2013a. Letter from Troy Bussey to Steve Teel with title of "Data Gap Work Plan for the Soil-to-Indoor Air Pathway and Response to Comments for Ecology's March 14, 2013 Comments," East Bay Redevelopment Site, April 12. See Appendix H.

——— 2013b. Interim Action Work Plan for the Remaining Portions of the East Bay Redevelopment Site, June.

——— 2013c. Letter from Troy Bussey to Steve Teel with title of "Response to Comments on (1) Interim Action Work Plan for the Remaining Portions of the East Bay Redevelopment Site, and (2) Evaluation of the Potential Soil-to-Indoor Air Pathway for TPH-G," East Bay Redevelopment Site, November 21.

——— 2014a. Memorandum from Troy Bussey to Steve Teel with title of "TPH-G and Total Naphthalenes Screening Level Exceedances for the Soil-to-Indoor Air Pathway," East Bay Redevelopment Site, April 11. See Appendix F.

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Figures

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Legend

East Bay Redevelopment Project Boundary

0 500 1,000 1,500
Feet

PIONEER
TECHNOLOGIES CORPORATION

Vicinity Map
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 1-1

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PIONEER
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Parcel Locations and Property Ownership
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 1-2

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PIONEER TECHNOLOGIES CORPORATION

Site Boundary
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 1-3

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Legend

Site Boundary

Original Predevelopment Shoreline (Pre-1888)

Notes:
Original predevelopment shoreline shapefile was provided by the Thurston Regional Planning Council.

0 500 1,000 1,500 Feet

PIONEER TECHNOLOGIES CORPORATION

Original Predevelopment Shoreline
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-1

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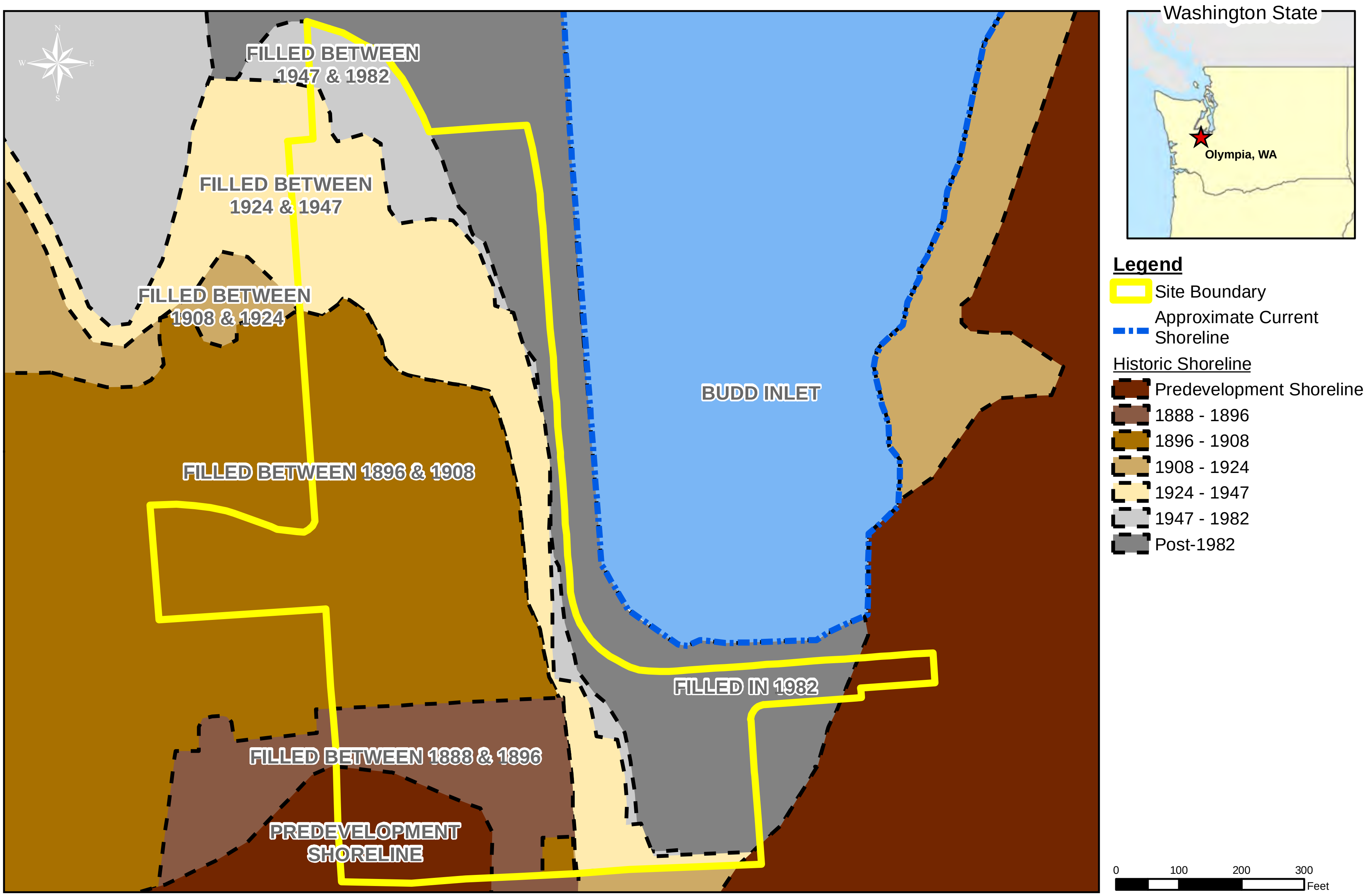

PIONEER TECHNOLOGIES CORPORATION

Site Fill History
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-2

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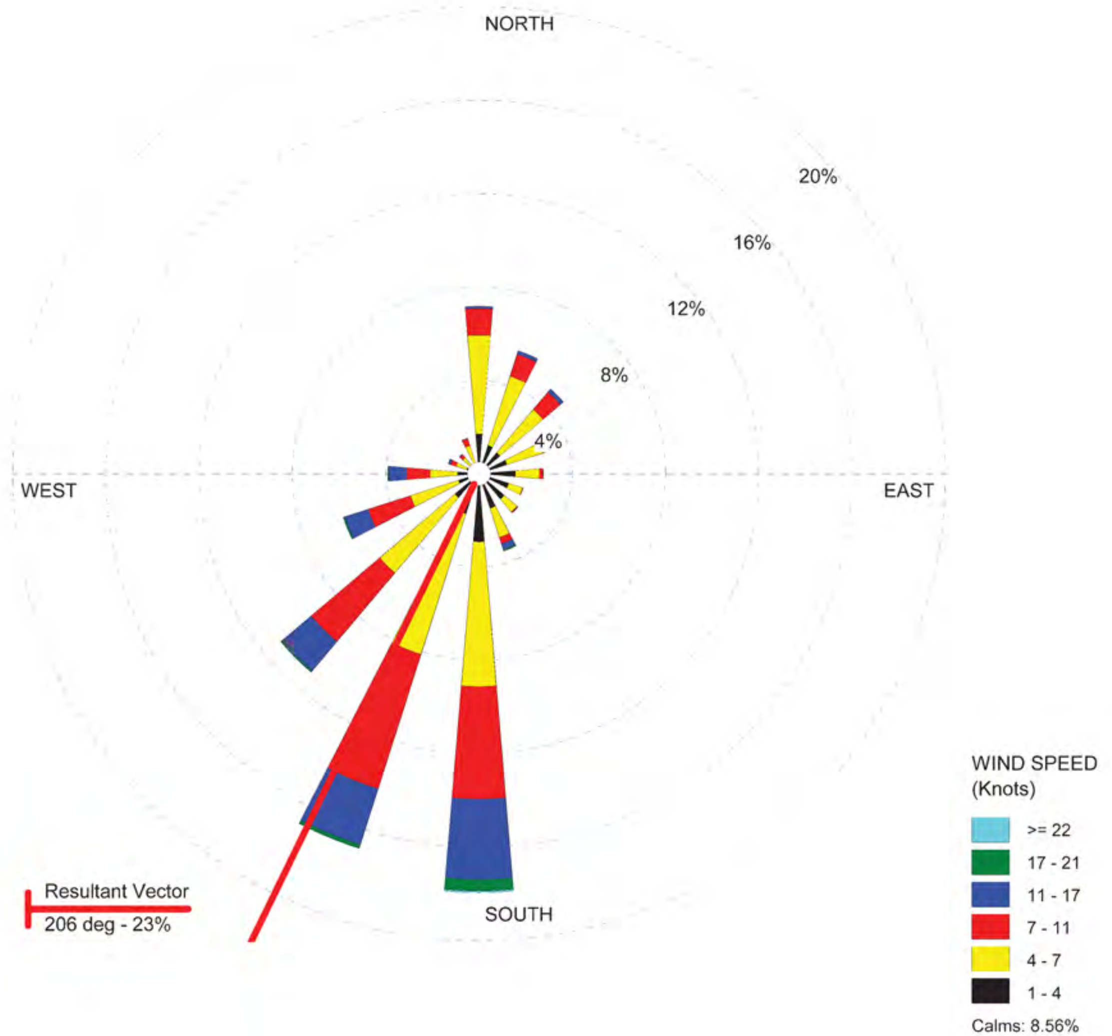

Notes:
The wind rose was obtained from the Office of Washington State Climatologist.

The wind rose shows the direction from which the wind was blowing. The data period was January 1, 1971 to December 31, 2000.

Average Wind Speed: 6.35 knots

PIONEER TECHNOLOGIES CORPORATION

Wind Rose for Olympia, Washington
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-3

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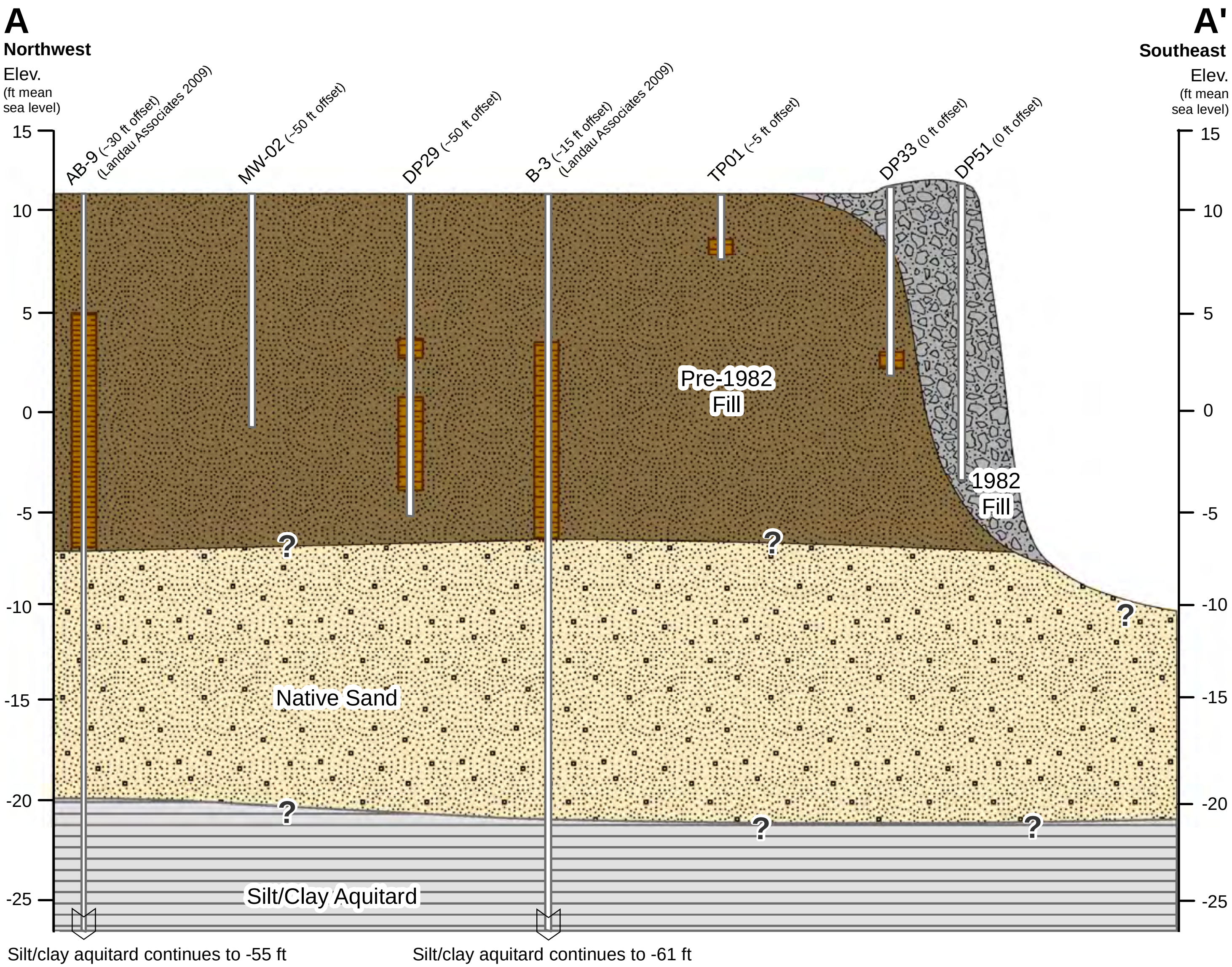

Cross Section Location

Legend

Soil Types

- 1982 Fill
- Pre-1982 Fill
- Native Sand
- Silt/Clay Aquitard
- Wood/Debris Encountered in Borings

Notes:
-Vertical exaggeration = 10x
-For the purpose of this figure, the ground surface elevation of the site was assumed to be flat, with the exception of near the 1982 fill. This approximation of the ground surface elevation is consistent within +/- one foot with a recent survey of the surface topography.
-The interface between pre-1982 fill and 1982 fill was generated using a 1979 survey of the surface topography and boring logs.
-The locations shown are approximate.
-See Appendix K for boring logs, unless otherwise noted.

PIONEER TECHNOLOGIES CORPORATION

Cross Section A-A'
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-4

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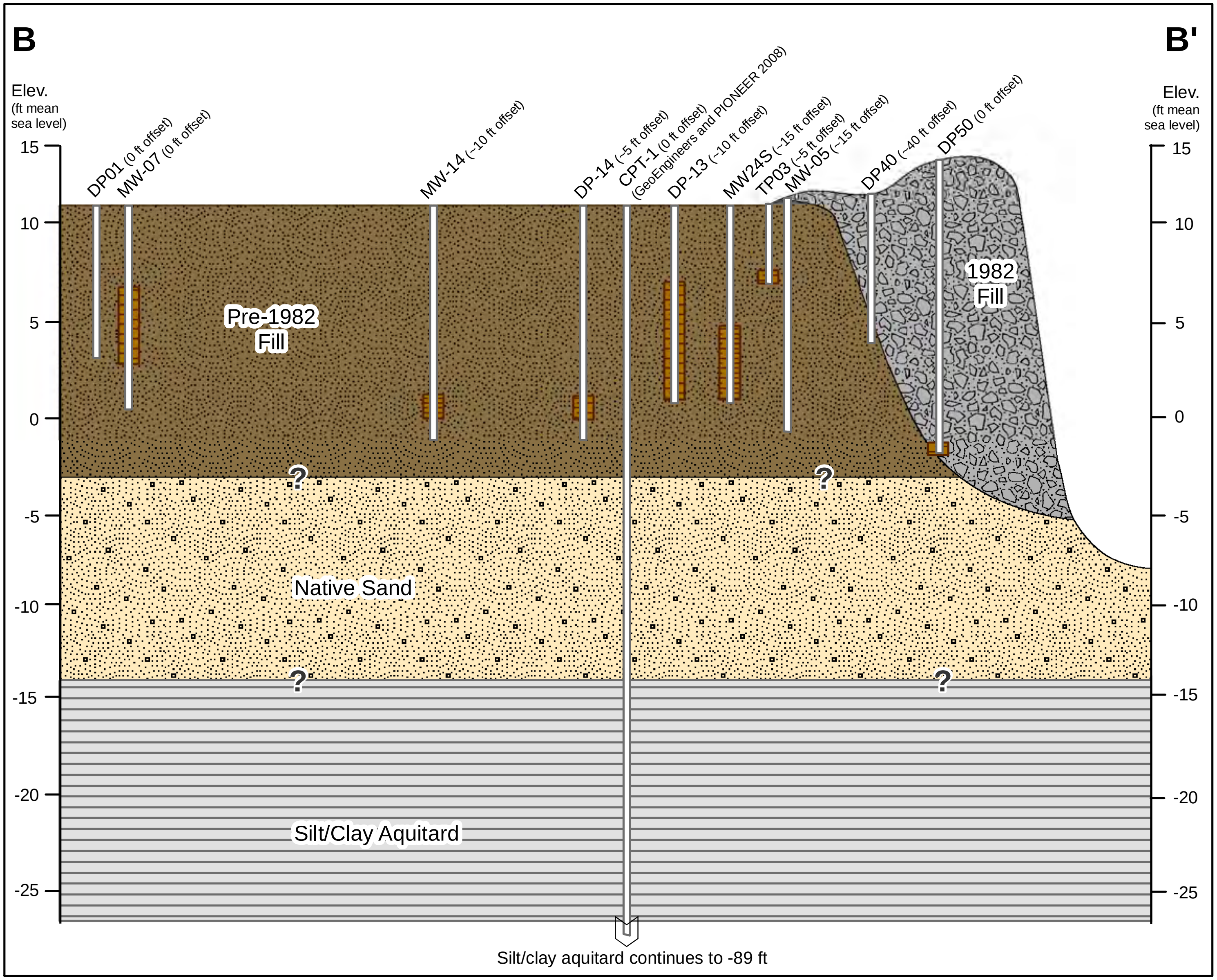

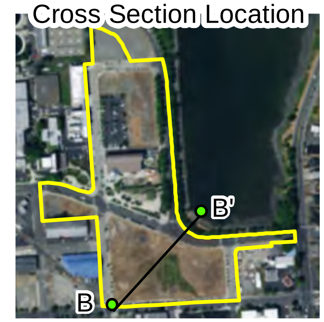

Legend

Soil Types

- 1982 Fill
- Pre-1982 Fill
- Native Sand
- Silt/Clay Aquitard
- Wood/Debris Encountered in Borings

Notes:
-Vertical exaggeration = 10x
-For the purpose of this figure, the ground surface elevation of the site was assumed to be flat, with the exception of near the 1982 fill. This approximation of the ground surface elevation is consistent within +/- one foot with a recent survey of the surface topography.
-The interface between pre-1982 fill and 1982 fill was generated using a 1979 survey of the surface topography and boring logs.
-The locations shown are approximate.
-See Appendix K for boring logs, unless otherwise noted.

PIONEER TECHNOLOGIES CORPORATION

Cross Section B-B'
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-5

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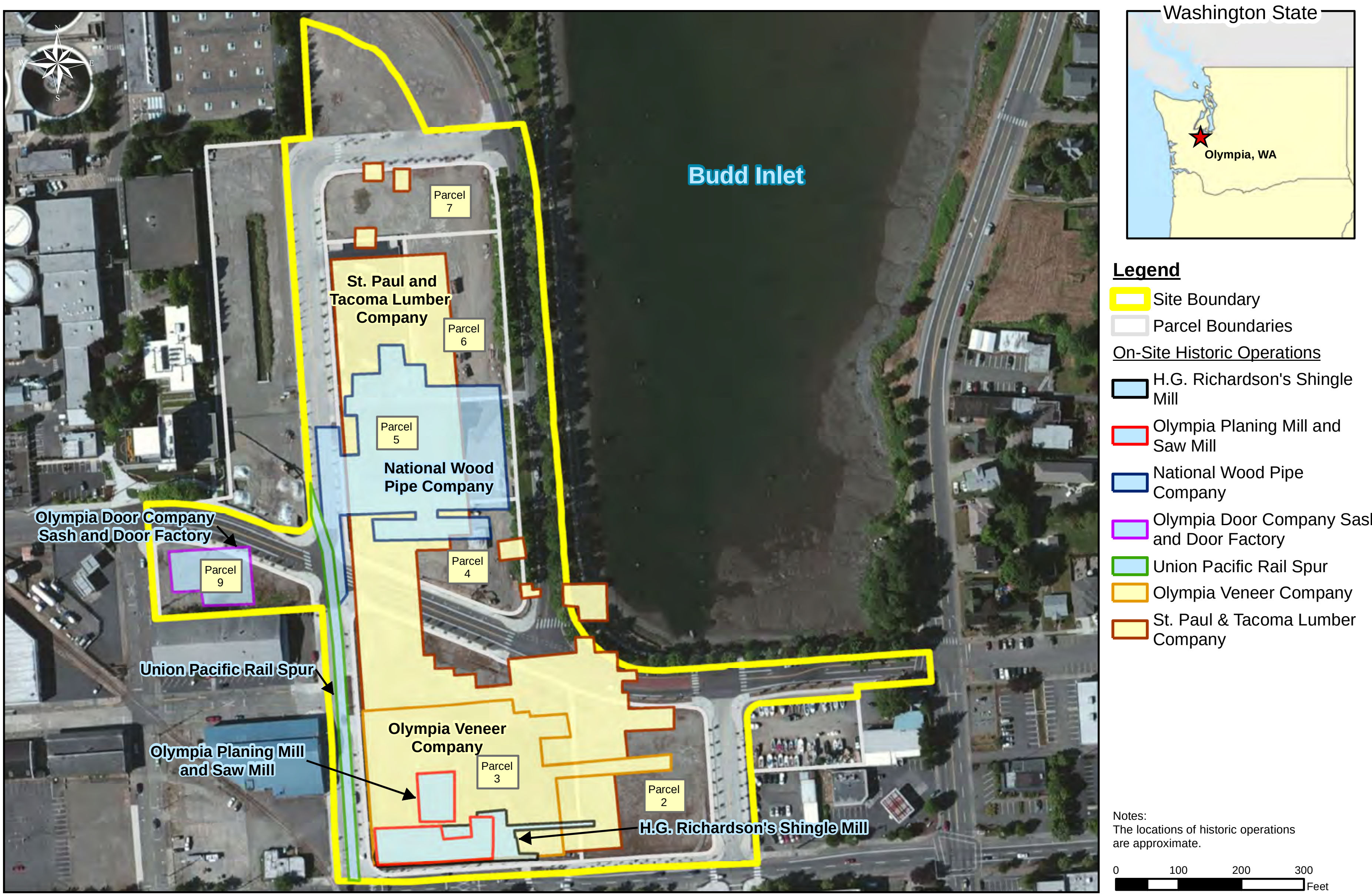

PIONEER TECHNOLOGIES CORPORATION

Extent of Historic Operations
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-6

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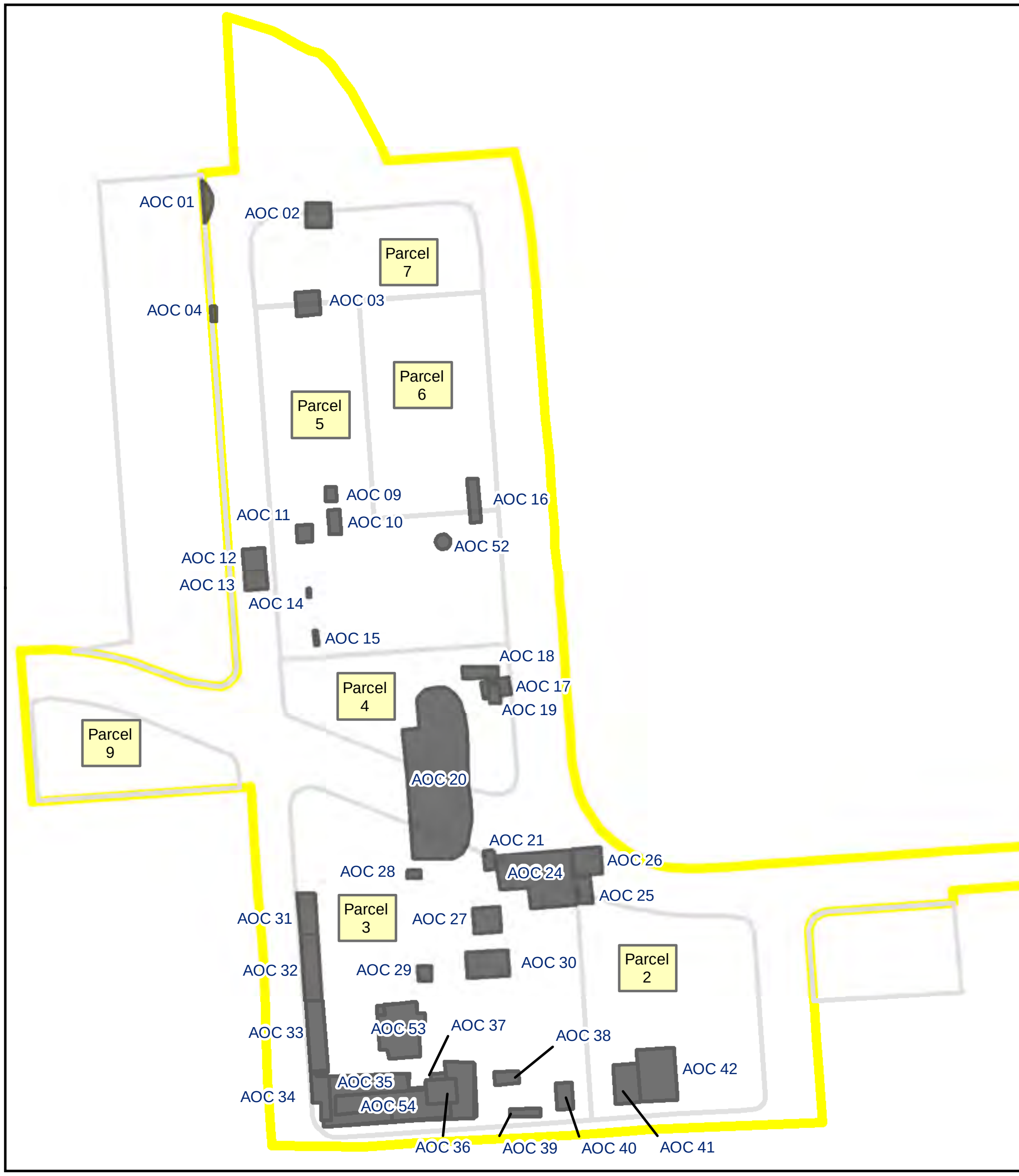

AOC ID	Description of Historic Feature
AOC 01	Refuse Fire
AOC 02	Panel Oiling
AOC 03	Spray Prints
AOC 04	Propane Lift Truck Fueling Shed
AOC 09	Oil House
AOC 10	Engine Room
AOC 11	Unidentified Structure
AOC 12	Machine Shop
AOC 13	Blacksmith Shop
AOC 14	Tar Dipping Tank North
AOC 15	Tar Dipping Tank South
AOC 16	Oil Cooled Transformer on Concrete Pad
AOC 17	Boiler House
AOC 18	Fuel Bin
AOC 19	Flammable Liquids
AOC 20	Hog Fuel Pile on Ground
AOC 21	Unidentified Structure - Oil House
AOC 24	Power House
AOC 25	Unknown Shop
AOC 26	Pipe Shop
AOC 27	Fuel Bin
AOC 28	Transformer Vault
AOC 29	Oil House
AOC 30	Fenced Electrical Enclosure
AOC 31	Jitney Shop
AOC 32	Electronic Shop
AOC 33	Machine Shop
AOC 34	Welding Shop
AOC 35	Engine
AOC 36	Engine
AOC 37	Repair Shop
AOC 38	Blacksmith Shop
AOC 39	Logway
AOC 40	Glue House
AOC 41	Blacksmith Shop
AOC 42	Machine Shop
AOC 52	Diesel Fuel Release
AOC 53	Planing Mill
AOC 54	Saw Mill

Washington State

Legend

- Site Boundary
- Parcel Boundaries
- Area of Concern (AOC)

Notes:
The locations of AOCs are approximate.

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Areas of Concern
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-7

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 2-7_Areas of Concern.mxd; Author: GM; Date Saved: 7/6/2015

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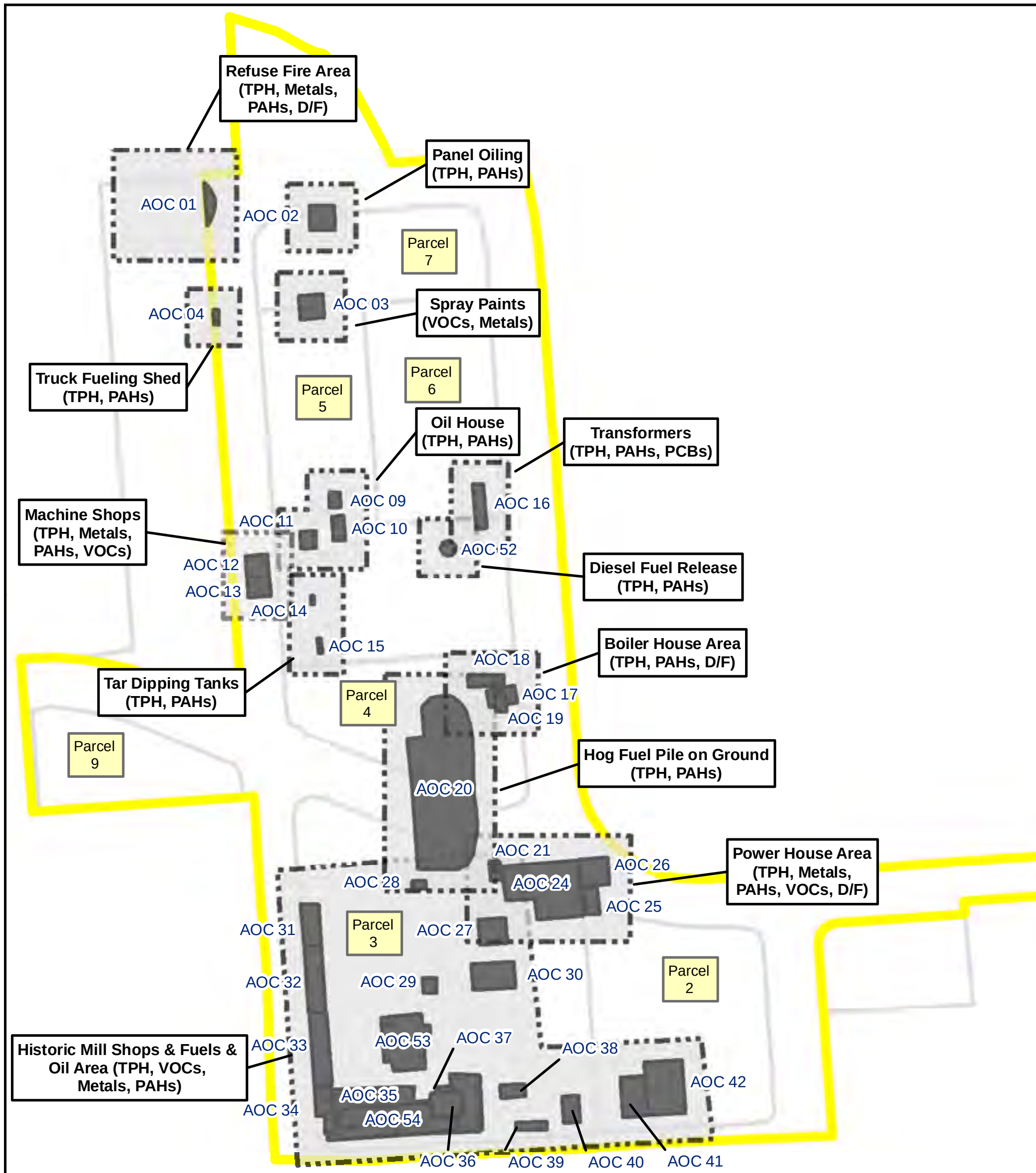

AOC ID	Description of Historic Feature
AOC 01	Refuse Fire
AOC 02	Panel Oiling
AOC 03	Spray Prints
AOC 04	Propane Lift Truck Fueling Shed
AOC 09	Oil House
AOC 10	Engine Room
AOC 11	Unidentified Structure
AOC 12	Machine Shop
AOC 13	Blacksmith Shop
AOC 14	Tar Dipping Tank North
AOC 15	Tar Dipping Tank South
AOC 16	Oiled Cooled Transformer on Concrete Pad
AOC 17	Boiler House
AOC 18	Fuel Bin
AOC 19	Flammable Liquids
AOC 20	Hog Fuel Pile on Ground
AOC 21	Unidentified Structure - Oil House
AOC 24	Power House
AOC 25	Unknown Shop
AOC 26	Pipe Shop
AOC 27	Fuel Bin
AOC 28	Transformer Vault
AOC 29	Oil House
AOC 30	Fenced Electrical Enclosure
AOC 31	Jitney Shop
AOC 32	Electronic Shop
AOC 33	Machine Shop
AOC 34	Welding Shop
AOC 35	Engine
AOC 36	Engine
AOC 37	Repair Shop
AOC 38	Blacksmith Shop
AOC 39	Logway
AOC 40	Glue House
AOC 41	Blacksmith Shop
AOC 42	Machine Shop
AOC 52	Diesel Fuel Release
AOC 53	Planing Mill
AOC 54	Saw Mill

Legend

- Site Boundary
- Parcel Boundaries
- Area of Concern (AOC)
- Historic Operation Areas

Notes:
D/F: dioxins/furans
The locations of AOCs are approximate.

Historic operation area footprints and constituents potentially associated with each historic operation area are presented in the Remedial Investigation Work Plan (GeoEngineers and PIONEER 2008), with the following modifications:
1. PAHs were added as potential constituents for all locations where TPH was listed as a potential constituent.
2. Historic operation areas were created for AOC 20 (hog fuel pile on ground), AOC 52 (diesel fuel release), and AOC 04 (propane lift truck fueling shed) with TPH and PAHs as potential constituents.
3. Each historic operation area was extended 25 feet beyond the boundary of the AOC (or group of AOCs).

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Historic Operation Areas
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-8

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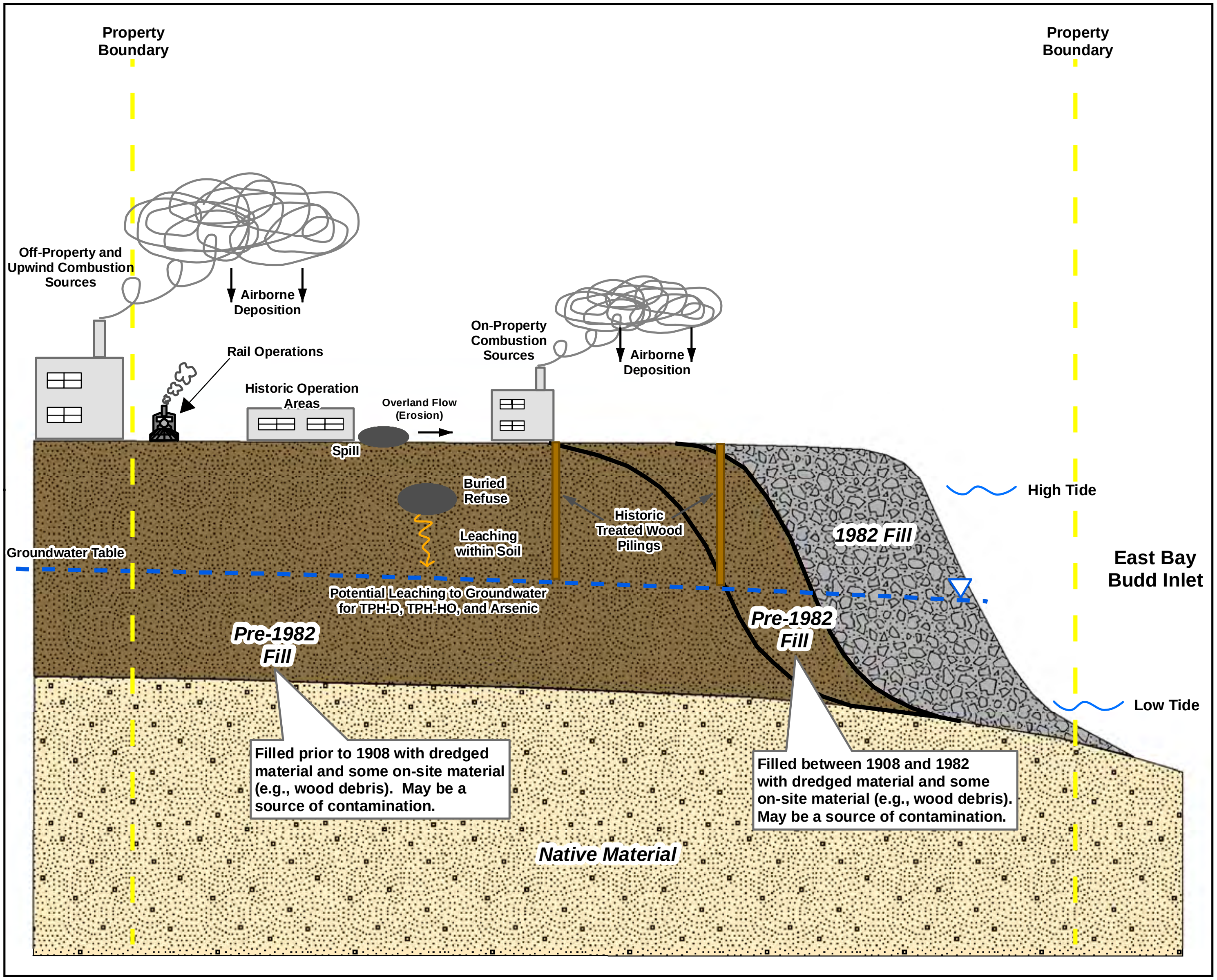

Legend

- Site Boundary
- Native Material
- 1982 Fill
- Pre-1982 Fill

PIONEER TECHNOLOGIES CORPORATION

Conceptual Release Model
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-9

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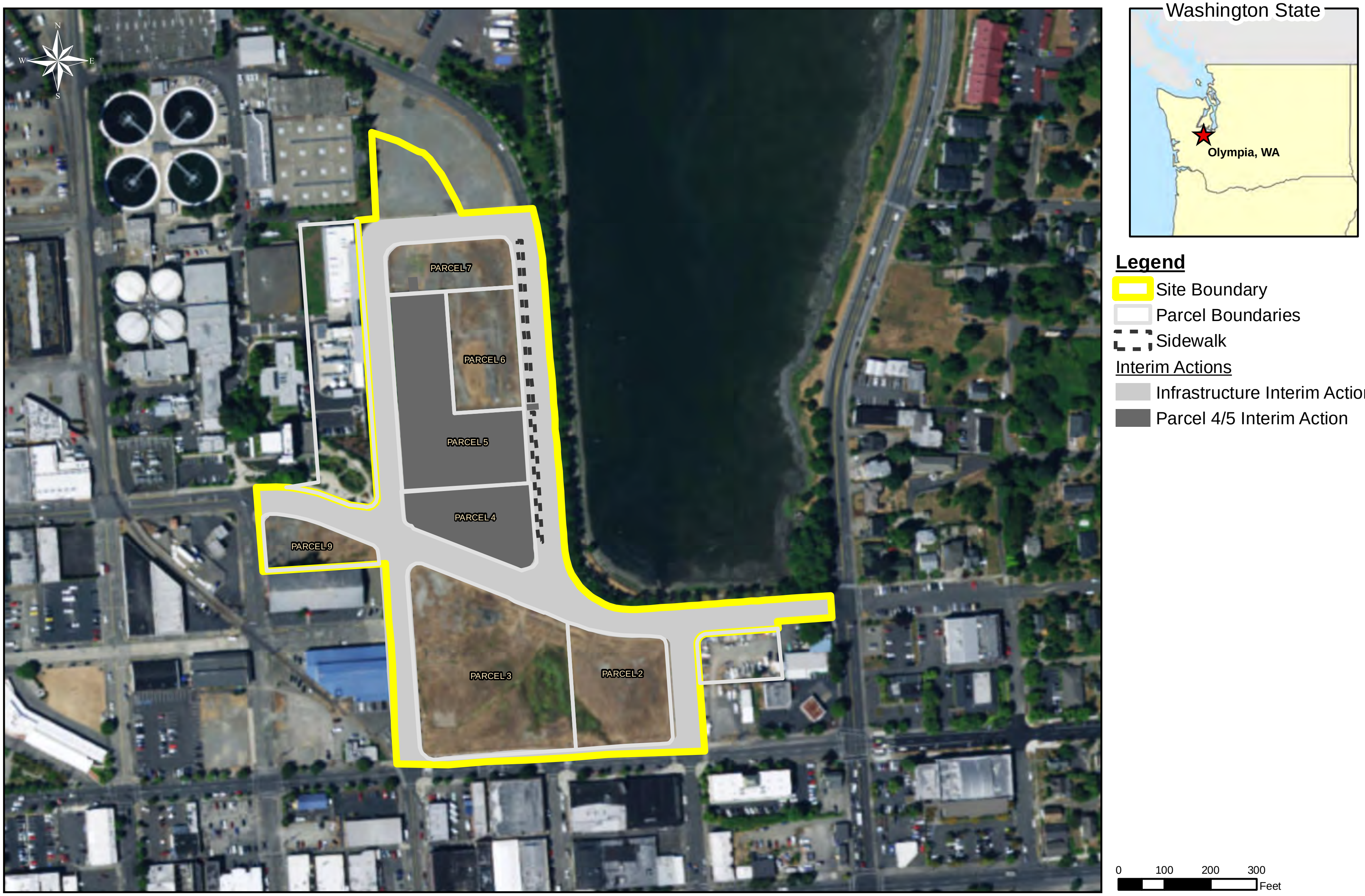

PIONEER
TECHNOLOGIES CORPORATION

Locations of Previous Interim Actions
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-10

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A

B

C

D

Photo Descriptions:

A: Photo facing north into Parcel 4 and 5 construction (HOCM and East Bay Plaza)
B: Photo facing north showing LOTT Clean Water Alliance Administration Building, HOCM, and East Bay Plaza
C: Photo facing southwest into Parcels 5, 6, and 7
D: Photo facing northwest into Parcels 2 and 3

Notes:
HOCM: Hands on Children's Museum
- Photo locations are approximate
- Photos taken March 7 and 8, 2012

PIONEER TECHNOLOGIES CORPORATION

Current Land Use Photographs
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-11

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PIONEER TECHNOLOGIES CORPORATION

Future Land Use
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 2-12

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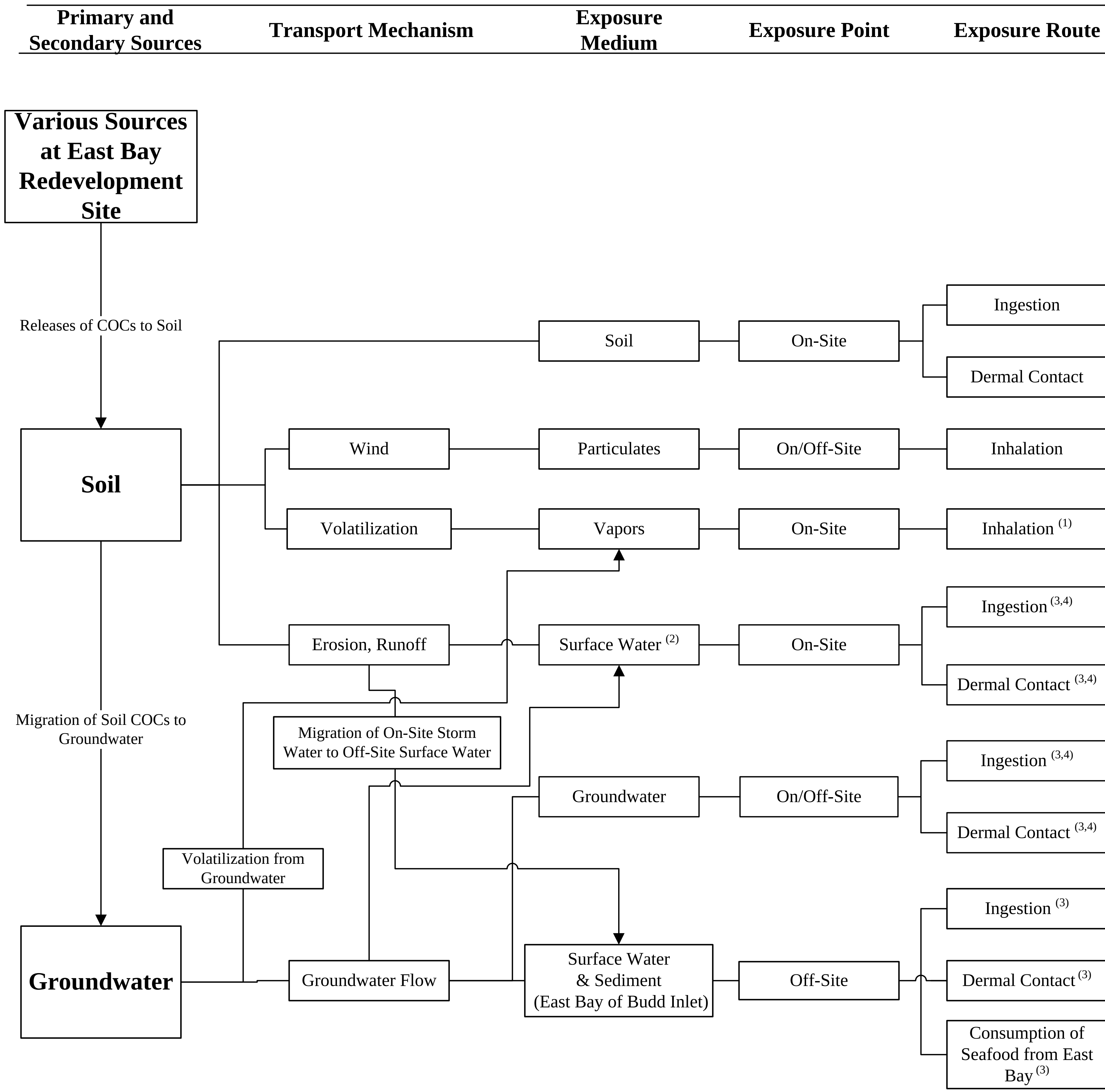

Exposure Medium	Exposure Point	Exposure Route	Baseline No Action Scenarios (5): Single-Family Residents	Baseline: Commercial Workers	Pre-Remediation and Pre-Redevelopment: Trespassers	Pre-Remediation: Recreators and Subsistence Fishers (6)	Remediation and Redevelopment Construction: Construction / Utility Workers (7)	Remediation: Trespassers (7)	Remediation: Recreators and Subsistence Fishers (6)	Post-Remediation and Post-Redevelopment: Urban Residents	Post-Remediation: Commercial Workers	Post-Remediation: Utility Maintenance Workers	Post-Remediation: Recreators and Subsistence Fishers (6)	Potential Ecological Exposures: Terrestrial Organisms	Potential Ecological: Aquatic Organisms (6)
Soil	On-Site	Ingestion	●	●	◆	○	●	◆	○	○	○	●	○	○	○
Soil	On-Site	Dermal Contact	●	●	◆	○	●	◆	○	○	○	●	○	○	○
Particulates	On/Off-Site	Inhalation	●	●	○	○	●	◆	○	○	○	●	○	○	○
Vapors	On-Site	Inhalation (1)	●	●	○	○	○	○	○	○	○	○	○	○	○
Surface Water (2)	On-Site	Ingestion (3,4)	○	○	◆	○	◆	○	○	○	○	◆	○	○	○
Surface Water (2)	On-Site	Dermal Contact (3,4)	○	○	◆	○	◆	○	○	○	○	◆	○	○	○
Groundwater	On/Off-Site	Ingestion (3,4)	○	○	○	○	◆	○	○	○	○	◆	○	○	○
Groundwater	On/Off-Site	Dermal Contact (3,4)	○	○	○	○	◆	○	○	○	○	◆	○	○	○
Surface Water & Sediment (East Bay of Budd Inlet)	Off-Site	Ingestion (3)	○	○	○	◆	○	○	◆	○	○	○	◆	○	◆
Surface Water & Sediment (East Bay of Budd Inlet)	Off-Site	Dermal Contact (3)	○	○	○	◆	○	○	◆	○	○	○	◆	○	◆
Surface Water & Sediment (East Bay of Budd Inlet)	Off-Site	Consumption of Seafood from East Bay (3)	○	○	○	◆	○	○	◆	○	○	○	◆	○	◆

PIONEER TECHNOLOGIES CORPORATION

Figure 2-13

Conceptual Site Exposure Model
Port of Olympia
East Bay Redevelopment Site

Key
- ● Complete Exposure Pathway
- ◆ Potentially Complete Exposure Pathway
- ○ Incomplete Exposure Pathway

NOTES:
These exposure scenarios are reasonable maximum exposure scenarios. Therefore, these scenarios are considered protective of other similar exposure scenarios. All potential receptors are on-site, unless otherwise noted.
(1) Vapor-related pathways are only potentially complete for TPH-G and total naphthalenes (PIONEER 2014a). The soil-to-indoor air pathway is incomplete for post-remediation and post-redevelopment urban residents and commercial workers provided that soils with TPH-G and total naphthalene RL exceedances are removed.
(2) On-site surface water also applies to any ponded groundwater prior to remediation and redevelopment.
(3) These pathways are potentially complete for arsenic, TPH-D, and TPH-HO only (PIONEER 2011a).
(4) For construction/utility workers and utility maintenance workers, the potential exposure pathway will be controlled by engineering controls, institutional controls, and required health and safety measures.
(5) These baseline no action scenarios are the MTCA default exposure scenarios that were used to develop more protective SLs. The baseline scenarios assume the Site is allowed to be developed without any controls or further remedial action, even though that is not a realistic assumption. These scenarios are not current land use.
(6) Prior to the redevelopment of a parcel, there is no recreational use of that parcel. Thus, all recreators prior to remediation and redevelopment are considered off-site recreators. Subsistence fishers and aquatic organisms are off-site receptors.
(7) Potential exposures will be addressed as necessary during remediation and redevelopment activities via Site control measures, HAZWOPER requirements, etc.

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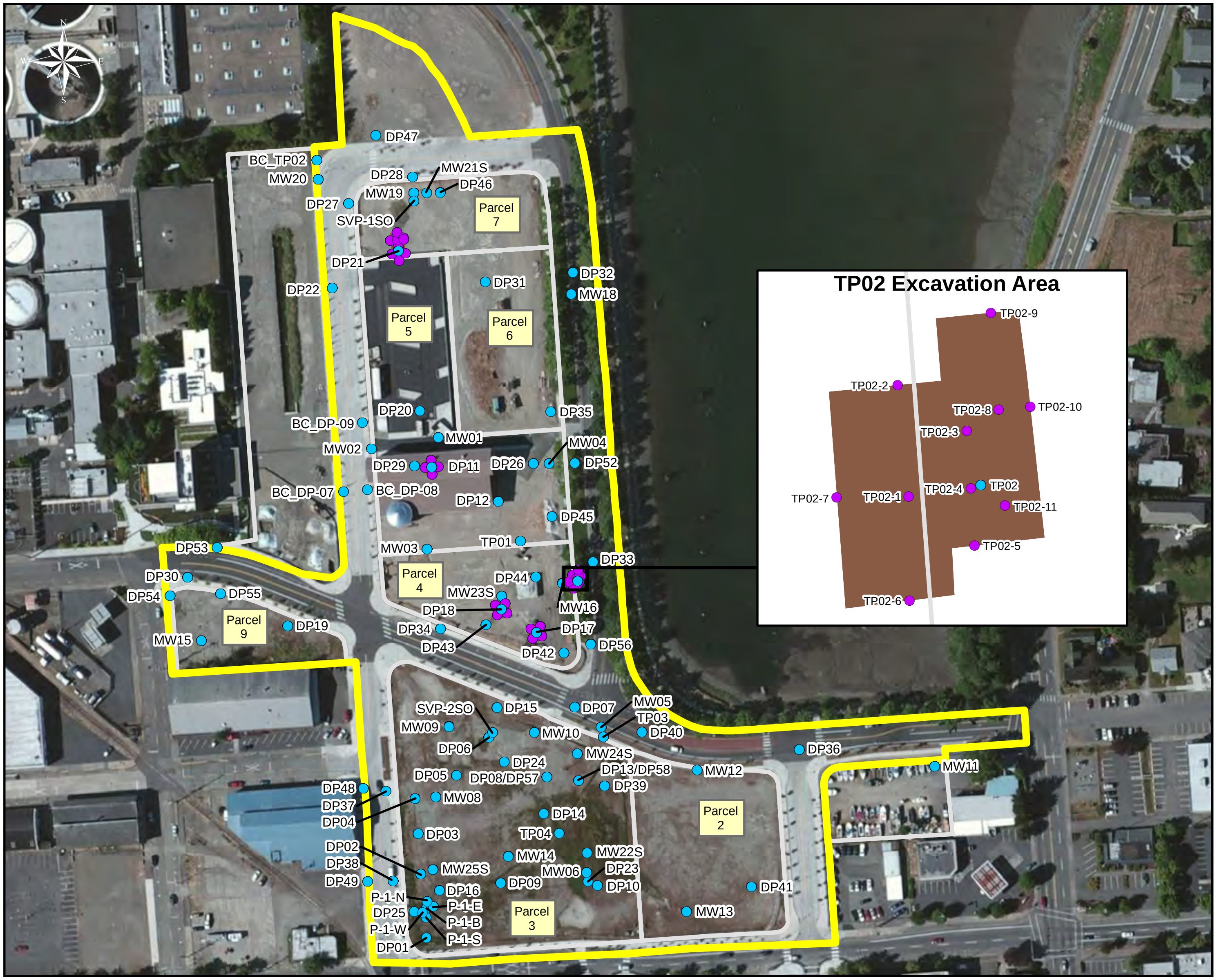

Legend

- Site Boundary
- Parcel Boundaries
- Excavation Footprint

Confirmation Sample Locations

- Confirmation Sidewall Soil Sample from IA Excavations
- RI Soil Sample

Notes:
- Only on-site soil sample locations are displayed.

- Confirmation sample locations surrounding DP11 are DP11-1 to DP11-5.
- Confirmation sample locations surrounding DP17 are DP17-1 to DP17-5.
- Confirmation sample locations surrounding DP18 are DP18-1 to DP18-5.
- Confirmation sample locations surrounding DP21 are DP21-1 to DP-21-10.

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Soil Sample Locations
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-1

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Legend

Site Boundary

Monitoring Wells

Existing MW

Decommissioned MW

MW for POC GWM

0 50 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Groundwater Monitoring Well Locations
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-2

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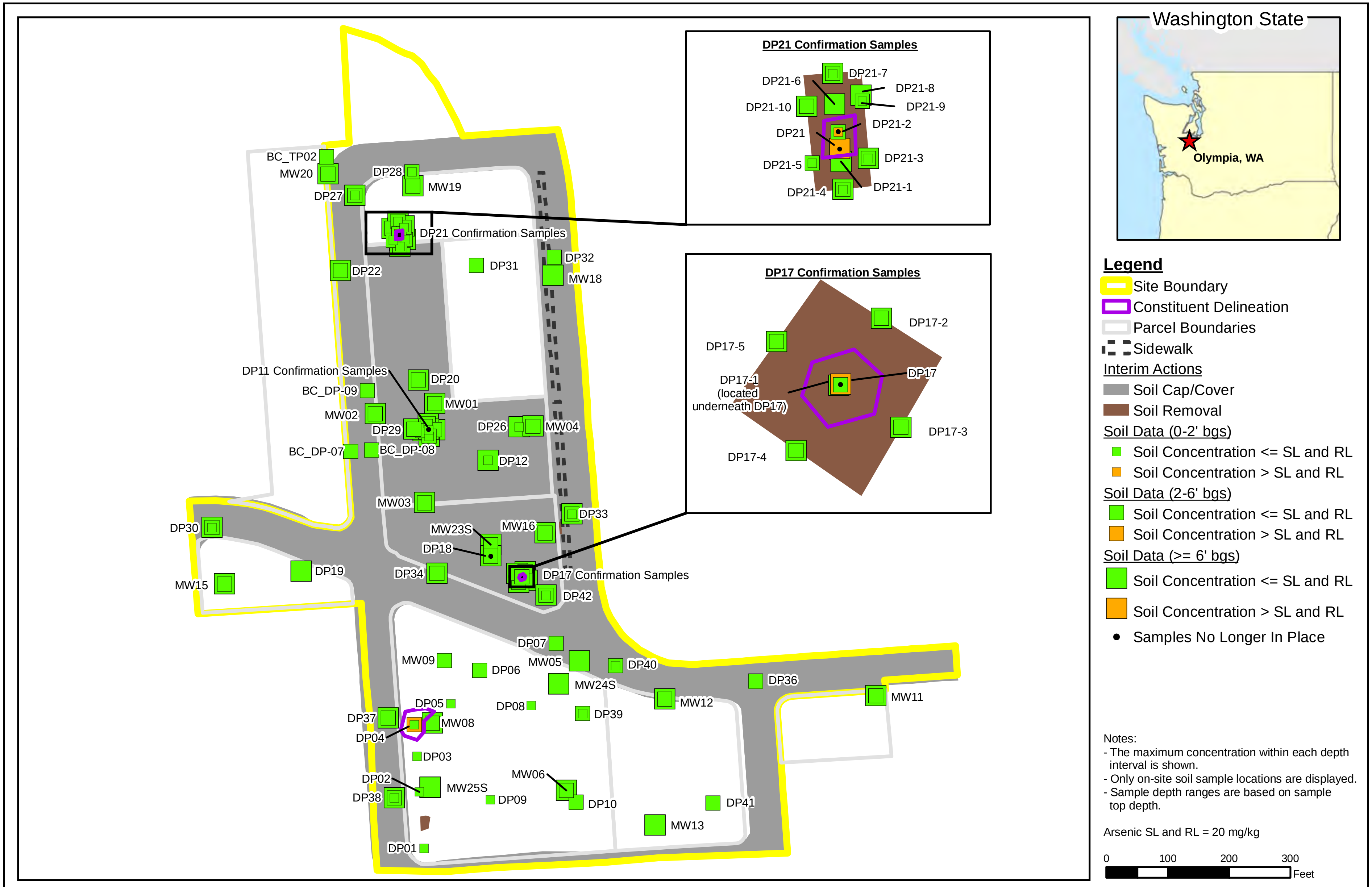

PIONEER TECHNOLOGIES CORPORATION

Location and Delineation of Arsenic Soil Screening Level Exceedances
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-3

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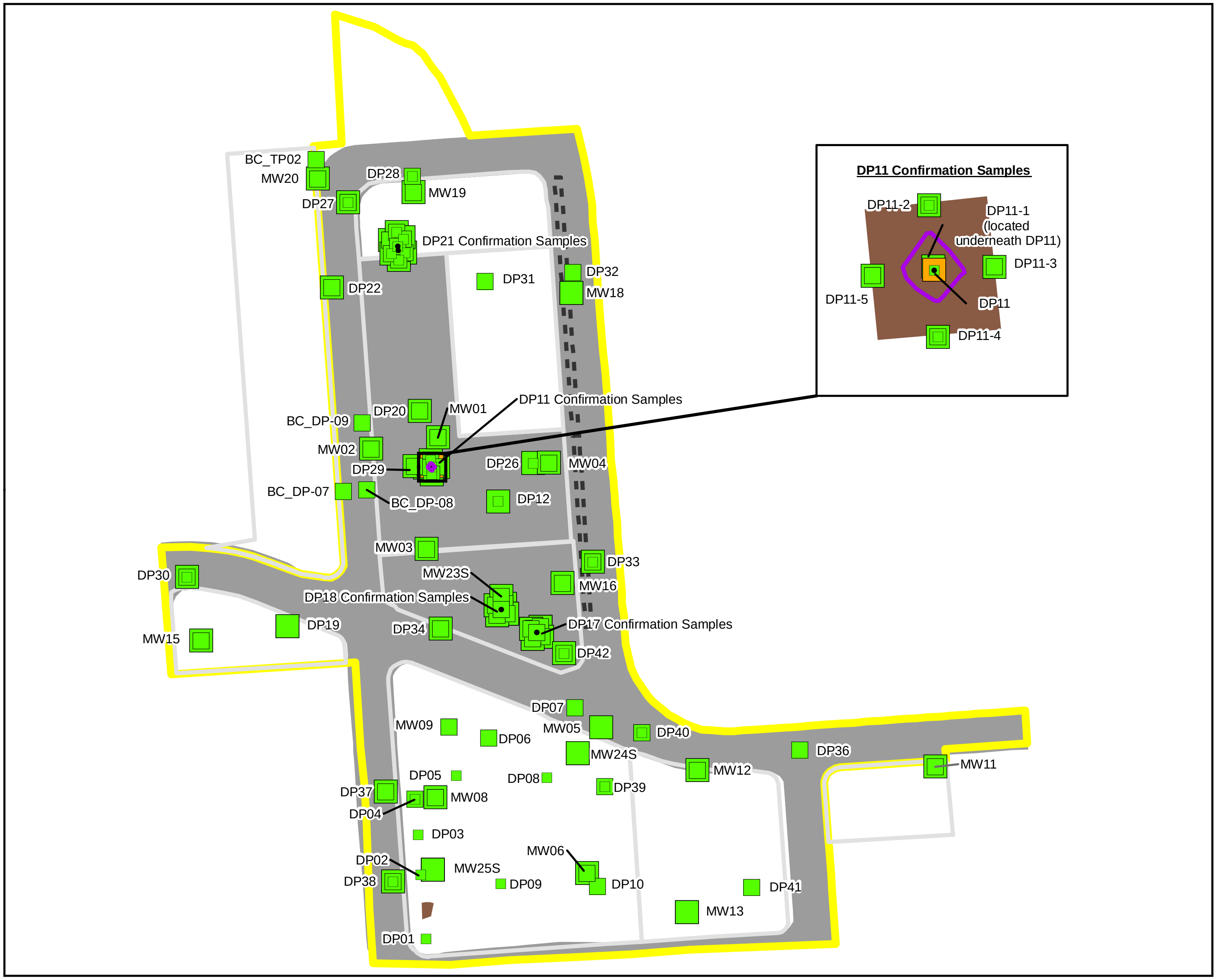

Legend

- Site Boundary
- Parcel Boundaries
- Constituent Delineation
- Sidewalk

Interim Actions

- Soil Cap/Cover
- Soil Removal

Soil Data (0-2' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (2-6' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (>=6' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

● Samples No Longer In Place

Notes:
- The maximum concentration within each depth interval is shown.
- Only on-site soil sample locations are displayed.
- Sample depth ranges are based on sample top depth.

Lead SL = 250 mg/kg
Lead RL = 1,000 mg/kg

0 50 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Location and Delineation of Lead Soil Screening Level Exceedances
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-4

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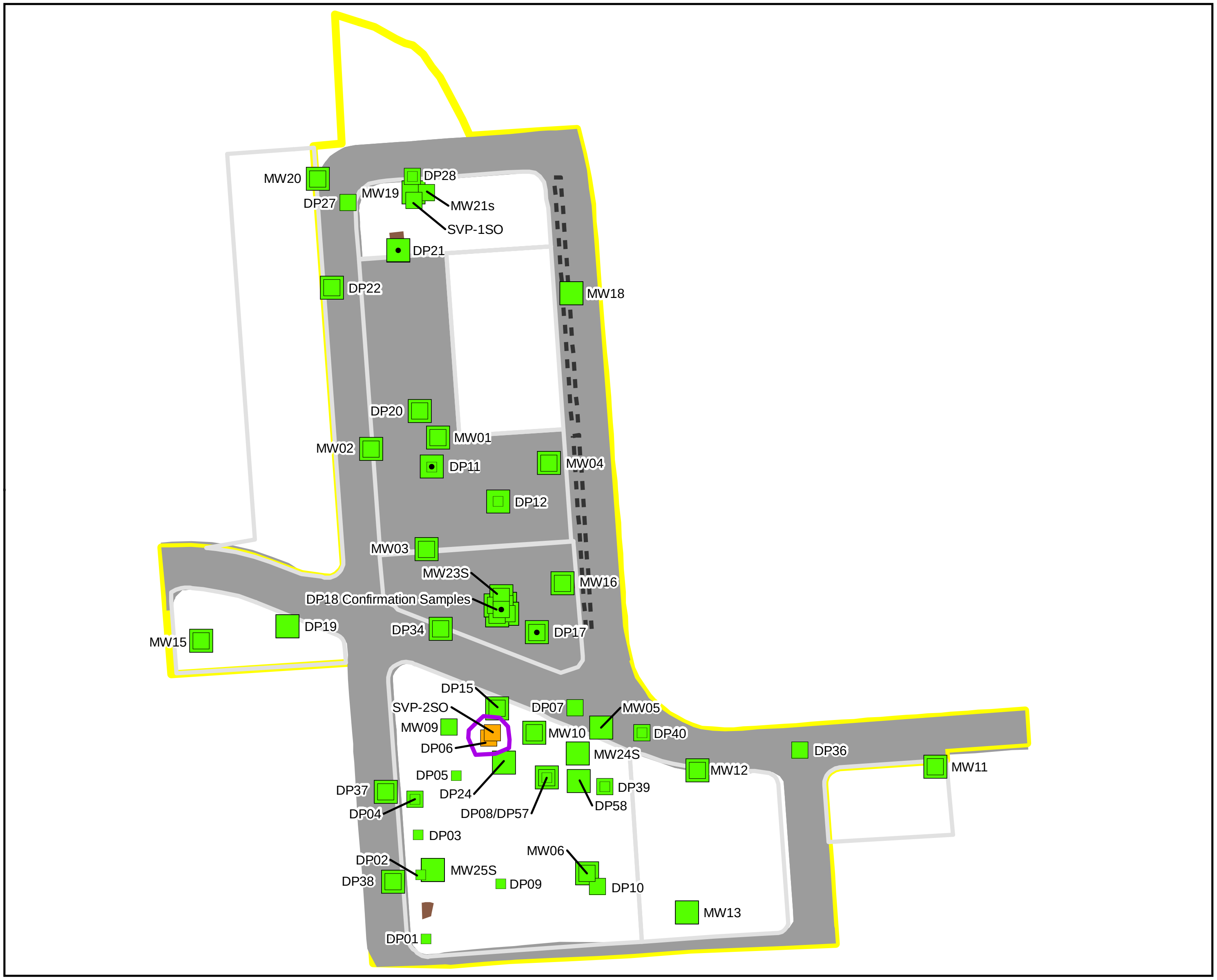

Legend

- Site Boundary
- Parcel Boundaries
- Constituent Delineation
- Sidewalk

Interim Actions

- Soil Cap/Cover
- Soil Removal

Soil Data (0-2' bgs)

- Soil Concentration <= SL and RL
- Soil Concentration > SL and RL

Soil Data (2-6' bgs)

- Soil Concentration <= SL and RL
- Soil Concentration > SL and RL

Soil Data (>= 6' bgs)

- Soil Concentration <= SL and RL
- Soil Concentration > SL and RL
- Samples No Longer In Place

Notes:

- The maximum concentration within each depth interval is shown.
- Only on-site soil sample locations are displayed.
- Sample depth ranges are based on sample top depth.
- TPH-G concentrations greater than 100 mg/kg in samples collected from MW19 and DP24 are not considered exceedences (and are not shown on this figure) because MW19 data were replaced by more recent co-located data from SVP-1SO and the DP24 sample was deeper than the TPH-G Soil POC (PIONEER 2014a).

TPH-G SL and RL = 100 mg/kg

0 100 200 300 Feet

P I O N E E R
TECHNOLOGIES CORPORATION

Location and Delineation of TPH-G Soil Screening Level Exceedances
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-5

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-5_Location_Delineation_TPH-G.mxd; Author: Melody Feden; Date Saved: 10/26/2016

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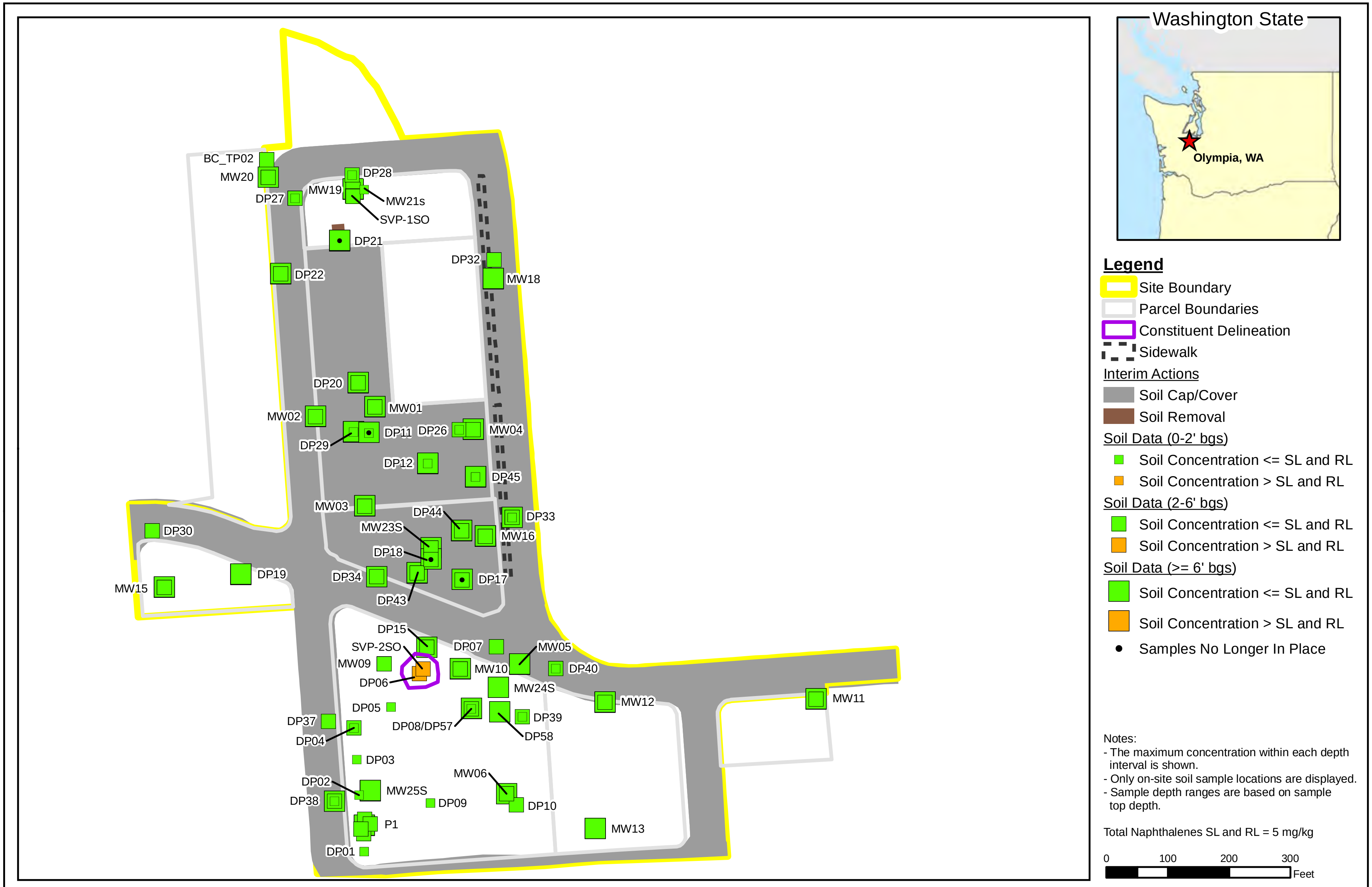

PIONEER TECHNOLOGIES CORPORATION

Location and Delineation of Total Naphthalenes Soil Screening Level Exceedances
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-6

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-6_Location_Delineation_Total_Naphthalenes.mxd; Author: SS; Date Saved: 10/26/2016

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Legend

Constituent Delineation
Site Boundary
Parcel Boundaries
Sidewalk

Interim Actions

Soil Cap/Cover
Soil Removal

Soil Data (0-2' bgs)

Soil Concentration <= SL
SL < Soil Concentration <= RL
Soil Concentration > RL

Soil Data (2-6' bgs)

Soil Concentration <= SL
SL < Soil Concentration <= RL
Soil Concentration > RL

Soil Data (>= 6' bgs)

Soil Concentration <= SL
SL < Soil Concentration <= RL
Soil Concentration > RL

Notes:
- The maximum concentration within each depth interval is shown.
- Only on-site soil sample locations are displayed.
- Sample depth ranges are based on sample top depth.
- The TPH-D and TPH-HO combined concentration greater than 4,700 mg/kg in samples collected from DP08 and DP13 are not considered exceedances (and are not shown on this figure) because the DP08 and DP13 data were replaced by more recent co-located data from DP57 and DP58.

TPH-D and TPH-HO Combined SL = 4,700 mg/kg
TPH-D and TPH-HO Combined RL = 24,000 mg/kg

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Location and Delineation of TPH-D and TPH-HO Combined Soil Screening Level Exceedances
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-7

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-7_Location_Delineation_CombinedTPH.mxd; Author: Melody Feden; Date Saved: 10/28/2016

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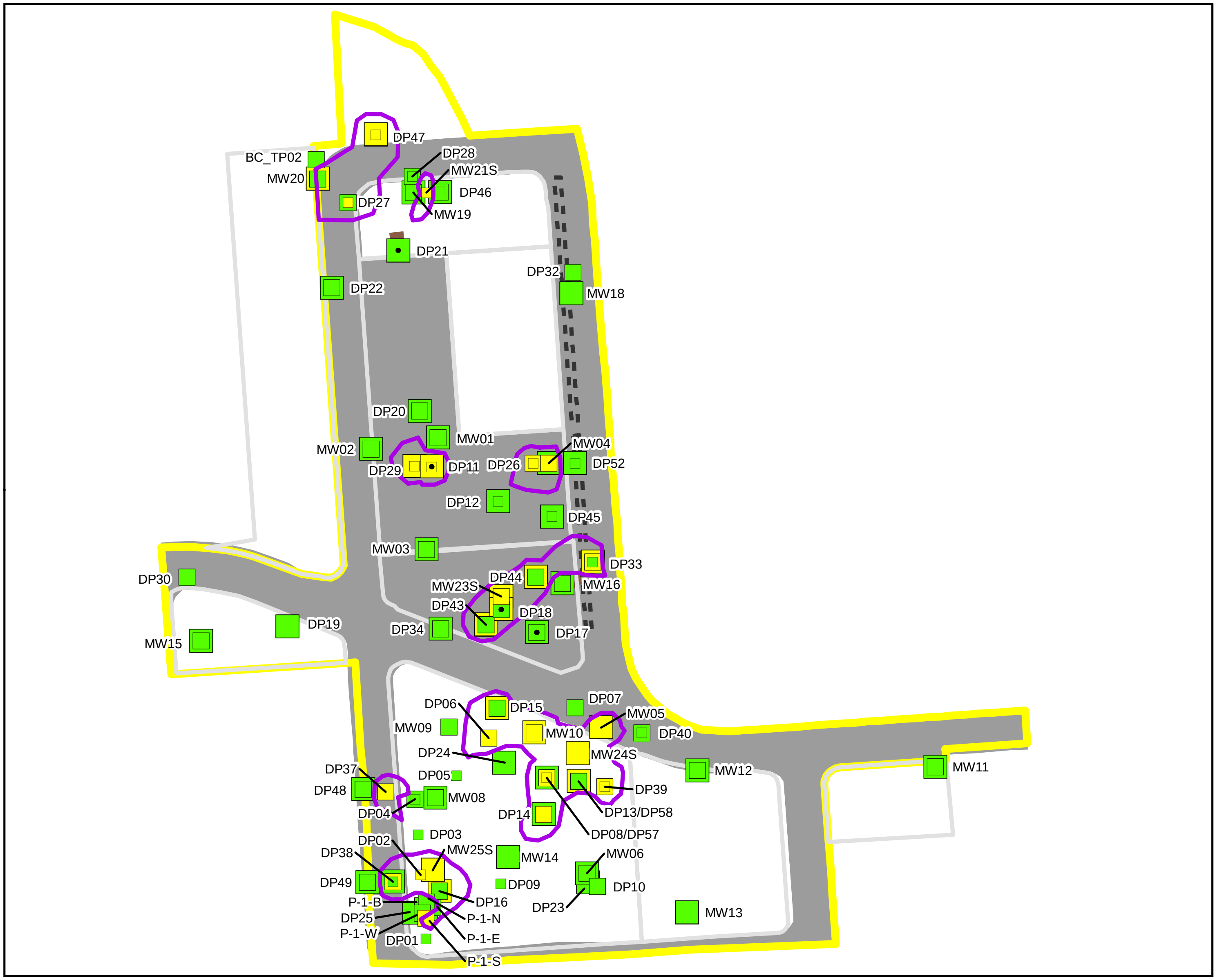

Washington State

Legend

- Site Boundary
- Parcel Boundaries
- Constituent Delineation
- Sidewalk

Interim Actions

- Soil Cap/Cover
- Soil Removal

Soil Data (0-2' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (2-6' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (>= 6' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL
- Samples No Longer In Place

Notes:
- The maximum concentration within each depth interval is shown.
- Only on-site soil sample locations are displayed.
- Non-detected values greater than the SL are not shown as exceedances.
- Sample depth ranges are based on sample top depth.

cPAHs SL = 0.095 mg/kg
cPAHs RL = 3.4 mg/kg

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Location and Delineation of Total cPAHs Soil Screening Level Exceedances
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-8

Legend

Site Boundary
Parcel Boundaries
Constituent Delineation
Sidewalk

Interim Actions

Soil Cap/Cover
Soil Removal

Soil Data (0-2' bgs)

Soil Concentration <= SL
SL < Soil Concentration <= RL
Soil Concentration > RL

Soil Data (2-6' bgs)

Soil Concentration <= SL
SL < Soil Concentration <= RL
Soil Concentration > RL

Soil Data (>= 6' bgs)

Soil Concentration <= SL
SL < Soil Concentration <= RL
Soil Concentration > RL
Samples No Longer In Place

Notes:
- The maximum concentration within each depth interval is shown.
- Only on-site soil sample locations are displayed.
- Sample depth ranges are based on sample top depth.

Total Dioxins/Furans SL = 11 ng/kg
Total Dioxins/Furans RL = 590 ng/kg

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Location and Delineation of Total Dioxins/Furans Soil Screening Level Exceedances
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-9

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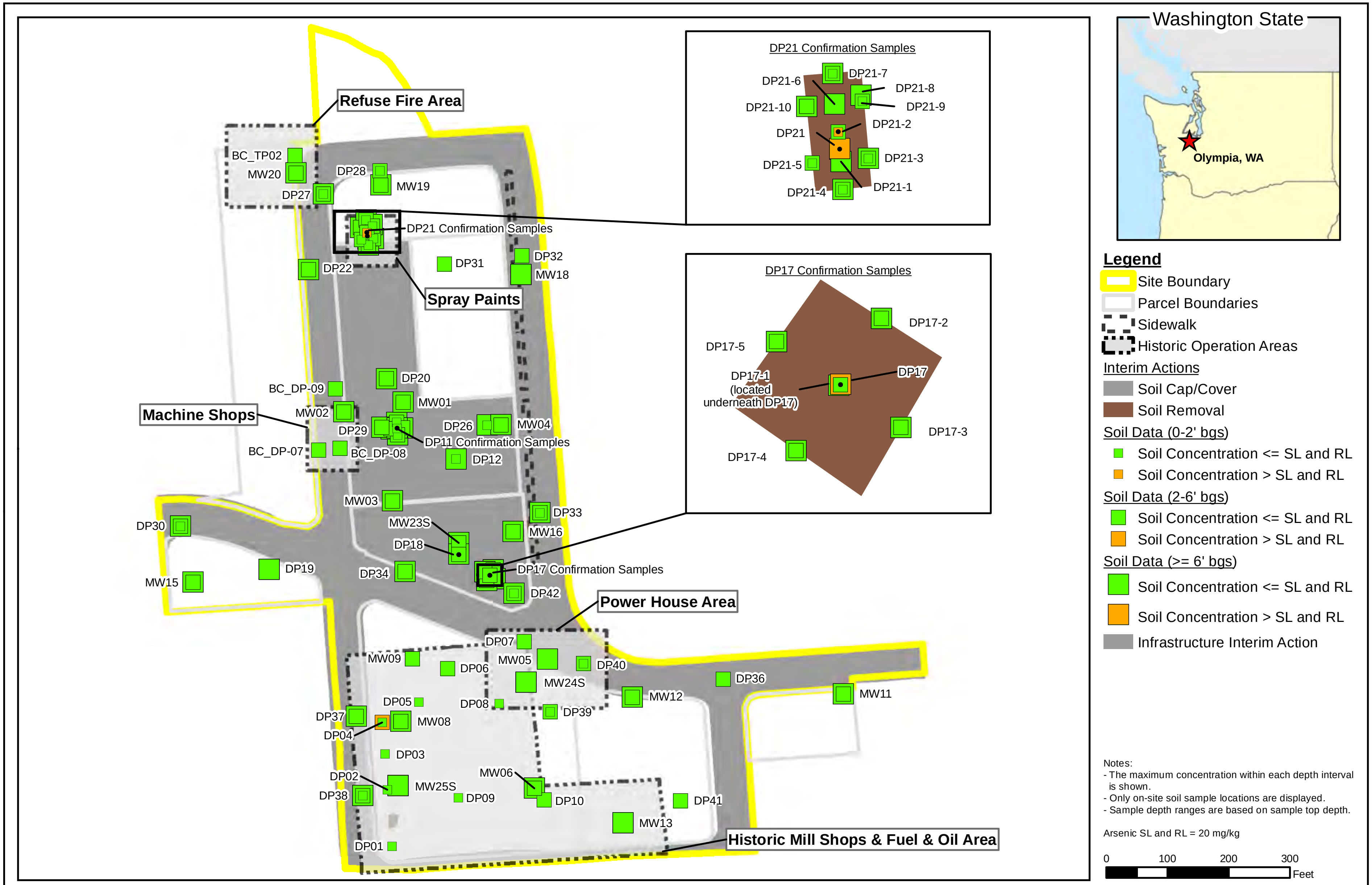

PIONEER TECHNOLOGIES CORPORATION

Comparison of Historic Operation Areas with Arsenic Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-10

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RI/FS Report\Figure 3-10_Comparison_Historic_Operations_Areas_Arsenic.mxd; Author: SS; Date Saved: 10/26/2016

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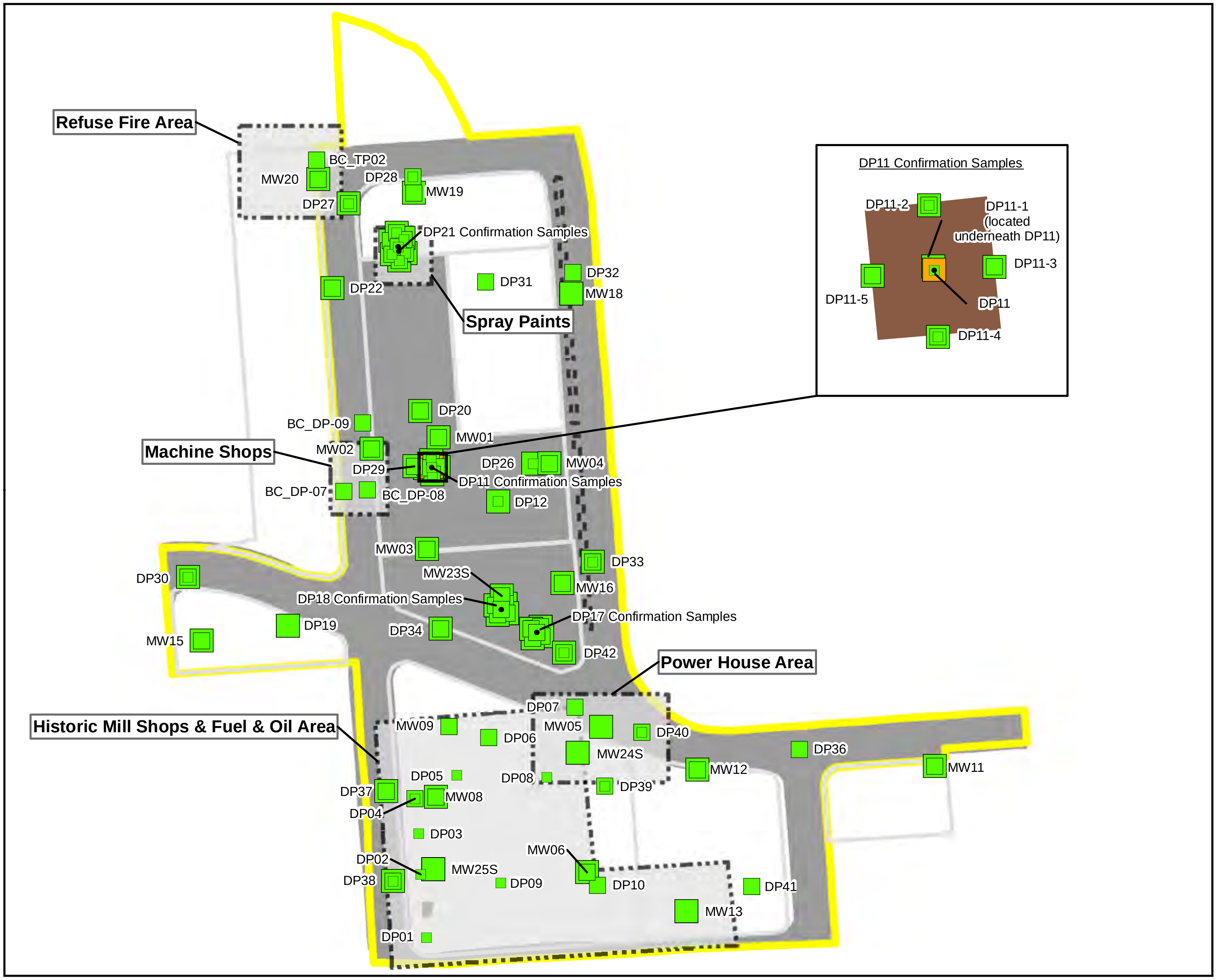

Legend

- Site Boundary
- Parcel Boundaries
- Historic Operation Areas
- Sidewalk

Interim Actions

- Soil Cap/Cover
- Soil Removal

Soil Data (0-2' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (2-6' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (>=6' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL
- Samples No Longer In Place

Notes:
- The maximum concentration within each depth is shown.
- Only on-site soil sample locations are displayed.
- Sample depth ranges are based on sample top depth.

Lead SL 250 mg/kg
Lead RL = 1,000 mg/kg

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Comparison of Historic Operation Areas with Lead Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-11

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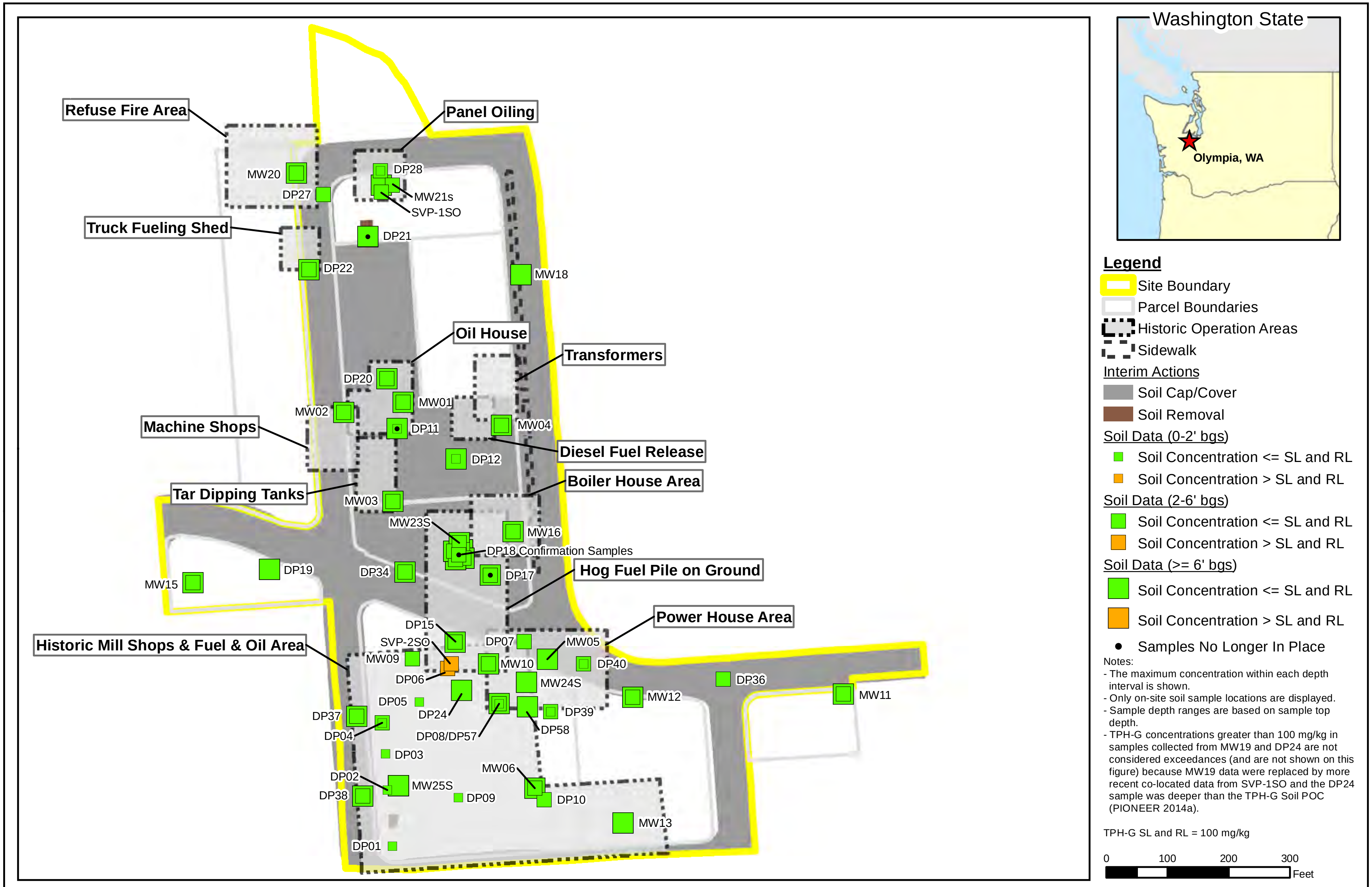

PIONEER TECHNOLOGIES CORPORATION

Comparison of Historic Operation Areas with TPH-G Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-12

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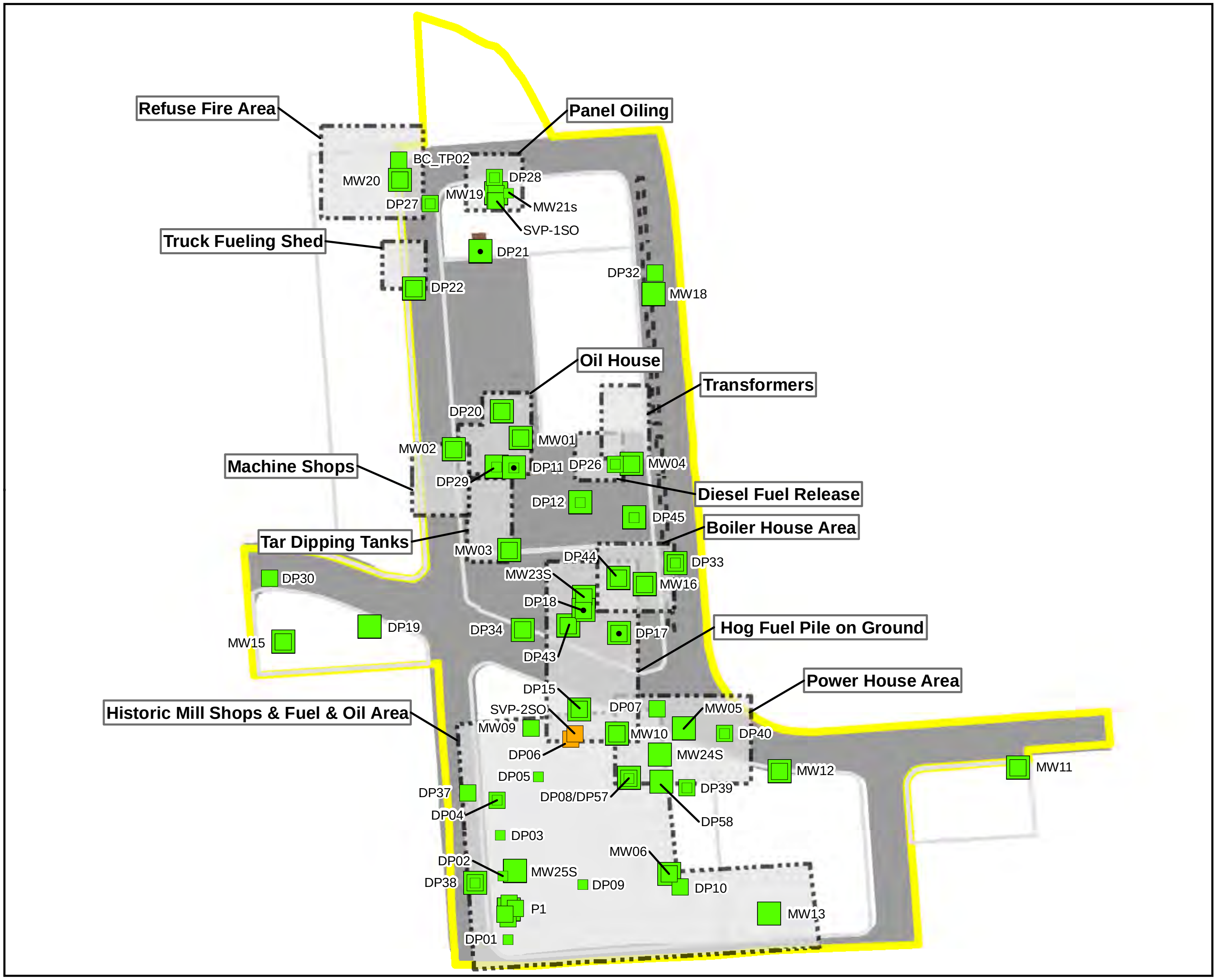

Legend

- Site Boundary
- Parcel Boundaries
- Historic Operation Areas
- Sidewalk

Interim Actions

- Soil Cap/Cover
- Soil Removal

Soil Data (0-2' bgs)

- Soil Concentration <= SL and RL
- Soil Concentration > SL and RL

Soil Data (2-6' bgs)

- Soil Concentration <= SL and RL
- Soil Concentration > SL and RL

Soil Data (>= 6' bgs)

- Soil Concentration <= SL and RL
- Soil Concentration > SL and RL
- Samples No Longer In Place

Notes:
- The maximum concentration within each depth interval is shown.
- Only on-site soil sample locations are displayed.
- Sample depth ranges are based on sample top depth.

Total Naphthalenes SL and RL = 5 mg/kg

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Comparison of Historic Operation Areas with Total Naphthalenes Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-13

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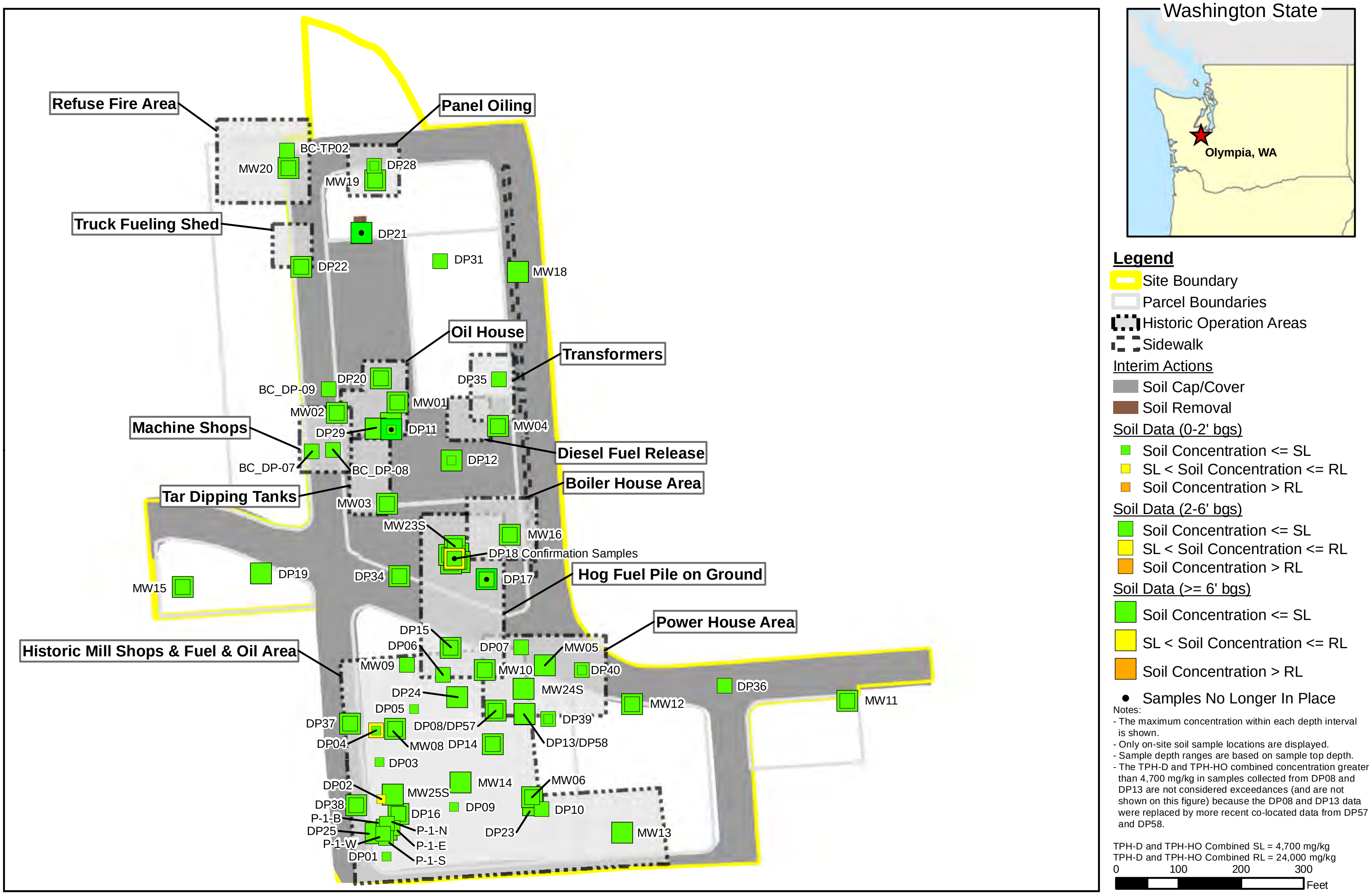

PIONEER TECHNOLOGIES CORPORATION

Comparison of Historic Operation Areas with TPH-D and TPH-HO Combined Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-14

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-14_Comparison_Historic_Operations_Area_CombinedTPH.mxd; Author: SS; Date Saved: 12/14/201

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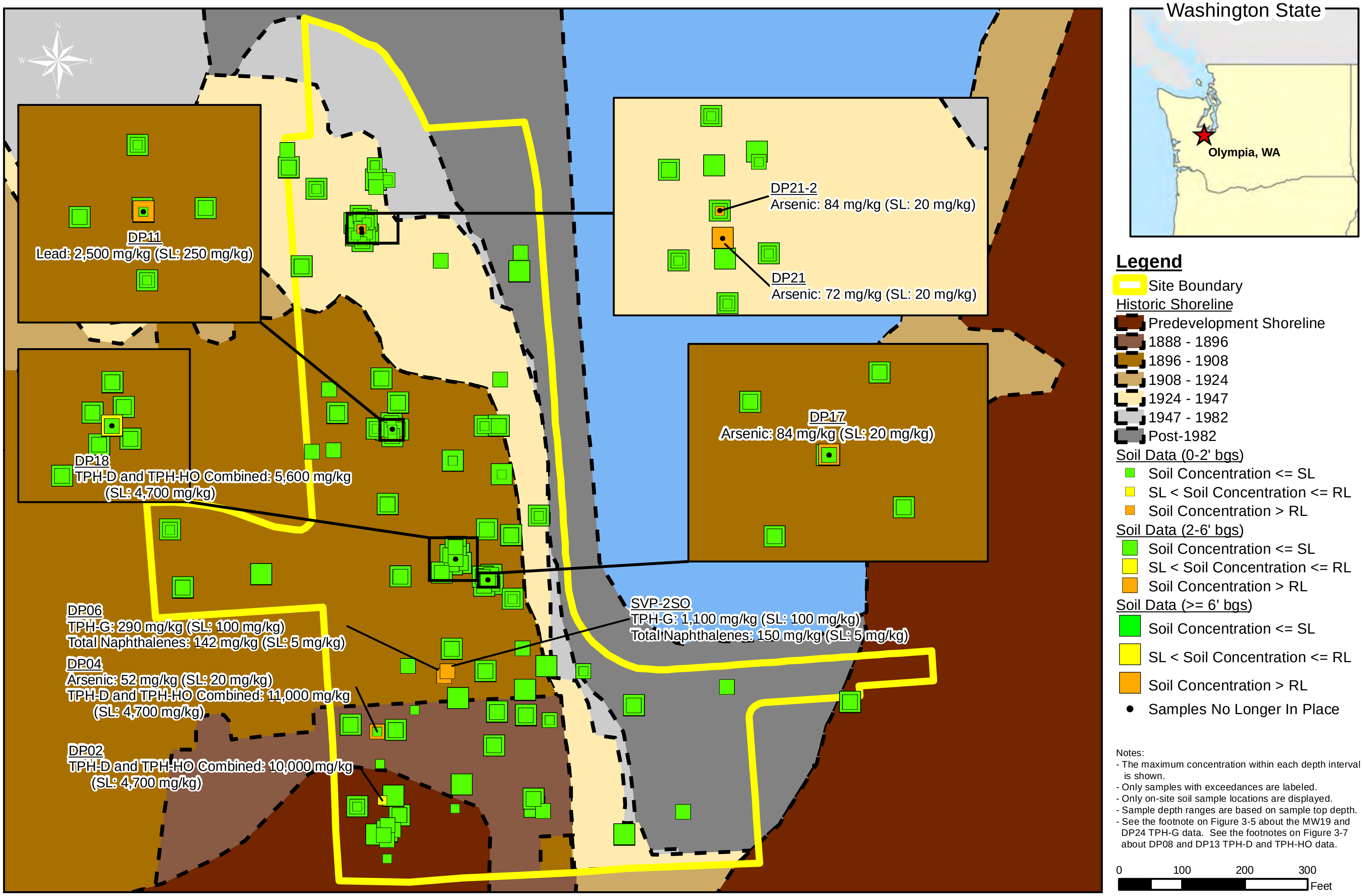

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-15_Comparison_Fill_History.mxd; Author: SS; Date Saved: 10/28/2016

PIONEER TECHNOLOGIES CORPORATION

Comparison of Fill History with Arsenic, Lead, TPH-G, Total Naphthalenes, and TPH-D and TPH-HO Combined Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-15

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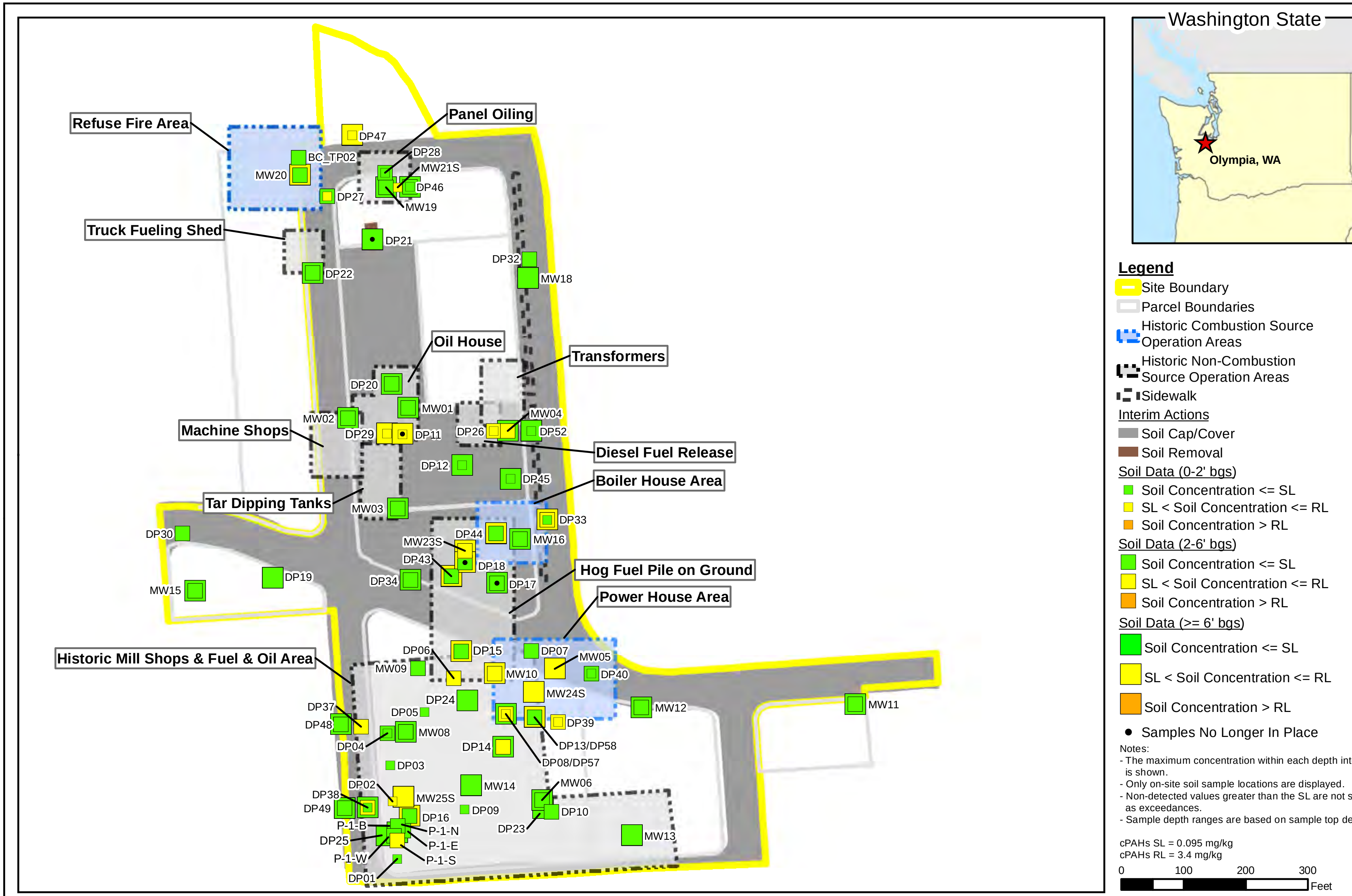

Legend

- Site Boundary
- Parcel Boundaries
- Historic Combustion Source Operation Areas
- Historic Non-Combustion Source Operation Areas
- Sidewalk

Interim Actions
- Soil Cap/Cover
- Soil Removal

Soil Data (0-2' bgs)
- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (2-6' bgs)
- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (>= 6' bgs)
- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

- Samples No Longer In Place

Notes:
- The maximum concentration within each depth interval is shown.
- Only on-site soil sample locations are displayed.
- Non-detected values greater than the SL are not shown as exceedances.
- Sample depth ranges are based on sample top depth.

cPAHs SL = 0.095 mg/kg
cPAHs RL = 3.4 mg/kg

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Comparison of Historic Operation Areas with Total cPAHs Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-16

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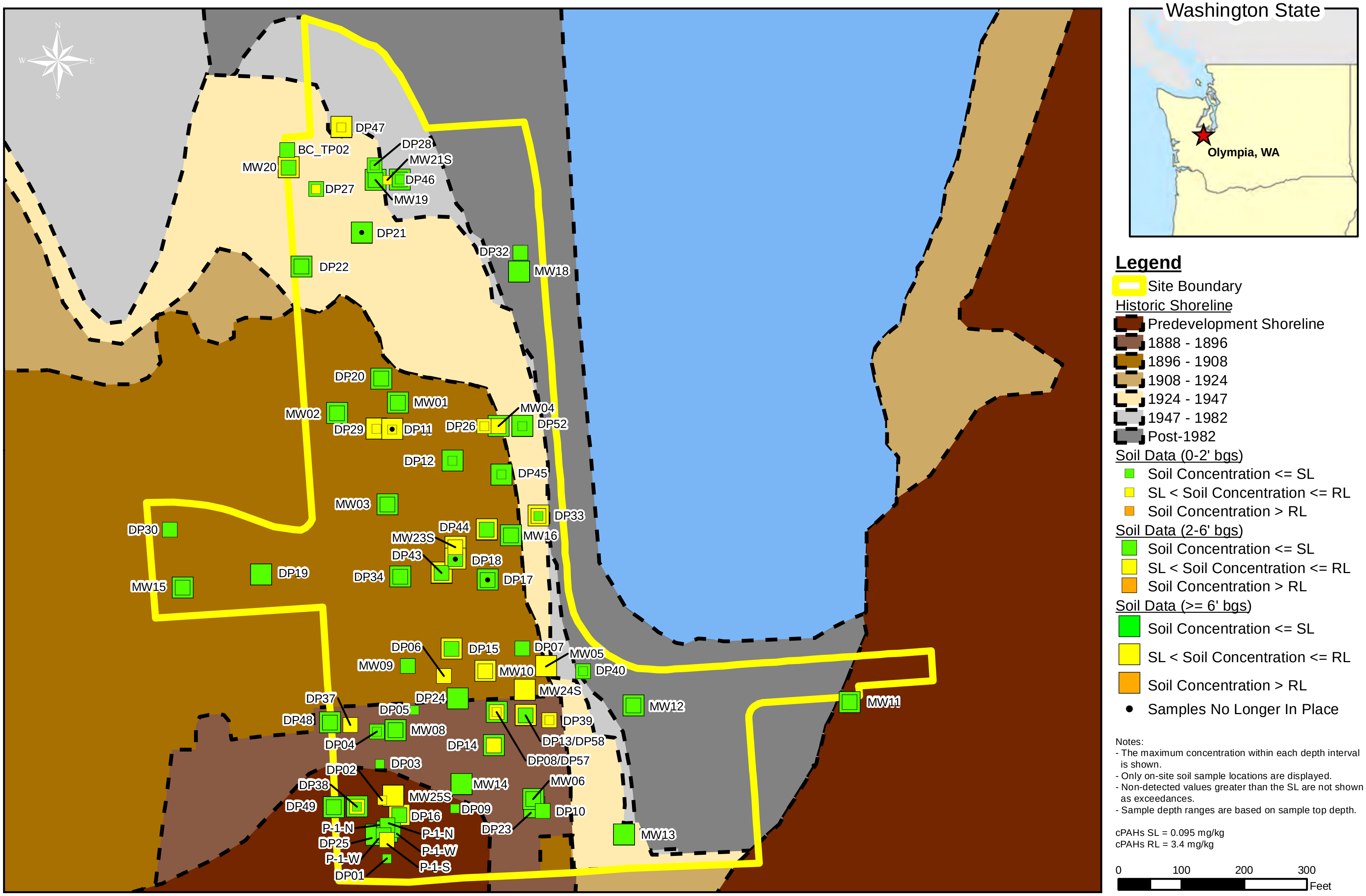

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-17_Comparison_Fill_History_cPAHs.mxd; Author: SS; Date Saved: 6/17/2015

PIONEER TECHNOLOGIES CORPORATION

Comparison of Fill History with Total cPAHs Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-17

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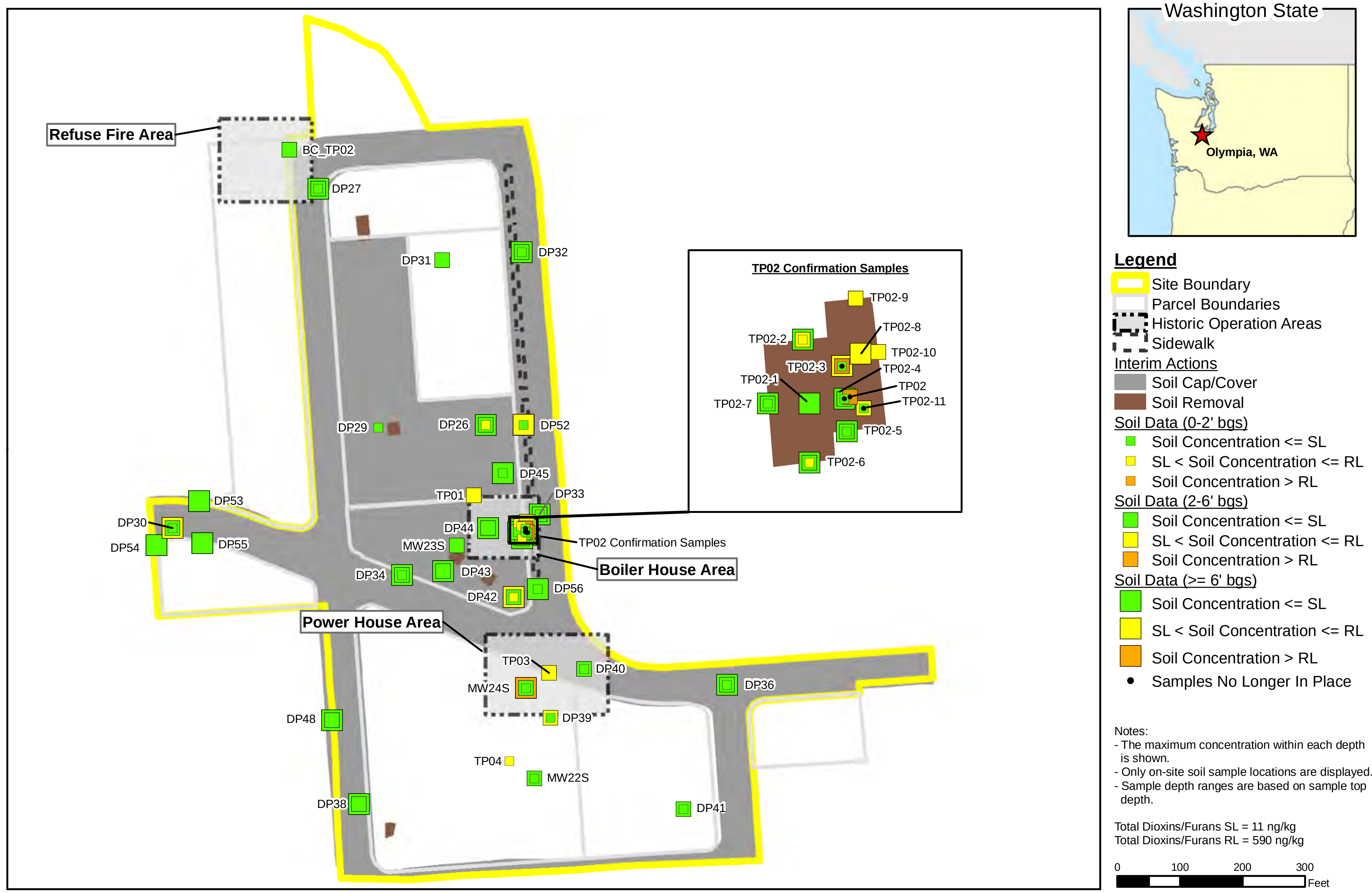

PIONEER TECHNOLOGIES CORPORATION

Comparison of Historic Operation Areas with Total Dioxins/Furans Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-18

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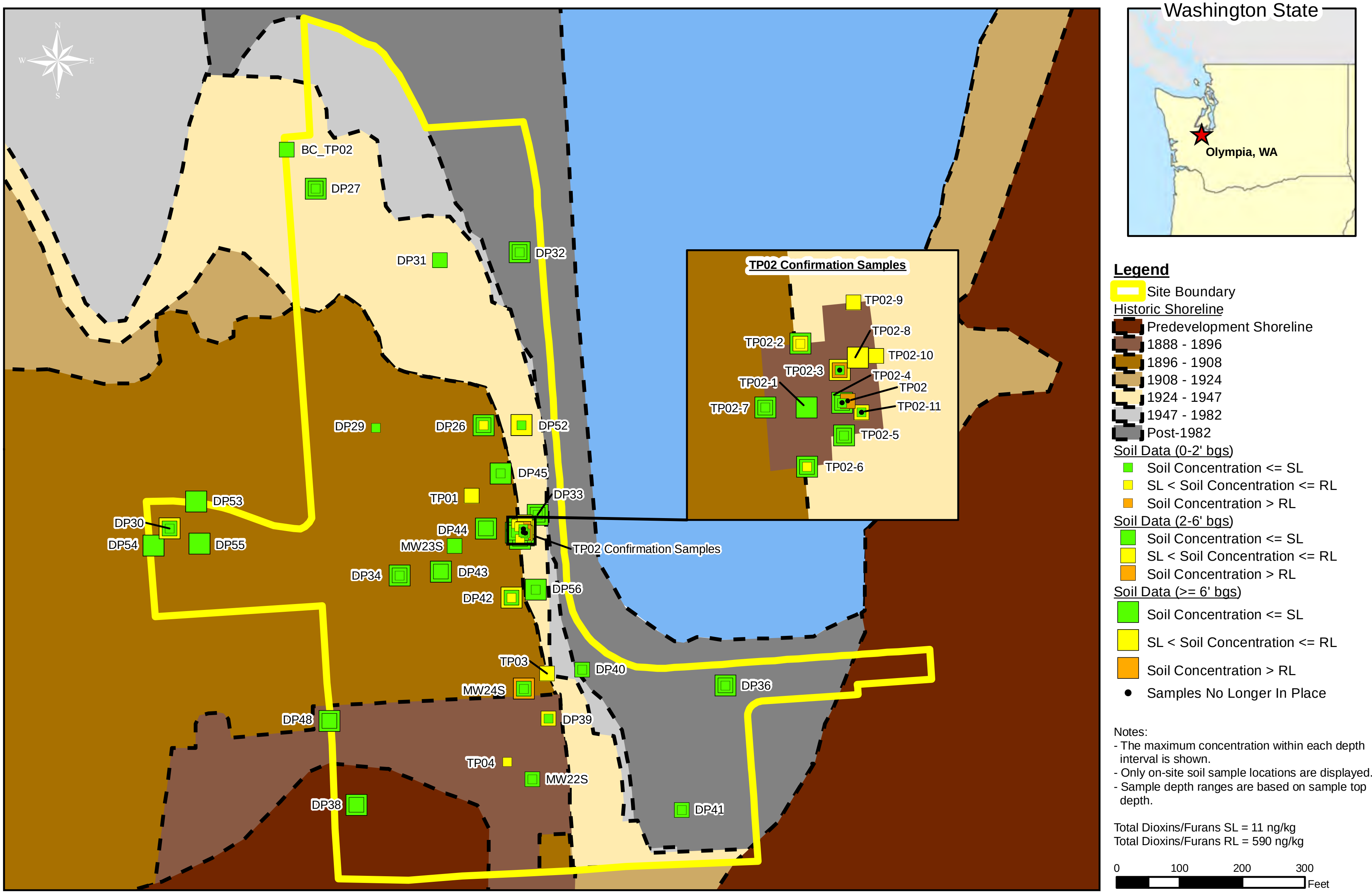

PIONEER TECHNOLOGIES CORPORATION

Comparison of Fill History with Total Dixons/Furans Soil Results
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-19

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Legend

- Site Boundary
- Depth to Groundwater Not Measured During Event
- Depth to Groundwater Measured During Event (feet)
- Groundwater Depth Contours

Notes:
NM: Not Measured
Groundwater depths are based on measurements from the top of monitoring well casings. The top of each casing is roughly equal to ground surface.

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Typical Depths to Groundwater (September 2009 Data)
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-20

Legend

- Site Boundary
- Monitoring Well Not Measured During Event
- Measured Monitoring Well and Groundwater Elevation (feet NAVD88)
- Groundwater Elevation Contours

Notes:
NAVD88: North American Vertical Datum of 1988
NM: Not Measured

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Typical Groundwater Elevation Contours (September 2009 Data)
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-21

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-21_Typical_Groundwater_Elevation_Contours.mxd; Author: SS; Date Saved: 7/26/2016

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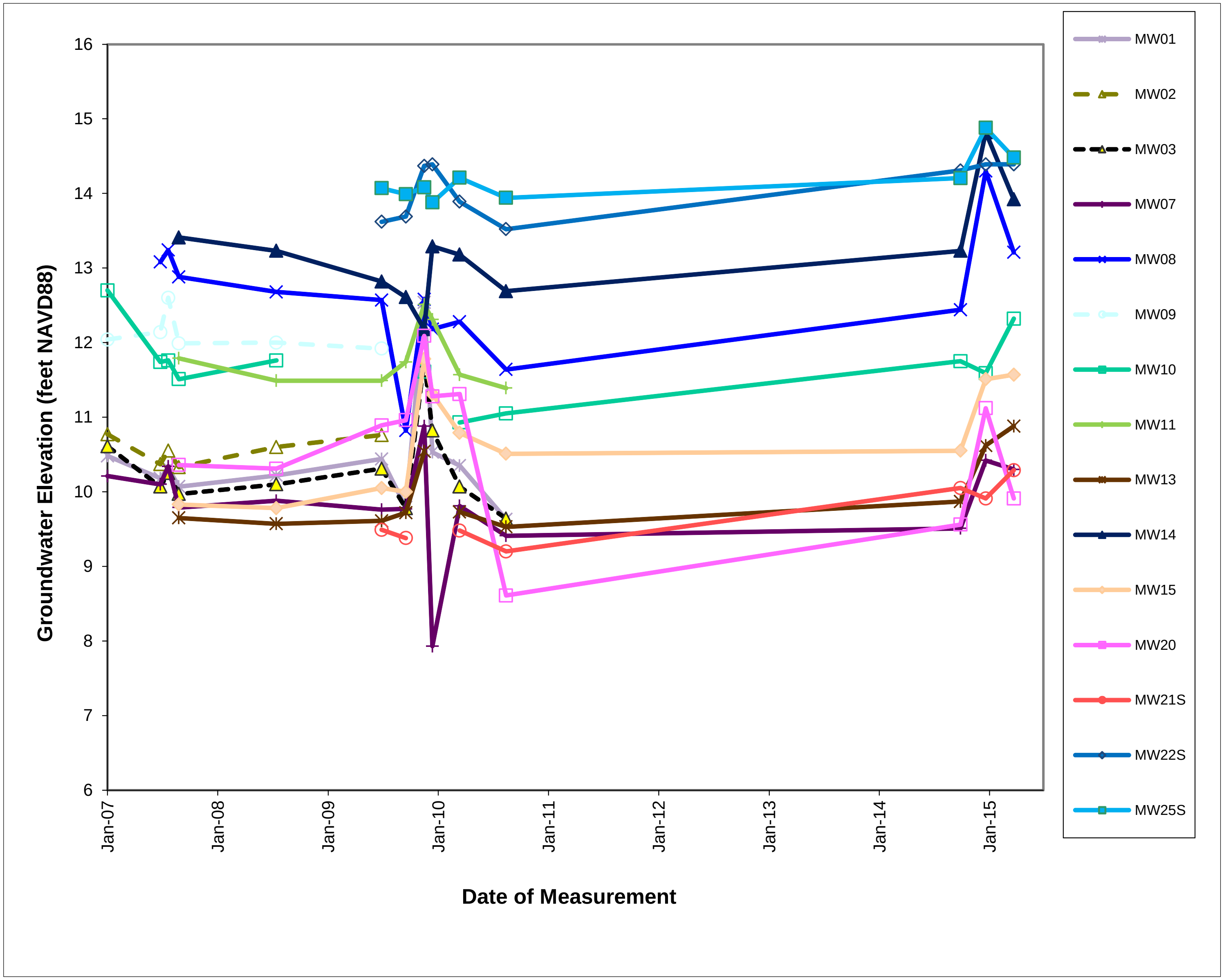

PIONEER TECHNOLOGIES CORPORATION

Hydrograph of Key Monitoring Wells
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-22

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Legend

Site Boundary

Groundwater Elevation Contours (September 2009 Data)

Monitoring Wells

- MWs with replicated groundwater SL exceedance
- MW with at least one unqualified dissolved groundwater SL exceedance
- Monitoring Well

Soil Data (0-2' bgs)

- Soil Concentration <= SL and RL
- Soil Concentration > SL and RL

Soil Data (2-6' bgs)

- Soil Concentration <= SL and RL
- Soil Concentration > SL and RL

Soil Data (>= 6' bgs)

- Soil Concentration <= SL and RL
- Soil Concentration > SL and RL

● Samples No Longer In Place

Notes:
- The maximum concentration within each depth interval is shown.
- Only on-site soil sample locations are displayed.
- Only samples with exceedances are labeled.
- Sample depth ranges are based on sample top depth.

Arsenic Groundwater SL = 5 ug/L
Arsenic Soil SL and RL = 20 mg/kg

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Comparison of Arsenic Soil and Groundwater Screening Level Exceedance Locations
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-23

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Legend

- Site Boundary
- Groundwater Elevation Contours (September 2009 Data)

Monitoring Wells

- MWs with replicated groundwater SL exceedance
- MW with at least one groundwater SL exceedance
- Monitoring Well
- Samples No Longer In Place

Soil Data (0-2' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (2-6' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL

Soil Data (>= 6' bgs)

- Soil Concentration <= SL
- SL < Soil Concentration <= RL
- Soil Concentration > RL
- Samples No Longer In Place

Notes:
- The maximum concentration within each depth interval is shown.
- Only on-site soil sample locations are displayed.
- Sample depth ranges are based on sample top depth.
- The TPH-D and TPH-HO combined concentration greater than 4,700 mg/kg in samples collected from DP08 and DP13 are not considered exceedances (and are not shown on this figure) because the DP08 and DP13 data were replaced by more recent co-located data from DP57 and DP58.

TPH-D Groundwater SL = 720 ug/L
TPH-D Soil SL = 4,700 mg/kg
TPH-D Soil RL = 24,000 mg/kg

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Comparison of TPH-D and TPH-HO Combined Soil and Groundwater Screening Level Exceedance Locations
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-24

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-24_Comparison_Soil_Gw_SL_Exceedances_CombinedTPH.mxd; Author: SS; Date Saved: 10/26/201

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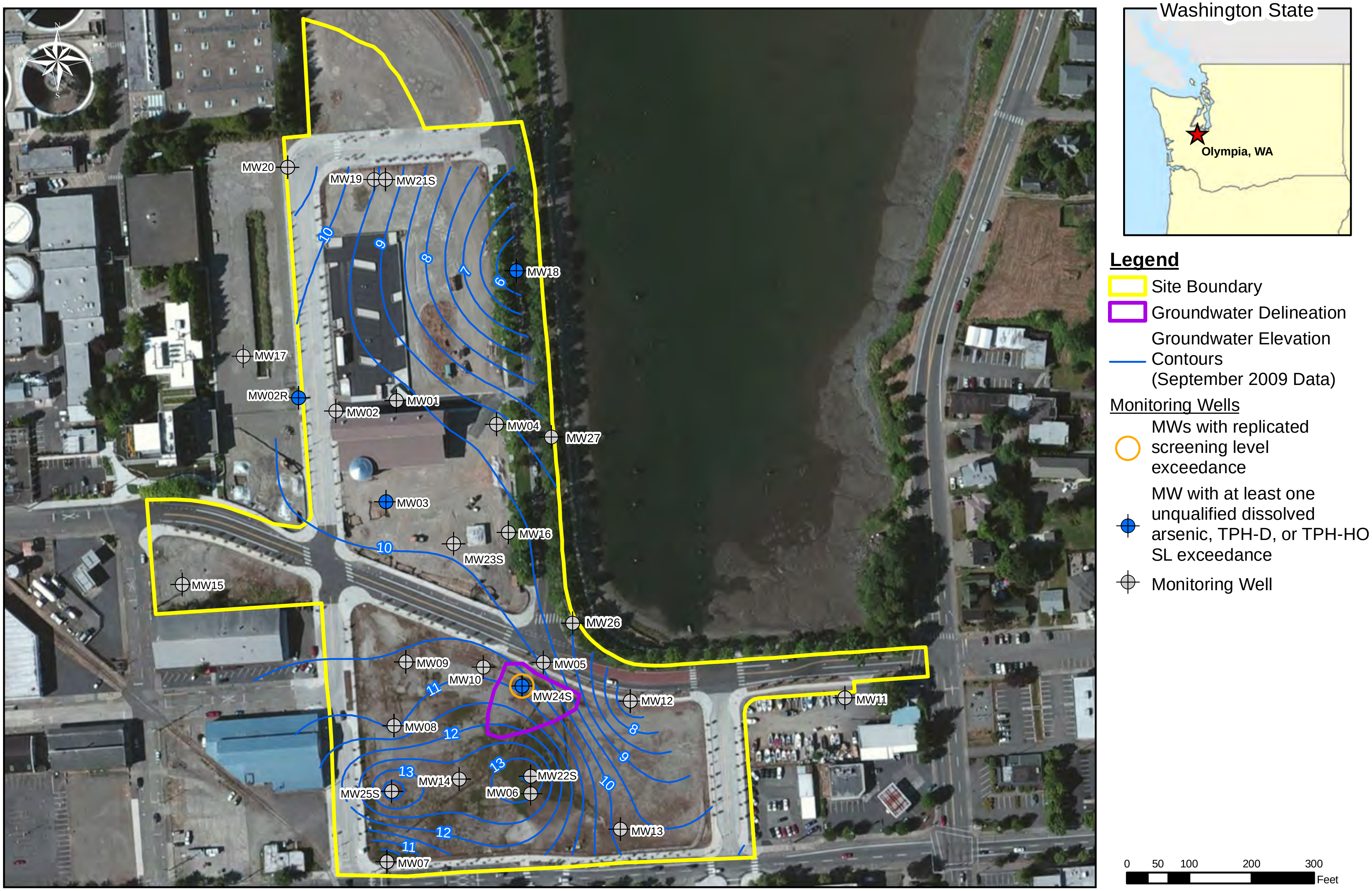

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-25_Location_Delineation_Groundwater.mxd; Author: SS; Date Saved: 5/28/2015

PIONEER TECHNOLOGIES CORPORATION

Location and Delineation of Groundwater Screening Level Exceedances
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-25

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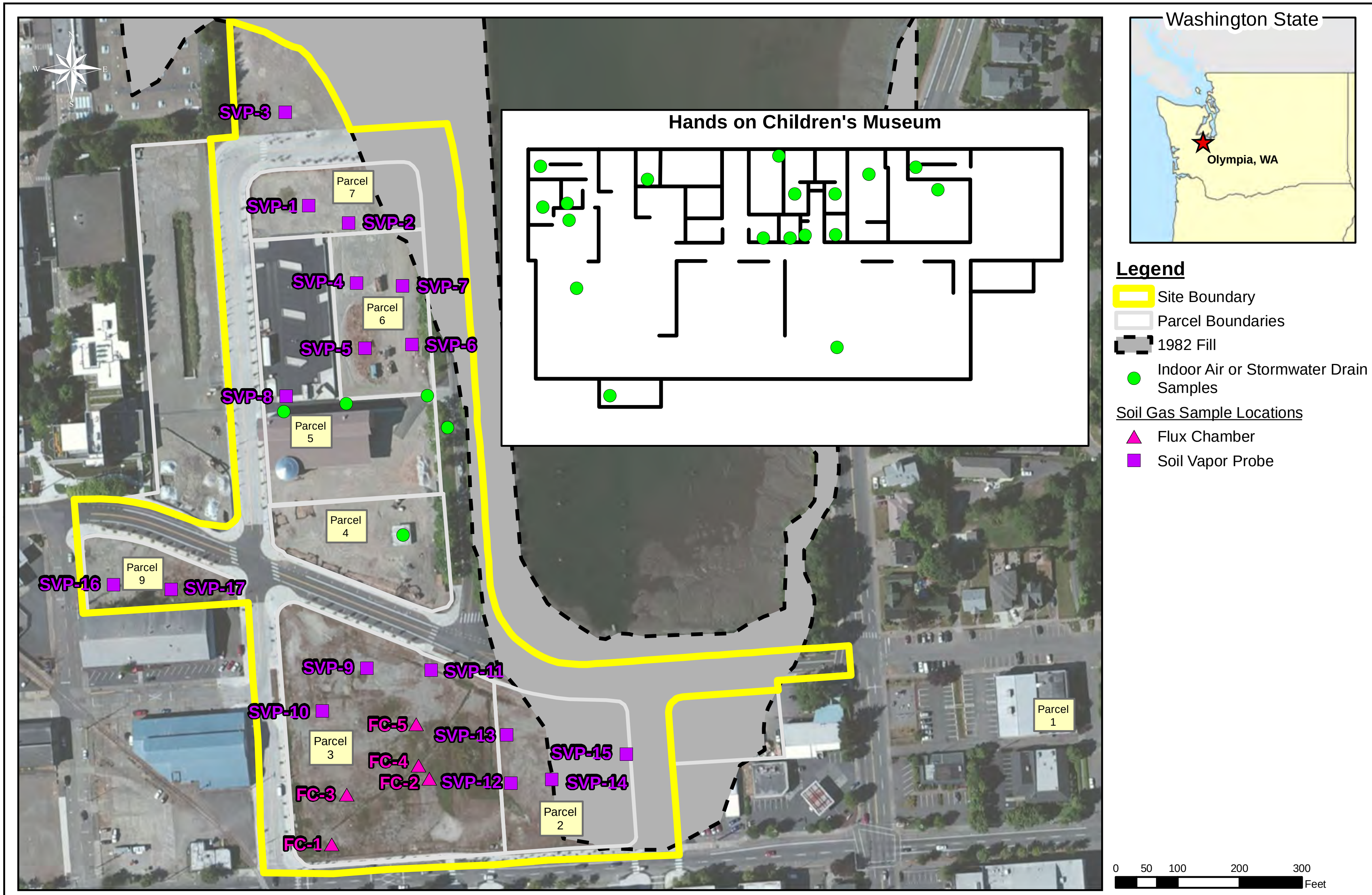
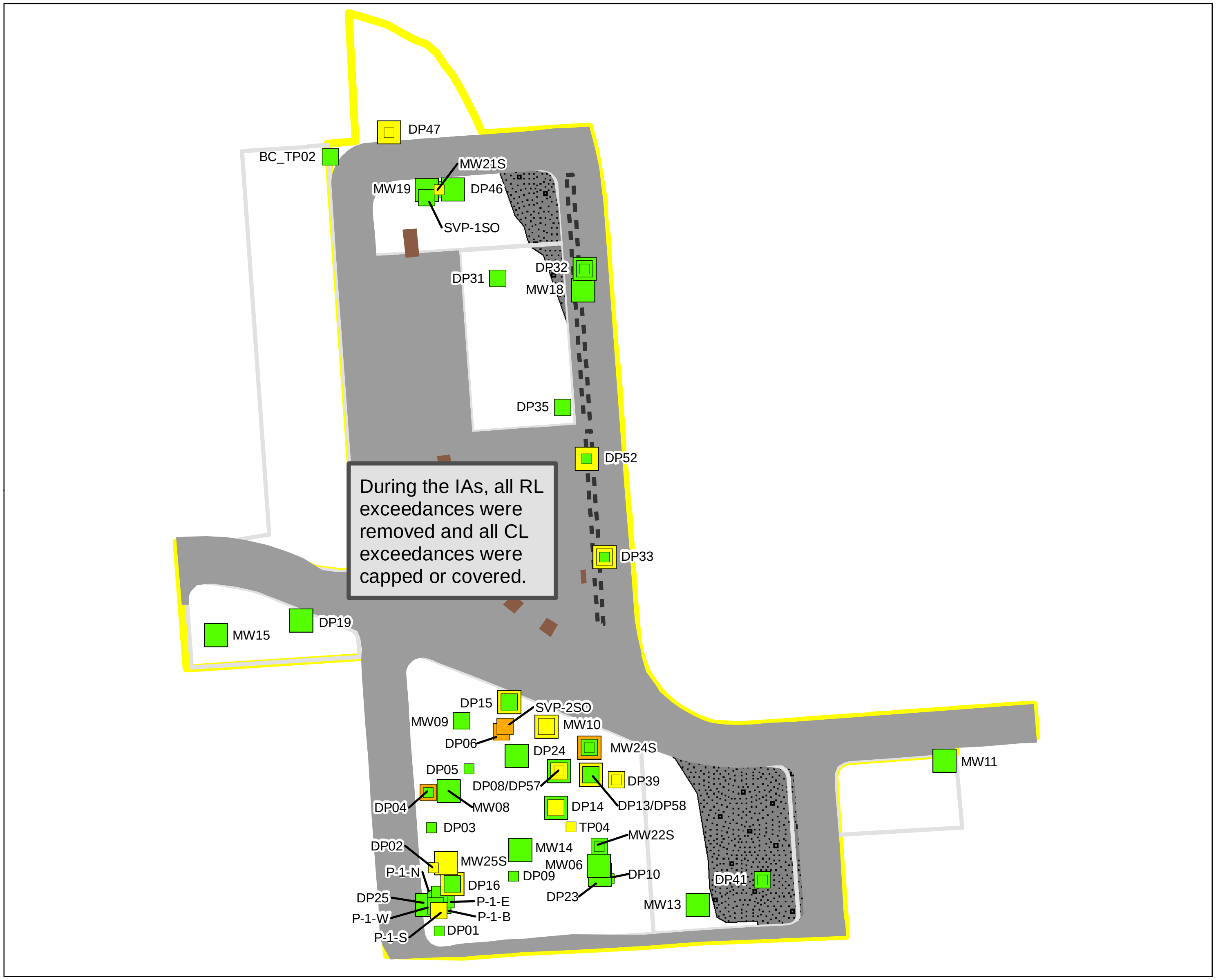


Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-26_CH4_Locations.mxd; Author: SS; Date Saved: 10/26/2016

PIONEER TECHNOLOGIES CORPORATION

Methane Evaluation Locations
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-26



Legend

- Site Boundary
- Parcel Boundaries
- 1982 Fill
- Sidewalk

Interim Actions

- Soil Cap/Cover
- Soil Removal

Soil Data (0-2' bgs)

- All COPCs <= SL
- SL < At least one soil concentration <= RL
- At least one soil concentration > RL

Soil Data (2-6' bgs)

- All COPCs <= SL
- SL < At least one soil concentration <= RL
- At least one soil concentration > RL

Soil Data (>=6' bgs)

- All COPCs <= SL
- SL < At least one soil concentration <= RL
- At least one soil concentration > RL

Notes:
- The maximum concentration within each depth is shown.
- Only on-site soil sample locations are displayed.
- Sample depth ranges are based on sample top depth.

0 150 300 Feet

PIONEER TECHNOLOGIES CORPORATION

RI Summary
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 3-27

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 3-27_RI_Summary.mxd; Author: SS; Date Saved: 10/26/2016

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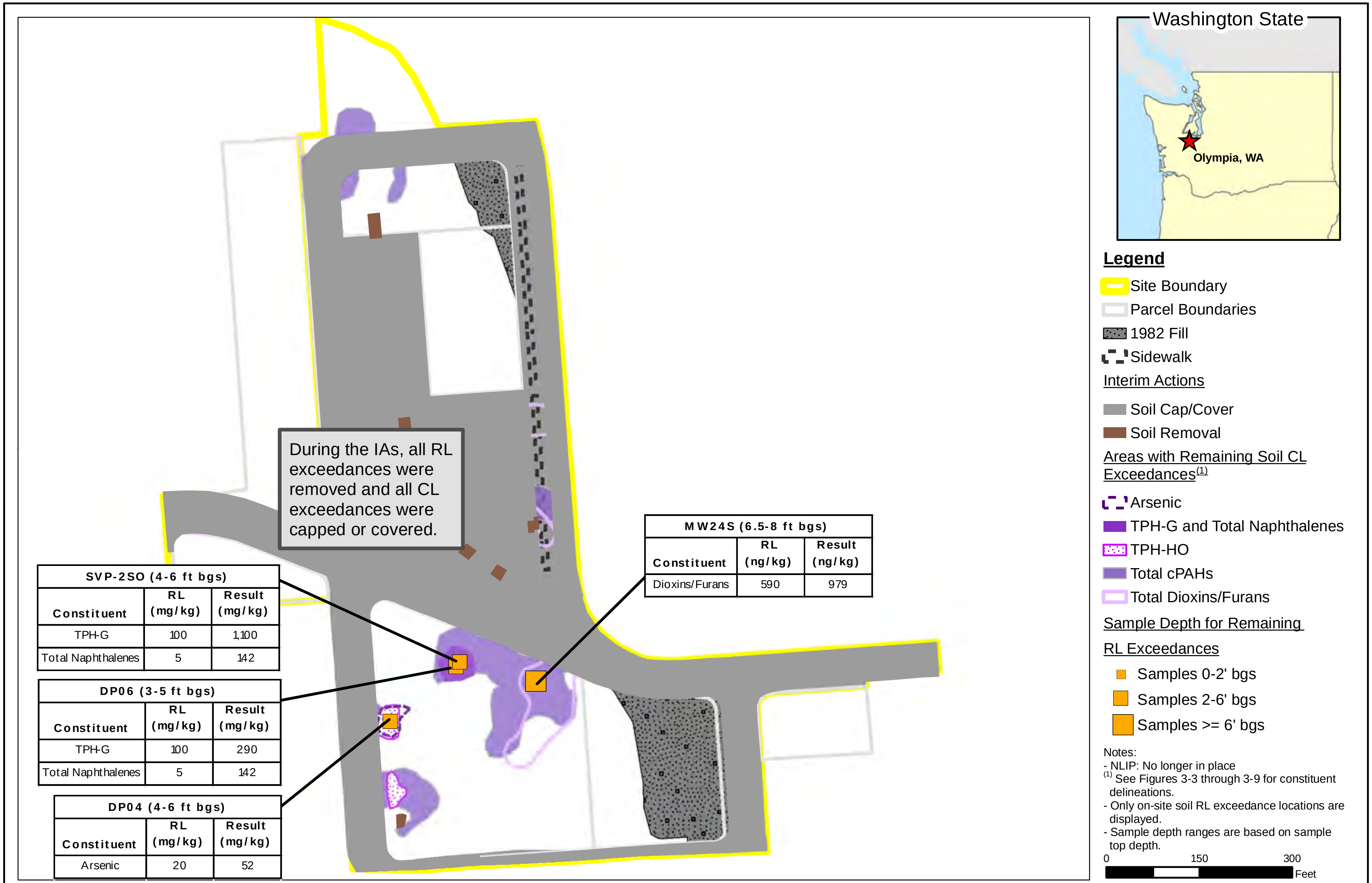

SVP-2SO (4-6 ft bgs)		
Constituent	RL (mg/kg)	Result (mg/kg)
TPH-G	100	1,100
Total Naphthalenes	5	142

DP06 (3-5 ft bgs)		
Constituent	RL (mg/kg)	Result (mg/kg)
TPH-G	100	290
Total Naphthalenes	5	142

DP04 (4-6 ft bgs)		
Constituent	RL (mg/kg)	Result (mg/kg)
Arsenic	20	52

MW24S (6.5-8 ft bgs)		
Constituent	RL (ng/kg)	Result (ng/kg)
Dioxins/Furans	590	979

PIONEER TECHNOLOGIES CORPORATION

Location of Remaining Soil Cleanup Level and Remediation Level Exceedances
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 4-1

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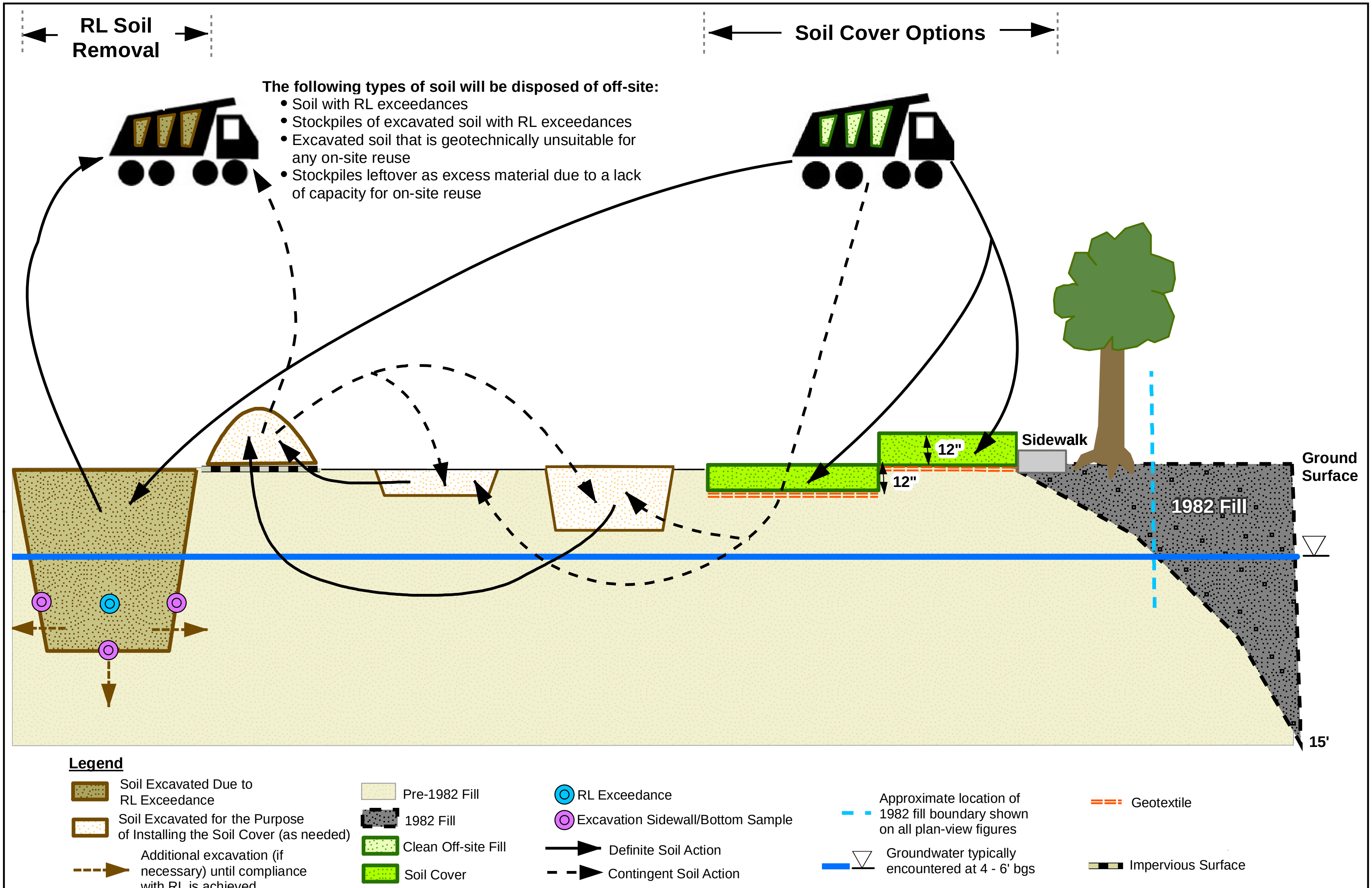

PIONEER TECHNOLOGIES CORPORATION

Conceptual Schematic for Targeted Soil Removal and Cover with Alternative 2
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 4-2

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Legend

Site Boundary

Sidewalk

Interim Actions

Soil Cap/Cover

Soil Removal

Alternative 2

1982 Fill [1]

Soil Removal

Soil Cover

Notes:
[1] Based on lithologic data and historical survey information, the existing clean fill thickness along the 1982 fill boundary is approximately five feet. This conservative boundary was used to ensure there would be a suitable soil cover thickness in the area where 1982 fill transitions to pre-1982 fill.

0 100 200 300 Feet

PIONEER TECHNOLOGIES CORPORATION

Alternative 2 Soil Removal and Cover Locations
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 4-3

Document Path: G:\Projects\Port of Olympia\East Bay\GIS\Maps\Maps 2015\February 2015\RIFS Report\Figure 4-3 Alternative 2 Cap_Cover and Soil Removal Locations.mxd; Author: SS; Date Saved: 10/26/2016

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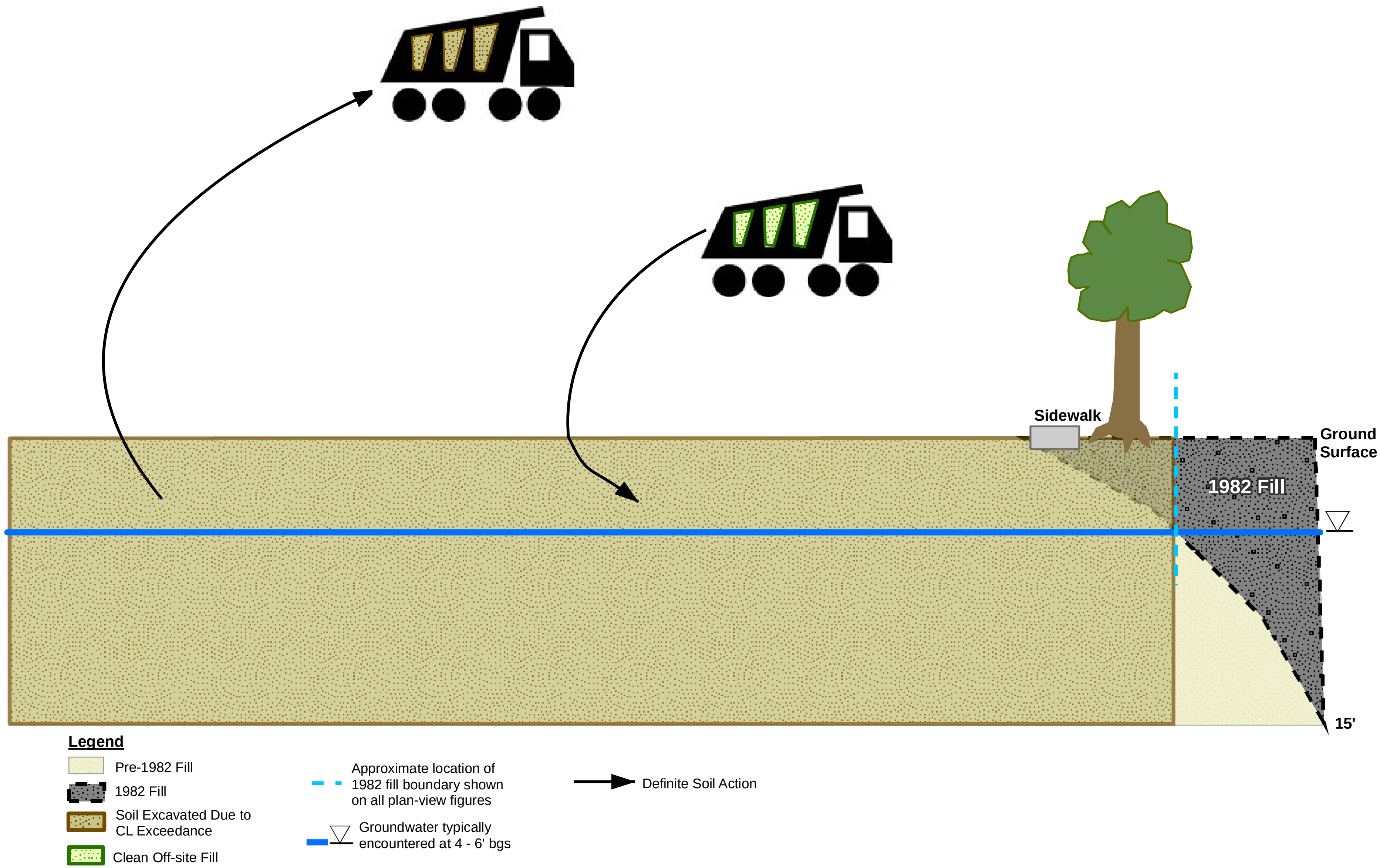

PIONEER TECHNOLOGIES CORPORATION

Conceptual Schematic for Total Soil Removal with Alternative 3
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 4-4

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Legend

Site Boundary

Sidewalk

Interim Actions

Soil Cap/Cover

Soil Removal

Alternative 3

1982 Fill (1)

Soil Removal

Notes:
(1) Based on lithologic data and historical survey information, the existing clean fill thickness along the 1982 fill boundary is five feet. This conservative boundary was used to ensure there would be a suitable soil cover thickness in the area where 1982 fill transitions to pre-1982 fill.

0 100 200 300 Feet

PIONEER
TECHNOLOGIES CORPORATION

Alternative 3 Soil Removal Locations
Remedial Investigation / Feasibility Study Report
East Bay Redevelopment Site

Figure 4-5

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Tables

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Table 2-1: Summary of Site Chronology

Year(s)	Date(s)	Activity Type	Activity Description/Summary
2006	9/25	Field Investigation	Soil samples were collected from soil borings DP01 through DP10 (Pre-AO RI)
2007	1/2 – 1/17	Field Investigation	Soil samples were collected from soil borings DP11 through DP16, MW01 through MW06, and MW08 through MW10; MW01 through MW10 were installed (Pre-AO RI)
2007	1/4 – 2/2	Field Investigation	The first comprehensive GWM event was conducted (Pre-AO RI)
2007	2/14	Field Investigation	Soil samples were collected from soil borings BC_DP-07 through BC_DP-09 as part of investigation activities on the adjacent LOTT Expansion Site (the boring locations are within the current East Bay Redevelopment Site boundary)
2007	3/14	Report	The Final Phase I Environmental Site Assessment Report was prepared
2007	6/28 – 8/28	Field Investigation	The second comprehensive GWM event was conducted (Pre-AO RI)
2007	7/31 – 8/7	Field Investigation	Soil samples were collected from soil borings DP17 through DP25 and MW11 through MW20; MW11 through MW20 were installed (Pre-AO RI)
2007	8/3	Report	The Final Supplemental Site Use History and Soil and Groundwater Sampling Clarifications was submitted to Ecology
2007	10/4	Field Investigation	Soil samples were collected from test pits TP01 through TP04 (Pre-AO RI)
2007	12/20	Report	A RI/FS Report and Conceptual Cleanup Action Plan (prepared under the Voluntary Cleanup Program) was submitted to Ecology
2008	7/16	Field Investigation	A groundwater tidal study was conducted
2008	October	Regulatory Mechanism	Implementation date for AO DE5471, which established procedures for preparing an RI Work Plan, an RI Report, a Supplemental RI Work Plan (if necessary), a Supplemental RI Report (if necessary), an Infrastructure IA Work Plan, and an Infrastructure IA Report
2008	10/9	Field Investigation	Soil samples were collected from test pit BC_TP02 as part of investigation activities on the adjacent LOTT Expansion Site (the test pit location is within the current East Bay Redevelopment Site boundary)
2008	10/22	Work Plan	The Final RI Work Plan was submitted to Ecology (amended in January 30, 2009 with some replacement pages)
2008	11/4	Field Investigation	Soil samples were collected from soil borings DP27, DP30, DP32 through DP34, DP36, DP38, and DP40 (Phase 1 RI)
2009	May	Work Plan	The Final Infrastructure IA Work Plan was submitted to Ecology
2009	5/4	Ecology Approval	Ecology approved the Final Infrastructure IA Work Plan
2009 - 2010	June - April	IA Implementation	Implementation of the Infrastructure IA
2009	6/10 - 6/16	Field Investigation	Soil samples were collected from soil borings DP26, DP28, DP29, DP31, DP35, DP37, DP39, DP41, DP42, and MW21S through MW25S; MW21S through MW25S were installed (Phase 2 RI)
2009	6/30 – 7/2	Field Investigation	The third comprehensive GWM event was conducted (Phase 2 RI)
2009	9/16	Field Investigation	Soil samples were collected from soil borings DP43 through DP45 (Parcel 4/5 Pre-IA)
2009	9/16	Field Investigation	MW02R was installed (Phase 2 RI)

Table 2-1: Summary of Site Chronology

Year(s)	Date(s)	Activity Type	Activity Description/Summary
2009	9/18 – 9/22	Field Investigation	The fourth comprehensive GWM event was conducted (Phase 2 RI)
2009	9/21	Ecology Approval	Ecology approved the Final RI Work Plan
2009	11/18 – 11/20	Field Investigation	The fifth comprehensive GWM event was conducted (Phase 2 RI)
2009	12/15 – 12/19	Field Investigation	The sixth comprehensive GWM event was conducted (Phase 2 RI)
2010	3/15 – 3/17	Field Investigation	The seventh comprehensive GWM event was conducted (Phase 2 RI)
2010	June	Report	The Final Infrastructure IA Report was submitted to Ecology
2010	6/18	Ecology Approval	Ecology approved the Final Infrastructure IA Report
2010	8/16 – 8/18	Field Investigation	The eigthth comprehensive GWM event was conducted (Phase 2 RI)
2010	9/23	Work Plan	The Final Parcel 4/5 IA Work Plan was developed and attached to AO DE7830
2010	9/23	Ecology Approval	Ecology approved the Final Parcel 4/5 IA Work Plan (as part of issuing AO DE7830)
2010	9/23	Regulatory Mechanism	Implementation date for AO DE7830, which superseded AO DE5471 and established procedures for implementing the Parcel 4/5 IA and preparing a Parcel 4/5 IA Report, Site Boundary Technical Memorandum, Data Gap Work Plan, RI/FS Report, and Cleanup Action Plan
2010 - 2012	October - June	IA Implementation	Implementation of the Parcel 4/5 IA
2010	November	Report	The Site Boundary Technical Memorandum was submitted to Ecology
2010	11/3 - 11/9	Field Investigation	Confirmation soil samples were collected from Parcel 4/5 IA excavations associated with sample locations DP11, DP17, DP18, and TP02 (Parcel 4/5 IA)
2011	1/5 - 1/21	Field Investigation	Confirmation soil samples were collected from Parcel 4/5 IA excavations associated with sample locations DP21 and TP02 (Parcel 4/5 IA)
2011	May	Report	The Final Empirical Evaluation of the Potential for Soil Constituents to Migrate to Surface Water Via Groundwater was submitted to Ecology
2011	8/10	Ecology Approval	Ecology approved the Final Empirical Evaluation of the Potential for Soil Constituents to Migrate to Surface Water Via Groundwater
2011	10/7	Work Plan	A final data gap investigation work plan regarding the Site boundary determination and P-1 anomaly was submitted to Ecology
2011	10/10	Ecology Approval	Ecology approved a final data gap investigation work plan regarding the Site boundary determination and P-1 anomaly
2011	10/18	Field Investigation	Soil samples were collected from soil borings DP46 through DP49 and DP52 through DP56 (data gap investigation activities regarding the Site boundary determination)
2011	12/2	Site Boundary	The Port proposed a Site boundary to Ecology
2011	12/12	Ecology Approval	Ecology approved the Site boundary proposed by the Port

Table 2-1: Summary of Site Chronology

Year(s)	Date(s)	Activity Type	Activity Description/Summary
2012	2/9	Field Investigation	The subsurface geophysical anomaly in Parcel 3 (referred to as P-1) and associated soil were excavated; soil samples P-1-N, P-1-W, P-1-S, P-1-E, and P-1-B were collected from the sidewalls and bottom of the excavation (data gap investigation activities regarding the P-1 anomaly)
2013	3/14	Regulatory Mechanism	The Port requested an amendment to AO DE7830 to conduct an IA for the portions of the Site not addressed during the Infrastructure IA and Parcel 4/5 IA(1)
2013	4/8	Regulatory Mechanism	Ecology agreed with the Port request to amend AO DE7830 in order to conduct an IA for the portions of the Site not addressed during the Infrastructure IA and Parcel 4/5 IA(1)
2013	4/12	Work Plan	A final data gap investigation work plan regarding the soil-to-indoor air pathway was submitted to Ecology
2013	4/30	Ecology Approval	Ecology approved a final data gap investigation work plan regarding the soil-to-indoor air pathway
2013	5/7	Field Investigation	Soil samples were collected from soil borings SVP-1SO and SVP-2SO (data gap investigation activities regarding the soil-to-indoor air pathway)
2013	June	Work Plan	An IA Work Plan for the portions of the Site not addressed during the Infrastructure IA and Parcel 4/5 IA was submitted to Ecology(1)
2013	10/14	Ecology Comments	Ecology commented on (1) the IA Work Plan for the portions of the Site not addressed during the Infrastructure IA and Parcel 4/5 IA(1) and (2) a draft evaluation report for the soil-to-indoor air pathway
2013	11/21	Response to Comments	The Port responded to Ecology comments on (1) the IA Work Plan for the portions of the Site not addressed during the Infrastructure IA and Parcel 4/5 IA(1) and (2) a draft evaluation report for the soil-to-indoor air pathway
2013	12/16	Ecology Comments	Ecology responded to the Port response to Ecology comments on (1) the IA Work Plan for the portions of the Site not addressed during the Infrastructure IA and Parcel 4/5 IA(1) and (2) a draft report evaluating the soil-to-indoor air pathway
2014	4/11	Report	A memorandum that summarized the agreed upon outcome for the evaluation of the soil-to-indoor air pathway was submitted to Ecology
2014	6/18	Work Plan	A final data gap investigation work plan regarding POC GWM was submitted to Ecology
2014	8/20	Ecology Approval	Ecology conditionally approved a final data gap investigation work plan regarding POC GWM
2014	9/22	Field Investigation	MW26 and MW27 were installed; soil samples were collected from soil borings DP57 and DP58 (data gap investigation activities regarding POC GWM)
2014	9/29 - 9/30	Field Investigation	Groundwater samples were collected from MW12, MW18, MW26, and MW27 (data gap investigation activities regarding POC GWM)
2014	12/22 - 12/23	Field Investigation	Groundwater samples were collected from MW12, MW18, MW26, and MW27 (data gap investigation activities regarding POC GWM)
2015	2/16	Field Investigation	Groundwater sample was collected from MW12 (data gap investigation activities regarding POC GWM)
2015	2/23	Report	The Parcel 4/5 IA Report was submitted to Ecology
2015	3/9	Ecology Approval	Ecology approved the memorandum that summarized the agreed upon outcome for the evaluation of the soil-to-indoor air pathway

Table 2-1: Summary of Site Chronology

Year(s)	Date(s)	Activity Type	Activity Description/Summary
2015	3/25 - 3/30	Field Investigation	Groundwater samples were collected from MW12, MW18, MW26, and MW27 (data gap investigation activities regarding POC GWM)
2015	6/9	Field Investigation	Groundwater samples were collected from MW12, MW18, MW26, and MW27 (data gap investigation activities regarding POC GWM)
2016	9/12	Field Investigation	Indoor air samples were collected from the Hands On Children's Museum (data gap investigation regarding methane in soil gas)
2016	9/27	Work Plan	A final data gap investigation work plan regarding methane in soil gas was submitted to Ecology
2016	9/28	Ecology Approval	Ecology approved a final data gap investigation work plan regarding methane in soil gas
2016	9/28 - 9/30	Field Investigation	Soil gas samples were collected from 22 locations (data gap investigation regarding methane in soil gas)
2016	10/25	Report	The Tier 2 Methane Evaluation Report was submitted to Ecology

Notes:

This summary table focuses on the key activities that support the RI/FS report. As a result, this table does not include all Site-related documents and correspondence. For instance, this table does not include draft documents, Ecology comments, or response to comments for documents that were subsequently finalized and approved.

(1) Although it was subsequently decided that it was not necessary to conduct an IA for the portions of the Site not addressed during the Infrastructure IA and Parcel 4/5 IA, these activities are included in this table since some of the Ecology comments and agreements reached during the IA process are pertinent to the RI/FS report.

Table 3-1: Summary of Monitoring Well Construction Details

MW Name	Date Installed	MW Diameter (inches)	Depth to Top of Screen (feet bgs)	Depth to Bottom of Screen (feet bgs)
MW01	1/2/2007	0.75	5	10
MW02	1/2/2007	0.75	5	10
MW02R	9/16/2009	2	2	12
MW03	1/2/2007	0.75	7	12
MW04	1/2/2007	0.75	10	15
MW05	1/15/2007	1	7	12
MW06	1/15/2007	1	7	12
MW07	1/17/2007	1	5.5	10.5
MW08	1/17/2007	1	7	12
MW09	1/17/2007	1	3.5	8.5
MW10	1/15/2007	1	6.5	11.5
MW11	8/3/2007	1	5	10
MW12	8/1/2007	1	4	12
MW13	8/1/2007	1	5	10
MW14	8/7/2007	1	5	10
MW15	8/3/2007	1	3	8
MW16	7/31/2007	2	9	10.5
MW17	8/2/2007	2	3	8
MW18	8/1/2007	2	7	12
MW19	8/1/2007	2	4	9
MW20	8/2/2007	2	4	9
MW21S	6/12/2009	2	2	7
MW22S	6/12/2009	2	1	6
MW23S	6/12/2009	2	4	9
MW24S	6/12/2009	2	2.5	7.5
MW25S	6/12/2009	2	2	7
MW26	9/22/2014	2	6	16
MW27	9/22/2014	2	6	16

Notes:
Surface completions for all MWs are flush mount.

Table 3-2: Arsenic Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
BC_DP-07	2/14/2007	4-8	7.1	
BC_DP-08	2/14/2007	4-8	3.9	
BC_DP-09	2/14/2007	4-8	3.8	
BC_TP02	10/9/2008	2	3.7	U
		4	3.1	U
DP01	9/25/2006	1-3	5.7	
DP02	9/25/2006	1-3	3.7	
DP03	9/25/2006	1-3	4.4	
DP04	9/25/2006	1-3	3.8	
		4-6	**52**	
DP05	9/25/2006	1.5-3.5	1.7	
DP06	9/26/2006	3-5	5.8	
DP07	9/26/2006	4.5-6.5	2.9	
DP08	9/26/2006	1-3	1.8	
DP09	9/25/2006	1-3	3.3	
DP10	9/26/2006	2-4	2.0	
DP11	1/2/2007	0-2	2.8	
		8-10	14	
DP11-1	11/3/2010	9	2.7	J
DP11-2	11/3/2010	1	2.1	J
	11/3/2010	3.5	2.5	
	11/3/2010	9	7.1	J
DP11-3	11/3/2010	3	3.6	J
	11/3/2010	9	2.6	
DP11-4	11/3/2010	1.5	3.7	J
	11/3/2010	3	3.6	J
	11/3/2010	9	4.1	J
DP11-5	11/3/2010	4	5.8	J
	11/3/2010	5	6.8	J
	11/3/2010	9	9.3	
DP12	1/2/2007	0-2	4.1	
		8-10	4.1	
DP17	8/3/2007	4-6	14	U
		10-12	**84**	
DP17-1	11/8/2008	15	7.1	
DP17-2	11/8/2008	2.5	5.1	
		6	4.2	
		10.5	2.2	U
		12	4.6	
DP17-3	11/8/2008	2.5	1.6	
		11	5.7	
		13	4.4	
DP17-4	11/8/2008	2	4.6	
		3.5	3.2	
		11	3.0	U
		12	3.2	
DP17-5	11/8/2008	2	15	Y
		7	7.4	
		11	2.0	
		12	2.6	
DP18	8/3/2007	2-4	4.3	U
		10-12	8.8	U
DP19	8/3/2007	6-8	3.5	U
		10-12	4.6	U
DP20	8/3/2007	2-4	3.6	U
		10-12	5.8	U

Table 3-2: Arsenic Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
DP21	8/3/2007	6-8	**72**	
		10-12	11	U
DP21-1	1/10/2011	10	3.5	
DP21-2	1/10/2011	1.75	**84**	
		5	4.7	
		7	2.7	U
DP21-3	1/10/2011	1.75	7.0	
		5	8.1	
		7	6.8	
DP21-4	1/10/2011	1.5	11	
		5	6.5	
		7	3.4	
DP21-5	1/10/2011	1.75	5.6	
		5	6.0	
		7	2.7	U
DP21-6	1/21/2011	10	6.8	
DP21-7	1/21/2011	1.75	2.9	
		5	6.4	
		9	11	
DP21-8	1/21/2011	9.5	4.8	
DP21-9	1/21/2011	1.75	3.8	
		5	6.5	
DP21-10	1/21/2011	2	3.9	
		5	6.3	
		9	5.3	
DP22	8/3/2007	4-6	3.8	U
		10-12	3.9	U
DP26	6/10/2009	1-2	9.8	
		7-8	3.8	
DP27	11/4/2008	0-1	3.0	
		3-4	3.5	
		4-5	3.1	
		6-7	2.1	
DP28	6/10/2009	1-2	6.1	
		3.5-5	3.8	
DP29	6/10/2009	3-4	5.9	
		7-8	3.6	
DP30	11/4/2008	1-2	3.4	
		3-4	5.1	
		7-7.5	9.9	
DP31	6/10/2009	3-4	7.3	
DP32	11/4/2008	4-5	2.3	
DP33	11/4/2008	1-2	1.9	
		3-4	2.1	
		5-6	3.0	
		7-8	2.8	
DP34	11/4/2008	4-6	3.9	
		7.5-9.5	15	
DP36	11/4/2008	5-6	2.6	
DP37	6/10/2009	2-3.5	3.9	
		6-7.5	6.7	
DP38	11/4/2008	1-2	2.9	
		5-6	6.8	
		6-7	7.5	

Table 3-2: Arsenic Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
DP39	6/10/2009	0.5-2	4.9	
		3-5	3.3	
DP40	11/4/2008	1-2	2.7	
		3-4	2.8	
		5-6	2.4	
DP41	6/10/2009	3-4	3.1	
DP42	6/10/2009	1-2	3.0	
		5-6	4.2	
		7-8	3.7	
MW01	1/2/2007	4-6	1.9	
		10-12	2.0	
MW02	1/2/2007	2-4	3.1	
		8-10	3.6	
MW03	1/2/2007	4-6	1.8	
		8-10	1.8	
MW04	1/2/2007	2-4	3.4	
		14-16	2.4	
MW05	1/15/2007	10-12	9.9	
MW06	1/15/2007	2-4	3.7	
		10-12	2.5	
MW08	1/17/2007	2-4	5.4	
		4-6	5.3	
		8-10	9.5	
MW09	1/17/2007	2-4	3.2	
		4-6	2.0	
MW11	8/1/2007	2-4	3.5	U
		10-12	3.9	U
MW12	8/1/2007	4-6	3.0	U
		10-12	3.3	U
MW13	8/1/2007	6-8	3.3	U
		10-12	4.4	
MW15	8/3/2007	4-6	3.6	
		10-12	9.8	U
MW16	7/31/2007	4-6	3.3	U
		16-18	6.4	
MW18	8/2/2007	8-10	3.7	U
		10-12	3.6	U
MW19	8/1/2007	4-6	4.5	U
		8-10	4.9	U
MW20	8/2/2007	2-4	3.4	U
		6-8	9.7	U
MW23S	6/12/2009	5-6	0.25	U
		9-10.5	8.6	
MW24S	6/12/2009	6.5-8	1.8	
		9-10	4.8	
MW25S	6/12/2009	6.5-7.5	4.1	
		10.5-12	4.9	
		12.5-14	3.1	

Notes:

J: Estimated value

U: Not detected at shown reporting limit

Shaded samples are no longer in place.

Bold type face results exceed the SL.

Soil SL: 20 mg/kg

Results are shown as two significant figures in standard notation with the exception that numbers greater than 100 are rounded to a whole number.

Table 3-3: Lead Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
BC_DP-07	2/14/2007	4-8	7.2	
BC_DP-08	2/14/2007	4-8	4.9	
BC_DP-09	2/14/2007	4-8	12	
BC_TP02	10/9/2008	2	3.3	
		4	1.6	U
DP01	9/25/2006	1-3	38	J
DP02	9/25/2006	1-3	12	J
DP03	9/25/2006	1-3	19	J
DP04	9/25/2006	1-3	12	J
		4-6	140	J
DP05	9/25/2006	1.5-3.5	2.2	J
DP06	9/26/2006	3-5	48	J
DP07	9/26/2006	4.5-6.5	1.5	J
DP08	9/26/2006	1-3	37	J
DP09	9/25/2006	1-3	2.5	J
DP10	9/26/2006	2-4	2.6	J
DP11	1/2/2007	0-2	8.2	
		8-10	**2,500**	
DP11-1	11/3/2010	9	6.4	
DP11-2	11/3/2010	1	4.6	
	11/3/2010	3.5	108	
	11/3/2010	9	56	
DP11-3	11/3/2010	3	8.9	
	11/3/2010	9	3.2	
DP11-4	11/3/2010	1.5	7.6	
	11/3/2010	3	4.9	
	11/3/2010	9	153	
DP11-5	11/3/2010	4	9.6	
	11/3/2010	5	51	
	11/3/2010	9	123	
DP12	1/2/2007	0-2	17	
		8-10	17	
DP17	8/3/2007	4-6	17	
		10-12	110	
DP17-1	11/8/2008	15	2.3	
DP17-2	11/8/2008	2.5	8.7	
		6	9.3	
		10.5	6.4	
		12.5	9.7	
DP17-3	11/8/2008	2.5	1.7	
		11	122	
		13	9.4	
DP17-4	11/8/2008	2	8.7	
		3.5	2.4	
		11	17	
		12	14	
DP17-5	11/8/2008	2	85	Y
		7	7.3	
		11	9.8	
		12	11	
DP18	8/3/2007	2-4	4.5	
		10-12	8.0	

Table 3-3: Lead Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
DP18-1	11/8/2010	15	2.8	Y
DP18-2	11/8/2010	2	4.0	
		10	36	
		13	7.4	
DP18-3	11/8/2010	2	3.8	
		10	127	
		13.5	14	
DP18-4	11/8/2010	2	4.1	
		10	19	
		13	28	
DP18-5	11/8/2010	2	2.1	
		10	65	
		13.5	16	
DP19	8/3/2007	6-8	3.0	
		10-12	10.0	
DP20	8/3/2007	2-4	1.8	U
		10-12	140	
DP21	8/3/2007	6-8	30	
		10-12	5.7	U
DP21-1	1/10/2011	10	5.5	
DP21-2	1/10/2011	1.75	8.8	
		5	4.3	
		7	4.6	
DP21-3	1/10/2011	1.75	19	
		5	6.1	
		7	7.6	
DP21-4	1/10/2011	1.5	28	
		5	6.2	
		7	4.8	
DP21-5	1/10/2011	1.75	7.7	
		5	6.0	
		7	4.5	
DP21-6	1/21/2011	10	4.0	
DP21-7	1/21/2011	1.75	6.4	
		5	4.2	
		9	5.4	
DP21-8	1/21/2011	9.5	6.5	
DP21-9	1/21/2011	1.75	3.6	
		5	4.1	
DP21-10	1/21/2011	2	3.6	
		5	4.5	
		9	4.8	
DP22	8/3/2007	4-6	2.2	
		10-12	11	
DP26	6/10/2009	1-2	13	
		7-8	2.4	
DP27	11/4/2008	0-1	6.6	
		3-4	5.1	
		4-5	4.2	
		6-7	1.3	
DP28	6/10/2009	1-2	131	
		3.5-5	7.6	

Table 3-3: Lead Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
DP29	6/10/2009	3-4	8.7	
		7-8	32	
DP30	11/4/2008	1-2	6.3	
		3-4	2.9	
		7-7.5	56	
DP31	6/10/2009	3-4	3.1	
DP32	11/4/2008	4-5	2.5	
DP33	11/4/2008	1-2	2.2	
		3-4	2.2	
		5-6	2.6	
		7-8	7.7	
DP34	11/4/2008	4-6	4.7	
		7.5-9.5	56	
DP36	11/4/2008	5-6	2.9	
DP37	6/10/2009	2-3.5	11	
		6-7.5	8.2	
DP38	11/4/2008	1-2	12	
		5-6	32	
		6-7	95	
DP39	6/10/2009	0.5-2	15	
		3-5	18	
DP40	11/4/2008	1-2	3.8	
		3-4	3.4	
		5-6	2.6	
DP41	6/10/2009	3-4	3.4	
DP42	6/10/2009	1-2	12	
		5-6	14	
		7-8	2.5	
MW01	1/2/2007	4-6	2.7	
		10-12	4.2	
MW02	1/2/2007	2-4	8.8	
		8-10	7.0	
MW03	1/2/2007	4-6	1.8	
		8-10	1.4	
MW04	1/2/2007	2-4	85	
		14-16	1.8	
MW05	1/15/2007	10-12	170	
MW06	1/15/2007	2-4	2.2	
		10-12	11	
MW08	1/17/2007	2-4	14	
		4-6	11	
		8-10	25	
MW09	1/17/2007	2-4	2.6	
		4-6	1.8	
MW11	8/1/2007	2-4	1.8	U
		10-12	2.0	
MW12	8/1/2007	4-6	1.5	U
		10-12	1.7	U
MW13	8/1/2007	6-8	21	
		10-12	52	
MW15	8/3/2007	4-6	1.7	U
		10-12	12	

Table 3-3: Lead Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
MW16	7/31/2007	4-6	1.6	U
		16-18	2.4	U
MW18	8/2/2007	8-10	1.8	U
		10-12	1.8	U
MW19	8/1/2007	4-6	2.3	
		8-10	2.4	U
MW20	8/2/2007	2-4	1.8	
		6-8	25	
MW23S	6/12/2009	5-6	0.46	
		9-10.5	71	
MW24S	6/12/2009	6.5-8	54	
		9-10	34	
MW25S	6/12/2009	6.5-7.5	108	
		10.5-12	17	
		12.5-14	2.5	

Notes:

J: Estimated value

U: Not detected at shown reporting limit

Y: Laboratory calculated value

Shaded samples are no longer in place.

Bold type face results exceed the SL.

Soil SL: 250 mg/kg

Results are shown as two significant figures in standard notation with the exception that numbers greater than 100 are rounded to a whole number.

Table 3-4: TPH-G Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
DP01	9/25/2006	1-3	2.5	J
DP02	9/25/2006	1-3	24	
DP03	9/25/2006	1-3	1.7	J
DP04	9/25/2006	1-3	1.6	J
		4-6	13	
DP05	9/25/2006	1.5-3.5	0.78	J
DP06	9/26/2006	3-5	**290**	
DP07	9/26/2006	4.5-6.5	2.1	J
DP08	9/26/2006	1-3	60	
DP09	9/25/2006	1-3	0.82	J
DP10	9/26/2006	2-4	8.7	
DP11	1/2/2007	0-2	7.6	J
		8-10	13	J
DP12	1/2/2007	0-2	0.92	UJ
		8-10	1.0	UJ
DP15	1/15/2007	2-4	15	U
		10-12	73	U
DP17	8/3/2007	4-6	72	U
		10-12	51	U
DP18	8/3/2007	2-4	11	
		10-12	37	U
DP18-1	11/8/2010	15	6.9	U
DP18-2	11/8/2010	2	6.3	U
		10	66	U
		13	13	U
DP18-3	11/8/2010	2	36	
		10	45	U
		13.5	17	U
DP18-4	11/8/2010	2	6.9	U
		10	61	U
		13	59	U
DP18-5	11/8/2010	2	4.3	U
		10	61	U
		13.5	15	U
DP19	8/3/2007	6-8	73	
		10-12	17	U
DP20	8/3/2007	2-4	8.5	U
		10-12	23	U
DP21	8/3/2007	6-8	11	U
		10-12	53	U
DP22	8/3/2007	4-6	8.4	U
		10-12	10.0	U
DP24	8/3/2007	8-10	**150** (1)	
		10-12	4.4	J
DP27	11/4/2008	3-4	5.0	U
DP28	6/10/2009	1-2	5.0	U
		3.5-5	5.0	U
DP34	11/4/2008	4-6	5.0	U
		7.5-9.5	5.0	U
DP36	11/4/2008	5-6	5.0	U
DP37	6/10/2009	2-3.5	5.0	U
		6-7.5	5.0	U
DP38	11/4/2008	5-6	5.0	U
		6-7	5.0	U
DP39	6/10/2009	0.5-2	5.0	U
		3-5	5.0	U

Table 3-4: TPH-G Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
DP40	11/4/2008	1-2	5.0	U
		3-4	5.0	U
		5-6	5.0	U
DP57 (2)	9/22/2014	3-5	25	U
		12-14	25	U
DP58 (2)	9/22/2014	6-8	25	U
MW01	1/2/2007	4-6	5.4	U
		10-12	5.6	U
MW02	1/2/2007	2-4	2.5	UJ
		8-10	9.8	J
MW03	1/2/2007	4-6	4.6	U
		8-10	1.3	UJ
MW04	1/2/2007	2-4	3.0	UJ
		14-16	0.73	UJ
MW05	1/15/2007	10-12	31	
MW06	1/15/2007	2-4	7.2	U
		10-12	34	
MW09	1/17/2007	2-4	6.5	U
		4-6	7.2	U
MW10	1/15/2007	2-4	11	U
		10-12	15	U
MW11	8/1/2007	2-4	10.0	U
		10-12	9.6	U
MW12	8/1/2007	4-6	9.0	U
		10-12	8.7	U
MW13	8/1/2007	6-8	14	
		10-12	24	
MW15	8/3/2007	4-6	8.5	U
		10-12	37	U
MW16	7/31/2007	4-6	7.8	U
		16-18	10.0	U
MW18	8/2/2007	8-10	10.0	U
		10-12	7.5	U
MW19	8/1/2007	4-6	**220** (1)	
		8-10	21	U
MW20	8/2/2007	2-4	11	U
		6-8	30	U
MW21S	6/12/2009	2.5-4	5.0	U
MW23S	6/12/2009	5-6	5.0	U
		9-10.5	5.0	U
MW24S	6/12/2009	6.5-8	5.0	U
		9-10	5.0	U
MW25S	6/12/2009	6.5-7.5	5.0	U
		10.5-12	5.0	U
		12.5-14	5.0	U
SVP-1SO	5/7/2013	3-5	5.0	U
SVP-2SO	5/7/2013	4-6	**1,100**	

Notes:

J: Estimated value

U: Not detected at shown reporting limit

Shaded samples are no longer in place.

Bold type face results exceed the SL.

Soil SL: 100 mg/kg

Results are shown as two significant in standard notation with the exception that numbers greater than 100 are rounded to a whole number.

(1) The TPH-G concentrations greater than 100 mg/kg in a sample collected from MW19 and DP24 are not considered exceedances because the MW19 data was replaced by more recent co-located data from SVP-1SO and the DP24 sample was deeper than the TPH-G Soil POC (PIONEER 2014a).

(2) These samples were analyzed for TPH-G by Ecology Method NWTPH-HCID.

Table 3-5: Total Naphthalenes Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg) [1]	Qualifier
BC_TP02	10/9/2008	2.0	0.018	U
		4.0	0.016	U
DP01	9/25/2006	1-3	0.074	U
DP02	9/25/2006	1-3	0.26	J
DP03	9/25/2006	1-3	0.036	J
DP04	9/25/2006	1-3	0.035	J
		4-6	0.050	J
DP05	9/25/2006	1.5-3.5	0.070	U
DP06	9/26/2006	3-5	**142**	
DP07	9/26/2006	4.5-6.5	0.070	U
DP08	9/26/2006	1-3	0.36	
DP09	9/25/2006	1-3	0.073	U
DP10	9/26/2006	2-4	0.073	U
DP11	1/2/2007	0-2	0.46	
		8-10	0.40	J
DP12	1/2/2007	0-2	0.089	
		8-10	0.0098	U
DP15	1/15/2007	2-4	0.092	U
		10-12	0.033	
DP17	8/3/2007	4-6	0.19	J
		10-12	0.68	U
DP18	8/3/2007	2-4	0.18	U
		10-12	0.51	U
DP19	8/3/2007	6-8	0.14	U
		10-12	0.25	U
DP20	8/3/2007	2-4	0.14	U
		10-12	0.33	U
DP21	8/3/2007	6-8	0.051	J
		10-12	0.71	U
DP22	8/3/2007	4-6	0.14	U
		10-12	0.17	U
DP26	6/10/2009	1-2	0.030	
		3-4	0.030	
DP27	11/4/2008	0-1	0.044	
		3-4	0.010	U
		4-5	0.026	
DP28	6/10/2009	1-2	0.025	
		3.5-5	0.090	
DP29	6/10/2009	1-2	0.083	
		13-14	0.030	U
		7-8	0.58	
DP30	11/4/2008	3-4	0.010	U
DP32	11/4/2008	4-5	0.010	U
DP33	11/4/2008	1-2	0.010	U
		3-4	0.017	
		5-6	0.010	U
		7-8	0.32	
DP34	11/4/2008	4-6	0.074	
		7.5-9.5	0.081	
DP37	6/10/2009	2-3.5	0.060	

Table 3-5: Total Naphthalenes Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg) (1)	Qualifier
DP38	11/4/2008	1-2	0.023	
		5-6	0.29	
		6-7	0.033	
DP39	6/10/2009	0.5-2	0.020	
		3-5	0.18	
DP40	11/4/2008	1-2	0.016	
		3-4	0.027	
		5-6	0.010	U
DP43	9/16/2009	2-3	0.75	U
		6-7	0.75	U
		9-10	1.6	
DP44	9/16/2009	2-3	0.75	U
		6-7	0.75	U
		9-10	0.75	U
DP45	9/16/2009	1-2	0.75	U
		6-7	0.75	U
		9-10	0.75	U
DP57	9/22/2014	3-5	2.6	
		12-14	0.020	U
DP58	9/22/2014	6-8	0.20	
MW01	1/2/2007	4-6	0.0071	U
		10-12	0.0077	U
MW02	1/2/2007	2-4	0.064	J
		8-10	0.0077	U
MW03	1/2/2007	4-6	0.0073	U
		8-10	0.0081	U
MW04	1/2/2007	2-4	0.052	
		14-16	0.0087	U
MW05	1/15/2007	10-12	0.0098	U
MW06	1/15/2007	2-4	0.0078	U
		10-12	0.018	
MW09	1/17/2007	2-4	0.073	U
		4-6	0.077	U
MW10	1/15/2007	2-4	0.11	U
		10-12	0.13	U
MW11	8/1/2007	2-4	0.16	U
		10-12	0.16	U
MW12	8/1/2007	4-6	0.032	J
		10-12	0.14	U
MW13	8/1/2007	6-8	0.13	J
		10-12	0.41	
MW15	8/3/2007	4-6	0.14	U
		10-12	0.54	U
MW16	7/31/2007	4-6	0.084	U
		14-16	0.20	U
		16-18	0.11	U
MW18	8/2/2007	8-10	0.16	U
		10-12	0.13	U
MW19	8/1/2007	4-6	0.25	
		8-10	0.29	U
MW20	8/2/2007	2-4	0.17	U
		6-8	0.13	J

Table 3-5: Total Naphthalenes Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg) [1]	Qualifier
MW21S	6/12/2009	0.5-1.5	0.14	
MW23S	6/12/2009	5-6	0.030	U
		9-10.5	0.29	
MW24S	6/12/2009	6.5-8	0.11	
		9-10	0.20	
MW25S	6/12/2009	6.5-7.5	0.23	
		10.5-12	0.048	
		12.5-14	0.030	U
P-1-B	2/9/2012	7.0	0.10	U
P-1-E	2/9/2012	2.5	0.020	U
P-1-N	2/9/2012	3.0	0.026	
P-1-S	2/9/2012	3.0	0.064	
P-1-W	2/9/2012	2.5	0.020	U
SVP-1SO	5/7/2013	3-5	0.42	
SVP-2SO	5/7/2013	4-6	**150**	

Notes:

J: Estimated value

U: Not detected at shown reporting limit

Shaded samples are no longer in place.

Bold type face results exceed the SL.

Non-detected values greater than the screening level are not bolded as an exceedance.

Soil SL: 5.0 mg/kg

Results are shown as two significant figures in standard notation with the exception that numbers greater than 100 are rounded to a whole number.

[1] Compound totaling was performed in accordance with Ecology's Concise Explanatory Statement for MTCA (Ecology, 2001b). For congeners that occur at the site (detected in any media), but not detected in that sample, a value of 1/2 the detection limit was assigned. For congeners that do not occur at the site (not detected in any media), a value of zero was assigned. In the case of naphthalenes, all congeners have been detected at least once in soil and groundwater.

Table 3-6: TPH-D and TPH-HO Combined Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
BC_DP-07	2/14/2007	4-8	110	
BC_DP-08	2/14/2007	4-8	700	
BC_DP-09	2/14/2007	4-8	330	
BC_TP02	10/9/2008	2	90	U
		4	75	U
DP01	9/25/2006	1-3	120	J
DP02	9/25/2006	1-3	**10,000**	
DP03	9/25/2006	1-3	700	
DP04	9/25/2006	1-3	100	J
		4-6	**11,000**	
DP05	9/25/2006	1.5-3.5	35	J
DP06	9/26/2006	3-5	420	
DP07	9/26/2006	4.5-6.5	80	U
DP08	9/26/2006	1-3	**16,000**(1)	
DP09	9/25/2006	1-3	80	U
DP10	9/26/2006	2-4	31	J
DP11	1/2/2007	0-2	210	J
		8-10	1,200	J
DP11-2	11/3/2010	9	4,100	
DP12	1/2/2007	0-2	310	J
		8-10	87	J
DP13	1/15/2007	4-6	**24,000**(1)	
		8-10	470	
DP14	1/17/2007	2-4	80	U
		4-6	1,500	
		8-10	570	
DP15	1/15/2007	2-4	790	
		10-12	1,300	
DP16	1/17/2007	2-4	80	U
		4-6	65	
		8-10	88	U
DP17	8/3/2007	4-6	250	
		10-12	530	
DP18	8/3/2007	2-4	1,300	
		10-12	**5,600**	
DP18-1	11/8/2010	15	120	U
DP18-2	11/8/2010	2	110	U
		10	540	U
		13	170	U
DP18-3	11/8/2010	2	108	U
		10	300	
		13.5	190	U
DP18-4	11/8/2010	2	61	U
		10	300	
		13	300	
DP18-5	11/8/2010	2	110	U
		10	510	U
		13.5	180	U
DP19	8/3/2007	6-8	400	
		10-12	160	
DP20	8/3/2007	2-4	88	U
		10-12	650	
DP21	8/3/2007	6-8	740	
	8/3/2007	10-12	340	

Table 3-6: TPH-D and TPH-HO Combined Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
DP22	8/3/2007	4-6	94	U
		10-12	99	U
DP23	8/1/2007	12-14	57	J
DP24	8/3/2007	8-10	250	
DP25	8/3/2007	10-12	81	U
DP28	6/10/2009	1-2	125	U
		3.5-5	125	U
DP29	6/10/2009	13-14	125	U
		7-8	125	U
DP31	6/10/2009	3-4	125	U
DP34	11/4/2008	4-6	18	
		7.5-9.5	52	
DP35	6/10/2009	5-6	125	U
DP36	11/4/2008	5-6	180	
DP37	6/10/2009	2-3.5	125	U
		6-7.5	125	U
DP38	11/4/2008	5-6	22	
		6-7	530	
DP39	6/10/2009	0.5-2	125	U
		3-5	450	
DP40	11/4/2008	1-2	140	
		3-4	42	
		5-6	310	
DP-57	9/22/2014	3-5	2,900	
		12-14	50	U
DP-58	9/22/2014	6-8	560	
MW01	1/2/2007	4-6	20	J
		10-12	40	U
MW02	1/2/2007	2-4	74	
		8-10	33	J
MW03	1/2/2007	4-6	36	J
		8-10	82	U
MW04	1/2/2007	2-4	840	J
		14-16	30	J
MW05	1/15/2007	10-12	210	
MW06	1/15/2007	2-4	83	U
		10-12	3,600	
MW08	1/17/2007	2-4	100	
		4-6	77	U
		8-10	178	U
MW09	1/17/2007	2-4	81	U
		4-6	80	U
MW10	1/15/2007	2-4	600	
		10-12	820	
MW11	8/1/2007	2-4	57	J
		10-12	100	UJ
MW12	8/1/2007	4-6	72	UJ
		10-12	81	UJ
MW13	8/1/2007	6-8	750	J
		10-12	280	J
MW14	8/7/2007	7-9	1,400	
		8-10	81	U

Table 3-6: TPH-D and TPH-HO Combined Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg)	Qualifier
MW15	8/3/2007	4-6	88	U
		10-12	750	
MW16	7/31/2007	4-6	55	J
		16-18	140	J
MW18	8/2/2007	8-10	89	UJ
		10-12	90	UJ
MW19	8/1/2007	4-6	111	UJ
		8-10	160	J
MW20	8/2/2007	2-4	89	UJ
		6-8	250	UJ
MW23S	6/12/2009	5-6	1,200	
		9-10.5	25	U
MW24S	6/12/2009	6.5-8	510	
		9-10	430	
MW25S	6/12/2009	6.5-7.5	2,000	
		10.5-12	1,100	
		12.4-14	25	U
P-1-B	2/9/2012	7	300	
P-1-E	2/9/2012	2.5	140	
P-1-N	2/9/2012	3	2,100	
P-1-S	2/9/2012	3	125	U
P-1-W	2/9/2012	2.5	1,300	

Notes:

J: Estimated value

U: Not detected at shown reporting limit

Shaded samples are no longer in place.

Bold type face results exceed the SL.

Total TPH SL: 4,700 mg/kg

Results are shown as two significant figures in standard notation with the exception that numbers greater than 100 are rounded to a whole number.
The decision rules for combined TPH concentrations were:

a) If TPH-D and TPH-HO were detected, the two sample concentrations were summed.

b) If only one fraction was detected in the sample, half the reporting limit of the non-detect sample was summed with the detected concentration.

c) If TPH-D and TPH-HO were both non-detect, the two reporting limits were summed.

(1) These results are not representative of current conditions because these DP08 and DP13 samples were replaced by recent co-located samples at DP57 and DP58. The sample depths in DP57 and DP58 were slightly deeper than the corresponding DP08 and DP13 samples because visual and olfactory observations in the field indicated the selected DP57 and DP58 sample intervals were the most likely intervals to be impacted by TPH-D and TPH-HO.

Table 3-7: Total cPAHs Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg) (1)	Qualifier
BC_TP02	10/9/2008	2	0.0095	
		4	0.0079	U
DP01	9/25/2006	1-3	0.019	J
DP02	9/25/2006	1-3	**0.19**	J
DP03	9/25/2006	1-3	0.055	J
DP04	9/25/2006	1-3	0.050	J
		4-6	0.047	J
DP05	9/25/2006	1.5-3.5	0.0059	J
DP06	9/26/2006	3-5	**0.096**	J
DP07	9/26/2006	4.5-6.5	0.0016	J
DP08	9/26/2006	1-3	**0.24**	J
DP09	9/25/2006	1-3	0.0042	J
DP10	9/26/2006	2-4	0.0013	J
DP11	1/2/2007	0-2	**1.0**	
		8-10	**0.17**	
DP12	1/2/2007	0-2	0.042	
		8-10	0.0078	
DP13	1/15/2007	4-6	1.1 (2)	U
		8-10	0.019	
DP14	1/17/2007	2-4	0.050	U
		4-6	**0.20**	
		8-10	0.030	
DP15	1/15/2007	2-4	0.030	
		10-12	**0.54**	
DP16	1/17/2007	2-4	0.051	U
		4-6	0.088	
		8-10	**0.15**	
DP17	8/3/2007	4-6	0.21 (2)	U
		10-12	0.082	
DP18	8/3/2007	2-4	0.063	U
		10-12	**0.16**	
DP19	8/3/2007	6-8	0.051	U
		10-12	0.068	U
DP20	8/3/2007	2-4	0.053	U
		10-12	0.089	U
DP21	8/3/2007	6-8	0.072	U
		10-12	0.17 (2)	U
DP22	8/3/2007	4-6	0.054	U
		10-12	0.060	U
DP23	8/1/2007	12-14	0.054	U
DP24	8/3/2007	8-10	0.062	U
DP25	8/3/2007	10-12	0.048	U
DP26	6/10/2009	1-2	**0.18**	
		3-4	**0.14**	
DP27	11/4/2008	0-1	**0.16**	
		3-4	0.0097	
		4-5	0.043	
DP28	6/10/2009	1-2	0.046	
		3.5-5	0.051	
DP29	6/10/2009	1-2	**0.39**	
		7-8	**0.20**	
		13-14	**0.20**	
DP30	11/4/2008	3-4	0.028	

Table 3-7: Total cPAHs Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg) [1]	Qualifier
DP32	11/4/2008	4-5	0.0076	U
DP33	11/4/2008	1-2	0.027	
		3-4	**0.26**	
		5-6	0.024	
		7-8	**0.33**	
DP34	11/4/2008	4-6	0.054	
		7.5-9.5	0.048	
DP37	6/10/2009	2-3.5	**0.12**	
DP38	11/4/2008	1-2	0.052	
		5-6	**0.098**	
		6-7	0.084	
DP39	6/10/2009	0.5-2	**0.18**	
		3-5	**1.1**	
DP40	11/4/2008	1-2	0.031	
		3-4	0.0075	
		5-6	0.037	
DP43	9/16/2009	2-3	0.20 [2]	U
		6-7	0.20 [2]	U
		9-10	**0.12**	
DP44	9/16/2009	2-3	0.20 [2]	U
		6-7	0.20 [2]	U
		9-10	**0.19**	
DP45	9/16/2009	1-2	0.20 [2]	U
		6-7	0.20 [2]	U
		9-10	0.20 [2]	U
DP46	10/18/2011	1-2	0.015	U
		2-3	0.015	U
		9-11	0.015	U
DP47	10/18/2011	1-2	**0.36**	
		6-8	0.015	U
		13-14	**0.45**	
DP48	10/18/2011	3-3.5	0.088	
		5-7	0.015	U
		11-12	0.010	
DP49	10/18/2011	4.5-6	0.0099	
		10.5-12	0.015	U
		14-15	0.015	U
DP52	10/18/2011	1-3.5	0.015	U
		7-10	0.015	U
		12-13.5	0.040	
DP57	9/22/2014	3-5	**0.34**	
		12-14	0.015	U
DP58	9/22/2014	6-8	**0.14**	
MW01	1/2/2007	4-6	0.0041	
		10-12	0.0077	
MW02	1/2/2007	2-4	0.035	
		8-10	0.0086	
MW03	1/2/2007	4-6	0.018	
		8-10	0.0053	U
MW04	1/2/2007	2-4	**0.11**	
		14-16	0.0056	U
MW05	1/15/2007	10-12	**0.14**	

Table 3-7: Total cPAHs Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (mg/kg) [1]	Qualifier
MW06	1/15/2007	2-4	0.0051	U
		10-12	0.0074	U
MW08	1/17/2007	2-4	0.031	
		4-6	0.030	
		8-10	0.11 [2]	U
MW09	1/17/2007	2-4	0.047	U
		4-6	0.050	U
MW10	1/15/2007	2-4	**0.11**	
		10-12	**0.10**	
MW11	8/1/2007	2-4	0.053	U
		10-12	0.062	U
MW12	8/1/2007	4-6	0.045	U
		10-12	0.051	U
MW13	8/1/2007	6-8	0.053	U
		10-12	0.085	
MW14	8/7/2007	7-9	0.0072	J
		8-10	0.0085	U
MW15	8/3/2007	4-6	0.051	U
		10-12	0.15 [2]	U
MW16	7/31/2007	4-6	0.0056	
		16-18	0.0072	U
MW18	8/2/2007	8-10	0.054	U
		10-12	0.051	U
MW19	8/1/2007	4-6	0.068	U
		8-10	0.072	U
MW20	8/2/2007	2-4	0.053	U
		6-8	**0.76**	
		8-10	0.019	JH
MW21S	6/12/2009	0.5-1.5	**0.16**	
MW23S	6/12/2009	5-6	**0.17**	
		9-10.5	**0.62**	
MW24S	6/12/2009	6.5-8	**0.90**	
		9-10	**0.26**	
MW25S	6/12/2009	6.5-7.5	**0.56**	
		10.5-12	0.050	
		12.5-14	**0.13**	
P-1-B	2/9/2012	7	0.076	U
P-1-E	2/9/2012	2.5	0.015	
P-1-N	2/9/2012	3	0.023	
P-1-S	2/9/2012	3	**0.13**	
P-1-W	2/9/2012	2.5	0.0093	

Notes:

H: Sample was prepped or analyzed beyond the specified holding time

J: Estimated value

U: Not detected at shown reporting limit

Shaded samples are no longer in place.

Bold type face results exceed the SL.

Non-detected values greater than the SL are not bolded as an exceedance.

Soil SL: 0.095 mg/kg

Results are shown as two significant figures in standard notation with the exception that numbers greater than 100 are rounded to a whole number.

[1] Compound totaling was performed in accordance with Ecology's Concise Explanatory Statement for MTCA (Ecology 2001c). For congeners that occur at the site (detected in any media), but not detected in that sample, a value of 1/2 the detection limit was assigned. For congeners that do not occur at the site (not detected in any media), a value of zero was assigned. In the case of cPAHs, all congeners have been detected at least once in soil and groundwater.

[2] Samples in which no congeners were detected were not considered exceedances.

Table 3-8: Total Dioxins/Furans Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (ng/kg) [1]	Qualifier
BC_TP02	10/9/2008	2	0.44	
		4	0.13	U
DP26	6/10/2009	1-2	**45**	
		3-4	4.9	J
		7-8	2.2	J
DP27	11/4/2008	0-1	3.6	JB
		3-4	0.21	BJIE
		4-5	0.93	BJIE
		6-7	0.16	IJB
DP29	6/10/2009	1-2	3.6	J
DP30	11/4/2008	1-2	0.73	JBI
		3-4	0.14	BJI
		7-7.5	**56**	EJ
DP31	6/10/2009	3-4	0.21	BJ
DP32	11/4/2008	1-2	0.14	JIB
		4-5	0.16	IJEB
		8-9	0.40	IJB
DP33	11/4/2008	1-2	2.9	JBE
		3-4	8.2	JIE
		5-6	0.68	IJBE
		7-8	5.3	JEI
DP34	11/4/2008	1-3	6.7	JEIB
		4-6	1.3	BJI
		7.5-9.5	2.7	IJEB
DP36	11/4/2008	1-2	0.18	IJB
		5-6	1.2	IJEB
		8-9	0.23	JIE
DP38	11/4/2008	5-6	4.1	JIE
		6-7	5.4	JI
DP39	6/10/2009	0.5-2	4.3	J
		3-5	**17**	J
DP40	11/4/2008	1-2	4.7	JIBE
		3-4	1.0	JIB
		5-6	0.69	JIB
DP41	6/10/2009	1-2	3.2	J
		3-4	0.19	J
DP42	6/10/2009	1-2	**31**	
		5-6	4.8	J
		7-8	**157**	
DP43	9/16/2009	2-3	0.52	
		6-7	0.36	
		9-10	2.2	
DP44	9/16/2009	2-3	1.3	
		6-7	0.26	
		9-10	0.29	
DP45	9/16/2009	1-2	6.1	
		6-7	0.72	
		9-10	4.1	
DP48	10/18/2011	3-3.5	1.3	JBIP
		5-7	0.16	JBI
		11-12	0.22	J

Table 3-8: Total Dioxins/Furans Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (ng/kg) [1]	Qualifier
DP52	10/18/2011	1-3.5	0.30	IJ
		7-10	0.46	IJB
		12-13.5	**335**	DEP
DP53	10/18/2011	7-7.5	0.32	BJI
		8-9	0.19	JI
DP54	10/18/2011	7-7.5	2.7	JBIP
		8-9	0.17	BJIE
DP55	10/18/2011	7-7.5	0.72	BJI
		8-9	0.15	JIB
DP56	10/18/2011	1-3	11	J
		7-8	0.45	BJI
		13-14	2.4	JIP
MW22S	6/12/2009	0.5-2	2.6	J
		2-4	0.30	J
MW23S	6/12/2009	5-6	1.1	J
MW24S	6/12/2009	1-2.5	1.2	J
		3-4.5	6.1	J
		6.5-8	**979**	
		9-10	**79**	J
TP01 [2]	10/4/2007	2-2.5	**430**	DCON
TP02	10/4/2007	2-2.5	**646**	DCON
TP02-1	11/9/2010	10	0.21	
TP02-2	11/9/2010	1.5	**215**	
		2.5	**12**	
		3.5	10	
		7.5	5.1	
TP02-3	11/9/2010	1	0.26	
		2.5	0.31	
		3.5	**2,180**	
		7.5	**13**	
	1/5/2011	3.5	0.42	
TP02-4	11/9/2010	2	0.29	
		2.5	2.2	
		3.5	8.5	
		7.5	0.47	
TP02-5	11/9/2010	1	0.47	
		2.5	1.5	
		3.5	0.26	
		7.5	2.2	
TP02-6	11/9/2010	1.5	**22**	
		2.5	4.7	
		3.5	0.28	
		7.5	0.23	
TP02-7	11/9/2010	1.5	7.2	
		2.5	5.6	
		3.5	0.44	
		7.5	0.19	
TP02-8	1/5/2011	6	**181**	
TP02-9	1/5/2011	2	0.27	
		5.5	**331**	

Table 3-8: Total Dioxins/Furans Concentrations in Soil

Site ID	Sample Date	Sample Depth Range (feet bgs)	Result (ng/kg) [1]	Qualifier
TP02-10	1/5/2011	2.25	0.24	
		3.25	**448**	
		5.5	**83**	
TP02-11	1/5/2011	1.75	0.40	
		3	**77**	
		3.25	**14**	
		5.5	**41**	
TP03	10/4/2007	3.5-4	**57**	CONJ
TP04	10/4/2007	1.5-2	**85**	CONJ

Notes:

B: Less than 10x higher than method blank level

CON: Confirmation analysis

D: Result was obtained from the analysis of a dilution

E: Polychlorinated diphenyl ether interference

I: Interference present

J: Estimated value

P: Recovery outside target range

U: Not detected at shown reporting limit

Shaded samples are no longer in place.

Bold type face results exceed the SL.

Soil SL: 11 ng/kg

Results are shown as two significant figures in standard notation with the exception that numbers greater than 100 are rounded to a whole number.

[1] Compound totaling was performed in accordance with Ecology's Concise Explanatory Statement for MTCA (Ecology 2001c). For congeners that occur at the site (detected in any media), but not detected in that sample, a value of half the detection limit was assigned. For congeners that do not occur at the site (not detected in any media), a value of zero was assigned. In the case of Total Dioxins/Furans, all congeners have been detected at least once in soil.

[2] The duplicate result for this sample is 370 ng/kg.

Table 3-9: Measured Depth to Groundwater and Calculated Groundwater Elevations

Measured Depth to Groundwater (feet) by Sampling Event[3]

Monitoring Well	Reference Point Elevations (feet)[1,2]	Jan-07	Jun-07[4]	Jul-07	Aug-07	Jul-08 Low Tide	Jul-08 High Tide	Jun-09[5]	Sep-09[5]	Nov-09[5]	Dec-09[5]	Mar-10	Aug-10	Sep-14	Dec-14	Mar-15	Jun-15
MW01	14.62	4.14	4.44	4.30	4.55	4.40	4.39	4.18	4.83	2.08	4.09	4.27	4.99	NM	NM	NM	NM
MW02	14.25	3.48	3.88	3.70	3.92	3.65	3.70	3.49	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW02R	13.99	NM	NM	NM	NM	NM	NM	NM	4.08	2.93	3.73	4.13	4.45	NM	NM	NM	NM
MW03	14.89	4.28	4.82	4.64	4.92	4.79	5.78	4.58	5.11	3.13	4.07	4.82	5.25	NM	NM	NM	NM
MW04	15.54	5.33	6.37	5.40	6.46	5.69	5.65	5.49	6.29	4.32	5.42	6.14	6.14	NM	NM	NM	NM
MW05	15.53	4.19	4.22	4.19	4.25	4.19	4.21	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW06	14.18	0.82	0.37	0.50	0.84	1.14	1.05	NM	NM	NM	NM	NM	1.50	NM	NM	NM	NM
MW07	14.93	4.70	4.81	4.57	5.12	5.03	5.00	5.15	5.16	4.05	7.00	5.12	5.52	5.42	4.51	4.63	5.21
MW08	15.30	NM	2.22	2.06	2.42	2.62	2.55	2.73	4.48	2.72	3.12	3.02	3.66	2.86	1.00	2.09	2.81
MW09	14.65	2.61	2.51	2.05	2.66	2.65	2.60	2.73	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW10	15.31	2.61	3.57	3.55	3.80	3.55	3.48	NM	NM	3.70	NM	4.38	4.26	3.56	3.72	2.99	3.71
MW11	14.91	NM	NM	NM	3.12	3.42	NM	3.42	3.17	2.40	2.60	3.34	3.52	NM	NM	NM	NM
MW12	15.70	NM	NM	NM	7.48	9.40	7.11	9.73	8.84	8.92	7.04	9.72	11.79	8.67	4.79	8.60	10.35
MW13	13.83	NM	NM	NM	4.18	4.26	4.23	4.22	4.11	3.29	NM	4.10	4.30	3.96	3.21	2.95	3.78
MW14	14.82	NM	NM	NM	1.41	1.59	1.48	2.00	2.21	2.64	1.53	1.64	2.13	1.59	0.00	0.90	1.48
MW15	13.87	NM	NM	NM	4.04	4.09	4.09	3.82	3.87	2.09	2.56	3.08	3.36	3.32	2.36	2.30	3.88
MW16	15.24	NM	NM	NM	6.35	5.32	5.41	5.21	5.51	4.36	4.50	5.60	5.90	NM	NM	NM	NM
MW17	14.12	NM	NM	NM	3.56	2.85	2.93	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW18	16.08	NM	NM	NM	8.63	11.40[6]	6.56	8.88	10.71	7.45	5.50	Dry	Dry	8.37	6.01	10.30	Dry
MW19	13.28	NM	NM	NM	3.47	3.78	3.68	NM	NM	NM	NM	NM	4.06	NM	NM	NM	NM
MW20	16.01	NM	NM	NM	5.65	5.70	5.70	5.12	5.05	3.92	4.73	4.70	7.40	6.45	4.89	6.10	6.84
MW21S	13.69	NM	NM	NM	NM	NM	NM	4.20	4.31	NM	NM	4.21	4.49	3.64	3.78	3.40	4.21
MW22S	14.39	NM	NM	NM	NM	NM	NM	0.77	0.70	0.02	0.00	0.50	0.87	0.08	0.00	0.00	0.50
MW23S	14.56	NM	NM	NM	NM	NM	NM	4.11	4.62	3.28	4.05	4.59	4.91	NM	NM	NM	NM
MW24S	15.33	NM	NM	NM	NM	NM	NM	3.70	4.49	3.71	3.65	3.87	4.26	NM	NM	NM	NM
MW25S	14.88	NM	NM	NM	NM	NM	NM	0.81	0.89	0.80	1.00[7]	0.67	0.94	0.68	0.00	0.40	0.72
MW26	15.52	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	8.31	6.13	10.20	9.84
MW27	15.66	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	8.73	6.64	11.80	12.72

Groundwater Elevation (feet NAVD88) by Sampling Event

Monitoring Well	Jan-07	Jun-07	Jul-07	Aug-07	Jul-08 Low Tide	Jul-08 High Tide	Jun-09	Sep-09	Nov-09	Dec-09	Mar-10	Aug-10	Sep-14	Dec-14	Mar-15	Jun-15
MW01	10.48	10.18	10.32	10.07	10.22	10.23	10.44	9.79	12.54	10.53	10.35	9.63	NM	NM	NM	NM
MW02	10.77	10.37	10.55	10.33	10.60	10.55	10.76	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW02R	NM	NM	NM	NM	NM	NM	NM	9.91	11.06	10.26	9.86	9.54	NM	NM	NM	NM
MW03	10.61	10.07	10.25	9.97	10.10	9.11	10.31	9.78	11.76	10.82	10.07	9.64	NM	NM	NM	NM
MW04	10.21	9.17	10.14	9.08	9.85	9.89	10.05	9.25	11.22	10.12	9.40	9.40	NM	NM	NM	NM
MW05	11.34	11.31	11.34	11.28	11.34	11.32	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW06	13.36	13.81	13.68	13.34	13.04	13.13	NM	NM	NM	NM	NM	12.68	NM	NM	NM	NM
MW07	10.21	10.10	10.34	9.79	9.88	9.91	9.76	9.77	10.88	7.93	9.81	9.41	9.51	10.42	10.30	9.72
MW08	NM	13.08	13.24	12.88	12.68	12.75	12.57	10.82	12.58	12.18	12.28	11.64	12.44	14.30	13.21	12.49
MW09	12.04	12.14	12.60	11.99	12.00	12.05	11.92	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW10	12.70	11.74	11.76	11.51	11.76	11.83	NM	NM	11.61	NM	10.93	11.05	11.75	11.59	12.32	11.6
MW11	NM	NM	NM	11.79	11.49	NM	11.49	11.74	12.51	12.31	11.57	11.39	NM	NM	NM	NM
MW12	NM	NM	NM	6.88	4.96	7.25	4.63	6.86	6.78	8.66	5.98	3.91	7.03	10.91	7.10	5.35
MW13	NM	NM	NM	9.65	9.57	9.60	9.61	9.72	10.54	NM	9.73	9.53	9.87	10.62	10.88	10.05
MW14	NM	NM	NM	13.41	13.23	13.34	12.82	12.61	12.18	13.29	13.18	12.69	13.23	14.82	13.92	13.34
MW15	NM	NM	NM	9.83	9.78	9.78	10.05	10.00	11.78	11.31	10.79	10.51	10.55	11.51	11.57	9.99
MW16	NM	NM	NM	8.89	9.92	9.83	10.03	9.73	10.88	10.74	9.64	9.34	NM	NM	NM	NM
MW17	NM	NM	NM	10.56	11.27	11.19	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW18	NM	NM	NM	7.45	4.68	9.52	7.20	5.37	8.63	10.58	Dry	Dry	7.71	10.07	5.78	Dry
MW19	NM	NM	NM	9.81	9.50	9.60	NM	NM	NM	NM	NM	9.22	NM	NM	NM	NM
MW20	NM	NM	NM	10.36	10.31	10.31	10.89	10.96	12.09	11.28	11.31	8.61	9.56	11.12	9.91	9.17
MW21S	NM	NM	NM	NM	NM	NM	9.49	9.38	NM	NM	9.48	9.20	10.05	9.91	10.29	9.48
MW22S	NM	NM	NM	NM	NM	NM	13.62	13.69	14.37	14.39	13.89	13.52	14.31	14.39	14.39	13.89
MW23S	NM	NM	NM	NM	NM	NM	10.45	9.94	11.28	10.51	9.97	9.65	NM	NM	NM	NM
MW24S	NM	NM	NM	NM	NM	NM	11.63	10.84	11.62	11.68	11.46	11.07	NM	NM	NM	NM
MW25S	NM	NM	NM	NM	NM	NM	14.07	13.99	14.08	13.88	14.21	13.94	14.21	14.88	14.48	14.16
MW26	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	7.21	9.39	5.32	5.68
MW27	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.93	9.02	3.86	2.94

Notes:

NAVD88: North American Vertical Datum of 1988

NM: Not measured

Groundwater elevations are based on actual measurements (i.e., no salt water density adjustment was made for MWs with elevated salinity).

(1) Surveyed by licensed surveyor from ESM Civil Engineering, with vertical datum of NAVD88.

(2) The applicable NAVD88 reference point elevations for MW07 and MW12 prior to September 2009 were 14.91 feet and 14.36 feet, respectively.

(3) From reference point on top of PVC casing.

(4) Depth to groundwater calculated from well elevations and map of groundwater elevations (GeoEngineers 2007c).

(5) Groundwater measurements were not collected synoptically during this event since the Remedial Investigation Work Plan (GeoEngineers and PIONEER 2008) did not specify collection of synoptic measurements, and previous tidal studies concluded there was minimal tidal influence at the site.

(6) Depth estimated by Greylock Consulting based on wetness at bottom of MW.

(7) Assumed depth to groundwater since depth was reported as "< 1" in field notes.

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Table 3-10: LNAPL Thickness Measurements

Monitoring Well	LNAPL Thickness Measurements by Sampling Event													
	Jan-07[1]	Jun-07[1]	Jul-07[1]	Aug-07[1]	Jun-09	Sep-09	Nov-09	Dec-09	Mar-10	Aug-10	Sep-14	Dec-15	Mar-15	Jun-15
MW01	NM	NM	NM	NM	--	--	--	--	--	--	NM	NM	NM	NM
MW02	NM	NM	NM	NM	--	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW02R	NM	NM	NM	NM	NM	--	--	--	--	--	NM	NM	NM	NM
MW03	NM	NM	NM	NM	--	--	--	--	--	--	NM	NM	NM	NM
MW04	NM	NM	NM	NM	--	--	--	--	--	--	NM	NM	NM	NM
MW05	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW06	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW07	NM	NM	NM	NM	--	--	--	--	--	--	--	--	--	--
MW08	NM	NM	NM	NM	--	--	--	--	--	--	--	--	--	--
MW09	NM	NM	NM	NM	--	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW10	NM	NM	NM	NM	NM	NM	--	NM	NM	NM	--	--	--	--
MW11	NM	NM	NM	NM	--	--	--	--	--	--	NM	NM	NM	NM
MW12	NM	NM	NM	NM	--	--	--	--	--	--	--	--	--	--
MW13	NM	NM	NM	NM	--	--	--	NM	--	--	--	--	--	--
MW14	NM	NM	NM	NM	--	--	--	--	--	--	--	--	--	--
MW15	NM	NM	NM	NM	--	--	--	--	--	--	--	--	--	--
MW16	NM	NM	NM	NM	--	--	--	--	--	--	NM	NM	NM	NM
MW17	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW18	NM	NM	NM	NM	--	--	--	--	--	--	--	--	--	--
MW19	NM	NM	NM	NM	--	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW20	NM	NM	NM	NM	--	--	--	--	--	--	--	--	--	--
MW21S	NM	NM	NM	NM	--	--	NM	NM	--	--	--	--	--	--
MW22S	NM	NM	NM	NM	--	--	--	--	--	--	--	--	--	--
MW23S	NM	NM	NM	NM	--	--	--	--	--	--	NM	NM	NM	NM
MW24S	NM	NM	NM	NM	--	--	--	--	--	--	NM	NM	NM	NM
MW25S	NM	NM	NM	NM	--	--	--	--	--	--	--	--	--	--
MW26	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	--	--	--	--
MW27	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	--	--	--	--

Notes:

NM: Not measured

--: No LNAPL thickness was measured using an interface probe with 0.01-foot accuracy.

[1] It is assumed that GeoEngineers did not measure for LNAPL with an interface probe while obtaining groundwater measurements during these GWM events since no records of such activity were discovered during a review of the GeoEngineers' reports associated with this field work. However, it is unlikely that LNAPL was present in any MW during those GWM events given the general lack of elevated dissolved-phase concentrations of TPH-G, TPH-D, and TPH-HO during these GWM events and the likelihood that GeoEngineers' reports would have mentioned the presence of a significant petroleum sheen on purge water if it was encountered.

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Table 3-11: Arsenic Concentrations in Groundwater

Monitoring Well	Concentration (ug/L) by Sampling Event																							
	Jan-07		Jun-Aug-07		Jun-09		Sep-09		Nov-09		Dec-09		Mar-10		Aug-10		Sep-14		Dec-14		Mar-15		Jun-15	
	Total	Dis.	Total	Dis.	Total	Dis.	Total	Dis.	Total	Dis.	Total	Dis.	Total	Dis.	Total	Dis.	Total	Dis.	Total	Dis.	Total	Dis.	Total	Dis.
MW01	1.3 J	NS	4.1	NS	3.2	NS	1.1	4.7 BJ	1.0 U	1.0 U	1.2	1.0 U	1.0 U	1.0 U	5.0	2.4	NS	NS	NS	NS	NS	NS	NS	NS
MW02	2.0 U	NS	2.0 U	NS	1.1	**5.4 BJ**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW02R [1]	NS	NS	NS	NS	NS	NS	**9.8**	**13 BJ**	**8.0**	1.6	**7.5**	1.0 U	**10**	1.3	**24**	**8.7**	NS	NS	NS	NS	NS	NS	NS	NS
MW03	2.0 U	NS	2.0 U	NS	**7.3**	**10 BJ**	2.7	**9.7 BJ**	2.7	3.0	4.6	4.0	2.2	2.3	**7.2**	2.7	NS	NS	NS	NS	NS	NS	NS	NS
MW04	**16**	NS	**13**	NS	**9.5**	**8.7 BJ**	**8.0**	**9.9 BJ**	**7.3**	1.8	**5.3**	1.0 U	**5.2**	1.0 U	1.1	1.9	NS	NS	NS	NS	NS	NS	NS	NS
MW05	2.0 U	NS	2.0 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW06	2.0 U	NS	2.0 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW07	2.0 U	NS	2.5	NS	2.7	NS	**6.2**	**10 BJ**	4.4	2.1	3.0	1.8	2.5	2.2	4.2	3.8	NS	NS	NS	NS	NS	NS	NS	NS
MW08	2.3	NS	2.0	NS	1.4	NS	1.3	**6.1 BJ**	2.1	1.0 U	1.4	1.0 U	3.0	1.0 U	2.0	1.0	NS	NS	NS	NS	NS	NS	NS	NS
MW09	2.0 U	NS	2.0 U	NS	0.90	NS	0.89	**2.4 BJ**	2.9	1.0 U	1.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NS	NS	NS	NS	NS	NS	NS	NS
MW10	NS	NS	2.0 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW11	NS	NS	2.0 U	NS	1.2	**5.3 BJ**	1.1	**5.2 BJ**	1.0 U	1.0 U	1.0 U	1.0 U	1.0	1.0 U	1.5	1.1	NS	NS	NS	NS	NS	NS	NS	NS
MW12	NS	NS	2.0 U	NS	NS	NS	1.5	**5.1 BJ**	1.0	1.0 U	1.0	1.0 U	1.1	1.0 U	1.0 U	1.0 U	1.1	1.2	4.0	1.0 U	1.1	1.0 U	1.1	1.0 U
MW13	NS	NS	**6.1**	NS	**7.9**	**6.5 BJ**	**7.5**	**6.9 BJ**	4.9	1.0 U	NS	NS	4.8	1.0 U	**6.6**	2.9	NS	NS	NS	NS	NS	NS	NS	NS
MW14	NS	NS	NS	NS	2.8	NS	2.4	4.9 BJ	2.8	1.3	1.4	1.0 U	1.8	1.1	3.5	3.1	NS	NS	NS	NS	NS	NS	NS	NS
MW15	NS	NS	2.0 U	NS	0.80	NS	0.52	3.5 BJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NS	NS	NS	NS	NS	NS	NS	NS
MW16	NS	NS	2.0 U	NS	2.0	4.4 BJ	0.91	4.7 BJ	1.0 U	1.0 U	1.0 U	1.0 U	1.4	1.0 U	1.0 U	1.0 U	NS	NS	NS	NS	NS	NS	NS	NS
MW17 [1]	NS	NS	**140**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW18	NS	NS	2.0 U	NS	2.2	**6.2 BJ**	1.3	3.6 BJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MW19	NS	NS	2.0 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW20	NS	NS	2.0 U	NS	1.6	NS	0.50 U	**5.2 BJ**	2.4	1.0 U	2.6	1.0 U	1.3	1.0 U	**12**	1.0 U	NS	NS	NS	NS	NS	NS	NS	NS
MW21S	NS	NS	NS	NS	4.8	**5.1 BJ**	4.6	**5.9 BJ**	NS	NS	NS	NS	3.2	1.0 U	3.9	1.1	NS	NS	NS	NS	NS	NS	NS	NS
MW22S	NS	NS	NS	NS	4.4	NS	3.0	3.2 BJ	3.1	1.0 U	1.8	1.0 U	2.2	1.0 U	2.1	1.5	NS	NS	NS	NS	NS	NS	NS	NS
MW23S	NS	NS	NS	NS	0.90	NS	0.56	3.9 BJ	2.9	1.9	1.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NS	NS	NS	NS	NS	NS	NS	NS
MW24S	NS	NS	NS	NS	**14**	**16 BJ**	**5.3**	**8.6 BJ**	**5.5**	**5.1**	**6.3**	**6.1**	5.0	5.0	**13**	**12**	NS	NS	NS	NS	NS	NS	NS	NS
MW25S	NS	NS	NS	NS	3.4	NS	2.3	4.2 BJ	1.8	1.0 U	2.3	1.0 U	1.4	1.0 U	2.7	1.6	NS	NS	NS	NS	NS	NS	NS	NS
MW26	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MW27	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Notes:
B: Constituent was detected in the method blank
Dis.: Dissolved
J: Estimated value
NS: Not sampled
U: Not detected at shown reporting limit
Bold type face results exceed the SL.
Groundwater SL: 5.0 ug/L
Detected concentrations and SLs presented with two significant figures.
[1] MW02R and MW17 are located on the LOTT Expansion Site.

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Table 3-12: TPH-D and TPH-HO Combined Concentrations in Groundwater

Monitoring Well	Concentration (ug/L) by Sampling Event										
	Jan-07	Jun-Aug-07	Jun-09	Sep-09	Nov-09	Dec-09	Mar-10	Aug-10	Sep-14	Dec-14	Mar-15	Jun-15
MW01	170 J	360 U	750 U(3)	750 U(3)	NS	590	600 U	600 U	NS	NS	NS	NS
MW02	370 U	360 U	750 U(3)	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW02R (1)	NS	NS	NS	750 U(3)	NS	670	350	**1,100**	NS	NS	NS	NS
MW03	380 U	360 U	750 U(3)	750 U(3)	NS	**1,000**	600 U	600 U	NS	NS	NS	NS
MW04	200 J	380 U	750 U(3)	750 U(3)	NS	390	600 U	600 U	NS	NS	NS	NS
MW05	360 U	320 UJ	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW06	290	300 UJ	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW07	360 U	280 UJ	750 U(3)	750 U(3)	NS	600 U	600 U	600 U	NS	NS	NS	NS
MW08	360 U	290 UJ	750 U(3)	750 U(3)	NS	500	600 U	600 U	NS	NS	NS	NS
MW09	360 U	360 U	750 U(3)	750 U(3)	NS	400	600 U	600 U	NS	NS	NS	NS
MW10	370 U	320 UJ	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW11	NS	360 U	750 U(3)	750 U(3)	NS	600 U	600 U	400	NS	NS	NS	NS
MW12	NS	360 U	NS	750 U(3)	NS	600 U	600 U	600 U	600 U	620 / 600 U(2)	600 U	600 U
MW13	NS	620	750 U(3)	750 U(3)	NS	NS	600 U	600 U	NS	NS	NS	NS
MW14	NS	NS	750 U(3)	750 U(3)	NS	410	600 U	390	NS	NS	NS	NS
MW15	NS	380 U	750 U(3)	750 U(3)	NS	420	600 U	600 U	NS	NS	NS	NS
MW16	NS	360 U	750 U(3)	750 U(3)	NS	410	600 U	600 U	NS	NS	NS	NS
MW17 (1)	NS	360 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW18	NS	350 U	750 U(3)	750 U(3)	NS	**1,800**	600 U	600 U	600 U	600 U	600 U	600 U
MW19	NS	360 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW20	NS	240	750 U(3)	750 U(3)	NS	600 U	600 U	600 U	NS	NS	NS	NS
MW21S	NS	NS	750 U(3)	750 U(3)	NS	NS	600 U	600 U	NS	NS	NS	NS
MW22S	NS	NS	750 U(3)	750 U(3)	NS	600 U	600 U	600 U	NS	NS	NS	NS
MW23S	NS	NS	750 U(3)	750 U(3)	NS	420	600 U	370	NS	NS	NS	NS
MW24S	NS	NS	750 U(3)	750 U(3)	NS	570	600 U	350	NS	NS	NS	NS
MW25S	NS	NS	750 U(3)	750 U(3)	NS	690	600 U	690	NS	NS	NS	NS
MW26	NS	NS	NS	NS	NS	NS	NS	NS	600 U	600 U	600 U	600 U
MW27	NS	NS	NS	NS	NS	NS	NS	NS	600 U	600 U	600 U	600 U

Notes:

J: Estimated value

NS: Not sampled

U: Not detected at shown reporting limit

Bold type face results exceed the SL.

Groundwater SL: 720 ug/L

Detected concentrations and SLs presented with two significant figures.

The decision rules for combined TPH concentrations were:

a) If TPH-D and TPH-HO were detected, the two sample concentrations were summed.

b) If only one fraction was detected in the sample, half the reporting limit of the non-detect sample was summed with the detected concentration.

c) If TPH-D and TPH-HO were both non-detect, the two reporting limits were summed.

(1) MW02R and MW17 are located on the LOTT Expansion Site.

(2) MW12 was resampled in February 2015.

(3) TPH-D and TPH-HO were both non-detect and below 720 ug/L as individual fractions.

Table 4-1: Cleanup Levels and Remediation Levels

Constituents of Concern	Soil Cleanup Level	Soil Remediation Level
Arsenic	20 mg/kg	20 mg/kg
Lead	250 mg/kg	1,000 mg/kg
TPH-G	100 mg/kg	100 mg/kg
Total Naphthalenes	5.0 mg/kg	5.0 mg/kg
TPH-D and TPH-HO Combined	4,700 mg/kg	24,000 mg/kg(1)
Total cPAHs	0.095 mg/kg	3.4 mg/kg
Total Dioxins/Furans	11 ng/kg	590 ng/kg

Notes:

See Appendix M for calculation of the cleanup levels and remediation levels.

(1) If a TPH-D and TPH-HO combined concentration higher than the RL is encountered in Site soil in the future, the TPH-D and TPH-HO combined RL will be adjusted up to that measured concentration since it has already been empirically demonstrated that existing TPH-D and TPH-HO combined concentrations in Site soil have not caused groundwater exceedances.

Table 4-2: Summary of Remaining Soil Exceedances

Constituents of Concern	Number of Samples Analyzed	Number of Detected Results	Frequency of Detection (%)	Number of CL Exceedances	Frequency of CL Exceedances (%)	Number of RL Exceedances	Frequency of RL Exceedances (%)
Arsenic	149	122	82	1	0.67	1	0.67
Lead	162	150	93	0	0.0	0	0.0
TPH-G	53	15	28	2	3.8	2	3.8
Total Naphthalenes	110	49	45	2	1.8	2	1.8
TPH-D and TPH-HO Combined	121	70	58	4	3.3	0	0.0
Total cPAHs	136	82	60	37	27	0	0.0
Total Dioxins/Furans	98	97	99	19	19	1	1.0

Note:

This table does not include results for (1) samples that are no longer in place because the soil was removed during an IA, (2) TPH-G samples that are not representative of current conditions (i.e., the MW19 sample collected from 4 to 6 feet bgs) because the samples were replaced by recent co-located samples (PIONEER 2014a), (3) TPH-G samples with sample tops deeper than the TPH-G soil POC (e.g., the DP24 sample collected from 8 to 10 feet bgs), and (4) TPH-D and TPH-HO combined samples that are not representative of current conditions (i.e., the DP08 sample collected form 1 to 3 feet bgs and the DP13 sample collected from 4 to 6 feet bgs) because the samples were replaced by more recent co-located data from DP57 and DP58.

Table 4-3: Evaluation of Cleanup Action Alternatives

Evaluation Criterion	Alternative 1 – Institutional Controls and Engineering Controls	Alternative 2 – Targeted Soil Removal, Cover, and Controls	Alternative 3 – Total Soil Removal
Protect human health and the environment	**Rating = Fair (2 points)** The alternative would adequately address all complete exposure pathways. However, the alternative would fully rely on the successful implementation of comprehensive controls for perpetuity.	**Rating = Excellent (3 points)** The alternative would adequately address all complete exposure pathways with limited reliance on long-term controls.	**Rating = Excellent (3 points)** The alternative would permanently address all on-site exposure pathways and would not require any long-term controls. However, there would be increased opportunities for exposure during implementation and the constituents would be transferred to another location (e.g., a landfill) instead of being treated to reduce toxicity, mobility, or volume.
Comply with cleanup standards	**Rating = Unacceptable (0 points)** The alternative would not be able to achieve cleanup standards.	**Rating = Excellent (3 points)** Within the POC, the alternative would remove all RL exceedances and remedy all CL exceedances with exposure barriers.	**Rating = Superior (4 points)** Within the POC, the alternative would comply with all cleanup standards.
Comply with applicable state and federal laws	**Rating = Excellent (3 points)** The alternative has the capability to comply with all applicable state and federal laws per WAC 173-340-710. For instance, the alternative would comply with water discharge, air emission, and waste management requirements since water discharges, air emissions, and waste would not be generated with the alternative.	**Rating = Excellent (3 points)** The alternative has the capability to comply with all applicable state and federal laws per WAC 173-340-710. For instance, it is expected that (1) any water discharges would comply with the Port's NPDES permit, (2) there would be no air emissions associated with a regulated source, and (3) all generated waste would be stored, handled, transported, treated (if necessary) and disposed of in accordance with applicable waste management requirements.	**Rating = Excellent (3 points)** The alternative has the capability to comply with all applicable state and federal laws per WAC 173-340-710. For instance, it is expected that (1) any water discharges would comply with the Port's NPDES permit, (2) there would be no air emissions associated with a regulated source, and (3) all generated waste would be stored, handled, transported, treated (if necessary) and disposed of in accordance with applicable waste management requirements.
Provide for compliance monitoring	**Rating = Fair (2 points)** The alternative would include protection monitoring (e.g., dust monitoring), performance monitoring (e.g., qualitative EC assessments during construction), and confirmational monitoring (e.g., long-term inspections of ICs). However, the alternative would not include collecting soil data to evaluate compliance with CLs and/or RLs.	**Rating = Excellent (3 points)** The alternative would include protection monitoring (e.g., dust monitoring), performance monitoring (e.g., soil sampling to ensure compliance with RLs), and confirmational monitoring (e.g., long-term inspections of the cover and ICs).	**Rating = Excellent (3 points)** The alternative would include protection monitoring (e.g., dust monitoring) and performance monitoring (e.g., soil sampling to ensure compliance with CLs as necessary). Confirmational monitoring would not be necessary since it is expected that performance monitoring would demonstrate all soil within the POC has constituent concentrations less than CLs.
Use permanent solutions to the maximum extent practicable (see Table 4-4) (1)	**Rating = Fair (2 points)** As determined in Table 4-4, the alternative would cost an order of magnitude less than Alternative 2 and two orders of magnitude less than Alternative 3, and would provide some potential benefits. However, the overall benefits are not as good as Alternative 2 and the alternative is the least permanent of the three alternatives.	**Rating = Excellent (3 points)** As determined in Table 4-4, Alternative 2 is permanent to the maximum extent practicable based on the results of the evaluation conducted in accordance with WAC 173-340-360(3). Alternative 2 is significantly more attractive than Alternative 3 because it provides better overall benefits and would cost approximately $30 million less than Alternative 3.	**Rating = Poor (1 point)** As determined in Table 4-4, the alternative offers no better benefits compared to Alternative 2 other than having slightly more permanence for protection of on-site exposures. The estimated alternative cost of approximately $31 million is significantly disproportionate to this singular benefit.

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Table 4-3: Evaluation of Cleanup Action Alternatives

Evaluation Criterion	Alternative 1 – Institutional Controls and Engineering Controls	Alternative 2 – Targeted Soil Removal, Cover, and Controls	Alternative 3 – Total Soil Removal
Provide for a reasonable restoration time frame	**Rating = Poor (1 point)** Although the controls would address all complete exposure pathways, potential risks posed by COC concentrations in soil would not significantly decrease over time.	**Rating = Excellent (3 points)** All exposure pathways would be fully addressed within a year or two (as soon as construction activities were completed).	**Rating = Superior (4 points)** All COC concentrations would be less than CLs within a year or two (as soon as construction activities were completed).
Consider public concerns	**Rating = Not rated** Public input for this alternative has not yet been obtained, but will be obtained through the public participation process in accordance with WAC 173-340-600.	**Rating = Not rated** Public input for this alternative has not yet been obtained, but will be obtained through the public participation process in accordance with WAC 173-340-600.	**Rating = Not rated** Public input for this alternative has not yet been obtained, but will be obtained through the public participation process in accordance with WAC 173-340-600.
Sustainability [(2)]	**Rating = Superior (4 points)** The alternative would have a negligible effect on air emissions, solid waste generation, traffic, and resource usage because of the general lack of heavy equipment and dump truck usage associated with this alternative.	**Rating = Excellent (3 points)** In order to remove all RL exceedances, an estimated 60 cubic yards of soil would be excavated and hauled to a waste facility and an equivalent amount of backfill material would be imported from a quarry. In order to install a soil cover, an estimated 9,400 cubic yards of soil would be imported from a quarry. Combined, this equates to 473 round-trip truck trips with a 20 cubic yard dump truck. This alternative would cause significantly less impacts for air emissions, solid waste generation, traffic, and resource usage compared to Alternative 3. In addition, this alternative would facilitate on-site beneficial reuse of soil (which is an important resource).	**Rating = Unacceptable (0 points)** In order to remove the CL exceedances, an estimated 145,000 cubic yards of soil would be excavated and hauled to a waste facility and an equivalent amount of backfill material would be imported from a quarry. This equates to 14,500 round-trip truck trips with a 20 cubic yard dump truck. This would result in unacceptable impacts for air emissions, solid waste generation, traffic, and resource usage, especially considering there is only an estimated 60 cubic yards of soil that pose a potential risk to human health and the environment for current and anticipated future land use.
Total Points	**14**	**21**	**18**

Notes:

Ratings were assigned to each criterion using the following scale:

Superior = 4 points. Superior means the alternative would significantly exceed the criterion expectations and/or the alternative would be significantly better than the other alternatives in satisfying the criterion.

Excellent = 3 points. Excellent means the alternative would satisfy the criterion.

Fair = 2 points. Fair means the alternative would not completely satisfy the criterion and/or the alternative would be slightly worse than the other alternatives in satisfying the criterion.

Poor = 1 point. Poor means the alternative would only satisfy part of the criterion and/or the alternative would be significantly worse than the other alternatives in satisfying the criterion and/or the alternative does not satisfy the criterion but the alternative has other means of mitigating its failure to satisfy the criterion.

Unacceptable = 0 points. Unacceptable means the alternative would not be able to satisfy the criterion.

[(1)] Table 4-4 presents the evaluation of this criterion in accordance with WAC 173-340-360(3).

[(2)] In accordance with Section 4.5.2, the sustainability criterion was evaluated qualitatively by considering air emissions, solid waste production, traffic, and resource usage.

Table 4-4: Disproportionate Cost Analysis

Evaluation Criterion [1,2]	Alternative 1 – Institutional Controls and Engineering Controls	Alternative 2 – Targeted Soil Removal, Cover, and Controls	Alternative 3 – Total Soil Removal
Protectiveness	**Rating = Fair (2 points)** The alternative would adequately address all complete exposure pathways. However, the alternative would fully rely on the successful implementation of comprehensive controls for perpetuity.	**Rating = Excellent (3 points)** The alternative would adequately address all complete exposure pathways with limited reliance on long-term controls.	**Rating = Excellent (3 points)** The alternative would permanently address all on-site exposure pathways and would not require any long-term controls. However, there would be increased opportunities for exposure during implementation and the constituents would be transferred to another location (e.g., a landfill) instead of being treated to reduce toxicity, mobility, or volume.
Permanence	**Rating = Poor (1 point)** Although the controls would address all complete exposure pathways, the alternative would not permanently reduce the potential for exposure.	**Rating = Excellent (3 points)** The alternative would permanently address all complete exposure pathways with permanent cover systems.	**Rating = Excellent (3 points)** The alternative would permanently address all on-site exposure pathways, but would transfer the potential for exposure to another location (e.g., a landfill). Potential exposures would not be reduced by treating waste to reduce toxicity, mobility, or volume.
Cost [3]	**Rating = Superior (4 points)** The estimated net present value cost of $140,000 (see Appendix N) for this alternative is an order of magnitude less than the Alternative 2 cost and two orders of magnitude less than the Alternative 3 cost.	**Rating = Excellent (3 points)** Although the estimated net present value cost of $1,010,000 (see Appendix N) for this alternative is an order of magnitude more than Alternative 1, the cost is not unreasonable for a site of this size.	**Rating = Unacceptable (0 points)** An estimated net present value cost exceeding $31 million (see Appendix N) for this alternative is unacceptable since there are only three remaining soil sample locations (i.e., the RL exceedances at DP04, MW24S, and DP06/SVP2-SO) that pose a potential risk to human health and the environment for current and anticipated future land use.
Effectiveness over the long term	**Rating = Poor (1 point)** Although the alternative would adequately address all complete exposure pathways, the alternative would fully rely on the successful implementation of comprehensive controls for perpetuity.	**Rating = Excellent (3 points)** Although the alternative would not destroy or detoxify constituents, the permanent cover systems would effectively address all potential exposures for the long-term.	**Rating = Excellent (3 points)** Although the alternative would permanently address all on-site exposure pathways, the constituents (and associated exposure potential) would be transferred to another location (e.g., a landfill) instead of being treated to reduce toxicity, mobility, or volume.
Management of short-term risks	**Rating = Excellent (3 points)** The potential risks to human health and the environment during implementation of the alternative would be addressed with ECs.	**Rating = Excellent (3 points)** The potential risks to human health and the environment during implementation of the alternative would be addressed with ECs.	**Rating = Fair (2 points)** Although the potential risks to human health and the environment during implementation of the alternative would be addressed with ECs, there is significantly more potential for short-term risks during implementation because of the size and scope of soil excavation, soil hauling, and groundwater dewatering activities.

Table 4-4: Disproportionate Cost Analysis

Evaluation Criterion [1,2]	Alternative 1 – Institutional Controls and Engineering Controls	Alternative 2 – Targeted Soil Removal, Cover, and Controls	Alternative 3 – Total Soil Removal
Technical and administrative implementability	**Rating = Excellent (3 points)** The alternative is technically and administratively implementable, and the necessary facilities, services, and materials are available to implement the alternative.	**Rating = Excellent (3 points)** The alternative is technically and administratively implementable, and the necessary facilities, services, and materials are available to implement the alternative.	**Rating = Fair (2 points)** Although the alternative is technically and administratively implementable, and the necessary facilities, services, and materials are available to implement the alternative, implementing the alternative would be significantly more complicated than Alternatives 1 and 2 because of the size and scope of soil excavation, soil hauling, and groundwater dewatering activities.
Consideration of public concerns	**Rating = Not rated** Public input for this alternative has not yet been obtained, but will be obtained through the public participation process in accordance with WAC 173-340-600.	**Rating = Not rated** Public input for this alternative has not yet been obtained, but will be obtained through the public participation process in accordance with WAC 173-340-600.	**Rating = Not rated** Public input for this alternative has not yet been obtained, but will be obtained through the public participation process in accordance with WAC 173-340-600.
Total Points or Benefits [4]	**14**	**18**	**13**
Conclusion	The alternative would cost an order of magnitude less than Alternative 2 and two orders of magnitude less than Alternative 3, and would provide some potential benefits. However, the overall benefits are not as good as Alternative 2 and the alternative is the least permanent of the three alternatives.	Alternative 2 is permanent to the maximum extent practicable based on the results of the evaluation conducted in accordance with WAC 173-340-360(3). Alternative 2 is significantly more attractive than Alternative 3 because it provides better overall benefits and would cost approximately $30 million less than Alternative 3.	The alternative offers no better benefits compared to Alternative 2 other than having slightly more permanence for protection of on-site exposures. The estimated alternative cost of approximately $31 million is significantly disproportionate to this singular benefit.

Notes:

Ratings were assigned to each criterion using the following scale:

Superior = 4 points. Superior means the alternative would significantly exceed the criterion expectations and/or the alternative would be significantly better than the other alternatives in satisfying the criterion.

Excellent = 3 points. Excellent means the alternative would satisfy the criterion.

Fair = 2 points. Fair means the alternative would not completely satisfy the criterion and/or the alternative would be slightly worse than the other alternatives in satisfying the criterion.

Poor = 1 point. Poor means the alternative would only satisfy part of the criterion and/or the alternative would be significantly worse than the other alternatives in satisfying the criterion and/or the alternative does not satisfy the criterion but the alternative has other means of mitigating its failure to satisfy the criterion.

Unacceptable = 0 points. Unacceptable means the alternative would not be able to satisfy the criterion.

(1) In accordance with WAC 173-340-360(3)(b), the disproportionate cost analysis procedures in WAC 173-340-360(3)(e) were used to evaluate whether a cleanup action uses permanent solutions to the maximum extent practicable.

(2) In accordance with WAC 173-340-360(3)(f), these seven evaluation criteria were used to perform the disproportionate cost analysis in WAC 173-340-360(3)(e).

(3) Cost estimates are presented in Appendix N.

(4) WAC 173-340-360(3)(e) discusses the disproportionate cost analysis results in terms of "benefits."