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Remedial Investigation/ Feasibility Study (RI/FS) Report

Interfor Pacific
Marysville

31 December 2018

Prepared for

The City of Marysville
1049 State Avenue
Marysville, Washington 98270

K/J Project No. 1896015.00

Remedial Investigation/Feasibility Study (RI/FS) Report

Report Version: Final

Site Name:	Interfor Pacific Site
Site Address:	60 State Avenue Marysville, WA 98270
Alternate Location Info:	Tax Parcel 30053300201200 Township 30N, Range 05E, Section 33

Ecology Facility Site ID No.:	85223839
Voluntary Cleanup Program Project No.:	NW2260
Order No.:	Not Applicable
Consent Decree No.:	Not Applicable

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List of Acronyms and Abbreviations

AES	Associated Earth Sciences
Ag	silver
amsl	above mean sea level
AOC	area of concern
ARAR	Applicable or Relevant and Appropriate Requirement
As	arsenic
AS	air sparging
AST	aboveground storage tank
Ba	barium
bgs	below ground surface
BTEX	benzene, ethylbenzene, toluene, and xylenes
BTV	Background Threshold Value
CAP	Cleanup Action Plan
Cd	cadmium
City	City of Marysville
cm/s	centimeters per second
COC	contaminant/chemical of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
Cr	chromium
CSID	Cleanup Site Identification Number
CSEM	conceptual site exposure model
CUL	cleanup level
cy	cubic yard(s)
DCA	disproportionate cost analysis
DNR	Washington State Department of Natural Resources
DO	dissolved oxygen
DRO	diesel-range organics
Ebey Park	Ebey Waterfront Park
EC	environmental convenant
Ecology	Washington State Department of Ecology
EDB	1,2-dibromoethane (ethylene dibromide)
EDC	1,2-dichloroethane (ethylene dichloride)
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
ESA	Environmental Site Assessment
ESC	ESC Lab Sciences
ft^2	square feet
ft/ft	feet per foot
FS	Feasibility Study

List of Acronyms and Abbreviations (cont'd)

FSID	Facility Site Identification Number
GES	Geotechnical and Environmental Services
Glacier	Glacier Environmental Services
GPS	Global Positioning System
GPY	gallons per year
GRO	gasoline-range organics
Hg	mercury
Holt	Holt Services, Inc.
HPA	Hydraulic Project Approval
HVOC	halogenated volatile organic compound
IC	institutional control
ID	identification
IDW	investigation-derived waste
IRA	interim remedial action
JARPA	Joint Aquatic Resources Permit Application
Kennedy/Jenks	Kennedy/Jenks Consultants
KM	Kaplan Meier
µg/l	micrograms per liter
µg/kg	micrograms per kilogram
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
MNA	monitored natural attenuation
MTBE	methyl-tertiary butyl ether
MTCA	Model Toxics Control Act
MSDS	Material Safety Data Sheet
NAD 83	North American Datum of 1983
NAVD	North American Vertical Datum
ND	non-detect
NFA	No Further Action
NWRO	Northwest Regional Office (Ecology)
NWTPH-Dx	Northwest Total Petroleum Hydrocarbon – Diesel and Oil Range
NWTPH-Gx	Northwest Total Petroleum Hydrocarbon - Gasoline Range
O&M	operation and maintenance
ORC®	oxygen releasing compound
ORO	oil-range organics
ORP	oxidation-reduction potential
OWI	oil-water interface
Pace	Pace National Laboratory

List of Acronyms and Abbreviations (cont'd)

Pb	lead
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	photoionization detector
POTW	publicly-owned treatment works
ppm	parts per million
PQL	Practical quantitation limit
PRB	permeable reactive barrier
PRDI	Pre-Remedial Design Investigation
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance and quality control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
Se	selenium
SHA	Site Hazard Assessment
SIM	Select Ion Monitoring
Site	Former Interfor Pacific site
SOG	standard operating guidelines
SPCC	Spill Prevention Control and Countermeasure
SVOC	semivolatile organic compound
SWPPP	Stormwater Pollution Prevention Plan
TCE	trichlorethene
TEE	Terrestrial Ecological Evaluation
TEF	Toxicity Equivalency Factor
TPH	total petroleum hydrocarbon
TOC	top of casing
True North	True North Land Surveying
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
UST	underground storage tank
UTL	Upper Tolerance Limit
VCP	Voluntary Cleanup Program
VES	vapor extraction system
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons
WAC	Washington State Administrative Code
WSDOT	Washington State Department of Transportation

Executive Summary

A Remedial Investigation (RI) was performed at the former Interfor Pacific site (hereafter "Interfor Site" or "Site") located in Marysville, Washington, to characterize contaminant impacts to Site soil, groundwater, and surface water identified during previous Site investigations and remedial actions, develop a conceptual Site exposure model (CSEM), and identify applicable cleanup standards for the Site. Based on the findings of the RI, a Feasibility Study (FS) was performed to evaluate potential cleanup alternatives for the Site.

The Site is located at 60 State Avenue in Marysville, Washington (see Figure 1), and is currently owned by the City of Marysville (City) (acquired in 2006). The City currently uses the Site for parking of solid waste collection vehicles, and storage of waste bins and other City-owned equipment and materials. Ebey Slough borders the Site to the south.

Historical Site uses have primarily included sawmill and wood products manufacturing (late 1900s through 2004/2005), with primary facilities located in the southern portion of the Site and log storage areas in the northern and southeastern portions (See Figure 3). A boat manufacturing facility was located in the southwestern portion of the Site (1920s to 1980s), but most of the related facilities are located on Washington State Department of Transportation (WSDOT) property west of the main Site.

Previous investigations have identified potential contaminants of concern (COCs) at concentrations above potential cleanup level (CULs) in Site soil and groundwater (see Figures 6 through 8). The primary COCs identified in previous investigations included total petroleum hydrocarbons (TPH, as gasoline-, diesel-, and oil- range), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and arsenic. Excavation and removal of TPH-impacted soil has been performed at three locations on the main Site (and on the west-adjoining WSDOT property), but localized impacts to soil and groundwater remained.

Sources of TPH impacts include former underground storage tanks (USTs) and localized spills. Specific sources of arsenic were not identified, but arsenic impacts appear to be related to fill materials placed at the Site during initial development and possibly during subsequent redevelopment. Backfill materials (possibly dredged fill) are the suspected sources of arsenic based on a similar development (i.e., concurrent placement of initial fill materials) and usage history for other sites located along Ebey Slough to the west of the Interfor Site (WSDOT Property, Ebey Park, Geddes Marina, Welco Property) and similarity of current arsenic impacts to soil and groundwater at these sites.

Soil types encountered at the Site generally include fill materials placed over native tide flat or tidal marsh deposits (silt/clay with peat layers/lenses and local sandy interbeds). Fill materials are generally 5 to 10 feet in thickness, and typically include sand and gravel with variable silt content, and include anthropogenic materials locally (such as wood chips, sawdust, concrete, ballast rock, and other refuse).

Groundwater at the Site occurs in a shallow, unconfined saturated zone, primarily within the backfill materials placed above the finer-grained native soils. The shallow groundwater gradient is generally to the southeast across the Site, and appears to be influenced by a drainage ditch located along the eastern margin of the Site and possibly by a former stream channel located in the southeastern portion of the Site. Site groundwater discharges to surface water along the drainage ditch and along the Ebey Slough banks. Stormwater runoff also discharges to to Ebey Slough, primarily through outfalls to the slough and to the eastern drainage ditch (which ultimately discharges to the slough).

The results of the 2017/2018 RI confirmed the presence of TPH and arsenic impacts to Site soil and groundwater. Soil with TPH (primarily oil-range but also gasoline-range locally) and arsenic impacts is present in localized areas of the Site (approximately 1,500 cubic yards total). TPH-impacted groundwater is also present locally on the main Site, but concentrations are generally less than two times the CUL (see Figure 27). [Note: Higher TPH concentrations in groundwater were identified in wells along the western and northern margins of the main Site, but appear to be related to migration onto the Site from off-property source.]

Arsenic concentrations in Site groundwater generally exceed potential CULs (for groundwater and surface water) and other potential Applicable or Relevant and Appropriate Requirements (ARARs); however, groundwater migrating onto the Site also contains arsenic at concentrations well above these standards.

An evaluation of background arsenic concentrations in groundwater migrating onto the Site was performed during the RI, including collection of multiple groundwater samples from 13 background monitoring wells and statistical evaluation of arsenic concentrations. Background threshold values for arsenic concentrations in groundwater entering the Site, calculated using United States Environmental Protection Agency (EPA) ProUCL software, were 31.98 micrograms per liter (µg/l) (for total arsenic) and 27.1 µg/l (for dissolved arsenic).

Arsenic concentrations detected in onsite monitoring wells were similar to the background threshold values, on average, but were somewhat higher in the central and southeastern area of the Site. A specific arsenic source (related to current or historical Site uses) was not identified on the Site. The increase in arsenic concentrations relative to background values at some locations may be attributable to enhanced leaching and mobilization of arsenic associated with reducing conditions from degradation of TPH-related COCs or the presence of organic matter (such as wood waste).

Arsenic and TPH were also detected in surface water samples collected from the drainage ditch and Ebey Slough, and in stormwater samples collected from outfalls (see Figure 28). Arsenic concentrations in surface water and stormwater samples were generally lower than in Site groundwater, but were above most of the applicable surface water CUL and ARAR values with arsenic concentrations as high as 36.4 µg/l in surface water samples collected from Ebey Slough.

The proposed CULs identified in the RI are primarily based on the most restrictive of the MTCA Method A/B CULs for soil , and the most restrictive MTCA surface water CULs and applicable ARARs for groundwater and surface water (and MTCA Method A groundwater CULs where surface water standards are not available), except for arsenic. The proposed CULs for arsenic in soil are based on standards established for the former Everett Smelter site and vary with depth. The proposed CULs for arsenic in groundwater and surface water are based on background values.

Although Site groundwater that discharges to adjoining surface water bodies appears to contain elevated arsenic concentrations (i.e., concentrations above applicable CULs and ARARs), the RI findings indicate that surface water in Ebey Slough also contains elevated arsenic concentrations that are not related to the Site (as does background groundwater entering the Site). Therefore, the background threshold value for total arsenic of 31.98 µg/l is proposed as the CUL for Site groundwater and surface water.

The FS included an evaluation of seven remedial alternatives for the Site. The alternatives were identified and evaluated based on Ecology's requirements, expectations, and criteria in accordance with MTCA (WAC 173-340), including review of applicable technologies, evaluation of threshold criteria, and a disproportionate cost analysis (DCA).

The technologies and methods described for the seven remedial alternatives included (in various combinations): Institutional controls, environmental covenants, excavation of impacted soil with offsite disposal, capping with asphalt pavement, groundwater treatment by air sparging, installation of a slurry wall, groundwater extraction for hydraulic control with discharge to City sewer system (with treatment if needed based on City requirements), and installation of a permeable reactive barrier.

The preferred remedial action alternative for the Site is a combination of institutional and engineering controls (Alternative 1) with hot spot excavation and offsite disposal of impacted soil (Alternative 2). The combination of these two alternatives provides the highest level of protection against direct contact with contaminants in soil and groundwater to protect human health and the environment.

The preferred alternative does not include groundwater treatment or active groundwater control; however, based on the elevated background arsenic concentrations in groundwater entering the Site and the arsenic concentrations present in the primary surface water body (Ebey Slough) potentially affected by Site groundwater, the implementation of groundwater treatment and/or active controls would not have an overall benefit to the environment and would be disproportionately costly to install and maintain indefinitely. In addition, the potential effectives of treatment technologies at reducing arsenic concentrations in groundwater (to meet MTCA CULs or other ARARs) are uncertain, particularly given the ongoing contribution of arsenic in groundwater migrating onto the Site.

Section 1: Introduction

This Remedial Investigation/Feasibility Study (RI/FS) Report has been prepared for the Washington State Department of Ecology (Ecology) and the City of Marysville for the Former Interfor Pacific site located at 60 State Avenue, Marysville, Snohomish County, Washington (hereafter "Interfor Site" or "Site") (see Figure 1).

The purpose of the RI was to collect and evaluate data to characterize current environmental conditions related to past releases of hazardous substances at the Site and identify concentrations of chemicals of concern (COCs) above Ecology's Model Toxics Control Act (MTCA) cleanup standards (Ecology 2007). The RI data were then used to evaluate potential contaminant exposure pathways and support the evaluation of possible cleanup alternatives in the FS. Both the RI and the FS have been prepared pursuant to the requirements of Ecology's MTCA regulations established under Chapter 173-340 of the Washington Administrative Code (WAC).

This RI/FS was conducted by Kennedy/Jenks Consultants (Kennedy/Jenks) on behalf of the City of Marysville (City).

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The Site is currently owned by the City and is currently being administered under Ecology's Voluntary Cleanup Program (VCP) (Project No. NW2260). The Site was entered into Ecology's VCP on 23 February 2010 (Ecology 2010).

The Site has been assigned the following Cleanup Identifications by Ecology:

- Ecology Site Name: Interfor Pacific Inc.
- Alternate Site Names: Crown Pacific, Crown Pacific Marysville, Garka Mill Co Inc.
- Facility Site Identification Number (FSID): 85223839
- Cleanup Site Identification Number (CSID): 4281
- Order Number for Consent Decree: Not Applicable.

Ecology defines a “Site” based on the extent of impacts to environmental media resulting from the release of hazardous substances; i.e., a “Site” may extend beyond the margins of a property on which a release of hazardous substances has occurred. As such, a Site may include multiple properties with multiple owners, potentially both private and public.

For the purposes of this RI, the term “Site” generally includes only the current City property (one tax parcel, see Section 1.1) and adjoining surface water drainage features. Other adjoining and nearby sites are referred to by name (i.e., Geddes site). The terms “on-property” and “off-property” are also used herein to describe the general locations of monitoring wells (and other features as appropriate) relative to the City parcel.

1.1 General Site Information

The Site consists of approximately 9.49 contiguous acres and is located at 60 State Avenue in southwest Marysville, Washington, in Snohomish County. The Site location is shown on Figure 1. The Site is zoned as “Downtown Commercial” by the City. Kennedy/Jenks understands future Site uses may include both commercial and residential development.

The Site is located on Snohomish County tax parcel number 30053300201200 and is described by the Snohomish County Assessor (https://snohomishcountywa.gov/2934/Assessor) as follows:

> Section 33 Township 30 Range 05 Quarter NW - A PTN OF NE1/4 NW1/4 & OF GOVT LOT 2 DAF - COM AT SW COR OF BLK 7 OF D A QUINN'S 1ST ADD TO MARYSVILLE TH S00*14 33E BEING THE SLY PROJ OF W LN OF SDBLK 7 FOR 80FT TO TPB TH CONT S00*14 33E 580FT TH S02*05 31W 533.62FT TH S50*37 44W 59.29FT TH S50*29 32W 4.98FT TH NWLY ALG NLY BK OF EBEY SLOUGH TO ELY MGN OF S/HWY 529 TH NLY ALG SD ELY MGN OFS/HWY 529 TO S LN OF PARCEL OF LAND CNVYD TO JAMES P & GLORIA FUNSTON BY DEED REC AFN 7907110029 TH CONT ALG ELY MGN OF SD HWY 529 ON CRV TO L RAD CTR BEARS N67*09 16W & HAVG RAD OF 1196.00FT & CONSAN ANG OF 00*53' 38" FOR 18.66FT TH N68*02 54W ALG SD RD MGN 10FT TH CONT ALG SD RD MGN ON CRV TO L RAD CTR BEARS N68*02 54W & HAVG RAD OF 1186FT & CONS AN ANG OF 00*34' 47" FOR 12FT TH S74*54 34E252.20FT TO LN 12.69FT E OF SD FUNSTON'S PARCEL TH N00*14 33W ALG LN 12.69FT E OF SD FUNSTON PARCEL 356.06FT TO S LN OF PROP OWNED BY CITY OF MARYSVILLE TH N85*34 37E 245.41FT TO W LN OF PARCELDEEDED TO CITY MARYSVILLE REC AFN 1342302 TH S43*24 26E ALG SD W LN 25.66FT TO POB PER BLA REC AFN 9704185001 & CORR REC AFN 9902100624 LESS RD R/W TO ST OF WA PER QCD REC AFN 200906230865

The Site is bounded to the south by Ebey Slough, to the west by State Avenue, to the east by Columbia Avenue; and to the north by an alley and City RV dump station (eastern portion); and by a commercial service station, car wash, and convenience store (western portion). The area surrounding the Site includes the City’s Ebey Waterfront Park (Ebey Park) and boat launch to the west, City offices, public works facilities, and wastewater treatment facilities (including wastewater treatment ponds) to the east, and commercial and residential properties to the north.

A public trail is located along the southern margin of the Site adjacent to Ebey Slough and is partially separated from the main Site area by a chain-link fence. A drainage ditch is located along the eastern margin of the Site that discharges to Ebey Slough. Water from the ditch is pumped to Ebey Slough, typically during periods of high runoff.

1.2 Current and Planned Site Uses

The City purchased the Site in 2006 from Crown Pacific and has used it primarily for storage of vehicles and empty solid waste containers since it was acquired. Existing structures (formerly part of Garka Mill, see Section 1.3.3.4) include a small office for City staff, a garage bay for solid waste truck parking, a former kiln, and a former maintenance shop (see Figure 2). Other pre-existing structures related to former mill operations were removed by the City in 2006-2007. No industrial activities are currently performed at the Site. Development of the Site since it was acquired by the City has included construction of an asphalt-paved walking path adjacent to Ebey Slough in 2016-2017, including placement of fill and landscaping in the southern portion of the Site.

A portion of the former Site area (the southwestern corner) was acquired by the Washington State Department of Transportation (WSDOT) in 2009 for the expansion of State Avenue and replacement of the Ebey Slough bridge. As part of the bridge replacement project, WSDOT performed remedial activities in 2010 (GeoEngineers 2011) that consisted of the excavation and offsite disposal of impacted soils adjacent to the Site to the west (discussed in Section 2.3.1).

Future plans for the Site include development by the City as part of a Waterfront Sector which includes the Site and other properties to the west along Ebey Slough. Proposed land use planning materials provided by the City indicate that the Site is included in a Waterfront Mixed-Use area described as pedestrian and recreation-oriented commercial, office, and residential. Copies of planning materials provided by the City are included in Appendix A.

1.3 Historical Site Uses and Development

The following information sources were primarily used to identify historical site usage and development:

- Historical aerial photographs obtained from the Washington State Department of Natural Resources (DNR) for the years 1933, 1961, 1969, 1978, and 1987 (Note: The DNR could not certify the exact date of the 1933 aerial photograph, but indicated the year is correct). The DNR aerial photographs of the Site are presented in Appendix B, and digital copies of the images (which cover a larger area) are included in Appendix C.

- Historical aerial photographs available online from Google Earth (viewed 19 January 2018) for years 1990 and 2003, 2005-2007, 2009, 2011, and 2014-2017.

- Phase I Environmental Site Assessment (ESA) reports for the Site included in Ecology’s Site records (Century West 1996a, 2000). These reports included copies of historical Sanborn Fire Insurance Maps from approximately 1902 to 1942.

- Phase I ESA reports for two nearby sites (Geddes Marina and Ebey Park) obtained from Ecology’s records [Associated Earth Sciences (AES) 2010; Geotechnical and Environmental Services (GES) 1996]. These reports provided information regarding regional development, including historical aerials and topographic maps which included the Site area.

Copies of the referenced reports are included in Appendix C.

The information reviewed suggests that initial Site development included placement of fill materials over native tidal marsh and tideflat areas at the Site and other nearby properties adjoining Ebey Slough. The initial fill materials were most likely placed in the late 19th century, but the exact date or source of the fill was not specified in the reviewed information. Mill facilities are depicted adjacent to Ebey Slough on the 1902 Sanborn Map, and the ESA for the Ebey Park site suggests that mills were present in the Marysville area by approximately 1887 (GES 1996).

The southern margin of the initial development fill appears to coincide with the margins of the Ebey Slough Levee, as described by a Snohomish County levee study (Snohomish County 2017) and the United States Army Corps of Engineers (USACE) National Levee Database (USACE 2018). The Snohomish County study describes the Ebey Slough Levee as extending from just downstream of Interstate 5 to approximately 2.4 miles upstream, indicating that initial development fill materials were likely placed concurrently over a wide area including the Site and other nearby properties. The levee is depicted on the historical topographic maps (1911 to 1973) included in the 2010 ESA for Geddes Marina (AES 2010), and the 1906 Sanborn Map depicts a small section of the levee along the Ebey Slough bank. Presumably, the initial development fill at the Site was placed behind (north of) the levee at the approximate time it was constructed. Consequently, one possible source of fill material at the Site could include former dredge materials obtained from Ebey Slough.

Placement of additional surface fill materials occurred periodically during the Site's development history. Fill materials were also subsequently placed at the location or a former stream channel in southeastern portion of the Site, and at an apparent embayment located adjacent to Ebey Slough (Figure 3) (Section 1.3.1).

In general, the southern portion of the Site (excluding the southeastern corner) was developed as mill facilities shortly after the initial fill was placed and was subsequently redeveloped several times throughout the Site's history. The northern and southeastern portions of the Site appear to have been undeveloped until the late 1960s when fill material was placed and these areas were used as log storage yards. Placement of fill is evident in both areas on the 1969 aerial photograph, and both areas are being used for log storage on the 1978 aerial photograph. No historical structures have been identified in the northern and southeastern areas.

Additional information regarding previous Site usage and development is presented in the following sections.

1.3.1 Former Stream Channel and Embayment

A former stream channel and small embayment are is visible in the southeastern portion of the Site on historical aerial photographs (Appendix B). The stream channel is also depicted on historical topographic maps from 1956 to 1973 (AES 2010).

The stream channel is visible on historical aerial photographs both on and east of the Site. It appears that the areas north and south of the channel were filled (presumably during the initial development phase in the Site vicinity), but the channel was not filled at that time, suggesting that is was an established stream (or tidal channel) when the area was initially developed. The stream crosses the City property east of the Site (current location of the wastewater treatment ponds) and the channel bisects the southeastern portion of the Site (Figure 3). The channel effectively separated the southeastern corner of the Site from the remainder of the Site until the channel was filled in the late 1960s to middle 1970s.

The streambed is visible within a wider stream channel on the 1933 aerial photograph, and the roadway east of the Site (now Columbia Avenue) does not extend southward past the stream channel. On the 1961 aerial photograph, the roadway has been extended southward to the Ebey Slough bank, over the stream channel. Discharge from the stream appears to have been rerouted under the roadway (through an apparent culvert visible on the 1961 aerial photograph) and to a drainage ditch east of the roadway, but it is unclear which was the primary flow path for stream runoff.

The location and appearance of the portion of the stream channel located on the Site are similar on the 1933, 1961, and 1969 aerial photographs. On the 1978 aerial photograph, the southeastern portion of the Site has been backfilled, including the stream channel, and logs are stored in the area formerly located south of the stream. Backfilling appears to have started to the southeast of the stream channel in the late 1960s (based on apparent filling activity southeast of the stream visible on the 1969 aerial), but the source and nature of the fill is unknown. Filling of the stream channel and southeastern portion of the Site appears to coincide with construction of the City's existing public works facilities east of the Site.

As development continued to the east of the Site, the channel was filled and diverted. On the 1987 aerial photograph, the City's western wastewater treatment pond is visible, and a drainage ditch is visible to the north of the pond, presumably to reroute runoff from the stream that was covered by the treatment pond. The culvert visible on the 1961 aerial photograph appears to be present on the 1978 aerial photograph but is not visible on the 1987 aerial photograph and could have been removed (a new roadway intersects Columbia Avenue at the approximate location of the culvert). A current drainage map provided by the City (summarized on Figure 4) does not show any connection between the existing ditches across Columbia Avenue at the culvert location, and a culvert was not observed during the RI field activities.

A small embayment along the northern bank of Ebey Slough is visible to the west of the stream channel outlet on historical aerial photographs from 1933, 1961, 1969, 1978, 1987, and 1990. The embayment is located near the log ramps of several former mill facilities (see Section 1.3.3). On the 1969, 1978, and 1987 aerial photographs, the embayment is apparently being used to facilitate moving logs from Ebey Slough to the mill and to upland areas of the Site for storage (logs and a crane are visible in/near the embayment).

The embayment appears to have been filled sometime after 1990 and is not visible on the 2003 and later aerial photographs (although removal of logs from the Slough appears to have continued at the same location). The source and nature of the fill is unknown. Log storage in Ebey Slough adjacent to the Site is evident in aerial photographs from 1933 to 2005.

As discussed in Section 4.2, it appears that the former stream channel may locally influence groundwater gradients and possibly tidal fluctuations at the Site.

1.3.2 Former Boat Building Facilities (1920s to 1980s, approximate)

Boat building facilities were previously located on the southwestern portion of the Site. Most of the area historically occupied by boat building facilities was included in the property sold to

WSDOT in 2009; but does extend a short distance eastward onto the current Site (see Figure 3). The 1996 and 2000 ESAs for the Site (Century West 1996a, 2000) indicate the occupant was Reinell Boat Company. Boat building facilities are not depicted on the Sanborn Maps. The construction date of the boat building facilities is unknown, but facilities related to a former mill (Marysville Mill, see Section 1.3.3.1) were present at the locations prior to the boat building facilities. It is most likely the boat building facility was constructed after the original State Avenue bridge over Ebey Slough was built in 1925.

Boat building facilities visible on the 1933 aerial photograph include two rectangular structures and a boat launch ramp extending into Ebey Slough. The northeastern portion of one structure and a portion of the boat launch ramp appear to be located within the current Site boundary. The configuration and proximity of the facilities to the current Site suggests work areas related to boat building operations may have extended onto the current Site. Boat building facilities are also visible on the 1961, 1969, and 1978 aerial photographs and show a similar layout to 1933, but with several additional structures connecting to the two original buildings.

A small building and what appears to be a storage yard are visible on the 1969 and 1978 aerial photographs to the north of the main boat building facilities. It is unclear whether the building and storage yard are related to the boat building facility, but boats appear to be present in the storage yard. The building could also be related to the Garka Mill (see Section 1.3.3.4). It is at the same location (but a different shape) as an existing structure that was associated with the mill, but it is inconclusive whether the two structures are related. Boat building facilities and the storage yard are not visible on the 1987 aerial photograph. The structure associated with the storage yard has been replaced (or remodeled) with the office structure currently present at that location.

1.3.3 Former Mill Facilities

Former saw and shingle mills represent the predominant historical usage of the Site. Mill facilities have been present at three separate locations on the southern half of the Site and are described in the following sections. Former mill facility locations are shown on Figure 3.

1.3.3.1 Marysville Mill (1890s to 1920s, approximate)

The 1996 and 2000 Phase I ESAs indicate the Marysville Mill Company Saw and Shingle Mill (Marysville Mill) was located in the southwestern portion of the Site, and a building identified as a saw mill is shown on the 1906 and 1912 Sanborn Maps. The Marysville Mill is not visible on any of the aerial photographs reviewed, but a rectangular outline presumed to be a former building footprint is visible east of the boat manufacturing buildings (Section 1.3.2) on the 1933 aerial (Appendix B). The Sanborn Maps show a conveyor extending eastward from the sawmill building and ending with a feature labeled as a “refuse fire”, possible one of the two refuse burners visible on the 1933 and 1961 aerial photographs (see Figure 3).

The Marysville Mill also appears to have occupied the area west of the Site (current WSDOT bridge and Ebey Park), with mill-related facilities visible on 1906 and 1912 Sanborn Maps included in the 2010 ESA for the nearby Geddes Marina property (AES 2010). It is likely the Marysville Mill was demolished prior to construction of the original State Avenue bridge over Ebey Slough, which was built in 1925.

1.3.3.2 Shingle Mill (Smith / Mutual) (1890s to 1930s, approximate)

Facilities identified as a shingle mill are depicted on Sanborn Maps from 1902 to 1926. The 1902 and 1906 maps list the occupant of the mill as Smith Shingle Manufacturing Company (Smith Mill) and the 1912 and 1926 maps show it as Mutual Shingle Company (Mutual Mill). The 1902 and 1906 Sanborn Maps show a main mill building adjacent to Ebey Slough, and a Steam Dry Kiln to the north of the main mill building. The 1912 and 1926 Sanborn Maps show shipping and loading sheds added to the north of the kiln building, and a rail spur north of the shipping shed.

A refuse burner and conveyor are depicted on the 1902 to 1926 Sanborn Maps. As noted above, two refuse burners are visible on the 1933 and 1961 aerial photographs, but only the northernmost of the two appears to be connected to the Smith/Mutual Mill by a conveyor. It is unclear whether the southern burner was used by Smith/Mutual, or if it was related to the previous Marysville Mill described in Section 1.3.3.1.

The Sanborn Maps appear to depict two steam boilers located in a structure attached to the western end of the main mill building (see Figure 3), and a small, separate oil shed structure located southwest of the main mill building. A log way extends from the main mill building southward into Ebey Slough. Although not provided in the available documentation, it is assumed the boiler used wood wastes from the Site for fuel.

The shingle mill facilities appear to have been repurposed for general wood products manufacturing sometime during the 1930s (see Section 1.3.3.3).

1.3.3.3 Pacific Wooden Ware (1930s to 1960s, approximate)

The shingle mill facilities are depicted on the 1942 Sanborn Map, but the occupant is listed as Pacific Wooden Ware Company (Pacific), a wood products manufacturer (butter tub heads and staves). Features shown on previous Sanborn Maps (refuse burners, oil house, steam boilers) are also shown on the 1942 map. The main mill building is present but is labeled as a Packing Factory. The kiln building is also present but appears to have been expanded. A new building labeled as a Factory is present at the former shipping shed location, north of the kiln building.

The facility configuration visible on the 1933 aerial photograph is similar to that shown on the 1942 Sanborn Map (i.e., the Factory building was present by 1933). The information reviewed does not indicate whether the new Factory building was used by the shingle mill prior to Pacific's occupancy, but it appears to have been built between 1926 and 1933. The 1961 aerial photograph shows an additional L-shaped building located west of the northern factory building, and a smaller structure west of the larger L-shaped building. The L-shaped building appears to be associated with the wood products facility and may be a shipping warehouse based on its location adjacent to the rail spur. Several small sheds or outbuildings are visible to the west of the steam kiln building.

The shingle mill and wood products manufacturing facilities are not present on the 1969 aerial photograph, other than the L-shaped building. The rail spur is still present on the 1969 aerial photograph. The 1996/2000 ESAs (Century West 1996a, 2000) indicates that the Pacific Wooden Ware buildings were destroyed by fire prior to the property being purchased by the Garka Sawmill Company in 1964. Structures associated with the Garka Mill (see Section 1.3.3.4) appear to be under construction on the 1969 aerial.

1.3.3.4 Garka / Crown Pacific / Interfor Mill (1960s to 2000s, approximate)

The Garka Mill was constructed in the late 1960s and was operational until the middle 2000s. The primary Garka Mill structures (sawmill and planer mill) were located on the Ebey Slough bank immediately to the west of the previous mill structure, and the supporting facilities (kiln, maintenance shop, covered storage, and office building structures) were located north of the sawmill and planer mill (see Figure 3).

The sawmill and planer mill were demolished and removed from the Site by 2007, but the other structures currently remain on the Site. The Garka Mill was subsequently occupied by other tenants including Crown Pacific (1996-2004) and Interfor (2004-2006). For the purposes of this discussion, the facility will be referred to as Garka Mill.

The 1996/2000 ESAs (Century West 1996a, 2000) indicate that the Garka Mill structures include foundation slabs supported by pilings, but no additional information regarding the pilings was provided. Given the shallow depth to water and heterogeneous nature of fill materials at the Site (see Section 4), previous mill-related structures may have been constructed in a similar manner.

Garka Mill facilities are visible on the 1969 aerial photograph including the kiln building and the sawmill building, which may be under construction. Logs are stored on the southeastern portion of the Site (north of the stream channel which has not yet been filled) but not in the northern portion of the Site. Logs are visible in Ebey Slough and in the small embayment east of the sawmill building. A crane is visible near the western margin of the embayment and appears to be used to move logs from the Slough to upland areas via the embayment.

A feature that appears to be a log ramp extends from the eastern side of the sawmill building toward the embayment and former debarker area described in the 1996/2000 ESAs (Century West 1996a, 2000). Two small rectangular features, presumably hoppers based on the location, are visible to northeast of the sawmill building and appear to be connected to the sawmill building by conveyers. The L-shaped building (see Section 1.3.3.3) is present and appears to be occupied, including what appears to be a bin or hopper located south of the building.

Additional Garka facilities are visible on the 1978 aerial photograph, including the planer mill, maintenance shop, and covered storage buildings. A linear feature is visible between the center of the planer mill and the hoppers, possibly a conveyor. A trailer is visible between the maintenance shop and the covered storage building in the same area as the bin/hopper visible on the 1969 aerial photograph. The L-shaped building is also present, but may be vacant, and the rail spur appears to have been removed.

The maintenance shop appears to have been constructed at the same location as the southern extension of the L-shaped building. It is unclear whether the maintenance shop was an entirely new structure, or the existing structure was remodeled. Logs are stored in both the northern and southeastern areas of the Site, and the stream channel in the southeastern corner has been filled.

On the 1987 aerial photograph, the L-shaped building has been removed and the existing office building (west of the maintenance building) is present. As discussed in Section 1.3.2, it is unclear whether the office building was a new structure or if an existing structure was remodeled. A small structure, presumably an oil storage shed described in previous ESAs (Century West 1996, 2000), is visible northwest of the planer mill. Logs are stored on the northern and southeastern areas of the Site, and to a lesser extent on the southwestern corner (former boat building area). Logs are also visible in Ebey Slough and within the embayment. The trailer noted on the 1978 aerial photograph is present at the same location.

The 1990 aerial photograph appears similar to 1987, but the log storage areas are vacant and the embayment may have been filled (at least partially). Logs are present in both the northern and southeastern areas on a 2003 aerial photograph, and the trailer located between the maintenance and storage buildings has been removed. Logs are also visible in Ebey Slough.

The Site appears vacant on the 2006 aerial photograph, and fill may have been spread over unpaved portions of the Site. By 2007, the sawmill and planer mill had been removed from the Site. The recently constructed walking path along the Ebey Slough bank (Ebey Waterfront Trail) is visible on the 2016 and more recent aerial photographs (see Figure 2).

1.4 Site Areas of Concern

Six areas of concern (AOCs) have been previously identified for the Site based on the results of historical investigations and remedial actions (Section 2). The AOCs are referenced throughout this document and in many of the historical Site documents and reports referenced herein. The AOCs were established during previous site investigations and are referenced by Ecology in its opinion letters (Ecology 2010, 2011, 2012, 2013a, 2013b, and 2017a).

The Site AOCs are listed below and depicted on Figure 2.

- AOC 1 – North Office Building (aka MW-7 Area); former underground storage tank (UST) and remedial excavation location.
- AOC 2 – Former Unknown UST and Drain Field Area; former UST and remedial excavation location.
- AOC 3 – Former Boat Manufacturing Facility (includes the WSDOT Bridge Replacement Area acquired by WSDOT in 2009), former UST and remedial excavation location.
- AOC 4 – Former North and South Log Yards; limited previous assessment.
- AOC 5 – Former Kiln UST Area; former UST and remedial excavation location.
- AOC 6 – General surface soils (primarily fill), limited previous assessment, Site-wide shallow soil.

Section 2: Previous Site Investigations and Remedial Actions

This section provides a summary of the previous environmental investigation and remedial actions performed at the Site, beginning in 1996. This section also includes a summary of other nearby and adjoining environmental investigation and cleanup sites (Section 2.3), and a summary of the data gaps identified from previous investigations (Section 2.4).

2.1 Underground and Aboveground Storage Tanks and Storage Areas

USTs and aboveground storage tanks (ASTs) historically located on the Site are discussed below. Locations of former USTs and petroleum-related ASTs are shown on Figure 3.

No USTs are known to be currently located on the Site. Five USTs have been previously removed from the Site in AOC 2 (one UST) and AOC 5 (four USTs). In addition, one UST was removed from the former boat building facility (AOC 3) but was located west of the current Site (see Section 2.3.1). Four operational USTs are located on the First Stop Deli site, which adjoins the Site to the north (see Section 2.3.2).

The Site is included in Ecology’s UST site database for inactive facilities (Ecology 2018a), with four former USTs listed for the Site. Two of the former USTs are listed as “removed” with the stored products listed as leaded and unleaded gasoline. Two additional USTs are listed as “exempt” but the stored products are not identified. Ecology’s UST site information does not indicate the UST capacities.

The four USTs listed by Ecology appear to have been located east of the existing Kiln building (AOC 5). The Century West Phase I ESAs (Century West 1996a, 2000) indicate two gasoline USTs with capacities of 1,000 and 12,000 gallons that were removed from east of the Kiln building in approximately 1990, and two 12,000-gallon diesel boiler fuel USTs that were removed from the same area in approximately 1993 by the property owner. The boiler fuel USTs are presumed to be the two USTs listed as “exempt” by Ecology. No additional information was available regarding site assessment activities at the time the USTs were removed, but subsequent investigation and remediation activities were performed in this area (see Section 2.2.1).

An additional UST was encountered in 2012 during an interim remedial action conducted in AOC 2 (Kennedy/Jenks 2012) (see Section 2.2.5) and was removed as part of the remedial action. The UST was approximately 8,000 gallons in capacity. The contents of the UST at the time of discovery were described as “petroleum-related constituents” based on laboratory analysis of the UST contents. The Century West Phase I ESAs (Century West 1996a, 2000) indicate that a gasoline UST (taken out of service prior to 1964) was suspected to be present in this area but was not discovered during the investigation and remedial action performed between 1996 and 1998 (see Section 2.2.1).

ASTs have been present historically at several locations on the Site. A 1996 Spill Prevention Control and Countermeasure (SPCC) Plan for the Site (Century West 1996b) indicates a 4,000-gallon diesel fuel AST was located south of the existing Kiln building (AOC 5), and that various substances (new oil, grease, hydraulic oil, thinner, methanol, used oil) were stored in smaller containers (20-gallon buckets and 55-gallon drums) in the former maintenance shop and sawmill debarker area (see Figure 3).

A 2001 Stormwater Pollution Prevention Plan (SWPPP) for the Site (Century West 2001) indicates that a 10,000-gallon diesel AST was previously located in a fueling area on the eastern side of the garage bay building (under the attached canopy). The AST was located on a concrete fueling pad with a sump and oil-water separator. The 2001 SWPPP also indicates that a 250-gallon AST was associated with an oil shed previously located north of the former planer mill (see Figure 3). Various oils were also stored in smaller containers (20-gallon buckets and 55-gallon drums) in the former Garka Mill oil shed vicinity.

A 2004 Review of Environmental Liabilities report (Pottinger Gaherty 2004; copy in Appendix C) provides an additional summary of historical ASTs and container storage areas at the Site, including locations and contents. In addition to the information in the SPCC and SWPPP, the 2004 Environmental Liabilities report describes a 750-gallon saw glide lubricant AST located in the Garka sawmill building, four 60- to 120-gallon new oil ASTs and “several” 30-gallon drums for used oil located in the Garka maintenance shop building, and two propane ASTs south of the Garka kiln building.

The 2004 Environmental Liabilities report also indicates that a spray booth and treated wood storage area were associated with the Garka planer mill building, and describes the wood treatment material as WoodBrite (an “anti-saptain” surface cleaning agent). The 2004 report indicates that WoodBrite application was performed by Garka in a spray box or booth (both designations are used in the referenced report) located in the planer mill building.

Based on past investigations, arsenic has been identified as a primary contaminant in Site groundwater and to a lesser extent in soil; however, a definitive source of the arsenic has not been identified during previous environmental activities for the Site (discussed in Section 7.1.2). Arsenic is known to have been used historically in wood preservative products, but does not appear to a component of the WoodBrite product that was used at the Site as a cleaning agent.

The 2004 Environmental Liabilities report does not specify the manufacturer of the Wood Brite product used at the Site, but two US manufacturers of Wood Brite products were identified. A Material Safety Data Sheet (MSDS) for a Wood Brite product manufactured by Synthetic Labs of Dracut, Massachusetts, described as a wood surface cleaner and stain remover, indicates that the product does not contain arsenic or any other hazardous substances. An unrelated Wood Brite product is manufactured by Chemco Industries of St. Louis, Missouri, but appears to be intended for use on finished wood surfaces (furniture, cabinets, floors). An MSDS for Chemco’s Wood Brite product indicates that it contains one hazardous product, Butyl Cellosolve^{TM} (ethylene glycol monobutyl ether), but does not contain arsenic. Based on the manufacturer’s product usage descriptions, the Synthetic Labs product appears to be more suitable for sawmill uses. It is also possible that the WoodBrite product at the time differed from the currently available products.

2.2 Previous Investigations and Remedial Actions

Environmental investigation and various remedial actions were conducted at the Site from 1996 through 2016. Previous work has generally included soil excavation, removal of USTs, soil sampling from borings and test pits, and groundwater sampling from wells and reconnaissance borings. Historical soil sampling locations are shown on Figure 5 and historical data are presented in Appendix D. Copies of referenced historical reports are included in Appendix C.

The primary COCs in soil and/or groundwater detected at concentrations above Ecology's MTCA Method A cleanup levels (CULs) included total petroleum hydrocarbons (TPH) as gasoline-range organics (GRO), diesel-range organics (DRO), and oil-range organics (ORO); benzene, toluene, ethylbenzene, and xylenes (BTEX); carcinogenic polycyclic aromatic hydrocarbons (cPAHs); lead; and arsenic [MTCA Method A CULs are referenced in this section as screening levels; see Section 8 for a summary of all potentially applicable CULs and Applicable or Relevant and Appropriate Requirement (ARARs)].

Previous investigations and remedial actions are summarized chronologically in Table 1, which includes a summary of the investigation and/or remediation activities performed at each AOC, sample locations and matrices, analytical testing performed, analytical results including COCs detected at concentrations above MTCA Method A CULs, and other pertinent information.

The results of previous investigations are summarized on Figure 6 (soil), Figure 7 (TPH in groundwater), and Figure 8 (arsenic and lead in groundwater). Each phase of previous work is described in the following sections.

2.2.1 Site Investigations and Remedial Actions (1996 to 1998)

Century West conducted site assessment and remediation activities from 1996 to 1998 (Century West 1996a; Century West 2000). Twenty-three soil borings (GB-1 through GB-19) and test pits (TP-1 through TP-4) were advanced at the Site and nine monitoring wells (MW-1 through MW-9) were installed for collection of soil and groundwater samples (see Figure 5). Impacts to soil and/or groundwater from TPH were detected in four areas of the Site (AOC 1, AOC 2, AOC 3, and AOC 5). Site assessment was also performed at three locations in the southern portion of the Site (AOC 6).

AOC 1

- Four soil borings (GB-14, -15, -18, -19) and four test pits (TP-1 to TP-4) were advanced in 1996, and three groundwater monitoring wells (MW-7, -8, and -9) were also installed. [Note: Borings GB-14 and GB-15 were located northeast of the office building in the southwestern portion of the northern log storage yard (AOC 4) but are discussed here because they were advanced to assess conditions related to AOC 1.]
- DRO [up to 12,000 milligrams per kilogram (mg/kg)] was detected in soil at concentrations above the MTCA Method A CUL.
- DRO [3.99 milligrams per liter (mg/l)] and ORO (1.11 mg/l) were detected in reconnaissance groundwater samples at concentrations above MTCA Method A CULs.

- DRO (up to 1.5 mg/l) was also detected in the groundwater samples collected from wells MW-7 and MW-9 in 1996 at concentrations above the MTCA Method A CUL.
- In 1998, approximately 150 cubic yards (cy) of petroleum hydrocarbon-impacted soil was excavated from this area and disposed offsite. TPH (DRO and ORO) concentrations in excavation confirmation soil samples were reported below CULs. However, impacted soil remained around well MW-7, which was located within the excavation area. Well MW-7 was left in-place during excavation, and impacted soil adjacent to the well was not excavated to prevent damage to the well.
- The most likely suspected source of the petroleum hydrocarbon impacts in this area was from a past spill or spills. Migration from an adjacent gas station to the north was also suspected (Century West 1996a), but DRO and ORO were not associated with a previous release at the gas station (see Section 2.3.2). This area was located beneath the former rail spur (see Figure 3).

AOC 2

- Three soil borings (GB-2, -3, and -4) were advanced in 1996 and three groundwater monitoring wells (MW-4, -5, and -6) were also installed.
- GRO (up to 1,440 mg/kg) was detected in soil at concentrations above the MTCA Method A CUL.
- GRO (1.2 mg/l) was detected in a groundwater sample collected from well MW-6 in 1996 at a concentration above the MTCA Method A CUL.
- The source of COCs in this area was likely from a former UST (see Section 2.1), but it is also the location of a former septic drainfield.
- Approximately 60 cy of petroleum hydrocarbon-impacted soil was excavated from AOC 2 in 1996 and disposed offsite. The excavation was reported to be approximately 65 feet by 20 feet and up to 7 feet deep. Three of the final excavation confirmation soil samples contained GRO (73 to 680 mg/kg) concentrations above the MTCA Method A soil CUL (assuming benzene is present). Impacted soils could not be fully removed at the time due to the proximity of a trailer and log loading crane.
- Additional excavation was performed in this area in 2012 (see Section 2.2.5).

AOC 3

- Three soil borings (GB-11, -12, and -13) were advanced in 1996. These borings were located west of the current Site boundary in the area acquired by WSDOT in 2009.
- GRO (1.02 mg/l), DRO (0.973 mg/l), and total lead [33.6 micrograms per liter (µg/l)] were detected in a reconnaissance groundwater sample collected from boring GB-11 at concentrations above MTCA Method A CULs.
- The source of COCs in this area was suspected to be the former boat manufacturing facility and a small gasoline UST (see Section 2.3.1).
- Additional investigation and remediation was performed in this area in 2009-2011 (see Section 2.3.1) after the property was acquired by WSDOT.

AOC 5

- Six soil borings (GB-1, and GB-5 through GB-9) were advanced in 1996 and three groundwater monitoring wells (MW-1, -2, and -3) were also installed.
- DRO (up to 4,060 mg/kg) was detected in soil at concentrations above the MTCA Method A CUL.
- DRO (16.5 mg/l) and ORO (1.53 mg/l) were detected in a reconnaissance groundwater sample collected from boring GB-5 at concentrations above MTCA Method A CULs.
- DRO (up to 2.5 mg/l) was detected in groundwater samples collected from wells MW-1 and MW-2 in 1996 at concentrations above the MTCA Method A CUL.
- The source of contamination in this area is the former UST located east of the Kiln building (see Section 2.1).
- Approximately 80 cy of petroleum hydrocarbon-impacted soil was excavated from AOC 5 in 1996. DRO concentrations in final confirmation soil samples were all below the MTCA Method A CUL. The excavation was reported to be approximately 100 feet by 50 feet and up to 10 feet deep. Soil with DRO impacts (440 mg/kg in a sample collected from the eastern sidewall) extended eastward beneath an asphalt-paved area and was left in-place (the DRO concentration is below the current MTCA Method A CUL, but was above the CUL at the time).

AOC 6

- Three soil borings were advanced in the southern portion of the Site in the former Garka Mill area. Boring GB-10 was located near a former debarker, and borings GB-16 and GB-17 were located near a former oil storage shed.
- No analytes were detected in soil and reconnaissance groundwater samples at concentrations above MTCA Method A CULs.

2.2.2 Groundwater Monitoring and Treatment (1997-2003)

Groundwater monitoring was performed periodically between 1997 and 2003 at one or more of the monitoring wells installed in 1996 in AOC 1, AOC 2, and AOC 5. Groundwater analyses generally included TPH (GRO, DRO, and ORO) and BTEX, but specific analyses varied by location. Historical TPH and BTEX concentrations above MTCA Method A CULs in groundwater are shown on Figure 7, and historical groundwater data collected between 1996 and 2002 are included in Appendix D. [Note: Analyzing groundwater samples for metals was not performed prior to 2011 (Section 2.2.4).]

No additional groundwater monitoring wells were installed between 1997 and 2003; however, six of the monitoring wells installed in 1996 were decommissioned in 2000 and one well was replaced (MW-1R). Groundwater monitoring activities and monitoring well details are summarized below for each Site AOC.

AOC 1

- Wells MW-7, MW-8, and MW-9 were initially sampled in October 1996 after installation and sampled again in January, April, and July 1997. Beginning in October 1997, only well MW-7 was sampled in AOC 1. Between 1998 and 2003, 13 sampling events were conducted at well MW-7 with analyses including DRO and ORO.
- Wells MW-8 and MW-9 were decommissioned in April 2000 based on previous quarterly sampling results (DRO and ORO not detected at concentrations above MTCA Method A CULs).
- DRO was detected in well MW-7 at concentrations above the MTCA Method A CUL for all monitoring events conducted between 1997 and 2003, ranging from 0.73 mg/l to 16 mg/l. ORO was detected at concentrations above the MTCA Method A CUL in six samples, ranging from 0.622 mg/l to 0.956 mg/l.
- Well MW-7 was treated with an oxygen releasing compound (ORC®) in 2003 to improve groundwater quality (Parametrix 2004).
- Additional groundwater monitoring was performed at well MW-7 in 2006 and 2011.

AOC 2

- Wells MW-4, MW-5, and MW-6 were initially sampled in October 1996 after installation and sampled again in January, April, and July 1997. Beginning in October 1997, only well MW-6 was sampled in AOC 2. Between 1998 and 2000, eight sampling events were conducted at well MW-6 with analyses including GRO (through June 1999) and BTEX.
- Wells MW-4 and MW-5 were decommissioned in April 2000 based on previous quarterly sampling results (GRO and BTEX not detected at concentrations above MTCA Method A CULs).
- GRO was detected in well MW-6 (1.3 mg/l) at a concentration above the MTCA Method A CUL in April 1997. GRO was detected at concentrations below the CUL (0.27 to 0.77 mg/) during the next four monitoring events, and was removed from the sampling program after the June 1998 sampling event
- Benzene was detected in well MW-6 at a concentration above the MTCA Method A CUL (14 µg/l) in samples collected in April and July 1997 but was not detected in subsequent monitoring events through November 2000. Well MW-6 was removed from the monitoring program after the November 2000 monitoring event.
- Additional groundwater monitoring was performed at well MW-6 in 2006 and 2011.

AOC 5

- Well MW-1 was decommissioned in April 2000 due to damage and was replaced with well MW-1R.
- Wells MW-1, MW-2, and MW-3 were initially sampled in October 1996 after installation and sampled again in January, April, and July 1997. In October 1997, only well MW-1 was sampled in AOC 5. Wells MW-1/1R and MW-2 were both sampled from 1998 to

2000, but only well MW-1R was sampled in 2001. Between 1998 and 2000, eight sampling events were conducted at well MW-6 with analyses including DRO and ORO.

- DRO was detected in well MW-1/1R at concentrations above the MTCA Method A CUL (0.68 to 5.56 mg/l) for all but two (November 2000 and August 2001) monitoring events. ORO was detected at concentrations above the MTCA Method A CUL (0.642 to 1.88 mg/l) for six monitoring events but was not detected during eight events conducted between 1998 and 2001. Well MW-1R was removed from the monitoring program after the August 2001 sampling event although DRO and ORO were detected at concentrations above MTCA Method A CULs in 2000 and 2001.
- DRO was detected in well MW-2 at concentrations above the MTCA Method A CUL (0.8 to 1.6 mg/l) during monitoring events conducted in 1997 and 1998. ORO was not detected at well MW-2. Well MW-2 was removed from the monitoring program after the November 2000 sampling event based on previous quarterly sampling results (DRO and ORO not detected at concentrations above MTCA Method A CULs).
- Additional groundwater monitoring was performed at well MW-1R in 2006 and 2011.

2.2.3 Phase II ESA (2006)

Prior to purchase of the Site in 2006, the City conducted a Phase II ESA of the entire property (Floyd and Snider 2006). The investigation included advancing 11 soil borings (GP-1 through GP-11) and 10 test pits (TP-1 through TP-10) in the six Site AOCs previously described. In addition, groundwater monitoring was performed at wells MW-1R, MW-6, and MW-7. Soil and groundwater sampling dates, locations, analyses performed, and analytical findings are listed in Table 1. Figure 6 (soil) and Figure 7 (TPH in groundwater) show locations where detected COC concentrations were above MTCA Method A CULs.

AOC 1

- Six soil borings (GP-1 to GP-6) were advanced in AOC 1 and soil samples were analyzed for DRO, ORO, and metals [arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), and mercury (Hg); GP-2 only]. DRO was detected at one location (GP-2; 14,000 mg/kg) at a concentration above the MTCA Method A CUL.
- A groundwater sample was collected from well MW-7 in March 2006 and analyzed for DRO and ORO. DRO was detected at a concentration of 0.51 mg/l, slightly above the MTCA Method A CUL.

AOC 2

- Three soil borings (GP-7 to GP-9) were advanced in AOC 2 and soil samples were analyzed for GRO and BTEX. GRO was detected at concentrations above the MTCA Method A CUL at GP-7 (3,600 mg/kg) and GP-8 (100 mg/kg). Ethylbenzene was also detected at GP-7 [6,600 micrograms per kilogram (µg/kg)] at a concentration above the MTCA Method A CUL. The petroleum hydrocarbon-impacted soil was subsequently removed in 2012 (see Section 2.2.5).
- A groundwater sample was collected from well MW-6 in March 2006 and analyzed for GRO and BTEX. GRO and BTEX were not detected in the sample.

AOC 3

- Five test pits (TP-6 to TP-10) were excavated in AOC 3. Three of the test pits (TP-6, TP-7, and TP-10) were located on the property acquired by WSDOT in 2009. Soil sample analyses included DRO, ORO, GRO, BTEX, metals (As, Cd, Cr, Pb and Hg), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs) (including cPAHs), but specific analyses varied by location.
- Detected concentrations above MTCA Method A CULs included GRO (66 mg/kg), arsenic (up to 29 mg/kg), methylene chloride (53 µg/kg), and total cPAHs [up to 1,425 µg/kg based on Toxicity Equivalency Factor (TEF) summation[1]]. Soil samples collected from test pits located within the current Site boundary (TP-8 and TP-9), reported concentrations of arsenic, methylene chloride, and total cPAHs above MTCA Method A CULs. Affected soil on the WSDOT site was excavated in 2010 (see Section 2.3.1). [Note: Methylene chloride is a common laboratory contaminant, and consequently, the reported low concentrations in soil do not necessarily represent Site contaminants.]

AOC 4

- Two test pits (TP-1 and TP-2) were excavated in the north log yard area, and one (TP-3) was excavated in the south log yard area. Soil samples were analyzed for DRO/ORO (TP-3 only), metals (As, Cd, Cr, Pb and Hg; TP-1 and TP-2), and SVOCs (TP-1 and TP-2). The ORO concentration in a soil sample collected at TP-3 (2,300 mg/kg) was above the MTCA Method A CUL. The source of the petroleum hydrocarbons is unknown, but may be due to localized spills of oil or fuel associated with the former sawmills.

AOC 5

- One soil boring (GP-11) was advanced near the former kiln (AOC 5) and soil samples analyzed for DRO, ORO, PCBs, and metals (As, Cd, Cr, Pb, and Hg). No soil analytes were detected at concentrations above the MTCA Method A CULs.
- A groundwater sample was collected from well MW-1R in March 2006 and analyzed for DRO and ORO. DRO and ORO were not detected in the sample at concentrations above MTCA Method A CULs.

AOC 6

- One soil boring (GP-10) and two test pits (TP-4 and TP-5) were advanced in the southern portion of the Site (south of AOC 2 and east of AOC 3). Soil sample analyses included GRO, BTEX, metals (As, Cd, Cr, Pb, and Hg), PCBs, VOCs, and SVOCs (including cPAHs), but specific analyses varied by location. Analytes detected at concentrations above MTCA Method A CULs included arsenic (26 mg/kg; GP-10),

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[1] Total cPAHs are based on the relative toxicity of each cPAH to benzo(a)pyrene and were calculated by multiplying the individual cPAH concentrations by a TEF and summing the adjusted concentrations.

methylene chloride (49 µg/kg; TP-5) and total cPAHs (481 µg/kg based on TEF summation). [Note: Methylene chloride is a common laboratory contaminant, and consequently, the reported low concentrations in soil do not necessarily represent Site contaminants]

2.2.4 Pre-Remedial Design Investigation - AOCs 1 and 2 (2011)

A Pre-Remedial Design Investigation (PRDI) was performed in AOCs 1 and 2 in 2011 (Kennedy/Jenks 2011). The investigation was conducted to evaluate shallow groundwater conditions and characterize the lateral and vertical extent of impacted soil in AOCs 1 and 2 prior to conducting an interim remedial action (see Section 2.2.5). The PRDI included advancing 10 soil borings (B1 through B10) and collection of soil and reconnaissance groundwater samples, and sampling of existing Site wells MW-1R, MW-6, and MW-7.

AOC 1

- Three soil borings (B1 to B3) were advanced near well MW-7 to the north of the existing office building. Soil samples were analyzed for TPH (DRO, ORO, GRO), BTEX, and Resource Conservation and Recovery Act (RCRA) 8 metals[2] (B1 and B2 only). TPH and BTEX were not detected in any of the soil samples, metals were not detected at concentrations above MTCA Method A CULs. [Note: Chromium was detected in two soil samples at 20 mg/kg, slightly above the CUL for hexavalent chromium but well below the CUL for total chromium].
- Reconnaissance groundwater samples were collected from borings B1 and B2 and analyzed for TPH (DRO, ORO, GRO) and BTEX. TPH and BTEX were not detected in any the reconnaissance groundwater samples above method reporting limits.
- A groundwater sample was collected from well MW-7 in August 2011 and analyzed for TPH (DRO, ORO, GRO), BTEX, and total (unfiltered) metals (RCRA 8). TPH and BTEX were not detected in the sample. The reported concentration of arsenic (43 µg/l) was above the MTCA Method A CUL.

AOC 2

- Seven soil borings (B4 through B10) were advanced in AOC 2 south of the previous (1996) excavation area (see Section 2.2.1). Soil samples were analyzed for TPH (DRO, ORO, GRO), BTEX, SVOCs (B5 and B7 only) and metals (RCRA 8; B5 and B7 only). The GRO concentration in sample B5-4 (1,390 mg/kg) and the DRO concentration in sample B7-3 (10,900 mg/kg) were above the MTCA Method A CULs. Petroleum hydrocarbon-impacted soil was excavated in 2012 (see Section 2.2.5). [Note: Chromium was reported in two soil samples at concentrations of 25 and 29 mg/kg, slightly above the CUL for hexavalent chromium but well below the CUL for total chromium].
- Reconnaissance groundwater samples were collected from borings B5 and B7 and analyzed for TPH (DRO, ORO, GRO), BTEX, SVOCs (B7 only), and total (unfiltered) metals (RCRA 8; B7 only). DRO (1.1 mg/l), arsenic (16 µg/l), and lead (67 µg/l) were

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[2] RCRA 8 metals include arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), selenium (Se), and silver (Ag).

reported in the sample collected from B7 at concentrations above MTCA Method A CULs.

- A groundwater sample was collected from well MW-6 in August 2011 and analyzed for TPH (DRO, ORO, GRO), BTEX, and total (unfiltered) metals (RCRA 8). TPH and BTEX were not detected in the sample above method reporting limits. The reported concentrations of arsenic (primary and duplicate samples; 57 µg/l and 56 µg/l, respectively) were above the MTCA Method A CUL.

AOC 5

- A groundwater sample was collected from well MW-1R in August 2011 and analyzed for TPH (DRO, ORO, GRO), BTEX, and total (unfiltered) metals (RCRA 8). TPH and BTEX were not detected in the sample above method reporting limits. The reported concentration of arsenic (9.2 µg/l) was above the MTCA Method A CUL.

Groundwater samples collected from wells MW-1R, MW-6, MW-7 and the reconnaissance groundwater sample collected from boring B7 were also analyzed for natural attenuation parameters. Natural attenuation analyses included dissolved (filtered) iron, nitrate/nitrite, and sulfate (monitored natural attenuation parameter results are discussed in Section 5.1.3.4).

2.2.5 Interim Remedial Action (2012)

An interim remedial action (IRA) was conducted at AOC 2 in 2012 (Kennedy/Jenks 2012). The remedial action included removal and offsite disposal of approximately 1,110 tons (750 cy) of petroleum hydrocarbon-impacted soil. Soil was removed from two separate, but closely spaced, excavations designated East Excavation and West Excavation (see Figures 5 and 6). The IRA also included removal and disposal of approximately 33,700 gallons of water from the excavations, and installation and sampling of two groundwater monitoring wells (MW-10 and MW-11) south of the excavation area.

The location and final extent of the excavations was based on historical findings regarding impacted soil remaining in AOC 2, observations of subsurface conditions during excavation, and confirmation soil sampling results. During remediation activities, a previously unknown UST was encountered in the northern portion of the West Excavation and was removed. The UST was observed to be in good condition with no obvious holes or significant corrosion, and was approximately half full when encountered.

In the West Excavation Area, impacted soils were removed to depths between approximately 8 and 12 feet below ground surface (bgs) with the deeper portion located in the vicinity of the UST. In the East Excavation Area, impacted soils were excavated to a depth of approximately 6 feet bgs. In general, impacted soils were excavated to the depth of contact with the lower permeability silt/clay layer (see Section 4.1), and confirmation soil samples collected from the bottom of the excavations typically consisted of organic rich clays.

Confirmation soil samples were collected from the sidewalls and bottoms of the excavations. Confirmation soil samples were analyzed for TPH (GRO, DRO, ORO), BTEX, arsenic, lead, VOCs [methyl-tertiary butyl ether (MTBE), ethylene dibromide (EDB), ethylene dichloride (EDC); select samples only], and PAHs (select samples only). At locations where field screening or analytical results indicated that impacted soil remained, additional excavation was performed in an iterative process until concentrations were below MTCA Method A CULs (except for arsenic, discussed below).

At the completion of excavation activities, TPH, BTEX, VOC, PAH, and lead concentrations were below MTCA Method A CULs for all of the final confirmation soil samples. Arsenic concentrations were above the MTCA Method A CUL of 20 mg/kg in 11 of the 32 final confirmation samples, with concentrations ranging from 21 mg/kg to 37 mg/kg.

The excavations were backfilled with imported pit-run materials. The backfill materials were amended with approximately 400 pounds of ORC® to promote biological degradation of residual petroleum hydrocarbons (if any). ORC® amendment was performed by mixing dry ORC® product with imported backfill materials as they were placed into the excavation, with an emphasis on the downgradient portions of the East Excavation and West Excavation Areas, and in the vicinity of the removed UST.

At the completion of excavation and backfilling activities, two groundwater monitoring wells were installed south of the West Excavation Area (MW-10) and East Excavation Area (MW-11) to monitor groundwater conditions downgradient from the excavation areas. Samples were collected from the new wells in August 2012 and analyzed for TPH (GRO, DRO, ORO), BTEX, and total and dissolved arsenic and lead. TPH, BTEX, and dissolved lead were not detected above method reporting limits in either of the groundwater samples. Reported concentrations of total lead (51 µg/l at MW-11), total arsenic (17 to 33 µg/l), and dissolved arsenic (9.8 to 31 µg/l) were above MTCA Method A CULs.

The August 2012 groundwater samples collected from wells MW-10 and MW-11 were also analyzed for natural attenuation parameters. Natural attenuation analyses included dissolved (filtered) iron and manganese, nitrate/nitrite, and sulfate (monitored natural attenuation parameter results are discussed in Section 5.1.3.4).

2.2.6 Ebey Slough Bank Area Wells (2016)

Three new groundwater monitoring wells (MW-12, MW-13, and MW-14) were installed at the southern margin of the Site adjacent to Ebey Slough in 2016 (HWA 2016). Groundwater samples were collected from the new wells in August 2016 and analyzed for total and dissolved arsenic.

Reported concentrations of total arsenic (5.4 to 9.6 µg/l) and dissolved arsenic (5.6 to 9.3 µg/l) in groundwater samples collected from the three wells were above the MTCA Method A CUL for potable water consumption.

2.3 Nearby Sites

This section provides a summary of nearby properties with environmental investigation and/or cleanup actions based on Ecology's listings and records. The following summaries are based on information included in Ecology's records (electronic and hard copy files). The WSDOT Bridge and Ebey Park site adjoin the Site to the west, and the First Stop Deli site adjoins the Site to the north of AOC 1. Geddes Marina and the Welco Property are located west of Ebey Park. Nearby site locations are shown on Figure 1.

Data from the referenced reports are provided in Appendix D, and complete copies of the reports are included in Appendix C.

[Note: The Ebey Park (Section 2.3.3), Geddes (Section 2.3.4), and Welco Property (Section 2.3.5) sites appear to have a similar development history to the Interfor Site, including levee construction and placement of fill materials over the native surface during or prior to initial development in the late 1800s (as discussed in Section 1.3), and similar historical uses including mills and wood product manufacturing . In particular, arsenic concentrations in soil and groundwater are similar between all of the sites, but specific onsite sources of arsenic have not been identified (as discussed in Section 7.1.2). This suggests the arsenic concentrations may be attributable to initial development fill placed at these sites and represent regional background conditions rather than site-specific impacts resulting from historical site uses (as discussed in Section 7.1.2.2)].

2.3.1 WSDOT Bridge Site

The WSDOT Bridge site adjoins the southern portion of the Interfor Site to the west and includes most of the former boat manufacturing facility (AOC 3). As previously discussed, WSDOT acquired the property from the City in 2009 for replacement of the State Avenue bridge across Ebey Slough. Prior to bridge construction, WSDOT conducted an ESA (GeoEngineers 2009) and subsequent remedial action (GeoEngineers 2011).

Eleven soil borings (B-1 through B-11) were advanced by WSDOT in 2009 (see Figures 5 and 6), and soil and reconnaissance groundwater (five locations) samples were collected. Analyses included TPH (GRO, DRO, ORO), BTEX, halogenated VOCs (HVOCs), PAHs, metals (As, Cd, Cr, Pb, and Hg), and hexavalent chromium, but specific analyses varied for each sample location.

The investigation identified concentrations of arsenic, lead, and total cPAHs above MTCA Method A CULs in soil samples. Arsenic was reported at concentrations above the MTCA Method A CUL at two locations [B-7 (21 mg/kg) and B-10 (28 mg/kg)], lead at one location [B-11 (310 mg/kg)], and total cPAHs (based on TEF summation) at one location [B-11 (0.34 mg/kg)].

DRO was reported in one reconnaissance groundwater sample (B-11) at a concentration of 1,500 µg/l, above the MTCA Method A CUL of 500 µg/l.

Based on the results of the 2009 investigation, WSDOT performed a remedial action in 2010 including excavation and offsite disposal of approximately 1,480 cy of impacted soil and debris (described as brick, wood, and construction debris) from three excavation areas (GeoEngineers 2011). The WSDOT excavations were performed in the areas around borings B-7, B-10, and B-11, and are shown on Figures 5 and 6. Confirmation soil sampling was performed in each of the excavation areas to verify removal of affected soil. Analyses included PAHs, metals (As and Pb), PAHs, and PCBs for all three excavation areas, and TPH (GRO, DRO, ORO) and BTEX for excavations around B-7 and B-11.

During excavation activities in area B-11, a 250-gallon UST with approximately 15 feet of associated piping was discovered. The UST was decommissioned and removed during the remedial action, and confirmation soil sampling included the area around the UST and piping. In addition, two 55-gallon drums were discovered in the B-11 excavation area and removed.

The contents of the drums (described as fiberglass compound with pigments) were analyzed for waste characterization purposes, and various SVOC, PAH, VOC, and metals analytes were detected. For reference, detected concentrations of cPAHs, BTEX, HVOCs [trichloroethene (TCE) and tetrachloroethene (PCE)], cadmium, and lead were above MTCA Method A soil CULs in the drum materials. Final confirmation soil samples collected from the vicinity of the UST and drums did not contain COCs at concentrations above CULs.

Excavation was performed in an iterative process, based on confirmation soil sample results. Interim confirmation soil samples (collected from areas that were subsequently over-excavated) included concentrations of arsenic (up to 40 mg/kg; areas B-7 and B-11), lead (up to 930 mg/kg; area B-11), ORO (up to 2,800 mg/kg; area B-11), and total cPAHs (up to 2.81 mg/kg; area B-11) above MTCA Method A CULs. COC concentrations in final confirmation soil samples were all below MTCA Method A CULs. Although below the soil CUL, detected concentrations of DRO (up to 270 mg/kg) and ORO (up to 1,700 mg/kg) in final soil confirmation samples could be related to the TPH-related groundwater impacts (suspected to be from an upgradient, off-property source) identified in the southwestern portion of the Site (refer to Section 5.1.3.2).

Groundwater was encountered in each of the excavation areas and was reportedly removed using a vactor truck and disposed offsite (GeoEngineers 2011). No additional testing of groundwater was performed, and no monitoring wells were installed.

Ecology issued an Early Notice Letter for the WSDOT Bridge site (Ecology FSID 23670 and CSID 12040) on 25 March 2014, indicating that the property would be listed as a site know to be contaminated by hazardous substances (Ecology 2014). Presumably, the listing is based on potential DRO impacts to groundwater identified during the 2009 investigation but not evaluated during or after the soil removal action.

The WSDOT site is considered a potential source for the petroleum hydrocarbon impacts to groundwater identified in the southwestern portion of the Interfor Site (see Section 7.1 for additional discussion), and for the soil impacts previously discussed in association with AOC 3 (see Sections 2.2.1 and 2.2.3).

2.3.2 First Stop Deli

The First Stop Deli site is located northwest of the Interfor Site, adjoining the MW-7 area (AOC 1) to the north, and the northern log yard (AOC 4) to the west. The site includes a service station, car wash, deli and mini-mart, and a tire center. The service station has four 10,000-gallon USTs, three contain gasoline and one contains diesel (see Figure 2). A June 2016 Leak Testing Checklist submitted to Ecology did not indicate any test failures. Ecology's UST site listings show four currently operational USTs at the First Stop Deli site including three 10,000-gallon gasoline USTs and one 10,000-gallon diesel UST.

A release of gasoline was discovered during a fuel system upgrade and was reported to Ecology in July 1996 (Omega 1996). Ecology subsequently added the site to its LUST list (#376125).

A 1996 Phase II ESA (Omega 1996) included advancing 17 hand-auger soil borings within and around the UST area. Field screening [using a photoionization detector (PID)] was performed at each boring location, and soil samples from five borings around the perimeter of the UST area (three of which were located between the USTs and the Interfor Site) were analyzed for GRO and BTEX. Benzene was reported at a concentration of 0.16 mg/kg, above the MTCA Method A CUL, in one boring located west of the USTs near State Avenue. GRO concentrations above the MTCA Method A CUL were suspected in the UST area based on field screening results [PID readings up to 579 parts per million (ppm)]. Omega concluded that the lateral extent of petroleum hydrocarbon-impacted soil was limited to the immediate UST area. Groundwater was observed at 2.5 to 4 feet bgs but was not sampled at the time.

An additional ESA was performed in 1997 (Brewer 1997) which included installation and sampling of three monitoring wells (identified as MW-1 through MW-3). Two of the wells (MW-2 and MW-3) were located south of the UST area, between the USTs and the Interfor Site. GRO, BTEX, and lead concentrations in soil samples collected from the monitoring well borings were below MTCA Method A CULs. Benzene was reported in groundwater samples collected from well MW-1, located southwest of the USTs near State Avenue, at concentrations above the MTCA Method A CUL (up to 27 µg/l). The 1997 report shows a groundwater flow direction to the west, but with a very flat gradient. The 1997 report indicates that Omega previously installed a vapor extraction system (VES) at the First Stop Deli site, but additional details were not available.

Groundwater sampling was performed at well MW-1 in 1999 (Adapt Engineering 1999), and GRO and BTEX concentrations were reported below MTCA Method A CULs. In June 2012, Ecology issued an No Further Action (NFA) letter for the First Stop Deli site (Ecology 2012b). The NFA letter indicates that the site met the Method A CULs for soil and groundwater and lists the site COCs as GRO and benzene. No other sampling data was reported for the three wells installed in 1997, and their current status is unknown.

Although the NFA letter was issued by Ecology for impacts related to the 1996 release, Ecology’s well log database includes recent (October to December 2016) driller’s logs for the First Stop Deli site. The logs indicate that two new monitoring wells were installed, and approximately 12 soil borings were advanced for environmental soil and groundwater sampling. No additional information regarding recent investigation activities was included in Ecology’s site records.

The First Stop Deli site is located upgradient from the Interfor Site and is a potential source of petroleum hydrocarbon compounds in groundwater and surface water,. Copies of the referenced reports are included in Appendix C.

2.3.3 Ebey Waterfront Park

The Ebey Park site is located west of the Interfor Site across State Avenue. The property was redeveloped by the City in approximately 2005 as a park and boat launch facility. The Ebey Park site was initially developed in the late 19th century (GES 1996). Historical site uses primarily included multiple shake and lumber mills, but also included a service station and junk yard located on the northeastern portion of the site (GES 1996).

Environmental investigations were performed prior to property redevelopment in 1997 and 2001. A 1997 Phase II ESA (GES 1997) included excavation of five test pits, installation of three groundwater monitoring wells, and collection of soil and groundwater samples for chemical analysis. DRO (up to 2,000 µg/l) was reported in groundwater samples and cadmium (up to

5.6 mg/kg) and cPAHs (>0.100 mg/kg total) were reported in soil samples at concentrations above MTCA Method A CULs. The 1997 ESA also included a test pit exploration for possible USTs in the former service station area, but no USTs were encountered. An ESA performed in 2001 (Hammond Collier 2001) included advancing six soil borings completed as groundwater monitoring wells. The following compounds were reported in groundwater samples at concentrations above MTCA Method A CULs: arsenic (up to 22.0 µg/l), lead (up to 19.2 µg/l), chromium (up to 66.3 µg/l), and naphthalene (up to 166 µg/l). The following compounds were reported in soil samples at concentrations above MTCA Method A CULs: arsenic (up to 21.5 mg/kg), and GRO (up to 310 mg/kg). COC impacts identified in the ESAs appeared localized (i.e., occurred at a limited number of locations).

The 2001 ESA describes subsurface soils at the site as alluvial and estuarine silts and sands, locally including high organic content, with up to 15 feet of fill material over the native materials. The 1997 ESA indicates that the source of the fill is unknown. According to the 1997 ESA, depths to groundwater ranged from 1.5 to 7.5 feet bgs, and the 2001 ESA indicates a shallow groundwater gradient to the south. The 2001 ESA suggests that the arsenic impacts to groundwater may be related to migration onto the site from the north, but sources of other COCs appear to be related to historical site uses.

Remediation activities appear to have been performed (to some degree) during property redevelopment, but Ecology’s files do not include detailed documentation. According to a 2008 Site Hazard Assessment (SHA) (Snohomish Health District 2008), the redevelopment project documents (primarily bid change orders) included disposal receipts for contaminated soils at a facility in Everett (Rinker), but does not indicate any quantities. The SHA also indicates that a City Engineer (name not provided) interviewed for the SHA believed that all or most of the affected soil identified in the Phase II ESAs had been removed. The City Engineer also indicated that a groundwater interception system had been installed between the property and Ebey Slough with groundwater discharged to the City’s sanitary sewer. No formal reports documenting cleanup activities or groundwater collection were included in Ecology’s files or referenced in other materials reviewed.

In August 2005, a Further Action Determination letter was submitted to the City by Ecology (Ecology 2005) based on a review of materials submitted to Ecology under the VCP (ID#NW1200). The letter indicated that additional site characterization (including assessment at former tank locations and evaluation of groundwater discharges to Ebey Slough surface water) and documentation of remedial actions (cap designs, soil stockpile data, confirmation and compliance monitoring data) were needed. However, no documentation of additional work or documentation of cleanup actions was included in Ecology’s files, and a VCP Notification of Pending Inactive Determination Status was submitted to the City by Ecology in July 2008 (Ecology 2008a). Ecology lists the current status of the Ebey Park site as Cleanup Started.

Based on the information reviewed, migration of COCs from Ebey Park onto the Interfor Site is possible from the northern portion of the Ebey Park site. Contamination at the Ebey Park site was typically localized and the reported concentrations, although above MTCA Method A CULs in some cases, were relatively low. Although detailed documentation was not included in Ecology’s files, it appears that impacted soil was removed from the Ebey Park site during redevelopment. The groundwater gradient described for Ebey Park site is generally to the south, cross-gradient to the Interfor Site which is located west of Ebey Park. However, groundwater elevation monitoring performed for the RI, which included two wells in the northern portion of the Ebey Park site (see Section 3.7), indicates a potential southeast gradient direction (towards the Interfor Site) in the northern part of the Ebey Park site. If impacted media remain, particularly in the vicinity of the former service station located in the northwestern portion of the Ebey Park site, migration of COCs onto the Interfor Site is possible.

2.3.4 Geddes Marina

The Geddes Marina site (Geddes) is located immediately west of the Ebey Park site. The property is owned by the City and is currently vacant. Historical site uses primarily included marina, sawmill, and shingle mill operations, with various retail and commercial storefronts located on the northern portion of the site adjacent to 1st Street (AES 2010).

A former 500-gasoline UST, which had been previously filled with sand, was discovered in the northeastern portion of the site in 2000 (Riley Group 2000). Concentrations of GRO and BTEX above MTCA Method A CULs were reported in soil and reconnaissance groundwater samples collected from hand-auger borings located in the UST area in February 2000 (Riley Group 2000). In June 2000, the UST was removed, and five confirmation soil samples were collected from the base and sidewalls of the excavation following UST removal (Shannon and Wilson 2000). GRO and BTEX concentrations were below MTCA Method A CULs in the UST confirmation soil samples (although the reporting limit for benzene was above the current soil CUL).

Additional environmental investigations were performed throughout the Geddes site between 2008 and 2015 and are summarized in a 2015 Site Assessment Report (Maul Foster & Alongi 2015). Investigation activities included collection and analysis of soil and groundwater samples throughout the upland portions of the site. [Note: Sediment sampling in an onsite lagoon was also performed but is not discussed herein; refer to the referenced report (included in Appendix C) for additional information].

The following compounds were reported in soil samples at concentrations above MTCA Method A CULs: arsenic (up to 56.9 mg/kg), lead (up to 544 mg/kg), and cadmium (up to 60.5 mg/kg). Samples with lead and cadmium concentrations above CULs were collected from the southern portion of the Geddes site, except one location near the former UST in the northern area (cadmium at 4.09 mg/kg). Soil samples with arsenic concentrations above the MTCA Method A CUL were collected at various locations throughout the Geddes site, and ranged from 2.42 to 56.9 mg/kg. The 2015 Site Assessment Report suggests that the spatial distribution of copper and zinc (although below MTCA Method A CULs) are generally similar to arsenic (higher concentrations nearer the onsite lagoon), but does not identify a specific source for arsenic.

The following compounds were reported at concentrations above MTCA Method A CULs in groundwater samples collected from Geddes site monitoring wells in 2015: total (unfiltered) arsenic (up to 13 µg/l), ORO (up to 1,800 µg/l), and DRO (up to 530 µg/l). For reference, reconnaissance groundwater samples collected in 2008 reported concentrations of arsenic (up to 178 µg/l), cadmium (up to 19 µg/l), lead (up to 3,040 µg/l), mercury (up to 3 µg/l), ORO (up to 25,000 µg/l), and DRO (up to 7,000 µg/l) above MTCA Method A CULs (Note: Reconnaissance groundwater samples are generally considered to be biased high due to relatively high turbidity of the samples, and are typically used only as a screening tool).

Based on the location of the Geddes site relative to the Interfor Site, migration of contaminants from the Geddes site onto the Interfor Site is unlikely. Ecology lists the current status of the Geddes site as Awaiting Cleanup.

[Note: Groundwater samples were collected from two existing Geddes wells, GM-02 and GM-03, in July and September 2018. Arsenic (dissolved) was detected at concentrations of 2.34 to 4.73 µg/l. Groundwater sample results for arsenic are discussed in greater detail in Section 5.1.3.]

2.3.5 Welco Property

The Welco Property (Welco) is located west of the Geddes site, with an elevated railroad track separating the two sites. The Welco site is owned by the City and is currently vacant expect for construction materials storage and staging on part of the site. Phase I ESAs performed for the Welco site in 2008 (URS 2008) and 2016 (HWA 2016) indicated primary historical uses of the site included lumber-mill related facilities and automotive repairs, with initial development documented as early as 1892 (presumably following levee construction and backfilling, as described in Section 1.3).

A subsurface investigation was performed at the Welco site in April 2016 (HWA 2016), and included advancement of 19 soil borings up to 10 feet bgs, collection of soil samples from each boring, and collection of reconnaissance groundwater samples from seven of the borings. Analyses included GRO, DRO, ORO, BTEX, VOCs, PAHs, and metals (dissolved for groundwater samples) but specific analyses varied by location.

Contaminants reported in soil samples at concentrations above MTCA Method A CULs included DRO (3,800 mg/kg; one location), ORO (up to 13,000 mg/kg; 3 locations), and lead (21,000 mg/kg; one location). Arsenic was detected in one soil sample at a concentration of 16 mg/kg, below the MTCA Method A soil CUL.

Contaminants reported in reconnaissance groundwater samples at concentrations above the MTCA Method A groundwater CUL included GRO (1,900 µg/l; one location), DRO (up to 13,000 µg/l; six locations), ORO (up to 12,000 µg/l; seven locations), dissolved chromium (120 µg/l; one location), dissolved lead (up to 93 µg/l; three locations), and dissolved arsenic (up to 75 µg/l; three locations). [Note: Although metals samples were filtered, reconnaissance groundwater samples are generally considered to be biased high due to relatively high turbidity of the samples, and are typically used only as a screening tool].

The 2016 ESA (HWA 2016) does not identify a specific source of arsenic related to historical site uses, but suggests that arsenic concentrations detected in groundwater may be a result of partitioning to groundwater from shallow fill materials, possibly mobilized by reducing conditions related to the presence of relatively high TPH-related impacts at the site. The occurrence of elevated arsenic concentrations in groundwater, although arsenic concentrations detected in soil samples are relatively low, is generally consistent with conditions observed at the Interfor Site and other nearby sites (WSDOT, Geddes, Ebey Park), suggesting that arsenic concentrations in groundwater may represent regional background conditions rather than site-specific impacts (see Section 7.1.2.2 for additional discussion).

[Note: Two background monitoring wells, MWBG-08 and MWBG-09, were installed along the northern margin of the Welco site in 2018 and sampled in July and September 2018. Arsenic (dissolved) was detected at concentrations of 4.80 to 9.67 µg/l. Arsenic concentration detected in soil samples collected during well installation ranged from 1.78 to 16.6 mg/kg. Soil and groundwater sample results for arsenic are discussed in greater detail in Section 5.1.2 (soil) Section 5.1.3 (groundwater).]

Based on the location of the Welco site relative to the Interfor Site, migration of contaminants from the Welco site onto the Interfor Site is unlikely. The Welco site is not currently listed by Ecology as a cleanup site.

2.4 Historical Summary and Data Gaps

Previous environmental investigation and interim remedial actions were performed at the Site between 1996 and 2016. Interim remedial actions included 1) removal of six USTs; four in AOC 5, one in AOC 2, and one in AOC 3 (on the adjoining WSDOT Bridge site) which likely acted as sources of impacts to soil and groundwater, and 2) removal of approximately 1,500 tons of primarily petroleum hydrocarbon-impacted soil from three Site areas (AOC 1, AOC 2, and AOC 5), plus removal of over 2,000 tons of petroleum hydrocarbon/metals-impacted soil from the adjoining WSDOT Bridge site (former boat building facility, AOC 3) which acted as ongoing sources of COCs in Site groundwater.

Although the primary known COC sources were removed from the Site, additional data needs (i.e., data gaps) were identified to characterize remaining impacts to environmental media based on the historical investigations and remedial actions, as summarized in Ecology’s 2017 opinion letter (Ecology 2017) and listed below.

- **AOC 1.** Additional evaluation of the nature and extent of petroleum hydrocarbon-affected media remaining around and downgradient of well MW-7 is needed, including evaluation of residual impacted soil remaining adjacent to well MW-7, and groundwater conditions downgradient from the MW-7 well area.

- **AOC 2.** No specific data gaps were identified related to releases from a former UST in this area. Additional groundwater monitoring at wells located west (MW-6) and south (MW-10 and MW-11, presumed downgradient) of the former UST is needed to verify current conditions.

- **AOC 3.** Most of the former AOC 3 area was acquired by WSDOT in 2009 (see Section 2.3.1). However, COCs, including cPAHs, arsenic, and methylene chloride, have been identified at concentrations above potential CULs in test pits (TP-5, TP-8, and TP-9) advanced on the Site to the east and southeast of the WSDOT work area. Consequently, additional evaluation of environmental media in the southwestern portion of the Site is needed to characterize current conditions.

- **AOC 4.** Previous investigations in the AOC 4 area, including both the former north and south log yard areas, have been limited in scope. Additional evaluation of environmental media is needed to characterize current conditions in the former north and south log yard areas.

- **AOC 5.** No specific data gaps have been identified for AOC 5. Additional groundwater monitoring at well MW-1R, located downgradient from the former Kiln UST area, is needed to verify current conditions.

- **AOC 6.** Evaluation of shallow soil conditions is needed throughout the Site, primarily to characterize the fill materials (including anthropogenic fill) in the uppermost 5 to 7 feet bgs. AOC 6 overlaps the other five Site AOCs, but also includes portions of the Site not included in the other AOCs, such as the former saw mill area located between AOC 2 and Ebey Slough.

Section 3: Site Characterization

This section presents a summary of the Site characterization activities performed at the Site during the RI. Site characterization activities were conducted to evaluate the nature of extent of COC concentrations in Site media (soil, groundwater, and surface water), and to evaluate Site hydrogeologic conditions. The findings and results of Site characterization activities are presented in Section 4 (geology and hydrogeology) and Section 5 (analytical, aquifer testing, and statistical evaluation results). The Site characterization findings were used to develop a conceptual site exposure model (CSEM) (Section 7), including potential COC transport and exposure pathways, and to develop cleanup alternatives for the Site (FS Sections 9 through 13).

3.1 Work Performed

The activities conducted during the RI are summarized below. Work was conducted or overseen by Kennedy/Jenks field personnel.

- Site reconnaissance and assessment of existing underground utilities.

- Assessment of background arsenic concentrations in groundwater, including assessment of regional area arsenic data from off-property wells (Section 3.3).

- Excavation of 15 test pits (2017-TP-1 through 2017-TP-15) and collection of soil samples in October 2017 (Section 3.4).

- Advancement of 23 soil borings from October 2017 and September 2018, with 13 completed as groundwater monitoring wells (Sections 3.4 and 3.5). Monitoring wells included three new on-property wells to supplement the existing well network for characterization of Site COCs, and 10 background wells (six off-property and four around the property perimeter) for characterization of background (i.e., upgradient) groundwater conditions (primarily for arsenic). In addition, three existing off-property wells were utilized for background arsenic groundwater sampling.

- Collection and laboratory analysis of 88 soil samples (including four duplicates) from test pits (October 2017 and May 2018), soil borings (October 2017, January 2018, June 2018, and September 2018), and one composite surface soil sample (November 2017).

- Collection and laboratory analysis of 10 reconnaissance groundwater samples (including one duplicate) at nine soil boring locations in October 2017 and June 2018.

- Performance of five rounds of groundwater monitoring for 21 Site wells, including eight background wells (seven new wells plus one existing well located on the Ebey Park site) and 13 on-property wells (three new and 10 existing wells) in October 2017, November to December 2017, January 2018, July 2018, and September 2018. In July 2018 and September 2018, five additional wells were sampled including three new off-property background wells [two installed on the Welco Property (see Section 2.3.5) west of the main Site and one on City property east of the main Site] and two existing off-property wells located on the Geddes site (see Section 2.3.4). Groundwater monitoring included measurement of groundwater elevations and collection and laboratory analysis of groundwater samples (Section 3.5 and 3.7). In addition to the primary groundwater sampling events, samples were periodically collected from select wells for general chemistry parameters and specific COCs.

- Performance of surface water monitoring at on-property catch basins, water in the eastern drainage ditch, storm drain outfalls to the eastern drainage ditch, water in Ebey Slough, and outfalls to Ebey Slough (Section 3.6). Surface water monitoring included collection and laboratory analysis of surface water samples, measurement of surface water elevations (eastern drainage ditch and Ebey Slough), and observation of surface water runoff at the Site. Surface water monitoring was performed between November 2017 and September 2018.

- Surveying of monitoring well, test pit, soil boring, outfall, and drainage ditch locations and elevations, and general Site features (structures, paved areas, fences, surface elevations, etc.). Surveying was performed by a licensed surveyor (True North of Everett, Washington) on 7 November 2017, and at various times by Kennedy/Jenks field personnel using a hand-held Global Positioning System (GPS) unit (Section 3.10).

- Extended water level monitoring using pressure transducers deployed in monitoring wells MW-01R, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16, MWBG-3, and MWBG-6, in Ebey Slough, and in the eastern drainage ditch (Section 3.8). Extended water level monitoring was performed to assess potential tidal influences in wells near Ebey Slough, and to evaluate the elevation of surface water relative to Site groundwater (i.e., to facilitate evaluation of potential groundwater seepage to surface water in bank areas adjacent to the eastern ditch and the slough).

- Performance of slug testing, including rising and falling head slug tests, at five wells (MW-1R, MW-12, MW-13, MW-16, and MWBG-6) in January and February 2018 Section 3.9). Slug testing was performed to assess aquifer parameters and provide data for evaluation of COC migration in groundwater.

The 2017 and 2018 investigation locations are shown on Figures 9 and 10.

3.2 Analytical Methods

This section provides a summary of the analytical methods used for soil, groundwater, and surface water samples collected during the RI.

Samples were typically submitted for the primary analyses listed below, although specific analyses varied for each sample. Primary analyses performed for each sample collected during the RI are listed in the analytical results tables (Tables 4 through 9; discussed in Section 5).

- GRO using Ecology Method Northwest Total Petroleum Hydrocarbons as Gasoline (NWTPH-Gx).

- DRO and ORO using Ecology Method Northwest Petroleum Hydrocarbons as Diesel Extended (NWTPH-Dx) without silica gel cleanup.

- BTEX using U.S. Environmental Protection Agency (EPA) Method 8260.
- VOCs using EPA Method 8260.
- Total (soil and water) and dissolved (water only) metals using EPA Methods 6010 and 6020. Dissolved metals samples were field filtered using an inline 0.45-micron filter. Metals analyses typically included arsenic (soil and water), lead (primarily water samples), and RCRA 8 metals (select soil samples).
- PAHs using EPA Method 8270, including Select Ion Monitoring (SIM) as needed.

Select samples were submitted for additional analyses as listed below:

- VPH and extractable petroleum hydrocarbons (EPH) using Ecology methods.
- Arsenic speciation (arsenic III and arsenic V) using standard laboratory methods [Pace Analytical Services of Minneapolis, Minnesota (Pace)] by ICPMS (groundwater only).

Select groundwater samples were also analyzed for general chemistry and monitored natural attenuation (MNA) parameters as listed below:

- Nitrate/nitrite by standard method 353.2.
- Sulfate and/or chloride using standard method 9056A.
- Metals (total and/or dissolved) metals including calcium, iron, magnesium, manganese, potassium, and sodium using EPA Method 6020.
- Alkalinity (total, carbonate, and bicarbonate) using standard method 2320 B-2011.
- Hardness (as calcium carbonate) using standard method 130.1.

Samples were submitted to the analytical laboratories under standard chain-of-custody protocol. Samples were handled as described in the standard operating guidelines (SOGs) provided with the Work Plan, including packing with ice in coolers for shipment to the analytical laboratories. Analytical methods, including laboratory methods, containers, and preservative requirements, were conducted in general accordance with laboratory specifications and the RI Work Plan, Sampling and Analysis Plan (SAP), and Quality Assurance Project Plan (QAPP) (Kennedy/Jenks 2017). These documents are included in Appendix C. See Section 3.12 for additional discussion of quality assurance/quality control (QA/QC) samples.

Most of the samples collected during the RI were submitted ESC Lab Sciences (ESC) of Mount Juliet, Tennessee, an Ecology-certified laboratory, for the primary analyses listed above. During the course of this project ESC was purchased by Pace. Select soil samples were submitted to ALS Environmental Laboratory (ALS) in Everett, Washington, for VPH/EPH analysis, and select groundwater samples were submitted to Pace in Minneapolis, Minnesota, for arsenic speciation.

Data received from analytical laboratories was reviewed and validated by Kennedy/Jenks. Overall, the findings of our data validations indicate the analytical data are appropriate for their intended use. Analytical results for soil, groundwater, and surface water samples are discussed in Section 5.1. Data validation is discussed in Section 5.1.1.

3.3 Background Arsenic Assessment

A background arsenic evaluation was conducted to support evaluation of Site conditions and develop potential cleanup standards related to arsenic. As part of this assessment, a search was conducted for wells located near the property that could be used to evaluate regional and local area background arsenic concentrations in groundwater (Section 3.3.1), and a statistical analysis was performed using Site groundwater data collected in 2017 and 2018 (Section 3.3.2). Additional information regarding the background arsenic assessment was presented to Ecology in a Draft Technical Memorandum (Kennedy/Jenks 2017b, copy provided in Appendix E).

3.3.1 Area Well Evaluation

Two sources of information were reviewed to identify potentially useful wells for the statistical evaluation of background arsenic concentrations in groundwater near the property. The sources included Ecology's EIM database (Ecology 2017, accessed 21 August 2017) for resource protection (i.e., monitoring) wells, and a database of Snohomish County water supply wells provided by Ecology in August 2017 (Ecology 2017b).

Based on the databases reviewed, the existing wells were insufficient to perform a statistical evaluation. No Snohomish County water supply wells were identified within a 1-mile radius of the Site, and only two shallow (<50-foot deep) wells were identified within a 5-mile radius of the Site. Additional information regarding arsenic in background wells is presented in the Draft Technical Memorandum (Kennedy/Jenks 2017b, copy provided in Appendix E) and in Section 5.5.

3.3.2 Statistical Evaluation

As discussed above, insufficient data was available to perform a statistical analysis for background arsenic concentrations within 5 miles of the Site. To facilitate the statistical evaluation of background arsenic concentrations in the Site area, 10 background monitoring wells (MWBG-1 to MWBG-10, see Figure 9) were installed at presumed upgradient locations on and near the Site. Background wells installed in 2017 and 2018 included four onsite wells installed along the western and northern margins of the property (perimeter wells), and six wells installed at offsite locations (three on City property to the east, one in Ebey Park to the west, and two on the Welco property to the west of the main Site). In addition, one existing well at Ebey Park (designated EP-1 for RI purposes) and two existing wells on the Geddes Site (GM-02 and GM-03) were also used for background sampling. The offsite properties to the west are discussed in Section 2.3. [Note: No documentation, such as reports or well logs, has been identified for the Ebey Park well. The well was in good condition and appeared to be relatively new, so it is likely not one of the wells installed during the Ebey Park redevelopment (discussed in Section 2.3.3), but no other information was available from Ecology's well databases or Site files, or from the City.]

Groundwater samples were collected from the background wells over five rounds of sampling (October 2017, November 2017, January 2018, July 2018, and September 2018) and analyzed for total and dissolved arsenic (MWBG-08 to -10 and the Geddes site wells were sampled only for the July and September 2018 events). Field parameters, including dissolved oxygen (DO) and oxidation-reduction potential (ORP) were also measured at these locations to facilitate the evaluation of arsenic mobility in groundwater (Section 5.5.2).

Based on laboratory analyses received, a statistical analysis of the total and dissolved arsenic data from background wells was performed using proUCL software. The statistical analysis is discussed further in Section 5.5.1.

3.4 Soil Characterization

This section provides a summary of soil characterization activities including collection of soil samples from borings and text pits, field screening and logging, and analytical testing.

3.4.1 Soil Borings

A Geoprobe^{TM} direct-push drilling rig operated by Holt Services, Inc. of Edgewood, Washington, (Holt), a licensed drilling contractor in the State of Washington, was used to advance 23 soil borings at 17 onsite and six offsite locations (Figure 9). Offsite locations included three on City property to the east, one in Ebey Park to the west, and two on the Welco property to the west of the main Site. Soil borings were typically advanced to a final depth of approximately 15 feet bgs, with the exception of borings 2017-B7 (25 feet bgs),2017-B11 (5.5 feet bgs), MWBG-9 (20 feet bgs), and MWBG-10 (20 feet bgs). Soil samples (all 23 borings) and reconnaissance groundwater samples (nine borings) were collected from the soil borings for laboratory analysis. At 13 locations, the soil borings were completed as permanent groundwater monitoring wells (see Section 3.5.1). Soil boring and well locations are shown on Figure 9. Soil sample intervals and analyses performed are listed in Table 4, and reconnaissance groundwater samples and analyses performed are listed in Table 5.

Borehole logging, screening, and sampling, including soil and reconnaissance groundwater, was performed in general accordance with the SOGs presented in the Work Plan (Kennedy/Jenks 2017a) and as described below.

Prior to performing drilling activities, the following activities were performed:

- Review of utility information provided by the property owner and available online.
- Private utility survey using surface detection methods.
- One-Call utility locate to identify public utilities.
- Advancement of the upper 5 to 6 feet of each soil boring using air-knife techniques (vacuum truck operated by Holt) to assess possible underground utilities.

Soil borings were advanced in the following locations, in general accordance with the Work Plan:

- Six borings [2017-B1, 2017-B2, 2017-B3 (completed as MWBG-2), 2017-B4 (completed as MW-17), and 2017-B5] were advanced in the vicinity of existing well MW-7 to evaluate existing soil and groundwater conditions adjacent to and downgradient from well MW-7 (AOC 1).

- Five borings (2017-B10, 2017-B11, HA-01, HA-02, and HA-03) were advanced near the center of the former North Log Yard (AOC 4).

- Three borings (MW-16, 2017-B7 and 2017-B9) were advanced in the former South Log Yard (AOC 4).

- Three borings (MW-15, 2017-B6, and 2017-B8) were advanced in the southwestern portion of the Site, near Ebey Slough and the Former Boat Manufacturing Facility (AOC 3) and Former Planer Mill (included in AOC 6).

- Four borings (MWBG-2 through MWBG-5) were advanced around the perimeter of the Site property (north and west of the North Log Yard, and west of the MW-7 area) to evaluated background arsenic concentrations.

- One boring (MWBG-1) was advanced in Ebey Park, and three borings (MWBG-6, MWBG-7, and MWBG-10) were advanced on City property east of the Site, to assess background arsenic concentrations.

- Two borings (MWBG-8 and MWBG-9) were advanced west of the site on the Welco property to assess background arsenic conditions.

Continuous soil cores were collected from each boring location for lithologic identification, field screening, and collection of soil samples. The lithology in each boring (except shallow hand auger borings HA-01 through HA-03) was logged by a Kennedy/Jenks geologist in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM D2488). Soil boring logs are included as Appendix F. Soil from each borehole was screened in the field for the presence of petroleum hydrocarbons using a combination of visual and olfactory observations, including sheen testing and headspace screening for VOCs using a PID.

Soil samples retained for laboratory analyses were collected from each soil boring directly from the soil core using either Terra Core samplers, by hand using a clean set of nitrile gloves, or using a decontaminated trowel, and placed directly into laboratory-supplied containers. Soil samples were immediately labeled with the sample identification (ID) and date and time of collection, and placed in a cooler with ice for delivery to the analytical laboratory under standard chain-of-custody protocol. Samples for GRO, BTEX, and VOC analyses were collected using EPA 5035 methodology. Analytical methods are summarized in Section 3.2.

At eight locations where no well was installed (2017-B2, 2017-B5 through 2017-B10, and 2018-B1), reconnaissance groundwater samples were collected following collection of soil cores. A reconnaissance groundwater sample was also collected from test pit 2018-TP-11. Reconnaissance groundwater samples were collected using a temporary polyvinyl chloride (PVC) well screen installed within the direct-push drilling rods. Once the temporary well was placed, the drilling rods were removed to expose the screened interval. Screen sections were either 5 feet or 10 feet long, depending on the saturated conditions and soil types observed at each boring location. The pump intake was typically placed in the upper 5 feet of the saturated interval.

Reconnaissance groundwater samples were collected using a peristaltic pump using low-flow methodology and dedicated polyethylene tubing. Groundwater was purged from each borehole for approximately 20 minutes prior to sample collection to reduce sample turbidity. Each reconnaissance groundwater sample was collected in laboratory-provided containers, labeled with the sample ID, date and time of collection, and placed into an ice-filled cooler for delivery to the analytical laboratory under standard chain-of-custody protocol.

Drilling rods and any reusable sampling equipment were decontaminated between borings using a detergent wash, followed by a water rinse. Soil cuttings and decontamination water were retained in 55-gallon drums for characterization and offsite disposal (Section 3.11).

3.4.2 Test Pits

On 23 and 24 October 2017, 15 test pits (2017-TP-1 through 2017-TP-15) were excavated at the Site. Thirteen additional test pits (2018-TP-01 through 2018-TP-13) were excavated at the Site between 30 and 31 May 2018. Test pits were excavated to collect supplemental information about shallow soil conditions, particularly anthropogenic fill materials. The test pits were excavated to depths of between 4.5 and 9 feet bgs using a backhoe operated by Glacier Environmental Services (Glacier). Test pit locations were advanced in the following locations (also see Figure 5):

- Five test pits (2017-TP-1 through 2017-TP-5) were excavated in the former North Log Yard (AOC 4).
- Nine test pits (2017-TP-6 through 2017-TP10, 2017-TP-15, 2018-TP-01, 2018-TP-07, and 2018-TP-11) were excavated in the former South Log Yard (AOC 4) area.
- One test pit (2017-TP-12) was excavated east of the former Boat Manufacturing Area (AOC 3).
- Three test pits (2018-TP-08, 2018-TP-09, and 2018-TP-13) were excavated in the former Kiln UST area (AOC 5).
- Ten test pits (2017-11, 2017-TP-13, 2017-TP-14, 2018-TP-02 through 2018-TP-06, 2018-TP-10, and 2018-TP-12) were excavated in the southern portion of the Site in the former Garka Mill vicinity (AOC 6). A ductile iron pipe was uncovered at 3.9 feet bgs in test pit 2018-TP-05, and no samples were analyzed from this location.

Soil was collected from each test pit for lithologic identification and field screening. The lithology in each boring was logged by a Kennedy/Jenks geologist, and field screening was performed, in the same manner as described for soil borings in Section 3.4.1. Test pit logs are included in Appendix F.

Soil samples were collected from test pits for laboratory analysis. Soil samples were collected directly from test pit walls when possible (i.e., for shallow samples) and were collected using the backhoe bucket for deeper samples. Soil samples were placed directly into laboratory-supplied containers, labeled with the sample ID and date and time of collection, and placed in a cooler with ice for delivery to the analytical laboratory under standard chain-of-custody protocol. Soil sample depths and analyses performed are listed in Table 5. One reconnaissance groundwater sample was collected from 2018-TP-11. Analytical methods are summarized in Section 3.2.

3.5 Groundwater Characterization

Groundwater characterization performed for the RI included installation and development of 13 new monitoring wells (including the 10 background wells described in Section 3.3), redevelopment of five existing Site wells (MW-1R, MW-6, MW-7, MW-10, and MW-11), and collection and laboratory analysis of groundwater samples from all new and existing wells. Well installation and sampling are discussed below. Additional hydrogeologic characterization, including groundwater elevation monitoring (Section 3.7), tidal fluctuation monitoring (Section 3.8), and aquifer testing (Section 3.9) are discussed in the indicated sections.

3.5.1 Well Installation

Following collection of soil samples, 2-inch-diameter monitoring wells were installed at 13 soil boring locations on 18-20 October 2017 (MW-15 through MW-17 and MWBG-1 through MWBG-7) and 4 June 2018 (MWBG-8 through MWBG-10). Wells were constructed using the direct-push rig operated by Holt which was equipped with a 3-inch-diameter core barrel and disposable drive point.

Monitoring wells were completed using a combination of 2-inch-diameter schedule 40 PVC solid casing and 2-inch-diameter machine-slotted casing with 0.010-inch slot size and pre-packed PVC screen with 10/20 silica sand. Wells were completed with either a 10-foot or 5-foot screened interval, with the top of the interval generally between 3 and 4 feet bgs. See Appendix F for boring logs and Table 2 for well construction details (new and existing wells). Once the casing and screen section was placed, additional silica sand was poured around the pre-pack screen until the sand extended approximately 1 foot above the top of the screen. The top of the well was sealed with 3/8-inch hydrated bentonite chips to within approximately 1 foot of the ground surface. Wells were either finished to match existing grade with an 8-inch traffic-rated flush-mounted monument set in concrete, or completed with a steel aboveground stand-pipe monument (MWBG-3 only).

New monitoring wells were developed after completion using a combination of surging and pumping with a submersible pump to remove fine-grained sediments from the filter pack and well casing. Wells were alternately surged and pumped until the purge water was generally free of visible turbidity. Existing monitoring wells MW-1R, MW-6, MW-7, MW-10, and MW-11 were also redeveloped using the same techniques [wells MW-12, MW-13, and MW-14 did not require redevelopment as they were recently (2016) installed and sampled].

3.5.2 On-Property Monitoring Well Groundwater Sampling

For RI discussion purposes, the on-property wells include the 11 new and previously installed wells (MW-1R, MW-6, MW-7, and MW-10 through MW-17) that are not designated as background (i.e., MWBG-##, EP-1, GM-2, GM-3) wells and are located within the margins of the main Interfor property. The primary purpose of the on-property wells is to evaluate the nature and extent of COC impacts related to previously documented releases (Section 2.2) and the general condition of Site groundwater. These wells are considered to be representative of Site conditions and are addressed separately from wells considered to be representative of background conditions (see Section 3.5.3).

Groundwater sampling at on-property wells was conducted during five primary monitoring events on 25 and 26 October 2017, 30 November to 1 December 2017, 8 and 9 January 2018, 16 to 19 July 2018, and 21 to 28 September 2018. All 11 on-property wells were sampled during each of the five primary monitoring events. Additional groundwater sampling was performed for select wells on 22 January 2018 (MW-6, MW-14, and MW-15), 30 January 2018 (MW-14), and 1 February 2018 (MW-12 and MW-13). Specific analyses performed for each groundwater sampling event are listed in Table 6. Groundwater elevations were measured in all wells prior to sampling during the primary monitoring events (discussed in Section 3.7).

Groundwater was sampled from each on-property well using low-flow purging and sampling techniques. A peristaltic pump was used to purge groundwater prior to collection of groundwater samples. Wells were purged until groundwater field parameters, including temperature, pH, specific conductance, DO, and ORP were stabilized (as described in the Work Plan). Groundwater purge and sample forms are included in Appendix G.

Following purging, groundwater samples were collected in laboratory-supplied containers. Following collection, samples were labeled and placed in an ice-filled cooler for transportation under chain-of-custody protocol to the analytical laboratory. Laboratory analytical methods are described in Section 3.2.

In general, groundwater samples from on-property wells were analyzed for GRO, DRO, ORO, BTEX, and total and dissolved arsenic and lead, but varied by location. Select samples were also analyzed for MNA parameters, general chemistry parameters, VOCs, and PAHs. Analyses performed for each sample are shown in Table 6 (primary metals and organics analyses) and Table 8 (MNA and general chemistry).

3.5.3 Background Well Sampling

For RI discussion purposes, background wells include 13 wells at presumed upgradient locations along the western and northern perimeter of the Interfor property (four wells), and at off-property locations to the east (three wells) and west (six wells) (see Figure 9). The purpose of the background wells was to monitor COC concentrations, primarily arsenic, in groundwater upgradient from the Site to facilitate the evaluation of potential offsite sources.

Seven of the background wells were installed in 2017 (MWBG-1 through MWBG-7), three were installed in 2018 (MWBG-8 through MWBG-10), and three are existing wells (EP-1, located in Ebey Park, and GM-2 through GM-3, located on the Geddes Marina Site). Groundwater sampling at background wells was conducted during the primary monitoring events on 25 and

26 October 2017 (eight wells), 30 November to 1 December 2017 (eight wells), 8 and 9 January 2018 (eight wells), 16 to 19 July 2018 (13 wells), and 21 to 28 September 2018 (13 wells). Additional sampling at select background wells was performed on 22 January 2018 (MWBG-4) and 30 January 2018 (MWBG-3).

Sampling of background wells was typically performed at the same time as the on-property wells using the same methodology described in Section 3.5.2. Groundwater elevations were measured in all wells prior to sampling for the primary monitoring events (discussed in Section 3.7). Groundwater purge and sample forms are included in Appendix G.

Following purging, groundwater samples were collected in laboratory-supplied bottles. Following collection, samples were labeled and placed in an ice-filled cooler for transportation under chain-of-custody protocol to the analytical laboratory. Laboratory analytical methods are described in Section 3.2.

In general, groundwater samples from background wells were analyzed for total and dissolved arsenic. Select samples were also analyzed for MNA and general chemistry parameters, and/or GRO, BTEX, DRO, and ORO. Analyses performed for each sample are shown in Table 7 (primary analyses) and Table 8 (MNA and general chemistry).

3.6 Surface Water Characterization

A surface water assessment was conducted at the Site to evaluate the potential for COCs at the Site to be transported to surface water in Ebey Slough via the storm drain system and surface water flow at the Site.

The surface water assessment at the Site included:

- Observation and documentation of overland surface water runoff at the Site.
- Collection of surface water samples at the Site following or during rainfall events.
- Collection of samples from Ebey Slough at low and high tides.
- Estimations of discharge from outfalls during storm events.

See Sections 3.6.2 and 5.1.4 for discussion of surface water samples at the Site. Surface water assessment and monitoring field maps, notes, and field sampling documentation are included in Appendix H.

3.6.1 Surface Water Flow

During Site visits, overland flow patterns were observed to assess general surface water flow paths, including areas of standing water. Surface water flow at the Site is primarily overland flow directed into a set of catch basins. The catch basins drain to a ditch along the eastern edge of the property, which discharges to Ebey Slough (see Section 5.1.4). Figure 4 shows the stormwater conveyance system at the Site and surrounding area.

3.6.2 Surface Water Sampling

During 2017/2018 RI field activities, surface water samples were collected from 12 locations, including Ebey Slough. The sampling locations are shown on Figure 10 and included:

- Collection of samples from one catch basin (CB-01) on 21 November 2017, 20 December 2017, and 9 January 2018. This catch basin collects water from a property located to the west of the Site (First Stop Deli site). Water flows into a storm drain line from the catch basin and runs beneath the former North Log Yard and discharges to the eastern drainage ditch (OF-01, see below).

- Collection of samples from two outfalls to the drainage ditch (OF-01 and OF-02) on 21 November 2017, 20 December 2017, and 9 January 2017. Outfall OF-2 drains part of the South Log Yard and the Office Building Area.

- Collection of samples from the eastern drainage ditch [DITCH-01 (upgradient of OF-01) and DITCH-02 (downgradient of OF-02)]. These locations were sampled on 20 December 2017, 9 January 2018, 17 July 2018, and 21 September 2018.

- Collection of samples from outfalls to Ebey Slough (SLOUGH-1 and SLOUGH-2). SLOUGH-1 was sampled on 9 January 2018 and SLOUGH-2 was sampled on 12 January 2018. These locations were also sampled on 21 September 2018.

- Collection of samples from Ebey Slough at low and high tides [SLOUGH(LT) and SLOUGH(HT)] on 9 January 2018. Both locations were also sampled on 21 September 2018 at low tide.

- Collection of samples from Ebey Slough at locations upstream [Slough (upstream)] and downstream [Slough (downstream)} of the slough outfalls on 30 January 2018 and 21 September 2018.

OF-, CB-, and ditch samples were collected using a peristaltic pump. Prior to sample collection, field parameters were measured for approximately 15 minutes. Field parameters are listed in Table 8 (for samples analyzed for MNA parameters) and on surface water sample field notes in Appendix H. Samples collected with a peristaltic pump were collected directly into laboratory-supplied bottles, and immediately labeled and placed into an ice-filled cooler for transfer to a laboratory under standard chain-of-custody procedure.

Samples from outfalls to the slough (SLOUGH-1 and SLOUGH-2) and from the slough at low and high tide were collected using clean laboratory-supplied bottles which were placed in the center of the flowing water. Water was then decanted into the bottles, which were labeled and placed into a chilled cooler for transfer to a laboratory under standard chain-of-custody procedure.

Slough samples were analyzed for total and dissolved arsenic and lead. Catch basin, outfall, and ditch samples were analyzed for total and dissolved arsenic and lead, TPH (GRO, DRO, and ORO), and BTEX. All dissolved metals samples were field filtered using an inline 0.45-micron filter prior to collection in laboratory-supplied bottles. Surface water sampling locations, dates, and analyses performed are listed in Table 9. Analytical methods are listed in Section 3.2.

3.7 Groundwater Elevation Monitoring

Groundwater elevations were measured in onsite and background wells on 26 October 2017, 21 November 2017, 29 November 2017, 22 January 2018, 16 July 2018, and 21 September 2018. Elevations were measured using an electronic oil/water interface probe (OWI). Elevations were recorded to the nearest 0.01 foot and were measured from the northern side of the top of casing (TOC). When groundwater elevation measurements coincide with groundwater sampling events, groundwater elevation measurements were collected prior to collection of groundwater samples. Field equipment was decontaminated between groundwater elevations measurements at each well. See Table 3 for groundwater elevations, and Figures 14 through 19 for potentiometric surface maps based on groundwater elevation measurements. Groundwater elevation data is discussed in Section 4.2.

3.8 Tidal Study

A tidal study was performed to better understand the interaction of tidal fluctuations in the Ebey Slough and their effects on Site groundwater and the ditch (locations are shown on Figures 20 and 21). The tidal study was performed in two phases. The first phase included placement of pressure transducers in monitoring wells located near the Ebey Slough bank (MW-13, MW-14, and MW-15) between 6 December 2017 and 8 January 2018. In addition, a pressure transducer was also placed in a stilling well installed in Ebey Slough and another was placed out-of-water to collect barometric pressure for conversion of the pressure data into water level elevations. Transducers were also placed at three locations in the eastern drainage ditch between 8 and 9 January 2018.

The second phase of tidal monitoring was performed in the same manner as the first and included the same Ebey Slough bank wells plus additional monitoring wells (MW-1R, MW-11, MW-12, MW-16, and MWBG-06) and three locations within the eastern drainage ditch to understand possible influence with surface water in the ditch (refer to Figure 21). The second event was performed between 19 July and 21 Septebmer 2018.

During the both phases, the transducers were programmed to collect a data point every 0.5 hour. Tidal study results are discussed in Sections 4.2 and 5.3. Results of the first phase of tidal monitoring are presented on Figure 20, and the second phase on Figure 21. Tidal study data and plots are included in Appendix I.

3.9 Aquifer Testing

Rising and falling head slug tests were conducted on five existing monitoring wells (MW-1R, MW-12, MW-13, MW-16, and MWBG-6) on 30 January and 6 February 2018. These tests were performed to acquire hydraulic conductivity (K) estimates for the shallow saturated zone by lowering a cylindrical slug of known volume into the well, imparting a near-instantaneous rise in head (water level) within the well casing. Pressure transducers were installed to monitor the recovering water level in the well as the aquifer rebounded to equilibrium conditions (falling head test). The slug was then removed from the well, and the rising water level in the well was monitored as it again recovered to equilibrium (rising head test). Aquifer testing results are discussed in Section 5.4 and listed in Table 10, and slug test data and charts are included in Appendix I.

3.10 Site Survey

The locations of monitoring wells (including existing wells and newly installed on-property and background wells), test pits, and soil borings were surveyed on 7 November 2017 by True North Land Surveying (True North) of Seattle, Washington, a Washington State licensed surveyor. Each well was surveyed for its horizontal position, and either ground surface elevation (boring and test pit locations) or TOC and top of monument elevation (wells). TOC elevations were measured to the nearest 0.01 foot. Survey results were recorded using the North American Datum of 1983 (NAD 83) for the horizontal survey datum and were recorded in the Washington State Plane (North) coordinate system. The vertical survey datum was the North American Vertical Datum of 1988 (NAVD 88). Horizontal positions of boring locations advanced in January 2018 were recorded using a handheld Trimble GPS with sub-meter accuracy. Well survey data and general well construction details are summarized in Table 2. Wells, test pits, and soil borings completed after 7 November 2017 (MWBG-8 through MWBG-10, 2018-TP-01 through 2018-TP-13, 2017-B6 through 2017-B11, and 2018-B1) and off-property Geddes Marina wells (GM-2 and GM-3) were not surveyed.

The survey also included general Site features (surface elevations, building corners, fences, etc.), outfalls, catch basins, and drainage ditch depths and water levels. Site survey data and maps are included in Appendix J.

3.11 IDW Characterization

Investigation-derived waste (IDW) generated during RI field activities included drill cuttings, well development and equipment decontamination water, and well purge water. The IDW was placed in 55-gallon drums, labeled, and temporarily stored onsite pending disposal. A waste profile was generated for this general waste stream based on soil and groundwater analytical results. After completion of field activities, the IDW was transported offsite by Cascade Drilling, Inc. of Woodinville, Washington, for disposal at an approved disposal facility. IDW profiling and disposal documents are included in Appendix M.

3.12 QA/QC Analyses

QA/QC samples were collected in general accordance with the Work Plan and QAPP (Kennedy/Jenks 2017a). Field duplicate samples were collected as described in the Work Plan, with the approximate frequency described below:

- Soil: One duplicate for every 20 soil samples analyzed.
- Reconnaissance Groundwater: One duplicate for the MW-7 area assessment.
- Groundwater: One duplicate for each primary monitoring event. Duplicate samples were collected at MW-17, MWBG-06, and MW-14.
- Surface Water: One duplicate for 15 primary samples collected.

Duplicate samples were collected at the same time as the related original samples. Duplicates were assigned unique names (distinct from the original sample name) and submitted “blind” to the analytical laboratory for analysis using the same methods as the original samples. Duplicate sample data is presented on the analytical data summary tables (Tables 4, 5, 6, 7, and 9) for comparison with the original sample data.

Section 4: Hydrogeologic Setting

This section provides an overview of the geologic and hydrogeologic setting of the Site based on published maps and Site investigation observations.

A 1985 United States Geological Survey (USGS) geologic map (Minard 1985; included in Appendix C) describes the surficial geologic unit in the vicinity of the Site as Younger Alluvial and Estuarine Deposits (denoted by Qyal on the map) and indicates the unit is “largely sand, silt, and clay with considerable amounts of organic matter” and includes “tidal flat mud and sand, local peat deposits, and disturbed land and fill.” This description is consistent with the observations from test pits and soil borings advanced at the Site.

The 1985 geologic map, and the historical topographic maps listed in Section 1.3, show multiple marshes in the vicinity of the Site. Multiple small depressions are shown in the area east of the Site (current City wastewater treatment pond area), as is the stream channel visible on historical aerial photographs (see Section 1.3.1). Similar features may have been present on the Site prior to its initial development. The depressions would have been conducive to the deposition of peat, which was encountered throughout the Site (as described below).

4.1 Site Geology

Soil materials encountered in test pits and soil borings at the Site generally included sand and gravel with silt overlying native tide flats or tidal marsh deposits. The fill material locally contains anthropogenic materials such as wood debris, ash, and burned materials. The contact between the fill and underlying native materials, where encountered in test pits and soil borings, is typically sharp. Lithologic descriptions of materials encountered in soil borings and test pits advanced during the RI are included in Appendix F. Historical logs, including consultant’s logs (where available in historical reports), are also provided in Appendix F. Generalized interpretive cross-sections are provided on Figure 11 (Section A-A’), Figure 12 (Section B-B’), and Figure 13 (Section C-C’). The locations of the three cross sections are shown on Figure 9.

The fill materials are typically encountered at the ground surface or immediately beneath paved surfaces (where present). The fill materials are approximately 5 to 10 feet thick at most locations (typically 5 to 7 feet) but may be up to 12 feet thick at former excavation areas in AOC 2 (former UST area excavated in 1996 and 2012) and AOC 5 (former Kiln UST area excavated in 1996).

The fill unit primarily includes materials placed when the Site and surrounding areas were initially developed in the late 19th century, but also includes materials placed in the southeastern portion of the Site when the former stream channel and embayment were filled, materials placed along the bank of Ebey Slough when the existing pathway was constructed, materials used as backfill in excavations, and other fill materials placed at various locations during previous phases of Site development. Excavations for building footings may also be present locally, and support pilings may be present beneath existing and historical building locations.

The types of the fill materials encountered at the Site are variable. The fill materials generally include mixtures of sand and gravel with varying amounts of silt, and locally include other anthropogenic materials such as wood chips, asphalt fragments, concrete fragments, sawdust, and general refuse (such as glass and metal). The fill materials typically encountered include well-graded sand with or without gravel and/or silt, poorly-graded to well-graded gravel with or without sand and/or silt, and silty sand. The source or sources of the fill material is unknown and has not been documented, and may be associated with the arsenic-related impacts to Site soil and groundwater (discussed in Section 7).

As indicated above, soil materials presumed to be native tide flat or tidal marsh deposits are encountered below the fill materials at depths of approximately 5 to 12 feet bgs. The native soils generally include fine-grained sediments (silt and clay) and peat, but sand and silty sand layers (typically interbedded with fine-grained materials) are encountered locally.

Peat was encountered in most of the soil borings that were advanced to sufficient depth, and appears to present beneath most of the Site. Peat typically occurs at the Site in laterally contiguous layers which correlate between borings, but also in laterally separated lenses. At most soil boring locations, the peat layer occurs within the native silt and clay units (i.e., silt/clay layers are present above and below the peat), but it was encountered at or near the top of the native soil sequence at some locations, particularly in the southern portion of the Site.

Typically, the peat layer is approximately 2 to 5 feet thick, but layers less than 1 foot thick were also observed, and some soil borings were terminated within the peat indicating that some layers are likely thicker. The peat layer is shown on the geologic cross sections (Figures 11, 12, and 13).

4.2 Site Hydrogeology

An unconfined shallow saturated zone has been identified throughout the Site. The shallow saturated zone occurs primarily within the fill materials and therefore, was constructed artificially through past filling activities above the former tide flat sediments. Saturated conditions were also observed in the underlying native materials, particularly in sandier intervals. The lower laying saturated zone, when encountered (MWBG-7), was locally under hydrostatic pressure and may represent a separate unit from the shallow saturated zone encountered elsewhere at the Site. In general, the shallow saturated zone appears to be perched above the native materials, which likely restricts the downward movement of groundwater. Additional deeper saturated zones likely exists beneath the fine-grained native materials but were not encountered in soil borings at the Site (other than at MWBG-7), which were typically terminated within native fine-grained or peat materials. The shallow saturated zone is discussed further below.

Groundwater at the main Site (i.e., on-property wells including background wells MWBG-2 through MWBG-5) is generally encountered at a depth of 1 to 6 feet bgs. Water level measurements in on-property monitoring wells (between October 2017 and September 2018) ranged from 0.61 to 6.26 feet below the top of the inner PVC casing (top of casing is approximately 0.5 foot bgs for most wells). Water levels were also measured in nine offsite wells (see Figure 9) and ranged from 2.28 to 8.69 feet below the inner casing (excluding well MWBG-7, which is an artesian well with the potentiometric surface approximately 1.5 feet above the inner casing).

Water levels and gradients (discussed below) are likely affected primarily by conditions in the upper fill unit, which is slightly more coarser-grained (and presumably more hydraulically conductive) than the underlying native fine-grained and peat materials. Slug testing performed at wells MW-1R, MW-12, MW-13, and MW-14 in January 2018 (described in Section 3.9) indicated an average hydraulic conductivity of approximately 3.4E-06 centimeters per second (cm/s). Slug test findings and results are discussed further in Section 5.3, and slug test data and graphical plots are included in Appendix I.

As discussed in Section 3.7, groundwater elevation monitoring was performed at all onsite and background monitoring wells on six occasions between October 2017 and September 2018 [Note: Elevation monitoring prior to July 2018 did not included the background wells installed in June 2018 or the Geddes wells). Elevation monitoring results are summarized in Table 3. Potentiometric surface maps for the shallow saturated zone, based on the groundwater elevation data, are presented on Figures 14 through 19 [Note: Potentiometric surface maps include the main Property only].

The groundwater elevation data indicates an overall hydraulic gradient direction generally to the southeast for most of the Site, but with localized variation in the southeastern corner of the Site (discussed below). The overall southeast gradient direction is evident for each of the monitoring events performed for the RI and is generally consistent with historical findings (Parametrix 2002; HWA 2016b) although additional wells (new onsite and background wells) were included in the recent water level monitoring events. The magnitude of the overall gradient (excluding the southeastern corner of the Site) based on groundwater elevation monitoring ranged from approximately 0.006 to 0.009 feet per foot (ft/ft) and was generally consistent between monitoring events. The estimated average groundwater discharge from the Site was calculated for Ebey Slough [11,789 gallons per year (GPY)] and drainage ditch along the eastern Site margin (7,744 GPY) (estimation methods and parameters are discussed in Section 5.5.2).

Gradients in southeastern portion of the Site show a localized variation in the overall gradient. The lowest potentiometric surface elevation was recorded at well MW-16 during each of the RI monitoring events (prior to installation of well MW-16, the lowest water levels were typically recorded at well MW-1R, which is located in the same general area as well MW-16). Water elevations in well MW-16 were consistently lower than in other wells closest to its location, averaging approximately 3.7 feet lower than well MW-14, 1.85 feet lower than well MW-1R, and 2.49 feet lower than well MW-11. As a result, the groundwater gradient in the southeastern portion of the Site is generally directed towards well MW-16, with local gradient directions to the north, northwest, and northeast (see Figures 14 through 19). The magnitude of the gradient in the southwestern portion of the Site generally ranged from approximately 0.01 to 0.02 ft/ft, but with greater variation between monitoring events than for the overall Site gradient.

The shallow zone gradients at the Site appear to be influenced by existing and historical drainage features, as listed below.

- Drainage ditch located along the eastern margin of the Site (between the Site and Columbia Avenue). Infiltration of groundwater into the drainage ditch could affect the local and overall gradient. This would likely be most evident along the southern half of the eastern Site margin where the drainage ditch is deeper relative to the Site and the exposed bank is higher. Groundwater elevations measured in wells MW-1R [6.28 to 7.65 feet above mean sea level (amsl)] and MW-16 (4.59 to 5.29 feet amsl), located near the drainage ditch in the southern portion of the Site, were higher than surface water levels measured in the eastern drainage ditch [see cross-section Figures 11 and 13) and Section 5.2.2]. The relative water elevations between the wells and the ditch are consistent with a hydraulic gradient towards the ditch, and with groundwater migration to surface water in the ditch.

- Onsite stormwater pipes. With respect to gradients, this primarily includes the section of pipe that discharges to the eastern ditch at outfall OF-2 [i.e., the pipe section located between the most downstream catch basin (southwest of the Kiln Building), and outfall OF-2] (see Figure 4). Groundwater seepage into the pipe, or preferential migration in coarser-grained pipe bedding materials, could affect the local gradient.

- Utility corridor along Columbia Avenue. The City storm and sewer utility corridors located along Columbia Avenue could affect the overall Site gradient by seepage into pipes or preferential migration in coarser-grained pipe bedding materials.

- Former stream channel. The former stream channel discussed in Section 1.3.1 bisects the southeastern portion of the Site in close proximity to well MW-16. Fill materials placed in the former stream channel are likely coarser than the surrounding native materials, and relatively coarse-grained sediments (i.e., sand) may be present within the stream channel. The depth of the channel is uncertain, but it appears to be somewhat deeper than the fill thickness (i.e., the channel fill materials extend vertically through the other fill materials and into the underlying native materials). Preferential groundwater migration within the former stream channel could have a significant influence on local groundwater gradients.

The shallow saturated zone does not generally appear to be influenced by significant tidal fluctuations in Ebey Slough, except as noted for wells located immediately adjacent to the slough where a varying degree of tidally-influenced water level variation was identified. The results of the tidal evaluation (refer to Section 5.3) which included Ebey Slough near-bank wells MW-12, MW-13, MW-14, and MW-15 (and the drainage ditch along the eastern margin of the Site for the second event plus additional upland wells) indicate a limited response to tidal fluctuations in wells MW-12, MW-13, and MW-15 (see Figures 20 and 21). Water levels in wells MW-14 and MW-15 show an a general correlation with tidal stage, but with a fluctuation typically less than 0.25 foot. Water levels in wells MW-12 and MW-13 show a more prominent correlation which varies with general tidal stage, with tidal fluctuations during periods of lower tides similar to wells MW-14 and MW-15, but greater (typically 0.5 foot) during periods of higher tides. Water levels in upland wells (MW-1R, MW-11, MW-16) show only a slight variation with tidal stage.

The variable response to tidal stage could be related to the relative difference between groundwater elevation and tidal stage, which is greater in wells MW-12 and MW-13 than in wells MW-14 or MW-15 (see Figures 20 and 21). In addition, well MW-13 is located near the former embayment area (see Figure 3). If fill materials in the former embayment area are coarser than the surrounding materials, the response to tidal stage may be greater than in other areas of the Ebey Slough bank. Water level variations in well MW-16 may also be related to its proximity to the former stream channel discussed above.

Transducers placed in the drainage ditch during the second phase of tidal monitoring indicated a tidally-influenced fluctuation of approximately 0.5 to 1.3 feet in the southern portion of the ditch near the outfall to Ebey Slough, but no apparent tidal fluctuation in the central and northern portions of the ditch (refer to Section 5.3 for additional discussion). Plots for monitoring well and drainage ditch water level monitoring are included in Appendix I.

Based on the potentiometric surface maps (Figures 14 through 19) and relative water levels in monitoring wells and the eastern drainage ditch, water levels in the ditch appear to be affected primarily by discharge of Site groundwater to the ditch along the bank (other than during precipitation events when surface water runoff would be expected to be more significant), i.e., the ditch appears to be generally recharged by Site groundwater (refer to Section 5.3 for additional discussion).

Section 5: Remedial Investigation Results

This section presents the findings for the investigation and evaluation activities (Section 3) performed for this RI.

5.1 Analytical Results

This section presents a summary of the analytical results for the soil, groundwater, and surface water samples collected during RI field activities. For the purposes of this Section, the analytical results summarized below are compared to screening levels based on potential Site cleanup standards (MTCA Method A/B CULs and ARARs), as described below.

The screening levels for soil are based on the most protective MTCA Method A or B CULs for unrestricted land use. Screening levels for groundwater and surface water are based on the most protective surface water standards (or groundwater standards where a surface water standard is not available), including MTCA groundwater and surface water standards and other ARARs. For example, total petroleum hydrocarbons analyses (GRO, DRO, and ORO) in groundwater and surface water were compared to the MTCA Method A groundwater standard because a commensurate surface water standard is not available.

For reference, all potentially applicable MTCA CULs and ARARs are summarized and discussed in greater detail in Section 8 and listed in the analytical data summary tables (Tables 4, 5, 6, 7, and 9) and CUL summary table (Table 11). [Note: The screening levels referenced in this Section may differ from the Proposed CULs presented in Section 8.]

5.1.1 QA/QC and Data Validation

Soil, groundwater, and surface water samples collected for QA/QC purposes (Section 3.12) were submitted for laboratory analyses in accordance with the RI Work Plan (Kennedy/Jenks 2017). QA/QC samples included field duplicates and trip blanks. Field duplicate samples were compared to parent samples to evaluate analytical precision, field precision and sampling bias, and sample homogeneity. When volatile analyses (GRO, BTEX, and/or VOC) were requested for samples, a trip blank was shipped with samples and analyzed by the laboratory for potential cross-contamination or exposure from ambient conditions.

Data received from analytical laboratories were reviewed and validated by Kennedy/Jenks, including laboratory QA/QC analyses such as method blanks, surrogate recovery, matrix spikes, and matrix spike duplicates. Data validation findings indicate the analytical data are appropriate for their intended use. Data validation reports are attached in Appendix L. Changes in reporting of analytical results associated with data validation findings (e.g., non-detect changes due to detection in method blanks, flags for values reported between the practical quantitation limit and method detection limit) are incorporated into results tables (e.g., Tables 4, 5, 6, 7, and 9).

[Note: The total number of samples submitted for laboratory analysis, as listed in the following sections (5.1.2 to 5.1.5), includes duplicate samples. The number of duplicates collected for each Site media is listed in Section 3.12.]

5.1.2 Soil Results

A total of 88 soil samples were collected from 54 locations, including test pits (27 locations), soil borings (26 locations), and a soil stockpile located in the southeastern corner of the Site (one location). See Table 4 for tabulated soil sample results, Figure 9 for sampling locations, and Appendix K for laboratory analytical reports.

In general, the following analyses were performed for soil samples:

- At least one soil sample collected from each soil boring or test pit was typically analyzed for DRO, ORO, GRO, BTEX, and arsenic. Additional samples were selected for analysis based on field observations or as follow-up analyses based on results of the initial sample analyses. DRO and ORO analyses were performed without silica gel cleanup.
- Select soil samples from borings and test pits were analyzed for PAHs, VOCs, and RCRA 8 metals plus copper based on field observations, historical sample data, or as follow-up analyses.
- One soil sample collected at TP-9 was analyzed for EPH and VPH.
- The sample collected from the soil stockpile was analyzed only for arsenic.

Specific analyses performed for each soil sample varied based on location, field observations, and ongoing analytical findings. Analyses performed for each soil samples are listed in Table 4 and summarized below.

5.1.2.1 Soil Sample Results - Metals

Arsenic was detected in all 65 soil samples submitted for laboratory analysis at concentrations of 1.36 mg/kg (with a laboratory “J” data flag) to 188 mg/kg. Soil samples collected from test pit 2017-TP-2 (1.5-2.0 feet bgs), 2018-TP-07 (4.0-4.5 feet bgs), 2018-TP-11 (6.0-6.5 feet bgs), 2018-TP-12 (5.0-5.5 feet bgs), borings 2017-B09 (7.5-8.5 feet bgs), 2017-B10 (2.0-2.5 feet bgs), and HA-03 (2.0-2.2) contained concentrations of arsenic above the screening level of 20 mg/kg. A deeper soil sample collected from 2017-TP-2 (5.0-5.5 feet bgs) did not contain arsenic at a concentration above the screening level (deeper samples from the listed soil borings were not analyzed for arsenic). The soil samples with detected arsenic concentrations above the screening level were collected from the former South Log Yard (2017-B09 and 2018-TP-07), North Log Yard (2017-B10, 2017-TP-2, and HA-03), areas (AOC 4), and Site-wide shallow soil areas (2018-TP-12) (AOC 6). See Figure 22 for arsenic concentrations in soil.

Eight soil samples were analyzed for RCRA 8 metals (see Table 4) and contained detected concentrations of barium, cadmium, chromium (total), copper, lead, mercury, selenium, and silver; however, concentrations of these metals were below screening levels.

5.1.2.2 Soil Sample Results - Organics

Soil sample results for GRO, DRO, ORO, BTEX, VOCs, and PAHs are discussed below. Soil sample results for GRO, DRO, ORO, and DRO+ORO are presented on Figures 23, 24, 25, and 26, respectively. All organics data are listed in Table 4.

GRO was detected at concentrations above the laboratory reporting limits in 20 of 59 soil samples submitted for laboratory analysis. Two samples, 2018-TP-9 (1.0-1.5 feet bgs) and 2018-TP-10 (2.0-2.25 feet bgs), contained GRO at a concentration above the screening level of 30 mg/kg (MTCA Method A CUL based on low levels of detected benzene, see below).

The TP-9 sample was collected from the center of the test pit at a depth of 1.0 to 1.5 feet bgs and contained 346 mg/kg of GRO. Additional soil samples collected from TP-9 below and lateral to the first sample (after TP-9 was expanded to collect additional characterization samples) also contained GRO [0.0417 mg/kg ("J" flagged) to 26.3 mg/kg] but at concentrations below the screening level. [Note: ORO was also detected above the screening level in TP-9, see below]. One sample from 2018-TP-10 (2.0-2.5 feet bgs) contained 751 mg/kg of GRO. Samples collected below the first sample at 2018-TP-10 (from 2.5 to 3.0 feet bgs and from 4.0-4.5 feet bgs) also contained GRO [0.320 and 0.711 ("J" flagged) mg/kg respectively], but at concentrations below the screening level. Based on field observations and analytical results, the areas of elevated GRO appear to include localized hotspots in the immediate vicinity of TP-9 and 2018-TP-10. See Figure 23 for GRO concentrations in soil.

DRO and/or ORO were detected at concentrations above laboratory reporting limits in most of the 74 soil samples submitted for laboratory analysis. DRO was detected in 47 samples at concentrations of 1.98 ("J" flagged) to 1,000 mg/kg, and ORO in 56 samples at concentrations of 4.24 ("J" flagged) to 4,900 mg/kg. None of the detected DRO concentrations were above the screening level of 2,000 mg/kg; however ORO was detected at concentrations above the screening level in five soil samples.

ORO was detected at concentrations above the screening level of 2,000 mg/kg in soil samples collected from 2017-TP-4 (3,120 mg/kg at 2.5-3.0 feet bgs), 2017-TP-9 (4,850 mg/kg at 4.0-4.5 feet bgs), 2017-B11 (4,900 mg/kg at 2.0-2.5 feet bgs; 4,820 mg/kg at 5.0-5.5 feet bgs), and HA-02 (4,140 mg/kg at 1.8-2.0 feet bgs). The summed DRO+ORO concentrations also exceeded the screening level for the samples listed above, plus one adiitional soil sample collected from TP-09 (2,610 mg/kg at 1.0-1.5 feet bgs). Based on field observations, the elevated ORO concentrations appear to represent localized hotspots in the vicinity of TP-9 (which also has elevated GRO concentrations) and in the vicinity of TP-4 and 2017-B11. See Figure 25 for ORO concentrations in soil, and Figure 26 for DRO+ORO concentrations.

A total of 59 soil samples were analyzed for BTEX, and 10 for VOCs (full EPA Method 8260 list). One or more BTEX compounds were detected at concentrations above laboratory reporting limits in 24 soil samples, but most were at concentrations well below the respective screening levels. Benzene was detected at concentrations above the screening level of 0.030 mg/kg in a soil sample collected from 2018-TP-03 at 5.5 to 6 feet bgs (0.0421 mg/kg). All other BTEX compounds were below the respective screening levels. One or more VOC analytes were detected at concentrations above laboratory reporting limits in eight soil samples. None of the detected VOC concentrations were above the screening levels. Detected VOCs (in addition to BTEX) included 1,1-dichloroethene; 1,2,3-Trimethylbenzene; 1,2,4-Trimethylbenzene; 1,3,5-Trimethylbenzene; acetone; and methyl ethyl ketone.

One or more PAH analytes were detected at concentrations above the laboratory reporting limits in 13 of the 15 soil samples were analyzed for PAHs, including cPAHs in 12 samples. None of the detected concentrations were above the screening levels. Detected non-carcinogenic PAH analytes included 1-Methylnaphthalene, 2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene.

Each of the cPAH compounds [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene] was detected in one or more soil samples. Total cPAH concentrations, calculated using TEF methodology and assigning a value of half the reporting limit for non-detected analytes, ranged from 0.000667 mg/kg to 0.0533 mg/kg, well below the screening level of 0.1 mg/kg (based on the MTCA Method A soil CUL).

5.1.3 Groundwater Results

This section provides a summary of analytical results for groundwater samples collected during the RI. Groundwater sampling locations, methods, and analyses are described in Section 3.5.

Groundwater from the Site is not a considered to be a suitable source of potable water for several reasons: Site groundwater is subject to tidal influence, represents an artificially produced saturated zone (based on the Site's fill history), and has low yield and poor water quality due high mineral content. Ultimately, groundwater discharges to surface water either directly to Ebey Slough or through the eastern drainage ditch that is both hydraulically connected to the slough and discharges to the Slough through stormwater outfalls (see Section 4.1). Consequently, cleanup standards used to evaluate groundwater quality for the Site would be based on protection of surface water. For simplicity and to facilitate screening of the analytical results (as discussed in Section 5.1), groundwater analyte concentrations are discussed in relationship to screening levels based on MTCA Method A/B groundwater CULs, MTCA surface water CULs, or other ARARs (as specified below).

5.1.3.1 Reconnaissance Groundwater Results

A total of 10 reconnaissance groundwater samples were collected from nine soil boring locations during the RI (a duplicate was collected at 2017-B05) and one from test pit 2018-TP-11 (arsenic only). Typically, reconnaissance groundwater results are biased high because of the inherent high turbidity (relative to developed, permanent monitoring wells) and are used primarily as a screening tool to identify locations with potentially impacted groundwater for additional characterization. Reconnaissance groundwater sampling results are summarized below:

- GRO was analyzed in three reconnaissance groundwater samples and detected in one (2017-B2) at a concentration above the laboratory reporting limit. The detected concentration [71.3 µg/l ("J" flagged)] was below the screening level of 1,000 µg/l.

- DRO and ORO were detected at concentrations above the laboratory reporting limits in nine reconnaissance groundwater samples submitted for analysis. DRO concentrations ranged from 87.5 µg/l ("J" flagged) to 979 µg/l, and ORO concentrations ranged from 156 µg/l ("J" flagged) to 703 µg/l. DRO concentrations were above the screening level of 500 µg/l at 2017-B-07 and 2017-B10, and ORO concentrations were above the screening level of 500 µg/l at 2017-B07 and 2017-B10, and at 2017-B06. In addition, the summed DRO+ORO concentrations were above the screening level in samples collected from 2017-B02 (844 µg/l), 2017-B05 (710 µg/l), and 2017-B09 (665 µg/l) although the individual DRO and ORO concentrations were below the screening level. Boring B06 was located in the southwestern corner of the Site, near well MW-15 which also contained DRO and ORO above the screening level (see Section 5.1.3.2). Borings B07, B08, and B10 were located near, and generally downgradient from, areas where ORO was detected in soil samples at concentrations above the screening level. Boring B07 and B09 were located near TP-9 (ORO at 4,850 mg/kg), and boring B10 was located near TP-4 and B-11 (ORO up to 3,120 mg/kg and 4,900 mg/kg, respectively). Borings B02 and B05 were located near well MW-7, where both DRO and ORO were detected in groundwater samples at concentations above the screening level (see Section 5.1.3.2).

- BTEX compounds were not detected at concentrations above laboratory reporting limits in three reconnaissance groundwater samples submitted for analysis.
- Dissolved arsenic was detected at concentrations above the laboratory reporting limits in all 10 reconnaissance groundwater samples submitted for analysis (nine soil borings and test pit 2018-TP-11). Dissolved arsenic concentrations ranged from 3.45 µg/l to 53.2 µg/l.

Reconnaissance groundwater results are listed in Table 5 and shown on Figure 27 (arsenic) and Figure 28 (organics).

5.1.3.2 On-Property Monitoring Well Results

On-property monitoring wells include 11 wells (three new and eight previously existing wells; excluding perimeter background wells) as summarized in Section 3.5.2. On-property groundwater sampling results are listed in Table 6 and shown on Figure 27 (arsenic) and Figure 28 (GRO, DRO, ORO). Most of the groundwater samples were collected during the primary monitoring events (October 2017, November/December 2017, January 2018, July 2018, and September 2018) but limited sampling was also performed later late January and February 2018.

Results for primary analyses (total and dissolved lead and arsenic, GRO, DRO, ORO, EPH, BTEX, VOCs, and PAHs) are summarized below. Results for MNA parameters, general chemistry, and arsenic speciation are discussed in Section 5.1.3.4.

Total and dissolved arsenic were analyzed during each monitoring event for samples collected from all on-property wells, and both were detected in all on-property groundwater samples at concentrations above the laboratory reporting limits. Total arsenic concentrations ranged from 1.16 µg/l (“J” flagged) to 123 µg/l, and dissolved arsenic concentrations ranged from 1.13 µg/l (“J” flagged) to 118 µg/l. Most of the detected arsenic concentrations are above the screening level of 5 µg/l based on the MTCA Method A groundwater CUL (see Figure 27). In most cases, the total and dissolved arsenic concentrations detected in groundwater samples are very similar, indicating that arsenic is predominantly in the dissolved phase.

Arsenic concentrations detected in groundwater samples display considerable variation throughout the on-property areas, and also at individual well locations (see Figure 27). The greatest variation was observed at well MW-14, with detected concentrations of dissolved arsenic ranging from 5.78 to 118 µg/l. In general, the highest detected concentrations of total and dissolved arsenic in on-property wells were detected in southeastern, southern, and central portions of the Site (e.g., the South Log Yard, Former Unknown UST area, and surrounding areas), though elevated concentrations of arsenic are present throughout the Site.

Total and dissolved lead analyses were also performed for groundwater samples collected from all on-property wells during the October 2017, November/December 2017, and January 2018 monitoring events. Total lead was detected at concentrations above the laboratory reporting limit in 16 samples [0.260 µg/l (“J” flagged) to 16.7 µg/l] and dissolved lead in 14 samples [0.259 µg/l to 4.86 µg/l (both results “J” flagged)]. Two groundwater samples contained concentrations of total lead above the screening level of 8.1 µg/l (based on surface water ARARs) including samples collected from well MW-11 (8.58 µg/l, October 2017) and MW-15 (16.7 µg/l, November 2017). Well MW-11 is located south (generally downgradient) from the former Unknown UST Area (AOC 2), and well MW-15 is located generally downgradient from the former Boat Manufacturing Area (AOC 3).

TPH (GRO, DRO, and ORO) and BTEX analyses were performed for samples collected from all on-property wells for each monitoring event.

GRO was detected in groundwater samples collected from seven on-property monitoring wells at concentrations of 32.2 µg/l (“J” flagged) to 323 µg/l. None of the detected GRO concentrations were above the screening level of 1,000 µg/l (or 800 µg/l if benzene is present, based on the MTCA Method A groundwater CUL). The highest concentrations of GRO were detected in samples collected from well MW-15 (178 µg/l in January 2018 and 323 µg/l in November 2017), although GRO was not detected at this location in the sample collected in October 2017. Well MW-15 is located downgradient from the former Boat Manufacturing Area (AOC 3) and also contained elevated concentrations of DRO and ORO (discussed below).

DRO and/or ORO were detected at concentrations above the laboratory reporting limits in samples collected from all 11 on-property wells, with both DRO and ORO detected in eight wells for at least one monitoring event (only ORO was detected in wells MW-10 and MW-11). Detected DRO concentrations ranged from 87.6 µg/l (“J” flagged) to 1,990 µg/l, and ORO concentrations ranged from 93.1 µg/l(“J” flagged) to 3,310 µg/l.

DRO concentrations were above the screening level of 500 µg/l (based on the MTCA Method A groundwater CUL) for samples collected during all five monitoring events at wells MW-15 (up to 1,990 µg/l), three monitoring events at MW-7 (up to 761 µg/l), and for at two monitoring event at wells MW-1R (up to 894 µg/l) and MW-16 (up to 661 µg/l). ORO concentrations were above the screening level of 500 µg/l (based on the MTCA Method A groundwater CUL) for samples collected during all five monitoring events at well MW-15 (up to 3,310 µg/l), and for at least one monitoring event at wells MW-1R (up to 939 µg/l),MW-7 (up to 536 µg/l), MW-12 (up to 668 µg/l), MW-13 (up to 575 µg/l), and MW-14 (up to 677 µg/l). In addition, the sum of DRO+ORO was above the screening level at wells MW-1R, MW-12, and MW-17 for at least one monitoring event where DRO and ORO were not detected individually at concentrations above the screening level.

The highest detected concentrations of DRO and ORO were in samples collected from well MW-15, located downgradient from the former Boat Manufacturing Area (AOC 3), with concentrations significantly above the indicated screening levels. Well MW-15 is the only well with detected concentrations of both DRO and ORO above the screening level for all five monitoring events. For other on-property wells (excluding perimeter background wells) with DRO and/or ORO detected at concentrations above the screening levels, the concentrations were less than 1,000 µg/l, and exceedances of the screening levels were intermittent. The wells with DRO and/or ORO concentrations above screening levels (other than MW-15, discussed above) are located near locations of known historical TPH impacts (MW-1R in AOC 5 and MW-7 in AOC 1) or locations where TPH-impacted soil was identified during this RI (MW-16, downgradient from TP-9). See Figure 28 for a summary of DRO and ORO concentrations in groundwater. DRO and ORO were also detected at concentrations above screening levels in some background wells, discussed in Section 5.1.3.3 below.

Four groundwater samples collected on 30 November 2017 (MW-07, MW-15, MW-16, and MW-17) were also analyzed for EPH. EPH analytes were not detected at concentrations above the laboratory reporting limits except for C21-C34 Aliphatics (120 µg/l) and C21-C34 Aromatics (180 µg/l). EPH results are listed in Table 6.

BTEX constituents were not detected at concentrations above the laboratory reporting limits in any groundwater samples collected from on-property wells except for toluene [(MW-15 at up to 14.2 µg/l, and MW-16 up to 0.442 µg/l (“J” flagged)] and benzene (MW-17 at 1.46 µg/l, October 2017 only). The detected toluene and benzene concentrations were below screening levels (based on MTCA Method A groundwater CULs).

VOCs analyses were performed for nine groundwater samples collected from four wells (MW-7, MW-12, MW-15, and MW-16). No VOC analytes were detected at concentrations above the respective screening levels; however, the laboratory reporting limits were above the screening levels for some analytes (1,2,4-trimethylbenzene, acrolein, acrylonitrile, and carbon tetrachloride). Several VOCs were detected at low concentrations, but above laboratory reporting limits, including acetone, cymene, and methyl ethyl ketone; however, published surface water cleanup standards or ARARs (see Section 8) are not available for these compounds. In general, VOCs (including BTEX) are not considered to be COCs for the Site based on the RI findings.

PAH analyses were performed for nine groundwater samples collected from five on-property wells (MW-7, MW-12, MW-13, MW-15, and MW-16). Several non-carcinogenic PAH compounds were detected at low concentrations in one or more groundwater samples (acenapthene, anthracene, naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, benzo(g,h,i)perylene, fluoranthene, and fluorene), but the concentrations were below the screening levels (although published cleanup standard or ARARs are not available for all detected non-carcinogenic PAHs).

Carcinogenic PAHs detected at concentrations above laboratory reporting limits included only dibenzo(a,h)anthracene at MW-7 (0.00430 µg/l, “J” flagged), MW-15 (0.00594 µg/l, “J” flagged), and MW-16 (0.00406 µg/l, “J” flagged). These concentrations are below the screening level of 0.018 µg/l (based on surface water ARARs).

Based on the detected concentrations of dibenzo(a,h)anthracene at the three wells listed above, the total cPAH concentrations of 0.00799 µg/l to 0.00871 µg/l (summed using TEF methodology and using half the reporting limit for non-detected analytes) were also below the screening level of 0.1 µg/l (based on the MTCA Method A groundwater CUL). In general PAHs (including cPAHs) do not appear to be a significant COC for the Site based on the RI findings.

5.1.3.3 Background Monitoring Well Results

Background wells include four on-property perimeter wells and nine off-property wells, as described in Section 3.5.3. Background wells are positioned upgradient relative to the main Site area, and are intended to evaluate the condition of groundwater entering the main Site from upgradient locations.

Groundwater samples were collected from eight background monitoring wells (MWBG-1 through MWBG-7 and EP-01) during the October 2017, November/December 2017, and January 2018 monitoring events. Five additional background monitoring wells (MWBG-8 through MWBG-10, GM-2, and GM-3) were sampled during the July 2018 and September 2018 monitoring events and provide a broader area of coverage for background arsenic concentrations. All samples were analyzed for total and dissolved arsenic during each monitoring event, and for DRO and ORO during the January 2018, July 2018, and September 2018 events. DRO and ORO (plus GRO and BTEX) were also analyzed in a groundwater sample collected from well MWBG-2 in November 2017. GRO was analyzed in all 13 background monitoring wells in September 2018. See Table 7 for tabulated background well groundwater results, Figure 9 for groundwater sampling locations, and Appendix K for laboratory analytical reports. The purpose of the hydrocarbon analyses in background wells was to assess whether reduced conditions may be present that may contribute to increase solubility of arsenic in groundwater.

Total arsenic was detected at concentrations above laboratory reporting limits for all samples collected from background wells, except for the sample collected at MWBG-1 in October 2017, with detected concentrations ranging from 0.290 µg/l ("J" flagged) to 67.9 µg/l. Dissolved arsenic was also detected at concentrations above laboratory reporting limits for all background groundwater samples, except for the samples collected at MWBG-1 in October 2017, December 2017,and July 2018, with detected concentrations ranging from 0.419 µg/l ("J" flagged) to 65.4 µg/l.

The detected total and dissolved total arsenic concentrations were above the screening level of 5 µg/l for at least one monitoring event in groundwater samples collected from all background wells except for MWBG-1, MWBG-7, and Geddes wells GM-2 and GM-3. See Figure 26 for total and dissolved arsenic concentrations in groundwater. [Note: MWBG-7 may be partially completed in a lower lying saturated zone (unlike the other background wells); consequently, the results may not be fully representative of the uppermost saturated zone.]

In general, the highest detected concentrations of total and dissolved arsenic in background groundwater were in samples collected from monitoring wells located north (MWBG-4), east (MWBG-6), and west (MWBG-2) of the main Site area. The total and dissolved arsenic concentrations in background groundwater samples were generally similar in range (but with somewhat lower concentrations overall) to samples collected from on-property wells (see Section 5.1.3.2), with the exception of wells located in the southeastern portion of the Site (i.e., MW-14 and MW-16).

DRO was detected in samples collected from nine background wells at concentrations of 89.0 µg/l ("J" flagged) to 1,250 µg/l, and ORO was detected in samples collected from 13 background wells at concentrations of 115 µg/l ("J" flagged) to 2,990 µg/l. The highest concentration of DRO and ORO were detected in well BGMW-4, located in the northwestern corner of the main Site area. DRO and ORO concentrations above the screening level of

500 µg/l were detected in samples collected from wells MWBG-2, MWBG-3, MWBG-4, MWBG-5, MWBG-6, and MWBG-9. In addition, the sum of DRO+ORO was above the screening level at wells MWBG-2, MWBG-4, MWBG-6, and GM-3 for at least one monitoring event where DRO and ORO were not detected individually at concentrations above the screening level.

GRO and BTEX constituents were not detected at concentrations above the laboratory reporting limits for the sample collected from MWBG-2 in November 2017. GRO was detected at concentrations above the laboratory reporting limits in GM-3 and MWBG-9 in September 2018. Concentrations of GRO were not detected above the screening level.

The petroleum hydrocarbon impacts identified in background groundwater samples appear to be related to offsite sources (i.e., impacted groundwater appears to be migrating onto the Site from adjoining sites). MWGB-2 is located downgradient from the former Boat Manufacturing Facility (AOC 3) which also appears to be a source of DRO and ORO impacts in MW-15. MWBG-3 and MWBG-4 are located east (generally downgradient) from the First Stop Deli site (see Section 2.3.2) which includes service station and car wash facilities. MWBG-6 is located on City property east of the Site near a public works maintenance facility, but the downgradient position of MWBG-6 relative to the main Site area suggests that migration of impacted groundwater onto the main Site is unlikely.

5.1.3.4 Monitored Natural Attenuation, General Chemistry, and Arsenic Speciation

Selected groundwater samples were analyzed for MNA parameters to evaluate whether natural breakdown of petroleum hydrocarbons was occurring at the Site, and to assess redox conditions that could affect the mobility of arsenic. Select samples were also analyzed for general chemistry parameters to evaluate general groundwater conditions and for calculation of hardness-based CULs for some metals analytes. MNA parameters typically included dissolved iron and manganese, nitrate/nitrite, sulfate, and alkalinity; and general chemistry parameters included chloride, hardness (as calcium carbonate), and additional metals (calcium, magnesium, potassium, and sodium.

Analytical methods MNA and general chemistry analyses are listed in Section 3.2. MNA and general chemistry results are summarized in Table 8 and discussed in Section 7.2.

In addition, groundwater samples collected from wells MWBG-05, MW-06, and MW-14 in January 2018 were analyzed for arsenic speciation (trivalent and pentavalent arsenic). Arsenic speciation results are listed in Table 8 and discussed in Sections 5.5 and 7.2.

5.1.4 Surface Water Monitoring Results

Surface water monitoring included collection and laboratory analysis of surface water samples from catch basins, outfalls (to the eastern drainage ditch and Ebey Slough), and directly from the drainage ditch and Ebey Slough as described in Section 3.6.2.

Surface water samples were typically analyzed for total and dissolved lead and arsenic, PAHs, DRO, ORO, GRO, and BTEX, but the samples of Ebey Slough water were only analyzed for metals.

Surface water sampling location are shown on Figure 10. Surface water data are summarized in Table 9 and shown on Figure 29, and discussed below. Screening levels in this section are based on the most protective applicable surface water CUL or ARAR (as listed in Table 11), unless otherwise indicated.

Both total and dissolved arsenic were detected in surface water samples at concentrations above the screening level for arsenic in surface water (0.0982 µg/l, based on surface water ARARs) at all surface water sampling locations for all sampling events. Total arsenic concentrations ranged from 0.464 µg/l (“J” flagged) to 36.4 µg/l, and dissolved arsenic from 0.359 µg/l (“J” flagged) to 16.9 µg/l.

The highest detected arsenic concentrations (total and dissolved) for direct surface water discharge from the Site (i.e., all samples except Ebey Slough outfalls and water) were typically in samples collected from outfalls to the drainage ditch (OF-01 and OF-02) and the catch basin that feeds into OF-1 (CB-1). Arsenic concentrations detected at these locations were highest during the December 2017 and January 2018 events and ranged from 3.43 µg/l to 6.00 µg/l for dissolved arsenic and from 3.46 µg/l to 9.86 µg/l for total arsenic. The data from CB-1, OF-01, and OF-2 are indicative of arsenic concentrations in surface water discharged from the Site to the drainage ditch, although additional monitoring is needed to evaluate seasonal variations and possible trends.

Arsenic concentrations in ditch water samples (Ditch-01 and Ditch-02) were lower than from the outfalls for most events, ranging from 1.08 µg/l (“J” flagged) to 16.9 µg/l for dissolved arsenic, and from 1.32 µg/l (“J” flagged) to 15.0 µg/l (“J” flagged) µg/l for total arsenic [Note: The sample collected from Ditch-02 in September 2018 contained higher total and dissolved arsenic concentrations than previous samples from the drainage ditch outfalls, but outfall samples could not collected in September 2018 due to lack of water flow at the time]. This indicates that arsenic concentrations in Site runoff are typically relatively diluted in the drainage ditch water relative to the ditch outfalls. In addition, the arsenic concentrations detected in direct surface water runoff samples are generally lower than those detected in Site groundwater samples.

The total and dissolved arsenic concentrations are generally similar in the samples collected from direct Site runoff suggesting that arsenic occurs primarily in the dissolved phase in surface water discharged to the ditch. This is also consistent with the arsenic results for Site groundwater (see Section 5.1.3.2), which also discharges to the drainage ditch along the eastern Site margin (refer to Section 4.2).

Samples collected from the outfalls to Ebey Slough (Slough-01 and Slough-02) in January 2018 and September 2018 contained dissolved arsenic concentrations of 0.457 µg/l (“J” flagged) to 4.33 µg/l and total arsenic at of 0.464 µg/l (“J” flagged) to 7.91 µg/l. The highest concentrations were detected in Ebey Slough outfall sample Slough-02 during the January 2018 event, located in the southwestern portion of the Site near the Ebey Slough bridge, downstream from most of the Site’s Ebey Slough bank area. Although not connected to the eastern drainage ditch, arsenic concentrations in Ebey outfall sample Slough-02 are similar to those detected in samples from outfalls to the drainage ditch. In both cases, sections of storm drain pipe, presumably in contact with arsenic-impacted groundwater, are located upstream from the outfalls. Infiltration of arsenic-impacted groundwater into storm drain pipes could account for the similarity in arsenic concentrations between the different outfall locations.

Samples collected from Ebey Slough water on 9 January 2018 [Slough(HT) and Slough(LT)]. contained elevated concentrations of total arsenic (12.0 to 36.4 µg/l) and lower concentrations of dissolved arsenic (0.961 µg/l to 1.21 µg/l, both “J” flagged). This may be due to increased turbidity in Ebey Slough water at the time, as other samples collected from elsewhere in the slough (Slough-Downstream and Slough-Upstream, collected 30 January 2018) did not contain elevated concentrations of total arsenic (up to 1.13 µg/l, “J” flagged) relative to dissolved arsenic (up to 0.892 µg/l, “J” flagged). The elevated total arsenic concentrations suggest that infiltration of water from Ebey Slough during high tidal stages could locally contribute to the arsenic concentrations detected in Site groundwater.

Total lead was detected in surface water samples at concentrations of 2.30 µg/l to 55.7 µg/l, and dissolved lead at 0.381 µg/l to 4.65 µg/l (both “J” flagged). Total lead concentrations were above the screening level of 8.1 µg/l in three samples [CB-1, Slough(HT), and Slough(LT)] and ranged from 9.65 µg/l to 55.7 µg/l; however, these samples did not contain concentrations of dissolved lead above the screening level and the total lead exceedances may be due to high turbidity in the samples.

TPH, BTEX, and PAH analyses were also performed for surface water samples, except for those collected from Ebey Slough water. GRO was detected in seven surface water samples collected from four locations at concentrations of 39.3 µg/l (“J” flagged) to 635 µg/l, below the screening level of 1,000 µg/l (based on the MTCA Method A groundwater CUL with no detected benzene in surface water samples). BTEX compounds were not detected at concentrations above the laboratory reporting limits in any of the surface water samples.

DRO and ORO were both detected in all of the surface water sample submitted for laboratory analysis. DRO concentrations ranged from 90.2 µg/l (“J” flagged) to 668 µg/l, and ORO from 138 µg/l (“J” flagged) to 2,110 µg/l. These concentrations are generally within the range of concentrations detected in Site groundwater samples. The highest ORO concentration was detected in a sample collected from Ebey Slough outfall Slough-02, and could be related to the ORO impacts identified at well MW-15 (the outfall and upstream pipe are located in close proximity to MW-15). The DRO concentration was above the screening level of 500 µg/l (based on the MTCA Method A groundwater CUL) in six samples (including outfalls to the drainage ditch and Slough), and the ORO concentration was above the screening level of 500 µg/l (based on the MTCA Method A groundwater CUL) in 12 samples (including those collected from catch basin, ditch outfall, ditch water, and Ebey Slough outfall locations).

PAHs, including cPAHs, were detected at concentrations above the laboratory reporting limits in 15 of 16 samples submitted for laboratory analsyis. The detected concentrations of non-cPAH compounds were very low and below the screening levels (although published cleanup standards or ARARs are not available for all detected non-carcinogenic PAHs). One cPAH compound, dibenzo(a,h)anthracene (0.00396 µg/l to 0.00506 µg/l, both “J” flagged), was detected in seven samples at concentrations below the screening level of 0.018 µg/l. Other cPAH compounds, including benzo(a)pyrene and indeno(1,2,3-c,d)pyrene, were not detected above the laboratory reporting limit, but the laboratory reporting limit was above the screening level of 0.018 µg/l for a few samples.

5.2 IDW Characterization

IDW generated during RI field activities consisted of soil cuttings, decontamination water, and purge water. IDW was placed in 55-gallon drums, labeled, and temporarily stored onsite. A waste profile was generated for the IDW using soil and groundwater analytical results. IDW profiling, transport, and disposal documents are included in Appendix M.

5.3 Tidal Study Findings

Figures 20 and 21 include plots of the monitoring well, drainage ditch, and Ebey Slough water levels for the tidal study described in Section 3.8.

For the first tidal monitoring event, the tidal swing in the adjacent slough was monitored to have minimum and maximum water stage elevations of approximately -1.5 to 10.7 feet amsl (or a magnitude of 12.2 feet change in water elevation). The large-scale water elevation shifts in the Ebey Slough had a hydraulic influence on well MW-13, imparting water elevation changes of approximately 0.5 foot. Well MW-15 also recorded water elevation changes due to tidal influence, but to a much lesser extent than well MW-13 (see Figure 20). The greatly dampened tidal response in wells MW-13 and MW-15 is likely due to the very low conductivity of these and other wells in the vicinity of the Ebey Slough (see Section 5.4 below).

In the second tidal monitoring event, the tidal swing in the adjacent slough was monitored to have minimum and maximum water stage elevations of approximately 2.8 to 11.7 feet amsl (or a magnitude of 8.9 feet change in water elevation). The large-scale water elevation shifts in Ebey Slough had a hydraulic influence on wells MW-12 and MW-13, imparting water elevation changes of approximately 0.3 foot and 0.5 foot, respectively, which were greatest during periods of generally higher tides. Lesser water elevation fluctuations (generally less than 0.2 foot) correlating with tidal fluctuations were also noted in wells MW-11, MW-14, MW-15, MW-16.

The tidal study findings indicate tidally-influenced water level fluctuations in Site monitoring wells are generally not significant at the Site, with up to 0.5 foot of fluctuation in some Ebey Slough near-bank wells and detectable, but minor, fluctuation in some upland wells. The overall Site groundwater gradient does not appear to be appreciably affected by tidal fluctuations.

Transducers were also placed at three locations in the drainage ditch located along the eastern margin of the Site for the first (2 days only) and second (same duration as monitoring wells) tidal monitoring events to assess the tidal influence on ditch surface water elevation. One transducer was placed in the northern portion of the ditch (Ditch-N), just south of OF-01, one transducer was placed in the center portion of the ditch (Ditch-Mid), north of outfall OF-02, and one transducer was placed in the southern portion of the ditch (Ditch-S) near the outfall to Ebey Slough (Figures 10, 20, and 21).

Ditch water elevations collected from the northern and middle transducer locations showed no evident correlation with slough water elevations. Water levels in the southern ditch transducer location showed a correlation with tidal stage, with a fluctuation of approximately 0.5 to 1.3 feet.

Average water elevations from the northern, middle, and southern transducers were approximately 6.0 feet amsl, 6.9 feet amsl, and 3.1 feet amsl, respectively, indicating that water flows from north to south within the ditch, toward Ebey Slough. Average groundwater elevations in wells closest to the ditch were 9.0 feet amsl in well MW-14, 6.6 feet amsl in well MW-16, 7.0 feet amsl in well MW-1R, and 7.1 feet amsl in well MWBG-6, indicating a groundwater flow pattern towards the ditch from the eastern and western sides. This is consistent with the groundwater gradients based on Site water level measurements shown on the potentiometric surface maps (Figures 14 through 19) and indicates the ditch is likely recharged by shallow-zone groundwater from the Site (in addition to stormwater contributions during periods of precipitation).

[Note: As indicated above, water in the ditch flows toward Ebey Slough. However, the water level measurements for Ditch-S during the second event appear to be anomalously low. The readings indicate a drop of almost 4 feet between Ditch-Mid and Ditch-S, which is inconsistent with previous measurements and visual observations. For the first event, the difference was approximately 1 foot, and for the water levels surveyed in November 2017, the difference was approximately 0.5 foot. In addition, water in the ditch typically appears stagnant without significant obvious flow. Based on this, Kennedy/Jenks suspects the readings are biased low, possibly based on subsurface irregularity affecting transducer placement and/or the approximately 45-foot distance from the transducer to the nearest accessible survey point used to calibrate the initial water level, although the data appear otherwise valid with respect to relative water level changes.]

Plots of ditch surface water elevation and tidal stage for the first monitoroing event are shown on Figure 20, and for the second on Figure 21. Tidal monitoring data and plots for each event are also included in Appendix I.

5.4 Slug Testing Findings

Rising and falling head slug test data were analyzed using the AQTESOLV computer software. The results of the analyses are summarized on Table 10. The AQTESOLV reports and curve-matched solutions are included in Appendix I.

Monitoring wells selected for slug testing were to estimate K at two different areas of the site: (1) adjacent to the Ebey slough (MW-12, MW-13) and (2) adjacent to the eastern bounding drainage ditch (MW-1R, MW-16, and MWBG-6). As can be seen, K value estimates nearest the slough are very low, averaging 3.6×10^{-6} centimeters per second (cm sec^{-1}). K value estimates near the ditch are highly variable, averaging 3.2×10^{-6} cm sec^{-1}.

An estimate of the volume of groundwater flowing offsite via discharge to the Ebey Slough and the Eastern Ditch has been performed and is included in Section 5.5.2 below.

5.5 Arsenic Evaluation

Arsenic in surface and groundwater can be present in a variety of oxidation states, the most common of which are arsenate (+5 oxidation state; pentavalent) and arsenite (+3 oxidation state; trivalent). Generally, arsenate is the predominant species under oxidizing conditions and arsenite is the predominant species under reducing conditions.

Arsenic behavior in groundwater is influenced by adsorption and desorption reactions, solid-phase precipitation, and dissolution reactions. These reactions are driven by changes in pH, ORP, oxidation state of arsenic, and presence of other ions in water. Field parameters collected during groundwater purging indicate reducing and slightly acidic conditions.

Three groundwater samples, collected from wells MW-6, MW-14, and MWBG-4, were analyzed for total trivalent and pentavalent arsenic. In the groundwater sample collected from well MWBG-4, pentavalent arsenic was not detected above the laboratory reporting limit (<0.028 µg/l) and trivalent arsenic was present at 0.72 µg/l; at well MW-14, trivalent arsenic (20.7 µg/l) was also the dominant species compared to pentavalent (6.6 µg/l). At well MW-6, pentavalent arsenic was the dominant species with 22.7 µg/l; trivalent arsenic was not detected above the laboratory reporting limit (<0.044 µg/l). This indicates arsenic in Site groundwater may exist in both valence states.

5.5.1 Statistical Evaluation Results

Arsenic results from were analyzed using EPA's ProUCL software. The data include five quarters of data from eight background wells (wells MWBG-01 through MWBG-07 and EP-1), and two quarters of data from five background wells (MWBG-08 through MWBG-10 and GM-02 and GM-03). Background well locations and arsenic data are shown on Figure 30. Two datasets were analyzed individually using ProUCL's Background Threshold Value (BTV) tools. A tabulated summary of results and the full ProUCL BTV outputs are included in Appendix N. The two datasets analyzed were:

- Total arsenic in background wells (MWBG-series wells, well EP-1, and GM-02 and GM-03)
- Dissolved arsenic in background wells.

In accordance with WAC 173-340-709(5)(b), values above the method detection limit (MDL) but below the practical quantitation limit (PQL) (i.e., J flagged values) were assigned a value equal to the MDL.

Goodness-of-fit tests were run for all datasets excluding non-detect (ND) values. Goodness-of-fit was evaluated using the Shapiro Wilk test for normal and lognormal distributions and using the Anderson Darling test for gamma distribution. Total arsenic from background wells appears gamma distributed; data do not appear normally or lognormally distributed at the 5 percent significance level. Dissolved arsenic does not appear to follow a discernable distribution (normal, lognormal, or gamma) at the 5 percent significance level. These results were verified by visual examination of quantile-quantile plots.

Potential outliers were identified in data sets for both total and dissolved arsenic. These include values significantly higher than the most observations including a value of 65.4 µg/l for dissolved arsenic and 67.9 µg/l for total arsenic. The data sets were analyzed both with and without these outlier values for comparison purposes; however, because the higher values were observed only for one monitoring event, they are not considered to be verified at this time and the data sets excluding the outliers are considered to be most representative of Site conditions.

For total arsenic in background wells, the ProUCL Upper Limits/BTVs tool was run using a gamma distribution and Kaplan Meier (KM) estimates at a 90 percent confidence level with 90 percent coverage using the Wilson Hilferty method. The Upper Tolerance Limit (UTL) was chosen as the representative statistic for the background threshold value. The UTL is a confidence limit on a percentile of the population rather than a confidence limit on the mean; for example, the 90 percent UTL with 90 percent coverage represents the value below which 90 percent of the population values are expected to fall with 90 percent confidence. Total arsenic results are listed below:

- OUTLIERS INCLUDED: The KM 90 percent Approximate UTL with 90 percent coverage for total arsenic in background wells is 35.56 µg/l.
- OUTLIERS EXCLUDED: The KM 90 percent Approximate UTL with 90 percent coverage for total arsenic in background wells is 31.98 µg/l.

For dissolved arsenic in background wells, the ProUCL Upper Limits/BTVs tool was run using nonparametric statistics to calculate the nonparametric upper limits for BTVs at a 90 percent confidence level with 90 percent coverage. The UTL was again chosen as the representative statistic for the background threshold value. Dissolved arsenic results are listed below:

- OUTLIERS INCLUDED: The nonparametric 90 percent UTL with 90 percent coverage for dissolved arsenic in background wells is 27.7 µg/L.
- OUTLIERS EXCLUDED: The nonparametric 90 percent UTL with 90 percent coverage for dissolved arsenic in background wells is 27.1 µg/L.

Concentrations of total and dissolved arsenic at all background wells are below the calculated KM 90 percent Approximate UTL with 90 percent coverage (based on exclusion of outliers), with the exception of wells MWBG-02, MWBG-05 (dissolved only), and MWBG-06. See Figure 29 for background well locations and arsenic concentrations.

Fifteen well samples from five on-property well locations (MW-6, MW-11, MW-14, MW-15, and MW-16) were above this threshold value for dissolved arsenic, and eight samples from three on-property well locations (MW-06, MW-14, and MW-16) were above the threshold value for total arsenic (based on exclusion of outliers). Wells MW-16 and MW-14 are located in the South Log Yard area, and wells MW-6 and MW-11 are located in the central part of the Site. Well MW-15 is located near the southwestern margin of the Site. See Figure 27 for on-property arsenic concentrations in groundwater.

5.5.1.1 Hypothesis tests

Three hypothesis tests were run to compare whether the two populations (background and Site) were different. The Wilcoxon-Mann-Whitney, Gehan, and Tarone-Ware tests were run in ProUCL at a 95 percent confidence level and the null hypothesis that the two populations were equal. At a 95 percent confidence level, all three tests for both total and dissolved arsenic concluded the null hypothesis should be rejected.

The three hypothesis tests were then run for total and dissolved arsenic with the null hypothesis that concentrations in the background wells were less or equal to concentrations in Site wells. At a 95 percent confidence level, all three tests concluded the null hypothesis should not be rejected for dissolved or total arsenic.

The two populations of concentrations (background and Site) are statistically significantly different at a 95 percent confidence level, and the null hypothesis that concentrations in background wells are less than or equal to Site concentrations was not rejected. It is likely concentrations in background wells represent a different population than Site wells, and it is valid to assume background concentrations represent background conditions and not Site conditions.

5.5.2 Groundwater Discharge Assessment Results

The volume of groundwater discharging from the Site to the adjacent Ebey Slough and the Eastern Drainage Ditch has been estimated. The estimates utilized the Darcy equation (Freeze and Cherry 1979) which quantifies groundwater discharge (Q) as a product of the hydraulic conductivity (K), cross-sectional area (A), and the hydraulic gradient (i). Thus, the equation for groundwater flow through a cross-sectional transect (or discharge plane) is:

$$Q = KAi$$

The computation to estimate the volume of groundwater discharging to the Ebey Slough and Eastern Ditch utilized the following parameters and data sets:

- *Cross Sectional Area (A).* The cross-sectional area for the discharge plane to the Ebey Slough was the width of the site adjacent to the slough multiplied by the approximate wetted thickness (based on water levels in bank area wells, tidal fluctuations, and the thickness of the shallow saturated zone). The width of the site was estimated to be 780 feet and the wetted thickness was 8 feet. This provides an estimated 6,240 square feet (ft^2) for the discharge plane to Ebey Slough.

  The cross-sectional area for the discharge plane to the Eastern Ditch was the width of the site adjacent the ditch multiplied by the approximate wetted thickness (based on water level measurements in the ditch and thickness of the shallow saturated zone). The width of the site was estimated to be 1,125 feet and the wetted thickness was 5 feet. This provides an estimated 5,625 ft^2 for the discharge plane to Eastern Ditch.

- *Hydraulic Conductivity (K).* A uniform K was assumed for the Ebey Slough and Eastern Ditch discharge planes and was based on slug testing results, discussed above, from wells adjacent to the slough (MW-12 and MW-13) and wells adjacent to the ditch (MW-1R, MW-16, and MWBG-6) (Table 10). In order to obtain a range of values for the estimates, the computation assessed discharge using the lowest and highest K values from slug testing. The computation used 6.70×10^{-6} and 1.87×10^{-6} cm sec^{-1} to estimate discharge to the Ebey Slough. The computation used 2.89×10^{-5} and 1.47×10^{-8} cm sec^{-1} to estimate discharge to the Eastern Ditch. Final discharge estimates are considered to be median average between the high and low discharge estimates.

- *Hydraulic Gradient (i).* The pressure transducer data collected during the tidal study discussed above (Section 3.8) was also used to estimate a bulk or net hydraulic gradient relation between site groundwater and Ebey Slough surface water. Additional water level data was collected from the Eastern Ditch collected from 30 January through

6 February 2018 to estimate the net hydraulic gradient relation between site groundwater and Eastern Ditch surface water. Hydraulic gradients were computed for the Ebey Slough and Eastern Ditch using the following:

$$i = \frac{H_{Gw} - H_{SW}}{L}$$

Where: H_{GW} is the water elevation in the wells, H_{SW} is the surface water elevation of Ebey Slough of Eastern Ditch, and L is the lateral distance between the wells and the slough at mid-tide or the bank of the Eastern Ditch.

As part of the computation, temporal plots of the hydraulic gradient between Site groundwater and the slough and the ditch have been included (Appendix N). As can be seen, the hydraulic gradient between Site groundwater and the slough is highly variable and controlled by the large tidal swings in the slough. To estimate discharge to the slough, two methods were used to estimate a net hydraulic gradient. Method 1 used an i value of 0.0447 (unitless) which is the average gradient from all the tidal study gradient data. Method 2 used an i value of 0.0568 (unitless) which is the average gradient from only the positive gradient values, as by convention, a positive value indicates flow toward the slough. Method 2 assumes discharge does not occur during negative gradients (slough stage is greater than water level elevation in the wells). The estimate is than corrected by accounting for the percent of the time that groundwater flows to the Ebey Slough, which is approximately 82 percent of the time (Appendix N).

The hydraulic gradient between Site groundwater and the Eastern Ditch was computed using the transducer data from the ditch along with hand-measured water level data. An average water level for each was assumed and applied throughout the year. The i value used to estimate discharge to the Eastern Ditch was 0.00616 which is the average gradient between the ditch and MW-1R and MWBG-6.

The computation is included in this report (Appendix N). The Site groundwater discharge estimates to the Ebey Slough ranged from approximately 4,022 to 15,076 GPY with an average of 9,431 GPY. Groundwater discharge estimates to the Eastern Ditch ranged from approximately 4 to 7,740 GPY with an average of 3,872 GPY. For both discharge estimates, the range of values relates directly to the range of K values encountered along each discharge plane.

5.6 Terrestrial Ecological Evaluation

Kennedy/Jenks conducted a Terrestrial Ecological Evaluation (TEE) to evaluate the potential impacts to terrestrial ecological receptors, in accordance with regulations published in WAC 173-340-7490 through 173-340-7494. The purpose of the TEE process is to determine whether a release of hazardous chemicals at the Site may cause potential adverse effects to terrestrial ecological receptors. The first step in the TEE process evaluates whether the Site qualifies for a primary exclusion under WAC 173-340-7941. If the Site does not qualify for a primary exclusion, the next steps in the tiered approach are used to evaluate whether the Site qualifies for a simplified TEE under WAC 173-340-7942 or requires additional evaluation and a Site-specific TEE under WAC 173-240-7943.

5.6.1 TEE Exclusion

The Site was evaluated for the potential to pose a threat to terrestrial ecological receptors. To qualify for exclusion from a TEE, the Site must meet one of the four criteria below and described in WAC 173-340-7491:

1. **Point of Compliance.** All soil contamination is, or will be, at least 6 feet bgs (or alternative depth if approved by Ecology), and institutional controls are used to manage remaining contamination.

2. **Barriers to Exposure.** All contaminated soil is, or will be, covered by physical barriers (such as buildings or paved roads) that prevent exposure to plants and wildlife, and institutional controls are used to manage remaining contamination.

3. **Undeveloped Land.** There is less than 1.5 acres of contiguous undeveloped land on or within 500 feet of any area of the Site.

4. **Background Concentrations.** Concentrations of hazardous substances in soil do not exceed natural background levels as described in WAC 173-340-200 and 173-340-709.

Based on an evaluation of the Site information and current and historical analytical data, the Site does not qualify for a TEE exclusion. Consequently, the Site was evaluated using the simplified TEE process in accordance with WAC 173-340-7492 (Ecology 2007).

5.6.2 Simplified TEE

The simplified TEE procedure consists of three steps including: an evaluation of the extent of exposure; evaluation of exposure pathways; and contaminant analysis. The steps need not be followed in order and any one step may be used to determine that no further evaluation is necessary to conclude that the Site does not pose a substantial threat of significant adverse effects to terrestrial ecological receptors.

5.6.2.1 Exposure Analysis

The exposure analysis consists of evaluation of two criteria: total area of contamination (no further evaluation is required if the total surface area of impacted media is less than 350 ft^2) and evaluation of the land use at the Site and surrounding areas that would make substantial wildlife exposure unlikely.

Based on a review of existing analytical data, the surface area of impacted soil is greater than 350 ft^2. The land use evaluation was conducted using Table 749-1 in WAC 173-340-7492, *Simplified Terrestrial Ecological Evaluation-Exposure Analysis Procedure*. The completed Table 749-1 is included in Appendix O. Using Table 749-1, the estimated area of contiguous undeveloped land on the Site or within 500 feet of any area of the Site is 1.9 acres, which corresponds to a score of 8 points.

If the sum of the remaining evaluation criteria, which include: property type; habitat quality rating; likelihood of undeveloped land to attract wildlife; and presence of a specific list of contaminants is greater than 8, the simplified TEE may be ended. The sum of the remaining criteria is 9; therefore, no further evaluation is necessary. The completed VCP TEE evaluation form is included as Appendix O.

Section 6: RI Summary and Conclusions

The primary findings and conclusions of the 2017/2018 RI performed at the former Interfor Site, based on the current and historical investigations, are summarized below. Additional discussion (based on the RI findings) regarding potential contaminant sources, contaminant migration, potential exposure pathways, CULs, and remedial alternatives is presented in subsequent sections of this document.

- The RI was conducted at the Site between October 2017 and November 2018, and included collection and analysis of soil, groundwater, and surface water samples at both on-property and off-property locations, and evaluation of geologic, hydrogeologic, and background conditions for the Site and other nearby properties. The results of the RI were used to develop a Site CSEM (Section 7), Site cleanup standards (Section 8), and to perform a Feasibility Study (Sections 9 through 13).

- The primary historical uses of the Site included sawmills and lumber products manufacturing facilities operated by several different companies, most recently Garka Mill (the primary Garka Mill facilities, located in the southern portion of the Site, were demolished by 2007). The Site has been owned by the City since 2006 and used for parking and maintenance of solid waste collection vehicles and general storage of solid waste containers and other materials.

- The Site was initial developed in the late 1800s. The initial development history of the Site is similar to other nearby sites located along Ebey Slough, and included placement of fill materials (possibly dredge fill) over native tideflat materials (primarily fine-grained deposits, locally including peat layers and lenses, and former drainage channels). Additional filling activities were performed in the southeastern portion of the Site in the late 1960s. The fill materials are the primary suspected source of arsenic impacts to Site media, and similar conditions (i.e., arsenic concentrations in soil and groundwater) have been documented at several adjoining and nearby sites.

- Site investigation activities performed since 1996 have included collection and analysis of soil and groundwater samples over several phases of investigation, most recently in 2012 (excluding the current RI). Remedial actions including removal and disposal of TPH-affected soil and groundwater in three areas of the Site (former Kiln area, former UST area near the maintenance building, MW-7/office area) were performed between 1996 and 2012. Over 1,000 cy of impacted soil were removed from these three areas.

- The primary COCs at the Site, based on the 2017/2018 RI findings, include TPH-related compounds (primarily DRO and ORO, but also GRO locally) and arsenic, which are present in Site media at concentrations above potential CULs. [Note: Lead was also detected at a concentration slightly above the potential CUL in one groundwater sample collected near the southwestern corner of the Site, but is likely from an offsite source to the west.] Other COCs (cPAHs and methylene chloride) identified during previous Site investigations, were not detected at concentrations above potential CULs during the 2017/20118 RI.

- TPH-related impacts to Site soil and groundwater were identified at several locations on the Site, and appear to be related to localized spills or residual impacts from historical USTs. TPH-related impacts to groundwater in the western portion (west of a former WSDOT cleanup site and historical boat building facility) and central/northwestern portion of the Site appear to be related to on-property migration of impacted groundwater from off-property locations.

- The petroleum hydrocarbon impacts identified in several background groundwater samples from wells located along the upgradient property boundaries appear to be related to offsite sources (i.e., impacted groundwater appears to be migrating onto the Site from adjoining sites). On-property migration of hydrocarbon compounds from off-property sources was observed at wells MWGB-2, MWBG-3, MWBG-4, MWBG-5, and MW-15.

- A specific source of arsenic impacts to Site soil was not identified during the RI. Historical Site uses do not appear to include processes or products associated with arsenic (such as wood preservative treatment), and soil containing slightly elevated concentrations of arsenic are present only in localized, non-contiguous areas, suggesting that the impacts are not a result of a release from any particular location. The most likely suspected source of low concentrations of arsenic is the fill materials placed during initial Site development, which is supported by similar conditions documents at multiple sites located west of the Interfor Site adjacent to Ebey Slough.

- As with soil, a specific source of arsenic impacts to Site groundwater was not identified. Arsenic concentrations detected in monitoring wells located at up-gradient positions around the perimeter of Site and at nearby sites (i.e., background wells), indicate that arsenic impacts (i.e., concentrations above potential cleanup standards) are present in groundwater migrating onto the Site from the north and west (groundwater flow is generally from the northwest to the southeast across the Site). Background threshold values for groundwater migrating onto the Site (calculated using ProUCL software; refer to Section 5.5.1) were 35.6 µg/l for total arsenic and 27.7 µg/l for dissolved arsenic. These values are discussed relative to potential Site CULs in Section 8.

- The arsenic concentrations in groundwater entering the Site are similar but slightly lower, on average, to those detected on the Site. In particular, arsenic concentrations in wells located in downgradient positions (southeastern portion of the Site) or in proximity to former TPH-related remediation areas, are somewhat higher than in perimeter background wells.

- The slight increase in average arsenic concentrations in groundwater on the Site compared to perimeter background locations may be attributable to reducing conditions identified throughout the Site. These reduced conditions in groundwater may be related to current and former TPH-related impacts or high organic content of the soils (i.e., wood waste) which may have resulted in increased leaching and greater mobility of arsenic present in fill materials or occurring naturally in native sediments and peat layers. In addition, the shallow-zone groundwater gradient across the Site is influenced by a locally increased gradient in the southeastern portion of the Site (possibly related to a former drainage channel, utility corridors, and/or a drainage ditch along the eastern margin of the Site) which may contribute to preferential migration of groundwater (including dissolved arsenic) toward the southeast, where the highest arsenic concentrations are encountered for most monitoring events.

- Site groundwater appears to ultimately discharge to surface water by seepage along the Ebey Slough and the drainage ditch bank along the eastern margin, and through the Site's stormwater conveyance system. Arsenic concentrations above potential CULs were detected in stormwater and ditch water samples, suggesting possible migration from the Site, but arsenic was also detected in surface water samples collected from Ebey Slough at concentrations significantly above potential CULs (typically one to three orders of magnitude above the most stringent potentially applicable surface water cleanup standard; refer to Section 8). Although tidal influence from Ebey Slough appears to be limited to near-bank areas and the downstream portions of the drainage ditch, infiltration of arsenic-containing surface water from the Slough is possible (both for Site groundwater and ditch water).

- The findings of this RI suggest that the elevated concentrations of arsenic in environmental media (with respect to regulatory cleanup standards) is a regional, rather than Site-specific, condition, and represent a natural condition for the Site and vicinity. Elevated concentrations of arsenic were present in both upgradient groundwater and surface water at similar concentrations to those detected at the Site. The CULs and remedial alternatives developed for the Site, as presented in the following sections, are based on the presumption that arsenic-related impacts from a defined source can be managed through performance of various remedial actions. However, remedial technologies are generally not available that can treat arsenic in groundwater to the low concentrations of the established CULs (i.e., sub-part per billion concentrations). Furthermore, elevated concentrations of arsenic in groundwater and surface water are an area-wide condition, and on-property controls for groundwater (if performed) would have no effect on the overall environmental conditions. Consequently, comparison of Site groundwater and surface water concentrations to the low regulatory standards and ARARs developed for protection of surface water is not appropriate for the Site conditions.

Section 7: Conceptual Site Exposure Model

Based on the findings of this RI and previous Site information, a CSEM was developed for the Site to identify and illustrate complete and potentially complete exposure pathways for Site COCs, and the processes through which receptors may be exposed to COCs. The CSEM is based on an evaluation of affected Site media and contaminant sources, hydrogeologic conditions, contaminant transport mechanisms, and potential human and ecological receptors.

The following sections describe and discuss the CSEM based on current and reasonably foreseeable future conditions at the Site:

- Section 7.1 identifies potential sources of Site COCs including potential on-property, off-property, and regional background sources, and media affected by COCs.
- Section 7.2 discusses fate and transport of COCs in Site media including mechanisms of COC transport and transfer between different media.
- Section 7.3 summarizes the potential exposure pathways at the Site for human and ecological receptors.

Figure 31 provides an illustration of the shallow-zone gradient and potentially related Site features, and the CSEM is illustrated on Figure 32, including potential exposure pathways for potential on-property and off-property human and ecological receptors base on Site COCs and affected media.

7.1 Potential Sources

Potential sources of COCs identified for the Site were located both on-property and off-property. Potential off-property sources include adjoining properties to the west of the Site. Likely sources have been identified for most of the organic COCs (i.e., TPH, cPAHs,) and lead, but not for arsenic. Arsenic impacts at the Site may be related to regional filling conditions (refer to Sections 1.3 and 4.1) and do not appear to be Site-specific or attributed to past industrial activities at the Site. Potential sources are discussed in the following sections.

7.1.1 Organics and Lead

Multiple potential sources for organic COCs have been identified on the Site (TPHs and cPAHs), including those directly related to previous remedial actions. Potential sources of TPH, cPAHs, methylene chloride, and lead have also been identified on adjoining properties, primarily the WSDOT Bridge site (Section 2.3.1) and, to a lesser extent, the Ebey Park (Section 2.3.3) and First Stop Deli (Section 2.3.2) sites. [Note: Although methylene chloride was detected in prior investigations at the Site, it was not detected during the RI activities completed in 2017 and 2018. In addition, no known sources of methylene chloride have been identified on-property; therefore, it is not considered a Site COC. The few historical detections of methylene chloride are likely attributed to laboratory cross-contamination and not attributed to site conditions.]

Known and potential onsite sources of organic COCs and lead are listed below:

- **Releases from USTs.** Petroleum hydrocarbon impacts to soil and groundwater in AOC 2 (GRO) and AOC 5 (DRO, ORO) are directly related to releases from USTs previously located in these areas (see Section 2.1). The former gasoline UST located in AOC 2 is also a potential source of lead.

- **Spills from ASTs, drums, or other storage containers.** Spills from diesel ASTs (previously located next to the existing maintenance and kiln buildings) and/or from ASTs, drums, and buckets stored at multiple locations on the Site (former oil storage sheds, former mill buildings, and the existing maintenance building) are potential sources for localized impacts from TPH and possibly cPAHs.

- **Spills from general Site operations, machinery, and vehicles.** Spills of hazardous materials during use or transport at the Site are potential sources of localized TPH and cPAH impacts. Spills or leaks from machinery and vehicles (including cranes and other log-handling equipment) are also potential sources of localized impacts at the Site. This includes potential spills from rail cars along the route of the former rail spur. The DRO and ORO impacts identified in MW-7 (AOC 1) have been attributed to an undocumented historical spill, but could also be related, at least in part, to downgradient migration from the First Stop Deli site (Section 2.3.2).

- **Former Refuse Burners.** Two refuse burners previously located at the Site (see Section 1.3.3) are potential sources of cPAHs encountered in the southwestern portion of the Site. Burnt wood debris was encountered in two test pits (2017-TP-13 and 2018-TP-12) located near the former refuse burners. Soil samples collected from materials containing burnt wood at 2017-TP-13 (3 to 3.5 feet bgs) and 2018-TP-12 (2 to 2.5 feet bgs) contained detectable concentrations of total cPAHs (0.012 mg/kg and 0.00355 mg/kg, respectively); however, these concentrations are below the proposed soil CULs (MTCA Method A Soil; see Section 8).

- **Treated pilings.** Wood pilings used to support the slab foundations of mill-related structures could be a source of cPAHs if the pilings were treated with creosote. Possible tops of wood pilings were encountered in test pits 2018-TP-02, 2018-TP-07, and 2018-TP-11. A soil sample was collected at 2018-TP-11 (3,5 to 4 feet bgs), but cPAHs were not detected in the sample.

- **Oiled roadway surfaces in log yards.** The spraying of oil on unpaved road surfaces (primarily for dust control purposes) was a common practice historically. Although the available information does not indicate that this type of activity was performed at the Site, it possibly occurred historically to manage dust in unpaved areas of the Site. If roadway oil spraying was performed historically, it could be a contributing factor for some of the low-level, localized petroleum hydrocarbon-related impacts, particularly in former log yard areas.

Potential off-property sources of organic COCs and lead are listed below:

- **Former Boat Manufacturing Facility.** The former boat manufacturing facility (AOC 3) is a known source of TPH, cPAHs, metals, and possibly methylene chloride impacts in the southwestern portion of the Site. In particular, the DRO and ORO impacts identified in wells MW-15 and MWBG-2 appear to be related to on-property migration from this off-property location west of the Site and not from onsite releases. DRO impacts to groundwater were identified during the recent bridge replacement project (see Section 2.3.1) but were not fully characterized at the time.

- **First Stop Deli USTs.** The north-adjoining First Stop Deli site is located upgradient from the Interfor Site and includes a service station with four USTs (gasoline and diesel). A previously documented gasoline release (see Section 2.3.2) does not appear to have impacted the Site, but the upgradient location of the USTs is a potential concern for the Site if other unknown releases have occurred, and if any spills or releases occur in the future. In addition, environmental investigation activities appear to have been recently performed at the First Stop Deli site (based on soil boring and well logs available from Ecology, see Section 2.3.2) but no information regarding potential recent releases of hazardous substances was identified. DRO and ORO detected in groundwater samples collected from wells MW-7, MWBG-3, and MWBG-4 could be attributable (at least in part) to downgradient migration of petroleum hydrocarbons from the First Stop Deli site; however, current monitoring results do not suggest an apparent GRO source originating from upgradient of the Site.

- **Ebey Park Former Service Station.** A former gasoline service station located in the northwestern portion of the Ebey Park site (across State Avenue from the First Stop Deli service station, see Figure 3) could be a source of GRO-related impacts (possibly including lead) if affected media remain at the location. The former service station is generally located upgradient from the Site (see Section 2.3.3) and gasoline-related petroleum hydrocarbons, if present, could be transported in groundwater to the Interfor Site (wells MW-7 and MWBG-2 in particular); however, current monitoring results do not suggest an apparent GRO source originating from upgradient of the Site.

7.1.2 Potential Arsenic Sources

This section provides a discussion of possible on-property, off-property and regional sources of arsenic that may contribute to elevated arsenic concentrations observed in Site groundwater and surface water.

As indicated above, no specific sources of arsenic have been identified at the Site based on historical Site uses or the RI findings. The known historical Site uses (Section 1.3) do not appear to include the storage or usage of arsenic (or arsenic-treated materials), and Site investigations have not identified areas with elevated arsenic concentrations relative to the overall distribution of arsenic in Site media (Section 5.1). Arsenic impacts could also be related to off-property (Section 7.1.2.1) or regional (Section 7.1.2.2) sources.

Despite the lack of obvious sources, arsenic concentrations above potential Site-specific CULs (see Section 8) have been detected in on-property soil samples (seven of 54 RI samples collected in 2017/2018 contained arsenic above 20 mg/kg) and on-property groundwater samples (14 of 15 wells sampled in 2017/2018 contained arsenic above 5 µg/l), and in surface water samples collected throughout the Site (catch basins and outfalls to ditch and Slough; 15 of 15 samples contained arsenic above the potential CUL of 0.0982 µg/l) and adjoining surface water bodies (drainage ditch and Ebey Slough; 16 of 16 samples contained arsenic above the potential CUL of 0.0982 µg/l) (see Section 5.1). Although the distribution of arsenic in soil (along with the variability in arsenic concentrations observed in groundwater and surface water) do not indicate a specific or identifiable on-property sources, Site groundwater concentrations appear to be somewhat elevated relative to background conditions.

While the cause for the slightly higher arsenic concentrations in groundwater is uncertain, it may be attributed to increased leaching of arsenic in Site fill material resulting from anaerobically reduced conditions in groundwater at the Site (discussed in Section 7.2). The reduced groundwater conditions could be caused by decomposition of petroleum hydrocarbon or other organic materials (such as wood waste), both of which are present at the Site.

7.1.2.1 Potential On-Property Arsenic Sources

Potential on-property sources of arsenic based on historical Site uses that were evaluated for this RI are summarized below:

- **Wood treatment.** Arsenic has historically been a component in various products used as wood preservatives; however, no known wood preservative treatment facilities or activities were identified in the historical reference materials for the Site (see Section 1.3). In addition to arsenic, some metals-based wood preservative treatment materials included other metals including copper. The analytical results (see Section 5.1) do not show a correlation between arsenic and copper concentrations in Site media, which is consistent with the historical findings (i.e., wood treatment has not been performed at the Site). Consequently, elevated arsenic in groundwater from wood treating does not appear to be a likely cause.

  [Note: As discussed in Section 2.1, a 2004 Review of Environmental Liabilities report (Pottinger Gaherty 2004) indicates that limited wood surface treatment with an “anti-sapstain” cleaning agent (WoodBrite), was historically performed by Garka in the planer mill building. The available information indicates that the WoodBrite product did not contain arsenic. See Section 2.1 for additional information.]

- **Storage of treated logs.** While logs were historically stored in the former log yards in the northern and southeastern portions of the Site (AOC 4), there is no available data to suggest that the logs had been treated prior to storage. However, if the stored logs were treated with an arsenic-based preservative, arsenic could have leached from the log surfaces during periods of precipitation and then transported into soil and groundwater via infiltration and/or discharged into surface water by overland runoff or via storm drains. However, the analytical results do not show elevated concentrations of arsenic (or other metals) in the former log yard areas (other than a few isolated soil samples with arsenic above the proposed CUL). It is also unlikely that cedar shingles and wood products would have been manufactured using arsenic-treated wood as a source material. Handling and storage of logs do not appear to be a source of arsenic at the Site.

- **Treated wood pilings beneath building slabs.** As indicated in Section 1.3.3.4, foundation slabs for the Garka Mill (and likely other previous mills) were supported by pilings. If pilings were treated with an arsenic-based preservative, they could potentially leach into soil and groundwater. Possible tops of wood pilings were encountered in test pits 2018-TP-02, 2018-TP-07, and 2018-TP-11. Four soil samples collected from these test pits contained arsenic at concentrations of 1.65 to 27.3 mg/kg, similar to the range concentrations detected throughout the Site. Consequently, if the remaining piles have any affected on arsenic concentrations in soil or groundwater, it appears to be minimal.

- **Ballast below building foundations, in log storage areas, and below rail spurs.** While there is no documentation or RI data to suggest that arsenic-containing ballast was used at the Site, if ballast materials containing arsenic were used on-property, they could potentially serve as a source of arsenic at the Site. Ballast material from local sources (quarries) are known to contain slightly elevated arsenic concentrations resulting from the arsenopyrite rock material from which ballast is derived. During drilling activities in the western portion of the Site, thick sections of rock ballast and quarry spalls were encountered below roadways. While not tested during the RI, this ballast material could contain arsenic and could contribute to low levels of arsenic found in Site groundwater.

- **Anthropogenic waste from onsite refuse burners.** Ash from refuse burners, although not identified at the Site could also be a source of metals. As indicated in Section 7.1.1, apparent burned anthropogenic wood materials (possibly wastes from the former refuse burners) were identified during the RI at two test pits located near the former burners (2017-TP-12 and 2017-TP-13). Arsenic concentrations in soil samples associated with the burnt materials were from 5.56 to 13.5 mg/kg. Other potentially burned materials (vitreous/lusterous materials with vesicles) were observed at two additional test pit locations (2017-TP-11 and 2018-TP-03). Soil samples collected at these test pits contained arsenic at concentrations of 6.52 to 19.1 mg/kg. Although the soil materials in which burnt materials were identified contained arsenic, the arsenic concentrations are below the MTCA Method A soil CUL and consistent with background conditions encountered throughout the Site and, consequently, the refuse burners do not appear to be a significant source of arsenic onsite.

- **Naturally-occurring peat materials**. Arsenic may also occur naturally in peat deposits at concentrations above natural background. Four soil samples collected from peat materials were analyzed for arsenic (from borings 2017-B8, 2017-B9, MWBG-7, and test pit 2018-TP-03) and contained arsenic at concentrations of 9.14 to 23.2 mg/kg. These concentrations are similar to the range of arsenic concentrations detected in other soil samples collected throughout the Site, indicating that arsenic concentrations in the peat are most likely not elevated relative to other Site soils. This suggests that the peat deposits are not a likely source of arsenic impacts to Site soil. Arsenic leached from the peat material could, however, contribute to arsenic impacts to Site groundwater (the screened intervals for most Site wells include peat-containing intervals).

7.1.2.2 Potential Off-Property Arsenic Sources

Arsenic impacts at the Site could also be related to offsite sources and/or to arsenic in the imported fill materials originally placed at the Site and surrounding area (Section 7.1.2.3) during initial development of the area. Localized leaching of arsenic (possibly greater during periods of high groundwater elevations and/or precipitation) could account, in part, for the variability in arsenic concentrations detected in groundwater samples collected from Site monitoring wells. In addition, reducing conditions in areas with existing and historical TPH-related impacts could have caused increased leaching of arsenic in these areas (discussed in Section 7.2).

Potential offsite sources of arsenic include a former Asarco smelter located in Everett (Everett Smelter), Washington, and properties adjoining the Site to the west (WSDOT Bridge and Ebey Park).

The former Everett Smelter is located approximately 2 miles south of the Site. Information available at Ecology’s Everett Smelter website (reviewed 6 February 2018; Ecology 2018b) indicates that the smelter was operational from 1894 to 1912 [corresponding approximately to the initial period of development at the Interfor Site (see Section 1.3)]; with arsenic being listed as a primary COC. Investigation and cleanup activities have been performed at the Everett Smelter site (Ecology CSID 4298) since approximately 1990 and affected areas include the former smelter facility and surrounding properties to the west. Impacts to surrounding properties were related to aerial deposition from smelter emissions. Aerial deposition of arsenic-containing emissions from the Everett Smelter could have occurred at the Site during the period of smelter operation, although presumably to a lesser degree than nearby properties located within Ecology’s formally-defined site area for the smelter.

Two sites (WSDOT Bridge, Ebey Park) located west of the Site are also potential sources of arsenic at the Site. Arsenic has been detected in soil and groundwater at both sites (see Section 2.3 and Table 1) at concentrations above the proposed Site CULs (Section 8). Groundwater elevations (see Section 4.2) measured during the RI show that the Interfor Site is directly downgradient from the WSDOT Bridge site, and generally downgradient from the northern portion of the Ebey Park site (see Section 2.3.3), indicating that transport of arsenic from these sites could affect the on-property portions of the Site. However, the arsenic concentrations detected in soil and groundwater samples from these adjoining sites are similar to those from the Interfor property (discussed in Section 7.1.2.1) and from background locations (see Section 5.1.4), suggesting that they are not likely sources for the arsenic concentrations observed in Site media. In addition, previous environmental investigations performed at these adjoining sites (see Section 2.3) did not identify specific sources of arsenic.

The lack of evident arsenic sources from historical site uses at both the Interfor Site and other nearby sites suggests that the arsenic impacts are likely related to a more extensive regional issue which affects multiple sites, as discussed below in Section 7.1.2.3.

7.1.2.3 Regional Arsenic Considerations

As discussed in previous sections, historical and analytical findings did not identify significant sources of arsenic related to historical uses or known releases of hazardous substances at the Site. This also appears to be the case for other nearby properties including the WSDOT Bridge, Ebey Park, Geddes, and Welco sites. Consequently, the most probable source of arsenic identified at the Site appears to be imported fill materials placed at the Site, primarily during the initial filling and development of the Site and other nearby properties in the late 19th century.

This is supported by the shared early development history of the Site and nearby properties (as described in Section 1.3 and depicted on historical maps and aerial photographs), and the similarity of arsenic concentrations detected in soil samples collected at each of these properties, as listed below:

- Interfor Site – 1.36 to 188 mg/kg (approximately 100 samples, collected during this RI and previous investigations). [Note: The majority arsenic concentrations detected in soil samples collected from the Site were less than 40 mg/kg. Only two samples, both collected in the central portion of the former northern log yard (AOC4), contained arsenic concentrations exceeding 40 mg/kg.]

- WSDOT Bridge – <11 to 40 mg/kg (approximately 46 samples).

- Ebey Park – 1.81 to 21.5 mg/kg (approximately eight samples, including one collected during this RI from MWBG-01).

- Geddes Marina – 2.42 to 56.9 mg/kg (approximately 24 samples).

- Welco Property – 1.78 to 16.6 mg/kg (approximately 13 samples, including two collected during this RI from MWBG-08 and MWBG-09).

Arsenic has also been detected in groundwater samples collected from monitoring wells at the Ebey Park, Geddes, and Welco sites at concentrations similar to the range detected in groundwater samples collected from the Interfor Site wells, as listed below: [Note: Results for total (unfiltered) arsenic are shown (unless otherwise noted) for comparison purposes because dissolved (filtered) data are not available for all sites. In most groundwater samples collected during the RI, total and dissolved arsenic concentrations were generally comparable]:

- Interfor Site – Samples from 15 onsite wells collected during this RI; 1.16 to 117 µg/l.

- Ebey Park – Samples from eight wells collected in 2001; 4.58 to 22 µg/l; samples from two wells collected during this RI in 2017 and 2018; 0.29 to 23.0 µg/l.

- Geddes – Samples from five wells collected in 2015; 3.9 to 13 µg/l; samples from two wells collected during this RI in 2018; 1.96 to 3.83 µg/l [Note: Reconnaissance groundwater samples collected in 2008 contained up to 178 µg/l of arsenic].

- Welco Property – Samples from two wells installed for this RI in 2018; 4.40 to 9.14 µg/l [Note: Reconnaissance groundwater samples collected in 2016 contained 24 to 75 µg/l arsenic (dissolved arsenic, total arsenic not analyzed)].

In addition, total arsenic concentrations detected in groundwater samples collected from upgradient (i.e., background, see Section 3.5.3) wells (on-property perimeter wells MWBG-2 through MWBG-05, off-property wells MWBG-1, MWBG-6 to MWBG-10, EP-1, GM-02, and GM-03) are similar to those detected in other on-property and off-property wells, ranging from

0.29 to 65.4 µg/l, demonstrating the regional occurrence of arsenic-affected groundwater upgradient from the Site. The results of the background arsenic concentration evaluation (Section 5.5) support this conclusion, with background concentrations in groundwater (calculated using ProUCL software; refer to Section 5.5.1) of 35.6 µg/l for total arsenic and 27.7 µg/l for dissolved arsenic.

7.1.2.4 Arsenic Source Summary

The available information indicates arsenic impacts to Site media (soil, groundwater, and surface water) most likely reflect regional background concentrations rather than Site-specific issues related to past uses or releases. The most likely source of arsenic is the imported backfill material placed on native soils during initial development of the Site in the late 19th century, but naturally-occurring arsenic in peat deposits and regional use of road ballast (base course material) containing arsenopyrite could also contribute to groundwater impacts.

Although the source of backfill materials used when the Site and surrounding bank areas were initially filled and developed is unknown, fill and ballast materials available from existing local quarries (such as Iron Mountain Quarry in Granite Falls, Washington) include rock which contains arsenopyrite, a potential source of arsenic leaching to groundwater. The local occurrence and availability of quarry rocks with a naturally high arsenic content suggests similar materials may have been historically placed at, and adjacent to, the Site.

7.2 Fate and Transport

This section provides a summary of contaminant transport mechanisms, pathways, and exposure media for potential receptors (discussed in Section 7.3). Transport mechanism and pathways are shown on the CSEM diagram (Figure 32) and discussed below.

As discussed in Section 7.1, the primary contaminant sources for most COCs except arsenic have generally included releases from USTs to subsurface soil and shallow zone groundwater, and localized spills of fuel and/or oils (or other materials or wastes related to historical Site uses) during previous Site operations. Impacted soil (primarily petroleum hydrocarbon-containing) has been removed from multiple locations on the Site (AOCs 1, 2, and 5; Section 2) and from the west-adjoining WSDOT Bridge site (see Section 2.3.1), but the remaining areas of impacted shallow and subsurface soil are an ongoing secondary source of contaminants in groundwater and surface water. Consequently, potentially complete exposure routes for both human and ecological receptors exist for Site soil, groundwater, and surface water (see Section 7.3).

Based on the Site characterization sampling performed for this RI, VOCs do not appear to be COCs for the Site. GRO was detected in some samples, but at concentrations below MTCA Method A CULs except for one localized occurrence in a soil sample from TP-9. Furthermore, the vapor intrusion exposure pathway has not been considered to be a potentially complete exposure pathway for the Site based on comparison to screening levels provided in Ecology's soil vapor intrusion guidance [Ecology 2009, as revised 2018 (Table B-1 screening levels only)]. Concentrations of VOCs detected in Site groundwater samples during the RI were compared to the Method B screening levels listed in Table B-1 (as revised 2018) in Ecology's vapor intrusion guidance. Detected VOCs in groundwater samples with screening levels listed in Ecology's Table B-1 included benzene (up to 1.46 µg/l), toluene (up to 14.2 µg/l), and methyl ethyl ketone (up to 8.49 µg/l). All of the detected VOC concentrations were well below the listed screening levels, supporting the conclusion that the vapor exposure pathway is incomplete for the Site. [Note: Although some low VOC concentrations were detected in vadose zone soil samples, screening levels are not provided for soil and no soil gas samples were collected. Consequently, comparison to screening levels is applicable only for groundwater samples.]

Contaminant transport typically occurs through leaching of contaminants from a source, infiltration through unsaturated soils to the saturated zone during precipitation events, and migration in shallow-zone groundwater through advection and dispersion. Site groundwater ultimately discharges to surface water in Ebey Slough, either directly or through drainage to the ditch located along the eastern margin of the Site. Discharge of groundwater to Ebey Slough and the drainage ditch may occur through seepage along bank areas and infiltration of stormwater pipes which discharge directly to the ditch and Slough (see Figure 4). Contaminants could also be transported in stormwater runoff directly to Ebey Slough and drainage ditches during precipitation events (via direct overland runoff or in the Site's stormwater conveyance system).

In general, shallow soil contamination appears to occur beneath paved locations or beneath fill (generally <1 to 3 feet, thickest in the southern portion) placed since the releases occurred (i.e., impacts to the existing surface materials were typically not identified). However, it is possible that localized impacts to surface soil may be present, including organic and metals contaminants (primarily arsenic) and could locally be transported in stormwater runoff.

The degree and magnitude of contaminant leaching and mobility may be affected by hydrogeologic conditions at the Site. Shallow groundwater may migrate preferentially along Site utility corridors (storm drains, sanitary sewer, Puget Sound Energy gas main; see Figure 4). This could include infiltration of storm drain pipes and subsequent discharge at Site outfalls, and/or preferential migration along relatively coarser-grained bedding materials in the utility corridors. Preferential migration may also occur in areas where relatively coarser fill materials have been placed, including the former stream channel (see Sections 1.3.1 and 4.2).

Figure 31 provides a representative illustration of the typical potentiometric surface and hydraulic gradient at the Site (for water levels measured 21 September 2018) as they relate to Site utilities, Site stormwater conveyance pipes, ditches, and other facilities, and the former drainage channel location. As discussed in Section 4.2, the gradient appears to influenced by the former drainage channel and existing ditch (and possibly by bedding materials associated with the high pressure gas line), which generally direct shallow groundwater flow toward the southeastern portion of the Site. Relatively high concentrations of arsenic in wells located in the southeastern portion of the Site may be attributable, in part, to the locally high gradient causing a preferential migration of Site groundwater toward this area. Most of the shallow groundwater migrating toward the southeastern portion of the Site would pass through fill materials placed during initial Site development, also including one or more areas that are currently or historically affected by TPH-related impacts. Mobilization (i.e., leaching) of arsenic from fill materials or natural sources (i.e., peat) can be enhanced by reducing conditions associated with TPH-related impacts (discussed below).

Contaminant mobility may also vary seasonally based on the fluctuation of groundwater elevations, with the greatest potential mobility during periods of higher groundwater elevations. Presumably, the quantity of affected soil (and thus, the mass of contaminants) in direct contact with shallow groundwater could increase as groundwater elevations increase, and vice-versa, resulting in a greater contaminant mass available for potential leaching during periods of higher groundwater elevation.

The degree and magnitude of contaminant leaching and mobility may also be affected by geochemical conditions at the Site. In particular, arsenic mobility may be increased under anaerobic and reducing conditions, which may occur regionally or locally. Localized anaerobic and reducing conditions may be associated the natural degradation of petroleum hydrocarbon contaminants.

In general, biodegradation of petroleum hydrocarbons results in the reduction of electron acceptors such as DO, nitrate, manganese, ferric iron, and sulfate. After DO is consumed, anaerobic microorganisms start to deplete electron acceptors in the following order: nitrate, manganese, ferric iron, sulfate, and carbon dioxide. Anaerobic destruction of petroleum hydrocarbons is therefore, associated with the reduction of nitrate and sulfate, solubilization of manganese (Mn^{+4} to MN^{+2}) and iron (ferric to ferrous iron) indicated by an increase in concentration, and the production of methane.

Site field parameters measured during groundwater purging typically indicated low dissolved oxygen (<1.0 mg/L) and negative ORP (i.e., reducing conditions) in groundwater, indicating anaerobic conditions. For samples where nitrate was analyzed, nitrate concentrations were mostly below laboratory reporting limits; concentrations of dissolved iron were elevated in the central (MW-6, MW-10, MW-11), eastern (MW-14, MW-16), and western (MW-15, MW-17) portions of the Site. These areas are the same as or are nearby/downgradient to areas with petroleum hydrocarbons in groundwater above MTCA Method A CULs.

On-property wells with relatively high arsenic groundwater concentrations (MW-06 and MW-11) are located downgradient of the former gasoline UST area (AOC 2), which included a large area of TPH-affected soil which was removed (with the UST) in 2012. Arsenic was detected in soil samples collected from the UST excavation sidewalls at concentrations of up to 37 mg/kg (see Section 2.2.5), indicating that arsenic-containing soils were present in the vicinity of the UST and could have been preferentially mobilized. Arsenic concentrations in MW-7 and MW-1R, both also located near former UST and TPH remediation areas (see Section 2.2.1) are generally lower than MW-06 and MW-11, but most of the affected soils were removed in the late 1990s, so potentially mobilized arsenic may have migrated further away from these areas. Arsenic mobilized by TPH-related geochemical conditions would also migrate preferentially toward the southeastern potion of the Site, as previously discussed, where the highest on-property concentrations of arsenic in groundwater have been detected (MW-14 and MW-16).

7.3 Exposure Pathways

Potentially complete exposure pathways for human and ecological receptors at the Site generally include direct contact and/or incidental ingestion of affected Site media (soil, groundwater, and surface water). As previously discussed, the vapor intrusion pathway is not considered to be a complete exposure pathway at the Site due to lack of VOCs detected. Human consumption of groundwater also does not appear to be a potentially complete exposure pathway as shallow Site groundwater is not suitable for use as a drinking water supply (tidal influence and low yield) and potable water is supplied by the City (see Section 7.3.1). However, for purposes of this RI, consumption and direct contact with groundwater will be considered as a potentially complete exposure pathway for evalution. Potential exposure pathways are identified and discussed in the following sections for human (Section 7.3.2) and ecological (Section 7.3.3) receptors. Potentially complete exposure pathways are also summarized on the flow chart presented on Figure 31.

7.3.1 Groundwater Usage and Potability

Consumption of, and dermal contact with, groundwater are considered a potentially complete exposure pathways for human receptors; however, consumption of Site groundwater is very unlikely as it could not be used as a domestic drinking water supply. The Site is currently served by the municipal (City) water utility and is available at multiple locations on the Site. Any future development is also anticipated to be served by the City water utility. Off-property migration of groundwater affecting other potential domestic water supplies does not appear realistic.

A search for water supply wells located within an approximate 0.5-mile radius of the Site was conducted using Ecology's online Well Log database (Ecology 2018c, accessed 6 February 2018). No water supply wells were identified within the search radius. In addition to the Ecology database, a 1952 USGS summary of historical groundwater resources for Snohomish County (Newcomb 1952) was reviewed. No wells are shown within a 0.5-mile radius of the Site, but three are located between 0.5 and 1 mile east of the Site. Depths are listed as 8 to 16.8 feet (for two dug wells) and 125 feet (for one drilled well) and water usage is listed as domestic. These wells are located upgradient of the Site and are unlikely to be currently used for domestic water supplies (they are not shown as such in Ecology's databases) and therefore, are not considered to be potentially complete exposure pathways.

A search was also conducted for existing water rights claims within an approximate 0.5-mile radius of the Site using Ecology's online Water Resources Explorer database (Ecology 2018d, accessed 6 February 2018). Two water rights claims, one for groundwater and one for surface water, were listed in Ecology's database within the search radius. Both claims were submitted by the same individual (Edward Hayes) in 1974 for general domestic and stockwater use. The claims are located south of the Site, across Ebey Slough. The water rights claims include extraction of groundwater from wells and sumps galleries, and extraction of surface water from Ebey Slough. The claims are listed as active by Ecology, but current usage status is not indicated, and the area appears vacant on recent aerial photographs available from GoogleEarth^{TM} (tide flats, roadways, and a vacant gravel lot are visible west of I-5). Regardless of usage, it is unlikely that Site contaminants would be transported across Ebey Slough and any potential exposure pathways are considered to be incomplete.

Based on the available information and this analysis, consumption of and dermal contact with groundwater are not currently considered to be complete exposure pathways for the Site, except as noted below for construction workers. In addition, the nature of the shallow saturated zone at the Site makes it unlikely to be identified as a drinking (domestic) water supply in the future. Tidal influences near Ebey Slough, locally high salinity, seasonal variation in water levels, elevated regional background arsenic concentrations, and the shallow depth and limited thickness of the saturated interval (insufficient yield) illustrate its unsuitability as a source of potable water.

7.3.2 Human Receptors

The following exposure pathways are considered to be complete, or potentially complete, for human receptors based on the existing Site conditions and uses (also see Figure 32):

- Surface soil direct contact and/or incidental ingestion by site workers (employees), construction workers, site visitors (including trespassers), and recreational users (walking path adjacent to Ebey Slough).
- Subsurface soil direct contact and/or incidental ingestion by construction workers.
- Groundwater direct contact and/or incidental ingestion by construction workers (saturated conditions exist within 3 to 6 feet bgs).
- Surface water direct contact and/or incidental ingestion by site workers (employees), construction workers, and visitors (including trespassers).
- Surface water direct contact and/or incidental ingestion by recreational users (Ebey Slough).
- Human consumption of aquatic organisms in surface water.

Future development of the Site by the City or other future owner will need to mitigate the potential exposure pathway for direct contact and/or incidental ingestion of affected Site media by visitors, employees (site workers), and residents (if housing units are constructed). Redevelopment would also include improvements to existing roadways, including Columbia Avenue, which would presumably mitigate the potential for direct contact or ingestion of surface water from the Site's existing drainage ditch.

Direct contact and/or incidental ingestion of affected Site media by construction, utility, or other workers performing invasive tasks, such as excavation or drilling/potholing, may remain a potentially complete exposure pathway even after Site remediation and/or redevelopment. These exposure pathways would be considered potentially complete until contaminant concentrations are below the established cleanup standards for the affected media.

7.3.3 Ecological Receptors

The following exposure pathways are considered to be potentially complete for ecological receptors based on the existing Site conditions and uses:

- Surface/subsurface soil contact or ingestion by terrestrial organisms.
- Groundwater contact or ingestion by terrestrial organisms (saturated conditions exist within 3 to 6 feet bgs).
- Surface water contact or ingestion by terrestrial and aquatic organisms.
- Consumption of aquatic organisms by terrestrial or other aquatic organisms.

Section 8: Proposed Cleanup Standards

This section presents a summary of potentially applicable cleanup standards for the Site based on Ecology's MTCA cleanup standards (applicable for all media), other ARARs (applicable for groundwater and surface water), and other relevant information pertinent to the establishment of Site-specific cleanup standards (for arsenic only).

The proposed CULs selected for the primary Site COCs (GRO, DRO, ORO, cPAHs, and arsenic) identified during this RI, based on the potentially applicable standards and other relevant information, are discussed in the following sections. Potentially applicable cleanup standards for these and other compounds detected in groundwater and surface water samples collected during the 2017/2018 RI are listed in Table 11 (and shown on the respective data summary tables referenced in previous sections). Points of compliance for affected Site media are discussed in Section 9.

8.1 Indicator Chemicals

The use of indicator chemicals is not proposed for the Interfor Site because of the limited number of different chemicals identified at concentrations above potentially applicable cleanup standards.

8.2 Soil Cleanup Standards

The proposed soil CULs for TPH-related COCs and cPAHs are based on Ecology's MTCA Method A soil CULs for unrestricted land uses, as listed below:

- GRO – 100 mg/kg (where benzene is not also present) or 30 mg/kg (where benzene is present). Benzene was not detected at a concentration above the MTCA Method A soil CUL for unrestricted land uses of 0.030 mg/kg at any location where the GRO concentration was above 30 mg/kg (2017-TP-09 and 2018-TP-10); therefore, a CUL of 100 mg/kg is appropriate for the Site. [Note: Benzene was detected at concentration slightly above the referenced CUL at only one location (2018-TP-3; 0.0421 mg/kg). GRO was also detected at 2018-TP-03, but at a concentration of 0.367 mg/kg ("J" flagged), well below the proposed CUL.]

- DRO – 2,000 mg/kg. For soil in the uppermost 6 feet, a more restrictive cleanup standard protective of terrestrial ecological receptors of 460 mg/kg (MTCA Table 749-2; for unrestricted land uses) may also be applicable for the Site.

- ORO – 2,000 mg/kg.

- DRO+ORO – The sum of DRO and ORO must also be compared to the MTCA Method A CUL of 2,000 mg/kg, and the CUL is applicable even if one or both of DRO and ORO are below 2,000 mg/kg individually (Ecology 2016).

- Total cPAHs – 0.100 mg/kg, based on a summation of individual cPAH compounds using TEF methodology. Although cPAHs were detected at concentrations above the proposed CUL in some historical samples, none of the soil samples analyzed for the 2017/2018 RI contained total cPAHs at a concentration above the proposed CUL (the maximum detected concentration was 0.0533 mg/kg). Therefore, the presence of cPAHs at concentrations above the proposed CUL was not confirmed by the RI findings, and cPAHs are consequently considered to be irrelevant for the evaluation of remedial alternatives.

The potential cleanup standard for arsenic in soil, based on Ecology's MTCA Method A CULs and for protection of terrestrial receptors, is 20 mg/kg. This CUL is based on unrestricted land uses, and is generally applicable for most sites. However, Ecology has approved alternative cleanup standards for arsenic at other nearby residential properties that may be applicable for the Site based on the nature of the impacts and Site-specific considerations.

- Arsenic concentrations above the MTCA Method A soil CUL were detected in samples collected from a small number of non-contiguous areas on the Site.
- A primary on-property source of arsenic was not identified (several potential secondary sources were evaluated in Section 7.1, but none could be confirmed).
- Arsenic impacts in soil appear to be regional (rather than Site-specific), and appear most likely related to a similar development history of the Site and nearby properties along the former tideflat areas north of Ebey Slough (i.e., the arsenic impacts occur over a wider area that includes the Site, but are not related to an identifiable, specific source).

Based on these considerations, development of cleanup standards in a manner similar to the those implemented for the nearby former Everett Smelter – Residential Yard Cleanup site is considered to be appropriate for the Site. Although the overall extent and magnitude of arsenic impacts related to the former Everett Smelter may differ from the Interfor Site, the two sites are comparable in that the impacts are generally similar in nature (relative to each site with respect to the particular affected area) and occur over a wide area (i.e., airborne smelter emissions for the Everett Smelter site compared to a common filling and development history for the Interfor Site and surrounding properties). In particular, soil cleanup standards developed for the Everett Smelter to address smelter-related wide-area arsenic impacts on surrounding residential properties appear to be applicable for the Interfor Site. Furthermore, the source of arsenic at the Site could be, in part, related to former Everett Smelter airborne deposition.

The primary arsenic soil CUL for the peripheral areas impacted by the Everett Smelter is equal to the MTCA Method A soil CUL for unrestricted land uses, 20 mg/kg. However, Ecology established remediation levels for soil cleanup which allow for higher concentrations of arsenic to remain in place (depending on contaminant depths and concentrations) provided a containment remedy is part of the cleanup action, and institutional controls and long-term monitoring are implemented as appropriate (Ecology 1999).

The following cleanup standards for arsenic in soil, based on the remediation levels set by Ecology for residential properties affected by the Everett Smelter, are proposed for the Interfor Site. [Note: The cleanup standards listed below assume that a containment remedy will be implemented along with institutional controls and long-term monitoring as appropriate. These are included in the preferred remedial alternative as described in Section 13]:

- For soil 0 to 1 foot bgs – Average arsenic concentration of 20 mg/kg and a maximum concentration of 40 mg/kg for any one sample.

- For soil 1 to 2 feet bgs – Average arsenic concentration of 60 mg/kg and a maximum concentration of 150 mg/kg for any one sample.

- For soil below 2 feet bgs – Average arsenic concentration of 150 mg/kg and a maximum concentration of 500 mg/kg for any one sample.

If institutional controls and/or long-term monitoring are not implemented as part of the cleanup action, the MTCA Method A soil CUL of 20 mg/kg would apply to all Site soils.

8.3 Groundwater Cleanup Standards

The results of the 2017/2018 RI indicate that Site groundwater occurs primarily in a shallow saturated zone comprised primarily of fill materials placed above native fine-grained materials, and discharges to surface water in Ebey Slough and the eastern drainage ditch (which also ultimately discharges to the Slough) through surface water outfalls and seepage along bank areas (see Section 4.2). Shallow groundwater at the Site is not considered to be potable, and future development of Site groundwater as a potable water source is not anticipated. Consequently, proposed cleanup standards for Site groundwater will be based on surface water cleanup standards (Section 8.4), except as indicated below.

The proposed groundwater CULs for TPH-related COCs (GRO, DRO, ORO) are based on Ecology’s MTCA Method A groundwater cleanup levels. These CULs are considered appropriate for the Site because they are the most stringent potential cleanup standards available for these compounds in groundwater, and because surface water standards are not available. The proposed CULs for TPH-related COCs are listed below:

- GRO – 1,000 µg/l (where benzene is not also present) or 800 µg/l (where benzene is present). Benzene was not detected at a concentration above the MTCA Method A groundwater CUL in any of the 2017/2018 RI samples; therefore, a CUL of 800 µg/l is appropriate for the Site.

- DRO – 500 µg/l.

- ORO – 500 µg/l.

- DRO+ORO – The sum of DRO and ORO must also be compared to the MTCA Method A CUL of 500 µg/l, and the CUL is applicable even if one or both of DRO and ORO are below 500 µg/l individually (Ecology 2016).

Surface water cleanup standards are also not available for total cPAHs (but are available for some individual cPAH analytes (see Section 8,4). Ecology’s MTCA Method A groundwater CUL for total cPAHs, based on TEF summation of the seven individual cPAH compounds, is 0.1 µg/l. This standard is considered to be applicable and appropriate for Site groundwater. In addition, no individual cPAH compounds were detected in Site groundwater samples at concentrations above potential surface water CULs or ARARs (see Section 8.4 and Table 11).

Proposed cleanup levels for the primary COCs and other analytes detected in Site groundwater samples (including BTEX, VOCs, SVOCs, PAHs, and metals) are listed in Table 11.

8.4 Surface Water Cleanup Standards

As indicated in Section 8.3, surface water cleanup standards are considered applicable for both surface water and groundwater (except as discussed in Section 8.3 for TPH-related COCs and total cPAHs).

Potentially applicable published surface water CULs and ARARs for Site include:

- MTCA Method B Surface Water CULs
- Surface water ARARs for protection of aquatic life (marine/chronic) based on Ecology's Water Quality Standards for Surface Water regulation (WAC 173-201A)
- Surface water ARARs for protection of aquatic life (marine/chronic) based on the Clean Water Act Section 304
- Surface water ARARs for protection of aquatic life (marine/chronic) based on the National Toxics Rule (40 CFR 131)
- Surface water ARARs for protection of human health (marine waters) based on the Clean Water Act Section 304
- Surface water ARARs for protection of human health (marine waters) based on the National Toxics Rule (40 CFR 131).

The CUL and ARAR values for the standards listed above are provided in Table 11 for the COCs detected in Site surface water (and groundwater, as applicable) samples. The most stringent of the potential CULs and ARARs for each detected COC is proposed as the CUL for the Site (excluding arsenic, as discussed below), as listed in Table 11.

For arsenic, the most stringent of the published CULs and ARARs is the MTCA Method B surface water CUL of 0.0982 µg/l. However, this cleanup standard is likely unachievable at the Site based on regional arsenic impacts and arsenic concentrations in groundwater migrating onto the Site from upgradient locations (as previously discussed in other Sections).

Consequently, an alternative CUL based on the background arsenic concentrations detected in groundwater entering the Site from upgradient locations is proposed for the Site, as discussed below in Section 8.5.

8.5 Proposed Surface Water Arsenic Cleanup Standard

As discussed in Section 7, a specific source of arsenic has not been identified at the Site, and arsenic impacts similar to those identified at the Site have been documented at several adjoining and nearby sites which share a similar development history with the Interfor Site. Based on the information reviewed during the 2017/2018 RI, elevated arsenic concentrations appear to be a regional, rather than Site-specific, occurrence. A likely regional arsenic source appeas to be the fill materials placed over native tideflats adjoining Ebey Slough during initial development in the late 1800s, and during subsequent phase of development. Mobilization of arsenic also appears to have been enhanced locally where TPH-related impacts or other organics created reducing conditions in the shallow saturated zone. Consequently, the regional background arsenic concentrations represent a “natural” condition for the Site and vicinity, and must be considered with respect to development of arsenic cleanup standards for Site groundwater and discharges to surface water.

As discussed in previous Sections, groundwater entering the Site from upgradient locations contains arsenic at concentrations above the most stringent potentially applicable cleanup standard or ARAR (MTCA Method B surface water; 0.0982 µg/l), and most of the other potentially applicable ARARs (refer to Table 11). In addition, arsenic concentrations detected in surface water background samples collected from Ebey Slough also contained arsenic at concentrations orders of magnitude above most or all of the cleanup standards and ARARs (as high as 36.4 µg/l total arsenic). These elevated arsenic concentrations, both upgradient and downgradient from the Site, also must be considered with respect to development of arsenic cleanup standards for Site groundwater and discharges to surface water.

Background arsenic threshold values for groundwater migrating onto the Site (calculated using ProUCL software, outliers excluded; refer to Section 5.5.1) were 31.89 µg/l for total arsenic and 27.1 µg/l for dissolved arsenic. Because CULs and ARARs for arsenic are typically based on the total (rather than dissolved) concentrations, the value of 31.89 µg/l is considered most relevant with respect to potential cleanup standards for arsenic. The calculated background threshold value of 31.89 µg/l is slightly lower than the surface water ARAR of 36.0 µg/l (for protection of aquatic marine life) based on Ecology’s Surface Water regulation (WAC 173-201A) and the Clean Water Act Section 304, and is also lower than the highest detected total arsenic concentration detected in samples collected from Ebey Slough.

Based on the findings of the 2017/2018 RI and regional arsenic conditions discussed herein, the proposed cleanup level for arsenic in Site groundwater and surface water is 31.89 µg/l. Points of compliance for this and other cleanup standards are discussed in Section 9.2.

Section 9: Cleanup Objectives and Points of Compliance

This section provides an overview of the objectives for Site cleanup and proposed points of compliance for the proposed CULs presented in Section 8.

9.1 Cleanup Objectives

The objective of the Site cleanup alternatives (discussed in the FS) is to restore the Site to a condition that is protective of human health and the environment, and suitable for redevelopment by the City as a commercial or combined commercial/residential property. This generally includes removal of accessible contaminated media (i.e., soil hotspots), institutional controls to limit potential exposure to remaining media with contaminant impacts (generally surface water and groundwater), and compliance monitoring. The specific actions proposed to meet these objectives are presented in the FS (Sections 11 through 13).

9.2 Points of Compliance

Proposed points of compliance for Site soil, groundwater, and surface water are listed below:

- **Soil –** The proposed point of compliance for soil is up to 15 feet bgs for all impacted soil (6 feet bgs for ecological cleanup standards, where applicable). Most of the Site soils with COC concentrations above proposed CULs occur within approximately 6 feet of the ground surface (estimated volumes are provided in Section 10). The proposed cleanup action includes removal of impacted soil, and documentation of contaminant removal by confirmation soil samples directly below the affected soil will be considered verification of compliance with cleanup standards.

- **Groundwater** – The proposed points of compliance for Site groundwater is throughout the Site. As the Proposed CUL is based on surface water protection, wells adjacent to Ebey Slough and the eastern ditch could used for compliance monitoring. As arsenic concentrations apprear to vary widely between sampling events, it is assumed a statistical approach to evaluating compliance monitoring would be used.

- **Surface Water** – Similar to groundwater, the proposed points of compliance for surface water include monitoring wells located in downgradient positions and near surface water bodies (Ebey Slough and the eastern drainage ditch). Currently, this includes wells MW-12, MW-13, MW-14, MW-16, and MW-1R. Points of compliance for surface water also include outfalls to the eastern drainage ditch and Ebey Slough.

Section 10: Estimated Volumes of Impacted Media above Proposed Cleanup Levels

This section provides an estimate of the volume of impacted Site soil and groundwater based on the findings of the RI.

10.1 Soil

The estimated volume of impacted soil, based on the proposed soil cleanup standards presented in Section 8, is approximately 1,500 cy. Soil with one or more COCs (primarily TPH-related contaminants and arsenic) at concentrations above the proposed CULs occurs only in three separate areas of the Site, as shown on Figure 33.

10.2 Groundwater

The areal extent of impacted groundwater at the Site depends primarily on the extent of arsenic impacts. If the extent of groundwater impacts is based on surface water ARARs (or MTCA Method A groundwater CULs), then impacted groundwater is present beneath the entire footprint of the main Site property. If the extent of impacts is based on the proposed cleanup standard of 31.89 µg/l, the affected area includes the central (MW-06 area) and southeastern portions of the Site (MW-14 and MW-16 areas). Based on the arsenic concentrations in background groudwater migrating onto the Site (including concentrations above ARARs and the proposed cleanup standard), it is assumed (for purposes of cleanup alternative evaluation) that groundwater beneath the entire property is impacted.

Concentrations of DRO and ORO marginally above the proposed CUL of 500 µg/l were identified at on-property wells MW-1R, MW-11, and MW-16, and ORO at MW-12, MW-13, and MW-14 for one monitiorng event. Due to the inconsistent nature of these detections, remedial action to address the low concentatoins is not proposed at this time. Future groundwater monitoring should be performed at these locations to assess whether future groundwater remedial actions are warranted.

Higher DRO and ORO concentrations were identified at perimeter and background wells MW-15, MWBG-2, MWBG-3, MWBG-4, and MWBG-5. Although Site areas are affected, the DRO and ORO impacts identified in the perimeter and background wells are migrating onsite from off-property locations including the former WSDOT bridge Site (MW-15 and MWBG-2). Remediation of offsite sources which impacted the Site were not included in the FS.

Section 11: Technology Screening and Alternative Development

This section presents the rationale for identifying remedial alternatives to address soil and groundwater containing COCs at concentrations exceeding Site CULs. Section 11.1 presents an initial evaluation (i.e., screening) to identify potentially applicable remedial methods (i.e., process options). In Section 11.2, remedial methods passing the initial screening process are combined to create potentially feasible remedial alternatives. The remedial alternatives are described in detail in the remainder of the section.

11.1 Identification and Evaluation of Potential Remedial Methods

General response actions, remedial technologies, and process options that may be appropriate for addressing Site conditions and COCs were identified. General response actions are broad categories of remedial methods that can address the cleanup of a specific matrix (i.e., soil or groundwater). Remedial technologies are various techniques within the general response actions. Process options are specific processes within each remedial technology category. The identification and evaluation of general response actions, remedial technologies, and process options for soil and groundwater are presented in Tables 12 and 13, respectively. Bold text in Tables 12 and 13 indicates the process option is included for further consideration in the FS.

Process options were initially screened using three criteria: effectiveness, ability to be implemented, and relative cost, as summarized below:

- Effectiveness involves consideration of a process option's ability to address the anticipated volume of soil and groundwater, meet cleanup standards, and protect human health and the environmental during construction and implementation.
- Ability to be implemented includes technical and administrative considerations. This criterion focuses on the ability to technically address COCs in soil and groundwater at concentrations detected during the RI. It also evaluates the permits necessary for onsite and offsite activities and discharges, and the availability of offsite facilities, services, and materials.
- Cost is based on engineering judgments rather than detailed estimates. Process options that are judged to be similar in effectiveness and ability to be implemented, yet costing several times more than other process options in the same technology category, were eliminated from further consideration.

Process options that are not appropriate for Site conditions, planned future Site uses, or COCs contained in soil and groundwater at concentrations detected during the RI were eliminated from further consideration. In addition, process options that are innovative but unproven were also eliminated. If more than one process option in a remedial technology group was identified as potentially appropriate for the Site, further screening was performed, and one process option was selected to represent that technology group.

Based on the initial evaluation, the general response actions and process options with the greatest potential for success in addressing arsenic and petroleum hydrocarbon-impacted soil and groundwater at the Site include:

- Institutional controls. Includes deed restrictions, physical barriers to limit access, and long-term monitoring.
- Excavation. Excavation and offsite disposal of accessible impacted soil exceeding applicable cleanup standards.
- Capping and *in situ* treatment. Includes capping the entire Site and *in situ* treatment. Treatment technologies include physical treatment through air sparging (AS).
- Excavation and *in situ* treatment. Excavation and offsite disposal of impacted soil. Treatment technologies include physical treatment through AS.
- Excavation and containment. Excavation and offsite disposal of impacted soil. Containment includes installation of a Site perimeter slurry wall, groundwater extraction, and discharge to the publicly-owned treatment works (POTW) for hydraulic control.
- Excavation and *in situ* treatment. Excavation and offsite disposal of impacted soil. Treatment technologies includes *in situ* treatment using a permeable reactive barrier (PRB) wall.

Institutional controls including performance and/or confirmation monitoring are required components of all response actions. Performance monitoring includes sampling performed during removal or treatment to assess progress and/or achievement of CULs. Groundwater confirmation monitoring is required to assess long-term effectiveness and compliance with CULs.

MTCA requires that the process options used minimize the amount of untreated COCs remaining at the Site and that preference be given to a permanent solution and hierarchy of preferred remedial methods. In general, technologies that reuse, recycle, destroy, or detoxify hazardous substances will result in permanent solutions.

Table 14 summarizes the results of the process option evaluation, as completed in Tables 12 (soil) and 13 (groundwater). As indicated in Table 14, the selected process options passing the initial evaluation include a range of technologies that reuse, recycle, destroy, or detoxify affected Site media, resulting in a potential permanent solution.

11.2 Development of Alternatives

This section identifies alternatives that could be appropriate for addressing arsenic and petroleum hydrocarbon-impacted soil and groundwater at the Site. These alternatives are identified using the requirements and expectations described in MTCA (WAC 173-340-360), which include:

- Meeting threshold requirements for remedial alternatives (refer to Section 12.1)

- Using permanent solutions to the maximum extent practicable
- Providing for a reasonable restoration timeframe.

Ecology has the following expectations for cleanup action alternatives (WAC 173-340-370):

- Use treatment technologies whenever practicable.
- Minimize the need for long-term management of contaminated materials by destroying, detoxifying, or removing hazardous substances that are above CULs.
- Recognize the need to use engineering controls, such as containment for sites with large volumes of relatively low levels of hazardous substances.
- Implement measures to prevent precipitation and runoff from contacting affected soils and waste materials.
- Consolidate hazardous substances to the maximum extent practicable if the hazardous substances remain onsite.
- Prevent/minimize releases to surface water via runoff and groundwater discharges exceeding cleanup levels.
- Consider the use of natural attenuation of hazardous substances, which may be appropriate under some circumstances.
- Do not undertake cleanup actions that will result in a greater overall threat to human health and the environment than will other alternatives.

MTCA recognizes that treatment may not be practicable for all sites. Treatment is required, wherever practicable, for sites containing liquid wastes, areas containing high concentrations of hazardous substances, highly mobile materials, or discrete areas of hazardous substances that lend themselves to treatment. MTCA also recognizes that engineering controls (such as containment, caps, and covers) are appropriate for sites or portions of sites that contain large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable [WAC 173-340-370(3)].

Based on the regulatory considerations and site-specific conditions, the following alternatives were developed for this Site:

- Alternative 1: Institutional controls (ICs) and environmental covenants (ECs).
- Alternative 2: Hotspot excavation of petroleum hydrocarbon- and arsenic-impacted soil and disposal at a permitted offsite facility.
- Alternative 3: Capping the Site with asphalt pavement and groundwater treatment by AS.
- Alternative 4: Excavation of hot spots and groundwater treatment by AS.

- Alternative 5: Excavation of hot spots, installation of a slurry wall around the Site with groundwater extraction and discharge to POTW for hydraulic control.

- Alternative 6: Excavation of hot spots and installation of a slurry wall around the entire Site to reduce groundwater movement.

- Alternative 7: Excavation of hot spots, installation of a PRB.

11.3 Alternative 1 – Institutional Controls and Environmental Covenants

This alternative involves development of ICs and ECs to limit exposures to potential receptors (onsite workers, visitors, and nearby residents). Implementation of ICs and ECs will likely be required for each of the remedial alternatives. During remediation construction activities, ECs will be implemented (e.g., Site control measures, dust control measures, implementation of a health and safety plan, use of appropriately trained workers). Since all alternatives, other than Alternative 1, provide protection against exposure to impacted soil, ICs would be primarily intended to prevent exposure to impacted soil and groundwater. The actual protective elements and language of the IC and EC may vary somewhat for each alternative and would be develop in coordination with Ecology. In order to limit exposures following construction activities, ICs would be implemented and maintained using an EC developed in accordance with Ecology procedures. Specifically, the EC would:

- Prohibit any activity on the Site that may result in the release of residual COCs, create a new exposure to residual COCs, or disturb the remedial appurtenances (asphalt cap, slurry wall, etc) without prior written approval from Ecology.

- Provide notification that residual contaminants may be present at the Site and include deed restrictions and that restrict certain future development uses that may result in exposure to soil and impacted groundwater.

- Prohibit the installation of wells for the purpose of water supply within the Site boundary.

- Restrict the extraction of groundwater for any purpose other than construction and hydraulic control dewatering, monitoring/investigation, or remediation.

- Require that any groundwater extracted for any purpose within the Site boundary be considered impacted and the discharge managed in accordance with state and federal regulations.

- Require that all stormwater infrastructure be of water tight construction within the Site boundary where the depth is greater than the highest measured groundwater.

11.4 Alternative 2 – Excavation and Offsite Disposal

This alternative involves excavation and disposing of affected soils offsite and conducting groundwater compliance monitoring to evaluate compliance with cleanup standards. Based on existing Site data, soil and groundwater with concentrations that exceed the CUL are present in three areas of the Site (see Figure 33). The volume of soil to be excavated is anticipated to be approximately 1,500 cy. A contingency is made for excavation and offsite disposal of an additional 500 cy of impacted soil that may be identified during the remedial action. Alternative 2 consists of the following elements (see Figure 33):

- Site preparation activities would include, but are not limited to, Cleanup Action Plan (CAP) preparation and design for a public works bidding process.

- Access to the Site for use by the City would need to be maintained during construction activities.

- Utilities serving the Site, including water, sewer, and electric may need to be temporarily rerouted where required. Any contamination encountered near the existing high pressure gas line would remain in place and would not be removed.

- The excavation area includes the onsite area where soil concentrations exceed MTCA Method A soil CULs for petroleum hydrocarbons and arsenic (as set for the Everett Residential Yard Program). Excavation depths are estimated to be between 2 feet and 6 feet bgs or the depth to groundwater. The total volume of excavated material is estimated at 1,500 cy with a contingency for an additional 500 cy. Affected soils would be removed to the maximum extent practicable. Final configuration of the excavation area would be based on physical constraints and performance monitoring (soil sampling) results using a fixed offsite analytical laboratory. Affected soil would be transported and disposed of at a licensed Subtitle D landfill facility as a non-hazardous waste.

- Dewatering is expected to be unnecessary and would not be performed as part of this alternative.

- After receipt of favorable performance monitoring results, the excavation would be backfilled with clean fill material and compacted to existing grade.

- At select locations where residual petroleum hydrocarbons may be remain below the water table, the imported backfill would be amended with an oxygen-releasing compound (or equivalent) to promote biological degradation of residual petroleum hydrocarbons in soil and groundwater. The amended backfill would be strategically placed alongside slopes and the floor of excavation in areas where affected soils may be inaccessible to further excavation. The volume of imported fill amended with the biological amendment is estimated to be approximately 200 cy.

- Site restoration would include reconnection of utilities, and other restoration activities to return the Site to its original configuration.

- Time required to achieve soil cleanup standards onsite would be relatively short (likely less than 1 year); however, because excavation by itself does not address impacted groundwater, the concentrations of arsenic in groundwater are not expected to be affected with this alternative.

11.5 Alternative 3 – Capping with Asphalt and Air Sparging on the Eastern and Western Sides

This alternative involves construction of an engineered asphalt cap over the portions of the Site where soil concentrations exceed MTCA Method A soil CULs for DRO and arsenic, installation of a low flow AS system to oxidize arsenic and performance/confirmation monitoring. The cap would be installed in the four areas illustrated on Figure 34 covering a total area of approximately 37,000 ft^2. The actual size of the cap footprint may be adjusted based on additional field and analytical data, buildings, and other Site considerations. The cap would consist of 4 inches of base course material and 3 inches of asphalt. The asphalt cap would prevent direct exposure to the DRO and arsenic-impacted soil remaining in soil by providing a physical barrier to minimize direct contact and leaching of COCs to the shallow groundwater. In addition, impacted soil that may exist beneath existing structures would remain and be managed if those structures are removed.

In addition, up to 50 AS wells would be installed on the eastern and western sides of the Site to convert arsenic +3 to arsenic +5 through oxidation in the saturated zone and promote biodegradation of DRO in the saturated zone by increasing oxygen concentrations. Contaminant mass removal/ reduction would be conducted via long-term operation of the AS system.

Groundwater monitoring would be performed quarterly for 2 years and then annually for additional 28 years to assess changes in Site conditions. This alternative would also include ICs (deed restrictions) because soils exceeding CULs would not be removed.

Alternative 3 includes the following elements (see Figure 34):

- Site preparation activities would include, but would not be limited to, CAP preparation and design, obtaining permits (e.g., City grading permit, etc.), and waste profiling and designation to manage any impacted soil generated during construction.

- The low flow AS system would include installation of up to 50 AS wells generally located on the eastern and western sides of the Site at approximately 35-foot centers. AS piping would be installed in trenches extending from each AS well to the AS compressor and manifold system. The AS compressor and other system components would be housed in one or more onsite constructed building(s) in a location to be determined based on potential Site redevelopment plans. Because VOCs are not a COC, air discharge permitting is not expected to be required for operation (air discharge, underground injection control, etc.).

- An AS pilot study would be conducted prior to full-scale implementation of an AS system to evaluate the effectiveness of AS in oxidizing arsenic III to arsenic V in the current Site conditions. The AS pilot study would consist of installation and operation of up to three AS wells and collection of groundwater samples in the immediate vicinity of the pilot study for analysis of speciated metals, pH, ORP, and other parameters as appropriate. The pilot study will be conducted for a duration of approximately 6 months to 1 year and, if successful, will be expanded to full-scale.

- Periodic groundwater confirmation monitoring would be conducted for up to 30 years or when it is determined that arsenic concentrations in groundwater no longer pose a threat to surface water and to assess treatment effectiveness and evaluate groundwater quality. Groundwater samples would be analyzed for metals, DRO, and natural attenuation parameters.

- Alternative specific ECs and ICs would be implemented as described in Alternative 1.

- Because the source mass is not removed, upkeep of the remedial alternative is expected to be required indefinitely.

11.6 Alternative 4 – Excavation and Offsite Disposal with Air Sparging on the Eastern and Western Sides

This alternative involves excavation and disposal of affected soils offsite as described in Alternative 2, AS pilot testing, installation and operation of an AS system on the eastern and western sides of the Site (as described in Alternative 3), and conducting groundwater compliance monitoring. Alternative 4 elements are similar to Alternatives 2 and 3 with modifications including the following (see Figures 33 and 34) :

- ECs and ICs will reflect that residual contamination has been removed from the Site; however, low concentrations of arsenic may remain in soil and shallow groundwater.

- As the hydrocarbon source mass is removed, the restoration time period for these compounds is expected to be approximately 1 to 2 years. For arsenic-impacted groundwater, the AS system would be expected to operate indefinitely. For cost estimating purposes in the FS, this period was estimated to be 30 years.

11.7 Alternative 5 – Excavation and Offsite Disposal With Installation of a Slurry Wall and Hydraulic Control with Discharge to POTW

This alternative involves excavation and disposing of affected soils offsite as described in Alternative 2, construction of a low permeability slurry wall in the approximate location of the Site boundary, and hydraulic control of groundwater within the slurry wall with discharge to the City sewer system. Long-term groundwater quality monitoring, ECs, and ICs will also be elements of this alternative. The excavation and offsite disposal of impacted soil will be conducted as described in Alternative 2. The slurry wall will be installed to provide a low permeability barrier to contain groundwater impacted with arsenic from migrating offsite and discharging to surface water. The slurry wall will consist of a vertical trench excavated through the shallow soils into the low permeability native tide flat or tide marsh deposits (silt/clay zone) described in Section 4.2. The top of the native silt/clay zone is observed at depths ranging from 5 to 12 feet bgs based on previous and current investigation and remediation activities. The total length of the slurry wall would be approximately 2,800 feet. Hydraulic control of groundwater would be accomplished using a network of groundwater extraction wells (the number of wells will depend on the amount of infiltration but expected to be 10 or less). The extracted groundwater would be discharged directly to the City sewer system through installed discharge pipes. Excavation and offsite disposal of impacted soils will be conducted as described in Alternative 2. In addition, soil generated during construction of the slurry wall will be managed using the same protocol as for the primary impacted soil excavation. Construction of the slurry wall and hydraulic control includes the following elements (see Figures 33 and 35):

- Site preparation activities would include, but would not be limited to, CAP preparation and design and obtaining grading and construction permits from the City. A Joint Aquatic Resources Permit Application (JARPA) will be completed for construction of the slurry wall near Ebey Slough. The JARPA is a streamlined methodology to obtain applicable permits from multiple agencies. At a minimum, a Hydraulic Project Approval (HPA) will be required from the Washington Department of Fish and Wildlife. A Shoreline permit may also be required from the City. The HPA and Shoreline permits can be obtained through the JARPA process.

- Prior to extraction of groundwater for hydraulic control and discharge to the City sanitary sewer, approval for the sewer connection will be obtained from the City. The sewer connection must be performed in compliance with the City Municipal Code and Sanitary Sewer Design Standards and Specifications.

- Construction of the slurry wall would be initiated by identification of all underground utilities within the footprint of the slurry wall. The slurry wall will be designed to accommodate pass through of utilities while maintaining the low permeability properties of the wall. The trenching would be conducted using a standard excavator. The excavated trench would be backfilled with soil/bentonite slurry from the base of the excavation to within 2 feet of the ground surface. The top of the excavation will be backfilled and compacted using excavated material. Where possible, a portion of the excavated materials would be used in the construction of the slurry wall.

- The groundwater extraction system will consist of approximate 10, 4-inch PVC extraction wells, extraction pumps, piping, and the sewer connection. The extracted groundwater will be routed to a sampling manifold and discharged to the sewer from the manifold. Based on preliminary aquifer analysis, the groundwater extraction wells will be located on approximate 150 to 300 feet centers and operated only as needed to maintain inward hydraulic gradient with the groundwater table outside the slurry wall.

- Groundwater extraction system sampling and chemical analysis would be performed to assess the arsenic concentration entering the City sewer and evaluate whether pre-treatment is needed prior to discharge.

- Groundwater confirmation monitoring would be conducted to evaluate groundwater quality within the slurry wall area. Groundwater samples would be analyzed for DRO and metals. Operation and maintenance (O&M) of the groundwater extraction system would be required throughout the duration of operation, estimated at 30 years for this FS.

- ECs and ICs would be implemented as described in Alternative 1 and tailored to the specific conditions for this alternative.

- As this alternative contains impacted groundwater preventing offsite migration, the restoration time period is expected to be indefinite (estimated at 30 years for the FS).

11.8 Alternative 6 – Excavation and Offsite Disposal With Installation of a Slurry Wall Around the Property and Without Hydraulic Control

Alternative 6 is identical to Alternative 5 except that hydraulic control is not provided. This alternative involves excavation and disposing of affected soils offsite as described in Alternative 2, construction of a low permeability slurry wall in the approximate location of the Site boundary without hydraulic control of groundwater within the slurry wall. The slurry wall would be designed so that the top of the slurry wall is at least 4 feet below grade to prevent site flooding. (Note: It is acknowledge that, in some parts of the site, seasonal water levels may exceed this depth.) Long-term groundwater quality monitoring, ECs, and ICs will also be elements of this alternative. The excavation and offsite disposal of impacted soil will be conducted as described in Alternative 2. The slurry wall will be installed as described in Alternative 5 to provide a low permeability barrier to contain groundwater impacted with arsenic from migrating offsite and discharging to surface water. Excavation and offsite disposal will be conducted as described in Alternative 2. In addition, soil generated during construction of the slurry wall will be managed using the same protocol as for the primary impacted soil excavation; however, a portion may be used during construction of the slurry wall. The elements of Alternative 6 are shown on Figures 33 and 35 and include:

- Site preparation activities would include, but would not be limited to, CAP preparation and design and obtaining grading and construction permits from the City. A JARPA will be completed for construction of the slurry wall near Ebey Slough. The JARPA is a streamlined methodology to obtain applicable permits from multiple agencies. At a minimum, an HPA will be required from the Washington Department of Fish and Wildlife. A Shoreline permit may also be required from the City. The HPA and Shoreline permits can be obtained through the JARPA process.

- Groundwater confirmation monitoring would be conducted to evaluate groundwater quality outside the slurry wall area. Groundwater samples would be analyzed for DRO and metals.

- ECs and ICs would be implemented as described in Alternative 1.

- As this alternative contains impacted groundwater reducing possible offsite migration, the restoration time period is expected to be indefinite (estimated at 30 years for the FS).

11.9 Alternative 7 – Excavation and Offsite Disposal With Installation of a Permeable Reactive Barrier

This alternative involves excavation and disposing of affected soils offsite as described in Alternative 2, and construction of a PRB. Long-term groundwater quality monitoring, ECs, and ICs will also be elements of this alternative. The excavation and offsite disposal of impacted soil will be conducted as described in Alternative 2. The PRB will consist of a trench excavated perpendicular to the direction of groundwater flow and backfilled with reactive materials (such as iron filings or similar materials and sand). As with the slurry wall installation described for Alternatives 5 and 6, the PRB trench will excavated into the low permeablity native tide flat or tide marsh deposits (silt/clay zone) described in Section 4.2. The top of the native silt/clay zone is observed at depths ranging from 5 to 12 feet bgs based on previous and current investigation and remediation activities. The total length of the PRB will be approximately 1,700 feet.

As impacted groundwater moves through the PRB, arsenic III and arsenic V are coprecipitated with iron oxyhydroxides and adsorption to iron oxide surfaces. A pilot study would be conducted to evaluate PRB installation methods and reactive materials, which may include mixtures of zero valent iron (such as iron filings) and possibly an organic carbon source (wood chips, compost, etc). The pilot study would also included an evaluation the potential effect of reverse flow through the PRB during high tide conditions. Soil generated during construction of the PRB will be managed using the same protocal as for the primary impacted soil excavation. Construction of the PRB includes the following elements (see Figures 33 and 34):

- Site preparation activities would include, but would not be limited to, CAP preparation and design and obtaining grading and construction permits from the City. If a portion of the PRB is constructed adjacent to Ebey Slough, a JARPA will be completed for construction. The JARPA is a streamlined methodology to obtain applicable permits from multiple agencies. At a minimum, an HPA will be required from the Washington Department of Fish and Wildlife. A Shoreline permit may also be required from the City. The HPA and Shoreline permits can be obtained through the JARPA process.

- Groundwater confirmation monitoring would be conducted to evaluate groundwater quality upgradient, within, and downgradient of the PRB. Groundwater samples would be analyzed for DRO and metals. O&M of the PRB would be required throughout the duration of operation.

- ECs and ICs would be implemented as described in Alternative 1.

- It is expected that arsenic concentrations in groundwater would be reduced significantly within a short distance after passing through the PRB. The useful lifespan of the PRB is unknown, but expected to be several decades. As the source of elevated arsenic is not removed, the alternative would be performed indefinitely (estimated to be 30 years for the FS).

Section 12: Evaluation of Remedial Alternatives

The section presents a preliminary analysis of the remedial alternatives against the MTCA threshold criteria in Section 12.1, followed by detailed analyses in Section 12.2.

12.1 MTCA Threshold Criteria

A remedial action must meet certain threshold criteria to be considered under the MTCA [WAC 173-340-360 (2)(a)]. An alternative cannot be selected if it cannot meet the following threshold requirements:

- Protect human health and the environment
- Comply with cleanup standards
- Comply with applicable state and federal laws
- Provide for compliance monitoring.

A cleanup is presumed to be protective of human health and the environment at the Site if it achieves the CULs. Compliance with cleanup standards involves achieving CULs at an appropriate point of compliance and complying with applicable federal and state laws. (Note: Due to the very low surface water standards that are applicable to Site groundwater, achieving cleanup standards is not practical with the available remedial technologies. Consequently, none of the remedial alternatives selected would fully meet the threshold criteria as cleanup standards for arsenic in groundwater would likely not be met.)

Compliance monitoring assesses the protection of human health and the environment during construction and the O&M period of a cleanup action. Compliance monitoring confirms the remedial action has met cleanup standards and verifies its long-term effectiveness. Compliance with the threshold requirements does not imply that untreated hazardous substances cannot remain onsite. MTCA recognizes non-treatment alternatives can comply with cleanup standards, provided compliance monitoring is included to ensure system integrity.

Table 15 summarizes the evaluation of the alternatives in relation to MTCA's threshold criteria. Based on this evaluation, all alternatives meet the threshold criteria. All alternatives can achieve cleanup levels; have an acceptable point of compliance; and provide for compliance monitoring.

12.2 Detailed Analyses of Alternatives

This section evaluates each remedial alternative against seven criteria set in WAC 173-340-360(3)(f) in order to establish whether a cleanup is permanent to the maximum extent practical. The seven criteria are:

1. Protectiveness
2. Permanence

3. Cost
4. Effectiveness over the long-term
5. Management of short-term risks
6. Technical and administrative implementability
7. Consideration of public concerns.

These criteria, as well as a discussion of providing a reasonable restoration timeframe and compliance with federal and state ARARs, are evaluated below.

12.2.1 Protectiveness

This criterion includes the degree to which existing risks are reduced, the time required to reduce risk at the Site and attain cleanup standards, onsite and offsite risks resulting from implementing the alternative, and improvement of the overall environmental quality.

The overall protectiveness evaluation is included in Table 16.

12.2.2 Permanence

A permanent cleanup achieves cleanup standards without requiring further action such as long-term monitoring or ICs. The remedial action alternatives were compared based on their adequacy in destroying hazardous substances, reducing or eliminating hazardous substance releases and sources, the irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated.

The overall permanence evaluation is included in Table 17.

12.2.3 Cost

The costs to implement the alternatives, including the cost of construction and the net present value of long-term costs, were estimated to determine practicability (see Section 13.1.3). Long-term costs include O&M costs, monitoring costs, equipment replacement costs, and the costs of maintaining ICs.

12.2.4 Long-Term Effectiveness

Long-term effectiveness is defined as the degree of certainty that the alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain onsite at concentrations that exceed CULs, the magnitude of residual risk with the alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes.

The results of the evaluation of these sub-criteria are presented in Table 18.

12.2.5 Short-Term Risks

The short-term risks to human health, public, and the environment associated with each alternative during construction and implementation, and the effectiveness of measures that would need to be taken to manage such risks, were considered.

This evaluation is included in Table 19.

12.2.6 Ability to Implement

This criterion evaluates an alternative's ability to be implemented, including technical feasibility; availability of necessary offsite facilities, services and materials; administrative and regulatory requirements; scheduling; access constraints; and integration with existing facility operations and other current or potential remedial actions.

The implementability evaluation is included in Table 20.

12.2.7 Consideration of Public Concerns

Ecology may assist with addressing public concerns, if any, during selection of the remedial action. However, the Site is currently administered under the VCP, and a Public Notice and Participation period (as described in WAC 173-340-600) is not required before implementation of the action.

12.2.8 Restoration Timeframe

None of the alternatives identified are expected to fully achieve CULs established for the Site (due to the low CUL for arsenic in groundwater). MTCA CULs for soil based on protection of direct contact and ingestion can be realized for petroleum hydrocarbons and arsenic with alternatives the include soil excavation and offsite disposal immediately; however, soil CULs for arsenic in groundwater are not practical to achieve consistently using available technologies. Furthermore, as arsenic concentrations in groundwater appear to be a regional problem and not attributed to Site conditions, implementing a Site-only cleanup would have limited benefit to the environment. While several alternatives may provide an overall reduction in arsenic concentrations, none are expected to fully meet the lowest surface water quality criteria for arsenic.

12.2.8.1 Alternative 1 – Engineering and Institutional Controls

For Alternative 1, the objective of limiting exposure to receptors is met upon implementation of engineering and ICs. However, soil and groundwater impacts are not addressed with Alternative 1; therefore, it is inappropriate to estimate a timeframe for attaining CULs.

12.2.8.2 Alternative 2 – Excavation and Offsite Disposal

For Alternative 2, it is estimated CULs for petroleum hydrocarbons in soil and groundwater and arsenic in soil will be attained following (or within 2 years) excavation of impacted soil. Excavation and removal would likely have an insubstantial impact on the arsenic concentrations in groundwater as the source of the elevated arsenic has not been identified and is likely attributed to off-property/regional conditions.

12.2.8.3 Alternative 3 – Capping with Asphalt with Air Sparging on the Eastern and Southern Sides

Alternative 3 provides containment of impacted soils to reduce the potential for direct contact with impacted Site media; however, the source concentrations would not be affected except that petroleum hydrocarbon concentrations in soil and groundwater would be expected to decompose eventually over time. AS at the downgradient property boundaries is expected to reduce arsenic concentrations in groundwater within a short distance of the AS well transect. The overall effectiveness of AS for achieving very low surface water quality criteria is uncertain and would be evaluated with a pilot study before full-scale implementation, but may not fully achieve cleanup standards. It is expected that the cap and AS system would be managed indefinitely.

12.2.8.4 Alternative 4 – Excavation and Offsite Disposal with Air Sparging on the Eastern and Southern Sides

Similar to Alternative 2, it is estimated that CULs for petroleum hydrocarbons in soil and groundwater and arsenic in soil will be attained following excavation of impacted soil. As with Alternative 3, AS at the downgradient property boundaries is expected to reduce arsenic concentrations in groundwater within a short distance of the AS well transect. The overall effectiveness of AS for achieving very low surface water quality criteria is uncertain and would be evaluated with a pilot study before full-scale implementation, but may not fully achieve cleanup standards. It is expected that the AS system would be managed indefinitely.

12.2.8.5 Alternative 5 – Excavation and Offsite Disposal, Slurry Wall and Hydraulic Control with Groundwater Discharge to the POTW

Similar to Alternative 2, it is estimated CULs for petroleum hydrocarbons in soil and groundwater and arsenic in soil will be attained following excavation of impacted soil. The installation of a slurry wall would reduce on-property and off-property flow of groundwater thereby reducing the mass flux of arsenic affected groundwater leaving the Site. However, as the source of arsenic in groundwater is not affected, groundwater extraction within the slurry wall would need to be performed indefinitely to achieve an inward gradient. As the extracted groundwater is discharged to the POTW which eventually discharges to Ebey Slough, it is questionable whether this alternative provides a net benefit to surface water quality.

12.2.8.6 Alternative 6 – Excavation and Offsite Disposal, Slurry Wall Without Hydraulic Control

This alternative is the same as Alternative 5, except that hydraulic control is not provided to maintain an inward hydraulic gradient within the slurry wall boundary. As with Alternative 2, it is estimated CULs for petroleum hydrocarbons in soil and groundwater and arsenic in soil will be attained following excavation. The slurry wall would impede groundwater movement which contains elevated arsenic concentrations; however, CULs may never be achieved for low concentrations of arsenic leaving the Site.

12.2.8.7 Alternative 7 – Excavation and Offsite Disposal, Permeable Reactive Barrier

Similar to Alternative 2, it is estimated CULs for petroleum hydrocarbons in soil and groundwater and arsenic in soil will be attained following excavation of impacted soil. This alternative also includes construction of a PRB to reduce metal concentrations in groundwater leaving the Site. The effectiveness of the PRB is uncertain and would require a pilot study to evaluate its effectiveness. If deemed effective, the PRB could reduce the concentrations of arsenic in groundwater leaving the Site. Replenishment of the PRB wall may be required in the future as zero valent iron used in the construction of the PRB is depleted.

12.2.9 Compliance with Applicable or Relevant and Appropriate Requirements

Action-specific ARARs regulate technologies or activities associated with the implementation of the remedial action. Action-specific ARARs are typically technology- or activity-based requirements or limitations. Table 21 summarizes the potential action-specific ARARs.

Section 13: Comparative Analyses and Disproportionate Cost Analysis

This section presents a comparative analysis using the MTCA criteria presented in the detailed analyses of alternatives presented in Section 12.0. A detailed analysis of alternatives for each MTCA criterion/sub-criterion is presented in Tables 12 through 16. In each table, the alternatives are ranked on a scale of 1 to 10 based on how completely each alternative satisfies the MTCA criteria (1 = does not meet criterion; 10 = meets criterion completely). A comparative analysis for each alternative is described below followed by a disproportionate cost analysis (DCA) using the comparative analysis multiplied by weighting factors. The comparative analyses scoring and DCA is summarized in Table 22.

13.1 Comparative Analyses

13.1.1 Protectiveness

For this criterion, the alternatives were ranked based on the degree that risk is reduced and/or managed and the time required to attain CULs.

Each of the alternatives were ranked similarly as the most protective, as risk would be reduced significantly through implementation of these alternatives.

The risk of exposure is reduced through implementation of institutional and engineering controls for each of the alternatives. The estimated timeframe for attaining soil CULs is based on the time required to complete the excavation activities for Alternatives 2, 4, 5, 6, and 7. Each alternative except Alternative 2 includes a means for addressing groundwater. However, given the very low cleanup standards for arsenic and the lack of technologies to achieve these levels, full compliance with CULs may never be achieved.

Alternative 1 was ranked the least protective because impacted groundwater is not addressed using any means. Soil CULs could be attained immediately with alternatives that include excavation (Alternative 2, 4, 5, 6, and 7) and therefore, were ranked the same. While Alternative 2 does not include active controls for groundwater, the overall effectiveness of all groundwater controls (like slurry walls, AS, and PRB) are unproven for the Site conditions and some will require pilot studies to evaluate their effectiveness. Consequently, their overall effectiveness at the Site is unknown.

13.1.2 Permanence

Rankings of the alternatives for this criterion were based on the ability to permanently reduce toxicity, mobility, and volume of affected media. Alternatives 4 and 7 were considered the most permanent alternative, as contaminant mass in soil is removed and arsenic and petroleum hydrocarbon toxicity reduction in groundwater through operation of the AS system or PRB is complete, irreversible, and biodegradation products are inert.

Alternative 1 addresses soil and groundwater contamination through implementation of ICs and will be in place permanently. Alternative 2 addresses contaminant mass in the unsaturated zone but not in the saturated zone. Alternative 3 permanently protects humans and ecological receptors from exposure to impacted soil but does not remove impacted soil or reduce toxicity in the unsaturated zone.

Alternatives 5 and 6 permanently remove impacted soil in the unsaturated zone and reduce the possibility of impacted groundwater from migrating offsite. However, groundwater extraction (Alternative 5) for hydraulic control is not intended to reduce the toxicity of impacted groundwater within the footprint of the slurry wall. Alternative 7 permanently removes impacted soil and reduces the toxicity of groundwater downgradient of the PRB. However, impacted groundwater upgradient of the Site is an ongoing source that will continually re-contaminate groundwater onsite.

13.1.3 Cost

Cost estimates were developed for each alternative based on capital and long-term costs. Long-term costs were estimated using a discount rate of 2.5 percent. Estimated costs are summarized as follows and provided in Tables 23 through 28 as listed below:

- Alternative 1 ($20,000)
- Alternative 2 ($561,000) (Table 23)
- Alternative 3 ($2,210,000) (Table 24)
- Alternative 4 ($1,125,000) (Table 25)
- Alternative 5 ($2,049,000) (Table 26)
- Alternative 6 ($1,651,000) (Table 27)
- Alternative 7 ($3,469,000) (Table 28).

***Note**: The cost estimates for each evaluated remedial action alternative are estimated with an accuracy of -30/+50 percent of actual cost based on available information. The estimated costs, including capital and long-term costs, were prepared for the purpose of relative comparison among alternatives. These costs are not definitive cost estimates based on the final remedial designs and should not be used for budgetary purposes.*

13.1.4 Long-Term Effectiveness

The alternatives were ranked for this criterion based on the degree of certainty that the alternative would be successful and its reliability during the period of time that affected media above CULs remain onsite. Alternative 1 ranked the highest for long-term effectiveness as ICs and ECs prevent exposure and limit residual risk.

Alternatives 2 through 7 had roughly equivalent rankings as both soil and groundwater are addressed and the overall effectiveness of groundwater alternatives at achieving very low arsenic cleanup levels is unknown.

13.1.5 Short-Term Risks

The alternatives were ranked for this criterion based on potential impacts to workers, the community, and environment during remediation activities.

Alternatives 1 carries the lowest degree of short-term risk as no construction activities (engineering controls) are required for these alternatives. The remaining alternative carry nearly the same short-term risk based on the higher potential for remediation workers to contact affected media (i.e., excavation of impacted soil and installation of slurry wall), potential for vehicular spillage during transportation of affected soil to the offsite disposal site. Alternatives 5 through 7 may pose an additional risk to workers through hitting and damaging a high pressure gas line that passes through the Site.

13.1.6 Ability to Implement

The alternatives were ranked based on the ease or difficulty of implementing the remedial action. Alternatives 3, 4, 5, 6, and 7 would be the most difficult to implement and would cause the most disturbances to Site infrastructure. Alternative 2 on its own would be relatively easy to implement with readily available equipment and could potentially be implemented with City staff. Alternative 1 is considered the easiest to implement as this alternative is largely administrative.

13.1.7 Consideration of Public Concerns

The alternatives were ranked based on whether the community has concerns regarding the alternative. Each of the alternatives which include active remediation would carry some public concern over increased truck traffic in the community. Alternatives 3 through 7 have the highest truck traffic and would likely have the greatest public concern.

13.2 Disproportionate Cost Analyses

MTCA specifies that when selecting a remedial action, preference shall be given to actions that are “permanent to the maximum extent practicable.” To determine whether a remedial action uses permanent solutions to the maximum extent possible, a DCA shall be used (WAC 173-340-360[3][b]). Costs are disproportionate to benefits if the incremental cost of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the lower cost alternative.

The most practical permanent alternative evaluated in the FS shall be the baseline cleanup alternative against which other alternatives are compared. The permanency of alternatives is largely qualitative and is based on best professional judgment. To document the qualitative analysis, weighting factors are assigned for each of the six non-cost benefits criteria to represent the importance of each benefit criterion and are expressed as a percent. Weighting factors for each non-cost criteria are summarized below.

- **Protectiveness.** A weighting factor of **25%** is assigned based on its overarching importance relative to the ultimate goal of environmental cleanup and protection of human health and the environment.

- **Permanence.** A weighting factor of **20%** is assigned in association with the need or lack thereof for further action in the future.

- **Long Term Effectiveness.** A weighting factor of **30%** is assigned in association with a measure of certainty related to the robustness of the action, as well as confidence in the technology used for the protection of human health and the environment.

- **Short Term Risk.** A weighting factor of **15%** is assigned because the majority of short-term risks can be managed through the use of best practices during process design and construction.

- **Implementability.** A weighting factor of **5%** is assigned because, although an important consideration, implementability is less associated with environmental concerns than with the above criteria.

- **Consideration of Public Concerns.** A weighting factor of **5%** is assigned because the majority of public concern issues are incorporated in the protectiveness, permanence, and long-term effectiveness criteria.

Based on the DCA, Alternative 1 provides the highest benefit/cost ratio; largely due to the very low cost to implement the alternative compared to the other alternatives. Alternative 7 provides the lowest benefit/cost ratio. The results of the DCA are summarized in Table 22. Table 22 also includes cost relative to the most permanent alternative. Figure 36 is a graphical representation of the benefit/cost ratio. Figure 37 presents the benefit/cost ratio and the benefit/cost ratio relative to the most permanent alternative. As the arsenic concentrations in groundwater have been detected at concentrations greater than the CULs both onsite and offsite and upgradient, implementation of any groundwater remediation alternative has a significant risk of recontamination from offsite sources. Furthermore, the overall effectiveness of each groundwater alternative is uncertain and likely would not be able to achieve the very low surface water/groundwater cleanup standards established for the Site.

Section 14: Recommended Alternative

The preferred remedial action for the Site is a combination of Alternative 1 (ICs and ECs) and Alternative 2 (hot spot excavation and offsite disposal of impacted soil) to protect human health and the environment. The combination of these two alternatives provides the highest level of protection against direct contact with contaminants in soil and groundwater among each of the alternatives evaluated. While this combination does not provide for groundwater treatment or active groundwater control (as with Alternatives 3 through 7), the overall effectiveness of those technologies at reducing arsenic concentrations in groundwater to the cleanup standard is uncertain. Based on an evaluation of groundwater quality in the vicinity of the Site, arsenic concentrations in groundwater are consistently several orders of magnitude above CULs both offsite and upgradient of the Site. Furthermore, surface water in Ebey Slough (the anticipated receiving water for onsite groundwater) also contains arsenic concentrations that are several orders of magnitude above the lowest groundwater cleanup standards, indicating a more regional condition which is not attributed to the Site. While the source of elevated arsenic in the regional area is uncertain, it is clear that active controls to treat onsite groundwater or restricting its movement would not have an overall benefit to the environment and would be disproportionately costly to install and maintain indefinitely. The proposed remedial alternative (IC and EC with excavation of contaminated soils) also provides the shortest estimated timeframe for completion and the highest potential to permanently attain soil CULs.

Section 15: Limitations

This report was prepared for the exclusive use of the Washington State Department of Ecology (Ecology) and the City of Marysville. Kennedy/Jenks Consultants' services were limited to scope of services specified in our agreement with Ecology and the City of Marysville. Use of, or reliance on, the information contained in this report by other parties is at their sole risk. The information contained in this report is based on review of readily available environmental records provided by Ecology, review of available aerial photographs and related site information acquired for the Site, and the results of limited Site characterization work completed by Kennedy/Jenks Consultants in accordance with our scope of services. Kennedy/Jenks Consultants' activities were conducted in accordance with practices and procedures generally accepted in the consulting field by others performing these types of services.

This report represents Kennedy/Jenks Consultants' professional opinion and judgment, which are dependent upon information obtained during performance of our consulting services. Site investigation activities identified in this report were not intended to be a comprehensive characterization of all Site conditions. Other environmental conditions and/or affected media may exist at the Site that cannot be or were not identified through the services performed. Any conclusions or recommendations provided herein are based, in part, on information supplied by others; therefore, the accuracy or sufficiency of which has not been independently reviewed by Kennedy/Jenks Consultants. No investigation can be thorough enough to identify the presence of all impacted media or adverse environmental conditions at the Site.

Any opinions presented in this report apply to conditions at the time the services were performed and do not address the potential for future releases or changing Site conditions. Changes in applicable environmental standards, practices, or regulations may occur following performance of services, which could impact the opinions presented.

Section 16: References

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Tables

Table 1: Summary of Historical Investigation and Remediation Activities(a)

Year	Description	Work Performed	Location(b)	Analyses Performed (# of samples)(c)	Results at or above MTCA Method A CULs	Other Detected Analytes(d)	Notes
1996	**Remedial Investigation** (Century West 1996)	Soil borings GB-1 to GB-19; collection and laboratory analysis of soil and reconnaissance groundwater samples.	AOC 1 (4 borings)	**Soil:** HCID (8), TPH-Dx (1) **RGW:** TPH-G (2), BTEX (2), TPH-Dx (1)	**Soil:** TPH-D (2,300 mg/kg) at GB-18 **RGW:** TPH-D (3.99 mg/l) and TPH-O (1.11 mg/l) at GB-18	**Soil:** TPH-O **RGW:** TPH-G, X, T	Two borings (B-14 and B-15) were located northeast of the office building in the southwestern portion of the northern log yard (AOC 4). Wells MW-7, MW-8, and MW-9 were installed in 1996. Most of the affected soil was subsequently removed in 1998.
			AOC 2 (3 borings)	**Soil:** HCID (6), TPH-G (2), TPH-Dx (2) **RGW:** TPH-G (1), BTEX (1)	**Soil:** TPH-G at GB-2 (343 mg/kg) and GB-4 (1,440 mg/kg) **RGW:** None	**Soil:** TPH-D, TPH-O **RGW**: B	Affected soil removed in 1996; wells MW-4, MW-5, and MW-6 were installed in 1996.
			AOC 3 (3 borings)	**Soil:** HCID (3), TPH-G (1), TPH-Dx (1) **RGW:** TPH-G (1), VOCs (1), Pb/Cr/Cd (1)	**Soil:** None **RGW:** TPH-G (1.02 mg/l), TPH-D (0.973 mg/l), Pb (33.6 µg/l) at GB-11 (tot)	**Soil:** TPH-D, TPH-O **RGW**: Cr	Borings were located in the area transferred to WSDOT in 2009; subsequent investigation and remediation was performed by WSDOT. Not part of current Site.
			AOC 5 (6 borings)	**Soil:** HCID (12), TPH-D (3), TPH-Dx (2) **RGW:** TPH-G (4), BTEX (4), TPH-Dx (1)	**Soil:** TPH-D at GB-1 (4,060 mg/kg) and GB-5 (2,970 mg/kg) **RGW:** TPH-D (16.5 mg/l) and TPH-O (1.53 mg/l) at GB-5	**Soil:** TPH-O **RGW:** TPH-G, X, T	Affected soil removed in 1996; monitoring wells MW-1, MW-2, and MW-3 installed in 1996.
			AOC 6 (3 borings)	**Soil:** HCID (6) **RGW:** TPH-G (1), BTEX (1)	**Soil:** None **RGW:** None	**Soil:** None **RGW**: B, T	Borings were located in the vicinity of the former Garka Mill (south of AOC 2 and east of AOC 3) near a former oil storage shed and debarker.
		Test pits TP-1 to TP-4; collection of soil samples.	AOC 1 (4 test pits)	**Soil:** TPH-D (6)	**Soil:** TPH-D at TP-2 (2,400 mg/kg) and TP-3 (12,000 mg/kg)	**Soil:** None	Wells MW-7, MW-8, and MW-9 were installed in 1996. Most of the affected soil was subsequently removed in 1998.
	Remedial Action (Century West 1996)	Excavation and offsite disposal of approximately 60 cubic yards of TPH-impacted soil.	AOC 2	**Excavation Soil (removed):** TPH-G (10) **Excavation Soil (final):** HCID (2), TPH-G (10)	**Excavation Soil (removed):** TPH-G (280 to 6,800 mg/kg) **Excavation Soil (final):** TPH-G (81 to 680 mg/kg), 2 locations	**Excavation Soil:** None	Impacted soil reportedly remained in place to the east of the excavation area. Additional excavation was performed in this area in 2012.
		Excavation and offsite disposal of approximately 80 cubic yards of TPH-impacted soil and 500 gallons of excavation water.	AOC 5	**Excavation Soil:** TPH-D (10) **Stockpiled Soil:** TPH-D (3) **Excavation Water:** TPH-D (2)	**Excavation Soil:** TPH-D (4,200 mg/kg) in Kiln-S3 (removed) **Stockpiled Soil:** None **Excavation Water:** 4.1 to 5.8 mg/l	**Excavation Soil:** None **Stockpiled Soil:** None **Excavation Water:** None	Final confirmation soil samples were all below the CUL for TPH-D; stockpiled soil was used as backfill; water samples were collected after soil removal.
	Well Installation and Sampling (Century West 1996)	Installation of nine groundwater monitoring wells (MW-1 to MW-9) and initial sampling event (October 1996).	AOC 1 MW-7,-8,-9	**1996 GW:** TPH-D, BTEX	**Oct96:** TPH-D in MW-7 (1.5 mg/l) and MW-9 (1 mg/l)	**Oct96:** None	Groundwater monitoring included collection of groundwater samples and measurement of groundwater elevations.
			AOC 2 MW-4,-5,-6	**1996 GW:** TPH-G, BTEX	**Oct96:** TPH-G in MW-6 (1.2 mg/l)	**Oct96:** EB and X (MW-6)	
			AOC 5 MW-1,-2,-3	**1996 GW:** TPH-D	**Oct96:** TPH-D in MW-1 (2.5 mg/l) and MW-2 (1.7 mg/l)	**Oct96:** TPH-D (MW-3)	
1997	**Groundwater Monitoring** (Century West 2000)	Quarterly groundwater monitoring in 1997 included all nine wells installed in 1996, except as noted below. Groundwater monitoring dates included: 1. January 1997 (excluding well MW-1) 2. April 1997 3. July 1997 4. October 1997 (wells MW-1, -6 and -7 only)	AOC 1 MW-7,-8,-9	**1997 GW:** TPH-Dx	**Jan97:** TPH-D in MW-7 (3.9 mg/l) **Apr97:** TPH-D in MW-7 (5.1 mg/l) **Jul97:** TPH-D in MW-7 (3.5 mg/l) **Oct97:** TPH-D in MW-7 (3.6 mg/l) [MW-8 and MW-9 NS]	**Jan97:** None **Apr97:** None **Jul97:** TPH-D (MW-9) **Oct97:** None	Sampling at wells MW-8 and MW-9 was discontinued after the July 1997 monitoring event, but water level measurement continued.
			AOC 2 MW-4,-5,-6	**1997 GW:** TPH-G, BTEX	**Jan97:** None **Apr97:** TPH-G (1.3 mg/l), B (14 µg/l) in MW-6 **Jul97**: B (14 µg/l) in MW-6 **Oct97:** None [MW-4 and MW-5 NS]	**Jan97:** B, EB, X (MW-6) **Apr97:** T, EB, X (MW-6) **Jul97:** B (MW-5); TPH-G, T, X (MW-6) **Oct97:** TPH-G, T, EB, X (MW-6)	Sampling at wells MW-4 and MW-5 was discontinued after the July 1997 monitoring event, but water level measurement continued.
			AOC 5 MW-1,-2,-3	**1997 GW:** TPH-Dx	**Jan97:** TPH-D in MW-2 (1.7 mg/l) [MW-1 NS] **Apr97:** TPH-D in MW-1 (2.2 mg/l) and MW-2 (1.4 mg/l) **Jul97:** TPH-D in MW-1 (1.9 mg/l) and MW-2 (1.4 mg/l) **Oct97:** TPH-D in MW-1 (3.8 mg/l) [MW-2 and MW-3 NS]	**Jan97:** None **Apr97:** None **Jul97:** TPH-D (MW-3) **Oct97:** None	Sampling at well MW-3 was discontinued after the July 1997 monitoring event, but water level measurement continued.

Year	Description	Work Performed	Location(b)	Analyses Performed (# of samples)(c)	Results at or above MTCA Method A CULs	Other Detected Analytes(d)	Notes
1998	**Remedial Action** (Century West 2000)	Excavation and offsite disposal of approximately 150 cubic yards of TPH-impacted soil in the vicinity of well MW-7 (June 1998).	AOC 1	Based on the summary provided in Century West's 2000 Phase I ESA, TPH-D and TPH-O were not detected in confirmational soil samples collected from the excavation; however, the referenced *Remedial Excavation Report* (Century West 1998) was not available for review and the locations, number of samples, and analyses performed could not be verified. Impacted soil was reportedly left in-place around well MW-7, which was located in the approximate center of the excavation.			Additional sampling was performed in 2006 and 2011 to evaluate the extent of impacted soil remaining around well MW-7, but was not fully characterized.
	Groundwater Monitoring (Century West 2000)	Quarterly groundwater monitoring in 1998 included only wells MW-1, MW-2, MW-6, and MW-7. Groundwater monitoring dates included: 1. February 1998 2. June 1998 3. September 1998 4. December 1998	AOC 1 MW-7	**1998 GW:** TPH-Dx	**Feb98:** TPH-D in MW-7 (5.9 mg/l) **Jun98:** TPH-D in MW-7 (1.4 mg/l) **Sep98:** TPH-D in MW-7 (4.4 mg/l) **Dec98:** TPH-D in MW-7 (16 mg/l)	**Feb98:** None **Jun98:** None **Sep98:** None **Dec98:** None	Impacted soil was removed from the area surrounding well MW-7 in June 1998; however, impacted soil remained in-place adjacent to the well.
			AOC 2 MW-6	**Feb/Jun 1998 GW:** TPH-G, BTEX **Sep/Dec 1998 GW:** BTEX	**Feb98:** None **Jun98:** None **Sep98:** None **Dec98:** None	**Feb98:** TPH-G, T, EB, X (MW-6) **Jun98:** TPH-G, T, EB, X (MW-6) **Sep98:** T, EB, X (MW-6) **Dec98:** T, EB, X (MW-6)	TPH-G was removed from the analytical program for well MW-6 following the June 1998 monitoring event.
			AOC 5 MW-1,-2	**1998 GW:** TPH-Dx	**Feb98:** TPH-D in MW-1 (4.6 mg/l) and MW-2 (1.6 mg/l) **Jun98:** TPH-D in MW-1 (3.6 mg/l), MW-2 (0.8 mg/l); TPH-O (1.1 mg/l) in MW-1 **Sep98:** TPH-D in MW-1 (3.5 mg/l) and MW-2 (0.84 mg/l) **Dec98:** TPH-D in MW-1 (6.2 mg/l) and MW-2 (1.5 mg/l)	**Feb98:** None **Jun98:** None **Sep98:** None **Dec98:** None	
1999	**Groundwater Monitoring** (Century West 2000)	Groundwater monitoring was performed only in December 1999, and included wells MW-1, MW-2, MW-6, and MW-7.	AOC 1 MW-7	**1999 GW:** TPH-Dx	**Dec99:** TPH-D (1.91 mg/l) and TPH-O (0.77 mg/l) in MW-7	**Dec99:** None	
			AOC 2 MW-6	**1999 GW:** BTEX	**Dec99:** None	**Dec99:** T, EB, X (MW-6)	
			AOC 5 MW-1,-2	**1999 GW:** TPH-Dx	**Dec99:** TPH-D (5.56 mg/l) and TPH-O (1.88 mg/l) in MW-1	**Dec99:** TPH-D (MW-2)	MW-1 was damaged by yard equipment and was subsequently replaced with MW-1R in 2000.
2000	**Well Closure** (Century West 2000)	Monitoring wells MW-1, MW-3, MW-4, MW-5, MW-8, and MW-9 were decommissioned in April 2000. MW-1 was replaced with MW-1R.	AOCs 1, 2, and 5	NA	NA	NA	Four wells, MW-1R, MW-2, MW-6, and MW-7, remained in the monitoring program.
	Groundwater Monitoring (Century West 2000)	Quarterly groundwater monitoring in 2000 included only wells MW-1R, MW-2, MW-6, and MW-7. Groundwater monitoring dates included: 1. April 2000 2. August 2000 3. November 2000	AOC 1 MW-7	**2000 GW:** TPH-Dx	**Apr00:** TPH-D (2.1 mg/l) and TPH-O (0.956 mg/l) in MW-7 **Aug00:** TPH-D (1.5 mg/l) in MW-7 **Nov00:** TPH-D (2.28 mg/l) and TPH-O (0.639 mg/l) in MW-7	**Apr00:** None **Aug00:** None **Nov00:** None	
			AOC 2 MW-6	**2000 GW:** BTEX	**Apr00:** None **Aug00:** None **Nov00:** None	**Apr00:** T, X (MW-6) **Aug00:** T, EB, X (MW-6) **Nov00:** T (MW-6)	Sampling at well MW-6 was discontinued after the November 2000 monitoring event, but water level measurement continued.
			AOC 5 MW-1R,-2	**2000 GW:** TPH-Dx	**Apr00:** TPH-D (2.46 mg/l) and TPH-O (1.39 mg/l) in MW-1R **Aug00:** TPH-D (1.15 mg/l) and TPH-O (0.727 mg/l) in MW-1R **Nov00:** None	**Apr00:** None **Aug00:** TPH-D (MW-2) **Nov00:** TPH-D (MW-1R)	Sampling at well MW-2 was discontinued after the November 2000 monitoring event, but water level measurement continued.
2001	**Groundwater Monitoring** (Parametrix 2002)	Quarterly groundwater monitoring in 2001 included only wells MW-1R and MW-7. Groundwater monitoring dates included: 1. February 2001 2. May 2001 3. August 2001	AOC 1 MW-7	**2001 GW:** TPH-Dx	**Feb01:** TPH-D (2.18 mg/l) and TPH-O (0.772 mg/l) in MW-7 **May01:** TPH-D (2.11 mg/l) and TPH-O (0.762 mg/l) in MW-7 **Aug01:** TPH-D (2.24 mg/l) and TPH-O (0.622 mg/l) in MW-7	**Feb01:** None **May01:** None **Aug01:** None	
			AOC 5 MW-1R	**2001 GW:** TPH-Dx	**Feb01:** TPH-D (0.68 mg/l) and TPH-O (0.676 mg/l) in MW-1R **May01:** TPH-D (0.77 mg/l) and TPH-O (0.642 mg/l) in MW-1R **Aug01:** None	**Feb01:** None **May01:** None **Aug01:** TPH-D (MW-1R)	Sampling at well MW-1R was discontinued after the August 2001 monitoring event, but water level measurement continued.
2002	**Groundwater Monitoring** (Parametrix 2002)	Groundwater monitoring was performed only at well MW-7 in July 2002 and October 2002.	AOC 1 MW-7	**2002 GW:** TPH-Dx	**Jul02:** TPH-D (0.79 mg/l) in MW-7 **Oct02:** TPH-D (0.729 mg/l) in MW-7	**Jul02:** None **Oct02:** None	
2003	**Groundwater Monitoring** (Parametrix 2004)	Groundwater monitoring was performed only at well MW-7 in December 2003.	AOC 1 MW-7	**2003 GW:** TPH-D	**Dec03:** TPH-D (3.23 mg/l) in MW-7	**Dec03:** None	Following the December 2003 sampling event, approximately three pounds of ORC were placed in well MW-7 to promote natural attenuation.
2004-2005	**No work performed**	Available reports and other documents in Ecology's Site file indicate that no investigation or remediation activities took place at the Site in 2004 and 2005, and that no groundwater monitoring was performed in 2004 and 2005.					

Table 1: Summary of Historical Investigation and Remediation Activities(a)

Year	Description	Work Performed	Location(b)	Analyses Performed (# of samples)(c)	Results at or above MTCA Method A CULs	Other Detected Analytes(d)	Notes
2006	**Remedial Investigation** (Floyd-Snider 2006)	Soil borings GP-1 to GP-11; collection and laboratory analysis of soil samples. Test pits TP-1 to TP-10; collection and laboratory analysis of soil samples.	AOC 1 (6 borings)	**GP-1**: TPH-Dx **GP-2:** TPH-Dx, As/Cd/Cr/Pb/Hg **GP-3**: TPH-Dx **GP-4:** TPH-Dx **GP-5:** TPH-Dx **GP-6:** TPH-Dx	**GP-1**: None **GP-2:** TPH-D (14,000 mg/kg) **GP-3**: None **GP-4:** None **GP-5:** None **GP-6:** None	**GP-1**: TPH-D, TPH-O **GP-2:** TPH-O, As, Cr, Pb **GP-3**: TPH-D, TPH-O **GP-4:** None **GP-5:** TPH-D, TPH-O **GP-6:** TPH-O	Boring GP-2 was located near MW-7 and may represent soil materials left in-place during the 1998 remedial action.
			AOC 2 (3 borings)	**GP-7**: TPH-G, BTEX **GP-8:** TPH-G, BTEX **GP-9**: TPH-G, BTEX	**GP-7**: TPH-G (3,600 mg/kg), EB (6.6 mg/kg) **GP-8:** TPH-G (100 mg/kg) **GP-9**: None	**GP-7**: X **GP-8:** EB **GP-9**: None	TPH-impacted soil at boring locations GP-7 and GP-8 was subsequently excavated in 2012.
			AOC 3 (5 test pits)	**TP-6**: TPH-G, BTEX, PCB, SVOC/PAH, VOC, As/Cd/Cr/Pb/Hg **TP-7:** TPH-Dx, As/Cd/Cr/Pb/Hg **TP-8**: TPH-Dx, SVOC/PAH, As/Cd/Cr/Pb/Hg **TP-9:** TPH-G, BTEX, VOC **TP-10:** TPH-G, BTEX	**TP-6:** TPH-G (66 mg/kg), cPAHs (151 µg/kg, total TEF) **TP-7:** None **TP-8:** As (29 mg/kg), cPAHs (1,425 µg/kg, total TEF) **TP-9:** As (25 mg/kg), MC (53 µg/kg) **TP-10:** None	**TP-6**: BTEX, As, Cd, Cr, Pb, SVOCs, VOCs (incl. MC) **TP-7:** TPH-D, TPH-O, As, Cr, Pb **TP-8**: TPH-D, TPH-O, Cr, Pb, Hg, SVOCs **TP-9:** T, X, Cd, Cr, Pb, Hg, VOCs **TP-10:** None	Test pits TP-6, TP-7, and TP-10 were located in the area that was transferred to WSDOT in 2009; subsequent investigation (2009) and remediation (2010) was performed by WSDOT. TP-8 and TP-9 are located on the Site east of the WSDOT area.
			AOC 4 (3 test pits)	**TP-1**: SVOC/PAH, As/Cd/Cr/Pb/Hg **TP-2:** SVOC/PAH **TP-3**: TPH-Dx, As/Cd/Cr/Pb/Hg	**TP-1**: None **TP-2:** None **TP-3**: TPH-O (2,300 mg/kg)	**TP-1**: Cr, Pb, Hg **TP-2:** SVOCs (BEP only) **TP-3**: TPH-D, Cr, Pb, Hg	Test pits TP-1 and TP-2 were located in the north log yard area, and TP-3 in the south log yard area.
			AOC 5 (1 boring)	**GP-11**: TPH-Dx, PCB, As/Cd/Cr/Pb/Hg	**GP-11**: None	**GP-11**: TPH-D, TPH-O, As, Cr, Pb, Hg	GP-11 was located east of the former Kiln UST excavation area.
			AOC 6 (1 boring; 2 test pits)	**GP-10**: TPH-G, BTEX, As/Cd/Cr/Pb/Hg **TP-4:** PCB, SVOC/PAH **TP-5**: TPH-G, BTEX, PCB, SVOC/PAH, VOC, As/Cd/Cr/Pb/Hg	**GP-10:** As (26 mg/kg) **TP-4:** None **TP-5**: MC (49 µg/kg), cPAHs (481 µg/kg, total TEF)	**GP-10**: Cr, Pb **TP-4:** None **TP-5**: TPH-G, B, As, Cr, Pb, Hg, VOCs, SVOCs	TP-4, TP-5, and GP-10 were located in the former mill area (south of AOC 2 and east of AOC 3).
	Groundwater Monitoring (Floyd-Snider 2006)	Groundwater monitoring was performed in March 2006 at wells MW-1R, MW-6, and MW-7.	AOC 1 MW-7	**2006 GW:** TPH-Dx	**Mar06:** TPH-D (0.51 mg/l) in MW-7	**Mar06:** None	Well MW-7 had not been sampled since 2003.
			AOC 2 MW-6	**2006 GW:** TPH-G, BTEX	**Mar06:** None	**Mar06:** None	Well MW-6 had not been sampled since 2000.
			AOC 5 MW-1R	**2006 GW:** TPH-Dx	**Mar06:** None	**Mar06:** TPH-D (MW-1R)	Well MW-1R had not been sampled since 2001.
2007-2008	**No work performed**	The available reports and other documents in Ecology's Site file indicate that no investigation or remediation activities took place at the Site in 2007 and 2008, and that no groundwater monitoring was performed in 2007 and 2008.					
2009	**Remedial Investigation WSDOT (offsite)** (GeoEngineers 2009)	Eleven soil borings were advanced by WSDOT in the area acquired for bridge replacement in 2009, and soil and reconnaissance groundwater samples were collected for analyses. The WSDOT investigation area included most of the former boat manufacturing facility (AOC 3).	AOC 3 (offsite)	**Soil:** TPH-Dx (11), TPH-G (11), BTEX (11), As/Pb (14), Cd/Cr/Cr6/Hg (2), HVOC (2), PAH (2) **RGW:** TPH-Dx (5), TPH-G (5), HVOC (1), PAH (3), As/Cd/Cr/Pb/Hg (diss) (2)	**Soil:** As (21 to 28 mg/kg, 2 samples), Pb (310 mg/kg, 1 sample), cPAHs (0.34 mg/kg total TEF, 1 sample) **RGW:** TPH-D (1.5 mg/l, 1 sample)	**Soil:** TPH-D (1), TPH-O (8), Cr (2), Pb (11), cPAHs (1), Naphthalene (1) **RGW:** TPH-D (1), As (diss) (2), PAHs (2), cPAHs (1)	The WSDOT borings were not located on the current Site. However, the eastern portion of AOC 3 is located on the current Site, and conditions similar to those encountered in the WSDOT borings could be present in the southwestern portion of the Site, east of the WSDOT work area.
2010	**Remedial Action WSDOT (offsite)** (GeoEngineers 2011)	Excavation and offsite disposal of approximately 1,480 cubic yards of impacted soil (TPH, metals, cPAHs) from three excavation areas located within the area acquired by WSDOT in 2009 (AOC 3) based on the findings of WSDOT's 2009 remedial investigation.	AOC 3 (offsite) B07 Area B10 Area B11 Area	**Soil B07:** TPH-Dx (5), TPH-G (5), BTEX (5), cPAH (5), PCB (5), As (10), Pb (5) **Soil B10:** cPAH (5), PCB (5), As/Pb (5) **Soil B11:** TPH-Dx (22), TPH-G (18), BTEX (18), cPAH (18), PCB (15), As (18), Pb (20)	**Soil B07 (removed):** As (21 to 37 mg/kg; 5 samples) **Soil B07 (final):** None **Soil B10 (final):** None **Soil B11 (removed):** TPH-O (2,100 to 2,800 mg/kg; 2 samples); As (22 to 40 mg/kg; 5 samples); Pb (290 to 930 mg/kg; 2 samples); cPAHs (0.179 to 2.81 mg/kg total TEF; 2 samples) **Soil B11 (final):** As (20 mg/kg; 1 sample)	**Soil B07 Exv'n (final):** As (3) **Soil B10 Exv'n (final):** Pb (2), cPAHs (1) **Soil B11 Exv'n (final):** TPH-D (1), TPH-O (6), T (1), EB (1), X (2), As (4), Pb (7), cPAHs (tot TEF, 8)	Conditions similar to those documented by WSDOT could be present in the southwestern portion of the Site (AOC 3), east of the WSDOT work area.

Table 1: Summary of Historical Investigation and Remediation Activities[(a)]

Year	Description	Work Performed	Location[(b)]	Analyses Performed (# of samples)[(c)]	Results at or above MTCA Method A CULs	Other Detected Analytes[(d)]	Notes
2011	**Remedial Investigation (Soil)** (Kennedy/Jenks 2011)	Soil borings B1 to B10; collection and laboratory analysis of soil samples.	AOC 1 (3 borings)	**B1 Soil:** TPH-Dx (1), TPH-G (1), BTEX (1), As/Ba/Cd/Cr/Pb/Se/Ag (1) **B2 Soil:** TPH-Dx (2), TPH-G (2), BTEX (2), As/Ba/Cd/Cr/Pb/Se/Ag/Hg (1) **B3 Soil:** TPH-Dx (2), TPH-G (2), BTEX (2)	**B1 Soil:** None **B2 Soil:** None **B3 Soil:** None	**B1 Soil:** Ba, Cr, Pb **B2 Soil:** Ba, Cr, Pb **B3 Soil:** None	Borings B1, B2, and B3 were located around the perimeter of the 1998 excavation in AOC 1.
			AOC 2 (7 borings)	**B4 Soil**: TPH-Dx (1), TPH-G (1), BTEX (1) **B5 Soil:** TPH-Dx (2), TPH-G (2), BTEX (2), PAH (1), As/Ba/Cd/Cr/Pb/Se/Ag/Hg (1) **B6 Soil**: TPH-Dx (1), TPH-G (1), BTEX (1) **B7 Soil:** TPH-Dx (2), TPH-G (2), BTEX (2), PAH (1), As/Ba/Cd/Cr/Pb/Se/Ag (1) **B8 Soil:** TPH-Dx (1), TPH-G (1), BTEX (1) **B9 Soil:** TPH-Dx (1), TPH-G (1), BTEX (1) **B10 Soil:** TPH-Dx (1), TPH-G (1), BTEX (1)	**B4 Soil**: None **B5 Soil:** TPH-G (1,390 mg/kg) **B6 Soil**: None **B7 Soil:** TPH-D (10,900 mg/kg) **B8 Soil:** None **B9 Soil:** None **B10 Soil:** None	**B4 Soil**: None **B5 Soil:** T, As, Ba, Cr, Pb, PAHs (naphthalene only) **B6 Soil**: None **B7 Soil:** As, Ba, Cr, Pb, PAHs, cPAHs (chrysene only) **B8 Soil:** None **B9 Soil:** None **B10 Soil:** TPH-D	Borings B5 and B7 were located within the 2012 excavation in AOC 2, and the TPH-impacted soil was subsequently removed.
	Remedial Investigation (RGW) (Kennedy/Jenks 2011)	Collection and laboratory analysis of reconnaissance groundwater samples at borings B1, B2, B5, and B7.	AOC 1 (2 locations)	**B1 RGW:** TPH-Dx, TPH-G, BTEX **B2 RGW:** TPH-Dx, TPH-G, BTEX	**B1 RGW:** None **B2 RGW:** None	**B1 RGW:** None **B2 RGW:** None	Borings B1 and B2 were located near the western margin of the 1998 excavation in AOC 1.
			AOC 2 (2 locations)	**B5 RGW:** TPH-Dx, TPH-G, BTEX **B7 RGW:** TPH-Dx, TPH-G, BTEX, PAH, As/Ba/Cd/Cr/Pb/Se/Ag/Hg (tot)	**B5 RGW:** None **B7 RGW:** TPH-D (1.1 mg/l), As (16 µg/l) (tot)	**B5 RGW:** TPH-D, TPH-G **B7 RGW:** Ba, Cr, Pb, Ag, cPAHs, PAHs	Borings B5 and B7 were located south (presumed downgradient) from the 1996 excavation in AOC 2. The RGW sample from B7 was also analyzed for natural attenuation parameters (nitrate, nitrite, sulfate, and dissolved iron).
	Groundwater Monitoring (Kennedy/Jenks 2011)	Groundwater monitoring was performed in August 2011 at remaining wells MW-1R, MW-6, and MW-7.	AOC 1 MW-7	**2011 GW:** TPH-Dx, TPH-G, BTEX, PAH, As/Ba/Cd/Cr/Pb/Se/Ag/Hg (tot)	**Aug11:** As (42 µg/l) (tot)	**Aug11:** Ba	Wells had not been sampled since 2006. This appears to have been the first time metals analyses had been performed for samples collected from Site monitoring wells. All samples were also analyzed for natural attenuation parameters (nitrate, nitrite, sulfate, and dissolved iron).
			AOC 2 MW-6	**2011 GW:** TPH-Dx, TPH-G, BTEX, PAH, As/Ba/Cd/Cr/Pb/Se/Ag/Hg (tot)	**Aug11:** As (57 µg/l) (tot)	**Aug11:** Ba	
			AOC 5 MW-1R	**2011 GW:** TPH-Dx, TPH-G, BTEX, PAH, As/Ba/Cd/Cr/Pb/Se/Ag/Hg (tot)	**Aug11:** As (9.2 µg/l) (tot)	**Aug11:** Ba, Cr, Pb	
2012	**Remedial Action** (Kennedy/Jenks 2012)	UST removal and excavation and offsite disposal of approximately 750 cubic yards of impacted soil and 33,700 gallons of excavation water from two excavations (west excavation and east excavation) in AOC 2.	AOC 2 West Excavation	**Soil (removed):** VOC (2), SVOC/PAH (1)	**Soil (removed):** X (20,000 µg/kg; 1 sample)	**Soil (removed):** VOCs, PAHs, SVOCs (BEP only)	Approximately 400 pounds of ORC was placed in the southern (downgradient) portions of the east and west excavations during excavation backfilling.
				Soil (final): TPH-Dx (13), TPH-G (13), BTEX (13), VOC (1), PAH (2), As/Pb (13)	**Soil (final):** As (20 mg/kg to 27 mg/kg; 7 samples)	**Soil (final):** TPH-D (6), As (6), Pb (13)	
			AOC 2 East Excavation	**Soil (removed):** TPH-Dx (1), TPH-G (1), BTEX (1), As/Pb (1)	**Soil (removed):** TPH-O (6,900 mg/kg), Pb (250 mg/kg)	**Soil (removed):** TPH-D, TPH-G, X, As	
				Soil (final): TPH-Dx (19), TPH-G (19), BTEX (19), VOC (1), PAH (4), As/Pb (19)	**Soil (final):** As (20 mg/kg to 37 mg/kg; 8 samples)	**Soil (final):** TPH-O (3), TPH-G (3), PAHs (1), cPAHs (1), As (11), Pb (19)	
	Well Installation (Kennedy/Jenks 2012)	Installation and development of monitoring wells MW-10 and MW-11.	AOC 2	NA	NA	NA	Wells MW-10 and MW-11 are located south (downgradient) of the AOC 2 excavations.
	Groundwater Monitoring (Kennedy/Jenks 2012)	Groundwater monitoring was performed in August 2012 at wells MW-10 and MW-11.	AOC 2	**2012 GW:** TPH-Dx, TPH-G, BTEX, PAH, As/Pb (tot+diss)	**Aug12:** As (tot) in MW-10 (33 µg/l) and MW-11 (17 µg/l) As (diss) in MW-10 (31 µg/l) and MW-11 (9.8 µg/l) Pb (tot) in MW-11 (51 µg/l)	**Aug11:** Pb (tot) in MW-10	August 2012 groundwater samples were also analyzed for natural attenuation parameters (nitrate, nitrite, sulfate, and dissolved iron and manganese).
2013-2015	**No work performed**	The available reports and other documents in Ecology's Site file indicate that no investigation or remediation activities took place at the Site between 2013 and 2015, and that no groundwater monitoring was performed between 2013 and 2015.					
2016	**Well Installation** (HWA 2016)	Installation and development of monitoring wells MW-12, MW-13, and MW-14 along the southern Site margin (Ebey Slough bank).	Ebey Slough Bank Area	NA	NA	NA	Wells MW-12, MW-13, and MW-14 are located south of the fence line along the paved pathway between the main Site area and Ebey Slough.
	Groundwater Monitoring (HWA 2016)	Groundwater monitoring was performed in August 2016 at wells MW-12, MW-13 and MW-14.	AOC 2	**2016 GW:** As (tot+diss)	**Aug16:** As (tot) in all three wells (5.4 to 9.6 µg/l); As (diss) in all three wells (5.6 to 9.3 µg/l)	**Aug16:** None	

Notes:

(a) Historical summary based on the available Site information provided by Ecology and reports included in Ecology's Site file.

(b) Primary areas of the Site where the described work was performed. Based on the areas of concern (AOCs) described in Section 1.4 of this report and shown on Figure 2, as listed below.

AOC 1 - North Office Building Area /MW-7 Area
AOC 2 - Former Unknown UST and Drain Field Area
AOC 3 - Former Boat Manufacturing and WSDOT Bridge Replacement Area
AOC 4 - Former North and South Log Yards
AOC 5 - Former Kiln UST Area
AOC 6 - Shallow Soil Site-Wide

(c) Laboratory analyses performed for historical Site samples. Number of samples for each analysis indicated in parentheses as applicable.

(d) Analytes detected in samples at concentrations above the laboratory reporting limits but below the referenced CULs.

Analyses and Analytes:

Ag	Silver	MC	Methylene Chloride
As	Arsenic	Se	Selenium
B	Benzene	SVOCs	Semivolatile Organic Compounds
Ba	Barium	T	Toluene
BEP	bis(2-ethylhexyl)phthalate	TPH-D	Diesel-range Total Petroleum Hydrocarbons
BTEX	Benzene, Toluene, Ethylbenzene, and total Xylenes	TPH-Dx	Diesel-range and Oil-range Total Petroleum Hydrocarbons
Cd	Cadmium	TPH-G	Gasoline-range Total Petroleum Hydrocarbons
Cr	Chromium	TPH-O	Oil-range Total Petroleum Hydrocarbons
Cr6	Hexavalent Chromium	PAHs	Polycyclic Aromatic Hydrocarbons
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons	PCBs	Polychlorinated Biphenyls
EB	Ethylbenzene	Pb	Lead
Hg	Mercury	VOCs	Volatile Organic Compounds
HVOCs	Halogenated Volatile Organic Compounds	X	Total Xylenes

Other Abbreviations:

CUL	Cleanup Level	tot	total (with respect to metals analyses performed for GW and RGW samples)
diss	dissolved (with respect to metals analyses performed for GW and RGW samples)	TP	Test Pit
Ecology	Washington State Department of Ecology	RGW	Reconnaissance Groundwater
GW	Groundwater	UST	Underground Storage Tank
HCID	Hydrocarbon Identification	WAC	Washington Administrative Code
MTCA	Model Toxics Control Act, WAC 173-340	WSDOT	Washington State Department of Transportation
MW	Monitoring Well	mg/kg	milligrams per kilogram
NA	Not applicable / No samples collected	mg/l	milligrams per liter
ORC	Oxygen Release Compound	µg/kg	micrograms per kilogram
TEF	Toxicity Equivalency Factor	µg/l	micrograms per liter

Table 2: Monitoring Well and Boring Construction Details

Well ID	Soil Boring ID	Ecology Well ID	Type	Installation Date	Survey Date(a)	Northing (feet)(b)	Easting (feet)(b)	Top of Casing Elevation(c) (feet amsl)	Ground Surface Elevation (feet amsl)	Flushmount Lid Elevation (feet amsl)	Boring / Well Depth (feet bgs)	Well Screen Diameter and Material	Screen Interval (feet bgs)	Screen Length (feet)
Groundwater Monitoring Wells; Primary On-Property Wells														
MW-1R	--	NA(d,e)	Well	April 2000	11/7/2017	384617.493	1312149.047	8.849	--	9.253	13	2-inch PVC	3 - 13	10
MW-6	--	NA(d,e)	Well	October 1996	11/7/2017	384766.034	1311920.372	9.716	--	10.085	14	2-inch PVC	3 - 13	10
MW-7	--	NA(d,e)	Well	October 1996	11/7/2017	384961.719	1311813.331	13.275	--	13.459	12.7	2-inch PVC	2.7 - 12.7	10
MW-10	--	BHS-241/2	Well	8/27/2012	11/7/2017	384691.789	1311908.677	9.434	--	9.681	10	1-inch PVC	2.5 - 10	7.5
MW-11	--	BHS-241/2	Well	8/27/2012	11/7/2017	384674.513	1311964.171	8.406	--	8.661	10	1-inch PVC	2.5 - 10	7.5
MW-12	--	NA(d)	Well	8/23/2016	11/7/2017	384561.577	1311746.428	12.224	--	12.870	15	2-inch PVC	5 - 15	10
MW-13	--	NA(d)	Well	8/23/2016	11/7/2017	384454.381	1311835.719	11.772	--	12.241	15	2-inch PVC	5 - 15	10
MW-14	--	NA(d)	Well	8/23/2016	11/7/2017	384238.174	1312062.825	12.382	--	12.992	15	2-inch PVC	5 - 15	10
MW-15	--	BKX-359	Well	10/20/2017	11/7/2017	384698.043	1311695.466	13.055	--	13.371	15	2-inch PVC	4 - 14	10
MW-16	--	BKX-358	Well	10/20/2017	11/7/2017	384433.205	1312116.878	7.853	--	8.103	15	2-inch PVC	3 - 8	5
MW-17	2017-B4	BKX-361	Well	10/20/2017	11/7/2017	384900.403	1311842.388	11.370	--	11.679	15	2-inch PVC	3 - 13	10
Groundwater Monitoring Wells; Background Wells														
MWBG-1	--	BKX-357	Well	10/18/2017	11/7/2017	385468.489	1311678.507	15.941	--	16.203	15	2-inch PVC	4 - 14	10
MWBG-2	2017-B3	BKX-360	Well	10/20/2017	11/7/2017	384862.562	1311747.541	11.115	--	11.427	15	2-inch PVC	3 - 13	10
MWBG-3	--	BKX-364	Well	10/20/2017	11/7/2017	384950.079	1311972.945	12.570	--	NM(f)	15	2-inch PVC	3 - 13	10
MWBG-4	--	BKX-355	Well	10/19/2017	11/7/2017	385283.640	1311992.141	12.641	--	12.956	15	2-inch PVC	3 - 13	10
MWBG-5	--	BKX-356	Well	10/19/2017	11/7/2017	385293.030	1312148.349	11.454	--	11.778	15	2-inch PVC	3 - 8	5
MWBG-6	--	BKX-362	Well	10/20/2017	11/7/2017	384986.617	1312303.016	8.902	--	9.223	15	2-inch PVC	3 - 13	10
MWBG-7	--	BKX-363	Well	10/19/2017	11/7/2017	385335.011	1312303.496	7.180	--	7.437	15	2-inch PVC	3 - 13	10
MWBG-8	--	BKL-381	Well	6/4/2018	Not Surveyed	--	--	--	--	--	20	2-inch PVC	3 - 13	10
MWBG-9	--	BKL-382	Well	6/4/2018	Not Surveyed	--	--	--	--	--	15	2-inch PVC	3 - 13	10
MWBG-10	--	BKL-383	Well	6/4/2018	Not Surveyed	--	--	--	--	--	20	2-inch PVC	5 - 15	10
Groundwater Monitoring Wells; Existing Off-Property Wells used as Background Wells														
EP-1(g)	--	NA	Well	2015 (g)	11/7/2017	385476.979	1311390.638	14.449	--	14.812	15	2-inch PVC	5 - 15	10
GM-2	--	NA	Well	2/3/2015	Not Surveyed	--	--	--	--	--	15	2-inch PVC	5 - 15	10
GM-3	--	NA	Well	2/2/2015	Not Surveyed	--	--	--	--	--	15	2-inch PVC	5 - 15	10
Soil Borings (monitoring wells not installed)														
--	2017-B1	--	Soil Boring	10/19/2017	11/7/2017	384960.167	1311807.263	--	13.26	--	15	--	--	--
--	2017-B2	--	Soil Boring	10/18/2017	11/7/2017	384959.714	1311819.319	--	13.09	--	15	--	--	--
--	2017-B5	--	Soil Boring	10/19/2017	11/7/2017	384923.996	1311878.462	--	11.44	--	15	--	--	--
--	2017-B6	--	Soil Boring	1/12/2018	Not Surveyed	384638.7089	1311664.849	--	--	--	15	--	--	--
--	2017-B7	--	Soil Boring	1/12/2018	Not Surveyed	384458.826	1312023.784	--	--	--	25	--	--	--
--	2017-B8	--	Soil Boring	1/12/2018	Not Surveyed	384717.3334	1311783.673	--	--	--	15	--	--	--
--	2017-B9	--	Soil Boring	1/12/2018	Not Surveyed	384402.030	1312170.076	--	--	--	15	--	--	--
--	2017-B10	--	Soil Boring	1/12/2018	Not Surveyed	385057.439	1312147.154	--	--	--	15	--	--	--
--	2017-B11	--	Soil Boring	1/12/2018	Not Surveyed	385062.4334	1312110.631	--	--	--	5.5	--	--	--
--	2018-B1	--	Soil Boring	6/4/2018	Not Surveyed	384783.3083	1312049.272	--	--	--	15	--	--	--

Notes:

(a) Elevation survey performed by True North Land Surveying of Seattle, WA.
(b) Northing and Easting based on survey by True North, or handheld GPS unit where 'Not Surveyed' is indicated and coordinates are present.
(c) Elevation measured at the top of the inner PVC well casing as marked by surveyors; typically measured at the northern side.
(d) Ecology well ID tag not present in well and not listed on well logs, where available.
(e) Consultant's boring logs not identified; depths and screen intervals are approximate based on field down-well camera survey and driller's logs for multiple wells installed in 1996 and 2000 (specific wells not listed on driller's logs, but construction details are similar for multiple wells).
(f) Well completed with a 2.25-foot stand pipe.
(g) Boring log for EP-1 not identified; depths and screen interval are approximate based on field down-well camera survey. Installed in approximatley 2015 based on aerial photographs.

amsl = above mean sea level
bgs = below ground surface
-- = Not applicable / not available
PVC = polyvinyl chloride

Table 3: Summary of Groundwater Elevation Data

Monitoring Well ID	Measurement Date	Top of Casing Elevation (feet amsl)	Depth to Groundwater (feet btoc)	Groundwater Elevation (feet amsl)
EP-1	10/25/2017	14.449	5.21	9.24
EP-1	11/25/2017	14.449	4.76	9.69
EP-1	11/29/2017	14.449	4.75	9.70
EP-1	1/8/2018	14.449	4.62	9.83
EP-1	7/16/2018	14.449	4.88	9.83
EP-1	9/21/2018	14.449	5.29	9.16
MW-10	10/25/2017	9.434	1.50	7.93
MW-10	11/25/2017	9.434	0.93	8.50
MW-10	11/29/2017	9.434	0.91	8.52
MW-10	1/8/2018	9.434	0.70	8.73
MW-10	7/16/2018	9.434	1.60	7.83
MW-10	9/21/2018	9.434	1.71	7.72
MW-11	10/25/2017	8.406	1.06	7.35
MW-11	11/25/2017	8.406	1.08	7.33
MW-11	11/29/2017	8.406	0.61	7.80
MW-11	1/8/2018	8.406	0.72	7.69
MW-11	7/16/2018	8.406	1.05	7.36
MW-11	9/21/2018	8.406	1.14	7.27
MW-12	10/25/2017	12.224	3.82	8.40
MW-12	11/25/2017	12.224	4.14	8.08
MW-12	11/29/2017	12.224	4.18	8.04
MW-12	1/8/2018	12.224	2.60	9.62
MW-12	7/16/2018	12.224	4.08	8.14
MW-12	9/21/2018	12.224	4.55	7.67
MW-13	10/25/2017	11.772	4.16	7.61
MW-13	11/25/2017	11.772	3.50	8.27
MW-13	11/29/2017	11.772	4.12	7.65
MW-13	1/8/2018	11.772	2.66	9.11
MW-13	7/16/2018	11.772	3.54	8.23
MW-13	9/21/2018	11.772	4.71	7.06
MW-14	10/25/2017	12.382	4.74	7.64
MW-14	11/25/2017	12.382	3.23	9.15
MW-14	11/29/2017	12.382	3.23	9.15
MW-14	1/8/2018	12.382	3.57	8.81
MW-14	7/16/2018	12.382	6.26	6.12
MW-14	9/21/2018	12.382	4.63	7.75
MW-15	10/25/2017	13.055	3.55	9.51
MW-15	11/25/2017	13.055	3.24	9.82
MW-15	11/29/2017	13.055	3.15	9.91
MW-15	1/8/2018	13.055	3.11	9.95
MW-15	7/16/2018	13.055	4.42	8.64
MW-15	9/21/2018	13.055	4.45	8.61
MW-16	10/25/2017	7.853	3.09	4.76
MW-16	11/25/2017	7.853	2.61	5.24
MW-16	11/29/2017	7.853	2.56	5.29
MW-16	1/8/2018	7.853	3.12	4.73
MW-16	7/16/2018	7.853	2.64	5.21
MW-16	9/21/2018	7.853	3.26	4.59

Table 3: Summary of Groundwater Elevation Data

Monitoring Well ID	Measurement Date	Top of Casing Elevation (feet amsl)	Depth to Groundwater (feet btoc)	Groundwater Elevation (feet amsl)
MW-17	10/25/2017	11.370	2.82	8.55
MW-17	11/25/2017	11.370	2.31	9.06
MW-17	11/29/2017	11.370	1.98	9.39
MW-17	1/8/2018	11.370	1.80	9.57
MW-17	7/16/2018	11.370	2.51	8.86
MW-17	9/21/2018	11.370	2.68	8.69
MW-1R	10/25/2017	8.849	2.34	6.51
MW-1R	11/25/2017	8.849	2.57	6.28
MW-1R	11/29/2017	8.849	1.36	7.49
MW-1R	1/8/2018	8.849	1.20	7.65
MW-1R	7/16/2018	8.849	2.21	6.64
MW-1R	9/21/2018	8.849	2.51	6.34
MW-6	10/25/2017	9.716	1.80	7.92
MW-6	11/25/2017	9.716	1.32	8.40
MW-6	11/29/2017	9.716	1.26	8.46
MW-6	1/8/2018	9.716	1.05	8.67
MW-6	7/16/2018	9.716	1.78	7.94
MW-6	9/21/2018	9.716	1.93	7.79
MW-7	10/25/2017	13.275	4.25	9.03
MW-7	11/25/2017	13.275	3.53	9.75
MW-7	11/29/2017	13.275	3.17	10.11
MW-7	1/8/2018	13.275	2.89	10.39
MW-7	7/16/2018	13.275	3.90	9.38
MW-7	9/21/2018	13.275	4.05	9.23
MWBG-1	10/25/2017	15.941	5.94	10.00
MWBG-1	11/25/2017	15.941	5.64	10.30
MWBG-1	11/29/2017	15.941	5.36	10.58
MWBG-1	1/8/2018	15.941	5.32	10.62
MWBG-1	7/16/2018	15.941	8.69	7.25
MWBG-1	9/21/2018	15.941	5.97	9.97
MWBG-2	10/25/2017	11.115	1.36	9.76
MWBG-2	11/25/2017	11.115	0.71	10.41
MWBG-2	11/29/2017	11.115	0.76	10.36
MWBG-2	1/8/2018	11.115	0.93	10.19
MWBG-2	7/16/2018	11.115	1.81	9.31
MWBG-2	9/21/2018	11.115	1.71	9.41
MWBG-3	10/25/2017	12.570	4.63	7.94
MWBG-3	11/25/2017	12.570	3.18	9.39
MWBG-3	11/29/2017	12.570	3.77	8.80
MWBG-3	1/8/2018	12.570	3.20	9.37
MWBG-3	7/16/2018	12.570	5.42	7.15
MWBG-3	9/21/2018	12.570	4.87	7.70
MWBG-4	10/25/2017	12.641	4.80	7.84
MWBG-4	11/25/2017	12.641	5.15	7.49
MWBG-4	11/29/2017	12.641	3.64	9.00
MWBG-4	1/8/2018	12.641	3.83	8.81
MWBG-4	7/16/2018	12.641	4.52	8.12
MWBG-4	9/21/2018	12.641	5.14	7.50

Table 3: Summary of Groundwater Elevation Data

Monitoring Well ID	Measurement Date	Top of Casing Elevation (feet amsl)	Depth to Groundwater (feet btoc)	Groundwater Elevation (feet amsl)
MWBG-5	10/25/2017	11.454	2.77	8.68
MWBG-5	11/25/2017	11.454	1.55	9.90
MWBG-5	11/29/2017	11.454	1.55	9.90
MWBG-5	1/8/2018	11.454	1.63	9.82
MWBG-5	7/16/2018	11.454	3.19	8.26
MWBG-5	9/21/2018	11.454	3.28	8.17
MWBG-6	10/25/2017	8.902	2.55	6.35
MWBG-6	11/25/2017	8.902	2.52	6.38
MWBG-6	11/29/2017	8.902	2.28	6.62
MWBG-6	1/8/2018	8.902	2.55	6.35
MWBG-6	7/16/2018	8.902	2.75	6.15
MWBG-6	9/21/2018	8.902	2.42	6.48
MWBG-7	10/25/2017	7.180	-1.49	8.67
MWBG-7	11/25/2017	7.180	-1.67	8.85
MWBG-7	11/29/2017	7.180	-1.70	8.88
MWBG-7	1/8/2018	7.180	-1.67	8.85
MWBG-7	7/16/2018	7.180	-1.17	8.35
MWBG-7	9/21/2018	7.180	-0.96	8.14
MWBG-8	7/16/2018	Not Surveyed	0.71	--
MWBG-8	9/28/2018	Not Surveyed	1.05	--
MWBG-9	7/16/2018	Not Surveyed	2.88	--
MWBG-9	9/28/2018	Not Surveyed	3.07	--
MWBG-10	7/16/2018	Not Surveyed	4.84	--
MWBG-10	9/21/2018	Not Surveyed	4.60	--
GM-02	7/16/2018	Not Surveyed	1.60	--
GM-02	9/27/2018	Not Surveyed	2.88	--
GM-03	7/16/2018	Not Surveyed	4.49	--
GM-03	9/28/2018	Not Surveyed	4.74	--

Notes:

Monitoring well MWBG-7 is artesian; potentiometric head is above ground surface.

amsl = above mean sea level

btoc = below top of casing

-- = not applicable

MWBG-8 through MWBG-10 and GM-02 through GM-03 were not surveyed. Depth to groundwater at these wells was measured immediately prior to sampling during the September 2018 monitoring event and not at the same time as the site-wide gauging event.

Table 4: Summary of RI Soil Analytical Results

			Location	2017-B01	2017-B01	2017-B01	2017-B02	2017-B02	2017-B05	2017-B05	2017-B06	2017-B06	2017-B07	2017-B08	2017-B09	2017-B09	2017-B10	2017-B10	2017-B11	2017-B11	2018-B1	2018-TP-01	2018-TP-02
			Sample ID	2017-B1(7.0-8.0)	DUP-01-20171019	2017-B1(11.5-12.0)	2017-B2(7.0-8.0)	2017-B2(12.0-13.0)	2017-B5(6.0-7.0)	2017-B5(12.0-13.0)	2017-B6(8.5-9.0)	2017-B6(14.5-15.0)	2017-B7(6.0-7.0)	2017-B8(8.0-8.5)	2017-B9(7.5-8.5)	2017-B9(12.0-13.0)	2017-B10(2.0-2.5)	2017-B10(12.5-13.5)	2017-B11(2.0-2.5)	2017-B11(5.0-5.5)	2018-B1(12.0-12.5)	2018-TP-01(4.0-4.5)	2018-TP-02(4.0-4.5)
			Parent ID		2017-B1(7.0-8.0)																		
			Date	10/19/2017	10/19/2017	10/19/2017	10/18/2017	10/18/2017	10/20/2017	10/20/2017	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	6/4/2018	5/30/2018	5/30/2018
			Sample Depths (bgs)	7.0-8.0 ft	7.0-8.0 ft	11.5-12.0 ft	7.0-8.0 ft	12.0-13.0 ft	6.0-7.0 ft	12.0-13.0 ft	8.5-9.0 ft	14.5-15.0 ft	6.0-7.0 ft	8.0-8.5 ft	7.5-8.5 ft	12.0-13.0 ft	2.0-2.5 ft	12.5-13.5 ft	2.0-2.5 ft	5.0-5.5 ft	12.0-12.5 ft	4.0-4.5 ft	4.0-4.5 ft
			Note																				
Chemical	**Unit**	**MTCA A Then B**	**MTCA A Then B note**																				
Total Petroleum Hydrocarbons																							
Gasoline-Range Organics	mg/kg	30/100	Method A	**0.436**	< 0.0468	< 0.0527	**0.655**	< 0.0598	**0.0433 J**	< 0.0595	--	--	--	--	--	--	--	--	--	--	< 0.120	< 0.0422	< 0.0378
Total Petroleum Hydrocarbons - Diesel - without silica gel cleanup																							
Oil-Range Organics	mg/kg	2000	Method A	**127**	**437**	< 5.13	**1340**	< 5.54	< 3.96	**12.4 J**	**1260**	--	**40.5**	--	**36.0**	--	**1120**	**30.9**	**4900**	**4820**	**309**	< 4.11	< 3.68
Diesel-Range Organics	mg/kg	2000	Method A	< 7.86	**20.3 J**	< 2.05	< 89.8	< 2.22	< 1.58	**6.17 J**	**82.7**	--	**7.63**	--	**4.89 J**	--	**80.2**	< 2.77	**231 J**	< 326	**31.8 J**	< 1.64	< 1.47
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	**131**	**457**	< 1.03	**1380**	< 1.11	< 0.79	**18.6**	**1340**	--	**48.1**	--	**40.9**	--	**1200**	**32.3**	**5130**	**4980**	**341**	< 0.82	< 0.735
Total Petroleum Hydrocarbons - Diesel - with silica gel cleanup																							
Oil-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	< 8.36	--	--	--	--	--	--	--	--	--
Diesel-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	< 3.35	--	--	--	--	--	--	--	--	--
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	< 1.68	--	--	--	--	--	--	--	--	--
BTEX																							
Benzene	mg/kg	0.03	Method A	< 0.000321	< 0.00180	< 0.00202	**0.000563 J**	< 0.00228	< 0.000324	< 0.00228	--	--	--	--	--	--	--	--	--	--	< 0.00123	< 0.000817	< 0.000455
Toluene	mg/kg	7	Method A	< 0.000517	< 0.00366	< 0.00412	**0.000924 J**	< 0.0925	< 0.000520	< 0.0902	--	--	--	--	--	--	--	--	--	--	< 0.00385	**0.00945 J**	**0.0134**
Ethylbenzene	mg/kg	6	Method A	< 0.000354	< 0.00178	< 0.00201	< 0.000404	< 0.0450	< 0.000356	< 0.0439	--	--	--	--	--	--	--	--	--	--	< 0.00163	**0.00130 J**	**0.00166 J**
Xylene, m,p-	mg/kg			< 0.000395	< 0.00553	< 0.00622	**0.00282**	< 0.140	< 0.000398	< 0.136	--	--	--	--	--	--	--	--	--	--	< 0.00462	**0.00342 J**	**0.00287 J**
Xylene, o-	mg/kg	16000	B Non Cancer	< 0.000436	< 0.00108	< 0.00122	**0.000958 J**	< 0.0274	< 0.000439	< 0.0267	--	--	--	--	--	--	--	--	--	--	< 0.00308	< 0.00204	**0.00178 J**
Xylene, total	mg/kg	9	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NWEPH																							
C10-C12 Aliphatic Hydrocarbons	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C10-C12 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NWVPH																							
C5-C6 aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C6-C8 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Hexane	mg/kg	4800	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi Volatile Organic Compounds using SIM																							
1-Methylnaphthalene	mg/kg	34.5	B Cancer	< 0.0119	--	--	**0.00657 J**	--	< 0.00240	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	mg/kg	6400	B Non Cancer	< 0.0119	--	--	< 0.00272	--	< 0.00240	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	mg/kg	320	B Non Cancer	< 0.0119	--	--	< 0.00272	--	< 0.00240	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg	4800	B Non Cancer	**0.00565 J**	--	--	**0.0113**	--	**0.000902 J**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	mg/kg			**0.00362 J**	--	--	**0.00126 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg	24000	B Non Cancer	**0.00439 J**	--	--	**0.00171 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg	1.37	B Cancer	**0.00429 J**	--	--	**0.00126 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg	0.1	Method A	**0.00763 J**	--	--	**0.00147 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)Fluoranthene	mg/kg	1.37	B Cancer	**0.0131 J**	--	--	**0.00218 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)Perylene	mg/kg			**0.0114 J**	--	--	**0.00173 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)Fluoranthene	mg/kg	13.7	B Cancer	< 0.00357	--	--	< 0.000816	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	mg/kg	137	B Cancer	< 0.00357	--	--	**0.00150 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)Anthracene	mg/kg	0.137	B Cancer	< 0.00357	--	--	< 0.000816	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg	3200	B Non Cancer	**0.00904 J**	--	--	**0.00205 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg	3200	B Non Cancer	< 0.00357	--	--	**0.00889**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-c,d)Pyrene	mg/kg	1.37	B Cancer	< 0.00357	--	--	**0.00120 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	5	Method A	< 0.0119	--	--	**0.00663 J**	--	< 0.00240	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg			**0.00743 J**	--	--	**0.00435 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg	2400	B Non Cancer	**0.0154 J**	--	--	**0.00231 J**	--	< 0.000719	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total cPAHs (HalfDL)	mg/kg	0.1	Method A	**0.00992**	--	--	**0.00203**	--	< 0.000543	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total cPAHs (HitsOnly)	mg/kg	0.1	Method A	**0.00937**	--	--	**0.00195**	--	< 0.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	mg/kg	38.5	B Cancer	< 0.000314	--	--	< 0.000359	--	< 0.000317	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	mg/kg	2	Method A	< 0.000340	--	--	< 0.000389	--	< 0.000343	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	mg/kg	5.00	B Cancer	< 0.000434	--	--	< 0.000497	--	< 0.000438	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	mg/kg	17.5	B Cancer	< 0.000330	--	--	< 0.000377	--	< 0.000332	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	mg/kg	175	B Cancer	< 0.000237	--	--	< 0.000271	--	< 0.000239	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	mg/kg	4000	B Non Cancer	< 0.000361	--	--	< 0.000412	--	< 0.000363	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloropropene	mg/kg			< 0.000377	--	--	< 0.000431	--	< 0.000380	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	mg/kg			< 0.000364	--	--	< 0.000416	--	< 0.000367	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	mg/kg	0.0333	B Cancer	< 0.000882	--	--	< 0.00101	--	< 0.000888	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trimethylbenzene	mg/kg			< 0.000342	--	--	**0.000534 J**	--	< 0.000344	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	mg/kg	34.5	B Cancer	< 0.000462	--	--	< 0.000528	--	< 0.000465	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	mg/kg			< 0.000251	--	--	**0.00117 J**	--	< 0.000253	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-Chloropropane (DBCP)	mg/kg	1.25	B Cancer	< 0.00125	--	--	< 0.00143	--	< 0.00126	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	mg/kg	0.005	Method A	< 0.000408	--	--	< 0.000467	--	< 0.000411	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg	7200	B Non Cancer	< 0.000363	--	--	< 0.000415	--	< 0.000366	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane (EDC)	mg/kg	11.0	B Cancer	< 0.000315	--	--	< 0.000361	--	< 0.000318	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	mg/kg	27.8	B Cancer	< 0.000426	--	--	< 0.000487	--	< 0.000429	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	mg/kg	800	B Non Cancer	< 0.000317	--	--	**0.000490 J**	--	< 0.000319	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	mg/kg			< 0.000284	--	--	< 0.000325	--	< 0.000287	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	mg/kg			< 0.000246	--	--	< 0.000282	--	< 0.000248	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg	185	B Cancer	< 0.000269	--	--	< 0.000307	--	< 0.000271	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	mg/kg			< 0.000332	--	--	< 0.000380	--	< 0.000334	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorotoluene	mg/kg	1600	B Non Cancer	< 0.000358	--	--	< 0.000409	--	< 0.000361	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorotoluene	mg/kg			< 0.000286	--	--	< 0.000326	--	< 0.000288	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	mg/kg	72000	B Non Cancer	**0.0129 J**	--	--	**0.0225 J**	--	**0.0217 J**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	mg/kg	1.85	B Cancer	< 0.00213	--	--	< 0.00244	--	< 0.00215	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	mg/kg			< 0.000338	--	--	< 0.000386	--	< 0.000340	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	mg/kg	16.1	B Cancer	< 0.000302	--	--	< 0.000346	--	< 0.000305	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	mg/kg	127	B Cancer	< 0.000505	--	--	< 0.000577	--	< 0.000508	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	mg/kg	112	B Non Cancer	< 0.00160	--	--	< 0.00182	--	< 0.00161	--	--	--	--	--	--	--	--	--	--	--	--	--	--

			Location	2017-B01	2017-B01	2017-B01	2017-B02	2017-B02	2017-B05	2017-B05	2017-B06	2017-B06	2017-B07	2017-B08	2017-B09	2017-B09	2017-B10	2017-B10	2017-B11	2017-B11	2018-B1	2018-TP-01	2018-TP-02
			Sample ID	2017-B1(7.0-8.0)	DUP-01-20171019	2017-B1(11.5-12.0)	2017-B2(7.0-8.0)	2017-B2(12.0-13.0)	2017-B5(6.0-7.0)	2017-B5(12.0-13.0)	2017-B6(8.5-9.0)	2017-B6(14.5-15.0)	2017-B7(6.0-7.0)	2017-B8(8.0-8.5)	2017-B9(7.5-8.5)	2017-B9(12.0-13.0)	2017-B10(2.0-2.5)	2017-B10(12.5-13.5)	2017-B11(2.0-2.5)	2017-B11(5.0-5.5)	2018-B1(12.0-12.5)	2018-TP-01(4.0-4.5)	2018-TP-02(4.0-4.5)
			Parent ID		2017-B1(7.0-8.0)																		
			Date	10/19/2017	10/19/2017	10/19/2017	10/18/2017	10/18/2017	10/20/2017	10/20/2017	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	1/12/2018	6/4/2018	5/30/2018	5/30/2018
			Sample Depths (bgs)	7.0-8.0 ft	7.0-8.0 ft	11.5-12.0 ft	7.0-8.0 ft	12.0-13.0 ft	6.0-7.0 ft	12.0-13.0 ft	8.5-9.0 ft	14.5-15.0 ft	6.0-7.0 ft	8.0-8.5 ft	7.5-8.5 ft	12.0-13.0 ft	2.0-2.5 ft	12.5-13.5 ft	2.0-2.5 ft	5.0-5.5 ft	12.0-12.5 ft	4.0-4.5 ft	4.0-4.5 ft
			Note																				
Chemical	**Unit**	**MTCA A Then B**	**MTCA A Then B note**																				
Carbon Tetrachloride	mg/kg	14.3	B Cancer	< 0.000390	--	--	< 0.000446	--	< 0.000393	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	mg/kg	1600	B Non Cancer	< 0.000252	--	--	< 0.000288	--	< 0.000254	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	mg/kg			< 0.00113	--	--	< 0.00129	--	< 0.00113	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	mg/kg	32.3	B Cancer	< 0.000273	--	--	< 0.000312	--	< 0.000275	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	mg/kg			< 0.000446	--	--	< 0.000510	--	< 0.000450	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/kg	160	B Non Cancer	< 0.000280	--	--	< 0.000320	--	< 0.000282	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	mg/kg	10.0	B Cancer	< 0.000312	--	--	< 0.000356	--	< 0.000314	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cymene (p-Isopropyltoluene)	mg/kg			< 0.000243	--	--	< 0.000278	--	< 0.000245	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	mg/kg	11.9	B Cancer	< 0.000444	--	--	< 0.000507	--	< 0.000447	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromomethane	mg/kg	800	B Non Cancer	< 0.000455	--	--	< 0.000520	--	< 0.000458	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	mg/kg	16000	B Non Cancer	< 0.000849	--	--	< 0.000970	--	< 0.000855	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-Isopropyl ether (DIPE)	mg/kg			< 0.000295	--	--	< 0.000337	--	< 0.000297	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Freon 113	mg/kg	2400000	B Non Cancer	< 0.000434	--	--	< 0.000497	--	< 0.000438	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	mg/kg	12.8	B Cancer	< 0.000407	--	--	< 0.000465	--	< 0.000410	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	mg/kg	8000	B Non Cancer	< 0.000289	--	--	< 0.000331	--	< 0.000291	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-Butanone)	mg/kg	48000	B Non Cancer	< 0.00557	--	--	< 0.00637	--	< 0.00561	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl Isobutyl Ketone (MIBK)	mg/kg	6400	B Non Cancer	< 0.00224	--	--	< 0.00256	--	< 0.00225	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tert-Butyl ether	mg/kg	0.1	Method A	< 0.000252	--	--	< 0.000288	--	< 0.000254	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	mg/kg	0.02	Method A	< 0.00119	--	--	< 0.00136	--	< 0.00120	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	5	Method A	< 0.00119	--	--	< 0.00136	--	< 0.00120	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	mg/kg	4000	B Non Cancer	< 0.000307	--	--	< 0.000351	--	< 0.000309	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	mg/kg	8000	B Non Cancer	< 0.000245	--	--	< 0.000280	--	< 0.000247	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sec-Butylbenzene	mg/kg	8000	B Non Cancer	< 0.000239	--	--	< 0.000273	--	< 0.000241	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	mg/kg	16000	B Non Cancer	< 0.000279	--	--	< 0.000318	--	< 0.000281	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tert-Butylbenzene	mg/kg	8000	B Non Cancer	< 0.000245	--	--	< 0.000280	--	< 0.000247	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	mg/kg	0.05	Method A	< 0.000329	--	--	< 0.000375	--	< 0.000331	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	mg/kg	1600	B Non Cancer	< 0.000314	--	--	< 0.000359	--	< 0.000317	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	mg/kg	10.0	B Cancer	< 0.000318	--	--	< 0.000363	--	< 0.000320	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene (TCE)	mg/kg	0.03	Method A	< 0.000332	--	--	< 0.000380	--	< 0.000334	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	mg/kg	24000	B Non Cancer	< 0.000455	--	--	< 0.000520	--	< 0.000458	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	mg/kg	0.670	B Cancer	< 0.000346	--	--	< 0.000396	--	< 0.000349	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																							
Arsenic	mg/kg	20	Method A	**5.58**	**6.46**	--	**5.74**	--	**4.26**	--	--	**15.8**	**19.5**	**10.6**	--	**23.3**	**41.7**	--	--	**8.69**	**14.0**	**1.62 J**	**1.65 J**
Barium	mg/kg	16000	B Non Cancer	--	--	--	--	--	--	--	--	**46.5**	**54.3**	**238**	--	**56.7**	--	--	--	--	--	--	--
Cadmium	mg/kg	2	Method A	--	--	--	--	--	--	--	--	**0.191 J**	**0.194 J**	< 0.203	--	**0.340 J**	--	--	--	--	--	--	--
Chromium, total	mg/kg			--	--	--	--	--	--	--	--	**60.0**	**68.7**	**19.7**	--	**72.2**	--	--	--	--	--	--	--
Copper	mg/kg	3200	B Non Cancer	--	--	--	--	--	--	--	--	**41.7**	**45.4**	**47.6**	--	**46.6**	--	--	--	--	--	--	--
Lead	mg/kg	250	Method A	--	--	--	--	--	--	--	--	**7.73**	**8.98**	**152**	--	**5.13**	--	--	--	--	--	--	--
Mercury	mg/kg	2	Method A	--	--	--	--	--	--	--	--	**0.0661**	**0.0775**	**0.0352 J**	--	**0.0589**	--	--	--	--	--	--	--
Selenium	mg/kg	400	B Non Cancer	--	--	--	--	--	--	--	--	**1.33**	**1.59**	**0.519 J**	--	**1.46**	--	--	--	--	--	--	--
Silver	mg/kg	400	B Non Cancer	--	--	--	--	--	--	--	--	< 0.284	< 0.256	< 0.393	--	< 0.338	--	--	--	--	--	--	--
Moisture																							
Solids, Percent	%			**84.0**	**72.4**	**64.3**	**73.5**	**59.5**	**83.4**	**57.0**	**60.9**	**54.5**	**60.5**	**39.5**	**31.8**	**45.9**	**28.9**	**47.7**	**91.5**	**40.5**	**32.5**	**80.3**	**89.6**

Table 4: Summary of RI Soil Analytical Results

			Location	2018-TP-03	2018-TP-03	2018-TP-04	2018-TP-06	2018-TP-06	2018-TP-07	2018-TP-08	2018-TP-09	2018-TP-10	2018-TP-10	2018-TP-10	2018-TP-11	2018-TP-11	2018-TP-12	2018-TP-12	2018-TP-12	2018-TP-13	HA-01	HA-02	HA-03
			Sample ID	2018-TP-03(4.0-4.5)	2018-TP-03(5.5-6.0)	2018-TP-04(3.0-3.5)	2018-TP-06 (3.0-3.5)	2018-TP-06 (5.5-6.0)	2018-TP-07 (4.0-4.5)	2018-TP-08 (3.0-3.5)	2018-TP-09 (3.0-3.5)	2018-TP-10(2.0-2.25)	2018-TP-10(2.5-3.0)	2018-TP-10(4.0-4.5)	2018-TP-11(3.5-4.0)	2018-TP-11(6.0-6.5)	2018-TP-12 (2.0-2.5)	2018-TP-12 (5.0-5.5)	DUP-01-20180531	2018-TP-13(3.0-3.5)	HA-01 (2.0-2.5)	HA-02 (1.8-2.0)	HA-03 (2.0-2.2)
			Parent ID																2018-TP-12 (5.0-5.5)				
			Date	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	9/21/2018	9/21/2018	9/27/2018
			Sample Depths (bgs)	4.0-4.5 ft	5.5-6.0 ft	3.0-3.5 ft	3.0-3.5 ft	5.5-6.0 ft	4.0-4.5 ft	3.0-3.5 ft	3.0-3.5 ft	2.0-2.3 ft	2.5-3.0 ft	4.0-4.5 ft	3.5-4.0 ft	6.0-6.5 ft	2.0-2.5 ft	5.0-5.5 ft	5.0-5.5 ft	3.0-3.5 ft	2.0-2.5 ft	1.8-2.0 ft	2.0-2.2 ft
			Note																				
Chemical	**Unit**	**MTCA A Then B**	**MTCA A Then B note**																				
Total Petroleum Hydrocarbons																							
Gasoline-Range Organics	mg/kg	30/100	Method A	--	**0.367 J**	**0.647**	**0.0661 J**	**0.107 J**	< 0.0505	< 0.0453	< 0.0409	**751**	**0.320**	**0.711 J**	**0.0447 J**	< 0.118	< 0.0748	< 0.0548	< 0.0511	**0.0554 J**	--	--	--
Total Petroleum Hydrocarbons - Diesel - without silica gel cleanup																							
Oil-Range Organics	mg/kg	2000	Method A	--	**1970**	**43.1**	< 5.55	**19.9 J**	**157 J**	**294**	< 8.72 U	**517 J**	**4.24 J**	< 11.3	< 3.83	**161**	**39.7**	**26.7 J**	< 8.11 U	< 4.02	**1680**	**4140**	**193 J**
Diesel-Range Organics	mg/kg	2000	Method A	--	**371**	**65.8**	< 2.22	**3.29 J**	**21.2 J**	**25.3 J**	< 1.59	< 71.1	< 1.53	**8.42 J**	< 1.53	**23.4**	**22.7**	**5.48 J**	< 1.99	< 1.61	< 170	**317 J**	< 76.3
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	--	**2340**	**109**	< 1.11	**23.2**	**178**	**319**	< 0.795	**553**	**5.01**	**14.1**	< 0.765	**184**	**62.4**	**32.2**	< 0.995	< 0.805	**1770**	**4460**	**231**
Total Petroleum Hydrocarbons - Diesel - with silica gel cleanup																							
Oil-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diesel-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BTEX																							
Benzene	mg/kg	0.03	Method A	--	**0.0421**	< 0.000612	< 0.000673	< 0.000728	< 0.000650	< 0.000506	< 0.000483	< 0.00862	--	**0.00249 J**	< 0.000465	< 0.00100	< 0.00110	< 0.000773	< 0.000688	< 0.000487	--	--	--
Toluene	mg/kg	7	Method A	--	**0.0321**	**0.00952**	< 0.00210	**0.00353 J**	< 0.00203	< 0.00158	< 0.00151	**0.0387 J**	--	< 0.00427	< 0.00145	< 0.00313	< 0.00342	< 0.00241	< 0.00214	**0.00155 J**	--	--	--
Ethylbenzene	mg/kg	6	Method A	--	**0.00381 J**	**0.00363 J**	< 0.000892	< 0.000964	< 0.000862	< 0.000670	**0.00366**	< 0.0114	--	< 0.00181	< 0.000616	< 0.00133	< 0.00145	< 0.00102	< 0.000911	< 0.000645	--	--	--
Xylene, m,p-	mg/kg			--	**0.00703 J**	**0.0201**	< 0.00252	< 0.00273	< 0.00244	< 0.00190	**0.0103**	--	--	--	--	--	< 0.00412	< 0.00291	< 0.00258	--	--	--	--
Xylene, o-	mg/kg	16000	B Non Cancer	--	< 0.00394	**0.00716**	< 0.00168	< 0.00182	< 0.00162	< 0.00126	**0.0112**	--	--	--	--	--	< 0.00274	< 0.00193	< 0.00172	--	--	--	--
Xylene, total	mg/kg	9	Method A	--	--	--	--	--	--	--	--	< 0.103	--	< 0.0163	< 0.00555	< 0.0120	--	--	--	< 0.00582	--	--	--
NWEPH																							
C10-C12 Aliphatic Hydrocarbons	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C10-C12 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NWVPH																							
C5-C6 aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C6-C8 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Hexane	mg/kg	4800	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi Volatile Organic Compounds using SIM																							
1-Methylnaphthalene	mg/kg	34.5	B Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.00232	--	**0.0158 J**	--	--	--	--	--	--
2-Chloronaphthalene	mg/kg	6400	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.00232	--	< 0.00359	--	--	--	--	--	--
2-Methylnaphthalene	mg/kg	320	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.00232	--	**0.0202 J**	--	--	--	--	--	--
Acenaphthene	mg/kg	4800	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00580 J**	--	--	--	--	--	--
Acenaphthylene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00411 J**	--	--	--	--	--	--
Anthracene	mg/kg	24000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00135 J**	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg	1.37	B Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00167 J**	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg	0.1	Method A	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00277 J**	--	--	--	--	--	--
Benzo(b)Fluoranthene	mg/kg	1.37	B Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00567 J**	--	--	--	--	--	--
Benzo(g,h,i)Perylene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.0268**	--	--	--	--	--	--
Benzo(k)Fluoranthene	mg/kg	13.7	B Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	< 0.00108	--	--	--	--	--	--
Chrysene	mg/kg	137	B Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00174 J**	--	--	--	--	--	--
Dibenz(a,h)Anthracene	mg/kg	0.137	B Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00119 J**	--	--	--	--	--	--
Fluoranthene	mg/kg	3200	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00820 J**	--	--	--	--	--	--
Fluorene	mg/kg	3200	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00251 J**	--	--	--	--	--	--
Indeno(1,2,3-c,d)Pyrene	mg/kg	1.37	B Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00854 J**	--	--	--	--	--	--
Naphthalene	mg/kg	5	Method A	--	--	--	--	--	--	--	--	--	--	--	< 0.00232	--	**0.0808**	--	--	--	--	--	--
Phenanthrene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.0101 J**	--	--	--	--	--	--
Pyrene	mg/kg	2400	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	< 0.000697	--	**0.00793 J**	--	--	--	--	--	--
Total cPAHs (HalfDL)	mg/kg	0.1	Method A	--	--	--	--	--	--	--	--	--	--	--	< 0.000526	--	**0.00455**	--	--	--	--	--	--
Total cPAHs (HitsOnly)	mg/kg	0.1	Method A	--	--	--	--	--	--	--	--	--	--	--	< 0.00	--	**0.00449**	--	--	--	--	--	--
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	mg/kg	38.5	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	mg/kg	2	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	mg/kg	5.00	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	mg/kg	17.5	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	mg/kg	175	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	mg/kg	4000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloropropene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	mg/kg	0.0333	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trimethylbenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	mg/kg	34.5	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-Chloropropane (DBCP)	mg/kg	1.25	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	mg/kg	0.005	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg	7200	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane (EDC)	mg/kg	11.0	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	mg/kg	27.8	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	mg/kg	800	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg	185	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorotoluene	mg/kg	1600	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorotoluene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	mg/kg	72000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	mg/kg	1.85	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	mg/kg	16.1	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	mg/kg	127	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	mg/kg	112	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 4: Summary of RI Soil Analytical Results

			Location	2018-TP-03	2018-TP-03	2018-TP-04	2018-TP-06	2018-TP-06	2018-TP-07	2018-TP-08	2018-TP-09	2018-TP-10	2018-TP-10	2018-TP-10	2018-TP-11	2018-TP-11	2018-TP-12	2018-TP-12	2018-TP-12	2018-TP-13	HA-01	HA-02	HA-03
			Sample ID	2018-TP-03(4.0-4.5)	2018-TP-03(5.5-6.0)	2018-TP-04(3.0-3.5)	2018-TP-06 (3.0-3.5)	2018-TP-06 (5.5-6.0)	2018-TP-07 (4.0-4.5)	2018-TP-08 (3.0-3.5)	2018-TP-09 (3.0-3.5)	2018-TP-10(2.0-2.25)	2018-TP-10(2.5-3.0)	2018-TP-10(4.0-4.5)	2018-TP-11(3.5-4.0)	2018-TP-11(6.0-6.5)	2018-TP-12 (2.0-2.5)	2018-TP-12 (5.0-5.5)	DUP-01-20180531	2018-TP-13(3.0-3.5)	HA-01 (2.0-2.5)	HA-02 (1.8-2.0)	HA-03 (2.0-2.2)
			Parent ID																2018-TP-12 (5.0-5.5)				
			Date	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/30/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	5/31/2018	9/21/2018	9/21/2018	9/27/2018
			Sample Depths (bgs)	4.0-4.5 ft	5.5-6.0 ft	3.0-3.5 ft	3.0-3.5 ft	5.5-6.0 ft	4.0-4.5 ft	3.0-3.5 ft	3.0-3.5 ft	2.0-2.3 ft	2.5-3.0 ft	4.0-4.5 ft	3.5-4.0 ft	6.0-6.5 ft	2.0-2.5 ft	5.0-5.5 ft	5.0-5.5 ft	3.0-3.5 ft	2.0-2.5 ft	1.8-2.0 ft	2.0-2.2 ft
			Note																				
Chemical	**Unit**	**MTCA A Then B**	**MTCA A Then B note**																				
Carbon Tetrachloride	mg/kg	14.3	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	mg/kg	1600	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	mg/kg	32.3	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/kg	160	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	mg/kg	10.0	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cymene (p-Isopropyltoluene)	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	mg/kg	11.9	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromomethane	mg/kg	800	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	mg/kg	16000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-Isopropyl ether (DIPE)	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Freon 113	mg/kg	2400000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	mg/kg	12.8	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	mg/kg	8000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-Butanone)	mg/kg	48000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl Isobutyl Ketone (MIBK)	mg/kg	6400	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tert-Butyl ether	mg/kg	0.1	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	mg/kg	0.02	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	5	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	mg/kg	4000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	mg/kg	8000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sec-Butylbenzene	mg/kg	8000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	mg/kg	16000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tert-Butylbenzene	mg/kg	8000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	mg/kg	0.05	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	mg/kg	1600	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	mg/kg	10.0	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene (TCE)	mg/kg	0.03	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	mg/kg	24000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	mg/kg	0.670	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																							
Arsenic	mg/kg	20	Method A	**6.52**	**19.1**	**5.41**	**7.09**	**17.4**	**22.9**	**1.63 J**	**6.67**	--	--	**10.5**	**1.36 J**	**27.3**	**13.5**	**20.1**	**12.8**	**3.96**	**7.76**	**3.72**	**188**
Barium	mg/kg	16000	B Non Cancer	**3000**	--	--	**491**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	mg/kg	2	Method A	< 0.126	--	--	< 0.118	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, total	mg/kg			**58.2**	--	--	**26.1**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	mg/kg	3200	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	mg/kg	250	Method A	**2.82**	--	--	**29.0**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	mg/kg	2	Method A	< 0.00928 U	--	--	< 0.00471	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	mg/kg	400	B Non Cancer	< 1.33	--	--	< 1.25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	mg/kg	400	B Non Cancer	**1.08 J**	--	--	< 0.471	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture																							
Solids, Percent	%			**55.6**	**34.8**	**65.3**	**59.4**	**57.2**	**67.1**	**83.0**	**82.8**	**92.8**	**86.1**	**29.3**	**86.1**	**39.9**	**55.8**	**66.8**	**66.3**	**82.1**	**78.2**	**91.7**	**87.2**

Table 4: Summary of RI Soil Analytical Results

Location				MW-15	MW-15	MW-16	MW-16	MW-17/2017-B04	MW-17/2017-B04	MWBG-01	MWBG-02/2017-B03	MWBG-02/2017-B03	MWBG-03	MWBG-04	MWBG-05	MWBG-06	MWBG-07	MWBG-08	MWBG-09	MWBG-10	SOILPILE-01	TP-01	TP-01
Sample ID				MW-15(8.0-9.0)	MW-15(13.0-14.0)	MW-16(6.0-7.0)	MW-16(12.0-13.0)	2017-B4(7.0-8.0)	2017-B4(11.0-12.0)	MWBG-1(7.0-7.5)	MWBG-2(7.0-8.0)	MWBG-2(12.0-13.0)	MWBG-3(7.0-8.0)	MWBG-4(7.0-8.0)	MWBG-5(7.0-7.5)	MWBG-6(6.0-7.0)	MWBG-7(7.5-8.0)	MWBG-8 (11.0-11.5)	MWBG-9 (11.0-11.5)	MWBG-10 (15.0-15.5)	SOILPILE-1	TP-1(2.5-3.0)	DUP-02-20171024
Parent ID																							TP-1(2.5-3.0)
Date				10/20/2017	10/20/2017	10/20/2017	10/20/2017	10/20/2017	10/20/2017	10/19/2017	10/20/2017	10/20/2017	10/20/2017	10/19/2017	10/19/2017	10/20/2017	10/19/2017	6/4/2018	6/4/2018	6/4/2018	11/30/2017	10/24/2017	10/24/2017
Sample Depths (bgs)				8.0-9.0 ft	13.0-14.0 ft	6.0-7.0 ft	12.0-13.0 ft	7.0-8.0 ft	11.0-12.0 ft	7.0-7.5 ft	7.0-8.0 ft	12.0-13.0 ft	7.0-8.0 ft	7.0-8.0 ft	7.0-7.5 ft	6.0-7.0 ft	7.5-8.0 ft	11.0-11.5 ft	11.0-11.5 ft	15.0-15.5 ft	0.0 ft	2.5-3.0 ft	2.5-3.0 ft
Note																							
Chemical	Unit	MTCA A Then B	MTCA A Then B note																				
Total Petroleum Hydrocarbons																							
Gasoline-Range Organics	mg/kg	30/100	Method A	< 0.0431	**0.211**	< 0.0417	< 0.0516	< 0.0439	< 0.0427	--	< 0.0390	< 0.0697	--	--	--	--	--	< 0.0426	**0.958**	< 0.0464	--	< 0.0671	< 0.0612
Total Petroleum Hydrocarbons - Diesel - without silica gel cleanup																							
Oil-Range Organics	mg/kg	2000	Method A	**58.1**	**234**	**127**	< 5.02	< 4.28	**311**	--	**53.2**	**41.4**	--	--	--	--	--	< 4.14	**132 J**	**152**	--	**1050**	**1490**
Diesel-Range Organics	mg/kg	2000	Method A	**17.2**	< 14.2	**8.83 J**	< 2.01	< 1.71	**17.7 J**	--	**10.1**	**6.18 J**	--	--	--	--	--	**2.17 J**	**20.0 J**	**55.3**	--	**101 J**	**175 J**
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	**75.3**	**241**	**136**	< 1.01	< 0.855	**329**	--	**63.3**	**47.6**	--	--	--	--	--	**4.24**	**152**	**207**	--	**1150**	**1670**
Total Petroleum Hydrocarbons - Diesel - with silica gel cleanup																							
Oil-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diesel-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BTEX																							
Benzene	mg/kg	0.03	Method A	**0.000416 J**	< 0.00139	**0.000375 J**	< 0.00198	< 0.00169	< 0.00164	--	< 0.000310	< 0.00271	--	--	--	--	--	< 0.000502	< 0.00119	< 0.000548	--	< 0.00420	< 0.00334
Toluene	mg/kg	7	Method A	< 0.000569	**0.00907**	< 0.000534	< 0.00403	< 0.00343	< 0.00334	--	< 0.000499	< 0.110	--	--	--	--	--	< 0.00157	**0.00924 J**	**0.00174 J**	--	**0.0139 J**	< 0.00681
Ethylbenzene	mg/kg	6	Method A	< 0.000389	< 0.00138	< 0.000366	< 0.00196	< 0.00167	< 0.00162	--	< 0.000341	< 0.0536	--	--	--	--	--	< 0.000665	< 0.00157	< 0.000726	--	**0.0902**	**0.0207**
Xylene, m,p-	mg/kg			< 0.000435	< 0.00429	< 0.000409	< 0.00609	< 0.00518	< 0.00504	--	< 0.000381	< 0.166	--	--	--	--	--	**0.00197 J**	**0.00528 J**	< 0.00205	--	< 0.0129	< 0.0103
Xylene, o-	mg/kg	16000	B Non Cancer	< 0.000480	< 0.000838	< 0.000451	< 0.00119	< 0.00101	< 0.000985	--	< 0.000421	< 0.0326	--	--	--	--	--	< 0.00126	< 0.00296	< 0.00137	--	**0.00285 J**	< 0.00202
Xylene, total	mg/kg	9	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NWEPH																							
C10-C12 Aliphatic Hydrocarbons	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C10-C12 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NWVPH																							
C5-C6 aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C6-C8 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Hexane	mg/kg	4800	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi Volatile Organic Compounds using SIM																							
1-Methylnaphthalene	mg/kg	34.5	B Cancer	< 0.00254	--	**0.0701**	--	--	--	--	< 0.00230	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	mg/kg	6400	B Non Cancer	< 0.00254	--	< 0.00493	--	--	--	--	< 0.00230	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	mg/kg	320	B Non Cancer	**0.00304 J**	--	**0.0945**	--	--	--	--	< 0.00230	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/kg	4800	B Non Cancer	**0.000969 J**	--	**0.00881 J**	--	--	--	--	< 0.000689	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	mg/kg			**0.00152 J**	--	< 0.00148	--	--	--	--	< 0.000689	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg	24000	B Non Cancer	**0.00160 J**	--	**0.0144 J**	--	--	--	--	< 0.000689	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg	1.37	B Cancer	**0.00177 J**	--	**0.00600 J**	--	--	--	--	**0.00137 J**	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg	0.1	Method A	**0.00245 J**	--	**0.00668 J**	--	--	--	--	**0.000810 J**	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)Fluoranthene	mg/kg	1.37	B Cancer	**0.00470 J**	--	**0.00924 J**	--	--	--	--	**0.00198 J**	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)Perylene	mg/kg			**0.0129**	--	**0.0108 J**	--	--	--	--	**0.00173 J**	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)Fluoranthene	mg/kg	13.7	B Cancer	**0.00179 J**	--	< 0.00148	--	--	--	--	**0.00102 J**	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	mg/kg	137	B Cancer	**0.00326 J**	--	**0.0119 J**	--	--	--	--	**0.00185 J**	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)Anthracene	mg/kg	0.137	B Cancer	< 0.000763	--	< 0.00148	--	--	--	--	**0.000825 J**	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/kg	3200	B Non Cancer	**0.0107**	--	**0.00821 J**	--	--	--	--	**0.00275 J**	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg	3200	B Non Cancer	**0.00156 J**	--	**0.0144 J**	--	--	--	--	< 0.000689	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-c,d)Pyrene	mg/kg	1.37	B Cancer	**0.00456 J**	--	< 0.00148	--	--	--	--	**0.00118 J**	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	5	Method A	**0.0175 J**	--	< 0.00493	--	--	--	--	**0.00241 J**	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg			**0.0114**	--	**0.0415**	--	--	--	--	**0.00163 J**	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg	2400	B Non Cancer	**0.00846**	--	**0.0212**	--	--	--	--	**0.00295 J**	--	--	--	--	--	--	--	--	--	--	--	--
Total cPAHs (HalfDL)	mg/kg	0.1	Method A	**0.00380**	--	**0.00855**	--	--	--	--	**0.00147**	--	--	--	--	--	--	--	--	--	--	--	--
Total cPAHs (HitsOnly)	mg/kg	0.1	Method A	**0.00376**	--	**0.00832**	--	--	--	--	**0.00147**	--	--	--	--	--	--	--	--	--	--	--	--
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	mg/kg	38.5	B Cancer	< 0.000346	--	< 0.000325	--	--	--	--	< 0.000303	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	mg/kg	2	Method A	< 0.000374	--	< 0.000352	--	--	--	--	< 0.000329	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	mg/kg	5.00	B Cancer	< 0.000478	--	< 0.000449	--	--	--	--	< 0.000419	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	mg/kg	17.5	B Cancer	< 0.000363	--	< 0.000341	--	--	--	--	< 0.000318	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	mg/kg	175	B Cancer	< 0.000261	--	< 0.000245	--	--	--	--	< 0.000229	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	mg/kg	4000	B Non Cancer	< 0.000397	--	**0.000456 J**	--	--	--	--	< 0.000348	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloropropene	mg/kg			< 0.000415	--	< 0.000390	--	--	--	--	< 0.000364	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	mg/kg			< 0.000401	--	< 0.000377	--	--	--	--	< 0.000352	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	mg/kg	0.0333	B Cancer	< 0.000971	--	< 0.000912	--	--	--	--	< 0.000851	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trimethylbenzene	mg/kg			< 0.000377	--	< 0.000353	--	--	--	--	< 0.000330	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	mg/kg	34.5	B Cancer	< 0.000509	--	< 0.000478	--	--	--	--	< 0.000446	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	mg/kg			< 0.000276	--	< 0.000260	--	--	--	--	< 0.000242	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-Chloropropane (DBCP)	mg/kg	1.25	B Cancer	< 0.00137	--	< 0.00129	--	--	--	--	< 0.00121	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	mg/kg	0.005	Method A	< 0.000449	--	< 0.000422	--	--	--	--	< 0.000394	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg	7200	B Non Cancer	< 0.000400	--	< 0.000376	--	--	--	--	< 0.000350	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane (EDC)	mg/kg	11.0	B Cancer	< 0.000347	--	< 0.000326	--	--	--	--	< 0.000304	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	mg/kg	27.8	B Cancer	< 0.000470	--	< 0.000441	--	--	--	--	< 0.000411	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	mg/kg	800	B Non Cancer	< 0.000349	--	< 0.000328	--	--	--	--	< 0.000306	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	mg/kg			< 0.000313	--	< 0.000294	--	--	--	--	< 0.000275	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	mg/kg			< 0.000271	--	< 0.000255	--	--	--	--	< 0.000238	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg	185	B Cancer	< 0.000296	--	< 0.000278	--	--	--	--	< 0.000260	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	mg/kg			< 0.000365	--	< 0.000344	--	--	--	--	< 0.000321	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorotoluene	mg/kg	1600	B Non Cancer	< 0.000394	--	**0.000429 J**	--	--	--	--	< 0.000346	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorotoluene	mg/kg			< 0.000314	--	< 0.000296	--	--	--	--	< 0.000276	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	mg/kg	72000	B Non Cancer	**0.0189 J**	--	**0.0382 J**	--	--	--	--	**0.0139 J**	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	mg/kg	1.85	B Cancer	< 0.00234	--	< 0.00220	--	--	--	--	< 0.00206	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	mg/kg			< 0.000372	--	< 0.000350	--	--	--	--	< 0.000326	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	mg/kg	16.1	B Cancer	< 0.000333	--	< 0.000313	--	--	--	--	< 0.000292	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	mg/kg	127	B Cancer	< 0.000556	--	< 0.000522	--	--	--	--	< 0.000487	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	mg/kg	112	B Non Cancer	< 0.00176	--	< 0.00165	--	--	--	--	< 0.00154	--	--	--	--	--	--	--	--	--	--	--	--

Table 4: Summary of RI Soil Analytical Results

			Location	MW-15	MW-15	MW-16	MW-16	MW-17/2017-B04	MW-17/2017-B04	MWBG-01	MWBG-02/2017-B03	MWBG-02/2017-B03	MWBG-03	MWBG-04	MWBG-05	MWBG-06	MWBG-07	MWBG-08	MWBG-09	MWBG-10	SOILPILE-01	TP-01	TP-01
			Sample ID	MW-15(8.0-9.0)	MW-15(13.0-14.0)	MW-16(6.0-7.0)	MW-16(12.0-13.0)	2017-B4(7.0-8.0)	2017-B4(11.0-12.0)	MWBG-1(7.0-7.5)	MWBG-2(7.0-8.0)	MWBG-2(12.0-13.0)	MWBG-3(7.0-8.0)	MWBG-4(7.0-8.0)	MWBG-5(7.0-7.5)	MWBG-6(6.0-7.0)	MWBG-7(7.5-8.0)	MWBG-8 (11.0-11.5)	MWBG-9 (11.0-11.5)	MWBG-10 (15.0-15.5)	SOILPILE-1	TP-1(2.5-3.0)	DUP-02-20171024
			Parent ID																				TP-1(2.5-3.0)
			Date	10/20/2017	10/20/2017	10/20/2017	10/20/2017	10/20/2017	10/20/2017	10/19/2017	10/20/2017	10/20/2017	10/20/2017	10/19/2017	10/19/2017	10/20/2017	10/19/2017	6/4/2018	6/4/2018	6/4/2018	11/30/2017	10/24/2017	10/24/2017
			Sample Depths (bgs)	8.0-9.0 ft	13.0-14.0 ft	6.0-7.0 ft	12.0-13.0 ft	7.0-8.0 ft	11.0-12.0 ft	7.0-7.5 ft	7.0-8.0 ft	12.0-13.0 ft	7.0-8.0 ft	7.0-8.0 ft	7.0-7.5 ft	6.0-7.0 ft	7.5-8.0 ft	11.0-11.5 ft	11.0-11.5 ft	15.0-15.5 ft	0.0 ft	2.5-3.0 ft	2.5-3.0 ft
			Note																				
Chemical	Unit	MTCA A Then B	MTCA A Then B note																				
Carbon Tetrachloride	mg/kg	14.3	B Cancer	< 0.000430	--	< 0.000404	--	--	--	--	< 0.000377	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	mg/kg	1600	B Non Cancer	< 0.000277	--	< 0.000261	--	--	--	--	< 0.000244	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	mg/kg			< 0.00124	--	< 0.00116	--	--	--	--	< 0.00109	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	mg/kg	32.3	B Cancer	< 0.000300	--	< 0.000282	--	--	--	--	< 0.000263	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	mg/kg			< 0.000491	--	< 0.000462	--	--	--	--	< 0.000431	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/kg	160	B Non Cancer	< 0.000308	--	< 0.000289	--	--	--	--	< 0.000270	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	mg/kg	10.0	B Cancer	< 0.000344	--	< 0.000323	--	--	--	--	< 0.000301	--	--	--	--	--	--	--	--	--	--	--	--
Cymene (p-Isopropyltoluene)	mg/kg			< 0.000267	--	< 0.000251	--	--	--	--	< 0.000234	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	mg/kg	11.9	B Cancer	< 0.000489	--	< 0.000459	--	--	--	--	< 0.000429	--	--	--	--	--	--	--	--	--	--	--	--
Dibromomethane	mg/kg	800	B Non Cancer	< 0.000500	--	< 0.000470	--	--	--	--	< 0.000439	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	mg/kg	16000	B Non Cancer	< 0.000934	--	< 0.000878	--	--	--	--	< 0.000819	--	--	--	--	--	--	--	--	--	--	--	--
Di-Isopropyl ether (DIPE)	mg/kg			< 0.000324	--	< 0.000305	--	--	--	--	< 0.000285	--	--	--	--	--	--	--	--	--	--	--	--
Freon 113	mg/kg	2400000	B Non Cancer	< 0.000478	--	< 0.000449	--	--	--	--	< 0.000419	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	mg/kg	12.8	B Cancer	< 0.000448	--	< 0.000421	--	--	--	--	< 0.000393	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	mg/kg	8000	B Non Cancer	< 0.000318	--	< 0.000299	--	--	--	--	< 0.000279	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-Butanone)	mg/kg	48000	B Non Cancer	< 0.00613	--	**0.00737 J**	--	--	--	--	< 0.00538	--	--	--	--	--	--	--	--	--	--	--	--
Methyl Isobutyl Ketone (MIBK)	mg/kg	6400	B Non Cancer	< 0.00247	--	< 0.00232	--	--	--	--	< 0.00216	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tert-Butyl ether	mg/kg	0.1	Method A	< 0.000277	--	< 0.000261	--	--	--	--	< 0.000244	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	mg/kg	0.02	Method A	< 0.00131	--	< 0.00123	--	--	--	--	< 0.00115	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	5	Method A	< 0.00131	--	< 0.00123	--	--	--	--	< 0.00115	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	mg/kg	4000	B Non Cancer	< 0.000338	--	< 0.000318	--	--	--	--	< 0.000296	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	mg/kg	8000	B Non Cancer	< 0.000270	--	< 0.000254	--	--	--	--	< 0.000237	--	--	--	--	--	--	--	--	--	--	--	--
Sec-Butylbenzene	mg/kg	8000	B Non Cancer	< 0.000263	--	< 0.000248	--	--	--	--	< 0.000231	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	mg/kg	16000	B Non Cancer	< 0.000307	--	< 0.000288	--	--	--	--	< 0.000269	--	--	--	--	--	--	--	--	--	--	--	--
Tert-Butylbenzene	mg/kg	8000	B Non Cancer	< 0.000270	--	< 0.000254	--	--	--	--	< 0.000237	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	mg/kg	0.05	Method A	< 0.000361	--	< 0.000340	--	--	--	--	< 0.000317	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	mg/kg	1600	B Non Cancer	< 0.000346	--	< 0.000325	--	--	--	--	< 0.000303	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	mg/kg	10.0	B Cancer	< 0.000350	--	< 0.000329	--	--	--	--	< 0.000307	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene (TCE)	mg/kg	0.03	Method A	< 0.000365	--	< 0.000344	--	--	--	--	< 0.000321	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	mg/kg	24000	B Non Cancer	< 0.000500	--	< 0.000470	--	--	--	--	< 0.000439	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	mg/kg	0.670	B Cancer	< 0.000382	--	< 0.000358	--	--	--	--	< 0.000334	--	--	--	--	--	--	--	--	--	--	--	--
Metals																							
Arsenic	mg/kg	20	Method A	**9.05**	--	**8.51**	--	**4.14**	--	**1.81 J**	**2.67**	--	**17.9**	**3.25**	**5.31**	**20.0**	**9.14 J**	**1.78 J**	**16.6**	**5.61**	**3.48**	**5.96**	--
Barium	mg/kg	16000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	mg/kg	2	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, total	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	mg/kg	3200	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	mg/kg	250	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	mg/kg	2	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	mg/kg	400	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	mg/kg	400	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture																							
Solids, Percent	%			**78.6**	**93.3**	**81.2**	**65.7**	**77.1**	**79.4**	**85.6**	**87.0**	**49.0**	**51.9**	**92.3**	**75.9**	**53.2**	**21.2**	**79.6**	**33.7**	**73.1**	**90.7**	**70.2**	**57.6**

Table 4: Summary of RI Soil Analytical Results

			Location	TP-01	TP-02	TP-02	TP-02	TP-03	TP-03	TP-04	TP-04	TP-05	TP-06	TP-07	TP-08	TP-09	TP-09	TP-09	TP-09-E	TP-09-N	TP-09-S	TP-09-W
			Sample ID	TP-1(7.0-7.5)	TP-2 (1.5-2.0)	TP-2(1.5-2.0)	TP-2(5.0-5.5)	TP-3(2.5-3.0)	TP-3(4.5-5.0)	TP-4(2.5-3.0)	TP-4(4.5-5.0)	TP-5(2.5-3.0)	TP-6(2.0-2.5)	TP-7(2.0-2.5)	TP-8(1.0-1.5)	TP-9(1.0-1.5)	TP-9 (4.0-4.5)	TP-9(5.0-5.5)	TP-9-E	TP-9-N	TP-9-S	TP-9-W
			Parent ID																			
			Date	10/24/2017	10/24/2017	10/24/2017	10/18/2017	10/24/2017	10/24/2017	10/23/2017	10/23/2017	10/24/2017	10/23/2017	10/23/2017	10/23/2017	10/23/2017	10/23/2017	10/23/2017	10/24/2017	10/24/2017	10/24/2017	10/24/2017
			Sample Depths (bgs)	7.0-7.5 ft	1.5-2.0 ft	1.5-2.0 ft	5.0-5.5 ft	2.5-3.0 ft	4.5-5.0 ft	2.5-3.0 ft	4.5-5.0 ft	2.5-3.0 ft	2.0-2.5 ft	2.0-2.5 ft	1.0-1.5 ft	1.0-1.5 ft	4.0-4.5 ft	5.0-5.5 ft	1.0-1.5 ft	1.0-1.5 ft	1.0-1.5 ft	1.5-2.0 ft
			Note													TP-9 (1.0-1.5)						
Chemical	**Unit**	**MTCA A Then B**	**MTCA A Then B note**																			
Total Petroleum Hydrocarbons																						
Gasoline-Range Organics	mg/kg	30/100	Method A	--	--	< 0.0402	--	< 0.0940	--	< 0.0410	--	< 0.0424	< 0.0364	< 0.0479	< 0.0389	**346**	**0.127 J**	--	**26.3**	**0.0955 J**	**7.82**	**0.0417 J**
Total Petroleum Hydrocarbons - Diesel - without silica gel cleanup																						
Oil-Range Organics	mg/kg	2000	Method A	**16.4 J-**	--	**371**	--	**942**	**48.0 J-**	**3120**	**35.4 J-**	**631**	**15.3**	**7.96 J**	< 3.79	**1610**	**4850**	**5.11 J-**	**669**	**20.9**	**439**	**7.21 J**
Diesel-Range Organics	mg/kg	2000	Method A	**7.91 J-**	--	**68.4**	--	**106 J**	**10.4 J-**	< 302	**10.0 J-**	**66.9**	**2.21 J**	**1.98 J**	< 1.52	**1000**	**796 J**	**3.00 J-**	**354**	**7.02**	**244**	< 1.57
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	**24.3**	--	**439**	--	**1050**	**58.4**	**3270**	**45.4**	**698**	**17.5**	**9.94**	< 2.66	**2610**	**5650**	**8.11**	**1020**	**27.9**	**683**	**8.00**
Total Petroleum Hydrocarbons - Diesel - with silica gel cleanup																						
Oil-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diesel-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BTEX																						
Benzene	mg/kg	0.03	Method A	--	--	< 0.00197	--	< 0.00220	--	< 0.00242	--	< 0.00174	< 0.00227	< 0.00146	< 0.00160	< 0.00670	**0.00445 J**	--	< 0.00139	< 0.00136	< 0.00184	< 0.00155
Toluene	mg/kg	7	Method A	--	--	< 0.00400	--	< 0.00448	--	< 0.00494	--	< 0.00355	< 0.00461	< 0.00297	< 0.00326	< 0.0137	**0.0147 J**	--	< 0.00283	< 0.00276	< 0.00375	< 0.00315
Ethylbenzene	mg/kg	6	Method A	--	--	< 0.00194	--	< 0.00219	--	< 0.00240	--	< 0.00172	< 0.00225	< 0.00145	< 0.00158	< 0.00666	< 0.00410	--	< 0.00138	< 0.00135	< 0.00183	< 0.00154
Xylene, m,p-	mg/kg			--	--	< 0.00604	--	**0.00769 J**	--	< 0.00745	--	< 0.00535	< 0.00697	< 0.00448	< 0.00492	< 0.0207	< 0.0127	--	**0.0122**	< 0.00417	**0.00801 J**	< 0.00476
Xylene, o-	mg/kg	16000	B Non Cancer	--	--	< 0.00118	--	**0.00318 J**	--	< 0.00146	--	< 0.00105	< 0.00137	< 0.000877	< 0.000961	< 0.00403	**0.00257 J**	--	**0.00433**	< 0.000816	**0.00143 J**	< 0.000931
Xylene, total	mg/kg	9	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NWEPH																						
C10-C12 Aliphatic Hydrocarbons	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**280**	--	--	--	--	--	--
C10-C12 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**37**	--	--	--	--	--	--
C12-C16 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**320**	--	--	--	--	--	--
C12-C16 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**65**	--	--	--	--	--	--
C16-C21 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**600**	--	--	--	--	--	--
C16-C21 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**180**	--	--	--	--	--	--
C21-C34 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**2700**	--	--	--	--	--	--
C21-C34 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**430**	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**42**	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**5.1**	--	--	--	--	--	--
NWVPH																						
C5-C6 aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	< 0.081	--	--	--	--	--	--
C6-C8 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	< 0.040	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**7.6**	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	**10**	--	--	--	--	--	--
n-Hexane	mg/kg	4800	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	< 0.021	--	--	--	--	--	--
Semi Volatile Organic Compounds using SIM																						
1-Methylnaphthalene	mg/kg	34.5	B Cancer	--	--	--	--	--	--	< 0.0457 R	--	--	--	< 0.00224	--	**0.228**	--	--	--	--	--	--
2-Chloronaphthalene	mg/kg	6400	B Non Cancer	--	--	--	--	--	--	< 0.0457 R	--	--	--	< 0.00224	--	< 0.00232	--	--	--	--	--	--
2-Methylnaphthalene	mg/kg	320	B Non Cancer	--	--	--	--	--	--	< 0.0457 R	--	--	--	< 0.00224	--	**0.0567**	--	--	--	--	--	--
Acenaphthene	mg/kg	4800	B Non Cancer	--	--	--	--	--	--	< 0.0137 R	--	--	--	< 0.000673	--	**0.0428**	--	--	--	--	--	--
Acenaphthylene	mg/kg			--	--	--	--	--	--	< 0.0137 R	--	--	--	< 0.000673	--	**0.0265**	--	--	--	--	--	--
Anthracene	mg/kg	24000	B Non Cancer	--	--	--	--	--	--	< 0.0137 R	--	--	--	< 0.000673	--	**0.0351**	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg	1.37	B Cancer	--	--	--	--	--	--	**0.0154 J-**	--	--	--	**0.000991 J**	--	**0.00331 J**	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg	0.1	Method A	--	--	--	--	--	--	**0.0362 J-**	--	--	--	< 0.000673	--	**0.00358 J**	--	--	--	--	--	--
Benzo(b)Fluoranthene	mg/kg	1.37	B Cancer	--	--	--	--	--	--	**0.0729 J-**	--	--	--	**0.00127 J**	--	**0.00394 J**	--	--	--	--	--	--
Benzo(g,h,i)Perylene	mg/kg			--	--	--	--	--	--	**0.108 J-**	--	--	--	< 0.000673	--	**0.00515 J**	--	--	--	--	--	--
Benzo(k)Fluoranthene	mg/kg	13.7	B Cancer	--	--	--	--	--	--	**0.0240 J-**	--	--	--	< 0.000673	--	**0.00119 J**	--	--	--	--	--	--
Chrysene	mg/kg	137	B Cancer	--	--	--	--	--	--	**0.0289 J-**	--	--	--	< 0.000673	--	**0.00606 J**	--	--	--	--	--	--
Dibenz(a,h)Anthracene	mg/kg	0.137	B Cancer	--	--	--	--	--	--	**0.0253 J-**	--	--	--	< 0.000673	--	< 0.000697	--	--	--	--	--	--
Fluoranthene	mg/kg	3200	B Non Cancer	--	--	--	--	--	--	**0.0343 J-**	--	--	--	**0.00112 J**	--	**0.0152**	--	--	--	--	--	--
Fluorene	mg/kg	3200	B Non Cancer	--	--	--	--	--	--	< 0.0137 R	--	--	--	< 0.000673	--	**0.0691**	--	--	--	--	--	--
Indeno(1,2,3-c,d)Pyrene	mg/kg	1.37	B Cancer	--	--	--	--	--	--	**0.0303 J-**	--	--	--	< 0.000673	--	**0.00110 J**	--	--	--	--	--	--
Naphthalene	mg/kg	5	Method A	--	--	--	--	--	--	**0.0700 J-**	--	--	--	< 0.00224	--	**0.0764**	--	--	--	--	--	--
Phenanthrene	mg/kg			--	--	--	--	--	--	**0.0180 J-**	--	--	--	< 0.000673	--	**0.101**	--	--	--	--	--	--
Pyrene	mg/kg	2400	B Non Cancer	--	--	--	--	--	--	**0.0614 J-**	--	--	--	**0.00123 J**	--	**0.0261**	--	--	--	--	--	--
Total cPAHs (HalfDL)	mg/kg	0.1	Method A	--	--	--	--	--	--	**0.0533**	--	--	--	**0.000667**	--	**0.00463**	--	--	--	--	--	--
Total cPAHs (HitsOnly)	mg/kg	0.1	Method A	--	--	--	--	--	--	**0.0533**	--	--	--	**0.000226**	--	**0.00459**	--	--	--	--	--	--
Volatile Organic Compounds																						
1,1,1,2-Tetrachloroethane	mg/kg	38.5	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	mg/kg	2	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	mg/kg	5.00	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	mg/kg	17.5	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	mg/kg	175	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	mg/kg	4000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloropropene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	mg/kg	0.0333	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trimethylbenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	mg/kg	34.5	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-Chloropropane (DBCP)	mg/kg	1.25	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	mg/kg	0.005	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg	7200	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane (EDC)	mg/kg	11.0	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	mg/kg	27.8	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	mg/kg	800	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg	185	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorotoluene	mg/kg	1600	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorotoluene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	mg/kg	72000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	mg/kg	1.85	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	mg/kg	16.1	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	mg/kg	127	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	mg/kg	112	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 4: Summary of RI Soil Analytical Results

			Location	TP-01	TP-02	TP-02	TP-02	TP-03	TP-03	TP-04	TP-04	TP-05	TP-06	TP-07	TP-08	TP-09	TP-09	TP-09	TP-09-E	TP-09-N	TP-09-S	TP-09-W
			Sample ID	TP-1(7.0-7.5)	TP-2 (1.5-2.0)	TP-2(1.5-2.0)	TP-2(5.0-5.5)	TP-3(2.5-3.0)	TP-3(4.5-5.0)	TP-4(2.5-3.0)	TP-4(4.5-5.0)	TP-5(2.5-3.0)	TP-6(2.0-2.5)	TP-7(2.0-2.5)	TP-8(1.0-1.5)	TP-9(1.0-1.5)	TP-9 (4.0-4.5)	TP-9(5.0-5.5)	TP-9-E	TP-9-N	TP-9-S	TP-9-W
			Parent ID																			
			Date	10/24/2017	10/24/2017	10/24/2017	10/18/2017	10/24/2017	10/24/2017	10/23/2017	10/23/2017	10/24/2017	10/23/2017	10/23/2017	10/23/2017	10/23/2017	10/23/2017	10/23/2017	10/24/2017	10/24/2017	10/24/2017	10/24/2017
			Sample Depths (bgs)	7.0-7.5 ft	1.5-2.0 ft	1.5-2.0 ft	5.0-5.5 ft	2.5-3.0 ft	4.5-5.0 ft	2.5-3.0 ft	4.5-5.0 ft	2.5-3.0 ft	2.0-2.5 ft	2.0-2.5 ft	1.0-1.5 ft	1.0-1.5 ft	4.0-4.5 ft	5.0-5.5 ft	1.0-1.5 ft	1.0-1.5 ft	1.0-1.5 ft	1.5-2.0 ft
			Note													TP-9 (1.0-1.5)						
Chemical	**Unit**	**MTCA A Then B**	**MTCA A Then B note**																			
Carbon Tetrachloride	mg/kg	14.3	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	mg/kg	1600	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	mg/kg	32.3	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/kg	160	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	mg/kg	10.0	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cymene (p-Isopropyltoluene)	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	mg/kg	11.9	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromomethane	mg/kg	800	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	mg/kg	16000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-Isopropyl ether (DIPE)	mg/kg			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Freon 113	mg/kg	2400000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	mg/kg	12.8	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	mg/kg	8000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-Butanone)	mg/kg	48000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl Isobutyl Ketone (MIBK)	mg/kg	6400	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tert-Butyl ether	mg/kg	0.1	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	mg/kg	0.02	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	5	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	mg/kg	4000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	mg/kg	8000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sec-Butylbenzene	mg/kg	8000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	mg/kg	16000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tert-Butylbenzene	mg/kg	8000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	mg/kg	0.05	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	mg/kg	1600	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	mg/kg	10.0	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene (TCE)	mg/kg	0.03	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	mg/kg	24000	B Non Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	mg/kg	0.670	B Cancer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																						
Arsenic	mg/kg	20	Method A	--	**20.8**	**20.8**	**3.90**	**6.53**	--	**7.08**	--	**4.76**	**3.12**	**2.44**	**5.35**	**1.60 J**	--	--	--	--	--	--
Barium	mg/kg	16000	B Non Cancer	--	**135**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	mg/kg	2	Method A	--	**0.176**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, total	mg/kg			--	**31.6**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	mg/kg	3200	B Non Cancer	--	**31.3**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	mg/kg	250	Method A	--	**30.7**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	mg/kg	2	Method A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	mg/kg	400	B Non Cancer	--	< 0.846	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	mg/kg	400	B Non Cancer	--	< 0.320	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture																						
Solids, Percent	%			**59.9**	**87.5**	**87.5**	**82.7**	**75.0**	**61.3**	**87.5**	**58.6**	**80.0**	**93.0**	**89.2**	**87.1**	**86.1**	**31.5**	**73.8**	**93.6**	**95.9**	**94.7**	**84.0**

Table 4: Summary of RI Soil Analytical Results

			Location	TP-10	TP-10	TP-11	TP-11	TP-12	TP-13	TP-13	TP-14	TP-15
			Sample ID	TP-10 (2.5-3.0)	TP-10(2.5-3.0)	TP-11(3.5-4.0)	DUP-01-20171024	TP-12(3.5-4.0)	TP-13(2.0-2.5)	TP-13(3.0-3.5)	TP-14(3.0-3.5)	TP-15(2.0-2.5)
			Parent ID				TP-11(3.5-4.0)					
			Date	10/23/2017	10/23/2017	10/24/2017	10/24/2017	10/24/2017	10/23/2017	10/23/2017	10/23/2017	10/24/2017
			Sample Depths (bgs)	2.5-3.0 ft	2.5-3.0 ft	3.5-4.0 ft	3.5-4.0 ft	3.5-4.0 ft	2.0-2.5 ft	3.0-3.5 ft	3.0-3.5 ft	2.0-2.5 ft
			Note									
Chemical	**Unit**	**MTCA A Then B**	**MTCA A Then B note**									
Total Petroleum Hydrocarbons												
Gasoline-Range Organics	mg/kg	30/100	Method A	--	< 0.0421	< 0.144	< 0.0512	< 0.0378	< 0.0410	--	< 0.0505	< 0.0364
Total Petroleum Hydrocarbons - Diesel - without silica gel cleanup												
Oil-Range Organics	mg/kg	2000	Method A	--	< 4.10	**45.8**	**58.2**	< 3.68	< 3.99	**125**	**5.25 J**	**16.5**
Diesel-Range Organics	mg/kg	2000	Method A	--	< 1.64	**29.7**	**39.7**	< 1.47	< 1.59	**67.5**	**4.24 J**	**2.34 J**
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	--	< 2.87	**75.5**	**97.9**	< 0.735	< 0.795	**193**	**9.49**	**18.8**
Total Petroleum Hydrocarbons - Diesel - with silica gel cleanup												
Oil-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--
Diesel-Range Organics	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--
Total Diesel+Oil (HalfDL)	mg/kg	2000	Method A	--	--	--	--	--	--	--	--	--
BTEX												
Benzene	mg/kg	0.03	Method A	--	< 0.00161	< 0.000397	**0.0190**	**0.000320 J**	< 0.000362	< 0.00142	< 0.00268	< 0.00213
Toluene	mg/kg	7	Method A	--	< 0.00329	< 0.000638	**0.0131**	< 0.000483	< 0.000582	< 0.00229	< 0.00544	< 0.00433
Ethylbenzene	mg/kg	6	Method A	--	< 0.00160	< 0.000437	**0.00617**	< 0.000331	< 0.000399	< 0.00156	< 0.00265	< 0.00210
Xylene, m,p-	mg/kg			--	< 0.00497	< 0.000489	**0.0202**	< 0.000370	< 0.000445	< 0.00175	< 0.00822	< 0.00653
Xylene, o-	mg/kg	16000	B Non Cancer	--	< 0.000971	< 0.000539	**0.00850**	< 0.000408	< 0.000490	< 0.00193	< 0.00161	< 0.00128
Xylene, total	mg/kg	9	Method A	--	--	--	--	--	--	--	--	--
NWEPH												
C10-C12 Aliphatic Hydrocarbons	mg/kg			--	--	--	--	--	--	--	--	--
C10-C12 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--
C12-C16 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--
C12-C16 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--
C16-C21 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--
C16-C21 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--
C21-C34 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--
C21-C34 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--
NWVPH												
C5-C6 aliphatics	mg/kg			--	--	--	--	--	--	--	--	--
C6-C8 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	mg/kg			--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	mg/kg			--	--	--	--	--	--	--	--	--
n-Hexane	mg/kg	4800	B Non Cancer	--	--	--	--	--	--	--	--	--
Semi Volatile Organic Compounds using SIM												
1-Methylnaphthalene	mg/kg	34.5	B Cancer	--	--	**0.0129 J**	--	< 0.00223	< 0.00242	**0.338**	--	--
2-Chloronaphthalene	mg/kg	6400	B Non Cancer	--	--	< 0.00286	--	< 0.00223	< 0.00242	< 0.00717	--	--
2-Methylnaphthalene	mg/kg	320	B Non Cancer	--	--	**0.0230 J**	--	< 0.00223	< 0.00242	**0.510**	--	--
Acenaphthene	mg/kg	4800	B Non Cancer	--	--	**0.00445 J**	--	< 0.000668	< 0.000725	**0.0620**	--	--
Acenaphthylene	mg/kg			--	--	**0.00769 J**	--	< 0.000668	< 0.000725	**0.0451**	--	--
Anthracene	mg/kg	24000	B Non Cancer	--	--	**0.00340 J**	--	< 0.000668	< 0.000725	**0.0392**	--	--
Benzo(a)anthracene	mg/kg	1.37	B Cancer	--	--	**0.00816 J**	--	**0.00165 J**	< 0.000725	**0.0117 J**	--	--
Benzo(a)pyrene	mg/kg	0.1	Method A	--	--	**0.0121**	--	**0.00272 J**	< 0.000725	**0.00847 J**	--	--
Benzo(b)Fluoranthene	mg/kg	1.37	B Cancer	--	--	**0.0182**	--	**0.00364 J**	< 0.000725	**0.0144 J**	--	--
Benzo(g,h,i)Perylene	mg/kg			--	--	**0.0272**	--	**0.00900**	< 0.000725	**0.0117 J**	--	--
Benzo(k)Fluoranthene	mg/kg	13.7	B Cancer	--	--	**0.00525 J**	--	**0.00162 J**	< 0.000725	**0.00357 J**	--	--
Chrysene	mg/kg	137	B Cancer	--	--	**0.0116**	--	**0.00239 J**	< 0.000725	**0.0172 J**	--	--
Dibenz(a,h)Anthracene	mg/kg	0.137	B Cancer	--	--	**0.00320 J**	--	**0.000949 J**	< 0.000725	< 0.00215	--	--
Fluoranthene	mg/kg	3200	B Non Cancer	--	--	**0.0194**	--	**0.00437 J**	< 0.000725	**0.0665**	--	--
Fluorene	mg/kg	3200	B Non Cancer	--	--	**0.00281 J**	--	< 0.000668	< 0.000725	**0.0735**	--	--
Indeno(1,2,3-c,d)Pyrene	mg/kg	1.37	B Cancer	--	--	**0.0142**	--	**0.00461 J**	< 0.000725	**0.00625 J**	--	--
Naphthalene	mg/kg	5	Method A	--	--	**0.0825**	--	**0.0102 J**	< 0.00242	**1.31**	--	--
Phenanthrene	mg/kg			--	--	**0.0196**	--	**0.00526 J**	< 0.000725	**0.288**	--	--
Pyrene	mg/kg	2400	B Non Cancer	--	--	**0.0180**	--	**0.00400 J**	< 0.000725	**0.0581**	--	--
Total cPAHs (HalfDL)	mg/kg	0.1	Method A	--	--	**0.0171**	--	**0.00399**	< 0.000547	**0.0123**	--	--
Total cPAHs (HitsOnly)	mg/kg	0.1	Method A	--	--	**0.0171**	--	**0.00399**	< 0.00	**0.0122**	--	--
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	mg/kg	38.5	B Cancer	--	--	< 0.000389	--	< 0.000294	< 0.000354	< 0.00139	--	--
1,1,1-Trichloroethane	mg/kg	2	Method A	--	--	< 0.000420	--	< 0.000319	< 0.000383	< 0.00151	--	--
1,1,2,2-Tetrachloroethane	mg/kg	5.00	B Cancer	--	--	< 0.000537	--	< 0.000406 J	< 0.000489	< 0.00192	--	--
1,1,2-Trichloroethane	mg/kg	17.5	B Cancer	--	--	< 0.000407	--	< 0.000308	< 0.000371	< 0.00146	--	--
1,1-Dichloroethane	mg/kg	175	B Cancer	--	--	< 0.000293	--	< 0.000222	< 0.000267	< 0.00105	--	--
1,1-Dichloroethene	mg/kg	4000	B Non Cancer	--	--	< 0.000446	--	< 0.000337	< 0.000406	< 0.00160	--	--
1,1-Dichloropropene	mg/kg			--	--	< 0.000466	--	< 0.000353	< 0.000425	< 0.00167	--	--
1,2,3-Trichlorobenzene	mg/kg			--	--	< 0.000450	--	< 0.000341	< 0.000411	< 0.00161	--	--
1,2,3-Trichloropropane	mg/kg	0.0333	B Cancer	--	--	< 0.00109	--	< 0.000825	< 0.000993	< 0.00391	--	--
1,2,3-Trimethylbenzene	mg/kg			--	--	< 0.000423	--	< 0.000320	< 0.000384	< 0.00151	--	--
1,2,4-Trichlorobenzene	mg/kg	34.5	B Cancer	--	--	< 0.000571	--	< 0.000432	< 0.000521	< 0.00204	--	--
1,2,4-Trimethylbenzene	mg/kg			--	--	**0.000523 J**	--	< 0.000235	< 0.000283	< 0.00111	--	--
1,2-Dibromo-3-Chloropropane (DBCP)	mg/kg	1.25	B Cancer	--	--	< 0.00154	--	< 0.00117	< 0.00140	< 0.00552	--	--
1,2-Dibromoethane (EDB)	mg/kg	0.005	Method A	--	--	< 0.000504	--	< 0.000382	< 0.000460	< 0.00181	--	--
1,2-Dichlorobenzene	mg/kg	7200	B Non Cancer	--	--	< 0.000449	--	< 0.000340	< 0.000408	< 0.00161	--	--
1,2-Dichloroethane (EDC)	mg/kg	11.0	B Cancer	--	--	< 0.000390	--	< 0.000295	< 0.000355	< 0.00140	--	--
1,2-Dichloropropane	mg/kg	27.8	B Cancer	--	--	< 0.000527	--	< 0.000399	< 0.000480	< 0.00189	--	--
1,3,5-Trimethylbenzene	mg/kg	800	B Non Cancer	--	--	< 0.000391	--	< 0.000296	< 0.000356	< 0.00140	--	--
1,3-Dichlorobenzene	mg/kg			--	--	< 0.000351	--	< 0.000266	< 0.000320	< 0.00126	--	--
1,3-Dichloropropane	mg/kg			--	--	< 0.000304	--	< 0.000231	< 0.000278	< 0.00109	--	--
1,4-Dichlorobenzene	mg/kg	185	B Cancer	--	--	< 0.000333	--	< 0.000252	< 0.000303	< 0.00119	--	--
2,2-Dichloropropane	mg/kg			--	--	< 0.000410	--	< 0.000311	< 0.000374	< 0.00147	--	--
2-Chlorotoluene	mg/kg	1600	B Non Cancer	--	--	< 0.000443	--	< 0.000335	< 0.000403	< 0.00159	--	--
4-Chlorotoluene	mg/kg			--	--	< 0.000353	--	< 0.000267	< 0.000321	< 0.00127	--	--
Acetone	mg/kg	72000	B Non Cancer	--	--	**0.0403 J**	--	**0.0311 J**	< 0.0134	< 0.0527	--	--
Acrylonitrile	mg/kg	1.85	B Cancer	--	--	< 0.00263	--	< 0.00199	< 0.00240	< 0.00943	--	--
Bromobenzene	mg/kg			--	--	< 0.000417	--	< 0.000316 J	< 0.000381	< 0.00150	--	--
Bromodichloromethane	mg/kg	16.1	B Cancer	--	--	< 0.000374	--	< 0.000283	< 0.000341	< 0.00134	--	--
Bromoform	mg/kg	127	B Cancer	--	--	< 0.000624	--	< 0.000472	< 0.000569	< 0.00223	--	--
Bromomethane	mg/kg	112	B Non Cancer	--	--	< 0.00197	--	< 0.00149	< 0.00180	< 0.00706	--	--

Table 4: Summary of RI Soil Analytical Results

			Location	**TP-10**	**TP-10**	**TP-11**	**TP-11**	**TP-12**	**TP-13**	**TP-13**	**TP-14**	**TP-15**
			Sample ID	**TP-10 (2.5-3.0)**	**TP-10(2.5-3.0)**	**TP-11(3.5-4.0)**	**DUP-01-20171024**	**TP-12(3.5-4.0)**	**TP-13(2.0-2.5)**	**TP-13(3.0-3.5)**	**TP-14(3.0-3.5)**	**TP-15(2.0-2.5)**
			Parent ID				**TP-11(3.5-4.0)**					
			Date	**10/23/2017**	**10/23/2017**	**10/24/2017**	**10/24/2017**	**10/24/2017**	**10/23/2017**	**10/23/2017**	**10/23/2017**	**10/24/2017**
			Sample Depths (bgs)	**2.5-3.0 ft**	**2.5-3.0 ft**	**3.5-4.0 ft**	**3.5-4.0 ft**	**3.5-4.0 ft**	**2.0-2.5 ft**	**3.0-3.5 ft**	**3.0-3.5 ft**	**2.0-2.5 ft**
			Note									
Chemical	**Unit**	**MTCA A Then B**	**MTCA A Then B note**									
Carbon Tetrachloride	mg/kg	14.3	B Cancer	--	--	< 0.000483	--	< 0.000365	< 0.000440	< 0.00173	--	--
Chlorobenzene	mg/kg	1600	B Non Cancer	--	--	< 0.000311	--	< 0.000236	< 0.000284	< 0.00112	--	--
Chloroethane	mg/kg			--	--	< 0.00139	--	< 0.00105	< 0.00127	< 0.00498	--	--
Chloroform	mg/kg	32.3	B Cancer	--	--	< 0.000337	--	< 0.000255	< 0.000307	< 0.00121	--	--
Chloromethane	mg/kg			--	--	< 0.000551	--	< 0.000418	< 0.000503	< 0.00198	--	--
cis-1,2-Dichloroethene	mg/kg	160	B Non Cancer	--	--	< 0.000346	--	< 0.000262	< 0.000315	< 0.00124	--	--
cis-1,3-Dichloropropene	mg/kg	10.0	B Cancer	--	--	< 0.000386	--	< 0.000292	< 0.000352	< 0.00138	--	--
Cymene (p-Isopropyltoluene)	mg/kg			--	--	< 0.000300	--	< 0.000227	< 0.000273	< 0.00108 J	--	--
Dibromochloromethane	mg/kg	11.9	B Cancer	--	--	< 0.000549	--	< 0.000415	< 0.000500	< 0.00197	--	--
Dibromomethane	mg/kg	800	B Non Cancer	--	--	< 0.000561	--	< 0.000425	< 0.000512	< 0.00202	--	--
Dichlorodifluoromethane	mg/kg	16000	B Non Cancer	--	--	< 0.00105	--	< 0.000794	< 0.000956	< 0.00377	--	--
Di-Isopropyl ether (DIPE)	mg/kg			--	--	< 0.000364	--	< 0.000276	< 0.000332	< 0.00131	--	--
Freon 113	mg/kg	2400000	B Non Cancer	--	--	< 0.000537	--	< 0.000406	< 0.000489	< 0.00192	--	--
Hexachlorobutadiene	mg/kg	12.8	B Cancer	--	--	< 0.000503	--	< 0.000381	< 0.000459	< 0.00180 J	--	--
Isopropylbenzene	mg/kg	8000	B Non Cancer	--	--	< 0.000357	--	< 0.000271	< 0.000326	< 0.00128	--	--
Methyl ethyl ketone (2-Butanone)	mg/kg	48000	B Non Cancer	--	--	< 0.00688	--	< 0.00521	< 0.00627	< 0.0247	--	--
Methyl Isobutyl Ketone (MIBK)	mg/kg	6400	B Non Cancer	--	--	< 0.00277	--	< 0.00209	< 0.00252	< 0.00990	--	--
Methyl tert-Butyl ether	mg/kg	0.1	Method A	--	--	< 0.000311	--	< 0.000236	< 0.000284	< 0.00112	--	--
Methylene Chloride	mg/kg	0.02	Method A	--	--	< 0.00147	--	< 0.00111	< 0.00134	< 0.00527	--	--
Naphthalene	mg/kg	5	Method A	--	--	< 0.00147	--	< 0.00111	< 0.00134	< 0.00527	--	--
n-Butylbenzene	mg/kg	4000	B Non Cancer	--	--	< 0.000380	--	< 0.000287	< 0.000345	< 0.00136 J	--	--
n-Propylbenzene	mg/kg	8000	B Non Cancer	--	--	< 0.000303	--	< 0.000229	< 0.000277	< 0.00109	--	--
Sec-Butylbenzene	mg/kg	8000	B Non Cancer	--	--	< 0.000296	--	< 0.000224	< 0.000269	< 0.00106	--	--
Styrene	mg/kg	16000	B Non Cancer	--	--	< 0.000344	--	< 0.000261	< 0.000314	< 0.00123	--	--
Tert-Butylbenzene	mg/kg	8000	B Non Cancer	--	--	< 0.000303	--	< 0.000229	< 0.000277	< 0.00109	--	--
Tetrachloroethene (PCE)	mg/kg	0.05	Method A	--	--	< 0.000406	--	< 0.000307	< 0.000370	< 0.00146	--	--
trans-1,2-Dichloroethene	mg/kg	1600	B Non Cancer	--	--	< 0.000389	--	< 0.000294	< 0.000354	< 0.00139	--	--
trans-1,3-Dichloropropene	mg/kg	10.0	B Cancer	--	--	< 0.000393	--	< 0.000297	< 0.000358	< 0.00141	--	--
Trichloroethene (TCE)	mg/kg	0.03	Method A	--	--	< 0.000410	--	< 0.000311	< 0.000374	< 0.00147	--	--
Trichlorofluoromethane	mg/kg	24000	B Non Cancer	--	--	< 0.000561	--	< 0.000425	< 0.000512	< 0.00202	--	--
Vinyl Chloride	mg/kg	0.670	B Cancer	--	--	< 0.000429	--	< 0.000324	< 0.000390	< 0.00153	--	--
Metals												
Arsenic	mg/kg	20	Method A	**2.68**	**2.68**	**8.10**	**11.8**	**4.90**	**1.92 J**	**5.56 J**	**5.55**	**4.26**
Barium	mg/kg	16000	B Non Cancer	**66.5**	--	--	--	--	--	--	--	--
Cadmium	mg/kg	2	Method A	< 0.0869	--	--	--	--	--	--	--	--
Chromium, total	mg/kg			**39.0**	--	--	--	--	--	--	--	--
Copper	mg/kg	3200	B Non Cancer	**20.4**	--	--	--	--	--	--	--	--
Lead	mg/kg	250	Method A	**1.79**	--	--	--	--	--	--	--	--
Mercury	mg/kg	2	Method A	--	--	--	--	--	--	--	--	--
Selenium	mg/kg	400	B Non Cancer	< 0.919	--	--	--	--	--	--	--	--
Silver	mg/kg	400	B Non Cancer	< 0.348	--	--	--	--	--	--	--	--
Moisture												
Solids, Percent	%			**80.5**	**80.5**	**70.0**	**66.2 J**	**89.8**	**82.8**	**27.9**	**69.1**	**93.1**

751	Detected concentrations above the cleanup level are shaded yellow and bolded.
< --	Non-detect values above the cleanup level are shaded gray and italicized.
0.436	Detected concentrations at or above the method detection limit are shown in bold.

NOTE: Cleanup levels shown in this table may differ from the Proposed Cleanup Levels presented in Section 8 of the RI, and are presented herein as screening levels for comparison purposes (refer to Section 5.1 of the RI).

Abbreviations and Symbols

" - -" denotes not measured, not available, or not applicable.
" < " denotes not detected at or above the indicated method detection limit.
"DUP" denotes a field duplicate sample. Primary sample ID is provided beneath the duplicate sample ID.
"J" indicates an estimated concentration based on either the being less than the laboratory reporting limit or data validation findings.
"U" denotes that the value has been qualified as undetected (at the detected concentration if above the method detection limit) due to blank contamination.
Total Diesel+Oil (HalfDL) = Sum of diesel- and oil-range organics. If diesel- or oil-range organics was not detected, a value of one half the method detection limit was used in the calculation unless all results were not detected then half the lowest method detection limit was used.
Total cPAHs (HitsOnly) = Possible total cPAHs are based on the relative toxicity of each cPAH to benzo(a)pyrene and were calculated by multiplying the individual detected cPAH concentrations by a toxicity equivalency factor (TEF) and summing the adjusted concentrations.
Total cPAHs (HalfDL) = Possible total cPAHs are based on the relative toxicity of each cPAH to benzo(a)pyrene and were calculated by multiplying the individual detected cPAH concentrations by a toxicity equivalency factor (TEF) and summing the adjusted concentrations. If an individual cPAH was not detected, a value of one half the method detection limit was used in the calculation.
TEF Values = Benzo(a)anthracene = 0.1, Benzo(a)pyrene = 1, Benzo(b)Fluoranthene = 0.1, Benzo(k)Fluoranthene = 0.1, Chrysene = 0.01, Dibenz(a,h)Anthracene = 0.1, and Indeno(1,2,3-c,d)Pyrene = 0.1
bgs = below ground surface.
ft = feet
mg/kg = milligrams per kilogram

Cleanup Levels (CUL)

Cleanup level values based on Model Toxics Control Act (MTCA) Method A values for unrestricted land use (Method A) based on Washington State Administrative Code (WAC) 173-340-740 Table 740-1. Where MTCA Method A values are not available, the lowest of MTCA Method B values (B Cancer or B Non Cancer) from Cleanup Levels and Risk Calculation (CLARC) tables have been used (Accessed January 2017).

Methods

Samples analyzed for gasoline-range organics (GRO) using Northwest Total Petroleum Hydrocarbon (NWTPH)-Gx and diesel- and oil-range organics (DRO and ORO) using NWTPH-Dx (with or without silica gel cleanup as indicated).
Samples analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and Volatile Organic Compounds using EPA Method 8260.
Samples analyzed for metals using EPA Method 6010, 6020, or 7471.
Samples analyzed for Semivolatile Organic Compound using EPA Method 8270 with selective ion monitoring (SIM).

Table 5: Summary of RI Reconnaissance Groundwater Analytical Results

									Location	**2017-B02**	**2017-B05**	**2017-B05**	**2017-B06**	**2017-B07**	**2017-B08**	**2017-B09**	**2017-B10**	**2018-B1**	**2018-TP-11**
									Date	**10/18/2017**	**10/20/2017**	**10/20/2017**	**1/12/2018**	**1/12/2018**	**1/12/2018**	**1/12/2018**	**1/12/2018**	**6/4/2018**	**6/4/2018**
									Sample ID	**2017-B2-20171018**	**2017-B5-20171020**	**DUP-02-20171020**	**2017-B6-20180112**	**2017-B7-20180112**	**2017-B8-20180112**	**2017-B9-20180112**	**2017-B10-20180112**	**2018-B1**	**2018-TP-11**
									Parent ID			**2017-B5-20171020**							
									Screen Intervals (btoc)	**5.0-10.0 ft**	**5.0-15.0 ft**	**5.0-15.0 ft**							
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**										
Total Petroleum Hydrocarbons																			
Gasoline-Range Organics	µg/L	800								**71.3 J**	< 31.6	< 31.6	--	--	--	--	--	< 31.6	--
Oil-Range Organics	µg/L	500								**408 J-**	**432 J-**	**360 J-**	**624**	**538**	**156 J**	**435**	**703**	**443 J**	--
Diesel-Range Organics	µg/L	500								**436 J-**	**278 J-**	**250 J-**	**200**	**979**	**87.5 J**	**230**	**560**	**343 J**	--
Total Diesel+Oil (HalfDL)	µg/L	500								**844**	**710**	**610**	**824**	**1520**	**244**	**665**	**1260**	**786**	--
Volatile Organic Compounds																			
Benzene	µg/L	5	22.7	1,990				51	71	< 0.331	< 0.331	< 0.331	--	--	--	--	--	< 0.331	--
Ethylbenzene	µg/L	700		6,820				2,100	29,000	< 0.384	< 0.384	< 0.384	--	--	--	--	--	< 0.384	--
Toluene	µg/L	1,000		18,900				15,000	200,000	< 0.412	< 0.412	< 0.412	--	--	--	--	--	< 0.412	--
Xylene, m,p-	µg/L									< 0.719	< 0.719	< 0.719	--	--	--	--	--	< 0.719	--
Xylene, o-	µg/L	1,600								< 0.341	< 0.341	< 0.341	--	--	--	--	--	< 0.341	--
Metals																			
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**12.4**	**8.65**	**8.56**	**21.7**	**20.2**	**53.2**	**21.0**	**17.9**	**3.45**	**5.20**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	--	--	--	--	--	--	--	--	**35.1**	**25.1**

Screening Levels

500	Screening level used for comparison to groundwater results based on MTCA Method A/B groundwater CULs or surface water ARARs (typically the most protective value; refer to Section 5.1 of the RI). Cleanup Standard and ARAR sources are listed below.
624	Detected concentrations above the screening level are shaded yellow and bolded.
< --	Non-detect values above the screening level are shaded gray and italicized.
71.3 J	Detected concentrations at or above the method detection limit are shown in bold.
NOTE:	**Screening levels for RI purposes may differ from the Proposed Cleanup Levels presented in Section 8 of the RI and summarized in Table 11.**

Abbreviations and Symbols

" - -" denotes not measured, not available, or not applicable.
" < " denotes not detected at or above the indicated method detection limit.
"DUP" denotes a field duplicate sample. Primary sample ID is provided beneath the duplicate sample ID.
"J" indicates an estimated concentration based on either the being less than the laboratory reporting limit or data validation findings.
"J-" indicates an estimated concentration that may be biased low based on data validation findings.
Total Diesel+Oil (HalfDL) = Sum of diesel- and oil-range organics. If diesel- or oil-range organics was not detected, a value of one half the method detection limit was used in the calculation unless all results were not detected then half the lowest method detection limit was used.
btoc = below top of casing.
ft = feet
µg/L = micrograms per liter

Methods

Samples analyzed for gasoline-range organics (GRO) using Northwest Total Petroleum Hydrocarbon (NWTPH)-Gx and diesel- and oil-range organics (DRO and ORO) using NWTPH-Dx (without silica gel cleanup).
Samples analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and Volatile Organic Compounds using EPA Method 8260.
Samples analyzed for metals using EPA Method 6020.

Cleanup Standards and ARARs:

WA_WG_MTCA_A_THEN_LOWEST_B_1507	MTCA Method A/B Groundwater Cleanup Levels from CLARC database spreadsheet marked July 2015
WA_WS_MTCA_METHOD_B_CANCER	MTCA Surface Water Method B Cancer
WA_WS_MTCA_METHOD_B_NONCANCER	MTCA Surface Water Method B Non cancer
WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	Surface Water Aquatic Life Marine/Chronic CWA 304
WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	Surface Water Aquatic Life Marine/Chronic NTR 40 CFR 131
WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	Surface Water Aquatic Life Marine/Chronic 173-201A WAC
WS_HUMAN_HEALTH_SW_CWA304	Surface Water Human Health Marine Waters CWA 304
WS_HUMAN_HEALTH_SW_NTR40CFR131	Surface Water Human Health Marine Waters NTR 40 CFR 131

Table 6: Summary of RI Groundwater Monitoring Results - Onsite

TPH, BTEX, NWEPH, and Metal Analytes

									Location	MW-01R	MW-01R	MW-01R	MW-01R	MW-01R	MW-06	MW-06	MW-06	MW-06	MW-06	MW-07
									Date	10/26/2017	11/30/2017	1/8/2018	7/17/2018	9/27/2018	10/26/2017	11/29/2017	1/8/2018	7/18/2018	9/24/2018	10/26/2017
									Sample ID	MW-1R-20171026	MW-1R-20171130	MW-1R-20180108	MW-01R-20180717	MW-1R-20180927	MW-06-20171026	MW-6-20171129	MW-6-20180108	MW-6-20180718	MW-06-20180924	MW-7-20171026
									Parent ID											
									Screen Intervals (btoc)											
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**											
Total Petroleum Hydrocarbons																				
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	**34.3 J**	**49.5 J**	**34.8 J**	< 31.6 U	< 31.6	**32.2 J**	**39.8 J**	**32.5 J**	--	**32.7 J**	**48.0 J**
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	**376**	**939**	**615**	**773**	< 167	**154 J**	**156 J**	< 82.5	< 248	< 83.3	**532**
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	**464**	**894**	**864**	**454**	**144 J**	< 66.0	< 66.0	< 66.0	**352 J**	< 66.7	**726**
Total Diesel+Oil (HalfDL)	µg/L	500								**840**	**1830**	**1480**	**1230**	**228**	**187**	**189**	< 33.0	**476**	< 33.4	**1260**
BTEX																				
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	< 0.719	< 0.719	< 0.719	--	< 0.719	--	< 0.719	< 0.719	--	< 0.719	< 0.719
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	< 0.341	< 0.341	< 0.341	--	< 0.341	--	< 0.341	< 0.341	--	< 0.341	< 0.341
Xylene, total	µg/L	1,000	--	--	--	--	--	--	--	--	--	--	< 1.06	--	< 1.06	--	--	< 1.06	--	--
NWEPH																				
C10-C12 Aliphatic Hydrocarbons	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C10-C12 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																				
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**5.28**	**10.7**	**8.67**	**9.20**	**11.2**	**28.6**	**35.0**	**29.4**	**21.4**	**41.0**	**7.71**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**5.60**	**10.8**	**8.14**	**2.83**	**9.67**	**29.0**	**34.1**	**28.8**	**46.2**	**41.0**	**8.45**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	**0.411 J**	< 0.240	< 0.379 U	--	--	< 0.240	< 0.240	< 0.240	--	--	< 0.240
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	< 0.240	< 0.240	< 0.396 U	--	--	< 0.240	< 0.240	< 0.281 U	--	--	**0.268 J**

Table 6: Summary of RI Groundwater Monitoring Results - Onsite

TPH, BTEX, NWEPH, and Metal Analytes

									Location	MW-07	MW-07	MW-07	MW-07	MW-10	MW-10	MW-10	MW-10	MW-10	MW-11	MW-11
									Date	11/30/2017	1/8/2018	7/19/2018	9/28/2018	10/26/2017	11/30/2017	1/8/2018	7/18/2018	9/24/2018	10/26/2017	11/30/2017
									Sample ID	MW-7-20171130	MW-7-20180108	MW-7-20180719	MW-07-20180928	MW-10-20171026	MW-10-20171130	MW-10-20180108	MW-10-20180718	MW-10-20180924	MW-11-20171026	MW-11-20171130
									Parent ID											
									Screen Intervals (btoc)											
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**											
Total Petroleum Hydrocarbons																				
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	< 56.9 U	< 31.6	--	< 31.6	< 31.6	< 31.6	< 31.6	--	< 31.6 R	< 31.6	**36.7 J**
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	**536**	**457**	**197 J**	**524**	< 82.5	**146 J**	< 82.5	**138 J**	< 83.3	< 165	**93.1 J**
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	**610**	**761**	**219**	**254**	< 66.0	< 66.0	< 66.0	< 66.0	< 66.7	< 132	< 66.0
Total Diesel+Oil (HalfDL)	µg/L	500								**1150**	**1220**	**416**	**778**	< 33.0	**179**	< 33.0	**171**	< 33.4	< 66.0	**126**
BTEX																				
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	< 0.719	< 0.719	--	< 0.719	< 0.719	< 0.719	< 0.719	--	< 0.719	--	< 0.719
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	< 0.341	< 0.341	--	< 0.341	< 0.341	< 0.341	< 0.341	--	< 0.341	--	< 0.341
Xylene, total	µg/L	1,000	--	--	--	--	--	--	--	--	--	< 1.06	--	--	--	--	< 1.06	--	< 1.06	--
NWEPH																				
C10-C12 Aliphatic Hydrocarbons	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
C10-C12 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
C12-C16 Aliphatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
C12-C16 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
C16-C21 Aliphatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
C16-C21 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
C21-C34 Aliphatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
C21-C34 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--	--	--	--	--
Metals																				
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**1.89 J**	**3.59**	**18.5**	**9.72**	**12.9**	**8.54**	**5.42**	**12.5**	**16.3**	**20.2**	**16.9**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**2.29**	**3.34**	**15.1**	**10.0**	**13.1**	**8.53**	**5.19**	**15.0**	**16.8**	**21.7**	**16.7**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	**3.30 J**	< 0.240	--	--	< 0.240	**0.259 J**	< 0.361 U	--	--	< 0.240	**0.392 J**
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	**4.36 J**	< 1.09 U	--	--	**0.458 J**	**0.260 J**	< 0.397 U	--	--	**8.58**	**0.656 J**

Table 6: Summary of RI Groundwater Monitoring Results - Onsite

TPH, BTEX, NWEPH, and Metal Analytes

									Location	MW-11	MW-11	MW-11	MW-12	MW-12	MW-12	MW-12	MW-12	MW-13	MW-13	MW-13
									Date	1/8/2018	7/17/2018	9/27/2018	10/26/2017	11/29/2017	1/8/2018	7/17/2018	9/27/2018	10/26/2017	11/29/2017	1/8/2018
									Sample ID	MW-11-20180108	MW-11-20180717	MW-11-20180927	MW-12-20171026	MW-12-20171129	MW-12-20180108	MW-12-20180717	MW-12-20180927	MW-13-20171026	MW-13-20171129	MW-13-20180108
									Parent ID											
									Screen Intervals (btoc)											
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**											
Total Petroleum Hydrocarbons																				
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	< 31.6	--	< 31.6 R	< 31.6	< 31.6	< 31.6	--	< 31.6	< 31.6	< 31.6	< 31.6
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	< 82.5	**302**	< 83.3	< 165	**233 J**	**144 J**	**668**	**468**	**236 J**	**154 J**	**117 J**
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	< 66.0	< 66.0	< 66.7	< 132	**102 J**	**102 J**	**233**	**119 J**	**111 J**	< 66.0	< 66.0
Total Diesel+Oil (HalfDL)	µg/L	500								< 33.0	**335**	< 33.4	< 66.0	**335**	**246**	**901**	**587**	**347**	**187**	**150**
BTEX																				
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	< 0.719	--	< 0.719	< 0.719	< 0.719	< 0.719	--	< 0.719	--	< 0.719	< 0.719
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	< 0.341	--	< 0.341	< 0.341	< 0.341	< 0.341	--	< 0.341	--	< 0.341	< 0.341
Xylene, total	µg/L	1,000	--	--	--	--	--	--	--	--	< 1.06	--	--	--	--	< 1.06	--	< 1.06	--	--
NWEPH																				
C10-C12 Aliphatic Hydrocarbons	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C10-C12 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C12-C16 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C16-C21 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C21-C34 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C8-C10 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																				
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**13.2**	**30.7**	**27.5**	**25.3**	**5.37**	**6.30**	**13.3**	**14.6**	**5.28**	**5.56**	**3.77**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**11.9**	**35.5**	**27.5**	**25.5**	**8.35**	**6.37**	**14.3**	**14.9**	**5.45**	**5.34**	**3.97**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	< 0.347 U	--	--	< 0.240	< 0.240	< 0.240	--	--	< 0.240	< 0.240	< 0.240
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	< 0.294 U	--	--	< 0.240	< 0.240	< 0.240	--	--	< 0.240	< 0.240	< 0.240

Table 6: Summary of RI Groundwater Monitoring Results - Onsite

TPH, BTEX, NWEPH, and Metal Analytes

Location										MW-13	MW-13	MW-14	MW-14	MW-14	MW-14	MW-14	MW-14	MW-15	MW-15	MW-15
Date										7/17/2018	9/26/2018	10/26/2017	11/29/2017	1/8/2018	7/17/2018	9/26/2018	9/26/2018	10/26/2017	11/30/2017	1/8/2018
Sample ID										MW-13-20180717	MW-13-20180926	MW-14-20171026	MW-14-20171129	MW-14-20180108	MW-14-20180717	MW-14-20180926	DUP-01-20180926	MW-15-20171026	MW-15-20171130	MW-15-20180108
Parent ID																	MW-14-20180926			
Screen Intervals (btoc)																		4.0-14.0 ft	4.0-14.0 ft	4.0-14.0 ft
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**											
Total Petroleum Hydrocarbons																				
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	--	< 31.6	< 31.6	< 31.6	< 31.6	--	< 31.6 R	< 31.6	< 31.6	**323**	**178**
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	**575**	**155 J**	< 165	**174 J**	**160 J**	**677**	**281 J**	< 250 J	**3,310**	**3,010**	**1,550**
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	**156 J**	< 66.7	< 132	**154 J**	**161 J**	**278**	< 200	< 200 J	**1,990**	**1,900**	**1,250**
Total Diesel+Oil (HalfDL)	µg/L	500								**731**	**188**	< 66.0	**328**	**321**	**955**	381	< 100 J	**5300**	**4910**	**2800**
BTEX																				
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	**0.558 J**
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	--	< 0.719	--	< 0.719	< 0.719	--	< 0.719	< 0.719	< 0.719	< 0.719	< 0.719
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	--	< 0.341	--	< 0.341	< 0.341	--	< 0.341	< 0.341	< 0.341	< 0.341	< 0.341
Xylene, total	µg/L	1,000	--	--	--	--	--	--	--	< 1.06	--	< 1.06	--	--	< 1.06	--	--	--	--	--
NWEPH																				
C10-C12 Aliphatic Hydrocarbons	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
C10-C12 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
C12-C16 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
C12-C16 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
C16-C21 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
C16-C21 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
C21-C34 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
C21-C34 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
C8-C10 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
C8-C10 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--
Metals																				
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**5.59**	**3.21**	**61.0**	**5.78**	**51.7**	**71.5**	**117**	**118**	**11.5**	**19.1**	**27.1**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**3.97**	**3.01**	**57.0**	**23.5**	**47.4**	**82.2**	**123**	**117**	**12.2**	**22.2**	**21.4**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	**0.281 J**	< 0.240	< 0.761 U	--	--	--	**0.347 J**	**4.86 J**	< 0.291 U
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	**0.404 J**	< 1.81 U	< 0.466 U	--	--	--	**1.03 J**	**16.7**	**7.19**

Table 6: Summary of RI Groundwater Monitoring Results - Onsite

TPH, BTEX, NWEPH, and Metal Analytes

									Location	MW-15	MW-15	MW-15	MW-16	MW-16	MW-16	MW-16	MW-16	MW-17	MW-17	MW-17
									Date	1/22/2018	7/17/2018	9/27/2018	10/26/2017	11/30/2017	1/8/2018	7/17/2018	9/26/2018	10/20/2017	10/26/2017	10/26/2017
									Sample ID	MW-15-20180122	MW-15-20180717	MW-15-20180927	MW-16-20171026	MW-16-20171130	MW-16-20180108	MW-16-20180717	MW-16-20180926	2017-B4-20171020	MW-17-20171026	DUP-02-20171026
									Parent ID											MW-17-20171026
									Screen Intervals (btoc)	4.0-14.0 ft	4.0-14.0 ft	4.0-14.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**											
Total Petroleum Hydrocarbons																				
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	--	--	**38.5 J**	**38.2 J**	< 65.5 U	**37.3 J**	--	< 31.6 R	**60.1 J**	< 31.6	< 31.6
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	**2,710**	**883 J**	**1,500**	**414 J**	< 82.5 J	**377**	**872**	< 250	**275 J-**	**482**	**382**
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	**1,170**	**639 J**	**634**	**552**	**195 J-**	**661**	**497**	< 200	**125 J-**	**232**	**214**
Total Diesel+Oil (HalfDL)	µg/L	500								**3880**	**1520**	**2130**	**966**	**236**	**1040**	**1370**	< 100	**400**	**714**	**596**
BTEX																				
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	--	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	**1.46**	< 0.331	< 0.331
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	--	**14.2**	< 0.412	< 0.412	< 0.412	< 0.412	**0.430 J**	**0.442 J**	< 0.412	< 0.412	< 0.412
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	--	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	--	--	< 0.719	< 0.719	< 0.719	< 0.719	--	< 0.719	< 0.719	--	--
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	--	--	< 0.341	< 0.341	< 0.341	< 0.341	--	< 0.341	< 0.341	--	--
Xylene, total	µg/L	1,000	--	--	--	--	--	--	--	--	< 1.06	--	--	--	--	< 1.06	--	--	< 1.06	< 1.06
NWEPH																				
C10-C12 Aliphatic Hydrocarbons	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C10-C12 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C12-C16 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C12-C16 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C16-C21 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C16-C21 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C21-C34 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	**120**	--	--	--	--	--	--
C21-C34 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	**180**	--	--	--	--	--	--
C8-C10 Aliphatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C8-C10 Aromatics	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
Metals																				
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	--	**17.4**	**28.7**	**14.1**	**36.3**	**40.7**	**28.5**	**9.57**	**2.29**	**2.20**	**2.30**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	--	**20.0**	**29.0**	**18.4**	**39.1**	**43.4**	**25.6**	**16.5**	--	**2.15**	**2.16**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	--	**0.525 J**	**4.11 J**	**0.997 J**	--	--	--	**0.858 J**	**0.904 J**
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	--	**1.17 J**	**6.24**	**1.56 J**	--	--	--	**0.853 J**	**0.931 J**

Table 6: Summary of RI Groundwater Monitoring Results - Onsite

TPH, BTEX, NWEPH, and Metal Analytes

Location										**MW-17**	**MW-17**	**MW-17**	**MW-17**	**MW-17**	**MW-17**	**MW-17**
Date										**11/30/2017**	**11/30/2017**	**1/9/2018**	**1/9/2018**	**7/19/2018**	**7/19/2018**	**9/24/2018**
Sample ID										**MW-17-20171130**	**DUP-01-20171130**	**MW-17-20180109**	**DUP-01-20180109**	**MW-17-20180719**	**DUP-01-20180719**	**MW-17-20180924**
Parent ID											**MW-17-20171130**		**MW-17-20180109**		**MW-17-20180719**	
Screen Intervals (btoc)										**3.0-13.0 ft**	**3.0-13.0 ft**	**3.0-13.0 ft**	**3.0-13.0 ft**	**3.0-13.0 ft**	**3.0-13.0 ft**	**3.0-13.0 ft**
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**							
Total Petroleum Hydrocarbons																
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	< 33.6 U	< 31.6	< 31.6	< 31.6	--	--	< 31.6
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	**244 J**	**148 J**	**160 J**	**147 J**	**182 J**	**195 J**	**271**
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	**118 J**	**102 J**	**100 J**	**103 J**	**95.5 J**	**96.7 J**	**87.6 J**
Total Diesel+Oil (HalfDL)	µg/L	500								**362**	**250**	**260**	**250**	**278**	**292**	**359**
BTEX																
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	< 0.719	< 0.719	< 0.719	< 0.719	--	--	< 0.719
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	< 0.341	< 0.341	< 0.341	< 0.341	--	--	< 0.341
Xylene, total	µg/L	1,000	--	--	--	--	--	--	--	--	--	--	--	< 1.06	< 1.06	--
NWEPH																
C10-C12 Aliphatic Hydrocarbons	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C10-C12 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C12-C16 Aliphatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C12-C16 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C16-C21 Aliphatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C16-C21 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C21-C34 Aliphatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C21-C34 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C8-C10 Aliphatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
C8-C10 Aromatics	µg/L	--	--	--	--	--	--	--	--	< 20	--	--	--	--	--	--
Metals																
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**2.35**	--	**1.13 J**	**1.24 J**	**2.29**	**2.20**	**2.49**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**2.30**	--	**1.16 J**	**1.16 J**	**1.95 J**	**1.95 J**	**3.00**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	**2.71 J**	--	< 0.240	**0.576 J**	--	--	--
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	**3.46 J**	--	< 0.318 U	< 1.09 U	--	--	--

Table 6: Summary of RI Groundwater Monitoring Results - Onsite

SVOC or VOC Analytes

									Location	MW-07	MW-07	MW-12	MW-13	MW-15	MW-15	MW-15	MW-16	MW-16	MW-16	MW-17
									Date	11/30/2017	1/8/2018	10/26/2017	10/26/2017	10/26/2017	11/30/2017	1/8/2018	10/26/2017	11/30/2017	1/8/2018	11/30/2017
									Sample ID	MW-7-20171130	MW-7-20180108	MW-12-20171026	MW-13-20171026	MW-15-20171026	MW-15-20171130	MW-15-20180108	MW-16-20171026	MW-16-20171130	MW-16-20180108	MW-17-20171130
									Parent ID											
									Screen Intervals (btoc)					4.0-14.0 ft	4.0-14.0 ft	4.0-14.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-13.0 ft
Chemical	Unit	WA_WG_MTCA_A_THEN_LOWEST_B_1507	WA_WS_MTCA_METHOD_B_CANCER	WA_WS_MTCA_METHOD_B_NONCANCER	WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	WS_HUMAN_HEALTH_SW_CWA304	WS_HUMAN_HEALTH_SW_NTR40CFR131											
Semi Volatile Organic Compounds using SIM																				
1-Methylnaphthalene	µg/L	1.51	--	--	--	--	--	--	--	**0.0380 J**	**0.298**	**0.0110 J**	**0.00916 J**	< 0.0821	**0.0132 J**	**0.0162 J**	--	**0.0407 J**	**0.0348 J**	--
2-Chloronaphthalene	µg/L	640	--	1,040	--	--	--	1,600	--	< 0.00647	< 0.00647	< 0.00647	< 0.00647	< 0.00647	< 0.00647	< 0.00647	--	< 0.00647	< 0.00647	--
2-Methylnaphthalene	µg/L	32	--	--	--	--	--	--	--	**0.0201 J**	**0.0137 J**	**0.0117 J**	**0.00937 J**	< 0.0902	< 0.00902	**0.0111 J**	--	**0.0296 J**	**0.0189 J**	--
Acenaphthene	µg/L	960	--	648	--	--	--	990	--	**0.288**	**0.579**	< 0.0100	< 0.0100	**0.0108 J**	**0.0126 J**	**0.0106 J**	--	< 0.0100	< 0.0100	--
Acenaphthylene	µg/L	--	--	--	--	--	--	--	--	< 0.0120	< 0.0120	< 0.0120	< 0.0120	< 0.0120	< 0.0120	< 0.0120	--	< 0.0120	< 0.0120	--
Anthracene	µg/L	4,800	--	25,900	--	--	--	40,000	110,000	**0.0206 J**	**0.0413 J**	< 0.0140	< 0.0140	**0.0153 J**	< 0.0140	**0.0300 J**	--	< 0.0140	**0.0164 J**	--
Benzo(a)anthracene	µg/L	0.120	0.296	--	--	--	--	0.018	0.0311	< 0.00410	< 0.00410	< 0.00410	< 0.00410	< 0.00410	< 0.00410	< 0.00410	--	< 0.00410	< 0.00410	--
Benzo(a)pyrene	µg/L	0.1	0.0296	--	--	--	--	0.018	0.0311	< 0.0116	< 0.0116	< 0.0116	< 0.0116	< 0.0116	< 0.0116	< 0.0116	--	< 0.0116	< 0.0116	--
Benzo(b)Fluoranthene	µg/L	0.120	0.296	--	--	--	--	0.018	0.0311	< 0.00212	< 0.00234 U	< 0.00212	< 0.00212	< 0.00212	< 0.00212	< 0.0128 U	--	< 0.00212	< 0.00212	--
Benzo(g,h,i)Perylene	µg/L	--	--	--	--	--	--	--	--	< 0.00227	< 0.00473 U	< 0.00227 J	< 0.00227 J	< 0.00227 J	**0.00336 J**	< 0.0120 U	--	< 0.00227	< 0.00459 U	--
Benzo(k)Fluoranthene	µg/L	1.20	2.96	--	--	--	--	0.018	0.0311	< 0.0136	< 0.0136	< 0.0136	< 0.0136	< 0.0136	< 0.0136	< 0.0136	--	< 0.0136	< 0.0136	--
Chrysene	µg/L	12.0	29.6	--	--	--	--	0.018	0.0311	< 0.0108	< 0.0108	< 0.0108	< 0.0108	< 0.0108	< 0.0108	< 0.0108	--	< 0.0108	< 0.0108	--
Dibenz(a,h)Anthracene	µg/L	0.0120	0.0296	--	--	--	--	0.018	0.0311	< 0.00396	**0.00430 J**	< 0.00396 J	< 0.00396 J	< 0.00396 J	< 0.00396	**0.00594 J**	--	< 0.00396	**0.00406 J**	--
Fluoranthene	µg/L	640	--	86.4	--	--	--	140	370	**0.0217 J**	**0.0316 J**	< 0.0157	< 0.0157	< 0.0157	< 0.0157	**0.0203 J**	--	< 0.0157	< 0.0157	--
Fluorene	µg/L	640	--	3,460	--	--	--	5,300	14,000	**0.0626**	**0.140**	< 0.00850	< 0.00850	**0.0105 J**	**0.0163 J**	**0.0322 J**	--	< 0.00850	< 0.00850	--
Indeno(1,2,3-c,d)Pyrene	µg/L	0.120	0.296	--	--	--	--	0.018	0.0311	< 0.0148	< 0.0148	< 0.0148 J	< 0.0148 J	< 0.0148 J	< 0.0148	< 0.0148	--	< 0.0148	< 0.0148	--
Naphthalene	µg/L	160	--	4,710	--	--	--	--	--	< 0.0757 U	< 0.140 U	**0.0254 J**	< 0.0198	**0.265 J**	< 0.0214 U	< 0.0411 U	--	< 0.0677 U	< 0.0577 U	--
Phenanthrene	µg/L	--	--	--	--	--	--	--	--	< 0.00820	**0.00905 J**	< 0.00820	< 0.00820	**0.00987 J**	**0.0265 J**	**0.0180 J**	--	**0.0330 J**	< 0.00820	--
Pyrene	µg/L	480	--	2,590	--	--	--	4,000	11,000	< 0.0117	**0.0148 J**	< 0.0117 J	< 0.0117 J	< 0.0117 J	**0.0135 J**	**0.0179 J**	--	< 0.0117	< 0.0117	--
Total cPAHs (HalfDL)	µg/L	0.1	--	--	--	--	--	--	--	< 0.00778	**0.00803**	< 0.00778	< 0.00778	< 0.00778	< 0.00778	**0.00871**	--	< 0.00778	**0.00799**	--
Total cPAHs (HitsOnly)	µg/L	0.1	--	--	--	--	--	--	--	< 0.00	**0.000430**	< 0.00	< 0.00	< 0.00	< 0.00	**0.000594**	--	< 0.00	**0.000406**	--
Volatile Organic Compounds																				
1,1,1,2-Tetrachloroethane	µg/L	1.68	--	--	--	--	--	--	--	< 0.385	< 0.385	< 0.385	--	< 0.385	< 0.385	< 0.385	< 0.385	< 0.385	< 0.385	--
1,1,1-Trichloroethane	µg/L	200	--	926,000	--	--	--	--	--	< 0.319	< 0.319	< 0.319	--	< 0.319	< 0.319	< 0.319	< 0.319	< 0.319	< 0.319	--
1,1,2,2-Tetrachloroethane	µg/L	0.219	6.48	10,400	--	--	--	4	11	< 0.130	< 0.130	< 0.130	--	< 0.130	< 0.130	< 0.130	< 0.130	< 0.130	< 0.130	--
1,1,2-Trichloroethane	µg/L	0.768	25.3	2,300	--	--	--	16	42	< 0.383	< 0.383	< 0.383	--	< 0.383	< 0.383	< 0.383	< 0.383	< 0.383	< 0.383	--
1,1-Dichloroethane	µg/L	7.68	--	--	--	--	--	--	--	< 0.259	< 0.259	< 0.259	--	< 0.259	< 0.259	< 0.259	< 0.259	< 0.259	< 0.259	--
1,1-Dichloroethene	µg/L	400	--	23,100	--	--	--	7,100	3.2	< 0.398	< 0.398	< 0.398	--	< 0.398	< 0.398	< 0.398	< 0.398	< 0.398	< 0.398	--
1,1-Dichloropropene	µg/L	--	--	--	--	--	--	--	--	< 0.352	< 0.352	< 0.352	--	< 0.352	< 0.352	< 0.352	< 0.352	< 0.352	< 0.352	--
1,2,3-Trichlorobenzene	µg/L	--	--	--	--	--	--	--	--	< 0.230	< 0.230	< 0.230	--	< 0.230	< 0.230	< 0.230	< 0.230	< 0.230	< 0.230	--
1,2,3-Trichloropropane	µg/L	0.00146	--	--	--	--	--	--	--	*< 0.807*	*< 0.807*	*< 0.807*	--	*< 0.807*	*< 0.807*	*< 0.807*	*< 0.807*	*< 0.807*	*< 0.807*	--
1,2,3-Trimethylbenzene	µg/L	--	--	--	--	--	--	--	--	< 0.321	< 0.321	< 0.321	--	< 0.321	< 0.321	< 0.321	< 0.321	< 0.321	< 0.321	--
1,2,4-Trichlorobenzene	µg/L	1.51	2.03	236	--	--	--	70	--	< 0.355	< 0.355	< 0.355	--	< 0.355	< 0.355	< 0.355	< 0.355	< 0.355	< 0.355	--
1,2,4-Trimethylbenzene	µg/L	--	--	--	--	--	--	--	--	< 0.373	< 0.373	< 0.373	--	< 0.373	< 0.373	< 0.373	< 0.373	< 0.373	< 0.373	--
1,2-Dibromo-3-Chloropropane (DBCP)	µg/L	0.0547	--	--	--	--	--	--	--	*< 1.33*	*< 1.33*	*< 1.33*	--	*< 1.33*	*< 1.33*	*< 1.33*	*< 1.33*	*< 1.33*	*< 1.33*	--
1,2-Dibromoethane (EDB)	µg/L	0.01	--	--	--	--	--	--	--	*< 0.381*	*< 0.381*	*< 0.381*	--	*< 0.381*	*< 0.381*	*< 0.381*	*< 0.381*	*< 0.381*	*< 0.381*	--
1,2-Dichlorobenzene	µg/L	720	--	4,170	--	--	--	1,300	17,000	< 0.349	< 0.349	< 0.349	--	< 0.349	< 0.349	< 0.349	< 0.349	< 0.349	< 0.349	--
1,2-Dichloroethane (EDC)	µg/L	0.481	59.4	13,000	--	--	--	37	99	< 0.361	< 0.361	< 0.361	--	< 0.361	< 0.361	< 0.361	< 0.361	< 0.361	< 0.361	--
1,2-Dichloropropane	µg/L	1.22	43.9	56,900	--	--	--	15	--	< 0.306	< 0.306	< 0.306	--	< 0.306	< 0.306	< 0.306	< 0.306	< 0.306	< 0.306	--
1,3,5-Trimethylbenzene	µg/L	80	--	--	--	--	--	--	--	< 0.387	< 0.387	< 0.387	--	< 0.387	< 0.387	< 0.387	< 0.387	< 0.387	< 0.387	--
1,3-Dichlorobenzene	µg/L	--	--	--	--	--	--	960	2,600	< 0.220	< 0.220	< 0.220	--	< 0.220	< 0.220	< 0.220	< 0.220	< 0.220	< 0.220	--
1,3-Dichloropropane	µg/L	--	--	--	--	--	--	--	--	< 0.366	< 0.366	< 0.366	--	< 0.366	< 0.366	< 0.366	< 0.366	< 0.366	< 0.366	--
1,4-Dichlorobenzene	µg/L	8.10	21.4	3,240	--	--	--	190	2,600	< 0.274	< 0.274	< 0.274	--	< 0.274	< 0.274	< 0.274	< 0.274	< 0.274	< 0.274	--
2,2-Dichloropropane	µg/L	--	--	--	--	--	--	--	--	< 0.321	< 0.321	< 0.321	--	< 0.321	< 0.321	< 0.321	< 0.321	< 0.321	< 0.321	--
2-Chlorotoluene	µg/L	160	--	--	--	--	--	--	--	< 0.375	< 0.375	< 0.375	--	< 0.375	< 0.375	< 0.375	< 0.375	< 0.375	< 0.375	--
4-Chlorotoluene	µg/L	--	--	--	--	--	--	--	--	< 0.351	< 0.351	< 0.351	--	< 0.351	< 0.351	< 0.351	< 0.351	< 0.351	< 0.351	--
Acetone	µg/L	7,200	--	--	--	--	--	--	--	< 10.0	< 10.0	< 10.0	--	< 10.0	< 10.0	< 10.0	**36.7 J**	< 10.0	< 10.0	--
Acrolein	µg/L	4	--	--	--	--	--	290	780	*< 8.87*	*< 8.87*	*< 8.87*	--	*< 8.87*	*< 8.87*	*< 8.87*	*< 8.87*	*< 8.87*	*< 8.87*	--
Acrylonitrile	µg/L	0.0810	0.400	3,460	--	--	--	0.25	0.66	*< 1.87*	*< 1.87*	*< 1.87*	--	*< 1.87*	*< 1.87*	*< 1.87*	*< 1.87*	*< 1.87*	*< 1.87*	--
Bromobenzene	µg/L	--	--	--	--	--	--	--	--	< 0.352	< 0.352	< 0.352	--	< 0.352	< 0.352	< 0.352	< 0.352	< 0.352	< 0.352	--
Bromodichloromethane	µg/L	0.706	27.5	13,600	--	--	--	17	22	< 0.380	< 0.380	< 0.380	--	< 0.380	< 0.380	< 0.380	< 0.380	< 0.380	< 0.380	--
Bromoform	µg/L	5.54	216	13,600	--	--	--	140	360	< 0.469	< 0.469	< 0.469	--	< 0.469	< 0.469	< 0.469	< 0.469	< 0.469	< 0.469	--
Bromomethane	µg/L	11.2	--	955	--	--	--	1,500	4,000	< 0.866	< 0.866	< 0.866	--	< 0.866	< 0.866	< 0.866	< 0.866	< 0.866	< 0.866	--
Carbon Tetrachloride	µg/L	0.625	4.87	546	--	--	--	1.6	4.4	< 0.379	< 0.379	< 0.379	--	< 0.379	< 0.379	< 0.379	< 0.379	< 0.379	< 0.379	--
Chlorobenzene	µg/L	160	--	5,190	--	--	--	1,600	21,000	< 0.348	< 0.348	< 0.348	--	< 0.348	< 0.348	< 0.348	< 0.348	< 0.348	< 0.348	--
Chloroethane	µg/L	--	--	--	--	--	--	--	--	< 0.453	< 0.453	< 0.453	--	< 0.453	< 0.453	< 0.453	< 0.453	< 0.453	< 0.453	--
Chloroform	µg/L	1.41	55.0	6,820	--	--	--	470	470	< 0.324	< 0.324	< 0.324	--	< 0.324	< 0.324	< 0.324	< 0.324	< 0.324	< 0.324	--
Chloromethane	µg/L	--	--	--	--	--	--	--	--	< 0.276	< 0.276	< 0.276	--	< 0.276	< 0.276	< 0.276	< 0.276	< 0.276	< 0.276	--
cis-1,2-Dichloroethene	µg/L	16	--	--	--	--	--	--	--	< 0.260	< 0.260	< 0.260	--	< 0.260	< 0.260	< 0.260	< 0.260	< 0.260	< 0.260	--
cis-1,3-Dichloropropene	µg/L	0.438	34.1	40,900	--	--	--	21	1,700	< 0.418	< 0.418	< 0.418	--	< 0.418	< 0.418	< 0.418	< 0.418	< 0.418	< 0.418	--
Cymene (p-Isopropyltoluene)	µg/L	--	--	--	--	--	--	--	--	< 0.350	< 0.350	< 0.350	--	< 0.350	**46.4**	**49.8**	< 0.350	< 0.350	**0.934 J**	--
Dibromochloromethane	µg/L	0.521	20.3	13,600	--	--	--	13	34	< 0.327	< 0.327	< 0.327	--	< 0.327	< 0.327	< 0.327	< 0.327	< 0.327	< 0.327	--

Table 6: Summary of RI Groundwater Monitoring Results - Onsite

SVOC or VOC Analytes

Location										MW-07	MW-07	MW-12	MW-13	MW-15	MW-15	MW-15	MW-16	MW-16	MW-16	MW-17
Date										11/30/2017	1/8/2018	10/26/2017	10/26/2017	10/26/2017	11/30/2017	1/8/2018	10/26/2017	11/30/2017	1/8/2018	11/30/2017
Sample ID										MW-7-20171130	MW-7-20180108	MW-12-20171026	MW-13-20171026	MW-15-20171026	MW-15-20171130	MW-15-20180108	MW-16-20171026	MW-16-20171130	MW-16-20180108	MW-17-20171130
Parent ID																				
Screen Intervals (btoc)														4.0-14.0 ft	4.0-14.0 ft	4.0-14.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-13.0 ft
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**											
Dibromomethane	µg/L	80	--	--	--	--	--	--	--	< 0.346	< 0.346	< 0.346	--	< 0.346	< 0.346	< 0.346	< 0.346	< 0.346	< 0.346	--
Dichlorodifluoromethane	µg/L	1,600	--	--	--	--	--	--	--	< 0.551	< 0.551	< 0.551	--	< 0.551	< 0.551	< 0.551	< 0.551	< 0.551	< 0.551	--
Di-Isopropyl ether (DIPE)	µg/L	--	--	--	--	--	--	--	--	< 0.320	< 0.320	< 0.320	--	< 0.320	< 0.320	< 0.320	< 0.320	< 0.320	< 0.320	--
Freon 113	µg/L	240,000	--	--	--	--	--	--	--	< 0.303	< 0.303	< 0.303	--	< 0.303	< 0.303	< 0.303	< 0.303	< 0.303	< 0.303	--
Hexachlorobutadiene	µg/L	0.561	29.7	926	--	--	--	18	50	< 0.256	< 0.256	< 0.256	--	< 0.256	< 0.256	< 0.256	< 0.256	< 0.256	< 0.256	--
Isopropylbenzene	µg/L	800	--	--	--	--	--	--	--	< 0.326	< 0.326	< 0.326	--	< 0.326	< 0.326	< 0.326	< 0.326	< 0.326	< 0.326	--
Methyl ethyl ketone (2-Butanone)	µg/L	4,800	--	--	--	--	--	--	--	< 3.93	< 3.93	< 3.93	--	< 3.93	< 3.93	< 3.93	**8.49 J**	< 3.93	< 3.93	--
Methyl Isobutyl Ketone (MIBK)	µg/L	640	--	--	--	--	--	--	--	< 2.14	< 2.14	< 2.14	--	< 2.14	< 2.14	< 2.14	< 2.14	< 2.14	< 2.14	--
Methyl tert-Butyl ether	µg/L	20	--	--	--	--	--	--	--	< 0.367	< 0.367	< 0.367	--	< 0.367	< 0.367	< 0.367	< 0.367	< 0.367	< 0.367	--
Methylene Chloride	µg/L	5	3,600	17,300	--	--	--	590	1,600	< 1.00	< 1.00	< 1.00	--	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	--
Naphthalene	µg/L	160	--	4,710	--	--	--	--	--	< 1.00	< 1.00	< 1.00	--	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	--
n-Butylbenzene	µg/L	400	--	--	--	--	--	--	--	< 0.361	< 0.361	< 0.361	--	< 0.361	< 0.361	< 0.361	< 0.361	< 0.361	< 0.361	--
n-Propylbenzene	µg/L	800	--	--	--	--	--	--	--	< 0.349	< 0.349	< 0.349	--	< 0.349	< 0.349	< 0.349	< 0.349	< 0.349	< 0.349	--
Sec-Butylbenzene	µg/L	800	--	--	--	--	--	--	--	< 0.365	< 0.365	< 0.365	--	< 0.365	< 0.365	< 0.365	< 0.365	< 0.365	< 0.365	--
Styrene	µg/L	1,600	--	--	--	--	--	--	--	< 0.307	< 0.307	< 0.307	--	< 0.307	< 0.307	< 0.307	< 0.307	< 0.307	< 0.307	--
Tert-Butylbenzene	µg/L	800	--	--	--	--	--	--	--	< 0.399	< 0.399	< 0.399	--	< 0.399	< 0.399	< 0.399	< 0.399	< 0.399	< 0.399	--
Tetrachloroethene (PCE)	µg/L	5	99.6	502	--	--	--	3.3	8.85	< 0.372	< 0.372	< 0.372	--	< 0.372	< 0.372	< 0.372	< 0.372	< 0.372	< 0.372	--
trans-1,2-Dichloroethene	µg/L	160	--	32,400	--	--	--	10,000	--	< 0.396	< 0.396	< 0.396	--	< 0.396	< 0.396	< 0.396	< 0.396	< 0.396	< 0.396	--
trans-1,3-Dichloropropene	µg/L	0.438	34.1	40,900	--	--	--	21	1,700	< 0.419	< 0.419	< 0.419	--	< 0.419	< 0.419	< 0.419	< 0.419	< 0.419	< 0.419	--
Trichloroethene (TCE)	µg/L	5	12.8	118	--	--	--	30	81	< 0.398	< 0.398	< 0.398	--	< 0.398	< 0.398	< 0.398	< 0.398	< 0.398	< 0.398	--
Trichlorofluoromethane	µg/L	2,400	--	--	--	--	--	--	--	< 1.20	< 1.20	< 1.20	--	< 1.20	< 1.20	< 1.20	< 1.20	< 1.20	< 1.20	--
Vinyl Chloride	µg/L	0.2	3.7	6,480	--	--	--	2.4	525	*< 0.259*	*< 0.259*	*< 0.259*	--	*< 0.259*	*< 0.259*	*< 0.259*	*< 0.259*	*< 0.259*	*< 0.259*	--

Screening Levels

500	Screening level used for comparison to groundwater results based on MTCA Method A/B groundwater CULs or surface water ARARs (typically, the most protective value; refer to Section 5.1 of the RI). Cleanup Standard and ARAR sources are listed below.
624	Detected concentrations above the screening level are shaded yellow and bolded.
< --	Non-detect values above the screening level are shaded gray and italicized.
71.3 J	Detected concentrations at or above the method detection limit are shown in bold.
NOTE:	**Screening levels for RI purposes may differ from the Proposed Cleanup Levels presented in Section 8 of the RI and summarized in Table 11.**

Abbreviations and Symbols

" - -" denotes not measured, not available, or not applicable.
" < " denotes not detected at or above the indicated method detection limit.
"DUP" denotes a field duplicate sample. Primary sample ID is provided beneath the duplicate sample ID.
"J" indicates an estimated concentration based on either the being less than the laboratory reporting limit or data validation findings.
"U" denotes that the value has been qualified as undetected (at the detected concentration if above the method detection limit) due to blank contamination.
Total Diesel+Oil (HalfDL) = Sum of diesel- and oil-range organics. If diesel- or oil-range organics was not detected, a value of one half the method detection limit was used in the calculation unless all results were not detected then half the lowest method detection limit was used.
Total cPAHs (HitsOnly) = Possible total cPAHs are based on the relative toxicity of each cPAH to benzo(a)pyrene and were calculated by multiplying the individual detected cPAH concentrations by a toxicity equivalency factor (TEF) and summing the adjusted concentrations.
Total cPAHs (HalfDL) = Possible total cPAHs are based on the relative toxicity of each cPAH to benzo(a)pyrene and were calculated by multiplying the individual detected cPAH concentrations by a toxicity equivalency factor (TEF) and summing the adjusted concentrations.
If an individual cPAH was not detected, a value of one half the method detection limit was used in the calculation.
TEF Values = Benzo(a)anthracene = 0.1, Benzo(a)pyrene = 1, Benzo(b)Fluoranthene = 0.1, Benzo(k)Fluoranthene = 0.1, Chrysene = 0.01, Dibenz(a,h)Anthracene = 0.1, and Indeno(1,2,3-c,d)Pyrene = 0.1
btoc = below top of casing.
ft = feet
µg/L = micrograms per liter

Methods

Samples analyzed for gasoline-range organics (GRO) using Northwest Total Petroleum Hydrocarbon (NWTPH)-Gx and diesel- and oil-range organics (DRO and C
Samples analyzed for Extractable Petroleum Hydrocarbons (EPH) using Northwest EPH.
Samples analyzed for metals using EPA Method 6020. Samples MW-7-20171130, MW-15-20171130, MW-16-20171130, and MW-17-20171130 analyzed for Lead by EPA Method 6010.
Samples analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and Volatile Organic Compounds using EPA Method 8260.
Samples analyzed for Semivolatile Organic Compound using EPA Method 8270 with selective ion monitoring (SIM).

Cleanup Standards and ARARs:

WA_WG_MTCA_A_THEN_LOWEST_B_1507	MTCA Method A/B Groundwater Cleanup Levels from CLARC database spreadsheet marked July 2015
WA_WS_MTCA_METHOD_B_CANCER	MTCA Surface Water Method B Cancer
WA_WS_MTCA_METHOD_B_NONCANCER	MTCA Surface Water Method B Non cancer
WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	Surface Water Aquatic Life Marine/Chronic CWA 304
WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	Surface Water Aquatic Life Marine/Chronic NTR 40 CFR 131
WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	Surface Water Aquatic Life Marine/Chronic 173-201A WAC
WS_HUMAN_HEALTH_SW_CWA304	Surface Water Human Health Marine Waters CWA 304
WS_HUMAN_HEALTH_SW_NTR40CFR131	Surface Water Human Health Marine Waters NTR 40 CFR 131

Table 7: Summary of RI Groundwater Monitoring Results - Background

									Location	EP-01	EP-01	EP-01	EP-01	EP-01	GM-02	GM-02	GM-03	GM-03	MWBG-01	MWBG-01	MWBG-01	MWBG-01	MWBG-01
									Date	10/25/2017	12/1/2017	1/8/2018	7/18/2018	9/27/2018	7/18/2018	9/27/2018	7/18/2018	9/28/2018	10/25/2017	12/1/2017	1/8/2018	7/18/2018	9/27/2018
									Sample ID	EP-1-20171025	EP-1-20171201	EP-01-20180108	EP-01-20180718	EP-01-20180927	GM-02-20180718	GM-02-20180927	GM-03-20180718	GM-03-20180928	MWBG-1-20171025	MWBG-1-20171201	MWBG-1-20180108	MWBG-1-20180718	MWBG-01-20180927
									Parent ID														
									Screen Intervals (btoc)										4.0-13.0 ft	4.0-13.0 ft	4.0-13.0 ft	4.0-13.0 ft	4.0-13.0 ft
Chemical	Unit	WA_WG_MTCA_A_THEN_LOWEST_B_1507	WA_WS_MTCA_METHOD_B_CANCER	WA_WS_MTCA_METHOD_B_NONCANCER	WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	WS_HUMAN_HEALTH_SW_CWA304	WS_HUMAN_HEALTH_SW_NTR40CFR131															
Total Petroleum Hydrocarbons																							
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	--	--	--	--	< 31.6	--	< 31.6	--	**35.3 J**	--	--	--	--	< 31.6
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	--	--	**132 J**	**85.8 J**	**323**	< 82.5	**305**	**123 J**	**482**	--	--	**115 J**	**89.9 J**	**434**
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	--	--	**109 J**	< 66.0	< 66.7	< 66.0	< 66.7	**89.0 J**	**192 J**	--	--	< 66.0	< 66.0	< 66.7
Total Diesel+Oil (HalfDL)	µg/L	500								--	--	**241**	**119**	**356**	< 33.0	**338**	**212**	**674**	--	--	**148**	**123**	**467**
Volatile Organic Compounds																							
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																							
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	--	--	**1.77 J**	**6.16**	**1.36 J**	**4.81**	**5.93**	**1.96 J**	**2.48**	**3.83**	**2.15**	< 0.250	< 0.250	**0.419 J**	< 0.250	**1.32 J**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	--	--	**23.0**	**6.00**	**7.85**	**7.64**	**10.0**	**3.45**	**3.04**	**4.73**	**2.34**	< 0.250	**0.290 J**	**0.436 J**	**0.307 J**	**1.32 J**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7: Summary of RI Groundwater Monitoring Results - Background

									Location	MWBG-02	MWBG-02	MWBG-02	MWBG-02	MWBG-02	MWBG-03	MWBG-03	MWBG-03	MWBG-03	MWBG-03	MWBG-04	MWBG-04	MWBG-04
									Date	10/25/2017	11/30/2017	1/8/2018	7/19/2018	9/24/2018	10/25/2017	11/30/2017	1/9/2018	7/18/2018	9/27/2018	10/25/2017	11/30/2017	1/9/2018
									Sample ID	MWBG-2-20171025	MWBG-2-20171130	MWBG-2-20180108	MWBG-2-20180719	MWBG-02-20180924	MWBG-3-20171025	MWBG-3-20171130	MWBG-3-20180109	MWBG-3-20180718	MWBG-03-20180927	MWBG-4-20171025	MWBG-4-20171130	MWBG-4-20180109
									Parent ID													
									Screen Intervals (btoc)	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**													
Total Petroleum Hydrocarbons																						
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	--	< 36.9 U	--	--	< 31.6	--	--	--	--	< 31.6	--	--	--
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	--	**1,150**	**727**	**311 J**	**664**	--	--	**1,190**	**1,960**	**1,220**	--	--	**1,700**
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	--	**575**	**582**	**253 J**	**274**	--	--	**743**	**1,040**	**666**	--	--	**1,250**
Total Diesel+Oil (HalfDL)	µg/L	500								--	**1730**	**1310**	**564**	**938**	--	--	**1930**	**3000**	**1890**	--	--	**2950**
Volatile Organic Compounds																						
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	--	< 0.331	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	--	< 0.384	--	--	--	--	--	--	--	--	--	--	--
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	--	< 0.412	--	--	--	--	--	--	--	--	--	--	--
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	--	< 0.719	--	--	--	--	--	--	--	--	--	--	--
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	--	< 0.341	--	--	--	--	--	--	--	--	--	--	--
Metals																						
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	--	--	**2.90**	**9.99 J**	**8.39**	**65.4**	**33.4**	**4.70**	**3.36**	**1.75 J**	**9.84**	**5.66**	**12.2**	**23.9**	**10.8**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	--	--	**3.16**	**11.5**	**7.96**	**67.9**	**37.3**	**4.77**	**3.64**	**1.84 J**	**12.4**	**7.01**	**21.3**	**23.5**	**11.2**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7: Summary of RI Groundwater Monitoring Results - Background

Location										MWBG-04	MWBG-04	MWBG-05	MWBG-05	MWBG-05	MWBG-05	MWBG-05	MWBG-06	MWBG-06	MWBG-06	MWBG-06	MWBG-06
Date										7/19/2018	9/27/2018	10/26/2017	11/30/2017	1/9/2018	7/19/2018	9/27/2018	10/25/2017	11/30/2017	1/9/2018	7/18/2018	9/24/2018
Sample ID										MWBG-4-20180719	MWBG-04-20180927	MWBG-5-20171026	MWBG-5-20171130	MWBG-5-20180109	MWBG-5-20180719	MWBG-05-20180927	MWBG-6-20171025	MWBG-6-20171130	MWBG-6-20180109	MWBG-6-20180718	MWBG-06-20180924
Parent ID																					
Screen Intervals (btoc)										3.0-13.0 ft	3.0-13.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-8.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**												
Total Petroleum Hydrocarbons																					
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	--	< 31.6	--	--	--	--	< 31.6	--	--	--	--	< 316
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	**417**	**2,990**	--	--	**315**	**658**	**1,260**	--	--	**648**	**116 J**	**474**
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	**311**	**1,060**	--	--	**147 J**	**774**	**962**	--	--	**525**	< 66.0	**343**
Total Diesel+Oil (HalfDL)	µg/L	500								**728**	**4050**	--	--	**462**	**1430**	**2220**	--	--	**1170**	**149**	**817**
Volatile Organic Compounds																					
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																					
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	--	--	**9.40**	**11.0**	**21.1**	**2.13**	**1.91 J**	**27.1**	**25.4**	**15.4**	**27.0**	**13.9**	**45.1**	**24.7**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	--	--	**8.57**	**17.7**	**22.0**	**3.43**	**3.20**	**32.0**	**24.9**	**17.4**	**26.9**	**13.9**	**52.1**	**24.9**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7: Summary of RI Groundwater Monitoring Results - Background

									Location	MWBG-06	MWBG-06	MWBG-06	MWBG-07	MWBG-07	MWBG-07	MWBG-07	MWBG-07	MWBG-08	MWBG-08	MWBG-09	MWBG-09	MWBG-10	MWBG-10
									Date	10/25/2017	11/30/2017	1/9/2018	10/25/2017	12/1/2017	1/9/2018	7/16/2018	9/24/2018	7/18/2018	9/28/2018	7/18/2018	9/28/2018	7/16/2018	9/24/2018
									Sample ID	DUP-01-20171025	DUP-02-20171130	DUP-02-20180109	MWBG-7-20171025	MWBG-7-20171201	MWBG-7-20180109	MWBG-7-20180716	MWBG-07-20180924	MWBG-8-20180718	MWBG-08-20180928	MWBG-9-20180718	MWBG-09-20180928	MWBG-10-20180716	MWBG-10-20180924
									Parent ID	MWBG-6-20171025	MWBG-6-20171130	MWBG-6-20180109											
									Screen Intervals (btoc)	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft						
Chemical	**Unit**	**WA_WG_MTCA_A_THEN_LOWEST_B_1507**	**WA_WS_MTCA_METHOD_B_CANCER**	**WA_WS_MTCA_METHOD_B_NONCANCER**	**WS_AQUATIC_LIFE_SW_CHRONIC_CWA304**	**WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131**	**WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A**	**WS_HUMAN_HEALTH_SW_CWA304**	**WS_HUMAN_HEALTH_SW_NTR40CFR131**														
Total Petroleum Hydrocarbons																							
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 31.6	--	< 31.6	--	**70.2 J**	--	< 31.6
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	--	--	**516**	--	--	< 82.5	**111 J**	< 83.3	**112 J**	< 83.3	**806**	**1,270**	**245 J**	< 83.3
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	--	--	**450**	--	--	< 66.0	< 66.0	< 66.7	< 71.3	< 66.7	**1,010**	**1,210**	**164 J**	< 66.7
Total Diesel+Oil (HalfDL)	µg/L	500								--	--	**966**	--	--	< 33.0	**144**	< 33.4	**148**	< 33.4	**1820**	**2480**	**409**	< 33.4
Volatile Organic Compounds																							
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																							
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	--	--	**14.9**	**27.7**	**14.7**	**0.602 J**	**0.619 J**	**1.65 J**	**1.70 J**	**1.68 J**	**4.83**	**4.40**	**7.87**	**9.14**	**13.5**	**12.4**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	--	--	**17.2**	**27.3**	**13.7**	**0.521 J**	**1.77 J**	**3.80**	**1.44 J**	**2.57**	**5.03**	**4.80**	**7.75**	**9.67**	**18.3**	**11.2**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	**2.18**	--	--	--	--	--	--	--	--	--	--	--
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	--	--	**2.42**	--	--	--	--	--	--	--	--	--	--	--

Screening Levels

500	Screening level used for comparison to groundwater results based on MTCA Method A/B groundwater CULs or surface water ARARs
624	Detected concentrations above the screening level are shaded yellow and bolded.
< --	Non-detect values above the screening level are shaded gray and italicized.
71.3 J	Detected concentrations at or above the method detection limit are shown in bold.
NOTE:	**Screening levels for RI purposes may differ from the Proposed Cleanup Levels presented in Section 8 of the RI and summarized in Table 11.**

Abbreviations and Symbols

" - -" denotes not measured, not available, or not applicable.
" < " denotes not detected at or above the indicated method detection limit.
"DUP" denotes a field duplicate sample. Primary sample ID is provided beneath the duplicate sample ID.
"J" indicates an estimated concentration based on either the being less than the laboratory reporting limit or data validation findings.
btoc = below top of casing.
ft = feet
µg/L = micrograms per liter
Total Diesel+Oil (HalfDL) = Sum of diesel- and oil-range organics. If diesel- or oil-range organics was not detected, a value of one half the method detection limit was used in the calculation unless all results were not detected then half the lowest method detection limit was used.

Methods

Samples analyzed for gasoline-range organics (GRO) using Northwest Total Petroleum Hydrocarbon (NWTPH)-Gx and diesel- and oil-range organics (DRO and ORO) using NWTPH-Dx (without silica gel cleanup).
Samples analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and Volatile Organic Compounds using EPA Method 8260.
Samples analyzed for metals using EPA Method 6020. Samples MWBG-2-20171130 and MWBG-5-20180719 were analyzed for metals using EPA Method 6010.

Cleanup Standards and ARARs:

WA_WG_MTCA_A_THEN_LOWEST_B_1507	MTCA Method A/B Groundwate	MTCA Method A/B Groundwater Cleanup Levels from CLARC database spreadsheet marked July 2015
WA_WS_MTCA_METHOD_B_CANCER	MTCA Surface Water Method B	MTCA Surface Water Method B Cancer
WA_WS_MTCA_METHOD_B_NONCANCER	MTCA Surface Water Method B	MTCA Surface Water Method B Non cancer
WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	Surface Water Aquatic Life Mari	Surface Water Aquatic Life Marine/Chronic CWA 304
WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	Surface Water Aquatic Life Mari	Surface Water Aquatic Life Marine/Chronic NTR 40 CFR 131
WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	Surface Water Aquatic Life Mari	Surface Water Aquatic Life Marine/Chronic 173-201A WAC
WS_HUMAN_HEALTH_SW_CWA304	Surface Water Human Health M	Surface Water Human Health Marine Waters CWA 304
WS_HUMAN_HEALTH_SW_NTR40CFR131	Surface Water Human Health M	Surface Water Human Health Marine Waters NTR 40 CFR 131

Table 8: Summary of Groundwater Natural Attenuation Parameter Results

		Groundwater-Background					Groundwater-Onsite											
Location		MWBG-03	MWBG-04	MWBG-04	MWBG-05	MWBG-07	MW-01R	MW-01R	MW-06	MW-06	MW-06	MW-07	MW-07	MW-07	MW-10	MW-10	MW-11	MW-12
Date		1/30/2018	1/22/2018	7/19/2018	10/26/2017	7/16/2018	1/8/2018	7/17/2018	1/8/2018	1/22/2018	7/18/2018	10/26/2017	11/30/2017	1/8/2018	10/26/2017	1/8/2018	1/8/2018	1/8/2018
Sample ID		MWBG-3(20180130)	MWBG-4-20180122	MWBG-4-20180719	MWBG-5-20171026	MWBG-7-20180716	MW-1R-20180108	MW-01R-20180717	MW-6-20180108	MW-6-20180122	MW-6-20180718	MW-7-20171026	MW-7-20171130	MW-7-20180108	MW-10-20171026	MW-10-20180108	MW-11-20180108	MW-12-20180108
Parent ID																		
Screen Intervals (btoc)		3.0-13.0 ft	3.0-13.0 ft	3.0-13.0 ft	3.0-8.0 ft	3.0-13.0 ft												
Chemical	Unit																	
Field Parameters																		
Depth to Water	ft	3.57	4.5	4.6	2.77	-0.827	1.2	2.26	0.95	1.2	1.81	4.25	3.19	2.89	1.5	0.56	0.72	2.6
Oxidation-Reduction Potential	mV	-41.7	-16	-13.2	-97.3	20.2	-52.8	-48.1	-52.2	-72.5	-118.4	-83.7	-27.2	-25.7	-148	-48.7	-122.2	-46.7
Oxygen, Dissolved	mg/L	0.44	0.47	0.32	0.18	0.32	0.31	0.63	0.5	0.37	0.12	0.17	0.53	0.32	0.18	0.61	0.26	0.31
pH	SU	7.26	6.4	6.41	6.66	6.53	6.63	6.63	6.78	6.81	6.9	6.75	6.97	6.8	6.88	6.83	7.17	6.73
Specific Conductivity	µS/cm	469	1492	1152	1489	182	2867	1095	2193	2271	2516	1053	925	1215	4215	3123	3131	3315
Temperature	deg c	9.43	9.81	17.2	15.88	20.31	9.71	20.15	10.21	10.02	23.96	17.7	12.97	10.84	16.11	8.58	8.37	11.51
Turbidity	ntu	1.12	2.61	34.87	5.01	14.69	0.92	2.06	1	11.22	11.72	14.2	5.69	14.81	0.58	0.6	0.93	-46.7
Anions																		
Chloride (as Cl)	µg/L	**6,320**		**21,900**		**5,470**		**2,110,000**			**235,000**							
Fluoride	µg/L			**663**		**12.3 J**		**984**			< 9.90							
Nitrogen, Nitrate (as NO3)	µg/L				< 22.7							< 22.7	**1,320**		< 22.7			
Nitrogen, Nitrate-Nitrite	µg/L	< 19.7		< 19.7		**1,510**		< 19.7			< 19.7							
Phosphorus, Total	µg/L			**435**		*< 64.7 U*		**3,880**			**2,330**							
Sulfate (as SO4)	µg/L	**29,200**		**816 J**	**106,000**	**15,700**		< 77.4			< 77.4	**124,000**	**29,100**		< 77.4			
GenChem																		
Alkalinity, total (as CaCO3)	µg/L	**185,000**		**543,000**		**51,600**		**868,000**			**680,000**							
Bicarbonate	µg/L	**185,000**		**543,000**		**51,600**		**868,000**			**680,000**							
Carbonate	µg/L	< 2,710		< 2,710		< 2,710		< 2,710			< 2,710							
Lime (As Calcium Carbonate)	µg/L	**186,000**		**484,000**		**62,200**		**895,000**			**540,000**							
Metals																		
Calcium, Total	µg/L	**66,500**		**74,400**		**10,200**		**82,400**			**96,700**							
Iron, Dissolved	µg/L				**69,900**		**9,130**		**25,400**			**16,600**	**1,660**	**6,720**	**40,500**	**43,300**	**15,500**	**8,360**
Iron, Total	µg/L	**322**		**23,400**		**98.3 J**		**12,800**			**21,300**							
Magnesium, Total	µg/L	**5,980**		**66,000**		**8,420**		**196,000**			**63,600**							
Manganese, Dissolved	µg/L				**6,510**		**508**		**1,920**			**1,290**	**684**	**1,570**	**1,230**	**1,660**	**1,750**	**1,600**
Manganese, Total	µg/L			**1,220**		**6.70**		**703**			**1,370**							
Potassium, Total	µg/L	**3,860**		**10,900**		**1,540**		**63,500**			**40,900**							
Sodium, Total	µg/L	**16,000**		**42,800**		**8,200**		**1,430,000**			**318,000**							
Metal Species																		
Arsenic, Pentavalent	µg/L		< 0.028 J							**22.7**								
Arsenic, Trivalent	µg/L		**0.72**							< 0.044								

Table 8: Summary of Groundwater Natural Attenuation Parameter Results

		Groundwater-Onsite															
	Location	**MW-12**	**MW-13**	**MW-13**	**MW-13**	**MW-14**	**MW-14**	**MW-14**	**MW-14**	**MW-15**	**MW-15**	**MW-15**	**MW-16**	**MW-16**	**MW-16**	**MW-17**	**MW-17**
	Date	**2/1/2018**	**1/8/2018**	**2/1/2018**	**7/17/2018**	**1/8/2018**	**1/22/2018**	**1/30/2018**	**7/17/2018**	**11/30/2017**	**1/8/2018**	**7/17/2018**	**10/26/2017**	**11/30/2017**	**1/8/2018**	**11/30/2017**	**7/19/2018**
	Sample ID	**MW-12-20180201**	**MW-13-20180108**	**MW-13-20180201**	**MW-13-20180717**	**MW-14-20180108**	**MW-14-20180122**	**MW-14(20180130)**	**MW-14-20180717**	**MW-15-20171130**	**MW-15-20180108**	**MW-15-20180717**	**MW-16-20171026**	**MW-16-20171130**	**MW-16-20180108**	**MW-17-20171130**	**MW-17-20180719**
	Parent ID																
	Screen Intervals (btoc)									**4.0-14.0 ft**	**4.0-14.0 ft**	**4.0-14.0 ft**	**3.0-8.0 ft**	**3.0-8.0 ft**	**3.0-8.0 ft**	**3.0-13.0 ft**	**3.0-13.0 ft**
Chemical	**Unit**																
Field Parameters																	
Depth to Water	ft	2.9	2.66	3.18	4.4	3.57	5.09	9.21	5.74	4.35	3.11	4.4	3.09	2.6	3.12	1.96	2.56
Oxidation-Reduction Potential	mV	-45.5	-19.2	-21.7	-38.9	-27.5	-14.1	-36	-59.4	-77.9	-31.9	-47.8	27.9	-82.9	-86.4	-20.2	-41.3
Oxygen, Dissolved	mg/L	0.29	0.22	0.3	0.37	0.5	0.32	0.62	0.32	0.25	0.67	0.7	0.55	0.57	0.55	0.23	0.14
pH	SU	6.76	6.34	6.61	6.37	6.33	6.26	6.35	6.35	6.67	6.64	6.39	6.61	6.63	6.7	6.23	6.52
Specific Conductivity	µS/cm	2891	6.95	5224	5509	4990	5187	8663	7633	1260	1262	4953	2820	4.805	4314	1080	1450
Temperature	deg c	10.27	12.37	9.94	16.9	11.56	10.44	11.8	17.54	11.5	10.03	15.53	15.29	10.78	9.6	12.4	19.37
Turbidity	ntu	10.23	1.34	26.52	0.66	1.17	1.98	53.23	4.55	5.62	5.44	23.52	4.05	0	2.11	3.61	3.08
Anions																	
Chloride (as Cl)	µg/L				**1,450,000**			**1,940,000**	**1,890,000**			**186,000**					**110,000**
Fluoride	µg/L				**355**				**156**			< 9.90					< 9.90
Nitrogen, Nitrate (as NO3)	µg/L									< 22.7			< 22.7	< 22.7		< 22.7	
Nitrogen, Nitrate-Nitrite	µg/L				< 19.7			< 19.7	**1,280**			< 19.7					< 19.7
Phosphorus, Total	µg/L				**1,020**				**874**			**479**					**471**
Sulfate (as SO4)	µg/L				**98,000**			**43,900**	**54,800**	**62,100**		< 77.4	**86,500**	**48,700**		**680 J**	**382 J**
GenChem																	
Alkalinity, total (as CaCO3)	µg/L				**296,000**			**806,000**	**660,000**			**721,000**					**266,000**
Bicarbonate	µg/L				**296,000**			**806,000**	**660,000**			**721,000**					**266,000**
Carbonate	µg/L				< 2,710			< 2,710	< 2,710			< 2,710					< 2,710
Lime (As Calcium Carbonate)	µg/L	**736,000**		**439,000**	**530,000**			**810,000**	**790,000**			**645,000**					**248,000**
Metals																	
Calcium, Total	µg/L				**44,700**			**66,400**	**64,000**			**158,000**					**55,500**
Iron, Dissolved	µg/L		**14,200**			**62,600**				**20,300**	**17,700**		**8,180**	**40,900**	**51,400**	**27,300**	
Iron, Total	µg/L				**18,600**			**18,200**	**113,000**			**43,700**					**23,900**
Magnesium, Total	µg/L				**93,700**			**155,000**	**157,000**			**54,200**					**18,100**
Manganese, Dissolved	µg/L		**572**			**1,760**				**6,080**	**5,180**		**3,460**	**5,820**	**9,900**	**1,920**	
Manganese, Total	µg/L				**661**				**3,510**			**8,960**					**1,610**
Potassium, Total	µg/L				**32,500**			**63,300**	**51,400**			**14,900**					**10,800**
Sodium, Total	µg/L				**757,000**			**1,350,000**	**1,230,000**			**131,000**					**86,700**
Metal Species																	
Arsenic, Pentavalent	µg/L						**6.6**										
Arsenic, Trivalent	µg/L						**20.7**										

6,320 Detected concentrations at or above the method detection limit are shown in bold.

Abbreviations and Symbols

" - -" denotes not measured, not available, or not applicable.
" < " denotes not detected at or above the indicated method detection limit.
"DUP" denotes a field duplicate sample. Primary sample ID is provided beneath the duplicate sample ID.
"J" indicates an estimated concentration based on either the being less than the laboratory reporting limit or data validation findings.
"U" denotes that the value has been qualified as undetected (at the detected concentration if above the method detection limit) due to blank contamination.
btoc = below top of casing.
ft = feet
µg/L = micrograms per liter

Methods

Samples analyzed for Anions by EPA Method 9056 with the exception of Nitrogen, Nitrate-Nitrite analyzed by EPA Method 353.2 and Phosphorus, Total analyzed by EPA Method 365.4.
Samples analyzed for Lime (As Calcium Carbonate) by EPA Method 130.1.
Samples analyzed for Alkalinity, total (as CaCO3), Bicarbonate, and Carbonate by Standard Method 2320B.
Samples analyzed for Metals by EPA Method 6020 with the exception of Iron and Manganese for samples MW-7-20171130, MW-15-20171130, MW-16-20171130, and MW-17-20171130 analyzed by EPA Method 6010.

Table 9: Summary of Surface Water Monitoring Results

Location										CB-01	CB-01	CB-01	DITCH-01	DITCH-01	DITCH-01	DITCH-01	DITCH-02	DITCH-02	DITCH-02	DITCH-02	OF-01	OF-01	OF-01	OF-01	OF-01
Date										11/21/2017	12/20/2017	1/9/2018	12/20/2017	1/9/2018	7/17/2018	9/21/2018	12/20/2017	1/9/2018	7/17/2018	9/21/2018	11/21/2017	12/20/2017	1/9/2018	12/20/2017	1/9/2018
Sample ID										CB-01-20171121	CB-01-20171220	CB-01-20180109	DITCH-01-20171220	DITCH-01-20180109	DITCH-01-20180717	DITCH-01-20180921	DITCH-02-20171220	DITCH-02-20180109	DITCH-02-20180717	DITCH-02-20180921	OF-01-20171121	OF-01-20171220	OF-01-20180109	DUP-01-20171220	DUP-03-20180109
Parent ID																								OF-01-	OF-01-
Screen Intervals (btoc)																									
Chemical	Unit	WA_WG_MTCA_A_THEN_LOWEST_B_1507	WA_WS_MTCA_METHOD_B_CANCER	WA_WS_MTCA_METHOD_B_NONCANCER	WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	WS_HUMAN_HEALTH_SW_CWA304	WS_HUMAN_HEALTH_SW_NTR40CFR131																
Field Parameters																									
Oxidation-Reduction Potential	mV	--	--	--	--	--	--	--	--	290.8	141.7	--	110.3	-26.2	-7.8	26.7	142.3	41.9	-21.9	-29.5	163.2	101.3	44.5	--	--
Oxygen, Dissolved	mg/L	--	--	--	--	--	--	--	--	9.77	2.08	--	4.5	0.36	1.03	1.37	4.27	2.8	1.97	1.35	8.13	1.9	2.96	--	--
pH	SU	--	--	--	--	--	--	--	--	6.72	6.87	--	6.69	6.44	6.43	6.07	6.78	6.59	6.65	6.81	6.38	6.66	6.54	--	--
Specific Conductivity	μS/cm	--	--	--	--	--	--	--	--	47	547	--	469	566	672	890	316	322	676	1397	139	0.764	709	--	--
Temperature	deg c	--	--	--	--	--	--	--	--	6.76	7.98	--	6.91	7.42	16.9	16.41	6.6	7.22	18.88	17.23	7.35	7.81	7.53	--	--
Turbidity	ntu	--	--	--	--	--	--	--	--	5.98	4.17	--	2.72	clear	10.83	57.82	12.41	brown	36.29	83.58	6.2	3.31	clear	--	--
Total Petroleum Hydrocarbons																									
Gasoline-Range Organics	μg/L	800	--	--	--	--	--	--	--	**41.2 J**	**635**	< 31.6	**43.1 J**	< 31.6	< 31.6	< 31.6	< 31.6	< 31.6	< 31.6	< 31.6	**39.3 J**	**127**	< 31.6	< 31.6	< 31.6
Oil-Range Organics	μg/L	500	--	--	--	--	--	--	--	**968**	**714**	**809**	**617**	**489**	**1,130**	**899**	**355**	**339**	**1,210**	**413 J**	**609**	**974**	**838**	**988**	**775**
Diesel-Range Organics	μg/L	500	--	--	--	--	--	--	--	**346**	**483**	**503**	**327**	**256**	**585**	**538**	**230**	**228**	**599**	**157 J**	**339**	**626**	**668**	**660**	**616**
Volatile Organic Compounds																									
Benzene	μg/L	5	22.7	1,990	--	--	--	51	71	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331	--	< 0.331	< 0.331	< 0.331	--	< 0.331	< 0.331	< 0.331	< 0.331	< 0.331
Ethylbenzene	μg/L	700	--	6,820	--	--	--	2,100	29,000	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384	--	< 0.384	< 0.384	< 0.384	--	< 0.384	< 0.384	< 0.384	< 0.384	< 0.384
Toluene	μg/L	1,000	--	18,900	--	--	--	15,000	200,000	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412	**2.64**	--	< 0.412	< 0.412	**1.91**	--	< 0.412	< 0.412	< 0.412	< 0.412	< 0.412
Xylene, m,p-	μg/L	--	--	--	--	--	--	--	--	< 0.719	< 0.719	< 0.719	< 0.719	< 0.719	--	--	< 0.719	< 0.719	--	--	< 0.719	< 0.719	< 0.719	< 0.719	< 0.719
Xylene, o-	μg/L	1,600	--	--	--	--	--	--	--	< 0.341	< 0.341	< 0.341	< 0.341	< 0.341	--	--	< 0.341	< 0.341	--	--	< 0.341	< 0.341	< 0.341	< 0.341	< 0.341
Xylene, total	μg/L	1,000	--	--	--	--	--	--	--	--	--	--	--	--	< 1.06	--	--	--	< 1.06	--	--	--	--	--	--
Semi-Volatile Organic Compounds using SIM																									
1-Methylnaphthalene	μg/L	1.51	--	--	--	--	--	--	--	**0.0232 J**	**0.507**	**0.0488 J**	< 0.0164	< 0.00821	--	--	**0.0290 J**	< 0.00821	--	--	**0.0218 J**	**0.190 J**	**0.0915 J**	**0.191 J**	**0.0953 J**
2-Chloronaphthalene	μg/L	640	--	1,040	--	--	--	1,600	--	< 0.00647	< 0.00647	< 0.00647	< 0.0129	< 0.00647	--	--	< 0.0129	< 0.00647	--	--	< 0.00647	< 0.00647	< 0.00647	< 0.00647	< 0.00647
2-Methylnaphthalene	μg/L	32	--	--	--	--	--	--	--	**0.0238 J**	**0.502**	**0.0463 J**	< 0.0180	< 0.00902	--	--	**0.0186 J**	< 0.00902	--	--	**0.0253 J**	**0.212 J**	**0.0882 J**	**0.207 J**	**0.0920 J**
Acenaphthene	μg/L	960	--	648	--	--	--	990	--	**0.0379 J**	**1.36**	**0.334**	< 0.0200	< 0.0100	--	--	**0.0213 J**	< 0.0100	--	--	**0.0734**	**0.431**	**0.342**	**0.438**	**0.345**
Acenaphthylene	μg/L	--	--	--	--	--	--	--	--	< 0.0120	**0.0190 J**	< 0.0120	< 0.0240	< 0.0120	--	--	< 0.0240	< 0.0120	--	--	< 0.0120	< 0.0120	< 0.0120	< 0.0120	< 0.0120
Anthracene	μg/L	4,800	--	25,900	--	--	--	40,000	110,000	< 0.0140	**0.0766**	**0.0268 J**	< 0.0280	< 0.0140	--	--	< 0.0280	< 0.0140	--	--	< 0.0140	**0.0303 J**	**0.0295 J**	**0.0305 J**	**0.0291 J**
Benzo(a)anthracene	μg/L	0.120	0.296	--	--	--	--	0.018	0.0311	< 0.00410	< 0.00410	**0.0155 J**	< 0.00820	< 0.00410	--	--	< 0.00820	< 0.00410	--	--	< 0.00410	< 0.00410	< 0.00410	< 0.00410	< 0.00410
Benzo(a)pyrene	μg/L	0.1	0.0296	--	--	--	--	0.018	0.0311	< 0.0116	< 0.0116	< 0.0116	*< 0.0232*	< 0.0116	--	--	*< 0.0232*	< 0.0116	--	--	< 0.0116	< 0.0116	< 0.0116	< 0.0116	< 0.0116
Benzo(b)Fluoranthene	μg/L	0.120	0.296	--	--	--	--	0.018	0.0311	< 0.00212	< 0.00252 U	< 0.0113 U	< 0.00424	< 0.00212	--	--	< 0.00638 U	< 0.00431 U	--	--	< 0.00212	< 0.00277 U	< 0.00523 U	< 0.00240 U	< 0.00608 U
Benzo(g,h,i)Perylene	μg/L	--	--	--	--	--	--	--	--	**0.0281 J**	< 0.00337 U	< 0.0138 U	< 0.00454	< 0.00518 U	--	--	< 0.00464 U	< 0.00827 U	--	--	**0.00300 J**	< 0.00227	< 0.00621 U	< 0.00241 U	< 0.00583 U
Benzo(k)Fluoranthene	μg/L	1.20	2.96	--	--	--	--	0.018	0.0311	< 0.0136	< 0.0136	< 0.0136	< 0.0272	< 0.0136	--	--	< 0.0272	< 0.0136	`	--	< 0.0136	< 0.0136	< 0.0136	< 0.0136	< 0.0136
Chrysene	μg/L	12.0	29.6	--	--	--	--	0.018	0.0311	< 0.0108	< 0.0108	< 0.0108	< 0.0216	< 0.0108	--	--	< 0.0216	< 0.0108	--	--	< 0.0108	< 0.0108	< 0.0108	< 0.0108	< 0.0108
Dibenz(a,h)Anthracene	μg/L	0.0120	0.0296	--	--	--	--	0.018	0.0311	< 0.00396	< 0.00396	**0.00506 J**	< 0.00792	**0.00396 J**	--	--	< 0.00792	**0.00418 J**	--	--	< 0.00396	< 0.00396	**0.00396 J**	< 0.00396	**0.00442 J**
Fluoranthene	μg/L	640	--	86.4	--	--	--	140	370	**0.0303 J**	**0.119**	**0.0382 J**	< 0.0314	< 0.0157	--	--	< 0.0314	< 0.0157	--	--	< 0.0157	**0.0401 J**	**0.0300 J**	**0.0428 J**	**0.0344 J**
Fluorene	μg/L	640	--	3,460	--	--	--	5,300	14,000	**0.0336 J**	**0.758**	**0.180**	< 0.0170	< 0.00850	--	--	< 0.0170	< 0.00850	--	--	**0.0459 J**	**0.248**	**0.188**	**0.255**	**0.191**
Indeno(1,2,3-c,d)Pyrene	μg/L	0.120	0.296	--	--	--	--	0.018	0.0311	< 0.0148	< 0.0148	< 0.0148	*< 0.0296*	< 0.0148	--	--	*< 0.0296*	< 0.0148	--	--	< 0.0148	< 0.0148	< 0.0148	< 0.0148	< 0.0148
Naphthalene	μg/L	160	--	4,710	--	--	--	--	--	0.117 U	**0.136 J**	< 0.0542 U	< 0.0396	< 0.0390 U	--	--	< 0.0396	< 0.0456 U	--	--	0.193 U	**0.0629 J**	< 0.0594 U	**0.0689 J**	< 0.0588 U
Phenanthrene	μg/L	--	--	--	--	--	--	--	--	**0.0259 J**	**0.0351 J**	**0.0148 J**	< 0.0164	< 0.00820	--	--	< 0.0164	< 0.00820	--	--	**0.0233 J**	**0.0195 J**	**0.0232 J**	**0.0201 J**	**0.0226 J**
Pyrene	μg/L	480	--	2,590	--	--	--	4,000	11,000	**0.0384 J**	**0.0622**	**0.0325 J**	< 0.0234	< 0.0117	--	--	< 0.0234	< 0.0117	--	--	< 0.0117	**0.0239 J**	**0.0205 J**	**0.0242 J**	**0.0219 J**
Total cPAHs (HalfDL)		0.1	--	--	--	--	--	--	--	< 0.00778	< 0.00780	**0.00990**	< 0.0156	**0.00798**	--	--	< 0.0157	**0.00811**	--	--	< 0.00778	< 0.00782	**0.00814**	< 0.00780	**0.00823**
Total cPAHs (HitsOnly)		0.1	--	--	--	--	--	--	--	< 0.00	< 0.00	**0.00206**	< 0.00	**0.000396**	--	--	< 0.00	**0.000418**	--	--	< 0.00	< 0.00	**0.000396**	< 0.00	**0.000442**
Metals																									
Arsenic, Dissolved	μg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**0.359 J**	**6.00**	**3.92**	**1.19 J**	**1.08 J**	**5.61**	**6.16**	**1.30 J**	**1.20 J**	**4.91**	**16.9**	**0.603 J**	**4.00**	**3.43**	**3.85**	**3.16**
Arsenic, Total	μg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**0.629 J**	**7.23**	**9.86**	**1.32 J**	**2.57**	**5.36**	**7.68 J**	**1.61 J**	**1.68 J**	**11.7**	**15.0 J**	**0.694 J**	**4.72**	**3.46**	**4.59**	**3.58**
Lead, Dissolved	μg/L	15	--	--	8.1	8.1	8.1	--	--	< 0.240	**4.47 J**	< 0.623 U	**2.10 J**	< 0.478 U	**0.310 J**	--	**2.10 J**	< 0.240	< 0.240	--	< 0.240	**4.65 J**	< 0.418 U	**2.86 J**	< 0.361 U
Lead, Total	μg/L	15	--	--	8.1	8.1	8.1	--	--	1.38 U	< 1.90	**13.2**	**4.83 J**	< 0.389 U	< 0.276 U	--	< 1.90	< 0.779 U	**1.66 J**	--	1.43 U	< 1.90	< 0.906 U	< 1.90	< 0.547 U

Table 9: Summary of Surface Water Monitoring Results

									Location	OF-02	OF-02	OF-02	SLOUGH-HT	SLOUGH-HT-LT	SLOUGH-LT	SLOUGH-LT	SLOUGH-01	SLOUGH-01	SLOUGH-02	SLOUGH-02	SLOUGH-DOWNSTREAM	SLOUGH-DOWNSTREAM	SLOUGH-UPSTREAM	SLOUGH-UPSTREAM
									Date	11/21/2017	12/20/2017	1/9/2018	1/9/2018	9/21/2018	1/9/2018	9/21/2018	1/9/2018	9/21/2018	1/12/2018	9/21/2018	1/30/2018	9/21/2018	1/30/2018	9/21/2018
									Sample ID	OF-02-20171121	OF-02-20171220	OF-02-20180109	SLOUGH(HT)-20180109	SLOUGH-HT-LT-20180921	SLOUGH(LT)-20180109	SLOUGH-LT-20180921	SLOUGH-01-20180109	SLOUGH-01-20180921	SLOUGH-2-20180112	SLOUGH-02-20180921	SLOUGH(DOWNSTREAM)	SLOUGH-DOWNSTREAM-20180921	SLOUGH(UPSTREAM)	SLOUGH-UPSTREAM-20180921
									Parent ID															
									Screen Intervals (btoc)															
Chemical	Unit	WA_WG_MTCA_A_THEN_LOWEST_B_1507	WA_WS_MTCA_METHOD_B_CANCER	WA_WS_MTCA_METHOD_B_NONCANCER	WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	WS_HUMAN_HEALTH_SW_CWA304	WS_HUMAN_HEALTH_SW_NTR40CFR131															
Field Parameters																								
Oxidation-Reduction Potential	mV	--	--	--	--	--	--	--	--	150.9	160.6	26.7	--	--	--	--	--	--	--	--	203.4	246.5	215.5	--
Oxygen, Dissolved	mg/L	--	--	--	--	--	--	--	--	10.23	6.98	8.05	--	--	--	--	--	--	--	--	10.94	4.99	11.38	--
pH	SU	--	--	--	--	--	--	--	--	6.82	6.88	6.68	--	--	--	--	--	--	--	--	6.73	5.6	6.73	--
Specific Conductivity	µS/cm	--	--	--	--	--	--	--	--	95	681	557	--	--	--	--	--	--	--	--	1067	2196	1173	--
Temperature	deg c	--	--	--	--	--	--	--	--	6.65	5.9	7.25	--	--	--	--	--	--	--	--	6.05	15.26	6.07	--
Turbidity	ntu	--	--	--	--	--	--	--	--	72.13	17.24	brown	--	--	--	--	--	--	--	--	--	9.73	--	--
Total Petroleum Hydrocarbons																								
Gasoline-Range Organics	µg/L	800	--	--	--	--	--	--	--	< 31.6	**45.7 J**	**45.7 J**	--	--	--	--	< 31.6	--	< 31.6	--	--	--	--	--
Oil-Range Organics	µg/L	500	--	--	--	--	--	--	--	**659**	**339**	**544**	--	--	--	--	**138 J**	--	**2,110**	--	--	--	--	--
Diesel-Range Organics	µg/L	500	--	--	--	--	--	--	--	**181 J**	**249**	**319**	--	--	--	--	**90.2 J**	--	**555**	--	--	--	--	--
Volatile Organic Compounds																								
Benzene	µg/L	5	22.7	1,990	--	--	--	51	71	< 0.331	< 0.331	< 0.331	--	--	--	--	< 0.331	--	--	--	--	--	--	--
Ethylbenzene	µg/L	700	--	6,820	--	--	--	2,100	29,000	< 0.384	< 0.384	< 0.384	--	--	--	--	< 0.384	--	--	--	--	--	--	--
Toluene	µg/L	1,000	--	18,900	--	--	--	15,000	200,000	< 0.412	< 0.412	< 0.412	--	--	--	--	< 0.412	--	--	--	--	--	--	--
Xylene, m,p-	µg/L	--	--	--	--	--	--	--	--	< 0.719	< 0.719	< 0.719	--	--	--	--	< 0.719	--	--	--	--	--	--	--
Xylene, o-	µg/L	1,600	--	--	--	--	--	--	--	< 0.341	< 0.341	< 0.341	--	--	--	--	< 0.341	--	--	--	--	--	--	--
Xylene, total	µg/L	1,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi-Volatile Organic Compounds using SIM																								
1-Methylnaphthalene	µg/L	1.51	--	--	--	--	--	--	--	**0.00994 J**	< 0.0164	**0.0131 J**	--	--	--	--	< 0.00821	--	--	--	--	--	--	--
2-Chloronaphthalene	µg/L	640	--	1,040	--	--	--	1,600	--	< 0.00647	< 0.0129	< 0.00647	--	--	--	--	< 0.00647	--	--	--	--	--	--	--
2-Methylnaphthalene	µg/L	32	--	--	--	--	--	--	--	**0.0108 J**	< 0.0180	< 0.00902	--	--	--	--	< 0.00902	--	--	--	--	--	--	--
Acenaphthene	µg/L	960	--	648	--	--	--	990	--	< 0.0100	**0.0200 J**	**0.0274 J**	--	--	--	--	< 0.0100	--	--	--	--	--	--	--
Acenaphthylene	µg/L	--	--	--	--	--	--	--	--	< 0.0120	< 0.0240	< 0.0120	--	--	--	--	< 0.0120	--	--	--	--	--	--	--
Anthracene	µg/L	4,800	--	25,900	--	--	--	40,000	110,000	< 0.0140	< 0.0280	< 0.0140	--	--	--	--	< 0.0140	--	--	--	--	--	--	--
Benzo(a)anthracene	µg/L	0.120	0.296	--	--	--	--	0.018	0.0311	< 0.00410	< 0.00820	< 0.00410	--	--	--	--	**0.00843 J**	--	--	--	--	--	--	--
Benzo(a)pyrene	µg/L	0.1	0.0296	--	--	--	--	0.018	0.0311	< 0.0116	*< 0.0232*	< 0.0116	--	--	--	--	< 0.0116	--	--	--	--	--	--	--
Benzo(b)Fluoranthene	µg/L	0.120	0.296	--	--	--	--	0.018	0.0311	< 0.00212	< 0.00424	< 0.00543 U	--	--	--	--	< 0.00489 U	--	--	--	--	--	--	--
Benzo(g,h,i)Perylene	µg/L	--	--	--	--	--	--	--	--	**0.00492 J**	< 0.00454	< 0.0103 U	--	--	--	--	< 0.00924 U	--	--	--	--	--	--	--
Benzo(k)Fluoranthene	µg/L	1.20	2.96	--	--	--	--	0.018	0.0311	< 0.0136	< 0.0272	< 0.0136	--	--	--	--	< 0.0136	--	--	--	--	--	--	--
Chrysene	µg/L	12.0	29.6	--	--	--	--	0.018	0.0311	< 0.0108	< 0.0216	< 0.0108	--	--	--	--	< 0.0108	--	--	--	--	--	--	--
Dibenz(a,h)Anthracene	µg/L	0.0120	0.0296	--	--	--	--	0.018	0.0311	< 0.00396	< 0.00792	**0.00452 J**	--	--	--	--	**0.00415 J**	--	--	--	--	--	--	--
Fluoranthene	µg/L	640	--	86.4	--	--	--	140	370	< 0.0157	< 0.0314	< 0.0157	--	--	--	--	< 0.0157	--	--	--	--	--	--	--
Fluorene	µg/L	640	--	3,460	--	--	--	5,300	14,000	< 0.00850	< 0.0170	**0.00984 J**	--	--	--	--	< 0.00850	--	--	--	--	--	--	--
Indeno(1,2,3-c,d)Pyrene	µg/L	0.120	0.296	--	--	--	--	0.018	0.0311	< 0.0148	*< 0.0296*	< 0.0148	--	--	--	--	< 0.0148	--	--	--	--	--	--	--
Naphthalene	µg/L	160	--	4,710	--	--	--	--	--	0.104 U	< 0.0396	< 0.0712 U	--	--	--	--	< 0.0522 U	--	--	--	--	--	--	--
Phenanthrene	µg/L	--	--	--	--	--	--	--	--	**0.0109 J**	< 0.0164	**0.0146 J**	--	--	--	--	**0.0158 J**	--	--	--	--	--	--	--
Pyrene	µg/L	480	--	2,590	--	--	--	4,000	11,000	< 0.0117	< 0.0234	< 0.0117	--	--	--	--	**0.0154 J**	--	--	--	--	--	--	--
Total cPAHs (HalfDL)		0.1	--	--	--	--	--	--	--	< 0.00778	< 0.0156	**0.00820**	--	--	--	--	**0.00878**	--	--	--	--	--	--	--
Total cPAHs (HitsOnly)		0.1	--	--	--	--	--	--	--	< 0.00	< 0.00	**0.000452**	--	--	--	--	**0.00126**	--	--	--	--	--	--	--
Metals																								
Arsenic, Dissolved	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**1.15 J**	**5.66**	**5.62**	**0.961 J**	**1.76 J**	**1.21 J**	**1.81 J**	**0.457 J**	**3.10**	**4.33**	**4.03**	**0.892 J**	**1.79 J**	**0.665 J**	**2.97**
Arsenic, Total	µg/L	5	0.0982	17.7	36	36	36	0.14	0.14	**2.08**	**6.93**	**7.31**	**36.4**	**3.38 J**	**12.0**	*< 2.50*	**0.464 J**	**2.77 J**	**7.91**	--	**1.13 J**	*< 2.50*	**1.03 J**	**3.70 J**
Lead, Dissolved	µg/L	15	--	--	8.1	8.1	8.1	--	--	**0.381 J**	**2.88 J**	**2.04**	< 1.20	--	< 0.597 U	--	< 0.380 U	--	< 0.715 U	--	--	--	--	--
Lead, Total	µg/L	15	--	--	8.1	8.1	8.1	--	--	**2.69 J**	< 1.90	**4.92**	**55.7**	--	**9.65**	--	< 1.19 U	--	**2.30**	--	--	--	--	--

Screening Levels

500 (typically the most protective value; refer to Section 5.1 of the RI) or MTCA groundwater CULs. Cleanup Standard and ARAR sources are listed below.

13.2 Detected concentrations above the screening level are shaded yellow and bolded.

< -- Non-detect values above the screening level are shaded gray and italicized.

71.3 J Detected concentrations at or above the method detection limit are shown in bold.

NOTE: Screening levels for RI purposes may differ from the Proposed Cleanup Levels presented in Section 8 of the RI and summarized in Table 11.

Abbreviations and Symbols

" - -" denotes not measured, not available, or not applicable.
" < " denotes not detected at or above the indicated method detection limit.
"DUP" denotes a field duplicate sample. Primary sample ID is provided beneath the duplicate sample ID.
"J" indicates an estimated concentration based on either the being less than the laboratory reporting limit or data validation findings.
"U" denotes that the value has been qualified as undetected (at the detected concentration if above the method detection limit) due to blank contamina
Total cPAHs (HitsOnly) = Possible total cPAHs are based on the relative toxicity of each cPAH to benzo(a)pyrene and were calculated by multiplying the individual detected cPAH concentrations by a toxicity equivalency factor (TEF) and summing the adjusted concentrations.
Total cPAHs (HalfDL) = Possible total cPAHs are based on the relative toxicity of each cPAH to benzo(a)pyrene and were calculated by multiplying the individual detected cPAH concentrations by a toxicity equivalency factor (TEF) and summing the adjusted concentrations. If an individual cPAH was not detected, a value of one half the method detection limit was used in the calculation.
TEF Values = Benzo(a)anthracene = 0.1, Benzo(a)pyrene = 1, Benzo(b)Fluoranthene = 0.1, Benzo(k)Fluoranthene = 0.1, Chrysene = 0.01, Dibenz(a,h)Anthracene = 0.1, and Indeno(1,2,3-c,d)Pyrene = 0.1
ft = feet
µg/L = micrograms per liter

Methods

Samples analyzed for gasoline-range organics (GRO) using Northwest Total Petroleum Hydrocarbon (NWTPH)-Gx and diesel- and oil-range organics (DRO and ORO) using NWTPH-Dx (without silica gel cleanup).
Samples analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and Volatile Organic Compounds using EPA Method 8260.
Samples analyzed for metals using EPA Method 6010 or 6020.
Samples analyzed for Semivolatile Organic Compound using EPA Method 8270 with selective ion monitoring (SIM). In cases where SIM was not used it is noted in the notes row.

Cleanup Standards and ARARs:

WA_WG_MTCA_A_THEN_LOWEST_B_1507	MTCA Method A/B Groundwater Cleanup Levels from CLARC database spreadsheet marked July 2015
WA_WS_MTCA_METHOD_B_CANCER	MTCA Surface Water Method B Cancer
WA_WS_MTCA_METHOD_B_NONCANCER	MTCA Surface Water Method B Non cancer
WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	Surface Water Aquatic Life Marine/Chronic CWA 304
WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	Surface Water Aquatic Life Marine/Chronic NTR 40 CFR 131
WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	
WS_HUMAN_HEALTH_SW_CWA304	
WS_HUMAN_HEALTH_SW_NTR40CFR131	

Table 10: Results of Slug Test Data Analyses

Monitoring Well Designation	Falling Head Test: Hydraulic Conductivity (ft/day)			Rising Head Test: Hydraulic Conductivity (ft/day)			Mean Hydraulic Conductivity (K) (ft/day)	Mean Hydraulic Conductivity (K) (cm/s)
	Hvorslev-1(a)	Bouwer-Rice(b)	KGS(c)	Hvorslev-1	Bouwer-Rice	KGS		
MW-1R	8.20E-02	--(d)	7.60E-02	6.40E-02	--	5.30E-02	0.068	2.4E-05
MWBG-6	--	--	--	2.50E-02	1.70E-02	2.20E-02	0.021	7.4E-06
MWBG-6	--	--	--	2.20E-02	1.50E-02	1.70E-02	0.018	6.3E-06
MW-16	9.01E-04	5.73E-04	4.17E-05	--	--	--	0.000	9.8E-08
MW-12	1.90E-02	1.40E-02	7.80E-03	--	--	--	0.01	4.5E-06
MW-13	8.10E-03	5.30E-03	5.40E-03	1.50E-02	9.80E-03	1.00E-02	0.01	2.9E-06
						Ditch Cond.	**0.009**	**3.2E-06**
						Slough Cond.	**0.010**	**3.6E-06**
						Site Average:	**0.01**	**3.4E-06**

Notes:

(a) AQTESOLV analysis. Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, U.S. Army, Vicksburg, Mississippi, pp. 1-50.

(b) AQTESOLV analysis. Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, vol. 12, no. 3, pp. 423-428.

(c) AQTESOLV analysis. Hyder, Z, J.J. Butler, Jr., C.D. McElwee and W. Liu, 1994. Slug tests in partially penetrating wells, Water Resources Research, vol. 30, no. 11, pp. 2945-2957.

(d) -- = Slug test not performed or analysis not included due to non-ideal fit to data set

ft/day = feet per day
cm/s = centimeters per second

Table 11: Summary of Cleanup Levels and ARARs for Groundwater and Surface Water

Chemical	cas_rn	Groundwater Cleanup Standards[(a)]	Surface Water Cleanup Standards and ARARs[(a)]							ProUCL Background Threshold Values[(b)]	Units	Proposed Cleanup Standard[(c)]
		WA_WG_MTCA_A_THEN_LOWEST_B_1507	WA_WS_MTCA_METHOD_B_CANCER	WA_WS_MTCA_METHOD_B_NONCANCER	WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	WS_HUMAN_HEALTH_SW_CWA304	WS_HUMAN_HEALTH_SW_NTR40CFR131			
Metals												
Arsenic	7440-38-2	5	0.0982	17.7	36	36	36	0.14	0.14	31.89	µg/L	31.89
Lead	7439-92-1	15			8.1	8.1	8.1				µg/L	8.1
Total Petroleum Hydrocarbons												
Gasoline-Range Organics	GRONWTPH	800									µg/L	800
Oil-Range Organics	RRO	500									µg/L	500
Diesel-Range Organics	68334-30-5	500									µg/L	500
Semi Volatile Organic Compounds using SIM												
1-Methylnaphthalene	90-12-0	1.51									µg/L	1.51
2-Chloronaphthalene	91-58-7	640		1,040				1,600			µg/L	1040
2-Methylnaphthalene	91-57-6	32									µg/L	32
Acenaphthene	83-32-9	960		648				990			µg/L	648
Acenaphthylene	208-96-8										µg/L	NA
Anthracene	120-12-7	4,800		25,900				40,000	110,000		µg/L	25900
Benzo(a)anthracene	56-55-3	0.120	0.296					0.018	0.0311		µg/L	0.018
Benzo(a)pyrene	50-32-8	0.1	0.0296					0.018	0.0311		µg/L	0.018
Benzo(b)Fluoranthene	205-99-2	0.120	0.296					0.018	0.0311		µg/L	0.018
Benzo(g,h,i)Perylene	191-24-2										µg/L	NA
Benzo(k)Fluoranthene	207-08-9	1.20	2.96					0.018	0.0311		µg/L	0.018
Chrysene	218-01-9	12.0	29.6					0.018	0.0311		µg/L	0.018
Dibenz(a,h)Anthracene	53-70-3	0.0120	0.0296					0.018	0.0311		µg/L	0.018
Fluoranthene	206-44-0	640		86.4				140	370		µg/L	86.4
Fluorene	86-73-7	640		3,460				5,300	14,000		µg/L	3460
Indeno(1,2,3-c,d)Pyrene	193-39-5	0.120	0.296					0.018	0.0311		µg/L	0.018
Naphthalene	91-20-3	160		4,710							µg/L	4710
Phenanthrene	85-01-8										µg/L	NA
Pyrene	129-00-0	480		2,590				4,000	11,000		µg/L	2590
Total cPAHs		0.1										0.1
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	630-20-6	1.68									µg/L	1.68
1,1,1-Trichloroethane	71-55-6	200		926,000							µg/L	926000
1,1,2,2-Tetrachloroethane	79-34-5	0.219	6.48	10,400				4	11		µg/L	4
1,1,2-Trichloroethane	79-00-5	0.768	25.3	2,300				16	42		µg/L	16
1,1-Dichloroethane	75-34-3	7.68									µg/L	7.68
1,1-Dichloroethene	75-35-4	400		23,100				7,100	3.2		µg/L	3.2
1,1-Dichloropropene	563-58-6										µg/L	NA
1,2,3-Trichlorobenzene	87-61-6										µg/L	NA
1,2,3-Trichloropropane	96-18-4	0.00146									µg/L	0.00146
1,2,3-Trimethylbenzene	526-73-8										µg/L	NA
1,2,4-Trichlorobenzene	120-82-1	1.51	2.03	236				70			µg/L	2.03
1,2,4-Trimethylbenzene	95-63-6										µg/L	NA

Table 11: Summary of Cleanup Levels and ARARs for Groundwater and Surface Water

		Groundwater Cleanup Standards(a)	Surface Water Cleanup Standards and ARARs(a)									
Chemical	cas_rn	WA_WG_MTCA_A_THEN_LOWEST_B_1507	WA_WS_MTCA_METHOD_B_CANCER	WA_WS_MTCA_METHOD_B_NONCANCER	WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	WS_HUMAN_HEALTH_SW_CWA304	WS_HUMAN_HEALTH_SW_NTR40CFR131	ProUCL Background Threshold Values(b)	Units	Proposed Cleanup Standard(c)
1,2-Dibromo-3-Chloropropane	96-12-8	0.0547									µg/L	0.0547
1,2-Dibromoethane (EDB)	106-93-4	0.01									µg/L	0.01
1,2-Dichlorobenzene	95-50-1	720		4,170				1,300	17,000		µg/L	1300
1,2-Dichloroethane (EDC)	107-06-2	0.481	59.4	13,000				37	99		µg/L	37
1,2-Dichloropropane	78-87-5	1.22	43.9	56,900				15			µg/L	15
1,3,5-Trimethylbenzene	108-67-8	80									µg/L	80
1,3-Dichlorobenzene	541-73-1							960	2,600		µg/L	960
1,3-Dichloropropane	142-28-9										µg/L	NA
1,4-Dichlorobenzene	106-46-7	8.10	21.4	3,240				190	2,600		µg/L	21.4
2,2-Dichloropropane	594-20-7										µg/L	NA
2-Chlorotoluene	95-49-8	160									µg/L	160
4-Chlorotoluene	106-43-4										µg/L	NA
Acetone	67-64-1	7,200									µg/L	7200
Acrolein	107-02-8	4						290	780		µg/L	290
Acrylonitrile	107-13-1	0.0810	0.400	3,460				0.25	0.66		µg/L	0.25
Benzene	71-43-2	5	22.7	1,990				51	71		µg/L	22.7
Bromobenzene	108-86-1										µg/L	NA
Bromodichloromethane	75-27-4	0.706	27.5	13,600				17	22		µg/L	17
Bromoform	75-25-2	5.54	216	13,600				140	360		µg/L	140
Bromomethane	74-83-9	11.2		955				1,500	4,000		µg/L	955
Carbon Tetrachloride	56-23-5	0.625	4.87	546				1.6	4.4		µg/L	1.6
Chlorobenzene	108-90-7	160		5,190				1,600	21,000		µg/L	1600
Chloroethane	75-00-3										µg/L	NA
Chloroform	67-66-3	1.41	55.0	6,820				470	470		µg/L	55
Chloromethane	74-87-3										µg/L	NA
cis-1,2-Dichloroethene	156-59-2	16									µg/L	16
cis-1,3-Dichloropropene	10061-01-5	0.438	34.1	40,900				21	1,700		µg/L	21
Cymene (p-Isopropyltoluene)	99-87-6										µg/L	NA
Dibromochloromethane	124-48-1	0.521	20.3	13,600				13	34		µg/L	13
Dibromomethane	74-95-3	80									µg/L	80
Dichlorodifluoromethane	75-71-8	1,600									µg/L	1600
Di-Isopropyl ether (DIPE)	108-20-3										µg/L	NA
Ethylbenzene	100-41-4	700		6,820				2,100	29,000		µg/L	2100
Freon 113	76-13-1	240,000									µg/L	240000
Hexachlorobutadiene	87-68-3	0.561	29.7	926				18	50		µg/L	18
Isopropylbenzene	98-82-8	800									µg/L	800
Methyl ethyl ketone (2-Butanone)	78-93-3	4,800									µg/L	4800
Methyl Isobutyl Ketone (MIBK)	108-10-1	640									µg/L	640
Methyl tert-Butyl ether	1634-04-4	20									µg/L	20
Methylene Chloride	75-09-2	5	3,600	17,300				590	1,600		µg/L	590
Naphthalene	91-20-3	160		4,710							µg/L	160
n-Butylbenzene	104-51-8	400									µg/L	400
n-Propylbenzene	103-65-1	800									µg/L	800

Table 11: Summary of Cleanup Levels and ARARs for Groundwater and Surface Water

		Groundwater Cleanup Standards(a)	Surface Water Cleanup Standards and ARARs(a)									
Chemical	cas_rn	WA_WG_MTCA_A_THEN_LOWEST_B_1507	WA_WS_MTCA_METHOD_B_CANCER	WA_WS_MTCA_METHOD_B_NONCANCER	WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	WS_HUMAN_HEALTH_SW_CWA304	WS_HUMAN_HEALTH_SW_NTR40CFR131	ProUCL Background Threshold Values(b)	Units	Proposed Cleanup Standard(c)
Sec-Butylbenzene	135-98-8	800									µg/L	800
Styrene	100-42-5	1,600									µg/L	1600
Tert-Butylbenzene	98-06-6	800									µg/L	800
Tetrachloroethene (PCE)	127-18-4	5	99.6	502				3.3	8.85		µg/L	3.3
Toluene	108-88-3	1,000		18,900				15,000	200,000		µg/L	15000
trans-1,2-Dichloroethene	156-60-5	160		32,400				10,000			µg/L	10000
trans-1,3-Dichloropropene	10061-02-6	0.438	34.1	40,900				21	1,700		µg/L	21
Trichloroethene (TCE)	79-01-6	5	12.8	118				30	81		µg/L	12.8
Trichlorofluoromethane	75-69-4	2,400									µg/L	2400
Vinyl Chloride	75-01-4	0.2	3.7	6,480				2.4	525		µg/L	2.4
Xylene, m,p-	XYLENES1314										µg/L	NA
Xylene, o-	95-47-6	1,600									µg/L	1600
Xylene, total	1330-20-7	1,000									µg/L	1000

Notes:

(a) **Cleanup Standards and ARARs:**

WA_WG_MTCA_A_THEN_LOWEST_B_1507	MTCA Method A/B Groundwater Cleanup Levels from CLARC database spreadsheet marked July 2015
WA_WS_MTCA_METHOD_B_CANCER	MTCA Surface Water Method B Cancer
WA_WS_MTCA_METHOD_B_NONCANCER	MTCA Surface Water Method B Non cancer
WS_AQUATIC_LIFE_SW_CHRONIC_CWA304	Surface Water Aquatic Life Marine/Chronic CWA 304
WS_AQUATIC_LIFE_SW_CHRONIC_NTR40CFR131	Surface Water Aquatic Life Marine/Chronic NTR 40 CFR 131
WS_AQUATIC_LIFE_SW_CHRONIC_WAC173-201A	Surface Water Aquatic Life Marine/Chronic 173-201A WAC
WS_HUMAN_HEALTH_SW_CWA304	Surface Water Human Health Marine Waters CWA 304
WS_HUMAN_HEALTH_SW_NTR40CFR131	Surface Water Human Health Marine Waters NTR 40 CFR 131

(b) Calculated background threshold value for total arsenic; refer to RI Sections 5.5 and 8.5.

(c) Proposed cleanup standard based on the lowest surface water cleanup standard or ARAR value, or based on groundwater cleanup standards for where surface water standards are not available (NA).

Table 12: General Response Actions, Remedial Technologies, and Process Options for Soil

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Institutional Controls	Access Restrictions	Physical Restrictions	Physical restrictions (e.g., fencing and signs) limit contact with media.	Risk receptor pathways not addressed.
		Deed Restrictions	**Restrictive covenants recorded in the property deed prohibit site activities (e.g., excavation) that could result in exposure to chemicals of concern; requires worker protection and Soil/Groundwater Management Plan.**	**Applicable to reduce human contact with impacted media; excavation or subgrade utility work.**
		Monitoring	**Laboratory chemical analyses of soil and groundwater samples.**	**Applicable for documenting conditions and concentrations of contaminants in soil and groundwater. Applicable to document effectiveness of treatment technologies.**
Containment	Covers	**Soil**	**Clean soil is placed over ground surface to provide a physical barrier to chemicals of concern. Geotextile is placed between existing ground surface and clean soil cover.**	**Applicable for site conditions in combination with removal of soil with COC concentrations above remediation levels.**
		Clay	Low permeability clay layer overlain with soil over chemically impacted materials provides physical barrier that minimizes potential for contact and infiltration.	Not appropriate for site conditions.
		Concrete	**Similar to clay cover description with concrete used as low permeability barrier.**	**Existing site conditions include gravel and degraded asphalt cover.**
		Asphalt	**Similar to clay cover description with asphalt used as low permeability barrier.**	**Existing site conditions include gravel and degraded asphalt cover.**
		RCRA	Multi-media barrier consisting of low-permeability layer, synthetic liner, drainage layer, and vegetative cover. Performs functions similar to those described for clay cover.	Not appropriate for site conditions.
	Vertical Barriers	**Slurry Wall**	**Subsurface vertical barrier consisting of low-hydraulic conductivity material surrounds a subsurface source to prevent chemical migration.**	**Applicable for containing COCs in groundwater onsite.**
		Grout Curtain	Subsurface vertical barrier consisting of low-hydraulic conductivity material is pressure injected into soil or rock. Performs function similar to slurry wall.	Not appropriate for site conditions.

Table 12: General Response Actions, Remedial Technologies, and Process Options for Soil

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Containment (continued)	Horizontal Barriers	Sheet Pile Cutoff Wall	Interlocking sheet piling driven vertically into subsurface to form a low permeability barrier. Performs function similar to slurry wall.	Not appropriate for site conditions.
		Grout Injection	Injection of grout to form a horizontal barrier in the ground underneath chemical source to reduce the vertical movement of chemicals.	Not appropriate for site conditions.
		Block Displacement	Vertical barrier (slurry trench or grout curtain) surrounds source. Continued injection of grout through injection holes causes displacement of source and forms a barrier beneath source.	Not appropriate for site conditions.
	Surface Controls	Revegetation	Planting grasses, shrubs, or trees to minimize contact with soil, reduce dust generation, and control surface water runoff.	Not appropriate for site conditions.
	Dust Suppression	**Wet Suppression**	**Watering ground surface to control dust generation.**	**Applicable for excavation and construction activities.**
		Chemical Stabilization	A suppressant sprayed on the ground binds dust and surface particles into a protective crust that minimizes dust generation.	Not appropriate for site conditions.
		Physical Stabilization	Placing a cover (e.g. rock, soil, straw) on exposed surfaces to prevent particles from becoming airborne.	Not appropriate for site conditions.
		Vegetative Stabilization	Same as revegetation above.	Not appropriate for site conditions.
		Wind Fences/Screens	Fences or screens are installed around site perimeter to block wind and reduce dust generation.	Not appropriate for site conditions.
Removal	Excavation	**Backhoe, Excavators, Loaders, Dozers**	**Excavate material for subsequent aboveground treatment and/or disposal.**	**Applicable for removal of impacted soils with concentrations above remediation levels.**
Ex Situ (Aboveground) Treatment	Solidification/ Stabilization	Solidification	Siliceous materials are combined with a setting agent (e.g., lime, cement, or gypsum) and soil. Treatment results in a solidified product that resists leaching.	Not appropriate for site conditions or chemicals of concern.
		Stabilization	Dry or liquid chemical mix which forms insoluble molecular bonds through hydroxyapaptite crystal formations with heavy metals [and polychlorinated biphenyls (PCBs)] which significantly reduces the metals leaching potential.	Not appropriate for site conditions or chemicals of concern.
	Physical/Chemical	Soil Washing	Removal of inorganic or organic chemicals by washing excavated soil with a liquid medium (e.g., water). The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.	Other more cost effective treatment methods are available. Creates secondary waste stream.

Table 12: General Response Actions, Remedial Technologies, and Process Options for Soil

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Ex Situ (Aboveground) Treatment (continued)	Physical/ Chemical (continued)	Organic Solvent Extraction	Removal of organics, oil, and grease from soil, using an organic solvent as the mass transfer medium and then recovering the solvent by distillation.	Other more cost effective treatment methods are available. Creates secondary waste stream.
		Vapor Extraction	Removal of low molecular weight organics by creating a vacuum pressure gradient in soil that causes volatile organics to transfer from soil to air stream.	Not appropriate for chemicals of concern.
		Chemical Dehalogenation	Specially synthesized chemical reagents are used to dehalogenate certain classes of chlorinated organics (e.g., PCBs).	Not appropriate for chemicals of concern.
		Chemical Oxidation/Reduction	Reduction/oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Not appropriate for chemicals of concern.
		Solar Detoxification	Solar detoxification is a process that destroys contaminants by photochemical and thermal reactions using the ultraviolet energy in sunlight.	Other more cost effective treatment methods are available.
		Separation/Sieving	Sieving and physical separation processes use different size sieves and screens to effectively concentrate contaminants into smaller volumes. Physical separation can also be used to remove undesirable materials (i.e., debris) which may impact treatment processes.	Soil matrix does not consist of large particles (i.e., cobbles/ boulders).
	Biological/ Bioremediation	Landfarming	Contaminated soil is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste.	Assumes treated soil would be suitable for re-use as backfill. Extended period of an open excavation (i.e., not backfilled) not acceptable. Ex Situ treatment duration unknown.
		Land Treatment	Contaminated surface soil is treated in-place by tilling to achieve aeration, and if necessary, by addition of amendments. Periodically tilling, to aerate the waste, enhances the biological activity.	Assumes treated soil would be suitable for re-use as backfill. Extended period of an open excavation (i.e., not backfilled) not acceptable. Ex Situ treatment duration unknown.
		Composting	Contaminated soil is excavated and mixed with bulking agents and organic amendments such as wood chips, hay, manure, and vegetative (e.g., potato) wastes. Proper amendment selection ensures adequate porosity and provides a balance of carbon and nitrogen to promote thermophilic, microbial activity.	Assumes treated soil would be suitable for re-use as backfill. Extended period of an open excavation (i.e., not backfilled) not acceptable. Ex Situ treatment duration unknown.
		Biopiles	Excavated soils are mixed with soil amendments and placed in aboveground enclosures. It is an aerated static pile composting process in which compost is formed into piles and aerated with blowers or vacuum pumps.	Assumes treated soil would be suitable for re-use as backfill. Extended period of an open excavation (i.e., not backfilled) not acceptable. Ex Situ treatment duration unknown.

Table 12: General Response Actions, Remedial Technologies, and Process Options for Soil

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Ex Situ (Aboveground) Treatment (continued)	Biological/ Bioremediation (continued)	Fungal Biodegradation	Fungal biodegradation refers to the degradation of a wide variety of organopollutants by using their lignin-degrading or wood-rotting enzyme system. White rot fungus has been tested under two different treatment configurations: in situ and bioreactor.	Other more cost effective treatment methods are available.
		Bio-Reactor System	Degradation with the use of a liquid/solids contact reactor. Reactor environment enhances mass transfer rates and contact between chemicals and microorganisms capable of degrading the chemicals.	Other more cost effective treatment methods are available.
	Thermal	Thermal Desorption	Soils are heated, driving off water and organics with boiling points less than 1,100°F. Organics are incinerated in an afterburner or collected for subsequent treatment.	Other more cost effective treatment methods are available.
		Rotary Kiln Incineration	Incineration process (in the presence of oxygen) uses temperatures ranging from 1,500°F to 3,000°F and turbulence caused by rotation to vaporize and destroy organics.	Other more cost effective treatment methods are available..
In Situ Treatment	Solidification/ Stabilization	Pozzolanic Cement-Based	In situ treatment of soil by the injection and mixing of solidifying agents with soil. Treatment results in a solidified product that resists leaching.	Not appropriate for chemicals of concern.
		Chemical-Based Stabilization	Liquid chemical mix which forms insoluble molecular bonds through hydroxyapaptite crystal formations with heavy metals (and PCBs) which significantly reduces the metals leaching potential.	Not appropriate for chemicals of concern.
	Physical/ Chemical	Soil Freezing	Freezing surrounding soil to create a physical barrier to chemical migration.	Not appropriate for site conditions.
		Soil Flushing	In situ extraction of inorganics or organics from soils, accomplished by passing solvents through soil using an injection/recirculation process.	Difficult to control; may result in groundwater contamination.
		Soil Vapor Extraction	Extraction of volatile organics from subsurface soil by creating a pressure gradient that causes volatile organics to transfer from soil to airstream.	Not appropriate for site conditions.
		Electrokinetic Separation	The Electrokinetic Remediation (ER) process removes metals and organic contaminants from low permeability soil. ER uses electrochemical and electrokinetic processes to desorb, and then remove, metals and polar organics. This in situ soil processing technology is primarily a separation and removal technique for extracting contaminants from soils.	Not appropriate for site conditions.
		Fracturing	Cracks are developed by fracturing beneath the surface in low permeability and over-consolidated sediments to open new passageways that increase the effectiveness of many in situ processes and enhance extraction efficiencies.	Not appropriate for site conditions.

Table 12: General Response Actions, Remedial Technologies, and Process Options for Soil

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
In Situ Treatment (continued)	Physical/ Chemical (continued)	Precipitation	Application of specific treatment reagents which aid in the formation of insoluble metal precipitates that reduce chemical mobility. Metals could later resolubilize as conditions change.	Not appropriate for organics; may result in groundwater contamination.
		Chemical Oxidation/Reduction	Reduction/oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Not appropriate for site soil conditions.
	Biological/ Bioremediation	Enhanced Bioremediation (Aerobic)	Application of nutrients, oxygen, and microorganisms to accelerate the natural biodegradation of organic compounds.	Not appropriate for site soil conditions.
		Enhanced Bioremediation (Anaerobic)	Same as aerobic process with the omission of oxygen application. The anaerobic process degrades organics generally slower than the aerobic process.	Not appropriate for chemicals of concern.
		Bioventing	Oxygen is delivered to contaminated unsaturated soils by forced air movement (either extraction or injection of air) to increase oxygen concentrations and stimulate biodegradation.	Not appropriate for site soil conditions.
		Phytoremediation	Phytoremediation is a process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment. Contaminants may be either organic or inorganic.	Not appropriate for site conditions.
	Thermal	Vitrification	Using high temperatures to melt soil and bind chemicals in a stable non-crystalline solid that resists leaching. Organics are destroyed by pyrolysis.	Not appropriate for chemicals of concern.
		Electrical Resistive Heating	Applying electrical current for heating subsurface soils to volatilize contaminants into the vapor phase for removal by soil vapor extraction.	More cost-effective methods are available.
		Steam-Enhanced Vapor Extraction	Vapor extraction with the addition of steam to increase chemical mobility and removal rate.	More cost-effective methods are available.
		Radio Frequency Heating	Application of radio frequency waves to heat soil and vaporize volatile organics. Volatiles are then collected for destruction or treatment.	Experimental. More tested and cost-effective methods are available.
Disposal	Offsite	**Management Unit**	**Disposal of soil in a permitted offsite management unit.**	**Applicable for offsite disposal at a licensed landfill facility.**
	Onsite	Containment	Containment of soil onsite.	Not appropriate for site conditions.

Table 12: General Response Actions, Remedial Technologies, and Process Options for Soil

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Reuse/Recycling	Onsite	Backfilling	Onsite reuse/recycling of site materials for suitable applications in accordance with applicable local, state, and federal regulations.	Not appropriate for site conditions.
		Grading	Onsite reuse/recycling of site materials for suitable applications in accordance with applicable local, state, and federal regulations. One option may be reuse treated soil onsite to consolidated impacted soils or bring low areas within an impacted zone to grade prior to placement of a cover.	Not appropriate for site conditions.

Note:

Bold text in table indicates the Process Option is included for further consideration.

Table 13: General Response Actions, Remedial Technologies, and Process Options for Groundwater

General Response Action	**Remedial Technologies**	**Process Options**	**Description**	**Evaluation Comments**
Institutional Controls	**Addressed under Evaluation of General Response Actions, Remedial Technologies, and Process Options for Soil (see Table 12).**			
Containment	Covers	Addressed under Evaluation of General Response Actions, Remedial Technologies, and Process Options for Soil (see Table 12).		
	Vertical Barriers	Addressed under Evaluation of General Response Actions, Remedial Technologies, and Process Options for Soil (see Table 12).		
Collection	**Extraction**	**Extraction Wells**	**Series of wells to extract contaminated groundwater.**	**Applicable for hydraulic control of groundwater within vertical barrier.**
		Extraction/Injection Wells	Inject treated or uncontaminated groundwater to increase flow to extraction wells.	Not appropriate for site conditions.
	Subsurface Drains	Interceptor Trenches	Perforated pipe in trenches backfilled with porous media to collect contaminated water.	Not appropriate for site conditions.
Aboveground Treatment (assuming extraction)	Physical/Chemical	Adsorption/ Absorption - Granulated Activated Carbon (GAC)/Liquid Phase Carbon Adsorption	In liquid adsorption, solutes concentrate at the surface of a sorbent, thereby reducing their concentration in the bulk liquid phase. Ground water is pumped through a series of canisters or columns containing activated carbon to which dissolved organic contaminants adsorb. Periodic replacement or regeneration of saturated carbon is required.	Not appropriate for site conditions.
		Air Stripping/Air Sparging	Volatile organics are partitioned from extracted ground water by increasing the surface area of the contaminated water exposed to air. Aeration methods include packed towers, diffused aeration, tray aeration, and spray aeration.	Other more cost effective treatment methods are available.
		Ion Exchange	Ion exchange removes ions from the aqueous phase by exchange with counter ions on the exchange medium.	Other more cost effective treatment methods are available.
		Precipitation/ Coagulation/ Flocculation	**This process transforms dissolved contaminants into an insoluble solid, facilitating the contaminant's subsequent removal from the liquid phase by sedimentation or filtration. The process usually uses pH adjustment, addition of a chemical precipitant, and flocculation.**	**Applicable for treatment of COCs in extracted groundwater prior to discharge.**
		Separation	Separation techniques concentrate contaminated waste water through physical and chemical means. Includes distillation, filtration. ultrafiltration/ microfiltration, freeze crystallization, membrane pervaporation, and reverse osmosis.	Other more cost effective treatment methods are available.
		Sprinkler Irrigation	The process that involves the pressurized distribution of volatile organic compound (VOC)-laden water through a standard sprinkler irrigation system.	Not appropriate for site conditions.
		UV Oxidation	Ultraviolet (UV) radiation, ozone, and/or hydrogen peroxide are used to destroy organic contaminants as water flows into a treatment tank. If ozone is used as the oxidizer, an ozone destruction unit is used to treat collected off-gases from the treatment tank and downstream units where ozone gas may collect, or escape.	Not appropriate for site conditions.

Table 13: General Response Actions, Remedial Technologies, and Process Options for Groundwater

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Aboveground Treatment (assuming extraction) (continued)	Biological/ Bioremediation	Bioreactors	Contaminants in extracted groundwater are put into contact with microorganisms in attached or suspended growth biological reactors. In suspended systems, such as activated sludge, contaminated groundwater is circulated in an aeration basin. In attached systems, such as rotating biological contractors and trickling filters, microorganisms are established on an inert support matrix.	Not appropriate for site conditions.
		Constructed Wetlands	The constructed wetlands-based treatment technology uses natural geochemical and biological processes inherent in an artificial wetland ecosystem to accumulate and remove metals, explosives, and other contaminants from influent waters. The process can use a filtration or degradation process.	Not appropriate for site conditions.
In Situ Treatment	Physical/Chemical	**Air Sparging**	**Air is injected into saturated matrices to remove contaminants through volatilization.**	**Applicable for oxidation of As III to As V and desorbing low molecular weight petroleum hydrocarbons from saturated zone.**
		Bioslurping	Bioslurping combines the two remedial approaches of bioventing and vacuum-enhanced free-product recovery. Bioventing stimulates the aerobic bioremediation of hydrocarbon-contaminated soils. Vacuum-enhanced free-product recovery extracts light non-aqueous phase liquids (LNAPLs) from the capillary fringe and the water table.	LNAPL not present at the site.
		Soil Vapor Extraction (SVE)/Bioventing	A vacuum is applied to wells screen in the unsaturated zone. The flow of oxygenated air through the vadose zone enhances natural biodegradation of petroleum hydrocarbon compounds in soil. SVE can also be used to apply a negative pressure in the subsurface to mitigate potential vapor intrusion.	Not applicable to Site conditions.
		Dual Phase Extraction	A high vacuum system is applied to simultaneously remove various combinations of contaminated groundwater, separate-phase petroleum product (LNAPLs), and hydrocarbon vapor from the subsurface.	LNAPL not present at the site.
		Fluid/Vapor Extraction	A high vacuum system is applied to simultaneously remove liquid and gas from low permeability or heterogeneous formations.	Other more cost-effective treatment options are available.
		Hot Water or Steam Flushing/Stripping	Steam is forced into an aquifer through injection wells to vaporize volatile and semivolatile contaminants. Vaporized components rise to the unsaturated zone where they are removed by vacuum extraction and then treated.	Other more cost-effective treatment options are available.
		Hydrofracturing	Injection of pressurized water through wells into low permeability and over-consolidated sediments. Cracks are filled with porous media that serve as substrates for bioremediation or to improve pumping efficiency.	Not appropriate for site conditions.

Table 13: General Response Actions, Remedial Technologies, and Process Options for Groundwater

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
In Situ Treatment (continued)	Physical/Chemical (continued)	In-Well Air Stripping	Air is injected into a double screened well, lifting the water in the well and forcing it out the upper screen. Simultaneously, additional water is drawn in the lower screen. Once in the well, some of the VOCs in the contaminated groundwater are transferred from the dissolved phase to the vapor phase by air bubbles. The contaminated air rises in the well to the water surface where vapors are drawn off and treated by a soil vapor extraction system.	Other more cost-effective treatment options are available.
		Passive/Reactive Treatment Walls	**These barriers allow the passage of water while causing the degradation or removal of contaminants by employing such agents as zero-valent metals, chelators (ligands selected for their specificity for a given metal), sorbents, microbes, and others.**	**Applicable for oxidizing As III to less toxic As V and co-precipitation with iron. Retained for treatment of As.**
	Biological/ Bioremediation	Co-metabolic Treatment	Injection of a dilute solution of primary substrate (e.g., toluene, methane) into the contaminated ground water zone to support the co-metabolic breakdown of targeted organic contaminants.	Not appropriate for chemicals of concern.
		Enhanced Biodegradation	Rate of bioremediation of organic contaminants by microbes is enhanced by increasing the concentration of electron acceptors and nutrients in groundwater. Oxygen is the main electron acceptor for aerobic bioremediation. Nitrate serves as an alternative electron acceptor under anoxic conditions.	Other more cost-effective treatment options are available.
		Natural Attenuation	**Natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials are allowed to reduce contaminant concentrations to acceptable levels.**	**Applicable.**
		Phytoremediation	Phytoremediation is a set of processes that uses plants to remove, transfer, stabilize and destroy organic/inorganic contamination in groundwater, surface water, and leachate.	Not appropriate for site conditions.
Disposal/Discharge	Onsite	Storm Drain	Discharge of treated groundwater to storm drain.	Not appropriate for site conditions.
	Offsite	**Publicly Owned Treatment Works (POTW)**	**Discharge treated groundwater to POTW.**	**Applicable and retained for disposal/discharge of treated water generated during dewatering activities.**
Reuse/Recycling	Onsite/Offsite	Landscape Irrigation	Use of treated groundwater for landscape irrigation.	Not appropriate for site conditions.

Note:

Bold text in table indicates the Process Option is included for further consideration.

Table 14: Potential Remedial Process Options for Soil and Groundwater

MTCA Preference[(a)]	General Technology Description	Soil and Groundwater Process Option
1	Reuse or Recycling	<u>Soil</u> Onsite: Soil for backfill/grading Offsite: Soil for daily landfill cover material
2	Destruction or Detoxification	*In Situ* Bioremediation *In Situ* Chemical Oxidation Groundwater Extraction with Treatment and Discharge
3	Separation Followed by Reuse or Destruction	Excavation Groundwater Extraction with discharge to POTW
4	Immobilization or Solidification	None
5	Onsite or Offsite Disposal	Offsite Management Unit (Landfill)
6	Containment	Asphalt or Impermeable Liner Covered with Soil Slurry Wall
7	Institutional Controls and Monitoring	Deed Restriction Compliance Monitoring

Note:

Cleanup action components, in descending order, when assessing relative degree of long-term effectiveness [WAC 173-340-360(3)(C)(iv)].

MTCA = Model Toxics Control Act
POTW = Publicly-Owned Treatment Works

Table 15: MTCA's Threshold Criteria

Threshold Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Protection of Human Health and Environment	Institutional controls, including deed restrictions, prevent direct human contact with impacted media through access restrictions. Deed restriction would also prevent future use of groundwater.	Excavation and offsite disposal of impacted soils eliminates direct human contact and potential exposure to terrestrial ecological receptors. Deed restriction would also prevent future use of groundwater.	Asphalt pavement prevents direct human contact with impacted media and reduces leaching to groundwater. Air sparging reduces toxicity of arsenic contaminated groundwater through oxidation of As III to As V.	Excavation and offsite disposal of impacted soils eliminates direct human contact and potential terrestrial ecological exposure. Air sparging reduces toxicity of arsenic contaminated groundwater through oxidation of As III to As V.	Excavation and offsite disposal of impacted soils eliminates direct human contact and potential terrestrial ecological exposure. Slurry wall contains contaminant mass on-property reducing the risk of exposure resulting from off-property migration. Hydraulic control using groundwater extraction prevents accumulation of impacted groundwater from migrating off-property. Impacted groundwater generated during pumping would be discharged to the City POTW.	Excavation and offsite disposal of impacted soils eliminates direct human contact and potential terrestrial ecological exposure. Slurry wall contains contaminant mass on-property reducing the risk of exposure from off-property migration.	Excavation and offsite disposal of impacted soils eliminates direct human contact and potential terrestrial ecological exposure. Installation of permeable reactive barrier reduces the COC concentrations in groundwater onsite and downgradient of the site.
Applicable State and Federal Laws	Yes	Yes.	Yes	Yes	Yes	Yes	Yes

Threshold Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Point of Compliance	The soil point of compliance is from the ground surface to a depth of 15 feet below ground surface throughout the site based on the direct contact pathway. The groundwater point of compliance is throughout the site.	The soil point of compliance is from the ground surface to a depth of 15 feet below ground surface throughout the site based on the direct contact pathway. The groundwater point of compliance is throughout the site.	The soil point of compliance is from the ground surface a depth of 15 feet below ground surface throughout the site based on the direct contact pathway. The groundwater point of compliance is throughout the site.	The soil point of compliance is from the ground surface a depth of 15 feet below ground surface throughout the site based on the direct contact pathway. The groundwater point of compliance is throughout the site.	The soil point of compliance is from the ground surface to a depth of 15 feet below ground surface throughout the site based on the direct contact pathway. The groundwater point of compliance is throughout the site.	The soil point of compliance is from the ground surface to a depth of 15 feet below ground surface throughout the site based on the direct contact pathway. The groundwater point of compliance is throughout the site.	The soil point of compliance is from the ground surface to a depth of 15 feet below ground surface throughout the site based on the direct contact pathway. The groundwater point of compliance is throughout the site.
Compliance Monitoring	Institutional controls will require long-term monitoring.	Confirmation soil samples would be collected and analyzed to evaluate compliance with soil cleanup levels. Periodic groundwater monitoring would be to evaluate changes in groundwater quality.	Long-term groundwater monitoring would be conducted to assess changes in groundwater quality.	Long-term groundwater monitoring would be conducted to assess changes in groundwater quality.	Long-term groundwater monitoring would be conducted to assess changes in groundwater quality.	Long-term groundwater monitoring would be conducted to assess changes in groundwater quality.	Long-term groundwater monitoring would be conducted to assess changes in groundwater quality.

Table 16: Protectiveness of Human Health and the Environment

Sub-Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Degree to which existing risks are reduced.	Institutional controls reduce risk to human health through administrative and engineering controls.	Excavation and offsite disposal of impacted soils eliminates direct human contact and leaching to groundwater. The ongoing contaminant source to groundwater is reduced. Institutional controls reduce risk to human health through administrative and engineering controls.	Asphalt pavement cover and deed restrictions prevent direct human contact with impacted media reducing the risk of exposure. Air sparging reduces COC concentrations by increasing oxygen in the saturated zone reducing risk over time. Institutional controls reduce risk to human health through administrative and engineering controls.	Excavation and offsite disposal of impacted soils eliminates direct human contact and leaching to groundwater. The ongoing contaminant source to groundwater is reduced. Air sparging reduces COC concentrations by increasing oxygen in the saturated zone reducing risk over time. Institutional controls reduce risk to human health through administrative and engineering controls. ICs can be allowed to expire upon achievement of groundwater cleanup standards.	Excavation and offsite disposal of impacted soils eliminates direct human contact and leaching to groundwater. The ongoing contaminant source to groundwater is reduced. Installation of a slurry wall provides containment of COCs onsite reducing risk to offsite receptors. Hydraulic control of groundwater prevents offsite migration of COCs beyond the limits of the slurry wall. COC-impacted groundwater is discharged offsite to the POTW reducing risk to onsite receptors. Institutional controls reduce risk to human health through administrative and engineering controls.	Excavation and offsite disposal of impacted soils eliminates direct human contact and leaching to groundwater. The ongoing contaminant source to groundwater is reduced. Installation of a slurry wall provides containment of COCs onsite reducing risk to offsite receptors. Hydraulic control of groundwater prevents offsite migration of COCs beyond the limits of the slurry wall. Institutional controls reduce risk to human health through administrative and engineering controls.	Excavation and offsite disposal of impacted soils eliminates direct human contact and leaching to groundwater. The ongoing contaminant source to groundwater is reduced. Installation of permeable reactive barrier will reduce As concentrations in groundwater. Institutional controls reduce risk to human health through administrative and engineering controls. ICs can be allowed to expire upon achievement of groundwater cleanup standards.
Time required in reducing risk and attaining cleanup standards.	Risk reduction will be accomplished upon implementation of engineering and institutional controls by limiting potential exposure to COCs. Because the source mass is not removed, the restoration time frame is expected to be several decades.	Remediation and site restoration activities completed within 1 year. Performance groundwater monitoring conducted for an additional 5 years following remediation and restoration activities. It is estimated soil cleanup levels on site would be attained within 1 year of implementation. Attainment of groundwater cleanup levels is expected to be 10 to 15 years after soil source mass is removed.	Remedial construction activities completed within 1 year with long-term maintenance of the cap. Implementation and operation of air sparge system is expected to reduce COC concentrations to cleanup standards within 10 to 15 years. Because the source mass is not removed, the restoration time frame for soil is expected to be several decades. Compliance groundwater monitoring conducted for 10 to 20 years following implementation of remediation activities.	Remediation and site restoration activities completed within 1 year. Performance groundwater monitoring conducted for an additional 5 years following remediation and restoration activities. It is estimated soil cleanup levels on site would be attained within 1 year of implementation. Implementation and operation of air sparge system is expected to reduce COC concentrations in groundwater to cleanup standards within 10 to 15 years.	Source mass removal and installation of slurry wall and groundwater extraction system activities completed within 1 year reducing the risk of exposure to onsite receptors. It is expected that groundwater extraction for hydraulic control will continue for several decades.	Source mass removal and installation of slurry wall and groundwater extraction system activities completed within 1 year reducing the risk of exposure to onsite receptors.	Source mass removal and installation of permeable reactive barrier completed within 1 year reducing the risk of exposure to onsite receptors. It is expected that the permeable reactive barrier will continue to reduce as concentrations in groundwater for at least 10 years.
Onsite and offsite risks from implementing alternative.	Onsite risk includes worker contact with impacted media.	Onsite risk includes worker contact with impacted media during remediation activities and physical hazards of construction activities. Offsite risk includes potential spillage of impacted soils during transport to landfill facility, potential dust exposure during excavation and backfill activities, and discharge of treated water if dewatering is required.	Onsite risk includes worker contact with impacted media during cap construction and sparge system installation activities. Offsite risk to the community and environment includes construction vehicle traffic during construction.	Onsite risk includes worker contact with impacted media during remediation activities and physical hazards of construction activities. Offsite risk to the community and environment includes construction vehicle traffic during construction.	Onsite risk includes worker contact with impacted media during remediation activities and physical hazards of construction activities. Offsite risk to the community and environment includes construction vehicle traffic during construction and potential exposure of POTW workers to COCs in discharged groundwater.	Onsite risk includes worker contact with impacted media during remediation activities and physical hazards of construction activities. Offsite risk to the community and environment includes construction vehicle traffic during construction.	Onsite risk includes worker contact with impacted media during remediation activities and physical hazards of construction activities. Offsite risk to the community and environment includes construction vehicle traffic during construction.

Table 16: Protectiveness of Human Health and the Environment

Sub-Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Improvement of overall environmental quality.	Engineering and institutional controls prevent potential exposure to COCs.	Will permanently reduce human exposure by removal of source mass in soil. Very little impact to environment for disposal of impacted soils at licensed landfill facility.	Capping reduces exposure to human and ecological receptors to COCs in soil. Implementation and operation of air sparge system reduces contaminant mass in groundwater and reduces the risk of exposure to COCs in groundwater.	Will permanently reduce human exposure by removal of source mass in soil. Implementation and operation of air sparge system reduces contaminant mass in groundwater and reduces the risk of exposure to COCs in groundwater.	Will permanently reduce human exposure by removal of source mass in soil. Implementation and operation of groundwater extraction system for hydraulic control reduces the offsite risk of exposure to COCs in groundwater.	Will permanently reduce human exposure by removal of source mass in soil. Implementation and operation of groundwater extraction system for hydraulic control reduces the offsite risk of exposure to COCs in groundwater.	Will permanently reduce human exposure by removal of source mass in soil. Installation of a permeable reactive barrier reduces the onsite and offsite risk of exposure to COCs in groundwater.
“Benefit” Score	6	7	6	7	7	7	7

Note:

Alternatives are ranked on a scale of 1 to 10 based on how each alternative satisfies the listed criteria (1 = does not meet criteria, 10 = meets criteria completely).

Table 17: Permanent Reduction of Toxicity, Mobility, or Volume

Sub-Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Reduction or elimination of hazardous substance releases and sources of releases.	Source mass is not removed. Exposure is limited through implementation of engineering and institutional controls.	Excavation of impacted soils removes contaminant mass from the Site. Residual COCs may remain beneath structures and would be managed upon destruction of structures.	Contaminant mass in soil remains in place. Asphalt cap prevents leaching of COCs from unsaturated to saturated zone. Installation and operation of air sparge system reduces COC concentrations in groundwater.	Excavation of impacted soils removes contaminant mass from the Site. Residual COCs may remain beneath structures and would be managed upon destruction of structures. Installation and operation of air sparge system reduces COC concentrations in groundwater.	Excavation of impacted soils removes contaminant mass from the Site. Residual COCs may remain beneath structures and would be managed upon destruction of structures. Installation of slurry wall reduces offsite migration of COCs through containment of groundwater. Hydraulic control is provided through groundwater extraction and discharge to POTW.	Excavation of impacted soils removes contaminant mass from the Site. Residual COCs may remain beneath structures and would be managed upon destruction of structures. Installation of slurry wall reduces offsite migration of COCs through containment of groundwater.	Excavation of impacted soils removes contaminant mass from the Site. Residual COCs may remain beneath structures and would be managed upon destruction of structures. Installation of permeable reactive barrier reduces the COC concentrations downgradient of the barrier.
Adequacy of alternative in destroying hazardous substances.	Source mass is not removed or destroyed. Exposure is limited through implementation of engineering and institutional controls.	Excavation of impacted soils removes contaminant mass from the Site. Concentrations of COCs in groundwater may decline with the implementation of this alternative.	Contaminant mass in soil remains in place. Asphalt cap prevents leaching of COCs from unsaturated to saturated zone. Installation and operation of air sparge system reduces COC concentrations in groundwater.	Excavation of impacted soils removes contaminant mass from the Site. Installation and operation of air sparge system reduces COC concentrations in groundwater.	Excavation of impacted soils removes contaminant mass from the Site. Installation of slurry wall contains impacted groundwater from migrating offsite. Residual impacted groundwater remains onsite. Operation of groundwater extraction system for hydraulic control removes limited COC-impacted groundwater for conveyance offsite to the POTW.	Excavation of impacted soils removes contaminant mass from the Site. Installation of slurry wall contains impacted groundwater from migrating offsite. Residual impacted groundwater remains onsite.	Excavation of impacted soils removes contaminant mass from the Site. Installation of permeable reactive barrier reduces the toxicity of COCs in groundwater downgradient of the barrier.

Table 17: Permanent Reduction of Toxicity, Mobility, or Volume

Sub-Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Irreversibility of waste treatment process.	Source mass is not removed or destroyed. Exposure is limited through implementation of engineering and institutional controls.	Impacted soils are transported to and managed in a licensed landfill facility.	Soil source mass remains onsite. Capping prevents leaching of COCs from the unsaturated zone to the saturated zone. Installation and operation of air sparge system reduces COC concentrations in groundwater.	Excavation of impacted soils permanently removes contaminant mass from the Site. Impacted soils are managed in a licensed landfill facility. Installation and operation of air sparge system reduces COC concentrations in groundwater.	Excavation of impacted soils permanently removes source soil from site. Impacted soils are managed in a licensed landfill facility. Residual impacted groundwater remains onsite and contained within slurry wall. Offsite migration of impacted groundwater hydraulically controlled and extracted groundwater discharged to the POTW.	Excavation of impacted soils permanently removes source soil from site. Impacted soils are managed in a licensed landfill facility. Offsite migration of impacted groundwater hydraulically controlled.	Excavation of impacted soils permanently removes source soil from site. Impacted soils are managed in a licensed landfill facility. Installation if permeable reactive barrier, permanently reduces the toxicity of COCs in groundwater by precipitation and adsorption of As.
Characteristics and quantity of treatment residuals generated.	Source mass is not removed or destroyed.	Excavated impacted soil is transported for disposal of in a licensed landfill. Residual impacted soil may remain onsite under existing structures.	Soil source mass remains onsite. Capping prevents leaching of COCs from the unsaturated zone to the saturated zone. No treatment residuals are generated from operation of the air sparge system.	Excavated impacted soil is transported for disposal in a licensed landfill. Residual impacted soil may remain onsite under existing structures. No treatment residuals are generated from operation of the air sparge system.	Excavated impacted soil is transported for disposal in a licensed landfill. Residual impacted soil may remain onsite under existing structures. Extracted impacted groundwater is conveyed to the POTW. No groundwater treatment residuals are generated.	Excavated impacted soil is transported for disposal in a licensed landfill. Residual impacted soil may remain onsite under existing structures. The slurry wall would reduce overall groundwater flow and arsenic mass leaving the site; however, no treatment of water is included.	Excavated impacted soil is transported for disposal in a licensed landfill. Residual impacted soil may remain onsite under existing structures. As III and As V are coprecipitated out of solution with iron oxyhydroxides and adsorbed to the iron oxide surfaces as groundwater transmits through the permeable reactive barrier.
Score	4	5	5	7	6	5	7

Note:

Alternatives are ranked on a scale of 1 to 10 based on how each alternative satisfies the listed criteria (1 = does not meet criteria, 10 = meets criteria completely).

Table 18: Long-Term Effectiveness

Sub-Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Degree of certainty that alternative will be successful.	Engineering and institutional controls prevent potential exposure to COCs.	Excavation of impacted soils removes majority of contaminant mass from on site. Residual contaminant mass may remain beneath existing structures.	Soil source mass remains onsite. Capping prevents leaching of COCs from the unsaturated zone to the saturated zone. Reduction of COCs concentrations in groundwater using air sparging will be slow.	Excavation of impacted soils removes majority of contaminant mass from on site. Residual contaminant mass may remain beneath existing structures. Reduction of COCs concentrations in groundwater using air sparging will be slow.	Excavation of impacted soils removes majority of contaminant mass from on site. Residual contaminant mass may remain beneath existing structures. Installation and maintenance of slurry wall and hydraulic control system will prevent COCs in groundwater from migrating offsite.	Excavation of impacted soils removes majority of contaminant mass from on site. Residual contaminant mass may remain beneath existing structures. Installation and maintenance of slurry wall will reduce COCs in groundwater from migrating offsite.	Excavation of impacted soils removes majority of contaminant mass from on site. Residual contaminant mass may remain beneath existing structures. A pilot study will be implemented prior to full scale installation to refine the composition of reactive material.
Magnitude of residual risk.	Residual risk is limited through implementation of engineering and institutional controls.	Residual risk to exposure to COCs in soil would be low. COC mass remains in groundwater and exposure is limited through engineering and institutional controls	Residual risk would be low for exposure to COCs in soil and moderate initially for exposure to COCs in groundwater reducing over time as COC concentrations decrease.	Residual risk to exposure to COCs in soil would be low. Residual risk to groundwater would be moderate initially reducing over time as COC concentrations decrease.	Residual risk to exposure to COCs in soil would be low. Residual risk to exposure to COCs in groundwater is limited through installation of slurry wall, operation of hydraulic control system, and institutional controls preventing the use of groundwater.	Residual risk to exposure to COCs in soil would be low. Residual risk to exposure to COCs in groundwater is limited through installation of slurry wall. However, low concentrations of arsenic would remain onsite and could potential affect onsite workers that may come in contact with groundwater.	Residual risk to exposure to COCs in soil would be low. Residual risk to exposure to COCs in groundwater is limited through installation of a permeable reactive barrier, particularly downgradient of the barrier.

Sub-Criteria	**ALTERNATIVE 1 Institutional Controls**	**ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls**	**ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides**	**ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides**	**ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW**	**ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control**	**ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier**
Effectiveness of controls required to manage treatment residues or remaining wastes.	Implementation of engineering and institutional controls will limit exposure to COCs remaining onsite.	Excavation of impacted soils permanently removes contaminant mass from the site. Long-term reliability of licensed landfill facility is expected to be adequate. Groundwater monitoring performed.	Installation and maintenance of asphalt cap will limit exposure to COCs remaining in soil and groundwater. Operation of air sparge system will decrease COC concentrations over time.	Excavation of impacted soils permanently removes contaminant mass from the site. Long-term reliability of licensed landfill facility is expected to be adequate. Operation of air sparge system will decrease COC concentrations over time.	Excavation of impacted soils permanently removes contaminant mass from the site. Long-term reliability of licensed landfill facility is expected to be adequate. Operation of the hydraulic control system prevents offsite migration of COCs in groundwater. Extracted groundwater is conveyed to the POTW reducing onsite exposure.	Excavation of impacted soils permanently removes contaminant mass from the site. Long-term reliability of licensed landfill facility is expected to be adequate.	Excavation of impacted soils permanently removes contaminant mass from the site. Long-term reliability of licensed landfill facility is expected to be adequate. Installation of a permeable reactive barrier prevents migration of COCs in groundwater downgradient of the barrier.
Score	8	6	6	6	6	6	6

Note:

Alternatives are ranked on a scale of 1 to 10 based on how each alternative satisfies the listed criteria (1 = does not meet criteria, 10 = meets criteria completely).

Table 19: Short-Term Risks

Sub-Criteria	**ALTERNATIVE 1 Institutional Controls**	**ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls**	**ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides**	**ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides**	**ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW**	**ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control**	**ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier**
Protection of human health during construction and implementation	Institutional controls prevent potential exposure to COCs. No construction activities are planned with this alternative.	Engineering controls will be implemented to protect remediation workers from potential contact with impacted media during excavation activities. Offsite transport of impacted soils would present risks for spillage and vehicle accident.	Engineering controls will be implemented to protect remediation workers from potential contact with impacted media during excavation activities or air sparge system installation and operation.	Engineering controls will be implemented to protect remediation workers from potential contact with impacted media during excavation activities or air sparge system installation and operation.	Engineering controls will be implemented to protect remediation workers from potential contact with impacted media during excavation activities to remove impacted soil and during groundwater extraction system installation and operation.	Engineering controls will be implemented to protect remediation workers from potential contact with impacted media during excavation activities to remove impacted soil.	Engineering controls will be implemented to protect remediation workers from potential contact with impacted media during excavation activities to remove impacted soil and installation of the permeable reactive barrier.
Degree of risk prior to attainment of cleanup standards	Institutional controls prevent potential exposure to COCs.	Moderate degree of risk to workers (contact with impacted media) and moderate risk to the community and environment (dust, spillage, and vehicle accident).	Moderate degree of risk to workers (contact with impacted media) and minimal risk to the community and environment.	Moderate degree of risk to workers (contact with impacted media) and moderate risk to the community and environment (dust, spillage, and vehicle accident).	Moderate degree of risk to workers (contact with impacted media) and moderate risk to the community and environment (dust, spillage, and vehicle accident).	Moderate degree of risk to workers (contact with impacted media and treatment chemicals) and moderate risk to the community and environment (dust, spillage, and vehicle accident).	Moderate degree of risk to workers (contact with impacted media and treatment chemicals) and moderate risk to the community and environment (dust, spillage, and vehicle accident).

Sub-Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Time to achieve objectives	Objectives are met upon implementation of institutional and engineering controls.	Soil cleanup levels would be attained following excavation of impacted soils except for residual contaminant mass beneath existing structures. Impacted soil excavation by itself does not address groundwater contamination.	Because the source mass is not removed, the restoration timeframe is expected to be several decades. Achievement of groundwater cleanup objectives using air sparging is expected to take 20 to 30 years.	Soil cleanup levels would be attained following excavation of impacted soils except for residual contaminant mass beneath existing structures. With soil source mass removed, achievement of groundwater cleanup objectives using air sparging is expected to take 15 to 20 years.	Soil cleanup levels would be attained following excavation of impacted soils except for residual contaminant mass beneath existing structures. Installation of slurry wall and groundwater extraction will contain impacted groundwater onsite and offsite migration is addressed throughout the operational period of the extraction system.	Soil cleanup levels would be attained following excavation of impacted soils except for residual contaminant mass beneath existing structures. Installation of slurry wall will reduce migration of impacted groundwater onsite and offsite.	Soil cleanup levels would be attained following excavation of impacted soils except for residual contaminant mass beneath existing structures. Groundwater cleanup objectives will be met as impacted groundwater transmits through the permeable reactive barrier.
Score	9	5	5	5	4	4	5

Note:

Alternatives are ranked on a scale of 1 to 10 based on how each alternative satisfies the listed criteria (1 = does not meet criteria, 10 = meets criteria completely).

Table 20: Ability to Implement

Sub-Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Consideration of whether alternative is technically possible.	Not applicable	Excavation and offsite disposal of impacted soil is relatively straightforward.	Installation of asphalt cap is relatively straightforward. Installation and operation of air sparge system is relatively straight forward.	Excavation and offsite disposal of impacted soil is relatively straight forward. Installation and operation of air sparge system is relatively straight forward.	Excavation and offsite disposal of impacted soil is relatively straight forward. Installation of slurry wall will present challenges related to utilities and incorporation with the Ebey Slough shoreline. Installation and operation of the groundwater extraction system is relatively straight forward.	Excavation and offsite disposal of impacted soil is relatively straight forward. Installation of slurry wall will present challenges related to utilities and incorporation with the Ebey Slough shoreline.	Excavation and offsite disposal of impacted soil is relatively straight forward. Installation of a permeable reactive barrier will present challenges related to utilities and incorporation with the Ebey Slough shoreline.
Availability of necessary offsite facilities, services, and materials.	Not applicable	Adequate offsite facilities, services, and materials are available.	Adequate offsite facilities, services, and materials are available.	Adequate offsite facilities, services, and materials are available.	Adequate offsite facilities, services, and materials are available.	Adequate offsite facilities, services, and materials are available.	Adequate offsite facilities, services, and materials are available.
Administrative and regulatory requirements.	Institutional control documents are recorded with county and state agencies.	Requirements include, but not limited to, the following: general construction permit. Permitting process may require up to 3 months. Institutional control documents are recorded with county and state agencies.	Requirements include, but not limited to, the following: general construction permit. Permitting process may require up to 3 months. Institutional control documents are recorded with county and state agencies.	Requirements include, but not limited to, the following: general construction permit. Permitting process may require up to 3 months. Institutional control documents are recorded with county and state agencies.	Requirements include, but not limited to, the following: general construction permit, hydraulic project approval and shoreline permit. Permit process may require up to 6 months. Institutional control documents are recorded with county and state agencies.	Requirements include, but not limited to, the following: general construction permit, hydraulic project approval and shoreline permit and NPDES permit (for discharge to suface water). Permit process may require up to 6 months. Institutional control documents are recorded with county and state agencies.	Requirements include, but not limited to, the following: general construction permit, hydraulic project approval and shoreline permit. Permit process may require up to 6 months. Institutional control documents are recorded with county and state agencies.
Scheduling, size, and complexity.	Not applicable	Dry season is more suitable for construction activities. Scheduling/traffic control for transportation of impacted soils offsite (in excess of 200 truck loads).	Dry season is more suitable for construction activities. Installation of air sparge wells. System installation would consist of trenching, piping, backfilling and construction of an onsite enclosure to house system components.	Dry season is more suitable for construction activities. Installation of air sparge wells. System installation would consist of trenching, piping, backfilling and construction of an onsite enclosure to house system components.	Dry season is more suitable for construction activities. Scheduling/traffic control for transportation of impacted soils offsite (in excess of 200 truck loads). Installation of groundwater extraction wells. System installation would consist of trenching, piping, backfilling and construction of an onsite enclosure to house system components.	Dry season is more suitable for construction activities. Scheduling/traffic control for transportation of impacted soils offsite (in excess of 200 truck loads). System installation would consist of trenching, backfilling.	Dry season is more suitable for construction activities. Scheduling/traffic control for transportation of impacted soils offsite (in excess of 200 truck loads). The pilot study duration is expected to be 1 to 2 years, followed by full scale installation.
Monitoring requirements.	Periodic groundwater monitoring will be required.	Confirmation soil samples would be collected and analyzed to evaluate compliance with soil cleanup levels. Groundwater monitoring would be performed to assess the effectiveness of the impacted soil removal and evaluate groundwater quality.	Long-term groundwater monitoring would be performed to assess treatment effectiveness and evaluate groundwater quality.	Confirmation soil samples would be collected and analyzed to evaluate compliance with soil cleanup levels. Long-term groundwater monitoring would be performed to assess treatment effectiveness and evaluate groundwater quality.	Confirmation soil samples would be collected and analyzed to evaluate compliance with soil cleanup levels. Samples of effluent would be collected to monitor the quality of water entering the POTW. Long-term groundwater monitoring would be performed to evaluate onsite and offsite groundwater quality.	Confirmation soil samples would be collected and analyzed to evaluate compliance with soil cleanup levels. Long-term groundwater monitoring would be performed to evaluate onsite and offsite groundwater quality.	Confirmation soil samples would be collected and analyzed to evaluate compliance with soil cleanup levels. Samples upgradient, within and downgradient would be collected to evaluate the effectiveness of the permeable reactive barrier. Long-term groundwater monitoring would be performed to evaluate onsite and offsite groundwater quality.

Sub-Criteria	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation/Offsite Disposal with Institutional Controls	ALTERNATIVE 3 Capping with Asphalt/ Air Sparging on Eastern & Western Sides	ALTERNATIVE 4 Excavation/Disposal/Air Sparging on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/Slurry Wall/ Hydraulic Control Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Access for construction, operations, and monitoring.	Available. Periodic site access for groundwater monitoring.	Available. Access required for impacted soil excavation activities. Periodic site access for groundwater monitoring.	Available. Access required for soil capping and air sparge well installation activities. Periodic site access required for air sparge system operation, maintenance, and groundwater monitoring.	Available. Access required for impacted soil excavation and air sparge well installation activities. Periodic site access required for air sparge system operation, maintenance, and groundwater monitoring.	Available. Access required for impacted soil excavation, slurry wall installation, and groundwater extraction well and infrastructure installation activities. Periodic site access required for groundwater extraction system operation, maintenance, and groundwater monitoring.	Available. Access required for impacted soil excavation, slurry wall installation, and groundwater extraction well and treatment system infrastructure installation activities. Periodic site access required for groundwater monitoring.	Available. Access required for impacted soil excavation, and pilot and full scale permeable reactive barrier installation activities. Periodic site access required for groundwater monitoring.
Integration with existing facility operations and other current or potential remedial actions.	Not applicable	Low to moderate degree of disturbance to site during construction activities.	Low to moderate degree of disturbance to site during construction activities. Moderate degree of disturbance to site infrastructure during sparge well installation and system construction. Minimal disturbance during long-term system operation and maintenance and monitoring activities.	Low to moderate degree of disturbance to site during construction activities. Moderate degree of disturbance to site infrastructure during sparge well installation and system construction. Minimal disturbance during long-term system operation and maintenance and monitoring activities.	Low to moderate degree of disturbance to site during impacted soil excavation activities. Slurry wall installation creates the highest degree of disturbance to site infrastructure of the evaluated alternatives. Moderate degree of disturbance to site infrastructure during extraction well installation and system construction. Minimal disturbance during long-term system operation and maintenance and monitoring activities.	Low to moderate degree of disturbance to site during impacted soil excavation activities. Slurry wall installation creates the highest degree of disturbance to site infrastructure of the evaluated alternatives. Moderate degree of disturbance to site infrastructure during extraction well installation and system construction.	Low to moderate degree of disturbance to site during impacted soil excavation activities. Permeable reactive barrier installation creates a moderate degree of disturbance to site infrastructure. Low degree of disturbance to site infrastructure during monitoring activities.
"Benefit" Score	9	8	4	5	4	4	5

Note:

Alternatives are ranked on a scale of 1 to 5 based on how each alternative satisfies the listed criteria (1 = does not meet criteria, 5 = meets criteria completely).

Table 21: Potential Action-Specific Applicable, Relevant, and Appropriate Requirements (ARARs)

Federal/State Citation	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation and Offsite Disposal	ALTERNATIVE 3 Capping with Asphalt with AS on Eastern & Western Sides	ALTERNATIVE 4 Excavation/ Disposal with AS on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/ Slurry Wall/ with Hydraulic Control & Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/ Slurry Wall/ Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Clean Water Act (CWA) National Pollutant Discharge Elimination System (NPDES)	Applicable for groundwater treatment and discharge.						
Safe Drinking Water Act (National Primary and Secondary Drinking Water Regulations)	The remedial actions are being completed to reduce chemical concentrations in soil and groundwater to MTCA Method A (unrestricted use) and MTCA Method B cleanup levels.						
Resource Conservation and Recovery Act (RCRA)	Waste generated during the remedial action will be characterized and disposed per RCRA, as implemented by the State of Washington Danger Waste Regulations (WAC 173-303).						
Clean Air Act, as Amended	Potentially applicable for production of air emissions. However, there are no elevated concentrations of VOCs at the site.						
Endangered Species Act (ESA)	Threatened or endangered species are known to inhabit the general area, but not the Interfor Pacific site. Site activities will not jeopardize threatened or endangered species.						
National Historic Preservation Act, Archeological Resources Protect (36 CFR 800)	Historically significant archeological resources are not known to be present at the site. Historically significant properties will not be disturbed by any remedial action proposed.						
Occupational Safety and Health Act (29 CFR 1910)	Site activities will be performed under appropriate Occupation Safety and Health Act standards and WISHA requirements.						
Standards Applicable to Transporters of Hazardous Waste (29 CFR 107, 29 CRF 171)	Hazardous waste, if any, generated at the site will be characterized/waste profiled as required to determine packaging, handling, and transportation requirements.						
STATE or LOCAL							
Dangerous Waste Regulations (WAC 173-303)	Waste generated during the remedial action will be characterized and disposed per RCRA, as implemented by the State of Washington Danger Waste Regulations (WAC 173-303).						
Model Toxics Control Act (MTCA) (WAC 173-340)	Applicable to all aspects of the project. Each remedial alternative would be completed in accordance with MTCA regulations.						
State Clean Air Act (RCW 70.94)	Applicable for production of air emissions. However, there are no elevated concentrations of VOCs at the site.						

Table 21: Potential Action-Specific Applicable, Relevant, and Appropriate Requirements (ARARs)

Federal/State Citation	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation and Offsite Disposal	ALTERNATIVE 3 Capping with Asphalt with AS on Eastern & Western Sides	ALTERNATIVE 4 Excavation/ Disposal with AS on Eastern & Western Sides	ALTERNATIVE 5 Excavation/Disposal/ Slurry Wall/ with Hydraulic Control & Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/ Slurry Wall/ Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal with Installation of Permeable Reactive Barrier
Washington Industrial Safety and Health Act (WISHA) (WAC 296-62)	Site activities will be performed under appropriate Washington Industrial and Safety and Health Act standards.						
Water Pollution Control Act (RCW 90.48)	Applicable for discharge of effluents from remediation activities.						
Water Quality Standards for Groundwater of the State of Washington (WAC 173-200)	The remedial actions are being completed to reduce chemical concentrations in groundwater to MTCA Method A (unrestricted use) and MTCA Method B cleanup levels.						
Underground Injection Control (WAC 173-218)	Potentially applicable if *in situ* remediation enhancements are implemented.						
Maximum Environmental Noise Levels (WAC 173-60)	Relevant depending on remedial action.						
Shoreline Management Act (RCW 90.58 and WAC 173-60)	Act directs local governments to develop and administer local shoreline master programs for regulation of uses of shoreline of the state.						
Minimum Standards for Construction and Maintenance of Wells (WAC 173-160)	Soil borings and well construction to be completed in accordance with these regulations.						
Maximum Environmental Noise Levels (WAC 173-60)	Applicable to all alternatives, especially those that include significant construction activities.						
State Environmental Policy Act (SEPA) (WAC 197-11)	Applicable to each alternative.						
Puget Sound Clean Air Regulatory Requirements	Applicable for potential dust generation during construction activities.						
Land Development Standards (SBC)	Compliance with substantive conditions of local permits; stormwater regulations, demolition, clearing, and grading.						
Building and Construction (SBC)	Compliance with substantive conditions of local building codes; building permits.						

Table 21: Potential Action-Specific Applicable, Relevant, and Appropriate Requirements (ARARs)

Notes:

CFR	= Code of Federal Regulations
WAC	= Washington Administrative Code
RCW	= Revised Code of Washington
SBC	= Seattle Building Code
AS	= air sparging
POTW	= Publicly-Owned Treatment Works

Table 22: Disproportionate Cost Analysis

Benefit	Benefit Weighting Factor	ALTERNATIVE 1 Institutional Controls	ALTERNATIVE 2 Excavation and Offsite Disposal	ALTERNATIVE 3 Soil Capping with Air Sparging	ALTERNATIVE 4 Soil Excavation and Offsite Disposal with Air Sparging	ALTERNATIVE 5 Excavation/Disposal/ Slurry Wall/Hydraulic Control with Groundwater Discharge to POTW	ALTERNATIVE 6 Excavation/Disposal/ Slurry Wall/ Hydraulic Control Without Hydraulic Control	ALTERNATIVE 7 Excavation/Disposal/ Installation of Permeable Reactive Barrier
Protectiveness (Table 12)	25%	6	7	6	7	7	6	7
Permanence (Table 13)	20%	4	5	5	7	6	5	7
Long-Term Effectiveness (Table 14)	30%	8	6	6	6	6	6	6
Short-Term Risks (Table 15)	15%	9	5	5	5	4	4	4
Ability to Implement (Table 16)	5%	9	8	4	5	4	4	5
Consideration of Public Concerns	5%	7	8	5	5	5	5	5
Total Weighted Benefits	**100%**	**6.9**	**6.1**	**5.5**	**6.2**	**5.8**	**5.4**	**6.1**
Cost (Million $)		**$0.020**	**$0.561**	**$2.210**	**$1.250**	**$2.049**	**$1.651**	**$3.469**
Benefit/Cost Ratio		3425	109	25	50	28	32	17
Benefit/Cost Ratio Relative to the Most Permanent Alternative		69.1	2.2	0.5	1.0	0.6	0.7	0.4

Table 23: Alternative 2 - Excavation and Offsite Disposal (Estimated Cost) Feasibility Study

Item Description	Quantity	Unit	Unit Cost	Extension	Assumptions
A. Preliminary Activities					
Cleanup Action Plan (CAP)	1	lump sum	$10,000	$10,000	
Design (plans and specifications)	1	lump sum	$10,000	$10,000	
Permitting					
General Demolition/Grading/Construction	1	lump sum	$10,000	$10,000	
Coordination with City of Marysville, Ecology	1	lump sum	$5,000	$5,000	
Health and Safety Plan	1	lump sum	$5,000	$5,000	
Deed Restriction/Soil Management Plan	1	lump sum	$20,000	$20,000	Estimate
Item A. Estimated Cost				**$60,000**	
B. Impacted Soil Excavation and Disposal/Amend and Backfill/Compaction					
Mobilization/Demobilization	1	lump sum	$15,333	$15,333	5 percent of construction cost (Item C, excluding construction management).
Private Utility Locate	1	lump sum	$2,000	$2,000	
Site Security	1	lump sum	$2,000	$2,000	Temporary fencing, signage, etc.
Erosion Control	1	lump sum	$3,000	$3,000	Construction entrance, silt fence, catch basin protection, stockpile management, etc.
Abandon Monitoring Wells	8	well	$500	$4,000	
Demo and Remove Existing Pavement	1	lump sum	$5,000	$5,000	
Haul and Dispose Pavement	100	ton	$30	$3,000	Estimate, assumes a portion of the waste concrete can be recyled for fill material onsite
Excavation (landfill disposal)	2,000	cubic yard	$10	$20,000	Load directly to trucks. Assume material previously profiled. Excavate to water table.
Waste Profiling for Landfill Disposal	1	lump sum	$1,000	$1,000	Use existing laboratory analytical data for landfill waste profiling.
Hauling	3,400	ton	$10	$34,000	Hauling from site to landfill. Assumes wet soil.
Landfill Disposal	3,400	ton	$40	$136,000	Non-hazardous waste - Subtitle D landfill facility in Seattle, Washington (Robanco/Allied Waste).
Soil Chemical Analyses (confirmation sampling)					
TPH-Gasoline	25	sample	$70	$1,750	Discrete soil samples from excavation floor and sidewalls, 1-week turn-around time.
BTEX	25	sample	$70	$1,750	
TPH-Diesel	25	sample	$70	$1,750	
Metals (arsenic and lead)	25	sample	$80	$2,000	
Imported Backfill (material and transport)	3,000	ton	$20	$60,000	Imported fill.
Placement and Compaction (imported fill)	2,000	cubic yard	$10	$20,000	
Biological Amendment (material and transport)	200	lb	$12	$2,400	Assume use of 200 pounds of ammendment
Placement/Mixing Amendment/Compaction	200	cubic yard	$10	$2,000	
Utility Restoration	1	lump sum	$5,000	$5,000	
Construction Management	1	lump sum	$16,099	$16,099	Project management, oversight, direct expenses, etc. 5 percent of construction cost (Item B).
Item B. Estimated Cost				**$338,082**	
C. Monitoring Well Installation/Groundwater Sampling and Chemical Analyses					
Monitoring Well Installation					
Mobilization/Demobilization	1	lump sum	$1,000	$1,000	
Well Installation	3	well	$2,500	$7,500	
Consultant Labor and Equipment	3	day	$1,200	$3,600	
Groundwater Sampling and Chemical Analyses					Following completion of remediation activities, quarterly for 2 years from 6 monitoring wells. After 2 years, semi annual for 10 years.
TPH-Gasoline	98	sample	$35	$3,430	
Metals (As & Pb)	98	sample	$40	$3,920	
TPH-Diesel	98	sample	$35	$3,430	
Consultant Labor and Equipment	14	event	$2,500	$35,000	
Investigation-Derived Waste Water Handling/Disposal	14	events	$1,000	$11,700	1 disposal event per sampling event.
Item C. Estimated Cost				**$69,580**	
D. Other					
Project Management	2	years	$6,000	$12,000	
Construction Report	1	report	$15,000	$15,000	Includes as-built drawings.
Groundwater Monitoring Report	8	report	$4,000	$32,000	Assume annual reports (8)
Washington State Sales Tax	1	lump sum	$34,146	$34,146	10.1 percent of construction capital cost (Item B).
Item D. Estimated Cost				**$93,146**	
Total Estimated Cost				**$561,000**	

Notes:
1. Estimated cost was prepared at -30/+50% for relative comparison amongst alternatives. The prepared cost estimate is not intended for budgetary purposes.
2. An engineering cost estimate will be prepared in conjunction with CAP preparation and design (technical specifications and drawings).

Table 24: Alternative 3 - Capping with Asphalt and Air Sparging (Estimated Cost), Feasibility Study

Item Description	Quantity	Unit	Unit Cost	Extension	Assumptions
A. Preliminary Activities					
Cleanup Action Plan (CAP)	1	lump sum	$10,000	$10,000	
Design (plans and specifications)	1	lump sum	$60,000	$60,000	
Pilot Study for AS System	1	lump sum	$40,000	$40,000	
Topographical Survey	1	lump sum	$10,000	$10,000	
Permitting					
General Demolition/Grading/Construction	1	lump sum	$10,000	$10,000	
Coordination with City of Marysville, Ecology	1	lump sum	$5,000	$5,000	
Health and Safety Plan	1	lump sum	$5,000	$5,000	
Deed Restriction/Soil Management Plan	1	lump sum	$20,000	$20,000	Estimate
Item A. Estimated Cost				**$160,000**	
B. Asphalt Cap Installation & Air Sparge System					
Mobilization/Demobilization	1	lump sum	$66,779	$66,779	5 percent of construction cost (Item C, excluding construction management).
Private Utility Locate	2	lump sum	$2,000	$4,000	
Site Security	1	lump sum	$5,000	$5,000	Temporary fencing, signage, etc.
Erosion Control	1	lump sum	$5,000	$5,000	Construction entrance, silt fence, catch basin protection, stockpile management, etc.
Abandon Monitoring Wells	8	well	$500	$4,000	
Air Sparge Well Installation	50	well	$1,500	$75,000	
Investigation-Derived Waste (IDW) Water Transport and Disposal	1	Unit Cost	$5,000	$5,000	Decontamination and development water.
Investigation-Derived Waste (IDW) Soil Transport and Disposal	1	Unit Cost	$5,000	$5,000	1 drum per AS well; $100 per drum T&D.
Power Drop/Electrical - Upgrade Existing	1	lump sum	$5,000	$5,000	
Enclosure Construction	1	lump sum	$5,000	$5,000	
Vaults/Well Head Appurtenances/Piping	50	each	$600	$30,000	
Site Regrading	37,268	square feet	$3	$111,804	
CSBC Pavement Subgrade (4" thick)	4,845	cubic yard	$30	$145,345	
Asphalt Concrete Pavement cap (3" thick)	6,079	Tons	$100	$607,934	
Stormwater Detention/Basic Treatment, above grade	300,000	lump sum	$1	$300,000	Assume basic treatment only
Utility Restoration	1	lump sum	$10,000	$10,000	
Construction Management	1	lump sum	$112,189	$112,189	Project management, oversight, direct expenses, etc. 8 percent of construction cost (Item B).
Item B. Estimated Cost				**$1,514,552**	
C. Monitoring Well Installation/Groundwater Sampling and Chemical Analyses					
AS System O&M	30	year	$4,000	$83,800	General contractor labor, equipment, replacement equipment.
AS System Consultant Labor (bi-monthly inspection)	30	year	$4,050	$84,800	One person, 5 hours per event, $135/hr every other month for 30 years.
Monitoring Well Installation					
Mobilization/Demobilization	1	lump sum	$1,000	$1,000	
Well Installation	3	well	$2,500	$7,500	
Consultant Labor and Equipment	2	day	$1,200	$1,800	
Groundwater Sampling and Chemical Analyses					Following completion of remediation activities, quarterly for 2 years from 6 monitoring wells. After 2 years, annual for 28 years.
TPH-Gasoline	252	sample	$35	$8,820	
Metals (As & Pb)	252	sample	$40	$10,080	
TPH-Diesel	252	sample	$35	$8,820	
Consultant Labor and Equipment	36	event	$2,500	$90,000	
Groundwater Monitoring Report	30	report	$4,000	$83,800	
Investigation-Derived Waste Water Handling/Disposal	36	events	$1,000	$23,600	1 disposal event per sampling event.
Item C. Estimated Cost				**$235,420**	
D. Other					
Project Management	2	years	$6,000	$12,000	
Construction Report	1	report	$15,000	$15,000	Includes as-built drawings.
Groundwater Monitoring Report	30	report	$4,000	$120,000	Annual reports
Washington State Sales Tax	1	lump sum	$152,970	$152,970	10.1 percent of construction capital cost (Item B).
Item D. Estimated Cost				**$299,970**	
Total Estimated Cost				**$2,210,000**	

Notes:

1. Estimated cost was prepared at -30/+50% for relative comparison amongst alternatives. The prepared cost estimate is not intended for budgetary purposes.
2. An engineering cost estimate will be prepared in conjunction with CAP preparation and design (technical specifications and drawings).

Table 25: Alternative 4 - Excavation and Offsite Disposal with Air Sparging (Estimated Cost), Feasibility Study

Item Description	Quantity	Unit	Unit Cost	Extension	Assumptions
A. Preliminary Activities					
Cleanup Action Plan (CAP)	1	lump sum	$10,000	$10,000	
Design (plans and specifications)	1	lump sum	$40,000	$40,000	
Pilot Study for AS System	1	lump sum	$35,000	$35,000	
Permitting					
General Demolition/Grading/Construction	1	lump sum	$10,000	$10,000	
National Pollutant Discharge Elimination System (NPDES)	1	lump sum	$10,000	$10,000	
Health and Safety Plan	1	lump sum	$5,000	$5,000	
Deed Restriction/Soil Management Plan	1	lump sum	$20,000	$20,000	
Item A. Estimated Cost				**$130,000**	
B. Impacted Soil Excavation and Disposal/Amend and Backfill/Compaction & Air Sparge System					
Mobilization/Demobilization	1	lump sum	$25,195	$25,195	5 percent of construction cost (Item C, excluding construction management).
Private Utility Locate	1	lump sum	$2,000	$2,000	
Site Security	1	lump sum	$5,000	$5,000	Temporary fencing, signage, etc.
Erosion Control	1	lump sum	$5,000	$5,000	Construction entrance, silt fence, catch basin protection, stockpile management, etc.
Traffic Control	10	day	$500	$5,000	Traffic control for dump trucks entering and leaving site.
Abandon Monitoring Wells	8	well	$500	$4,000	
Excavation (landfill disposal)	2,000	cubic yard	$15	$30,000	Load directly to trucks. Assume material previously profiled. Excavate to 15' bgs.
Waste Profiling for Landfill Disposal	0	lump sum	$1,000	$0	Use existing laboratory analytical data for landfill waste profiling.
Hauling	3,400	ton	$15	$51,000	Hauling from site to landfill. Assumes wet soil.
Landfill Disposal	3,400	ton	$45	$153,000	Non-hazardous waste - Subtitle D landfill facility in Seattle, Washington (Robanco/Allied Waste).
Soil Chemical Analyses (confirmation sampling)					
TPH-Gasoline	25	sample	$35	$875	Discrete soil samples from excavation floor and sidewalls.
BTEX	25	sample	$35	$875	
TPH-Diesel	25	sample	$35	$875	
Metals (As & Pb)	25	sample	$75	$1,875	
Air Sparge Well Installation	50	well	$1,500	$75,000	
Investigation-Derived Waste (IDW) Water Transport and Disposal	1	Unit Cost	$5,000	$5,000	
Investigation-Derived Waste (IDW) Soil Transport and Disposal	1	Unit Cost	$5,000	$5,000	
Power Drop/Electrical - Upgrade Existing	1	lump sum	$5,000	$5,000	
Enclosure Construction	1	lump sum	$5,000	$5,000	
Vaults/Well Head Appurtenances	50	each	$600	$30,000	
NPDES Water Chemical Analyses					
TPH-Gasoline	0	sample	$35	$0	Weekly collection, influent and effluent water samples.
BTEX	0	sample	$35	$0	
TPH-Diesel	0	sample	$35	$0	
Imported Backfill (material and transport)	3,000	ton	$30	$90,000	Imported fill. Includes 20% compaction factor in quantity estimate.
Placement and Compaction (imported fill)	2,000	cubic yard	$10	$20,000	
Biological Amendment (material and transport)	200	lb	$12	$2,400	Assume use of 200 pounds of ammendment
Placement/Mixing Amendment	200	cubic yard	$10	$2,000	
Utility Restoration	1	lump sum	$5,000	$5,000	
Construction Management	1	lump sum	$24,845	$24,845	Project management, oversight, direct expenses, etc. 5 percent of construction cost (Item B).
Item B. Estimated Cost				**$553,940**	
C. Monitoring Well Installation/Groundwater Sampling and Chemical Analyses					
AS System O&M	30	year	$4,000	$83,800	General contractor labor, equipment, replacement equipment.
AS System Consultant Labor (bi-monthly inspection)	30	year	$4,050	$84,800	One person, 5 hours per event, $135/hr every other month for 30 years.
Monitoring Well Installation					
Mobilization/Demobilization	1	lump sum	$1,000	$1,000	
Well Installation	3	well	$2,500	$7,500	
Consultant Labor and Equipment	3	day	$1,200	$3,600	
Groundwater Sampling and Chemical Analyses					Following completion of remediation activities, quarterly for 2 years from 6 monitoring wells. After 2 years, annual for 28 years.
TPH-Gasoline	252	sample	$35	$8,820	
Metals (As & Pb)	252	sample	$40	$10,080	
TPH-Diesel	252	sample	$35	$8,820	
Consultant Labor and Equipment	36	event	$2,500	$90,000	
Groundwater Monitoring Report	30	report	$4,000	$83,800	
Investigation-Derived Waste Water Handling/Disposal	36	events	$1,000	$23,600	1 disposal event per sampling event.
Item C. Estimated Cost				**$237,220**	
D. Other					
Project Management	2	years	$6,000	$12,000	
Construction Report	1	report	$15,000	$15,000	Includes as-built drawings.
Groundwater Monitoring Report	30	report	$4,000	$120,000	Annual reports
Washington State Sales Tax	1	lump sum	$55,948	$55,948	10.1 percent of construction capital cost (Item B).
Item D. Estimated Cost				**$202,948**	
Total Estimated Cost				**$1,125,000**	

Notes:

1. Estimated cost was prepared at -30/+50% for relative comparison amongst alternatives. The prepared cost estimate is not intended for budgetary purposes.
2. An engineering cost estimate will be prepared in conjunction with CAP preparation and design (technical specifications and drawings).

Table 26: Alternative 5 - Excavation and Offsite Disposal, Slurry Wall, Groundwater Extraction and Discharge to POTW (Estimated Cost), Feasibility Study

Item Description	Quantity	Unit	Unit Cost	Extension	Assumptions
A. Preliminary Activities					
Cleanup Action Plan (CAP)	1	lump sum	$10,000	$10,000	
Design (plans and specifications)	1	lump sum	$80,000	$80,000	
Topographical Survey	1	lump sum	$10,000	$10,000	
Permitting					
General Demolition/Grading/Construction	1	lump sum	$10,000	$10,000	
National Pollutant Discharge Elimination System (NPDES)	1	lump sum	$10,000	$10,000	
Health and Safety Plan	1	lump sum	$5,000	$5,000	
Deed Restriction/Soil Management Plan	1	lump sum	$20,000	$20,000	
Item A. Estimated Cost				**$145,000**	
B. Impacted Soil Excavation and Disposal/Amend and Backfill/Compaction					
Mobilization/Demobilization	1	lump sum	$46,446	$46,446	5 percent of construction cost (Item C, excluding construction management).
Private Utility Locate	1	lump sum	$2,000	$2,000	
Site Security	1	lump sum	$5,000	$5,000	Temporary fencing, signage, etc.
Erosion Control	1	lump sum	$5,000	$5,000	Construction entrance, silt fence, catch basin protection, stockpile management, etc.
Traffic Control	10	day	$500	$5,000	Traffic control for dump trucks entering and leaving site.
Abandon Monitoring Wells	8	well	$500	$4,000	
Utility Disconnect/Re-Route	1	lump sum	$5,000	$5,000	Estimate.
Sawcut Existing Pavement	100	linear feet	$5	$500	
Demo and Remove Existing Pavement	1	lump sum	$5,000	$5,000	
Haul and Dispose Pavement	100	ton	$30	$3,000	
Excavation (landfill disposal) Impacted areas	2,000	cubic yard	$15	$30,000	Load directly to trucks. Assume material previously profiled.
Excavation for Slurry Walls (2' wide/ 9 ft avg depth)	1,933	cubic yard	$15	$29,000	Load directly to trucks. Assume material previously profiled. Slurry wall trench is 2,900 linear feet, assume is spread over site
Waste Profiling for Landfill Disposal	1	lump sum	$1,000	$1,000	Use existing laboratory analytical data for landfill waste profiling.
Hauling	3,400	ton	$10	$34,000	Hauling from site to landfill. Assumes wet soil.
Landfill Disposal	3,400	ton	$40	$136,000	Non-hazardous waste - Subtitle D landfill facility in Seattle, Washington (Robanco/Allied Waste).
Soil Chemical Analyses (confirmation sampling)					
TPH-Gasoline	25	sample	$35	$875	Discrete soil samples from excavation floor and sidewalls.
BTEX	25	sample	$35	$875	
TPH-Diesel	25	sample	$35	$875	
Metals (As & Pb)	25	sample	$40	$1,000	
NPDES Water Chemical Analyses					Assume one sample monthly for 30 years
TPH-Gasoline	360	sample	$35	$12,600	
TPH-Diesel	360	sample	$35	$12,600	
Metals (As & Pb)	360	sample	$40	$14,400	
Imported Backfill (material and transport)	3,000	ton	$20	$60,000	Imported fill.
Placement and Compaction (imported fill)	2,000	cubic yard	$10	$20,000	
Placement and Compaction (imported fill)	0	cubic yard	$10	$0	
Bentonite Slurry Wall Construction	26,100	SF	$18	$469,800	Soil and bentonite wall, assume reuse of excavated soils, estimated cost includes mobilization/demobilization by a local contractor
Biological Amendment (material and transport)	200	lb	$12	$2,400	Assume use of 200 pounds of ammendment
Placement/Mixing Amendment/Compaction	200	cubic yard	$10	$2,000	
Utility Restoration	1	lump sum	$5,000	$5,000	
Extraction Well Installation					
Mobilization/Demobilization	1	lump sum	$1,000	$1,000	
Well Installation and wast disposal	10	well	$2,750	$27,500	
Consultant Labor and Equipment	10	day	$1,200	$12,000	
Well Pumps	10	EA	$3,000	$30,000	
Piping	1,100	LF	$7	$7,700	2" pvc pipe & trenching
Enclosure	1	LS	$5,000	$5,000	
Sewer Connection (assumes connection to existing line on property)	1	LS	$10,000	$10,000	
Construction Management	1	lump sum	$106,857	$106,857	Project management, oversight, direct expenses, etc. 10 percent of construction cost (Item B).
Item B. Estimated Cost				**$1,175,428**	
C. Monitoring Well Installation/Groundwater Sampling and Chemical Analyses/ Ongoing Operations					
Monitoring Well Installation					
Mobilization/Demobilization	1	lump sum	$1,000	$1,000	
Well Installation	3	well	$2,500	$7,500	
Consultant Labor and Equipment	3	day	$1,200	$3,600	
Groundwater Sampling and Chemical Analyses					Following completion of remediation activities, quarterly for 2 years from 6 monitoring wells. After 2 years, annual for 28 years.
TPH-Gasoline	252	sample	$35	$8,820	
Metals (As & Pb)	252	sample	$40	$10,080	
TPH-Diesel	252	sample	$35	$8,820	
Consultant Labor and Equipment	36	event	$2,500	$90,000	
Groundwater Monitoring Report	30	report	$4,000	$83,800	
Investigation-Derived Waste Water Handling/Disposal	36	events	$1,000	$23,600	1 disposal event per sampling event.
Extraction Well System O&M	30	YR	$2,500.00	$75,000	$250 per extraction well per year
Disposal to POTW (30 years)	30	YR	$5,000.00	$150,000	estimated cost from POTW for water disposal
Item C. Estimated Cost				**$462,220**	
D. Other					
Project Management	2	years	$6,000	$12,000	
Construction Report	1	report	$15,000	$15,000	Includes as-built drawings.
Groundwater Monitoring Report	30	report	$4,000	$120,000	Annual reports
Washington State Sales Tax	1	lump sum	$118,718	$118,718	10.1 percent of construction capital cost (Item B).
Item D. Estimated Cost				**$265,718**	
Total Estimated Cost				**$2,049,000**	

Notes:

1. Estimated cost was prepared at -30/+50% for relative comparison amongst alternatives. The prepared cost estimate is not intended for budgetary purposes.
2. An engineering cost estimate will be prepared in conjunction with CAP preparation and design (technical specifications and drawings).

Table 27: Alternative 6 - Excavation and Offsite Disposal, Slurry Wall, Groundwater Extraction and Discharge to POTW (Estimated Cost), Feasibility Study

Item Description	Quantity	Unit	Unit Cost	Extension	Assumptions
A. Preliminary Activities					
Cleanup Action Plan (CAP)	1	lump sum	$10,000	$10,000	
Design (plans and specifications)	1	lump sum	$80,000	$80,000	
Topographical Survey	1	lump sum	$10,000	$10,000	
Permitting					
General Demolition/Grading/Construction	1	lump sum	$10,000	$10,000	
Health and Safety Plan	1	lump sum	$5,000	$5,000	
Deed Restriction/Soil Management Plan	1	lump sum	$20,000	$20,000	
Item A. Estimated Cost				**$135,000**	
B. Impacted Soil Excavation and Disposal/Amend and Backfill/Compaction					
Mobilization/Demobilization	1	lump sum	$44,466	$44,466	5 percent of construction cost (Item C, excluding construction management).
Private Utility Locate	1	lump sum	$2,000	$2,000	
Site Security	1	lump sum	$5,000	$5,000	Temporary fencing, signage, etc.
Erosion Control	1	lump sum	$5,000	$5,000	Construction entrance, silt fence, catch basin protection, stockpile management, etc.
Traffic Control	10	day	$500	$5,000	Traffic control for dump trucks entering and leaving site.
Abandon Monitoring Wells	8	well	$500	$4,000	
Utility Disconnect/Re-Route	1	lump sum	$5,000	$5,000	Estimate.
Sawcut Existing Pavement	100	linear feet	$5	$500	
Demo and Remove Existing Pavement	1	lump sum	$5,000	$5,000	
Haul and Dispose Pavement	100	ton	$30	$3,000	
Excavation (landfill disposal) Impacted areas	2,000	cubic yard	$15	$30,000	Load directly to trucks. Assume material previously profiled.
Excavation for Slurry Walls (2' wide/ 9 ft avg depth)	1,933	cubic yard	$15	$29,000	Load directly to trucks. Assume material previously profiled. Slurry wall trench is 2,900 linear feet, assume is spread over site
Waste Profiling for Landfill Disposal	1	lump sum	$1,000	$1,000	Use existing laboratory analytical data for landfill waste profiling.
Hauling	3,400	ton	$10	$34,000	Hauling from site to landfill. Assumes wet soil.
Landfill Disposal	3,400	ton	$40	$136,000	Non-hazardous waste - Subtitle D landfill facility in Seattle, Washington (Robanco/Allied Waste).
Soil Chemical Analyses (confirmation sampling)					
TPH-Gasoline	25	sample	$35	$875	Discrete soil samples from excavation floor and sidewalls.
BTEX	25	sample	$35	$875	
TPH-Diesel	25	sample	$35	$875	
Metals (As & Pb)	25	sample	$40	$1,000	
Imported Backfill (material and transport)	3,000	ton	$20	$60,000	Imported fill.
Placement and Compaction (imported fill)	2,000	cubic yard	$10	$20,000	
Placement and Compaction (imported fill)	0	cubic yard	$10	$0	
Bentonite Slurry Wall Construction	26,100	SF	$18	$469,800	Soil and bentonite wall, assume reuse of excavated soils, estimated cost includes mobilization/demobilization by local contractor
Biological Amendment (material and transport)	200	lb	$12	$2,400	Assume use of 200 pounds of ammendment
Placement/Mixing Amendment/Compaction	200	cubic yard	$10	$2,000	
Utility Restoration	1	lump sum	$5,000	$5,000	
Construction Management	1	lump sum	$93,379	$93,379	Project management, oversight, direct expenses, etc. 10 percent of construction cost (Item B).
Item B. Estimated Cost				**$1,027,170**	
C. Monitoring Well Installation/Groundwater Sampling and Chemical Analyses/ Ongoing Operations					
Monitoring Well Installation					
Mobilization/Demobilization	1	lump sum	$1,000	$1,000	
Well Installation	3	well	$2,500	$7,500	
Consultant Labor and Equipment	3	day	$1,200	$3,600	
Groundwater Sampling and Chemical Analyses					Following completion of remediation activities, quarterly for 2 years from 6 monitoring wells. After 2 years, annual for 28 years.
TPH-Gasoline	252	sample	$35	$8,820	
Metals (As & Pb)	252	sample	$40	$10,080	
TPH-Diesel	252	sample	$35	$8,820	
Consultant Labor and Equipment	36	event	$2,500	$90,000	
Groundwater Monitoring Report	30	report	$4,000	$83,800	
Investigation-Derived Waste Water Handling/Disposal	36	events	$1,000	$23,600	1 disposal event per sampling event.
Item C. Estimated Cost				**$237,220**	
D. Other					
Project Management	2	years	$6,000	$12,000	
Construction Report	1	report	$15,000	$15,000	Includes as-built drawings.
Groundwater Monitoring Report	30	report	$4,000	$120,000	Annual reports
Washington State Sales Tax	1	lump sum	$103,744	$103,744	10.1 percent of construction capital cost (Item B).
Item D. Estimated Cost				**$250,744**	
Total Estimated Cost				**$1,651,000**	

Notes:
1. Estimated cost was prepared at -30/+50% for relative comparison amongst alternatives. The prepared cost estimate is not intended for budgetary purposes.
2. An engineering cost estimate will be prepared in conjunction with CAP preparation and design (technical specifications and drawings).

Table 28: Alternative 7 - Excavation and Offsite Disposal, Installation of a Permeable Reactive Barrier (Estimated Cost), Feasibility Study

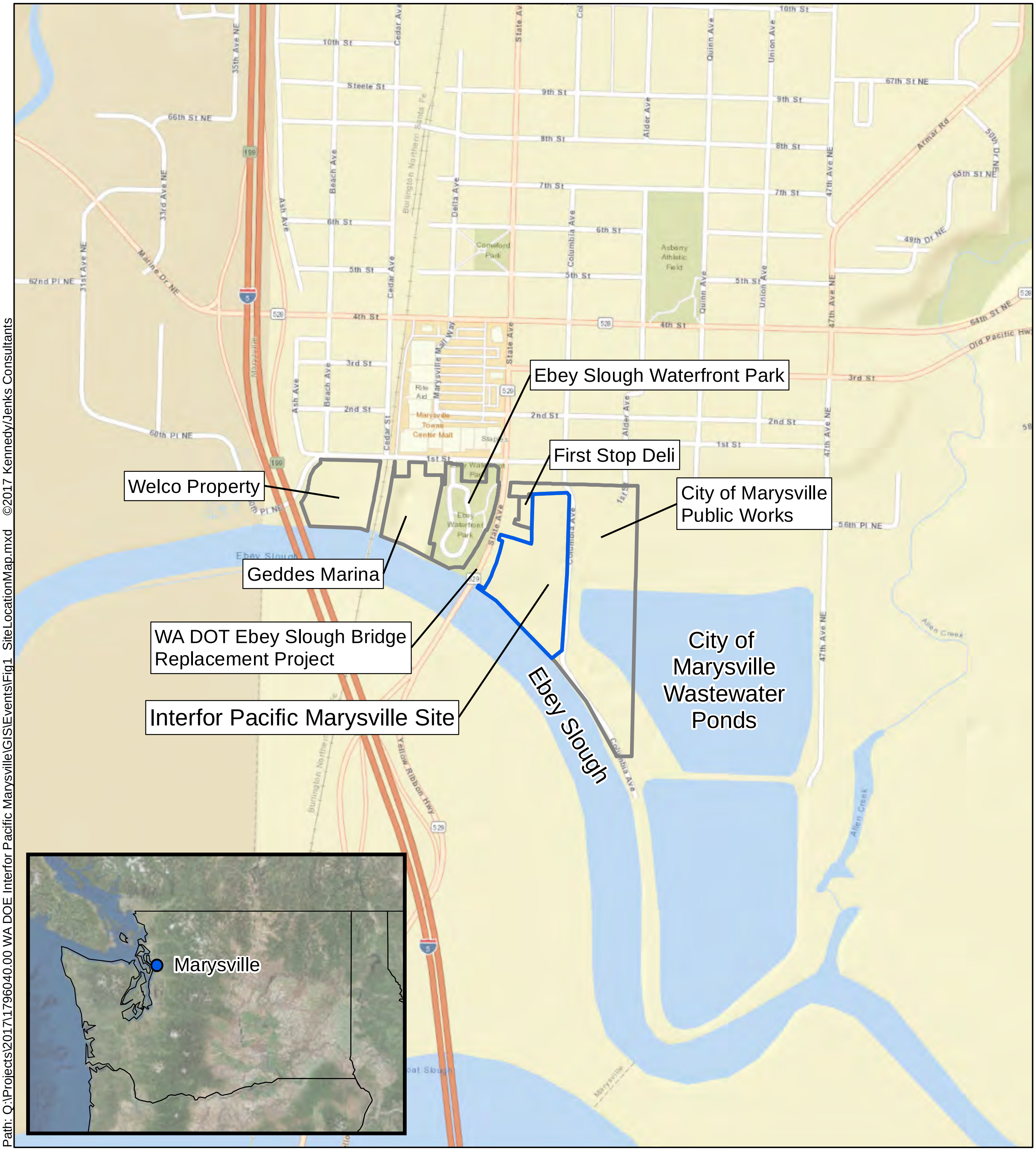
Item Description	Quantity	Unit	Unit Cost	Extension	Assumptions
A. Preliminary Activities					
Cleanup Action Plan (CAP)	1	lump sum	$10,000	$10,000	
Design (plans and specifications)	1	lump sum	$70,000	$70,000	
Pilot Study	1	lump sum	$50,000	$50,000	
Topographical Survey	1	lump sum	$10,000	$10,000	
Permitting					
General Demolition/Grading/Construction	1	lump sum	$10,000	$10,000	
National Pollutant Discharge Elimination System (NPDES)	1	lump sum	$10,000	$10,000	
Health and Safety Plan	1	lump sum	$5,000	$5,000	
Deed Restriction/Soil Management Plan	1	lump sum	$20,000	$20,000	
Item A. Estimated Cost				**$185,000**	
B. Impacted Soil Excavation and Disposal/Amend and Backfill/Compaction/PRB					
Mobilization/Demobilization	1	lump sum	$77,100	$77,100	5 percent of construction cost (Item C, excluding construction management).
Private Utility Locate	1	lump sum	$2,000	$2,000	
Site Security	1	lump sum	$5,000	$5,000	Temporary fencing, signage, etc.
Erosion Control	1	lump sum	$5,000	$5,000	Construction entrance, silt fence, catch basin protection, stockpile management, etc.
Abandon Monitoring Wells	8	well	$500	$4,000	
Utility Disconnect/Re-Route	1	lump sum	$5,000	$5,000	Estimate.
Demo and Remove Existing Pavement	1	lump sum	$5,000	$5,000	
Haul and Dispose Pavement	100	ton	$30	$3,000	
Excavation (landfill disposal) Impacted areas	2,000	cubic yard	$15	$30,000	Load directly to trucks. Assume material previously profiled.
Excavation for PRB Wall (1700' X 2' X 9' ave depth)	30,600	cubic yard	$15	$459,000	Load directly to trucks. Assume material previously profiled. PRB wall trench soil material is spread over site
Waste Profiling for Landfill Disposal	1	lump sum	$1,000	$1,000	Use existing laboratory analytical data for landfill waste profiling.
Hauling	3,400	ton	$10	$34,000	Hauling from site to landfill. Assumes wet soil.
Landfill Disposal	3,400	ton	$40	$136,000	Non-hazardous waste - Subtitle D landfill facility in Seattle, Washington (Robanco/Allied Waste).
Soil Chemical Analyses (confirmation sampling)					
TPH-Gasoline	25	sample	$35	$875	Discrete soil samples from excavation floor and sidewalls.
BTEX	25	sample	$35	$875	
TPH-Diesel	25	sample	$35	$875	
Metals (As & Pb)	25	sample	$40	$1,000	
Imported Backfill for excavations (material and transport)	3,000	ton	$20	$60,000	Imported fill.
Placement and Compaction (imported fill)	2,000	cubic yard	$10	$20,000	
Biological Amendment (material and transport)	200	lb	$12	$2,400	Assume use of 200 pounds of ammendment
Placement/Mixing Amendment/Compaction	200	cubic yard	$10	$2,000	
PRB Wall Construction (1700'X2'X9')	15,300	SF	$100	$1,530,000	PRB wall is constructed of sand with zero valent iron and compost (1700 ft long by 9 ft deep)
Utility Restoration	1	lump sum	$10,000	$10,000	
Construction Management	1	lump sum	$239,413	$239,413	Project management, oversight, direct expenses, etc. 10 percent of construction cost (Item B).
Item B. Estimated Cost				**$2,633,538**	
C. Monitoring Well Installation/Groundwater Sampling and Chemical Analyses/ Ongoing Operations					
Monitoring Well Installation					
Mobilization/Demobilization	1	lump sum	$1,000	$1,000	
Well Installation	3	well	$2,500	$7,500	
Consultant Labor and Equipment	3	day	$1,200	$3,600	
Groundwater Sampling and Chemical Analyses					Following completion of remediation activities, quarterly for 2 years from 6 monitoring wells. After 2 years, annual for 28 years.
TPH-Gasoline	252	sample	$35	$8,820	
Metals (As & Pb)	252	sample	$40	$10,080	
TPH-Diesel	252	sample	$35	$8,820	
Consultant Labor and Equipment	36	event	$2,500	$90,000	
Groundwater Monitoring Report	30	report	$4,000	$83,800	
Investigation-Derived Waste Water Handling/Disposal	36	events	$1,000	$23,600	1 disposal event per sampling event.
Item C. Estimated Cost				**$237,220**	
D. Other					
Project Management	2	years	$6,000	$12,000	
Construction Report	1	report	$15,000	$15,000	Includes as-built drawings.
Groundwater Monitoring Report	30	report	$4,000	$120,000	Annual for 30 years.
Washington State Sales Tax	1	lump sum	$265,987	$265,987	10.1 percent of construction capital cost (Item B).
Item D. Estimated Cost				**$412,987**	
Total Estimated Cost				**$3,469,000**	

Notes:

1. Estimated cost was prepared at -30/+50% for relative comparison amongst alternatives. The prepared cost estimate is not intended for budgetary purposes.
2. An engineering cost estimate will be prepared in conjunction with CAP preparation and design (technical specifications and drawings).

Figures

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig1_SiteLocationMap.mxd ©2017 Kennedy/Jenks Consultants



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap

Legend

▭ Property Parcel Boundary

▭ Nearby Cleanup Site Boundaries

N

0 500 1,000

Scale: Feet

Note:

1. All locations are approximate.

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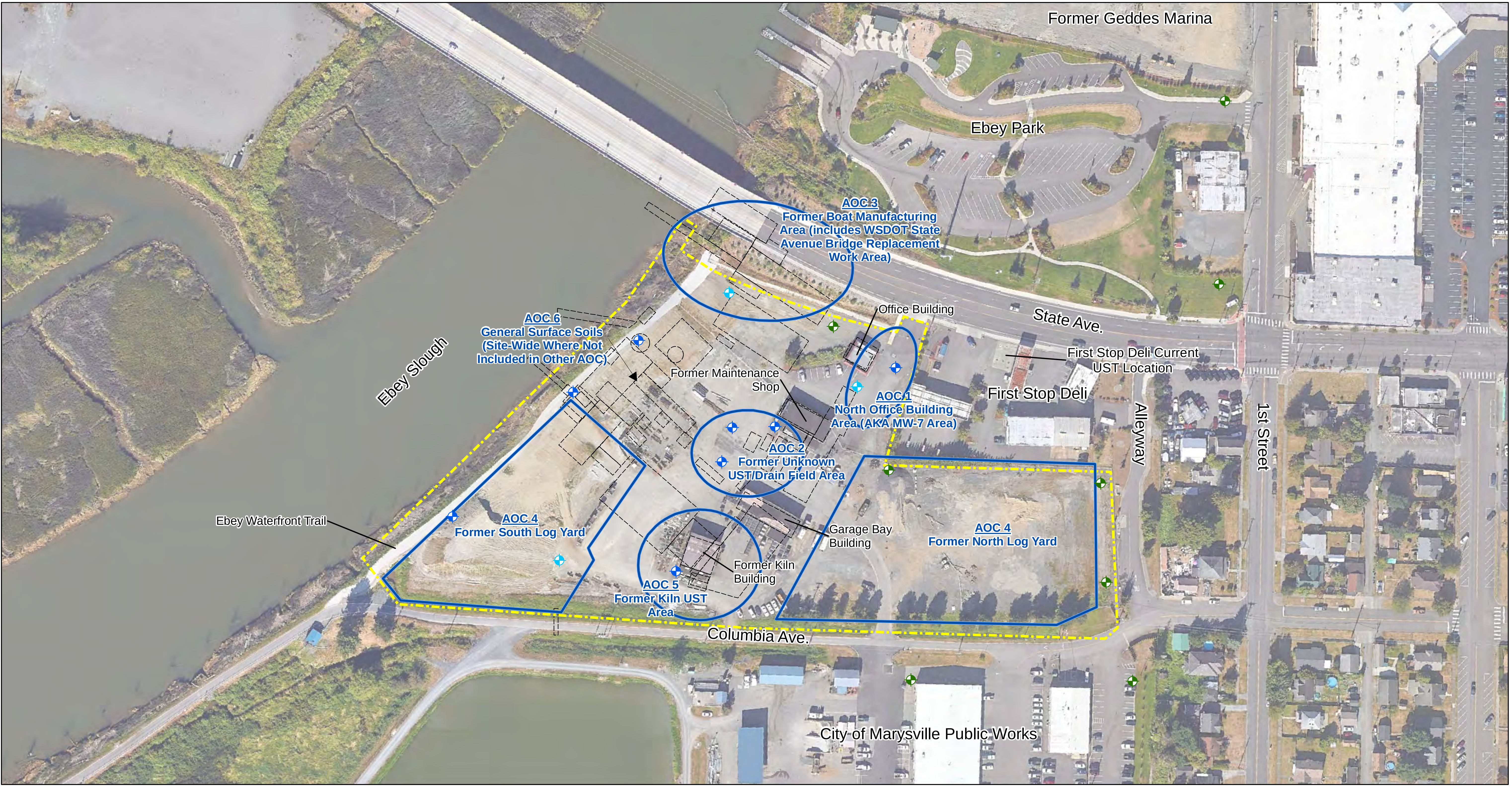
60 State Avenue Property
City of Marysville, WA

Site Location and Vicinity Map

1896015*00

Figure 1



Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig2_CurrentFeatures_AreasofConcern.mxd ©2017 Kennedy/Jenks Consultants

Legend

- ✦ New Monitoring Well
- ✦ Background Monitoring Well
- ✦ Existing Monitoring Well
- ▭ Areas of Concern (AOCs)
- ▭ Property Parcel Boundary
- ▭ Historical Site Features (see Figure 3 for details)

Notes:

1. All locations are approximate.
2. AOC boundaries are approximate based on descriptions from previous Site reports and as established in Ecology's opinion letters (see Ecology 2017).
3. Aerial imagery from Google Earth, 2016.

N

0 75 150

Scale: Feet

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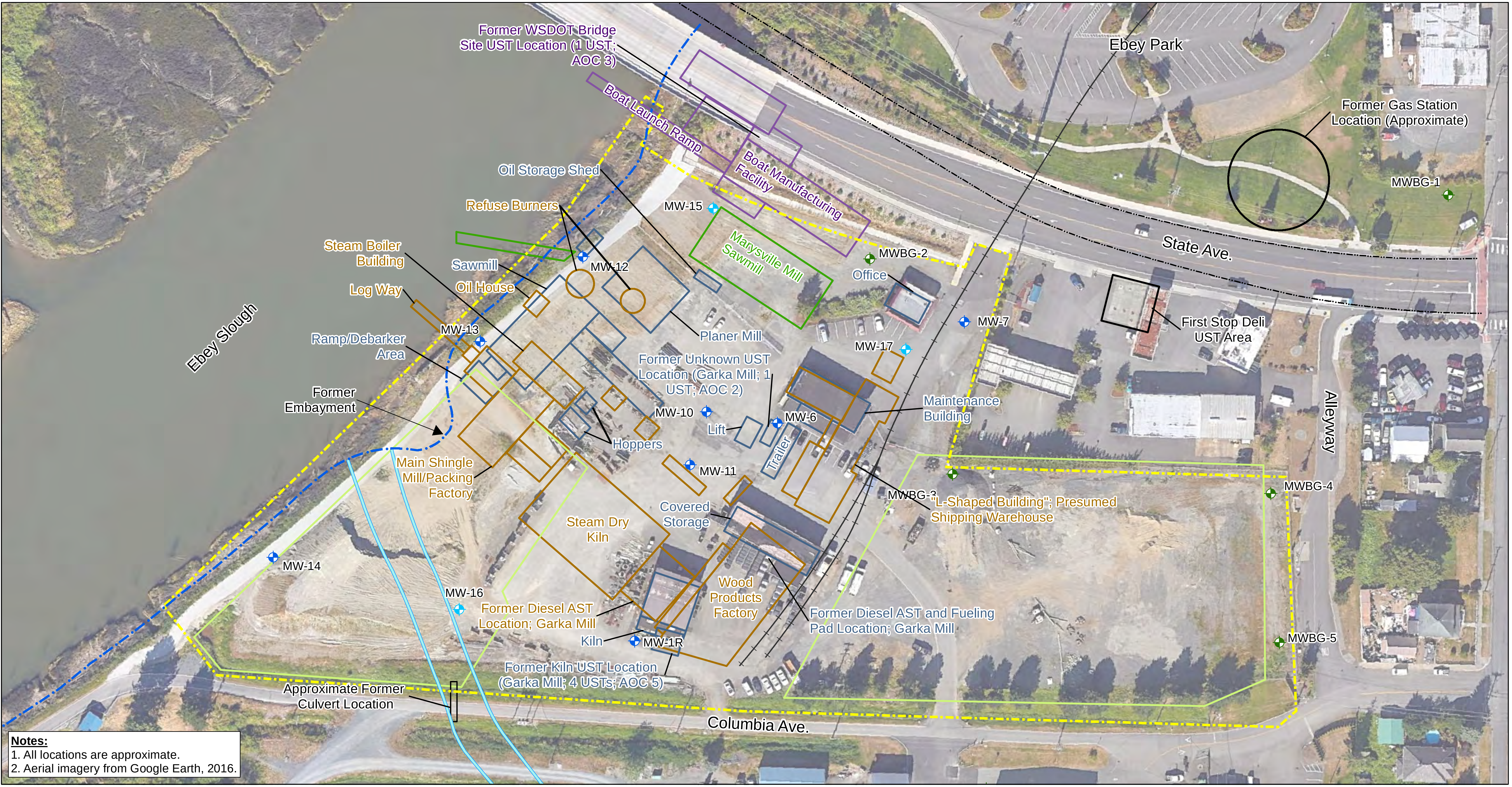
60 State Avenue Property
City of Marysville, WA

Current Site Features and Areas of Concern

1896015*00

Figure 2



Notes:
1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig3_HistoricalFeatures.mxd

Legend

- Approximate Former Stream Channel
- Approximate Former Bank Location
- Approximate Former State Avenue Roadway
- Approximate Former Rail Spur Location
- Approximate Former Boat Manufacturing Facilities (presumed removed early 1980s)
- Approximate Former Garka/Crown Pacific/Interfor Mill Facilities (mid 1960s to mid 2000s)
- Approximate Former Smith/Mutual Mill and Pacific Wooden Ware Facilities (presumed 1890s to early 1960s)
- Approximate Former Marysville Mill (presumed 1890s to mid 1920s)
- Approximate Former Log Storage Areas
- Other Former Features (Approximate)
- Property Parcel Boundary
- New Monitoring Well
- Existing Monitoring Well
- Background Monitoring Well

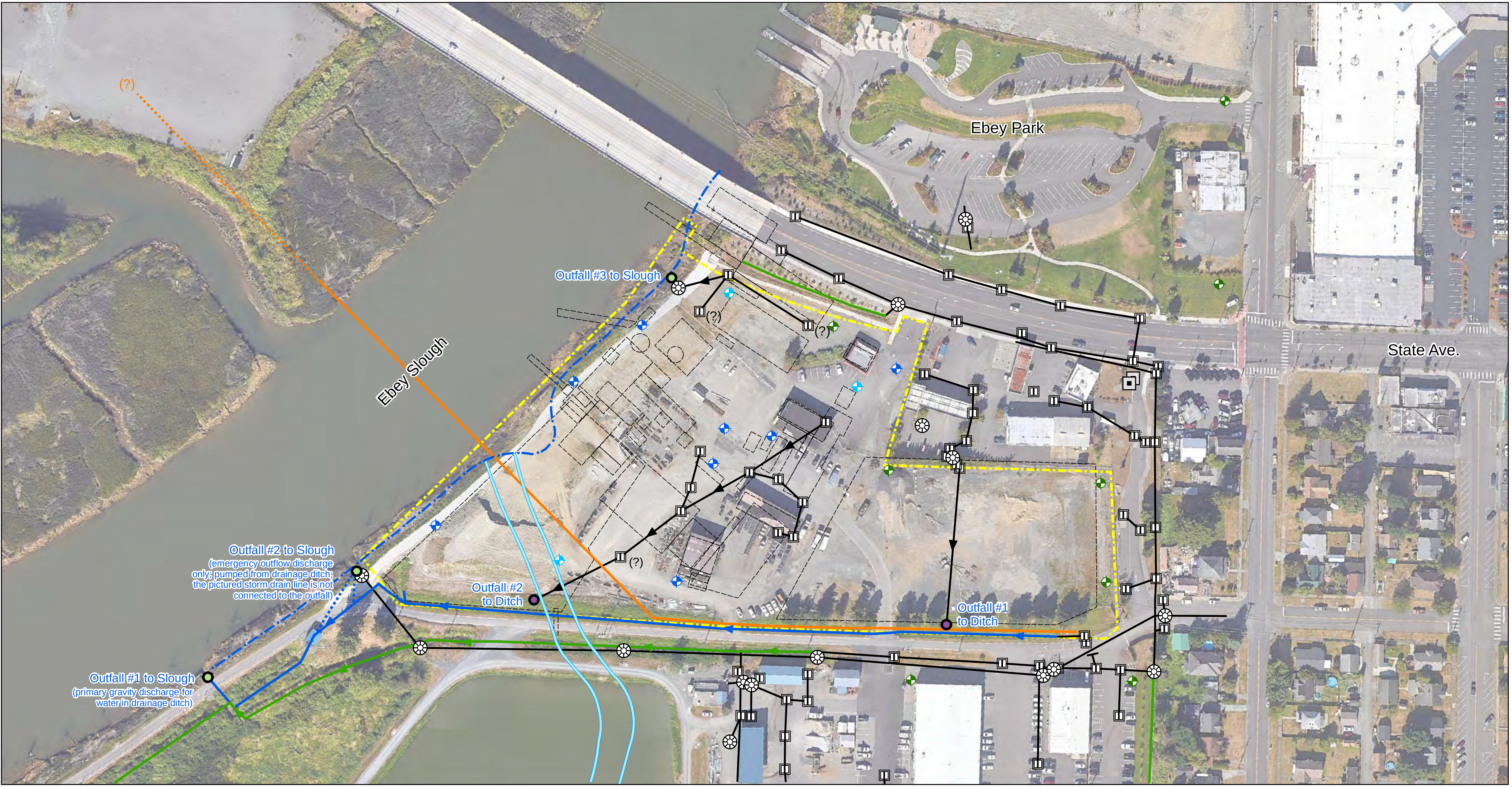
Kennedy/Jenks Consultants

60 State Avenue Property
City of Marysville, WA

Historical Site Features

1896015*00

Figure 3



Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig4_SurfaceWaterFlowPath.mxd

Legend

- ⊟ Catch Basin
- ⊛ Manhole
- ▣ Other Stormwater Feature
- ● Outfall to Ditch
- ● Outfall to Slough
- ⊕ New Monitoring Well
- ⊕ Existing Monitoring Well
- ⊕ Background Monitoring Well
- ― Stormwater Pipe
- ― Surface Water Flow - Onsite
- ― Surface Water Flow - Offsite
- ┈ Emergency/Overflow Pumped Discharge to Outfall
- ═ Approximate Former Stream Channel
- ─·─ Approximate Former Bank Location
- ― High Pressure PSE Natural Gas Main (Approximate)
- ▭ Former Site Features
- ▭ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Surface water monitoring locations are shown on Figure 10.
4. Storm drain features and outfall locations and descriptions are based on a map provided by the City on 17 January 2018.

N

0 75 150

Scale: Feet

Kennedy/Jenks Consultants

60 State Avenue Property
City of Marysville, WA

Site Drainage and Storm Water Conveyance Utilities Map

1896015*00

Figure 4

Legend

- ● Previous Soil Boring (1996)
- ◆ Previous Soil Boring (2006)
- △ Previous Soil Boring (2009)
- ● Previous Soil Boring (2011)
- ☒ Previous Test Pit (1996)
- ☒ Previous Test Pit (2006)
- ⊕ Abandoned Monitoring Well
- ⊕ Existing Monitoring Well
- ▭ Former Site Features
- ▭ Property Parcel Boundary

Former Remedial Excavation

- ▨ Approximate Excavation Limits (1996-1998)
- 🟩 Approximate Excavation Limits (2012)
- ▨ Approximate WSDOT Bridge Site Excavation Limits (2011)

Notes:

1. All locations are approximate.
2. Additional sampling was performed in excavation areas (Appendix C).
3. Aerial imagery from Google Earth, 2016.

N

0 50 100

Scale: Feet

Kennedy/Jenks Consultants

60 State Avenue Property
City of Marysville, WA

Historical Sample and Remedial Excavation Location Summary Map

1896015*00

Figure 5

Abbreviations:
GRO = Gasoline-Range Organics
DRO = Diesel-Range Organics
ORO = Oil-Range Organics
cPAHs = Total carcinogenic Polycyclic Aromatic Hydrocarbons
As = Arsenic
Pb = Lead
MC = Methylene Chloride

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in milligrams per kilogram (mg/kg).
4. Only locations with detected concentrations exceeding MTCA Method A soil cleanup levels shown on map.
5. Samples collected between 1996 and 2011.
6. Samples from soil subsequently removed from onsite remedial (excavation) areas are not shown on this map.
7. Excavation area sample data and maps are included in Appendix C.

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig6_HistoricalData_Soil.mxd ©2017 Kennedy/Jenks Consultants

Legend

● Previous Soil Boring (1996)
◆ Previous Soil Boring (2006)
△ Previous Soil Boring (2009)
● Previous Soil Boring (2011)
☒ Previous Test Pit (1996)
☒ Previous Test Pit (2006)
⊕ Existing Monitoring Well
☐ Former Site Features
☐ Property Parcel Boundary

Former Remedial Excavation Areas:

🟪 Approximate Excavation Limits (1996-1998)
🟩 Approximate Excavation Limits (2012)
🟪 Approximate WSDOT Bridge Site Excavation Limits (2011)

* Offsite samples, WSDOT Bridge Area, affected soil excavated in 2011.

N
0 50 100
Scale: Feet

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60 State Avenue Property
City of Marysville, WA

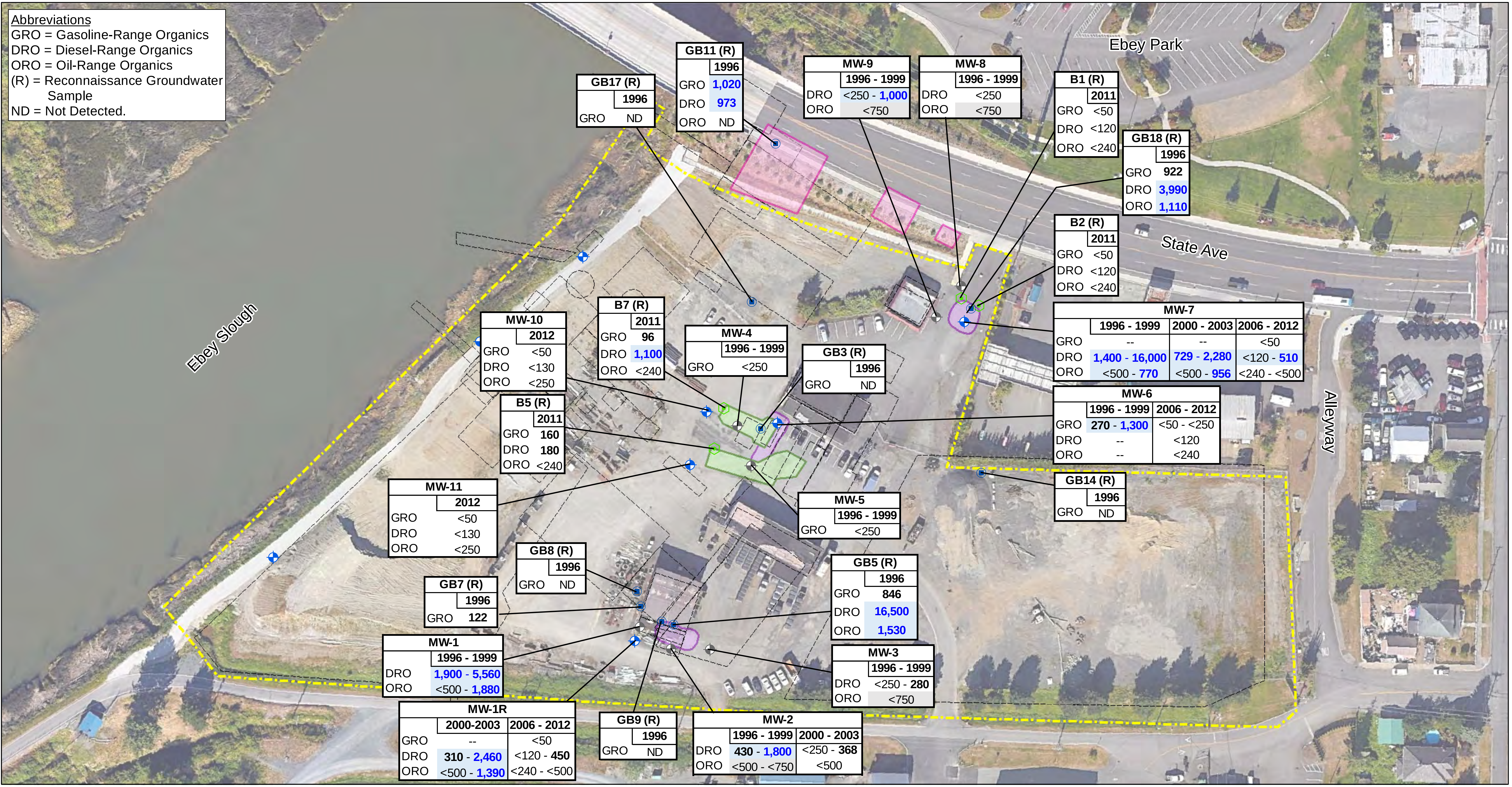
Summary of Historical Soil Data

1896015*00

Figure 6

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig7_HistoricalData_GW_TPH.mxd

Abbreviations
GRO = Gasoline-Range Organics
DRO = Diesel-Range Organics
ORO = Oil-Range Organics
(R) = Reconnaissance Groundwater Sample
ND = Not Detected.



GB17 (R)	1996
GRO	ND

GB11 (R)	1996
GRO	**1,020**
DRO	**973**
ORO	ND

MW-9	1996 - 1999
DRO	<250 - **1,000**
ORO	<750

MW-8	1996 - 1999
DRO	<250
ORO	<750

B1 (R)	2011
GRO	<50
DRO	<120
ORO	<240

GB18 (R)	1996
GRO	**922**
DRO	**3,990**
ORO	**1,110**

B2 (R)	2011
GRO	<50
DRO	<120
ORO	<240

MW-7	1996 - 1999	2000 - 2003	2006 - 2012
GRO	--	--	<50
DRO	**1,400** - **16,000**	**729** - **2,280**	<120 - **510**
ORO	<500 - **770**	<500 - **956**	<240 - <500

MW-10	2012
GRO	<50
DRO	<130
ORO	<250

B7 (R)	2011
GRO	**96**
DRO	**1,100**
ORO	<240

MW-4	1996 - 1999
GRO	<250

GB3 (R)	1996
GRO	ND

MW-6	1996 - 1999	2006 - 2012
GRO	**270** - **1,300**	<50 - <250
DRO	--	<120
ORO	--	<240

B5 (R)	2011
GRO	**160**
DRO	**180**
ORO	<240

GB14 (R)	1996
GRO	ND

MW-11	2012
GRO	<50
DRO	<130
ORO	<250

MW-5	1996 - 1999
GRO	<250

GB8 (R)	1996
GRO	ND

GB5 (R)	1996
GRO	**846**
DRO	**16,500**
ORO	**1,530**

GB7 (R)	1996
GRO	**122**

MW-1	1996 - 1999
DRO	**1,900** - **5,560**
ORO	<500 - **1,880**

MW-3	1996 - 1999
DRO	<250 - **280**
ORO	<750

MW-1R	2000-2003	2006 - 2012
GRO	--	<50
DRO	**310** - **2,460**	<120 - **450**
ORO	<500 - **1,390**	<240 - <500

GB9 (R)	1996
GRO	ND

MW-2	1996 - 1999	2000 - 2003
DRO	**430** - **1,800**	<250 - **368**
ORO	<500 - <750	<500

Legend

- Abandoned Monitoring Well
- Existing Monitoring Well
- Previous Soil Boring with Reconnaissance Groundwater Sample (1996)
- Previous Soil Boring with Reconnaissance Groundwater Sample (2011)
- Site Features
- Property Parcel Boundary

Former Remedial Excavation Areas:

- Approximate Excavation Limits (1996-1998)
- Approximate Excavation Limits (2012)
- Approximate WSDOT Bridge Site Excavation Limits (2011)

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in micrograms per liter (µg/l).
4. Detected concentrations shown in bold; concentrations exceeding MTCA Method A cleanup levels highlighted in blue, non-detects exceeding the cleanup levels are highlighted in gray. Range of lowest to highest concentrations shown for each time period.

N

0 50 100

Scale: Feet

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60 State Avenue Property
City of Marysville, WA

Summary of Historical Groundwater Data - Total Petroleum Hydrocarbons

1896015*00

Figure 7

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig8_HistoricalData_GW_AsPb.mxd ©2017 Kennedy/Jenks Consultants

Legend

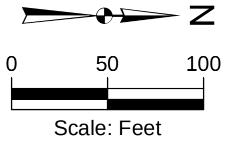
- ⊕ Abandoned Monitoring Well
- ⊕ Existing Monitoring Well
- ▣ Previous Soil Boring with Reconnaissance Groundwater Sample (1996)
- ⊙ Previous Soil Boring with Reconnaissance Groundwater Sample (2011)
- ⬚ Site Features
- ⬚ Property Parcel Boundary

Former Remedial Excavation

- 🟪 Approximate Excavation Limits (1996-1998)
- 🟩 Approximate Excavation Limits (2012)
- 🟥 Approximate WSDOT Bridge Site Excavation Limits (2011)

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in micrograms per liter (µg/l.)
4. Detected concentrations shown in bold; concentrations exceeding MTCA Method A cleanup levels highlighted in blue.



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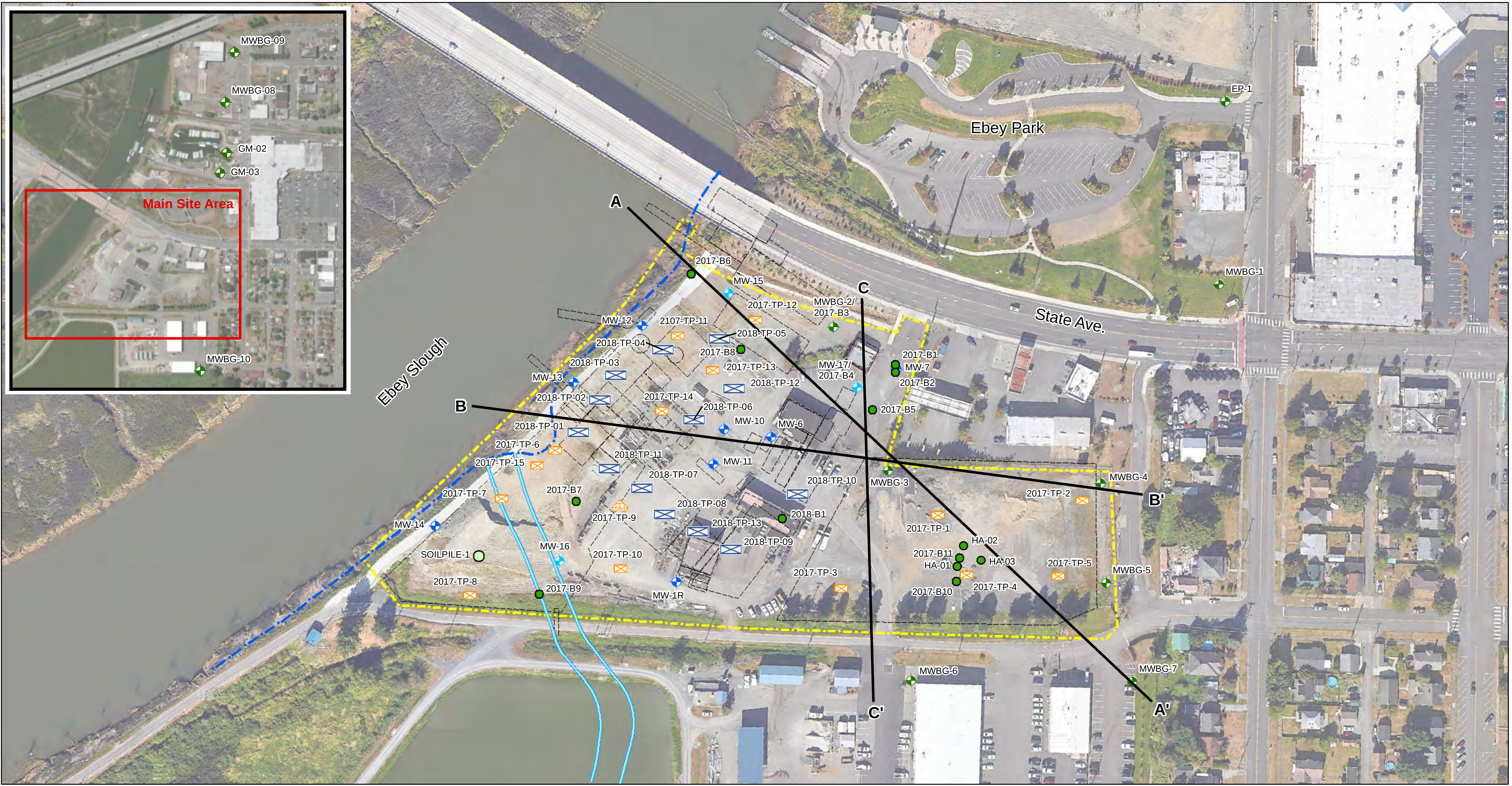
60 State Avenue Property
City of Marysville, WA

Summary of Historical Groundwater Data - Metals

1896015*00

Figure 8

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig9_20172018_SoilGWLocs.mxd ©2017 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

●	Soil Boring	☒	Test Pit (2017)	⬚	Former Site Features
⊕	New Monitoring Well	☒	Test Pit (2018)	⬚	Property Parcel Boundary
⊕	Background Monitoring Well	—	Cross Section Location		
⊕	Existing Monitoring Well	—	Approximate Former Stream Channel		
○	Soil Pile Composite Sample (2017)	-·-	Approximate Former Bank Location		

Notes:
1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.

N

0 75 150

Scale: Feet

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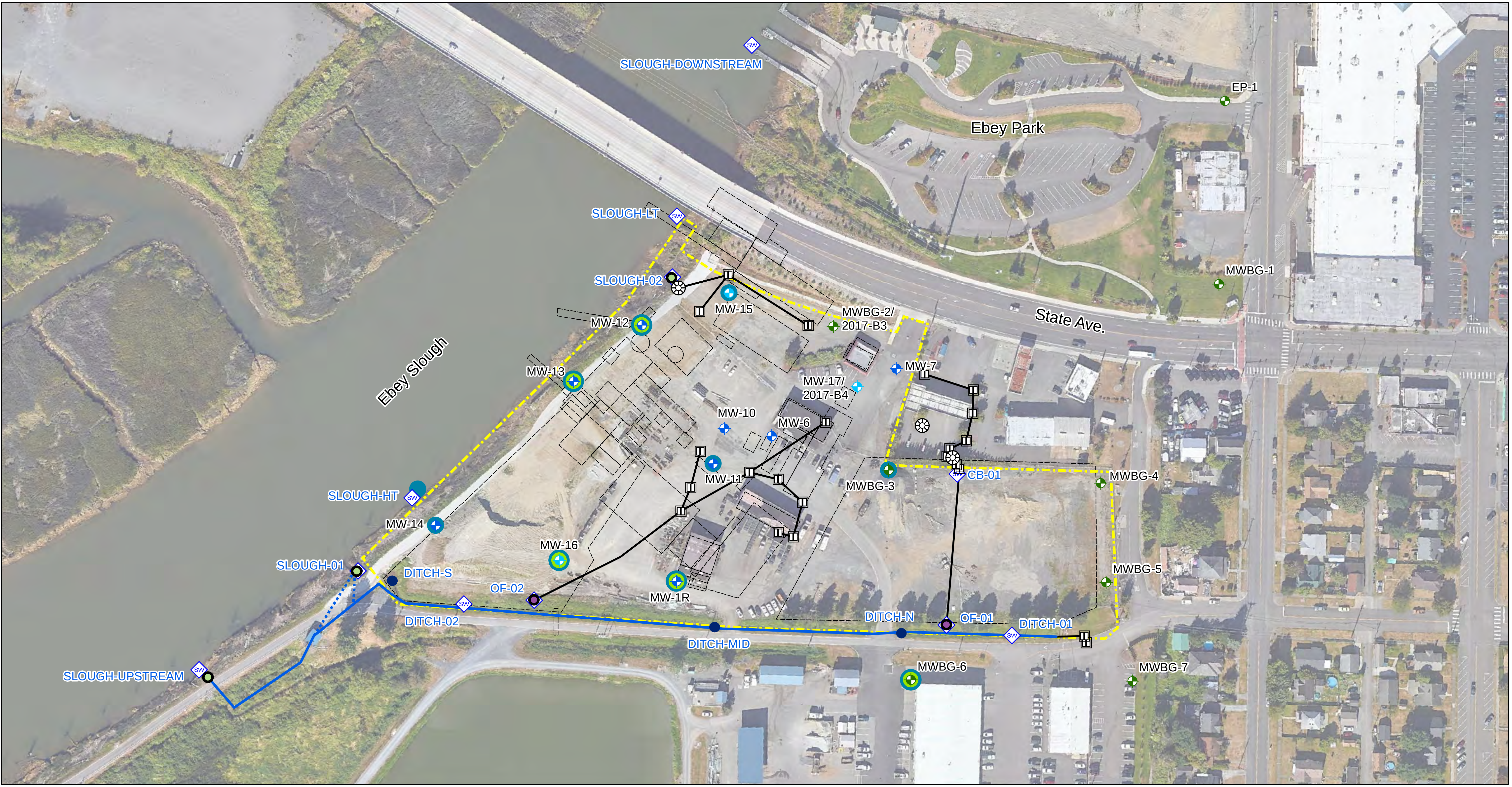
60 State Avenue Property
City of Marysville, WA

2017/2018 Investigation - Soil Sampling and Groundwater Monitoring Locations

1896015*00

Figure 9



Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig10_20172018_SWLocs.mxd

Legend

- New Monitoring Well
- Background Monitoring Well
- Existing Monitoring Well
- Surface Water Sample
- Outfall to Ditch
- Outfall to Slough
- Ditch Water Level Monitoring Location
- Slug Test
- Tidal Study
- Tidal Study and Slug Test
- Catch Basin
- Manhole
- Stormwater Pipe
- Surface Water Flow - Onsite
- Emergency/Overflow Pumped Discharge to Outfall
- Former Site Features
- Property Parcel Boundary

Notes:
1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.

N

0 75 150

Scale: Feet

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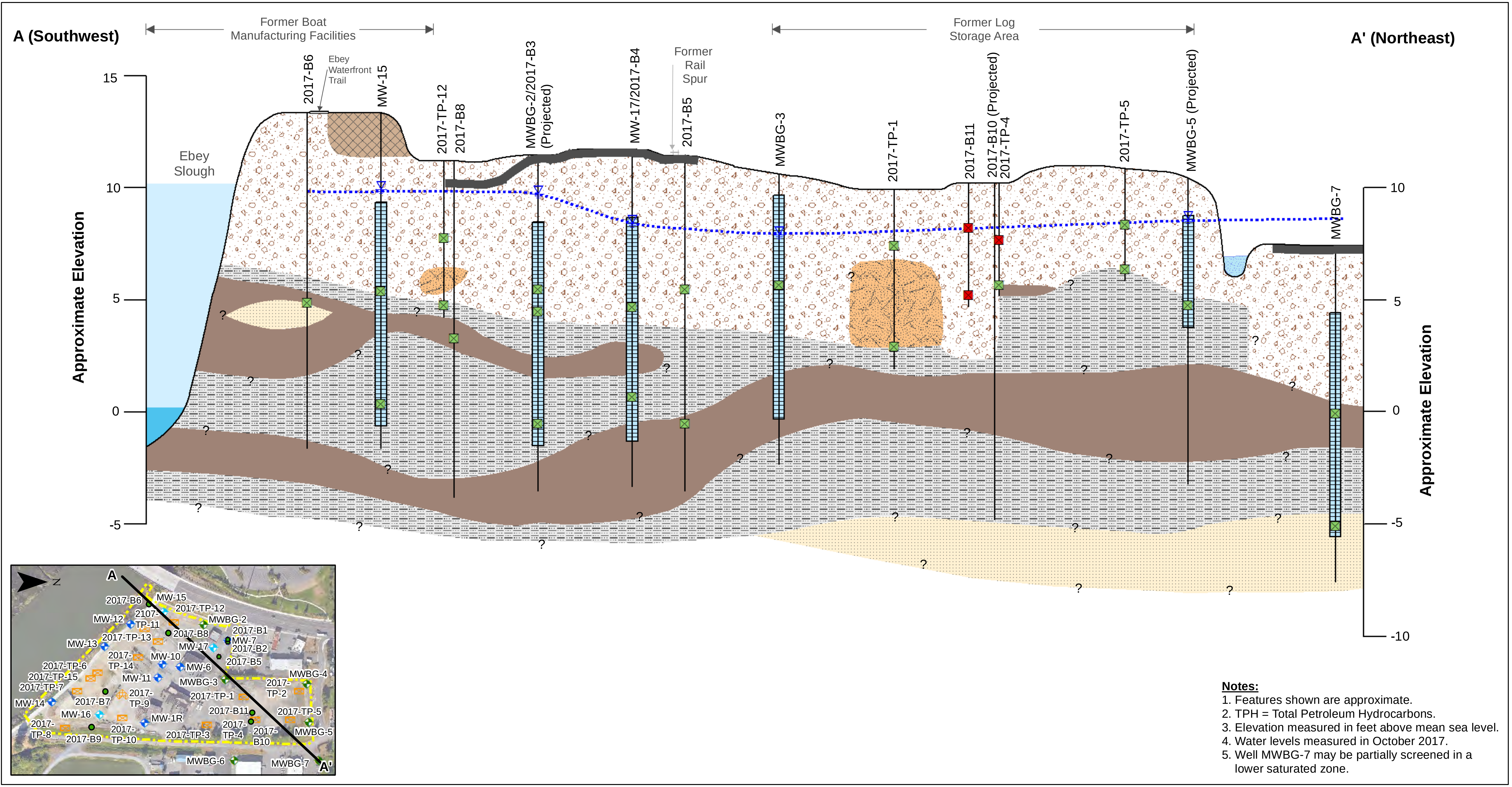
60 State Avenue Property
City of Marysville, WA

2017/2018 Investigation - Surface Water Monitoring and Aquifer Testing Locations

1896015*00

Figure 10



Notes:
1. Features shown are approximate.
2. TPH = Total Petroleum Hydrocarbons.
3. Elevation measured in feet above mean sea level.
4. Water levels measured in October 2017.
5. Well MWBG-7 may be partially screened in a lower saturated zone.

Legend

- ☒ Soil Sample, TPH concentration below MTCA cleanup level
- ☒ Soil Sample, TPH concentration exceeding MTCA cleanup level
- ▽ Static Water Level
- ⋯ Approximate Water Table
- ▭ Approximate high mean sea level
- ■ Approximate low mean sea level
- ▨ Surface Water Ditch
- ▥ Screened Interval of Well

Anthropogenic Fill Materials

- ▨ Dark brown wood chips
- ▬ Asphalt
- ▨ Fill (Brown poorly graded sand and gravel with some silt)
- ▨ Red woody debris, cedar odor

Native Soil

- ■ Brown peat or peat-rich silt
- ▤ Brown clayey silt to sandy silt
- ▨ Brown fine to medium sand with silt

Vertical Scale: Feet 0 2.5 5

Vertical Exageration = 20X

Horizontal Scale: Feet 0 50 100

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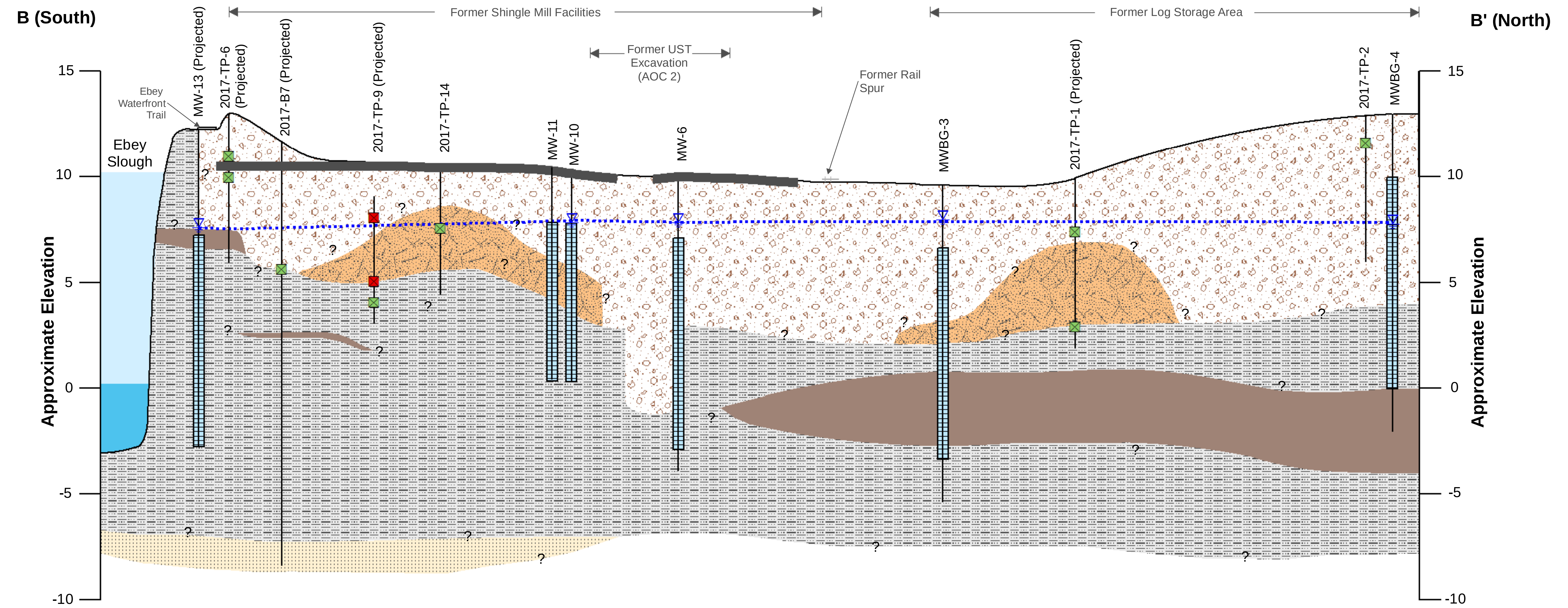
60 State Avenue Property
City of Marysville, WA

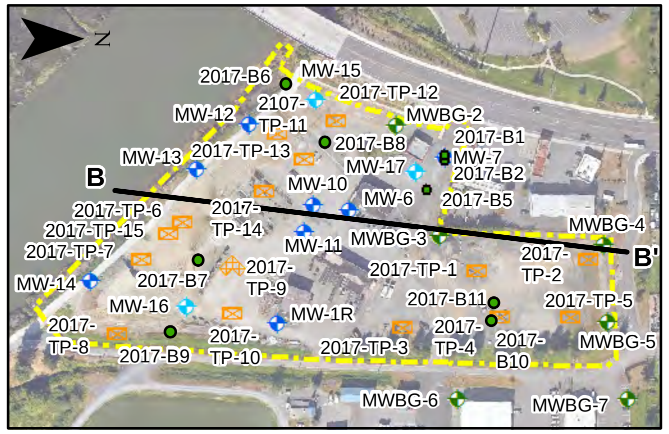
Interpretive Geologic Cross Section A-A'

18969015*00

Figure 11

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig11_CrossSectionA_REV.mxd





Notes:
1. Features shown are approximate.
2. TPH = Total Petroleum Hydrocarbons
3. Elevation measured in feet above mean sea level.
4. Water levels measured in October 2017.
5. 2017-TP-9 sidewalls were excavated further; TPH concentrations in sidewall samples did not exceed MTCA cleanup levels.
7. The area around wells MW-10 and MW-6 was excavated in 1996 and 2012.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig12_CrossSectionB.mxd

Legend

☒ Soil Sample, TPH concentrations below MTCA cleanup levels

■ Soil Sample, TPH concentration exceeding MTCA cleanup level

∇ Static Water Level

······ Approximate Water Table

■ Approximate high mean sea level

■ Approximate low mean sea level

▤ Screened Interval of Well

Anthropogenic Fill Materials

▬ Asphalt

▨ Fill (Brown poorly graded sand and gravel with some silt)

▨ Red woody debris, cedar odor

Native Soil

■ Brown peat or peat-rich silt

▤ Brown clayey silt to sandy silt

▨ Brown fine to medium sand with silt

Vertical Scale: Feet
0
2.5
5

Vertical Exageration = 15X

0
37.5
75
Horizontal Scale: Feet

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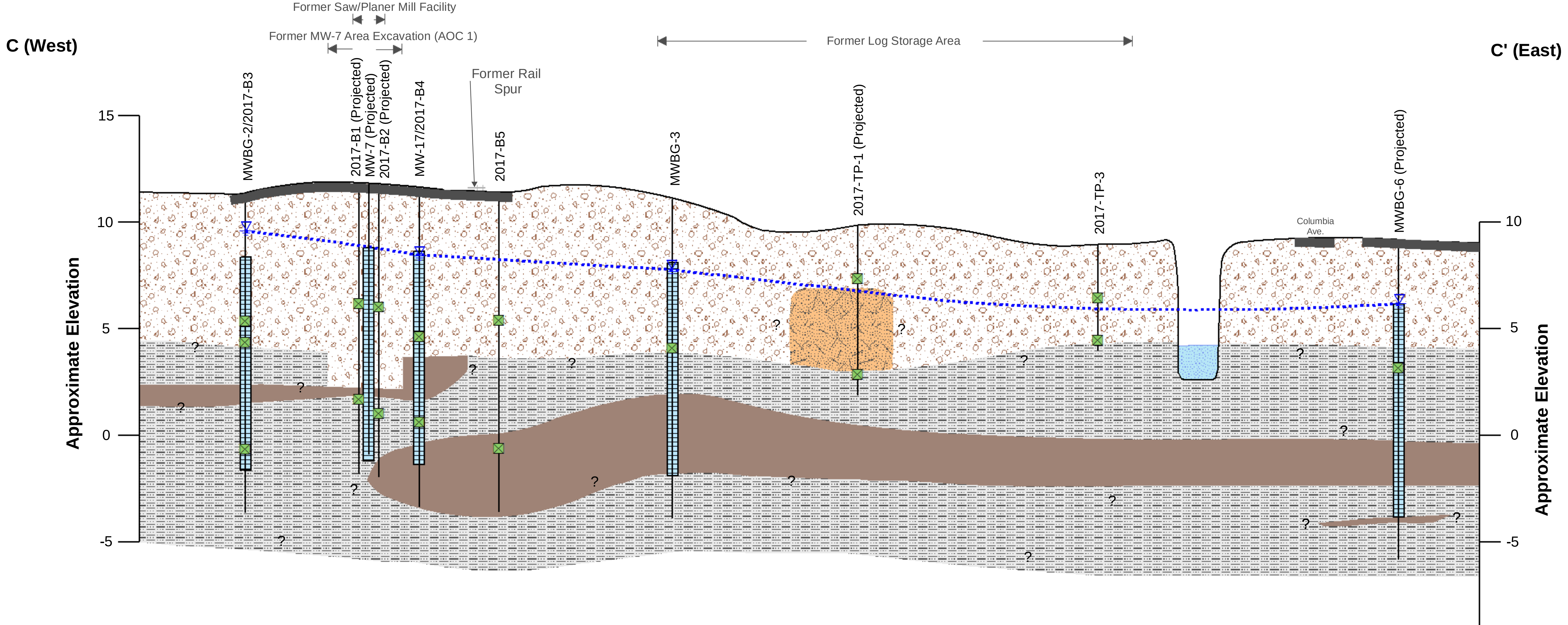
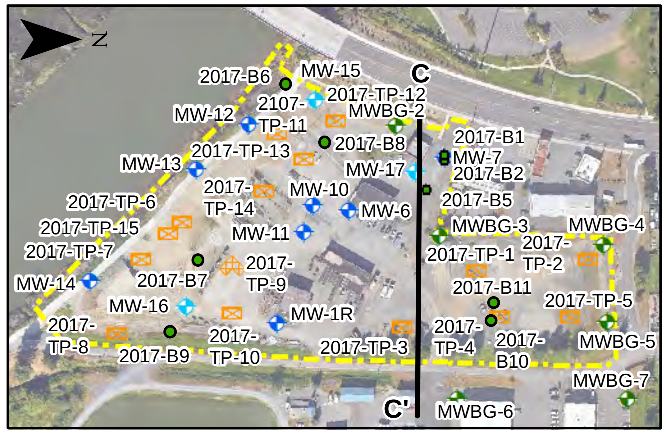
60 State Avenue Property
City of Marysville, WA

Interpretive Geologic Cross Section B-B'

1896015*00

Figure 12





Notes:
1. Features shown are approximate.
2. TPH = Total Petroleum Hydrocarbons.
3. Elevation measured in feet above mean sea level.
4. Water levels measured in October 2017.
5. The area around 2017-B1, 2017-B2, and MW-7 was excavated in 1998.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig13_CrossSectionC.mxd

Legend

- ☒ Soil Sample, TPH concentrations below MTCA cleanup levels
- ⊽ Static Water Level
- ······ Approximate Water Table
- ▨ Surface Water Ditch

Anthropogenic Fill Materials

- ▬ Asphalt
- ▨ Fill (Brown poorly graded sand and gravel with some silt)
- ▨ Red woody debris, cedar odor

Native Soil

- ▬ Brown peat or peat-rich silt
- ▤ Brown clayey silt to sandy silt

Vertical Scale: Feet 0 2.5 5

Vertical Exageration = 10X

0 25 50
Horizontal Scale: Feet

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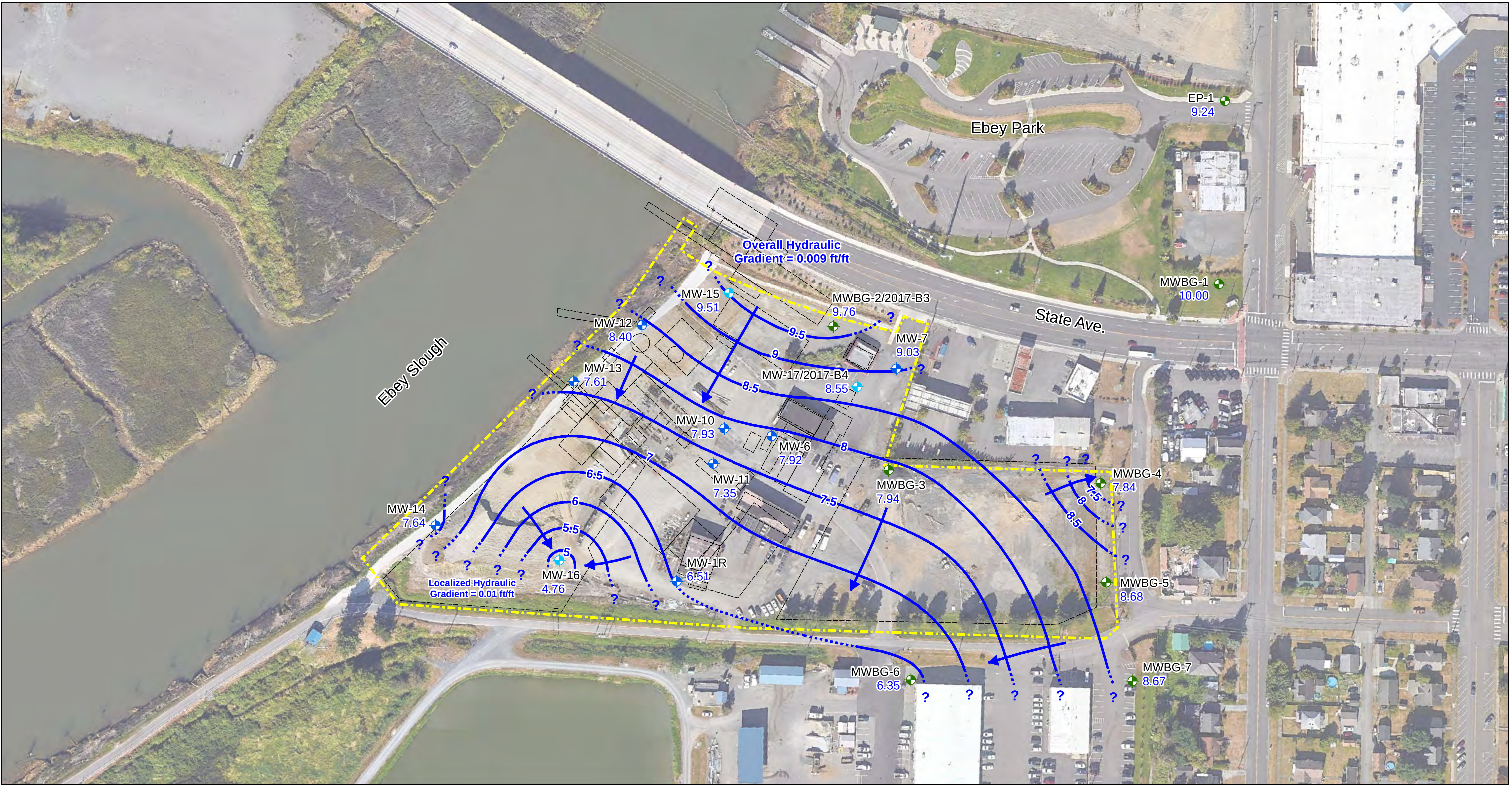
City of Marysville, WA

Interpretive Geologic Cross Section C-C'

1896015*00

Figure 13



Legend

⊕ New Monitoring Well

⊕ Background Monitoring Well

⊕ Existing Monitoring Well

6.51 Groundwater elevation in feet amsl

→ Approximate direction of hydraulic gradient

— Groundwater elevation contour, dashed where inferred

▭ Former Site Features

▭ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Water levels measured from 6:30AM to 10:15AM on 25 October 2017. Low tide at 3:12AM (0.18 ft) and high tide at 11:03AM (10.07 ft) at Ebey Slough.

N

0 75 150

Scale: Feet

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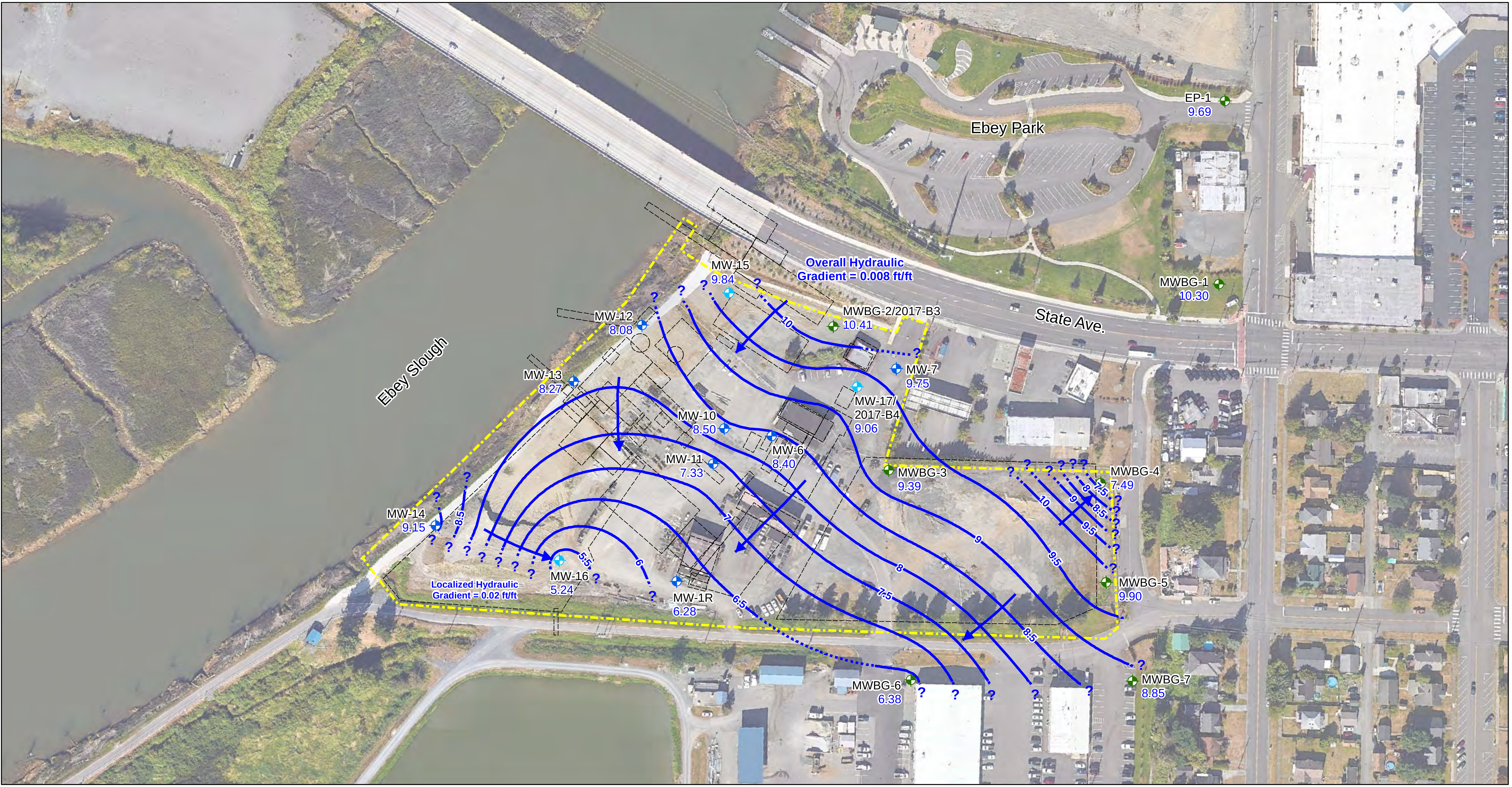
60 State Avenue Property
City of Marysville, WA

Potentiometric Surface Map - 25 October 2017

1896015*00

Figure 14

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig15_November2017PotentiometricMap.mxd



Legend

⊕ New Monitoring Well

⊕ Background Monitoring Well

⊕ Existing Monitoring Well

6.28 Groundwater elevation in feet amsl

→ Approximate direction of hydraulic gradient

Groundwater elevation contour, dashed where inferred

Former Site Features

Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Water levels measured from 11:25AM to 1:36PM on 21 November 2017. High tide at 7:23AM (11.13 ft), low tide at 1:25PM (6.22 ft) at Ebey Slough.

N

0 75 150

Scale: Feet

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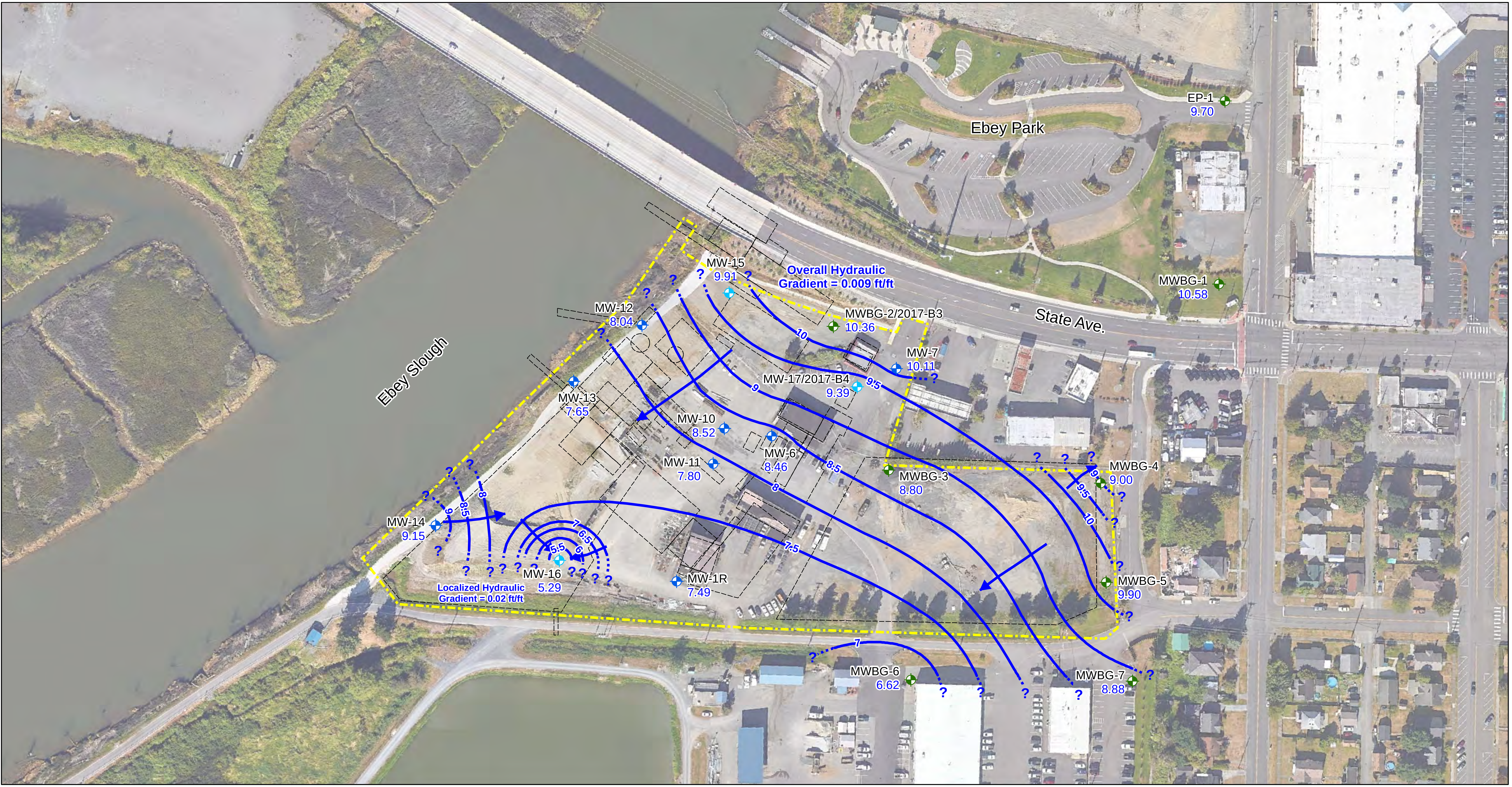
60 State Avenue Property
City of Marysville, WA

Potentiometric Surface Map - 21 November 2017

1896015*00

Figure 15



Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig16_November2017PotentiometricMap_secondevent.mxd

Legend

✦	New Monitoring Well
⊕	Background Monitoring Well
✦	Existing Monitoring Well
6.62	Groundwater elevation in feet amsl
➔	Approximate direction of hydraulic gradient
—	Groundwater elevation contour, dashed where inferred
▭	Former Site Features
▭	Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Water levels measured from 11:57AM to 1:56PM on 29 November 2017. Low tide at 7:02AM (3.74 ft), high tide at 1:07PM (11.13 ft) at Ebey Slough.

N

0 75 150

Scale: Feet

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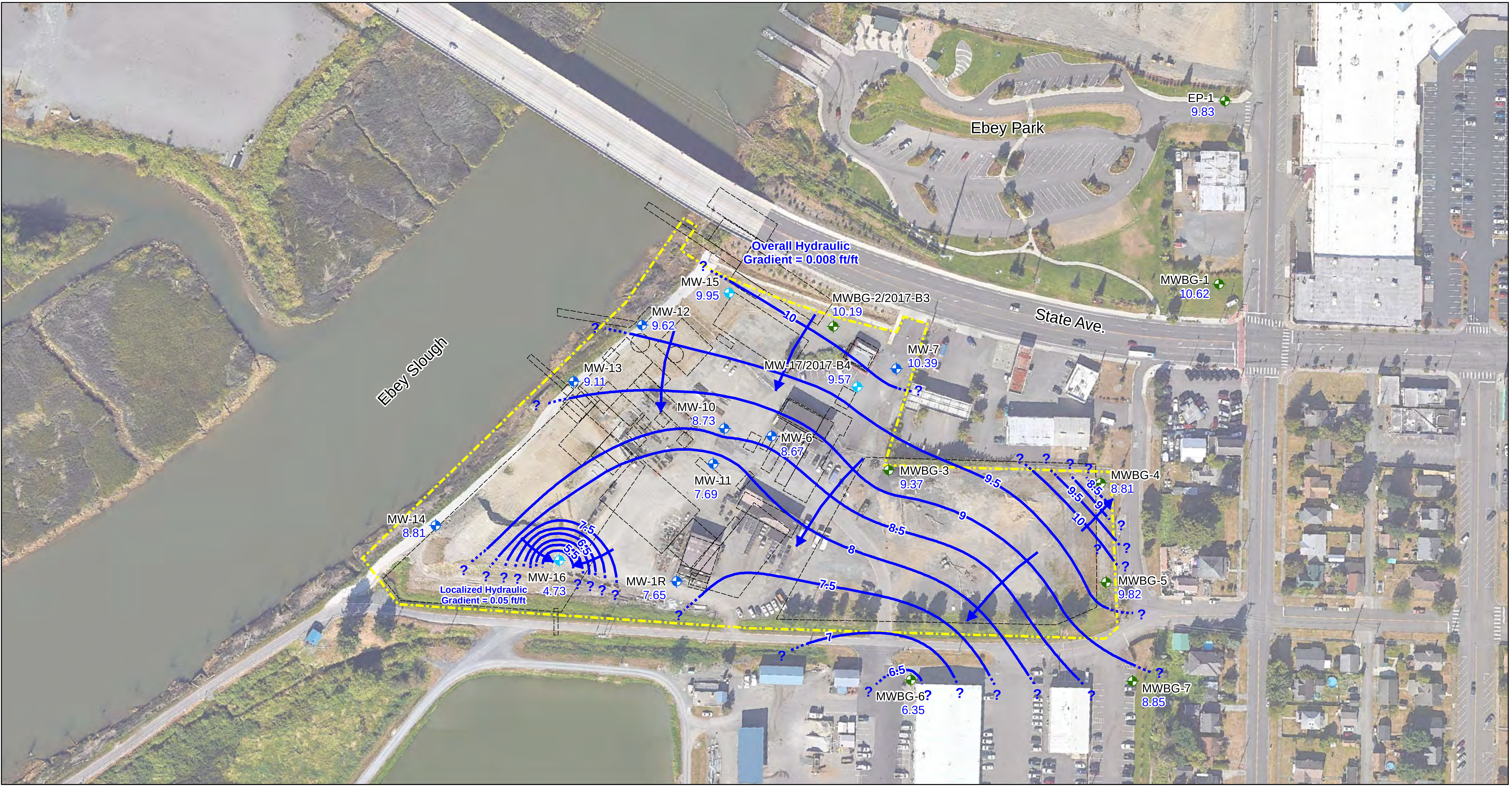
60 State Avenue Property
City of Marysville, WA

Potentiometric Surface Map - 29 November 2017

1896015*00

Figure 16



Legend

- ⊕ New Monitoring Well
- ⊕ Background Monitoring Well
- ⊕ Existing Monitoring Well
- 7.65 Groundwater elevation in feet amsl
- → Approximate direction of hydraulic gradient
- Groundwater elevation contour, dashed where inferred
- ▭ Former Site Features
- ▭ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Water levels measured from 8:25 AM to 12:40 PM on January 8, 2018. Low tide at 3:35AM (1.90 ft) and high tide at 10:16AM (11.84 ft) at Ebey Slough.

N

0 75 150

Scale: Feet

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60 State Avenue Property
City of Marysville, WA

Potentiometric Surface Map - 8 January 2018

1896015*00

Figure 17

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig17_January2018PotentiometricMap.mxd

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig18_July2018PotentiometricMap.mxd

Legend

- ⊕ New Monitoring Well
- ⊕ Background Monitoring Well
- ⊕ Existing Monitoring Well
- 7.65 Groundwater elevation in feet amsl
- → Approximate direction of hydraulic gradient
- — Groundwater elevation contour, dashed where inferred
- ▭ Former Site Features
- ▭ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Water levels measured from 7:21 AM to 3:35 PM on July 16, 2018. High tide at 7:30AM (9.79 ft) and low tide at 2:32PM (-1.69 ft) at Ebey Slough.

N

0 75 150

Scale: Feet

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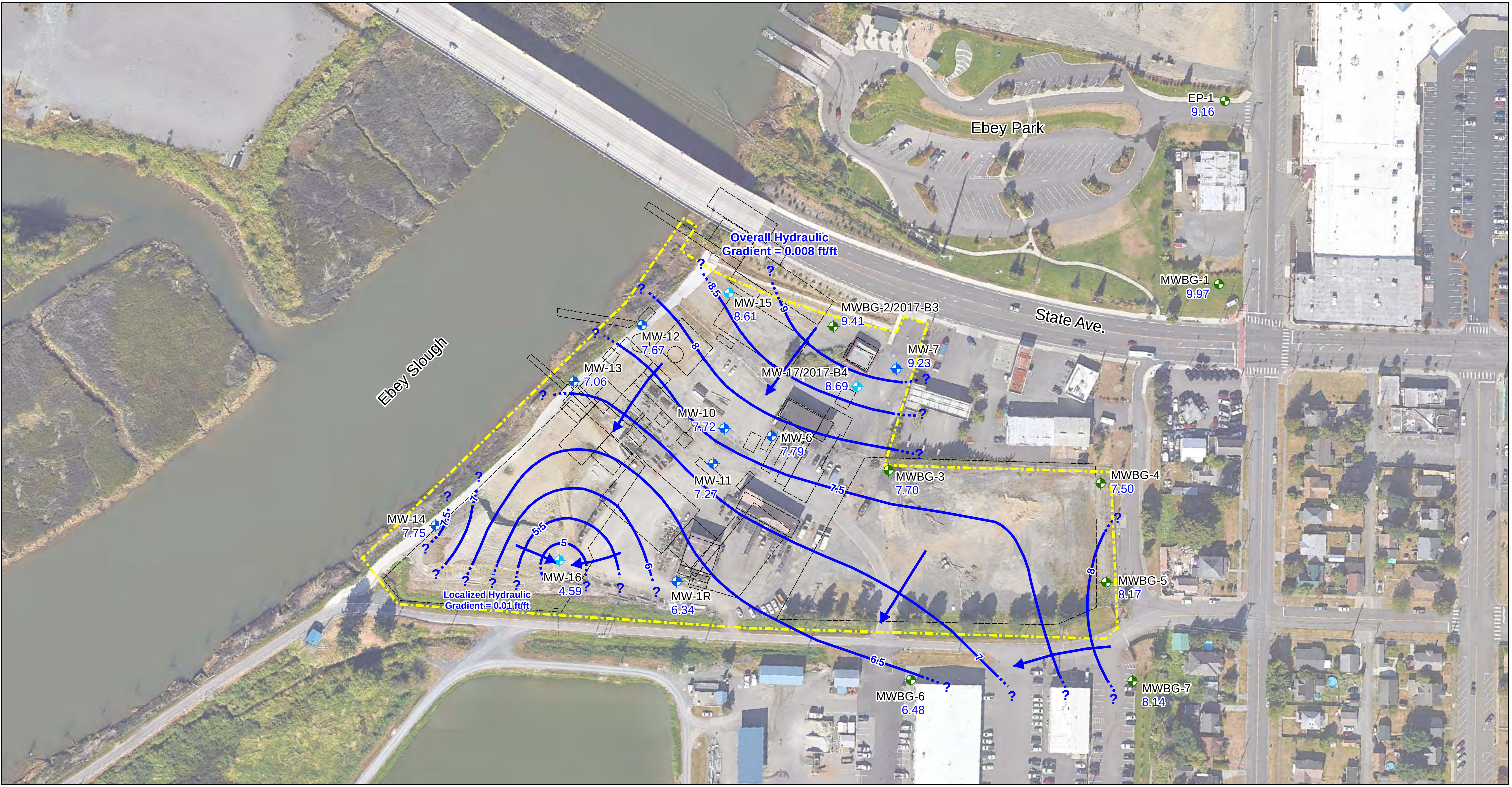
60 State Avenue Property
City of Marysville, WA

Potentiometric Surface Map - 16 July 2018

1896015*00

Figure 18



Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig19_Sept2018PotentiometricMap.mxd

Legend

- New Monitoring Well
- Background Monitoring Well
- Existing Monitoring Well
- 7.65 Groundwater elevation in feet amsl
- → Approximate direction of hydraulic gradient
- Groundwater elevation contour, dashed where inferred
- Former Site Features
- Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Water levels measured from 8:49 AM to 1:22 PM on September 21, 2018. Low tide at 9:47 AM (1.02 ft) and high tide at 4:42 PM (10.1 ft) at Ebey Slough.

N

0 75 150

Scale: Feet

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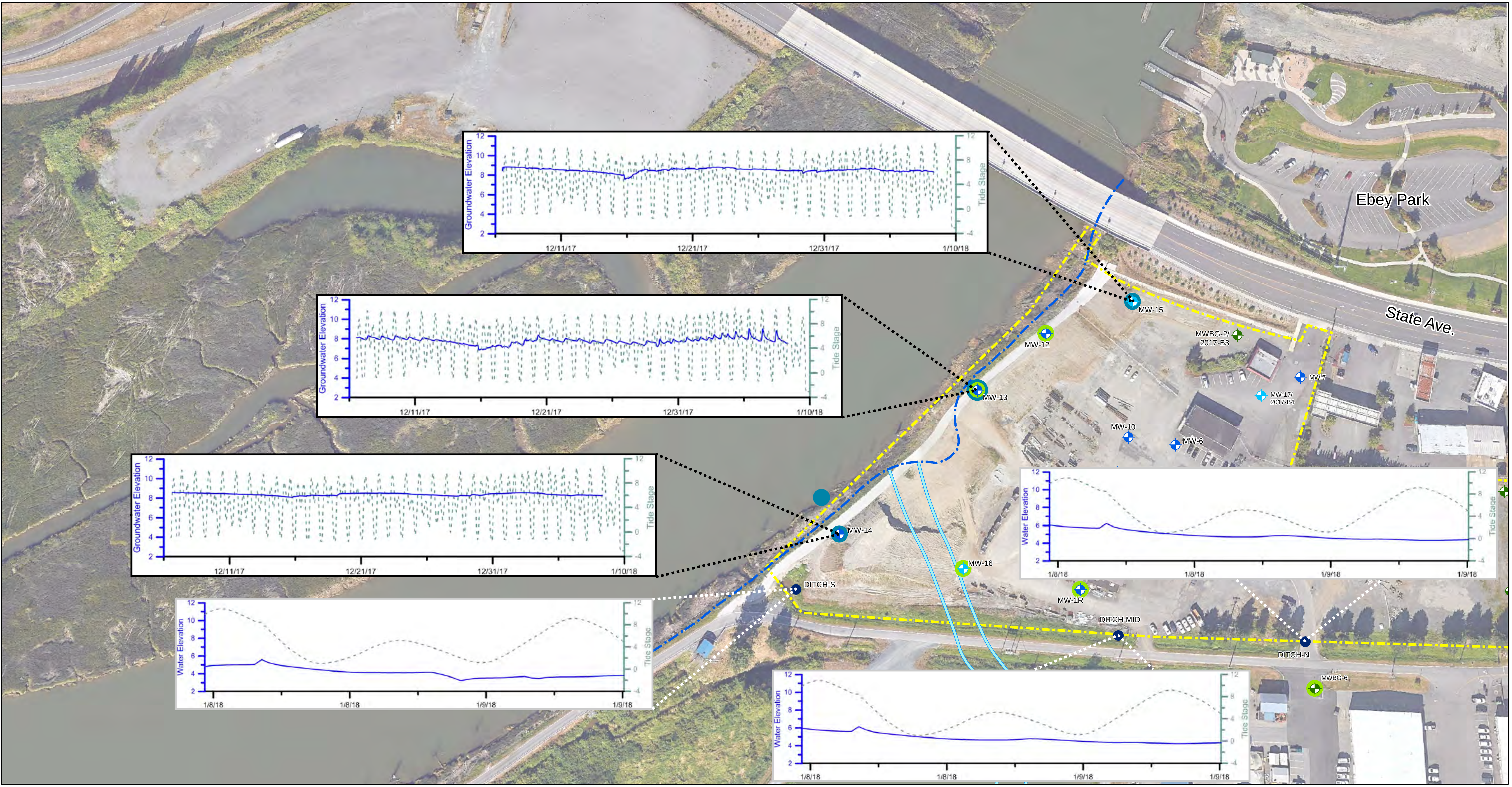
60 State Avenue Property
City of Marysville, WA

Potentiometric Surface Map - 21 September 2018

1896015*00

Figure 19



Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig20_TidalStudy_FirstEvent.mxd ©2017 Kennedy/Jenks Consultants

Legend

- ⊕ New Monitoring Well
- ⊕ Background Monitoring Well
- ⊕ Existing Monitoring Well
- ● Ditch Monitoring (8 January 2018 - 9 January 2018)
- ● Slug Test
- ● Tidal Study (6 December 2017 - 8 January 2018)
- ◉ Tidal Study and Slug Test
- ═ Approximate Former Stream Channel
- -·- Approximate Former Bank Location
- ▭ Property Parcel Boundary

Notes:
1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Elevations in feet above mean sea level.

N

0 75 150

Scale: Feet

Kennedy/Jenks Consultants

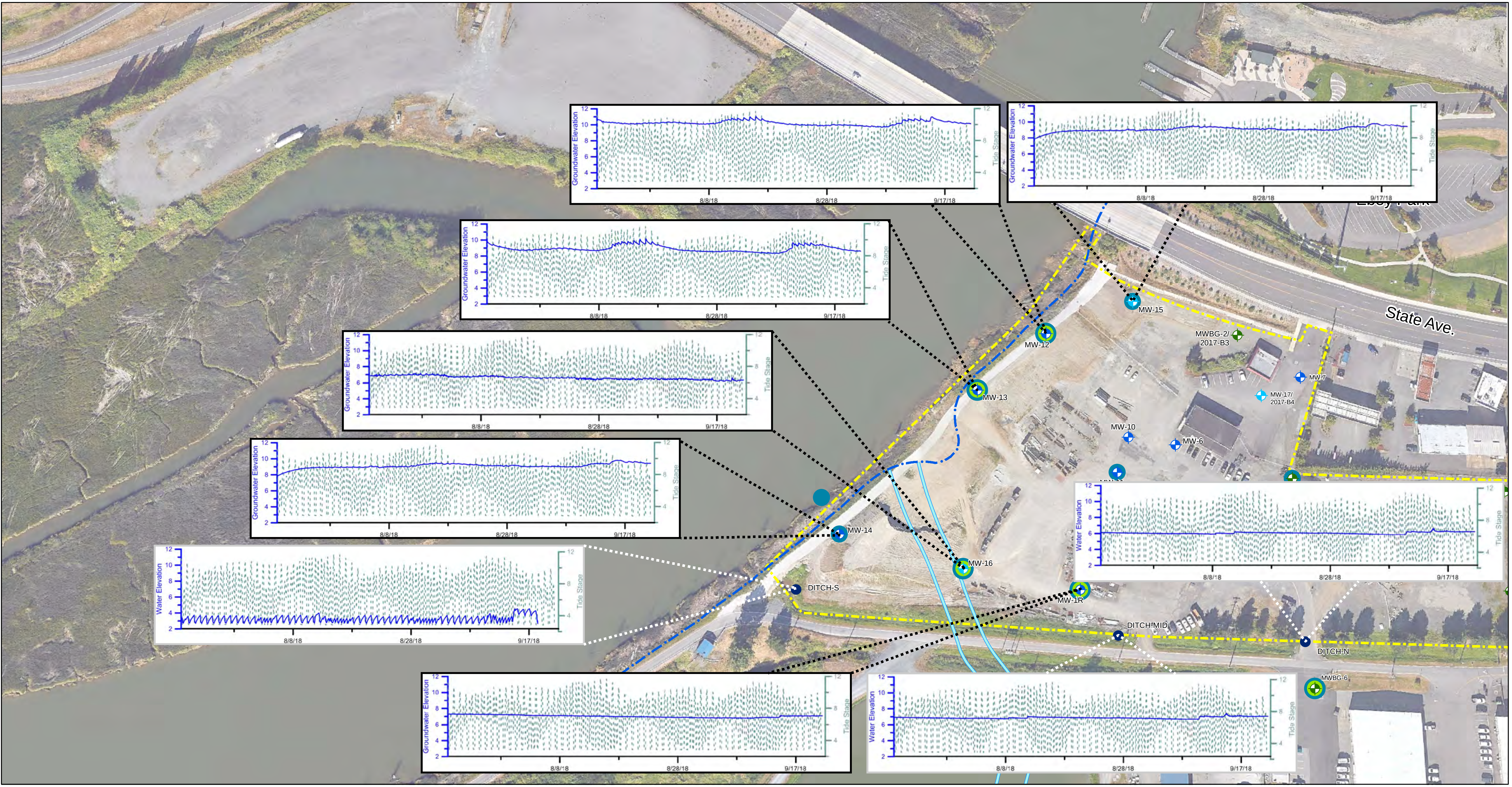
60 State Avenue Property
City of Marysville, WA

Tidal Evaluation and Aquifer Testing Summary - First Event

1896015*00

Figure 20

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig21_TidalStudy_JulySept.mxd



Legend

⊕	New Monitoring Well
⊕	Background Monitoring Well
⊕	Existing Monitoring Well
●	Ditch Monitoring (19 July 2018 - 21 September 2018)
●	Slug Test
●	Tidal Study (19 July 2018 - 21 September 2018)
◎	Tidal Study and Slug Test
═	Approximate Former Stream Channel
-·-	Approximate Former Bank Location
▭	Property Parcel Boundary

Notes:
1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Elevations in feet above mean sea level.
4. All slug tests occurred during the first event.

N

0 75 150

Scale: Feet

Kennedy/Jenks Consultants

60 State Avenue Property
City of Marysville, WA

Tidal Evaluation and Aquifer Testing
Summary - Second Event

1896015*00

Figure 21

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig22_Soil_As_REV.mxd ©2017 Kennedy/Jenks Consultants

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- ● Soil Boring
- ☒ Test Pit (2017)
- ☒ Test Pit (2018)
- ○ Soil Pile Composite Sample (2017)
- ⊕ Existing Monitoring Well
- ⊕ New Monitoring Well
- ⊕ Background Monitoring Well
- 🟩 Approximate Excavation Limits (2012)
- ☐ Former Site Features
- ☐ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in milligrams per kilogram (mg/kg).
4. Where duplicate samples were collected, only highest detected concentration shown on map.
5. Detected concentrations shown in bold, concentrations exceeding MTCA Method A Cleanup Levels are in blue.
6. 'J' = below laboratory reporting limit, concentration is estimated.

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Soil COC Concentration Map - Arsenic

1896015*00

Figure 22

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig23_Soil_TPH_GRO.mxd ©2017 Kennedy/Jenks Consultants

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- ⊕ Background Monitoring Well
- ⊕ New Monitoring Well
- ⊕ Existing Monitoring Well
- ● Soil Boring
- ⊠ Test Pit (2017)
- ⊠ Test Pit (2018)
- ▨ Approximate extent of GRO impacted soil (Exceeds MTCA Method A CUL for Unrestricted Land Use)
- ☐ Former Site Features
- ☐ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in milligrams per kilogram (mg/kg).
4. GRO = Gasoline-Range Organics.
5. Duplicate samples collected from 2017-B1(7.0-8.0), TP-01(2.5-3.0), 2018-TP-12, and TP-11(3.5-4.0); highest detected concentration shown on map.
6. Detected concentrations shown in bold, concentrations exceeding MTCA Method A Cleanup Levels are highlighted.
7. 'J' = below laboratory reporting limit, concentration is estimated; 'J-' = estimated concentration biased low based on data validation; '<' = analyte not detected at the method detection limit.
8. Only samples analyzed for GRO shown on map.

N

0 75 150

Scale: Feet

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City of Marysville, WA

Soil COC Concentration Map - GRO

1896015*00

Figure 23

Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig24_Soil_TPH_DRO.mxd ©2017 Kennedy/Jenks Consultants

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- New Monitoring Well
- Background Monitoring Well
- Existing Monitoring Well
- ● Soil Boring
- Test Pit (2017)
- Test Pit (2018)
- Former Site Features
- Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in milligrams per kilogram (mg/kg).
4. DRO = Diesel-Range Organics.
5. Duplicate samples collected from 2017-B1(7.0-8.0), TP-01(2.5-3.0), TP-11(3.5-4.0), 2018-TP-12(5.0-5.5), and 2017-B8(8.0-8.5); highest detected concentration shown on map.
6. Detected concentrations shown in bold, concentrations exceeding MTCA Method A Cleanup Levels are highlighted.
7. 'J' = below laboratory reporting limit, concentration is estimated; 'J-' = estimated concentration biased low based on data validation; '<' = analyte not detected at the method detection limit.
8. Only samples analyzed for DRO shown on map.

N

0 75 150

Scale: Feet

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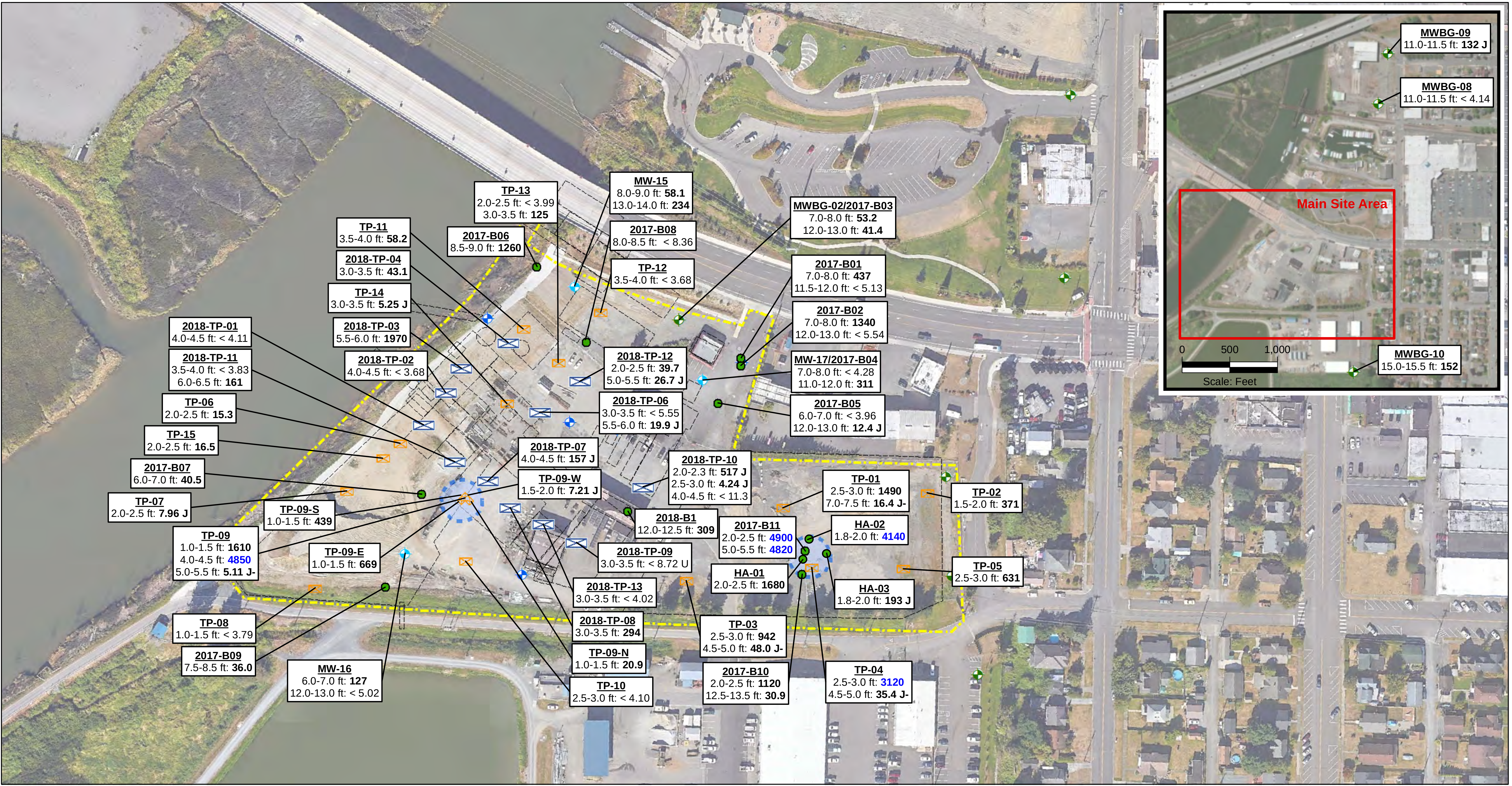
Soil COC Concentration Map - DRO

1896015*00

Figure 24



Path: Q:\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig25_Soil_TPH_ORO.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- ⊕ Background Monitoring Well
- ⊕ New Monitoring Well
- ⊕ Existing Monitoring Well
- ● Soil Boring
- ⊠ Test Pit (2017)
- ⊠ Test Pit (2018)
- ▨ Approximate extent of ORO impacted soil (Exceeds MTCA Method A CUL for Unrestricted Land Use)
- ☐ Former Site Features
- ☐ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in milligrams per kilogram (mg/kg).
4. ORO = Oil-Range Organics.
5. Duplicate samples collected from 2017-B1(7.0-8.0), TP-01(2.5-3.0), TP-11(3.5-4.0), 2018-TP-12(5.0-5.5), and 2017-B8(8.0-8.5); highest detected concentration shown on map.
6. Detected concentrations shown in bold, concentrations exceeding MTCA Method A Cleanup Levels are in blue.
7. 'J' = below laboratory reporting limit, concentration is estimated; '<' = analyte not detected at the method detection limit.

N

0 75 150

Scale: Feet

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Soil COC Concentration Map - ORO

1896015*00

Figure 25

Path: \\FWY01\data\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig26_Soil_TPHDx.mxd ©2017 Kennedy/Jenks Consultants

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Background Monitoring Well
- New Monitoring Well
- Existing Monitoring Well
- ● Soil Boring
- ☒ Test Pit (2017)
- ☒ Test Pit (2018)
- Approximate extent of DRO and ORO impacted soil (Exceeds MTCA Method A CUL for Unrestricted Land Use)
- ▭ Former Site Features
- ▭ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in milligrams per kilogram (mg/kg).
4. Sum of diesel- and oil-range organics concentrations shown on map.
5. Duplicate samples collected from 2017-B1(7.0-8.0), TP-01(2.5-3.0), TP-11(3.5-4.0), 2018-TP-12(5.0-5.5), and 2017-B8(8.0-8.5); highest detected concentration shown on map.
6. Detected concentrations shown in bold, concentrations exceeding MTCA Method A Cleanup Levels are in blue.
7. 'J' = below laboratory reporting limit, concentration is estimated; '<' = analyte not detected at the method detection limit.

N

0 75 150

Scale: Feet

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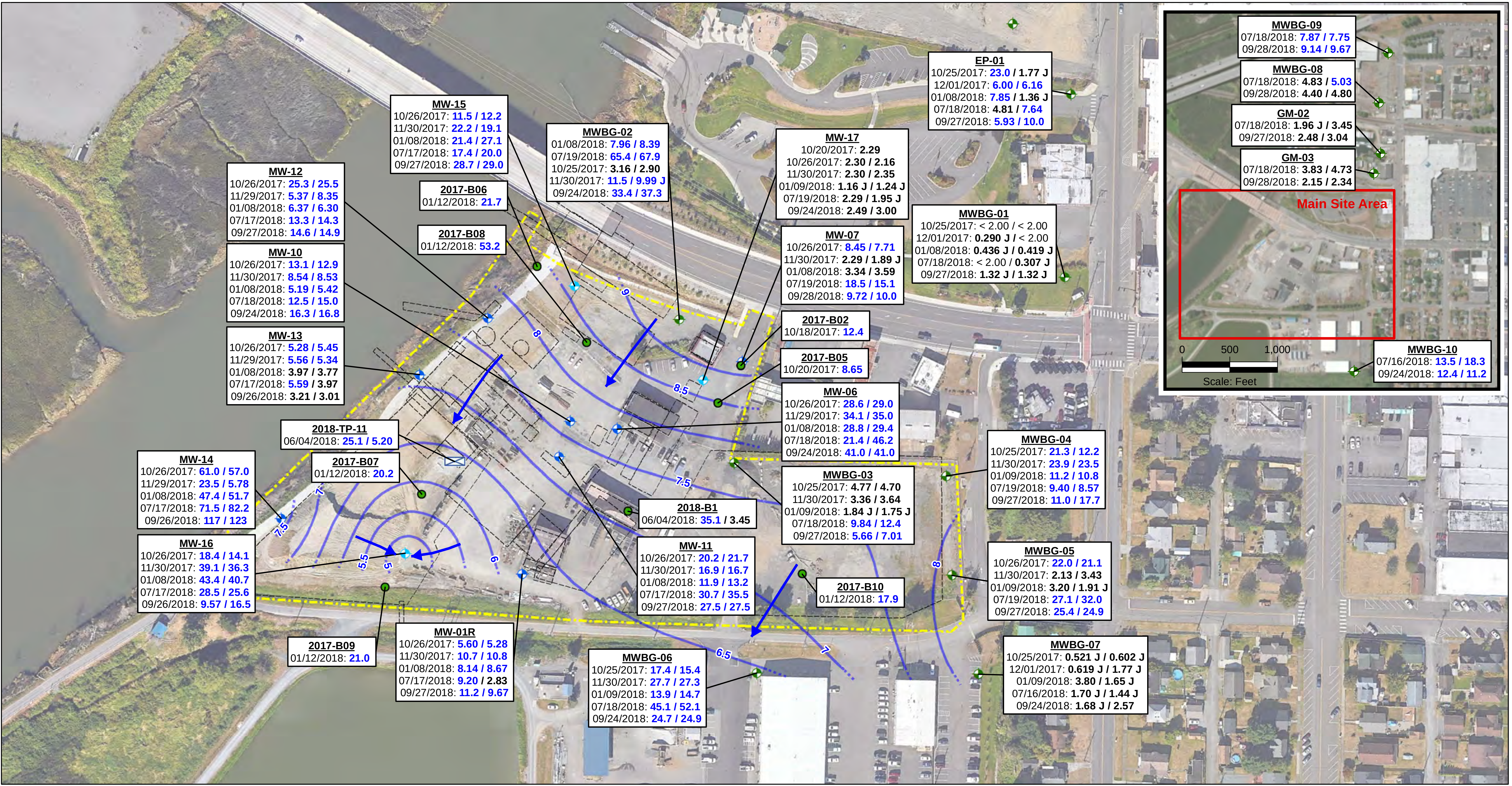
City of Marysville, WA

Soil COC Concentration Map - DRO and ORO

1896015*00

Figure 26

Path: \\FWY01\data\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig27_GW_As.mxd ©2017 Kennedy/Jenks Consultants



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- ● Soil Boring with Reconnaissance Groundwater Sample
- ⊠ Test Pit with Groundwater Sample (2018)
- ⊕ New Monitoring Well
- ⊕ Background Monitoring Well
- ⊕ Existing Monitoring Well
- → Approximate direction of hydraulic gradient
- ― Groundwater elevation contour, dashed where inferred (ft amsl)
- ▭ Former Site Features
- ▭ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. All concentrations in micrograms per liter (µg/l.)
3. First value shown represents total arsenic, second value represents dissolved arsenic. Single values represent dissolved arsenic only. Values from boring locations indicate reconnaissance groundwater samples.
4. Duplicate samples collected from MW-17, MWBG-6, and 2017-B5; highest detected concentration shown on map.
5. Detected concentrations shown in bold, concentrations exceeding MTCA Method A Cleanup Levels are in blue.
6. 'J' = below laboratory reporting limit, concentration is estimated; '<' = analyte not detected at the method detection limit.
7. Groundwater elevation contours from groundwater levels measured on 21 September 2018.

N

0 75 150

Scale: Feet

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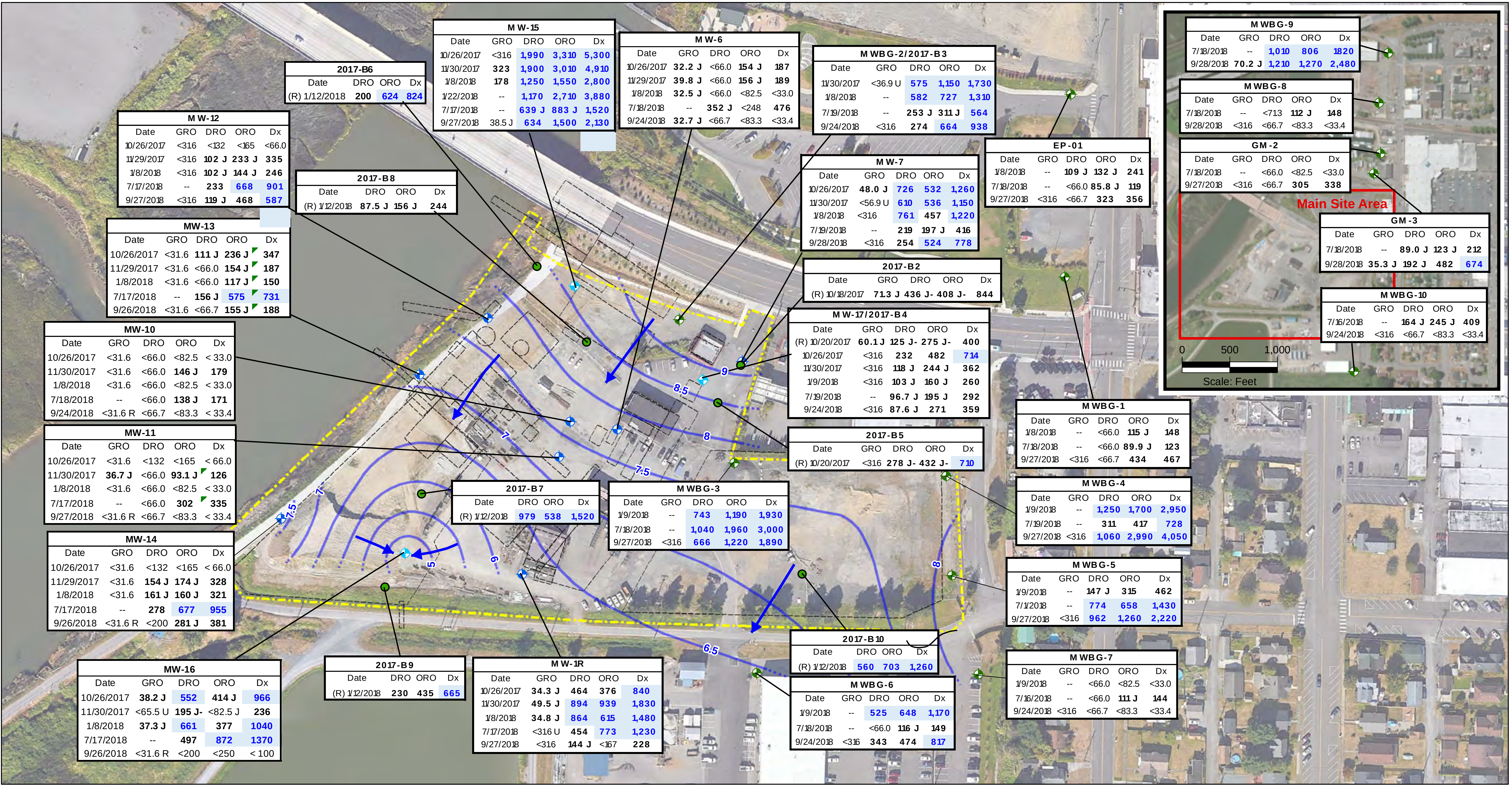
City of Marysville, WA

Groundwater COC Concentration Map - Arsenic

1896015*00

Figure 27



MW-15

Date	GRO	DRO	ORO	Dx
10/26/2017	<31.6	1,990	3,310	5,300
11/30/2017	323	1,900	3,010	4,910
1/8/2018	178	1,250	1,550	2,800
1/22/2018	--	1,170	2,710	3,880
7/17/2018	--	639 J	883 J	1,520
9/27/2018	38.5 J	634	1,500	2,130

MW-6

Date	GRO	DRO	ORO	Dx
10/26/2017	32.2 J	<66.0	154 J	187
11/29/2017	39.8 J	<66.0	156 J	189
1/8/2018	32.5 J	<66.0	<82.5	<33.0
7/18/2018	--	352 J	<248	476
9/24/2018	32.7 J	<66.7	<83.3	<33.4

MWBG-2/2017-B3

Date	GRO	DRO	ORO	Dx
11/30/2017	<36.9 U	575	1,150	1,730
1/8/2018	--	582	727	1,310
7/19/2018	--	253 J	311 J	564
9/24/2018	<31.6	274	664	938

2017-B6

Date	DRO	ORO	Dx
(R) 1/12/2018	200	624	824

MW-12

Date	GRO	DRO	ORO	Dx
10/26/2017	<31.6	<132	<165	<66.0
11/29/2017	<31.6	102 J	233 J	335
1/8/2018	<31.6	102 J	144 J	246
7/17/2018	--	233	668	901
9/27/2018	<31.6	119 J	468	587

2017-B8

Date	DRO	ORO	Dx
(R) 1/12/2018	87.5 J	156 J	244

MW-13

Date	GRO	DRO	ORO	Dx
10/26/2017	<31.6	111 J	236 J	347
11/29/2017	<31.6	<66.0	154 J	187
1/8/2018	<31.6	<66.0	117 J	150
7/17/2018	--	156 J	575	731
9/26/2018	<31.6	<66.7	155 J	188

MW-10

Date	GRO	DRO	ORO	Dx
10/26/2017	<31.6	<66.0	<82.5	< 33.0
11/30/2017	<31.6	<66.0	146 J	179
1/8/2018	<31.6	<66.0	<82.5	< 33.0
7/18/2018	--	<66.0	138 J	171
9/24/2018	<31.6 R	<66.7	<83.3	< 33.4

MW-11

Date	GRO	DRO	ORO	Dx
10/26/2017	<31.6	<132	<165	< 66.0
11/30/2017	36.7 J	<66.0	93.1 J	126
1/8/2018	<31.6	<66.0	<82.5	< 33.0
7/17/2018	--	<66.0	302	335
9/27/2018	<31.6 R	<66.7	<83.3	< 33.4

MW-14

Date	GRO	DRO	ORO	Dx
10/26/2017	<31.6	<132	<165	< 66.0
11/29/2017	<31.6	154 J	174 J	328
1/8/2018	<31.6	161 J	160 J	321
7/17/2018	--	278	677	955
9/26/2018	<31.6 R	<200	281 J	381

MW-16

Date	GRO	DRO	ORO	Dx
10/26/2017	38.2 J	552	414 J	966
11/30/2017	<65.5 U	195 J-	<82.5 J	236
1/8/2018	37.3 J	661	377	1040
7/17/2018	--	497	872	1370
9/26/2018	<31.6 R	<200	<250	< 100

2017-B7

Date	DRO	ORO	Dx
(R) 1/12/2018	979	538	1,520

2017-B9

Date	DRO	ORO	Dx
(R) 1/12/2018	230	435	665

MW-1R

Date	GRO	DRO	ORO	Dx
10/26/2017	34.3 J	464	376	840
11/30/2017	49.5 J	894	939	1,830
1/8/2018	34.8 J	864	615	1,480
7/17/2018	<31.6 U	454	773	1,230
9/27/2018	<31.6	144 J	<167	228

MWBG-3

Date	GRO	DRO	ORO	Dx
1/9/2018	--	743	1,190	1,930
7/18/2018	--	1,040	1,960	3,000
9/27/2018	<31.6	666	1,220	1,890

MW-7

Date	GRO	DRO	ORO	Dx
10/26/2017	48.0 J	726	532	1,260
11/30/2017	<56.9 U	610	536	1,150
1/8/2018	<31.6	761	457	1,220
7/19/2018	--	219	197 J	416
9/28/2018	<31.6	254	524	778

EP-01

Date	GRO	DRO	ORO	Dx
1/8/2018	--	109 J	132 J	241
7/18/2018	--	<66.0	85.8 J	119
9/27/2018	<31.6	<66.7	323	356

2017-B2

Date	GRO	DRO	ORO	Dx
(R) 10/18/2017	71.3 J	436 J-	408 J-	844

MW-17/2017-B4

Date	GRO	DRO	ORO	Dx
(R) 10/20/2017	60.1 J	125 J-	275 J-	400
10/26/2017	<31.6	232	482	714
11/30/2017	<31.6	118 J	244 J	362
1/9/2018	<31.6	103 J	160 J	260
7/19/2018	--	96.7 J	195 J	292
9/24/2018	<31.6	87.6 J	271	359

2017-B5

Date	GRO	DRO	ORO	Dx
(R) 10/20/2017	<31.6	278 J-	432 J-	710

2017-B10

Date	DRO	ORO	Dx
(R) 1/12/2018	560	703	1,260

MWBG-6

Date	GRO	DRO	ORO	Dx
1/9/2018	--	525	648	1,170
7/18/2018	--	<66.0	116 J	149
9/24/2018	<31.6	343	474	817

MWBG-1

Date	GRO	DRO	ORO	Dx
1/8/2018	--	<66.0	115 J	148
7/18/2018	--	<66.0	89.9 J	123
9/27/2018	<31.6	<66.7	434	467

MWBG-4

Date	GRO	DRO	ORO	Dx
1/9/2018	--	1,250	1,700	2,950
7/19/2018	--	311	417	728
9/27/2018	<31.6	1,060	2,990	4,050

MWBG-5

Date	GRO	DRO	ORO	Dx
1/9/2018	--	147 J	315	462
7/1/2018	--	774	658	1,430
9/27/2018	<31.6	962	1,260	2,220

MWBG-7

Date	GRO	DRO	ORO	Dx
1/9/2018	--	<66.0	<82.5	<33.0
7/16/2018	--	<66.0	111 J	144
9/24/2018	<31.6	<66.7	<83.3	<33.4

MWBG-9

Date	GRO	DRO	ORO	Dx
7/18/2018	--	1,010	806	1820
9/28/2018	70.2 J	1,210	1,270	2,480

MWBG-8

Date	GRO	DRO	ORO	Dx
7/18/2018	--	<71.3	112 J	148
9/28/2018	<31.6	<66.7	<83.3	<33.4

GM-2

Date	GRO	DRO	ORO	Dx
7/18/2018	--	<66.0	<82.5	<33.0
9/27/2018	<31.6	<66.7	305	338

GM-3

Date	GRO	DRO	ORO	Dx
7/18/2018	--	89.0 J	123 J	212
9/28/2018	35.3 J	192 J	482	674

MWBG-10

Date	GRO	DRO	ORO	Dx
7/16/2018	--	164 J	245 J	409
9/24/2018	<31.6	<66.7	<83.3	<33.4

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\FWY01\data\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig28_GW_TPH_REV_Dx.mxd

Legend

- ● Soil Boring with Reconnaissance Groundwater Sample
- ⊕ New Monitoring Well
- ⊕ Existing Monitoring Well
- ⊕ Background Monitoring Well
- → Approximate direction of hydraulic gradient
- — Groundwater elevation contour, dashed where inferred (ft amsl)
- ☐ Former Site Features
- ☐ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in micrograms per liter (µg/l).
4. GRO = Gasoline-Range Organics; DRO = Diesel-Range Organics; ORO = Oil-Range Organics; Dx = Sum of DRO and ORO; (R) = Sample collected from a temporary reconnaissance well.
6. Duplicate samples collected from 2017-B5 and MW-17; highest detected concentration shown.
7. Detected concentrations shown in bold, concentrations exceeding MTCA Method A Cleanup Levels are highlighted.
8. 'J' = below laboratory reporting limit, concentration is estimated; 'J-' = estimated concentration biased low based on data validation; 'U' = value qualified as undetected due to blank contamination; 'R' = value qualified as rejected in data validation; '<' = analyte not detected at the method detection limit.
9. Groundwater elevation contours from groundwater levels measured on 21 September 2018.

N

0 75 150

Scale: Feet

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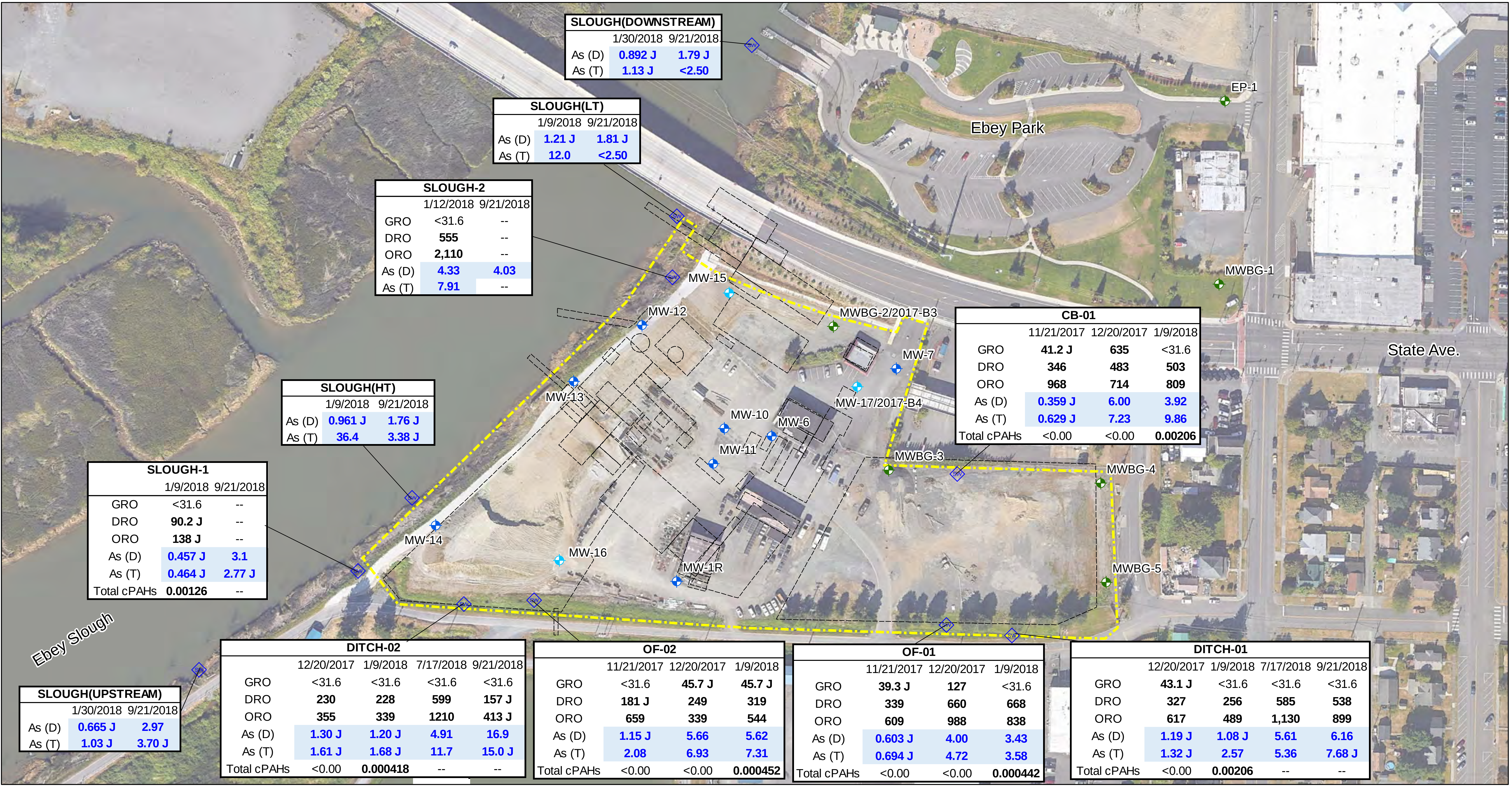
City of Marysville, WA

Groundwater COC Concentration Map - Organics

1896015*00

Figure 28

Path: \\FWY01\data\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig29_SW_TPH_As.mxd ©2017 Kennedy/Jenks Consultants



SLOUGH(DOWNSTREAM)

	1/30/2018	9/21/2018
As (D)	**0.892 J**	**1.79 J**
As (T)	**1.13 J**	<2.50

SLOUGH(LT)

	1/9/2018	9/21/2018
As (D)	**1.21 J**	**1.81 J**
As (T)	**12.0**	<2.50

SLOUGH-2

	1/12/2018	9/21/2018
GRO	<31.6	--
DRO	**555**	--
ORO	**2,110**	--
As (D)	**4.33**	**4.03**
As (T)	**7.91**	--

SLOUGH(HT)

	1/9/2018	9/21/2018
As (D)	**0.961 J**	**1.76 J**
As (T)	**36.4**	**3.38 J**

SLOUGH-1

	1/9/2018	9/21/2018
GRO	<31.6	--
DRO	**90.2 J**	--
ORO	**138 J**	--
As (D)	**0.457 J**	**3.1**
As (T)	**0.464 J**	**2.77 J**
Total cPAHs	**0.00126**	--

CB-01

	11/21/2017	12/20/2017	1/9/2018
GRO	**41.2 J**	**635**	<31.6
DRO	**346**	**483**	**503**
ORO	**968**	**714**	**809**
As (D)	**0.359 J**	**6.00**	**3.92**
As (T)	**0.629 J**	**7.23**	**9.86**
Total cPAHs	<0.00	<0.00	**0.00206**

SLOUGH(UPSTREAM)

	1/30/2018	9/21/2018
As (D)	**0.665 J**	**2.97**
As (T)	**1.03 J**	**3.70 J**

DITCH-02

	12/20/2017	1/9/2018	7/17/2018	9/21/2018
GRO	<31.6	<31.6	<31.6	<31.6
DRO	**230**	**228**	**599**	**157 J**
ORO	**355**	**339**	**1210**	**413 J**
As (D)	**1.30 J**	**1.20 J**	**4.91**	**16.9**
As (T)	**1.61 J**	**1.68 J**	**11.7**	**15.0 J**
Total cPAHs	<0.00	**0.000418**	--	--

OF-02

	11/21/2017	12/20/2017	1/9/2018
GRO	<31.6	**45.7 J**	**45.7 J**
DRO	**181 J**	**249**	**319**
ORO	**659**	**339**	**544**
As (D)	**1.15 J**	**5.66**	**5.62**
As (T)	**2.08**	**6.93**	**7.31**
Total cPAHs	<0.00	<0.00	**0.000452**

OF-01

	11/21/2017	12/20/2017	1/9/2018
GRO	**39.3 J**	**127**	<31.6
DRO	**339**	**660**	**668**
ORO	**609**	**988**	**838**
As (D)	**0.603 J**	**4.00**	**3.43**
As (T)	**0.694 J**	**4.72**	**3.58**
Total cPAHs	<0.00	<0.00	**0.000442**

DITCH-01

	12/20/2017	1/9/2018	7/17/2018	9/21/2018
GRO	**43.1 J**	<31.6	<31.6	<31.6
DRO	**327**	**256**	**585**	**538**
ORO	**617**	**489**	**1,130**	**899**
As (D)	**1.19 J**	**1.08 J**	**5.61**	**6.16**
As (T)	**1.32 J**	**2.57**	**5.36**	**7.68 J**
Total cPAHs	<0.00	**0.00206**	--	--

Legend

◇ Surface Water Sample	▭ Site Features
✚ New Monitoring Well	▭ Property Parcel Boundary
✚ Background Monitoring Well	
✚ Existing Monitoring Well	

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. All concentrations in micrograms per liter (µg/l).
4. GRO = Gasoline-Range Organics; DRO = Diesel-Range Organics; ORO = Oil-Range Organics; As = Arsenic; D = Dissolved; T = Total.
5. Duplicate sample collected from OF-01 in December and January, highest detected concentration shown on map.
6. Detected concentrations shown in bold, concentrations exceeding MTCA Method B Cleanup Levels for surface water are shaded in blue.
7. 'J' = below laboratory reporting limit, concentration is estimated; '<' = analyte not detected at the method detection limit.

N

0 75 150

Scale: Feet

Kennedy/Jenks Consultants

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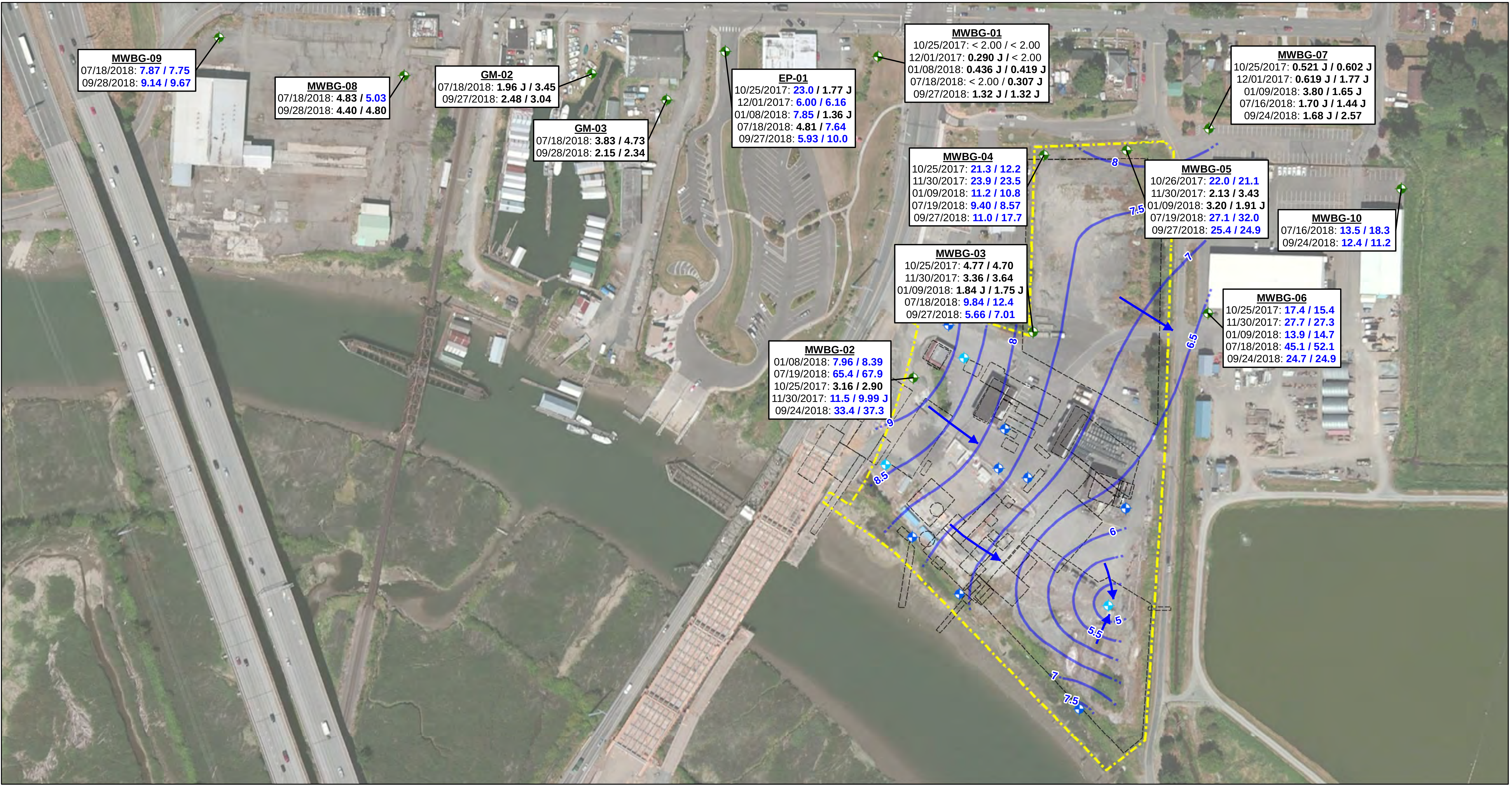
City of Marysville, WA

Surface Water COC Concentration Map

1896015*00

Figure 29



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\FWY01\data\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig30_Background_GW_As.mxd

Legend

⯐	Background Monitoring Well
⯐	New Monitoring Well
⯐	Existing Monitoring Well
→	Approximate direction of hydraulic gradient
―	Groundwater elevation contour, dashed where inferred (ft amsl)
▭	Former Site Features
▭	Property Parcel Boundary

Notes:

1. All locations are approximate.
2. All concentrations in micrograms per liter (µg/l.)
3. First value shown represents total arsenic, second value represents dissolved arsenic. Single values represent dissolved arsenic only.
4. Duplicate samples collected from MWBG-6,; highest detected concentration shown on map.
5. Detected concentrations shown in bold, concentrations exceeding MTCA Method A Cleanup Levels are in blue.
6. 'J' = below laboratory reporting limit, concentration is estimated; '<' = analyte not detected at the method detection limit.
7. Groundwater elevation contours from groundwater levels measured on 21 September 2018.

N

0 90 180

Scale: Feet

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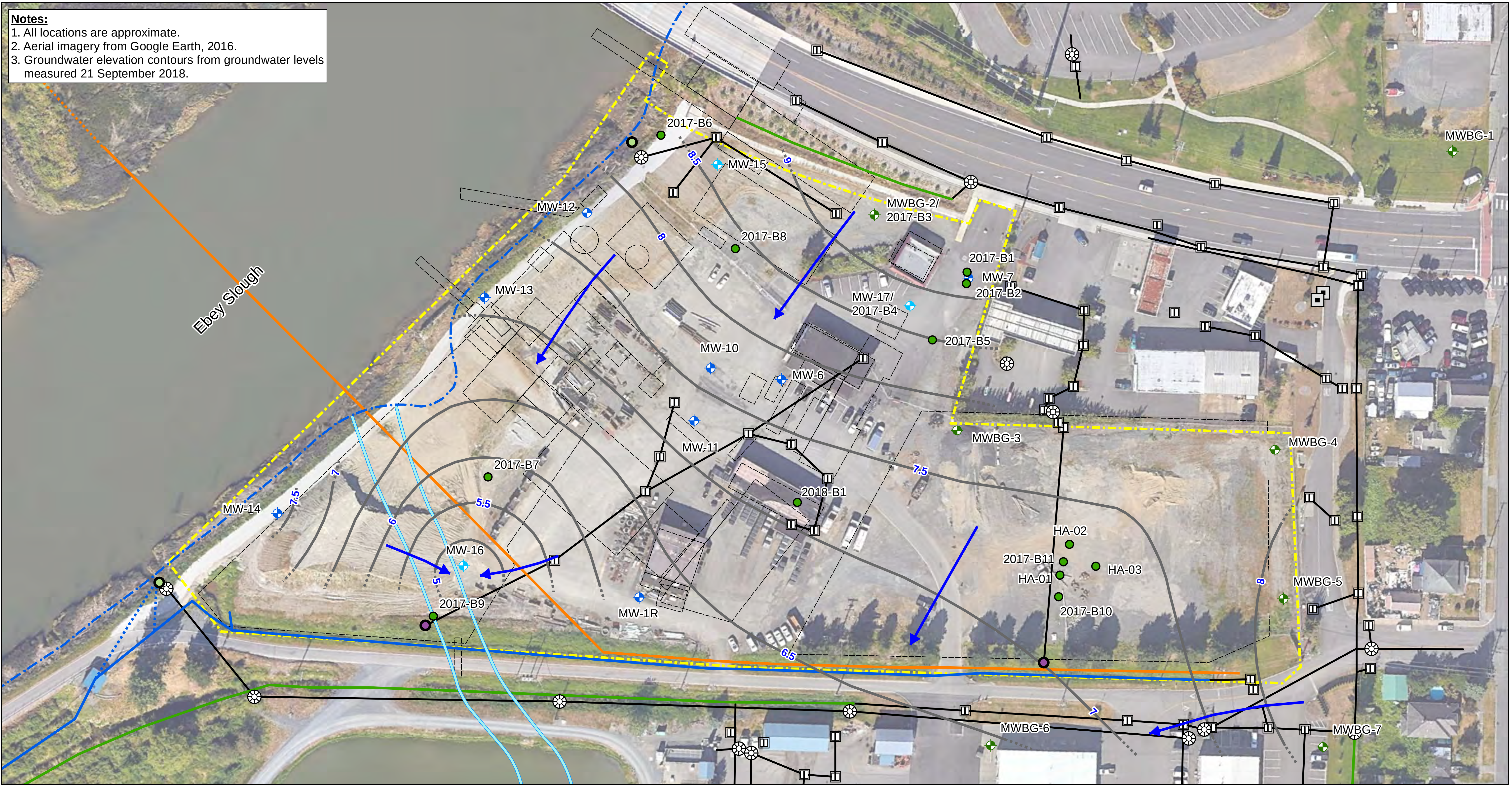
City of Marysville, WA

Arsenic Concentrations in Background Wells

1896015*00

Figure 30



Notes:
1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Groundwater elevation contours from groundwater levels measured 21 September 2018.

Path: \\FWY01\data\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\Fig31_GradientSummary.mxd ©2017 Kennedy/Jenks Consultants

Legend

- ● Soil Boring
- ◆ New Monitoring Well
- ◆ Existing Monitoring Well
- ◆ Background Monitoring Well
- → Approximate direction of hydraulic gradient
- Groundwater elevation contour, dashed where inferred (ft amsl)
- Approximate Former Stream Channel
- Approximate Former Bank Location
- High Pressure PSE Natural Gas Main (Approximate)
- ⊟ Catch Basin
- ⊛ Manhole
- ▣ Other Stormwater Feature
- ● Outfall to Ditch
- ○ Outfall to Slough
- Stormwater Pipe
- Surface Water Flow - Onsite
- Surface Water Flow - Offsite
- Emergency/Overflow Pumped Discharge to Outfall
- ☐ Former Site Features
- ☐ Property Parcel Boundary

N

0 50 100

Scale: Feet

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Approximate Gradient Summary Map

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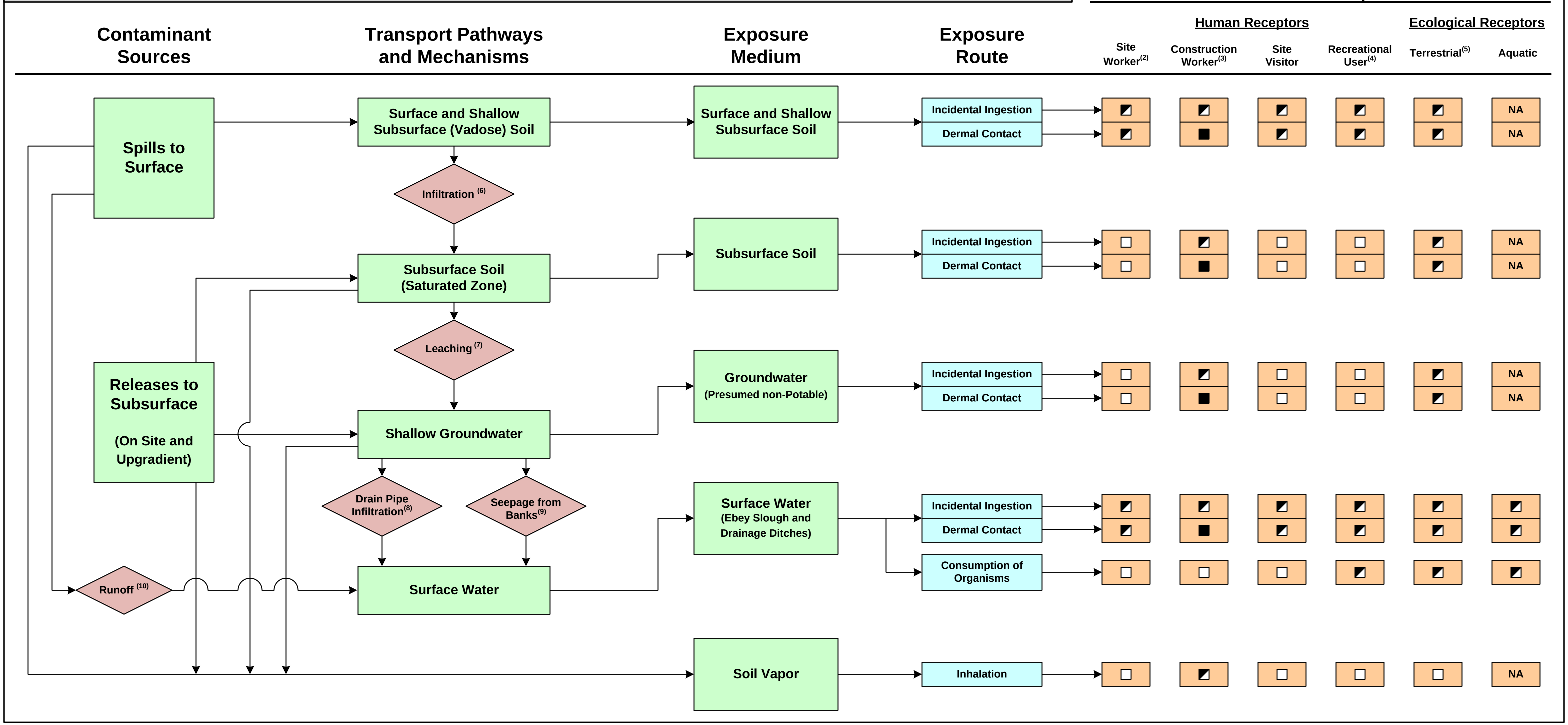
Figure 31

Interfor Pacific Site - Conceptual Site Exposure Model based on Current Site Uses and Conditions (1)



Exposure Medium	Exposure Route	Site Worker(2)	Construction Worker(3)	Site Visitor	Recreational User(4)	Terrestrial(5)	Aquatic
Surface and Shallow Subsurface Soil	Incidental Ingestion	◩	◩	◩	◩	◩	NA
	Dermal Contact	◩	■	◩	◩	◩	NA
Subsurface Soil	Incidental Ingestion	☐	◩	☐	☐	◩	NA
	Dermal Contact	☐	■	☐	☐	◩	NA
Groundwater (Presumed non-Potable)	Incidental Ingestion	☐	◩	☐	☐	◩	NA
	Dermal Contact	☐	■	☐	☐	◩	NA
Surface Water (Ebey Slough and Drainage Ditches)	Incidental Ingestion	◩	◩	◩	◩	◩	◩
	Dermal Contact	◩	■	◩	◩	◩	◩
	Consumption of Organisms	☐	☐	☐	◩	◩	◩
Soil Vapor	Inhalation	☐	◩	☐	☐	☐	NA

Legend:

■	Complete exposure pathway.
☐	Incomplete exposure pathway.
◩	Potentially complete exposure pathway or insufficient information.
NA	Exposure pathway considered not applicable for the listed receptors.

Notes:

1. Potential exposure pathways may differ after remediation and/or redevelopment of the Site.

2. Onsite employees performing routine tasks.

3. Onsite construction and/or industrial workers performing invasive activities; workers performing environmental investigation or sampling activities.

4. Includes public use of the paved pathway adjacent to Ebey Slough and recreational users of Ebey Slough, including potential consumption of organisms from Ebey Slough. Also includes Site trespassers.

5. Based on the Terrestrial Ecological Evaluation performed for the Site (see Section 5.6).

6. Precipitation and infiltration through vadose soil to shallow groundwater.

7. Leaching of contaminants in soil to groundwater and downgradient dissolved-phase transport in shallow groundwater.

8. Infiltration of impacted groundwater into storm drain pipes and/or bedding with preferential migration to surface water bodies.

9. Seepage from groundwater to surface water along bank area adjacent to drainage ditches and Ebey Slough

10. Runoff of spills or spill-impacted liquids to storm drain catch basins or directly to surface water bodies .

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Conceptual Site Exposure Model Diagram

Figure 32

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\FWY01\data\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig33_FS_SoilExc.mxd

Legend

- ● Soil Boring
- ☒ Test Pit (2017)
- ☒ Test Pit (2018)
- ○ Soil Pile Composite Sample
- ⊕ New Monitoring Well
- ⊕ Background Monitoring Well
- ⊕ Existing Monitoring Well
- ▨ Approximate Excavation Limits (2012)
- 🟦 Approximate Removal Area of TPH-Impacted Soil
- 🟩 Approximate Removal Area of Arsenic-Impacted Soil
- ☐ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. Removal areas include areas where soil exceeds TPH cleanup levels (100 mg/kg for GRO; 2,000 mg/kg for DRO and ORO) or arsenic remediation levels (see table inset on map for arsenic cleanup levels).
4. Arsenic remediation level table from Washington State Department of Ecology, Everett Smelter Site Integrated Final Cleanup Action Plan and Final Environmental Impact Statement for the Upland Area, 1999.

Arsenic Remediation Levels

Depth of Soil	Average Arsenic Level	Maximum Arsenic Level (at one sample point)
0 - 12 inches	20 ppm	40 ppm
12 - 24 inches	60 ppm	150 ppm
24 - 36 inches	150 ppm	500 ppm

N

0 50 100

Scale: Feet

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Excavation of Impacted Soil Area (Alternatives 2, 4, 5, 6, and 7)

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Figure 33

Path: \\FWY01\data\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig34_FS_AsphaltCap.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- ● Sparge Well
- ◈ New Monitoring Well
- ◈ Existing Monitoring Well
- ◈ Background Monitoring Well
- ▬ Ditch
- ▬ Approximate Sparge Transect or PRB Location
- ▨ Asphalt Cap
- ▭ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.
3. PRB = Permeable Reactive Barrier.

N

0 50 100

Scale: Feet

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Asphalt Cap and Air Sparging or PRB Transect Locations (Alternatives 3, 4, and 7)

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Figure 34

Path: \\FWY01\data\Projects\2017\1796040.00 WA DOE Interfor Pacific Marysville\GIS\Events\2018 Events\Fig35_FS_SlurryWall.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- ⊕ New Monitoring Well
- ⊕ Existing Monitoring Well
- ⊕ Background Monitoring Well
- ▬ Ditch
- ☐ Approximate Slurry Wall
- ☐ Property Parcel Boundary

Notes:

1. All locations are approximate.
2. Aerial imagery from Google Earth, 2016.

N

0 50 100

Scale: Feet

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Approximate Slurry Wall Location
(Alternatives 5 and 6)

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Figure 35

Figure 36: Benfit/Cost Ratio

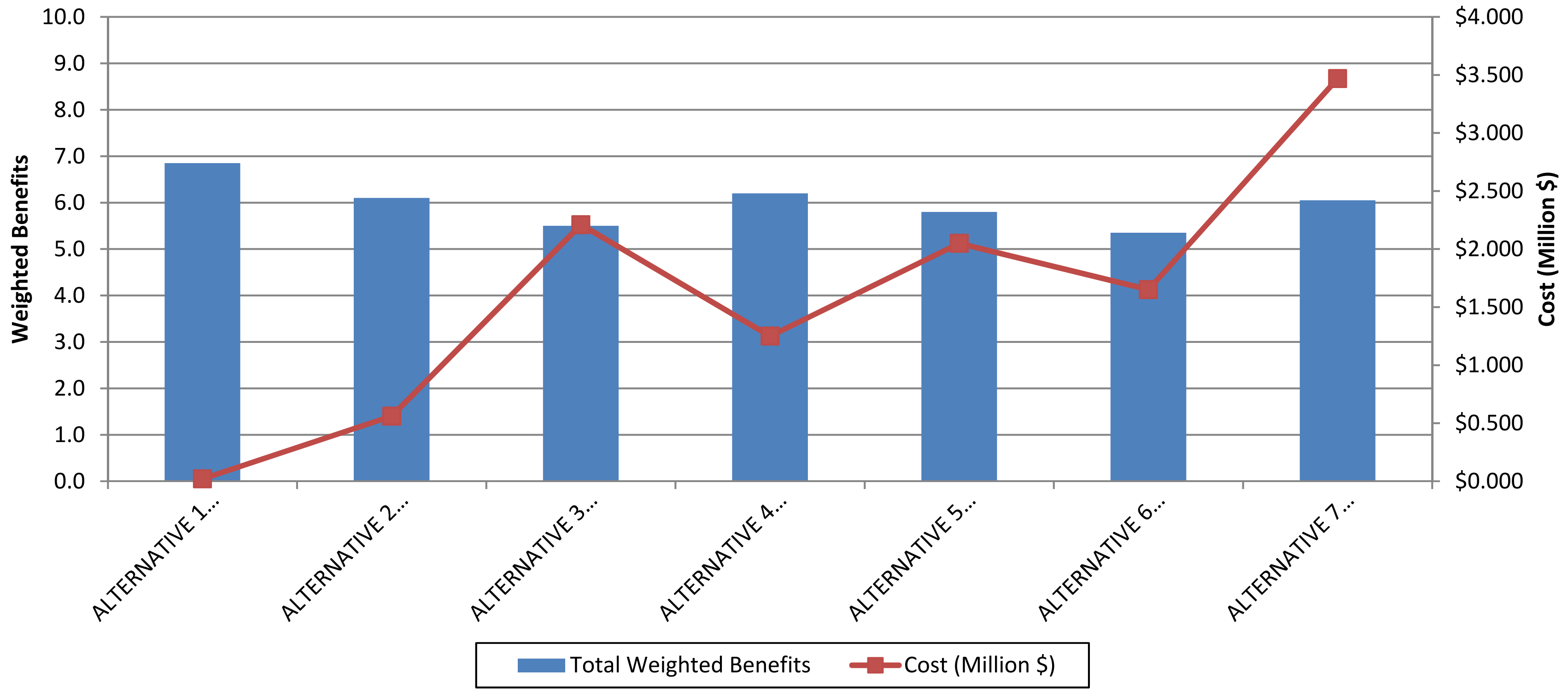

Figure 37: Benefit/Cost Ratio Relative to Most Permanant Alternative