

**FOURTH QUARTER 2018 PROGRESS REPORT / THIRD QUARTER 2018
GROUNDWATER PERFORMANCE MONITORING REPORT
SITE: FORMER BP HARBOR ISLAND TERMINAL
CLEANUP SITE ID: 4426
1652 SW LANDER STREET
SEATTLE, WASHINGTON**

CONSENT DECREE NO. 00-2-05714-8SEA

JANUARY 2019

Prepared for
TLP Management Services LLC
1670 Broadway
Suite 3100
Denver, CO 80202

Prepared by
TechSolve Environmental, Inc.
7518 NE 169th Street
Kenmore, WA 98028

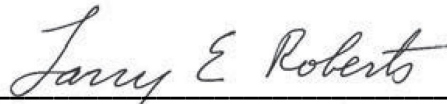
**FOURTH QUARTER 2018 PROGRESS REPORT / THIRD QUARTER 2018
GROUNDWATER PERFORMANCE MONITORING REPORT
SITE: FORMER BP HARBOR ISLAND TERMINAL
CLEANUP SITE ID: 4426
1652 SW LANDER STREET
SEATTLE, WASHINGTON**

CONSENT DECREE NO. 00-2-05714-8SEA

JANURARY 2019



Scott K. Larsen, CHMM
Project Scientist/Project Manager
TechSolve Environmental, Inc.



Larry E. Roberts, LG, LHG
Principal Hydrogeologist/Site Manager
TechSolve Environmental, Inc.



TABLE OF CONTENTS

1. INTRODUCTION	1
2. REMEDIATION SYSTEM OPERATIONS	1
2.1. WATERFRONT SYSTEM OPERATIONS.....	1
2.2. INLAND SYSTEM OPERATIONS	3
3. SUMMARY OF GROUNDWATER PERFORMANCE MONITORING PROGRAM	3
4. SUMMARY OF DATA VALIDATION	5
5. ADDITIONAL ACTIVITIES	5
6. SUMMARY	5
7. REFERENCES	6

TABLES

1. Waterfront Groundwater System Petroleum Hydrocarbon Recovery Rates
2. Groundwater Performance Monitoring Schedule
3. Groundwater Performance Monitoring Groundwater Elevations
4. Summary of Analytical Results for Groundwater - TPH-G, TPH-D, TPH-O, and Benzene
5. Summary of Free Product Measurement Results for Groundwater
6. Summary of Data Validation Results

FIGURES

1. Site Location Map
2. Plant 1 Third Quarter 2018 Groundwater Monitoring Analytical Results

1. INTRODUCTION

TLP Management Services LLC is submitting this report prepared by TechSolve Environmental, Inc. (TechSolve) to summarize the Third Quarter 2018 Groundwater Monitoring event and operation and maintenance of the waterfront remediation system during the fourth quarter (October through December) of 2018 for the Former BP Harbor Island Terminal Site. Groundwater monitoring and remediation system reporting periods are staggered due to the time required to receive and validate laboratory reports from groundwater monitoring events. The combination of these two summary reports was based upon the recommendation of the Washington State Department of Ecology (Ecology) project manager (Ecology, 2004a). This progress report satisfies reporting schedule submittal requirements pursuant to Ecology Consent Decree No. 00-2-05714-8SEA, entered into court March 24, 2000 (Ecology, 2000b).

2. REMEDIATION SYSTEM OPERATIONS

Remediation systems were installed and completed at the Site in accordance with specifications outlined in the Engineering Design Report (EDR) (TechSolv and AG&M, 2000) and Cleanup Action Plan (CAP) (Ecology, 1999). Throughout 2018, a waterfront groundwater/Light Non-Aqueous Phase Liquid (LNAPL) remediation system has operated to remove free-phase LNAPL and dissolved petroleum hydrocarbons from groundwater at Plant 1 (Figure 1).

2.1. WATERFRONT SYSTEM OPERATIONS

Installation and startup of the final waterfront remediation system was completed in 2002 and operational testing was conducted through 2003. Standard operation began once testing showed the system operated as designed and in accordance with Consent Decree and EDR requirements. Reports were submitted to Ecology summarizing both construction and operation & maintenance (O&M) of the remediation system. The Construction Completion Report (CCR) (TechSolve, 2003b) summarized construction, installation, and startup testing of the final remediation system, and documented that systems met design criteria, attained desired capture, and hydraulic control along the waterfront. The Final O&M Manual (TechSolve, 2003c) contains procedures to operate and maintain systems, vendor-supplied manuals for components, and health and safety practices. Ecology stated that the CCR and O&M Manual complied with the requirements of the Consent Decree, the Groundwater Compliance Monitoring Program, and the Model Toxics Control Act (WAC 173-340-400) and, as such, were approved (Ecology, 2004b). The O&M Manual is updated as practices or procedures change, or as systems are altered.

O&M activities are conducted on systems weekly to ensure they operate as designed and in accordance with applicable permits. These activities include, but are not limited to:

- Weekly checks of groundwater recovery system pumping rates.
- Weekly inspections of system components and waste storage containers for integrity per the requirements of WAC 173-303-320.
- Monthly sampling of recovered groundwater influent and effluent streams to ensure compliance with King County Department of Natural Resources and Parks (KCDNR) Discharge Permit 7592-05 for discharge A43262.

- Monthly monitoring and calculation of system LNAPL recovery.
- Monthly sampling of system flow rates and hydrocarbon concentrations.

Additional maintenance activities are conducted as needed to maintain system operational integrity and to ensure discharges are within permitted ranges.

Operation of waterfront air sparging and SVE systems were discontinued in May 2008, as the bulk of available hydrocarbons had been recovered. System data collected during 5 years of operation prior to shutdown were presented in previous reports, and support system shutdown. These findings were presented to Ecology in a 5-year Review meeting, conducted October 8, 2008, and summarized in the 2008 Annual Site Report (TechSolve, 2009).

Combined LNAPL recovery (free-phase, residual, and dissolved) from final SVE and groundwater/LNAPL recovery systems is approximately 14,555 gallons (October 2002 to December 2018) (Table 1). Interim systems, operating from 1992 through 2002, recovered an additional 15,223 gallons of LNAPL, for a combined LNAPL recovery from interim and final remediation systems of 29,778 gallons. The majority of LNAPL recovered by interim remediation systems was free-phase LNAPL. The majority of LNAPL recovered by final remediation systems was from enhanced biodegradation, calculated from SVE vapor sampling for CO₂. SVE system shutdown in 2008 was based, in part, on concentrations of CO₂ reaching atmospheric (background) levels.

Groundwater/LNAPL recovery system data presented in Table 1 show influent concentrations of dissolved benzene, diesel, and gasoline in recovered groundwater fluctuate slightly throughout the year but have decreased over time. Table 1 also shows that measurable volumes of free LNAPL have not been generated since 2008, which was the last time sufficient quantities of LNAPL were recovered to warrant off-site shipment. These data correspond with the lack of free LNAPL observed in recovery wells utilized by the groundwater/LNAPL recovery system. Lack of free LNAPL in wells and limited free LNAPL recovery by the groundwater/LNAPL recovery system indicates that the recovery system has captured most available free LNAPL.

Effluent discharges from the groundwater/LNAPL recovery system to sanitary have been within KCDNR's permitted ranges (Table 1) in 2018. Average monthly effluent flow rates ranged from 1.7 to 1.0 gallons per minute (gpm) in 2018, below KCDNR's maximum permitted flow of 17.5 gpm, consistent with past rates.

Maintenance and repair activities of remediation systems and wells are conducted to maintain integrity, effective operation, capture, and hydraulic control along the waterfront. Notable activities conducted in the third quarter of 2018 include:

- Piping and system inspections for corrosion and integrity to ensure system are operable.
- Piping and system back flushing and preventative maintenance to maintain conveyance piping and pumping wells.

Data show that the system continues to operate as designed and in accordance with permit requirements.

2.2. INLAND SYSTEM OPERATIONS

An Inland SVE system operated from 2008 through 2014 to improve soil and groundwater conditions along the southern boundary of Plant 1. The SVE system was shut down in December 2014 as data indicated the system no longer recovered measurable concentrations of petroleum hydrocarbons and induced airflow was no longer affecting biodegradation. Additional information regarding shutdown of the Inland SVE system was provided in the 2015 Annual Site Report (TechSolve, 2016). In 2018, a plan (TechSolve, 2018) was submitted to and approved by Ecology (Ecology 2018) to decommission the mechanical and electrical components of the Inland SVE System that required ongoing maintenance. These components were subsequently decommissioned. The in-ground SVE piping and control manifold for this system remain onsite as a contingency in case operation of the system is warranted in the future.

Groundwater monitoring data collected along Plant 1's southern boundary indicate the system improved groundwater conditions at the southern property boundary, as discussed in the following section.

3. SUMMARY OF GROUNDWATER PERFORMANCE MONITORING PROGRAM

The Third Quarter 2018 Groundwater Monitoring Event was conducted in accordance with requirements of the Consent Decree, CAP, and Groundwater Compliance Monitoring and Contingency Program (TechSolve, 1999). The Groundwater Compliance Monitoring and Contingency Program describes the monitoring well network, sampling frequency, and analytes. Some revisions to the monitoring plan were included in the EDR, per Ecology's approval. Additional revisions have been made with Ecology's approval, as highlighted below. The current groundwater monitoring schedule is summarized in Table 2. Monitoring well locations are shown on Figure 2 for Plant 1.

In 2005, four wells (MW-1-T9, MW-2-T9, MW-3-T9, and MW-4-T9) were installed along the southern property boundary of Plant 1 (Figure 2) to evaluate groundwater trends due to cleanup level exceedances in Monitoring Well AR-03. These wells were monitored quarterly from December 2005 through March 2018, which aided in evaluating the effectiveness of the Inland SVE system in meeting cleanup objectives. In 2018, a monitoring revision plan (TechSolve, 2018a) was submitted to and approved by Ecology (Ecology 2018) to eliminate monitoring of Well MW-4-T9 and reduce the monitoring frequency in Wells AR-03, GM-15S, MW-1-T9, MW-2-T9, and MW-3-T9 from quarterly to semi-annual. Contingency actions were detailed in the plan to resume quarterly monitoring of Wells AR-03, GM-15S, MW-1-T9, MW-2-T9, and MW-3-T9 for specified periods if cleanup levels are exceeded in these wells.

Well GM-14S was historically used to monitor for sheens on groundwater, as discussed below. As sheens are no longer detected in GM-14S, quarterly groundwater monitoring for indicator hazardous substances (IHSs) was initiated in this well in 2007.

Wells GM-16S and GM-17S are hydraulically upgradient from Plant 1. These wells were removed from most of the monitoring program with approval from Ecology in March 2000 (Ecology, 2000a) as sufficient upgradient data had been collected. Monitoring for hydrocarbons was voluntarily reinitiated in these wells in September 2007, as recommended by Ecology, to monitor for petroleum hydrocarbon migration onto the property from upgradient, off-site sources.

Revisions to the groundwater monitoring program were approved by Ecology in 2009 (Ecology, 2009), which reduced monitoring frequencies and required analyses. These revisions reduced the monitoring frequency from Wells GM-16S, and 17S from quarterly to semi-annual. The monitoring frequency from 16S, and 17S was reduced due to consistent monitoring data for total petroleum hydrocarbons (TPH) and benzene below cleanup levels. Additionally, the voluntary monitoring frequency of sampling for carcinogenic polynuclear aromatic hydrocarbons (cPAHs) was set to an annual basis in waterfront wells (AMW-01 through AMW-05) as extensive historical sampling does not indicate any significant detection trends. Ecology agreed that analysis for cPAHs from these wells is voluntary until cleanup objectives are met (Ecology, 2003). Sampling for cPAHs was last conducted in the fourth quarter of 2017 (TechSolve, 2018b)

Wells monitored on a semi-annual basis are sampled in the first and third quarter, which typically correspond with seasonal groundwater highs and lows, respectively. As such, Wells AR-03, GM-15S, GM-16S, GM-17S, MW-1-T9, MW-2-T9, and MW-3-T9 were sampled in the third quarter of 2018. These wells will next be sampled in the first quarter of 2019.

The Third Quarter 2018 Groundwater Monitoring event was conducted September 11th and 12th, 2018. Overall, the third quarter 2018 groundwater elevations (Table 3) were lower than the elevations measured in the first and second quarters of 2018. These data indicate that the seasonal groundwater high occurred in early 2018, which corresponds with historic trends showing groundwater elevations rise to seasonal highs in the winter and spring and decrease to seasonal lows in the summer and autumn.

Third Quarter 2018 Groundwater Monitoring Event samples were submitted to Test America Laboratories of Tacoma, Washington for laboratory analysis of IHSs identified in the CAP. The IHSs include TPH as gasoline (TPH-G), TPH as diesel (TPH-D), TPH as oil (TPH-O), and benzene.

Petroleum hydrocarbon monitoring results for the Third Quarter 2018 Groundwater Monitoring Event are included in Table 4 and Figures 2 and 3. The only detection of IHSs (benzene, TPH-G, TPH-D, or TPH-O) above cleanup levels from any of the samples analyzed in the second quarter of 2018 was for TPH-G, detected from Well GM-14S. All other IHS monitoring results were below associated cleanup levels in all other wells. The TPH-G concentration detected in well GM-14S was within historic ranges and consistent with historical trends. Data trend evaluations will be presented in the 2018 Annual Site Report, in accordance with Consent Decree requirements.

Three wells (GM-11S, GM-12S, and GM-13S) are examined monthly for the presence of free LNAPL and sheens. Laboratory analysis for IHSs will not be conducted on groundwater from these Wells until they are removed from the monthly LNAPL gauging program, as required by the Groundwater Compliance Monitoring and Contingency Program. Historically, gauging for free LNAPL at Plant 1 was conducted at four wells; however, gauging of Wells GM-14S was discontinued in 2004, with concurrence from Ecology (Ecology, 2004c), and converted to a monitoring well in 2007, as it has been free of LNAPL since 1999.

No sheens were detected in Well GM-12S in 2018. A slight sheen was detected in well GM-11S from April through August of 2018. A slight sheen was also detected in GM-13S in January, May and October 2018. The results of LNAPL monitoring for 2018 are within historic ranges and consistent with past trends. LNAPL and sheen monitoring results are presented in Table 5.

4. SUMMARY OF DATA VALIDATION

Laboratory analytical results were reported with associated laboratory quality assurance/quality control data (QA/QC). Analytical reports were reviewed and data were validated. During this quarter, limited data were qualified with a J or a UJ qualifier (the associated value is approximate or the analyte was not detected at an approximated quantitation limit, respectively). A summary of the data qualified during validation, qualifiers assigned, and reasons for data qualification are provided in Table 6. All laboratory reports are retained at the TechSolve office.

5. ADDITIONAL ACTIVITIES

Preliminary discussions were conducted with Ecology during the fourth quarter of 2018 related to proposed remedial work to be conducted at the Site and a memorandum was submitted to Ecology (TechSolve, 2018c) discussing these proposed remedial activities. The proposed activities include a voluntary probing investigation to evaluate if ongoing remedial actions along the Plant 1 waterfront are achieving cleanup objectives, and a regulatory driven (Ecology, 2015) evaluation of how a new seawall installed along the Plant 1 waterfront in 2018 has affected site hydrology. Discussions with Ecology related to the activities are currently ongoing.

6. SUMMARY

This progress report and groundwater monitoring report summarizes operation of remediation systems during the fourth quarter of 2018 (October through December 2018) and the Third Quarter 2018 Groundwater Monitoring Event. In accordance with the Consent Decree, the 2018 Annual Site Report will be the next report submitted to Ecology. This report will be submitted to Ecology by April 15, 2019.

7. REFERENCES

TechSolve Environmental, Inc. (Techsolve) (formerly TechSolv Consulting Group, Inc.). 1999. Groundwater Compliance Monitoring and Contingency Program, ARCO Harbor Island Terminal 21T, Seattle, Washington. November 19, 1999.

_____. 2003b. Groundwater Remedy Final Construction Completion Report, BP West Coast Products Company Terminal 21T. September 2003.

_____. 2003c. Final Operations and Maintenance Manual, BP West Coast Products Company Terminal 21T. September 2003.

_____. 2007. Tank 9 Soil Vapor Extraction (SVE) System Expansion. Atlantic Richfield Company. BP Terminal 21 T. Harbor Island. Consent Decree No. 00-2-05714-8SEA. September 2007.

_____. 2009. 2008 Annual Site Report, BP West Coast Products Terminal, 1652 SW Lander Street, Seattle, Washington. April 2009.

_____. 2016. 2015 Annual Site Report, BP West Coast Products Terminal, 1652 SW Lander Street, Seattle, Washington. April 2016.

_____. 2018a. Email from Scott Larsen to Jerome Cruz. RE: BP Harbor island SVE decommissioning petition (SL 2/2). February 15, 2018 9:31 AM.

_____. 2018b. 2017 Annual Site Report, BP West Coast Products Terminal, 1652 SW Lander Street, Seattle, Washington. April 2018.

_____. 2018c. Summary of Recent Telephone Conversation and Planned Activities at the Former BP Harbor Island Terminal Site (Cleanup Site ID: 4426). December 18, 2018.

TechSolv Consulting Group, Inc. and ARCADIS Geraghty & Miller (TechSolv and AG&M). 2000. Engineering Design Report, ARCO Harbor Island Terminal 21T, Seattle, Washington. September 2000.

Washington State Department of Ecology (Ecology). 1999. Cleanup Action Plan (CAP), ARCO Terminal 21T, Seattle, Washington. November 19, 1999.

_____. 2000a. Meeting with Nnamdi Madakor, Project Manager, Northwest Regional Office. Personal communication to L. Roberts and C. Lybeer, TechSolv Consulting Group, Inc. March 16, 2000.

_____. 2000b. Consent Decree No. 00-2-05714-8SEA. March 24, 2000.

_____. 2002. Letter from Nnamdi Madakor, Northwest Regional Office, to Ralph Moran, ARCO. June 29, 2002.

_____. 2003. Meeting with Roger Nye, Project Manager, Northwest Regional Office. Personal communication to L. Roberts, TechSolv Consulting Group, Inc. March 14, 2003.

_____. 2004a. Annual Site Review Meeting with Roger Nye, Project Manager, Northwest Regional Office. Personal communication to Ralph Moran, BP, and L. Roberts and S. Larsen, TechSolv Consulting Group, Inc. April 14, 2004.

_____. 2004b. Letter from Roger K. Nye, Northwest Regional Office, to Ralph Moran, BP. June 8, 2004.

_____. 2004c. Proposal approval email from Roger K. Nye, Northwest Regional Office, to Larry E. Roberts, TechSolv Consulting Group, Inc. June 15, 2004.

_____. 2007. Tank 9 Soil Remediation System email from Roger K. Nye, Northwest Regional Office, to Larry E. Roberts, TechSolv Consulting Group, Inc. August 23, 2007.

_____. 2009. Letter from Roger Nye to Larry E. Roberts. RE: Revisions to Monitoring. April 3, 2009.

_____. 2015. Letter from Maura S. O'Brien to Paul Supple. Subject: Ecology Comments for Proposed Bulkhead Replacement at BP West Coast Products Terminal Harbor Island, former ARCO Site at 1652 SW Lander Street, Seattle, WA Consent Decree No. 00-2-05714-8SEA and Cleanup Id No. 4426. September 3, 2015.

_____. 2018. Email from Jerome Cruz to Scott Larsen. RE: BP Harbor Island inland SVE decommissioning petition (SL 2/2). February 15, 2018 11:29 AM.

TABLES

Table 2. Groundwater Performance Monitoring Schedule
 Site: Former BP Harbor Island Terminal

Analyses Conducted by Quarter				
Well	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Plant 1				
MW-1-T9	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
MW-2-T9	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
MW-3-T9	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
GM-14S	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O
GM-15S	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
GM-16S	Benzene, TPH-G, TPH-D, TPH-O		Benzene, TPH-G, TPH-D, TPH-O	
GM-17S	Benzene, TPH-G, TPH-D, TPH-O		Benzene, TPH-G, TPH-D, TPH-O	
GM-24S	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O
AR-03	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
AMW-01	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-02	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-03	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-04	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-05	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs

Plant 2

All Plant 2 monitoring has been discontinued.

- Notes: Field Duplicate and QA/QC samples collected from wells highlighted in bold.
 TPH-G - Gasoline Range organics utilizing NWTPH-Gx method
 TPH-D - Diesel Range Organics utilizing NWTPH-Dx
 TPH-O - Extended Range Organics (Motor Oil) utilizing NWTPH-Dx
 Benzene is analyzed for utilizing EPA 8021 or 8260B.
 cPAHs - Carcinogenic Polycyclic Aromatic Hydrocarbons utilizing EPA 8270SIM
 Field Parameters (pH, Temperature, Conductivity, Turbidity, Water Level, & Product Level) are recorded from all wells sampled
 (1) - If a groundwater cleanup level exceedance occurs in first or third quarter in any of these highlighted wells, all (1) wells will be sampled the following quarter. Wells exceeding cleanup levels will continue quarterly monitoring until four consecutive quarters below cleanup level are achieved.

Table 3. Groundwater Performance Monitoring Groundwater Elevations
 Third Quarter 2018
 Site: Former BP Harbor Island Terminal

Well	Date	TOC Elevation (ft msl)	Depth to Water (ft below TOC)	Groundwater Elevation (ft msl)
Plant 1				
GM-14S	9/12/2018	8.57	5.34	3.23
GM-15S	9/11/2018	8.92	6.04	2.88
GM-16S	9/12/2018	8.53	5.83	2.70
GM-17S	9/12/2018	9.19	6.03	3.16
GM-24S	9/12/2018	7.62	4.64	2.98
AR-03	9/11/2018	9.35	6.80	2.55
AMW-01	9/11/2018	8.88	6.42	2.46
AMW-02	9/11/2018	12.14	8.45	3.69
AMW-03	9/11/2018	12.07	8.03	4.04
AMW-04	9/11/2018	8.00	8.72	-0.72
AMW-05	9/11/2018	8.14	7.56	0.58
MW-1-T9	9/12/2018	9.07	6.59	2.48
MW-2-T9	9/12/2018	9.23	6.49	2.74
MW-3-T9	9/12/2018	8.73	5.92	2.81

ft Feet

msl Mean sea level

NA Not available. Well elevations have not been surveyed.

NM Not measured. Well was not gauged or sampled due to inaccessibility caused by the Island redevelopment activities.

TOC Top of casing

Elevations measurements are calculated using NGVD29 Datum.

Table 4. Summary of Analytical Results for Groundwater - TPH-G, TPH-D, TPH-O, and Benzene
 Third Quarter 2018
 Site: Former BP Harbor Island Terminal

Well	Date	TPH-G WTPH-G (µg/L)	TPH-D WTPH-DX (µg/L)	TPH-O WTPH-DX (µg/L)	Benzene (µg/L)
Plant 1					
GM-14S	9/12/2018	2,200 J	1,200	ND	ND
GM-15S	9/11/2018	310	460	ND	ND
GM-16S	9/12/2018	260	700	ND	ND
GM-17S	9/12/2018	63	ND	ND	ND
GM-24S	9/12/2018	530 J	990 J	ND UJ	ND
AR-03	9/11/2018	690 J	690	ND	ND
AMW-01	9/11/2018	ND	ND	ND UJ	ND
AMW-02	9/11/2018	ND	300	ND	1.2
AMW-03	9/11/2018	ND	ND	ND	ND
AMW-04	9/11/2018	ND	ND	ND	ND
AMW-05	9/11/2018	ND	ND	ND	ND
MW-1-T9	9/12/2018	320	1,000	ND	ND
MW-2-T9	9/12/2018	660	1,000	ND	ND
MW-3-T9	9/12/2018	960	690	ND	ND
Cleanup Level		1,000	10,000	10,000	71
Method Reporting Limit		50	250	750	0.5

Note: Values in **bold** exceed the cleanup level.
 µg/L Micrograms per liter.
 ND Constituent not detected above reporting limit.
 NR Not required. Well was not tested for these analyses, as per Ecology approval.
 redevelopment activities.
 TPH Total petroleum hydrocarbons.
 TPH-D Total petroleum hydrocarbons as diesel.
 TPH-G Total petroleum hydrocarbons as gasoline.
 TPH-O Total petroleum hydrocarbons as oil.
 WTPH-DX Washington State Method for Analysis of Diesel in Soil and Water - Extended.
 WTPH-G Washington State Method for Analysis of Gasoline in Soil and Water.
 J Estimated value.
 UJ Not detected at an estimated value.
 R Rejected value.

Table 5. Summary of Free Product Measurement Results for Groundwater
 2018 Monitoring Data
 Site: Former BP Harbor Island Terminal

Well	Date	Free Product (feet)
Plant 1		
GM-11S	1/17/2018	None
GM-11S	2/14/2018	None
GM-11S	3/14/2018	None
GM-11S	4/18/2018	Sheen
GM-11S	5/16/2018	Sheen
GM-11S	6/13/2018	Sheen
GM-11S	7/18/2018	Sheen
GM-11S	8/15/2018	Sheen
GM-11S	9/19/2018	None
GM-11S	10/17/2018	None
GM-11S	11/14/2018	None
GM-11S	12/19/2018	None
GM-12S	1/17/2018	None
GM-12S	2/14/2018	None
GM-12S	3/14/2018	None
GM-12S	4/18/2018	None
GM-12S	5/16/2018	None
GM-12S	6/13/2018	None
GM-12S	7/18/2018	None
GM-12S	8/15/2018	None
GM-12S	9/19/2018	None
GM-12S	10/17/2018	None
GM-12S	11/14/2018	None
GM-12S	12/19/2018	None
GM-13S	1/17/2018	Sheen
GM-13S	2/14/2018	None
GM-13S	3/14/2018	None
GM-13S	4/18/2018	None
GM-13S	5/16/2018	Sheen
GM-13S	6/13/2018	None
GM-13S	7/18/2018	None
GM-13S	8/15/2018	None
GM-13S	9/19/2018	None
GM-13S	10/17/2018	Sheen
GM-13S	11/14/2018	None
GM-13S	12/19/2018	None
Cleanup Level		No Sheen

Notes: Values in **bold** exceed the cleanup level.

Table 6. Summary of Data Validation Results
 Groundwater Performance Monitoring
 Third Quarter 2018
 Site: Former BP Harbor Island Terminal

Sample ID	Constituent	Qualifier	Reason
P1-GWGM-14S-318 & P1-GWAR-03-318	Gasoline	J	Gasoline was detected in an associated rinsate sample. Associated samples with positive results are qualified as estimated values (J).
P1-GWGM-24S-318 & P1-GWGM-224S-318	Gasoline	J	Relative percent difference (RPD) for this field duplicate pair exceeded the control limit of 20%. These results are, therefore, qualified as estimated values (J).
P1-GWGM-14S-318	Gasoline	J	The recovery of one surrogate in this sample exceeded the control limit. This result is, therefore, qualified as an estimated value.
P1-GWGM-24S-318	Gasoline	J	Recovery in a matrix spike duplicate prepared from the sample was below the control limit and the relative percent difference of the matrix spike/matrix spike duplicate prepared from the sample was above the control limit. This sample result is, therefore, qualified as an estimated value (J)
P1-GWGM-24S-318 & P1-GWGM-224S-318, P1-GWAMW-01-318 & P1-GWAMW-201-318	Diesel & Oil	J & UJ	Relative percent difference (RPD) for these two field duplicate pairs exceeded the control limit of 20%. These results are, therefore, qualified as estimated values (J) and non-detect results are qualified as undetected at an approximate quantitation limit (UJ).

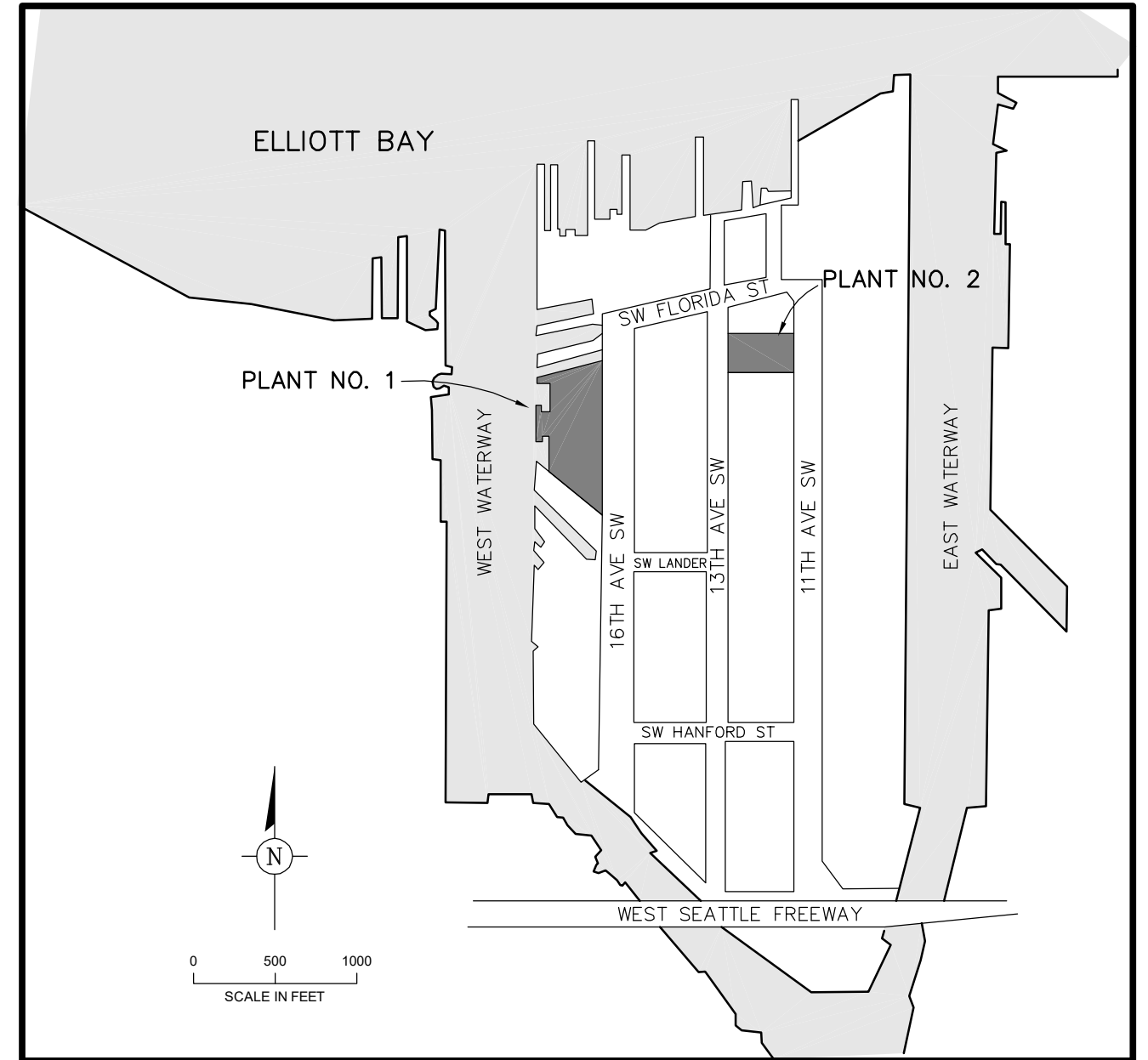
Definitions:

- J The associated value is approximate.
- UJ The non-detected results are undetected at an approximate quantitation limit.
- RPD Relative Percent Difference

FIGURES

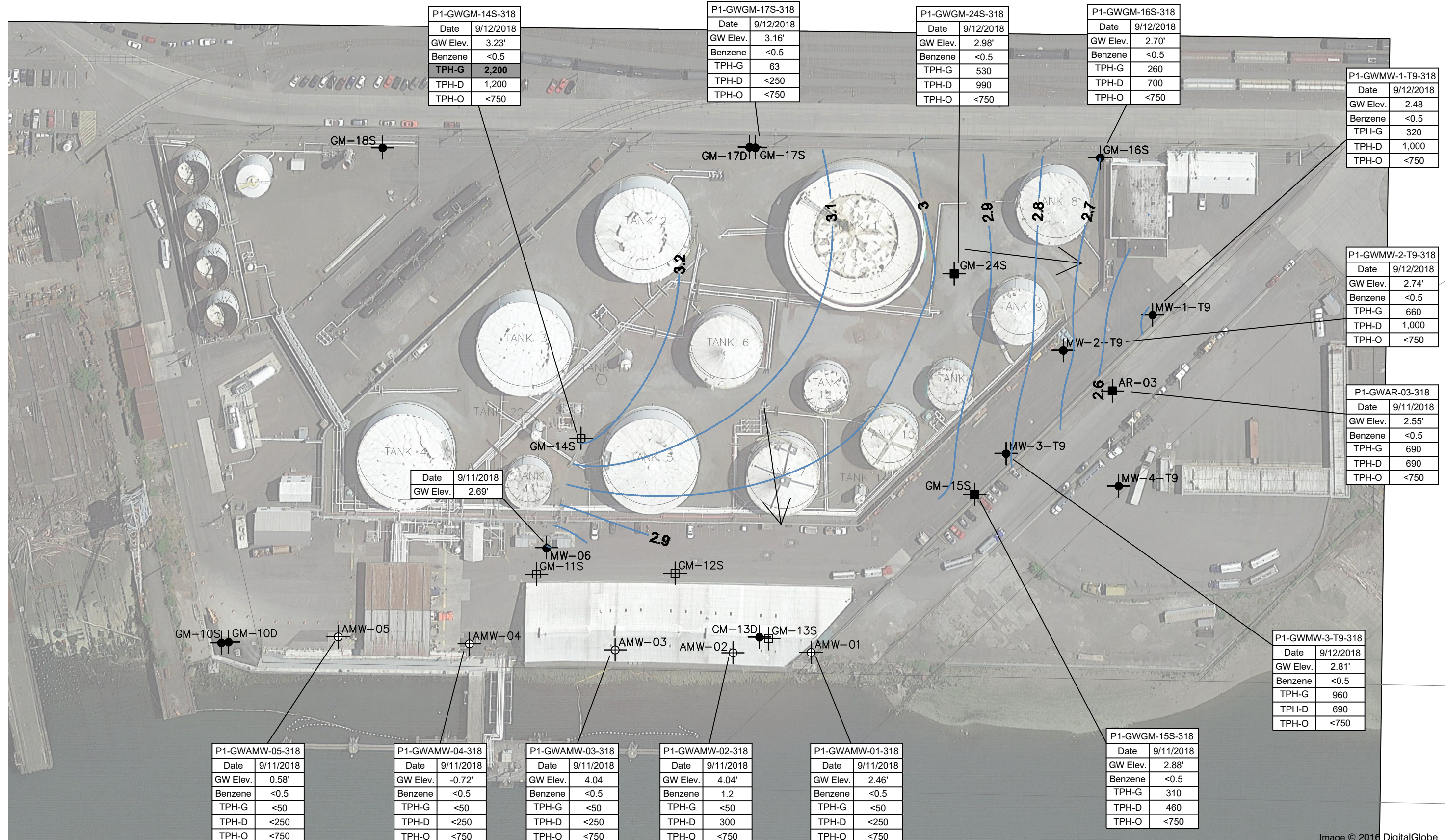


AREA PLAN



SITE PLAN

\\server\ServerData\Project\ARCD 21\Drawings and CAD files\Autocad files: Plant 1 GWM Figs.dwg October 9, 2018



P1-GWGM-14S-318	
Date	9/12/2018
GW Elev.	3.23'
Benzene	<0.5
TPH-G	2,200
TPH-D	1,200
TPH-O	<750

P1-GWGM-17S-318	
Date	9/12/2018
GW Elev.	3.16'
Benzene	<0.5
TPH-G	63
TPH-D	<250
TPH-O	<750

P1-GWGM-24S-318	
Date	9/12/2018
GW Elev.	2.98'
Benzene	<0.5
TPH-G	530
TPH-D	990
TPH-O	<750

P1-GWGM-16S-318	
Date	9/12/2018
GW Elev.	2.70'
Benzene	<0.5
TPH-G	260
TPH-D	700
TPH-O	<750

P1-GWMMW-1-T9-318	
Date	9/12/2018
GW Elev.	2.48
Benzene	<0.5
TPH-G	320
TPH-D	1,000
TPH-O	<750

P1-GWMMW-2-T9-318	
Date	9/12/2018
GW Elev.	2.74'
Benzene	<0.5
TPH-G	660
TPH-D	1,000
TPH-O	<750

P1-GWAR-03-318	
Date	9/11/2018
GW Elev.	2.55'
Benzene	<0.5
TPH-G	690
TPH-D	690
TPH-O	<750

P1-GWMMW-3-T9-318	
Date	9/12/2018
GW Elev.	2.81'
Benzene	<0.5
TPH-G	960
TPH-D	690
TPH-O	<750

P1-GWAMW-05-318	
Date	9/11/2018
GW Elev.	0.58'
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

P1-GWAMW-04-318	
Date	9/11/2018
GW Elev.	-0.72'
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

P1-GWAMW-03-318	
Date	9/11/2018
GW Elev.	4.04
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

P1-GWAMW-02-318	
Date	9/11/2018
GW Elev.	4.04'
Benzene	1.2
TPH-G	<50
TPH-D	300
TPH-O	<750

P1-GWAMW-01-318	
Date	9/11/2018
GW Elev.	2.46'
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

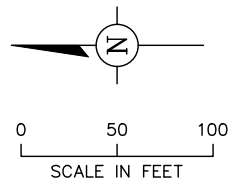
P1-GWGM-15S-318	
Date	9/11/2018
GW Elev.	2.88'
Benzene	<0.5
TPH-G	310
TPH-D	460
TPH-O	<750

LEGEND

- GM-16S Monitoring Well
- ⊕ AMW-01 Performance/Confirmation Well
- GM-13D Performance Well
- ⊕ GM-13S Product Performance Well
- 3.1 Groundwater Contour (Feet MSL)

Sample ID	
Date	Date Sample Collected
GW Elev.	Groundwater Elevation in Feet Mean Sea Level (MSL)
Benzene	Benzene (EPA 8260) in µg/L
TPH-G	Total Petroleum Hydrocarbons as Gasoline (NWTPH-GX) in µg/L
TPH-D	Total Petroleum Hydrocarbons as Diesel (NWTPH-DX) in µg/L
TPH-O	Total Petroleum Hydrocarbons as Oil (NWTPH-OX) in µg/L

Notes: **Bold** - Detected concentration exceeds site specific cleanup level
 < = Not detected at listed laboratory reporting limit



TECHSOLVE
 ENVIRONMENTAL

7518 N.E. 169th Street
 Kenmore, WA 98028
 P:(425) 402-8277 F:(425) 402-7917

Plant 1 Third Quarter 2018
Groundwater Monitoring Analytical Results

Site: Former BP Harbor Island Terminal
 1652 Southwest Lander Street
 Seattle, WA 98134

Image © 2016 DigitalGlobe