

**Groundwater Monitoring Report (Year 3)**

Former Shell Oil Tank Farm Site  
Anacortes, Washington  
Ecology Consent Decree No. 14-2-01249-0

*for*

**Washington State Department of Ecology  
on Behalf of Port of Anacortes**

August 5, 2018



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# Groundwater Monitoring Report (Year 3)

## Former Shell Oil Tank Farm Site Anacortes, Washington Ecology Consent Decree No. 14-2-01249-0

File No. 5147-012-08

August 5, 2018

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## INTRODUCTION

This report presents the results of the post-construction confirmation groundwater monitoring completed for the Former Shell Oil Tank Farm Site (Site; Facility/Site Identification No. 4781157) located between 13<sup>th</sup> and 14<sup>th</sup> Streets west of Q Avenue in Anacortes, Washington (Figure 1). Pursuant to Washington State Department of Ecology (Ecology) Consent Decree No. 14-2-01249-0 (Consent Decree) filed with the Skagit County Superior Court on July 14, 2014 and Ecology Opinion Letter dated May 24, 2017 (Ecology 2017), long-term confirmation groundwater monitoring activities were completed by the Port of Anacortes (Port) to confirm:

- Compliance with the site-specific groundwater cleanup levels following completion of the cleanup construction;
- Natural attenuation performance; and
- Stability of the residual soil contamination that remains in-place as part of the final Cleanup Action for the Site.

Historically, the Site was used for bulk fuel storage and distribution. Between October 2014 and March 2015, cleanup construction activities were completed in accordance with Ecology's Cleanup Action Plan (CAP; Ecology 2014) to remove contaminated soil within the readily accessible portions of the Site (i.e., gravel paved area) followed by the placement of an oxygen releasing agent during backfilling activities to enhance the biological degradation of residual soil contamination potentially present beneath the inaccessible portions of the Site (i.e., Q Avenue and 14<sup>th</sup> Street Rights-of-Way). Exposure to residual soil contamination that may remain in-place at the Site is being managed utilizing a combination of engineering (paved surfaces) and institutional (environmental covenant) controls.

To evaluate the long-term effectiveness of the completed remedial action and assess the need for future monitoring requirements, two years of annual groundwater monitoring (Rounds 5 and 6) were completed following one year of initial quarterly groundwater monitoring (Rounds 1 through 4) at the Site. Annual groundwater monitoring activities for Rounds 5 and 6 were completed in accordance with the Compliance Monitoring Plan Addendum (GeoEngineers 2015) and Ecology Opinion Letter dated May 24, 2017 (Ecology 2017).

The location of the Site relative to surrounding physical features is shown on Figure 1. The general layout of the Site and surrounding area is shown on Figure 2. Sampling activities and chemical analytical data for annual groundwater monitoring are summarized in the following sections.

## GROUNDWATER MONITORING

Existing groundwater monitoring wells GEI-MW-5 and GEI-MW-7 were used to monitor groundwater conditions downgradient of the cleanup action area. Monitoring well GEI-MW-5 is positioned downgradient of the area in which residual soil contamination remains in-place. Monitoring well GEI-MW-7 is positioned at the conditional point of compliance along the Fidalgo Bay shoreline groundwater/surface water interface downgradient from the Site. In accordance with the Compliance Monitoring Plan Addendum and Ecology Opinion Letter, groundwater samples were collected from monitoring wells GEI-MW-5 and GEI-MW-7 on an annual basis for two consecutive years to evaluate groundwater conditions at the Site.



The location of monitoring wells GEI-MW-5 and GEI-MW-7 are shown relative to the Site on Figures 2 and 3. Well construction details for these wells are presented in Appendix A. Groundwater performance criteria and monitoring activities are summarized in the following sections.

### **Groundwater Performance Criteria**

Groundwater cleanup criteria were developed to be protective of aquatic organisms and of humans that may ingest these marine organisms. Except for petroleum hydrocarbons (gasoline, diesel and heavy oil), Model Toxics Control Act (MTCA) Method B marine surface water preliminary cleanup levels were developed in accordance with Washington Administrative Code (WAC) 173-340-730(3). Because groundwater cleanup levels are based on protection of marine surface water and not protection of groundwater as drinking water, a conditional point of compliance for the groundwater was established by Ecology as the point of at which groundwater discharges to Fidalgo Bay—within the Cap Sante Marina. This conditional point of compliance corresponds to the groundwater/surface water interface east of the Site at the Fidalgo bay shoreline.

### **Completed Groundwater Monitoring Events**

Monitoring wells GEI-MW-5 and GEI-MW-7 were sampled on an annual basis between June 2017 and June 2018. Groundwater samples were obtained during the following monitoring events:

- Round 5 Groundwater Monitoring Event – Completed on June 28, 2017
- Round 6 Groundwater Monitoring Event – Completed on June 13, 2018

During each monitoring event, monitoring wells located within 200 feet of the shoreline (i.e., GEI-MW-7) were sampled at or within one hour of low tide to best capture groundwater at the Site and minimize tidal inundation effects. Predicted tide elevations were based on U.S. National Oceanic and Atmospheric Administration (NOAA) Tide Station No. 9448794 located within Guemes Channel.

### **Groundwater Sampling and Analysis**

Prior to collecting samples, groundwater levels were measured from the top of each surveyed well casing rim to the nearest 0.01 foot using a decontaminated electronic water level indicator (e-tape). Decontamination procedures are described in the Compliance Monitoring Plan Addendum (CMPA). Measured water levels for each monitoring event are summarized in Table 1.

Groundwater samples were obtained using low-flow/low-turbidity sampling techniques during each monitoring event to minimize the suspension of sediment in groundwater samples. Using a peristaltic pump, groundwater was pumped from the well at a rate not exceeding 0.5 liter per minute through dedicated polyethylene tubing. A Horiba U-50 series water quality meter with flow-through-cell was used to monitor the following parameters during purging:

- Acidity (pH);
- Electrical conductivity (EC);
- Turbidity;
- Dissolved oxygen (DO);
- Temperature;
- Total dissolved solids (TDS);

- Oxygen reduction potential (ORP); and
- Salinity.

Collection of water samples began once these parameters were observed to vary by less than 10 percent on three consecutive measurements. The stabilized field measurements for each monitoring event are summarized in Table 2.

Purge and decontamination water generated during these activities was placed in a sealed and labeled 55-gallon drum located on the Port's Pier 2 Facility pending waste characterization and permitted disposal. Incidental waste generated during sampling activities such as gloves, plastic sheeting, paper towels and similar expended and discarded field supplies were disposed of in a local trash receptacle.

Groundwater conditions observed at the time of sampling and chemical analytical results are summarized in the following sections.

### **Groundwater Conditions**

During the two years of annual monitoring, the groundwater level near the shoreline (GEI-MW-7) ranged in elevation between +6.59 and +6.76 feet mean lower low water (MLLW). Further inland, the groundwater level ranged in elevation between +7.77 and +7.91 feet MLLW at GEI-MW-5. Based on the measured groundwater elevations and previous groundwater investigations (GeoEngineers 2016), the inferred predominant groundwater flow direction is to the east toward the shoreline of Fidalgo Bay.

Groundwater elevations measured during each sampling event are summarized in Table 1. Stabilized groundwater water quality parameters measured during each sampling event are summarized in Table 2.

### **Chemical Analytical Results**

Groundwater samples collected during the June 2017 and June 2018 monitoring events were submitted to OnSite Environmental, Inc. in Redmond, Washington (OnSite), for the following chemical analysis:

- Gasoline-range hydrocarbons using Ecology Method NWTPH-Gx;
- Diesel- and heavy oil-range hydrocarbons using Ecology Method NWTPH-Dx;

Based on a review of the chemical analytical results, contaminants either were not detected or were detected at concentrations less than the site-specific groundwater cleanup levels in each of the monitoring wells during each annual monitoring events with no exceptions. Groundwater analytical results for monitoring wells GEI-MW-5 and GEI-MW-7 are summarized in Table 3 and shown on Figures 2 and 3. Trend plots for contaminants including gasoline-, diesel- and heavy oil-range petroleum hydrocarbons are shown on Figures 4 through 6.

Field procedures, including sample handling, labeling, container and preservation are described in the Quality Assurance Project Plan (QAPP) presented as Appendix A to the Compliance Monitoring Plan (CMP; GeoEngineers 2014). Copies of laboratory reports are presented in Appendix B. Laboratory data presented in Appendix B were subjected to a United States Environmental Protection Agency (EPA)-defined Stage 2B validation (EPA Document 540-R-08-005; EPA 2009) and were determined to be acceptable for their intended use as qualified. The data validation review is presented in Appendix C.

## CONCLUSIONS

Annual groundwater monitoring activities were completed by the Port of Anacortes for the Former Shell Oil Tank Farm Site for two years following Ecology review of the initial quarterly monitoring activities to demonstrate compliance with the cleanup criteria established by the CAP. Based on a review of the annual groundwater monitoring results, groundwater conditions for the Site demonstrate compliance with the groundwater performance criteria downgradient of the cleanup action area and at the conditional point of compliance (i.e., shoreline). These results provide supporting evidence of the stability of the residual soil contamination remaining in-place at the Site.

In accordance with the Compliance Monitoring Plan Addendum, the performance criteria established for the Site has been achieved and that the current Ecology-required groundwater monitoring for the Site has been completed. No further monitoring is planned at this time. Future groundwater monitoring (if required) will be determined by Ecology based on review of the annual monitoring data presented in this report.

## LIMITATIONS

We have prepared this report for the exclusive use by the Port of Anacortes (Port), their authorized agents and regulatory agencies for the Former Shell Oil Tank Farm Site. This report is not intended for use by others and the information contained herein is not applicable to other sites. No other party may rely on the product of our services unless we agree in advance, and in writing, to such reliance. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with our general agreement with Port and generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood. Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

## REFERENCES

GeoEngineers, Inc., "Compliance Monitoring Plan Addendum, Former Shell Oil Tank Farm, Anacortes, Washington, Ecology Consent Decree No. 14-2-01249-0," GEI File No. 5147-012-07, prepared for the Washington State Department of Ecology on behalf of Port of Anacortes, July 14, 2015.

GeoEngineers, Inc., "Compliance Monitoring Plan, Former Shell Oil Tank Farm, Anacortes, Washington," GEI File No. 5147-012-04, prepared for the Washington State Department of Ecology on behalf of Port of Anacortes, July 29, 2014.

GeoEngineers, Inc., "Groundwater Monitoring Report, Former Shell Oil Tank Farm, Anacortes, Washington, Ecology Agreed Order No. DE-08TCPHQ-5474," GEI File No. 5147-012-02, prepared for the Washington State Department of Ecology on behalf of Port of Anacortes, October 26, 2016.

Washington State Department of Ecology (Ecology; 2017), “Re: Request for review of submitted Groundwater Monitoring Report and determination for future conformational monitoring requirements for the Shell Oil Tank Farm site (FSID: 4781157),” by the Washington State Department of Ecology, Toxics Cleanup Program, Lacey, Washington, May 24, 2017.

Washington State Department of Ecology (Ecology; 2014), “Cleanup Action Plan (CAP), Former Shell Oil Tank Farm Site, Anacortes, Washington,” by the Washington State Department of Ecology, Toxics Cleanup Program, Lacey, Washington, February 3, 2014.

U.S. Environmental Protection Agency (EPA). “Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use,” EPA-540-R-08-005. January 2009.

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**Table 1**  
**Summary of Groundwater Elevation Data**  
Former Shell Oil Tank Farm Site  
Anacortes, Washington

Groundwater Monitoring Well <sup>1</sup>	Groundwater Monitoring Event	Date Measured	Top of Casing Elevation <sup>2</sup> (feet)	Depth to Water from Top of Casing (feet)	Groundwater Elevation <sup>2</sup> (feet)
GEI-MW-2	Round 1	08/28/15	12.98	5.69	7.29
	Round 2	12/17/15		3.91	9.07
	Round 3	03/24/16		4.81	8.17
	Round 4	06/29/16		5.04	7.94
	Round 5 <sup>3</sup>	--		--	--
	Round 6 <sup>3</sup>	--		--	--
GEI-MW-4	Round 1	08/28/15	12.98	5.84	7.14
	Round 2	12/17/15		3.91	9.07
	Round 3	03/24/16		4.91	8.07
	Round 4	06/29/16		5.29	7.69
	Round 5 <sup>3</sup>	--		--	--
	Round 6 <sup>3</sup>	--		--	--
GEI-MW-5	Round 1	08/28/15	12.67	5.54	7.13
	Round 2	12/17/15		3.82	8.85
	Round 3	03/24/16		4.72	7.95
	Round 4	06/29/16		4.81	7.86
	Round 5	06/28/17		4.76	7.91
	Round 6	06/13/18		4.90	7.77
GEI-MW-7	Round 1	08/28/15	11.65	5.91	5.74
	Round 2	12/17/15		4.16	7.49
	Round 3	03/24/16		5.51	6.14
	Round 4	06/29/16		4.95	6.70
	Round 5	06/28/17		4.89	6.76
	Round 6	06/13/18		5.06	6.59

**Notes:**

<sup>1</sup>Monitoring well locations are shown on Figure 2.

<sup>2</sup>Elevation is referenced to Mean Lower Low Water (MLLW).

<sup>3</sup>Groundwater monitoring activities were discontinued following Round 4 in accordance with Ecology's May 24, 2017 opinion letter (Ecology, 2017).

**Table 2**  
**Summary of Groundwater Field Parameters**  
 Former Shell Oil Tank Farm Site  
 Anacortes, Washington

Groundwater Monitoring Well <sup>1</sup>	Groundwater Monitoring Event	Date Measured	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	Total Dissolved Solids (g/L)	Oxidation Reduction Potential (mV)	Salinity (ppt)
GEI-MW-2	Round 1	08/28/15	7.15	2.38	5.8	0.26	18.1	1.54	-95.5	1.22
	Round 2	12/17/15	7.18	0.92	1.43	1.25	10.1	0.50	159.8	0.42
	Round 3	03/24/16	7.20	2.10	2.05	0.28	9.9	1.89	-70.1	1.51
	Round 4	06/29/16	7.17	2.67	2.01	0.47	15.1	2.21	-96.5	1.62
	Round 5 <sup>2</sup>	--	--	--	--	--	--	--	--	--
	Round 6 <sup>2</sup>	--	--	--	--	--	--	--	--	--
GEI-MW-4	Round 1	08/28/15	7.39	8.18	14.2	0.81	17.0	6.10	-129.3	4.12
	Round 2	12/17/15	7.00	1.18	2.05	0.28	12.2	0.76	65.1	0.59
	Round 3	03/24/16	7.13	1.54	0.62	0.17	10.7	1.38	-115.3	1.08
	Round 4	06/29/16	7.21	3.88	0.82	0.28	14.4	3.15	-141.9	2.62
	Round 5 <sup>2</sup>	--	--	--	--	--	--	--	--	--
	Round 6 <sup>2</sup>	--	--	--	--	--	--	--	--	--
GEI-MW-5	Round 1	08/28/15	6.93	13.8	10.5	0.22	17.2	8.84	-135.2	7.82
	Round 2	12/17/15	6.91	7.37	2.11	0.25	14.2	5.00	-58.1	4.35
	Round 3	03/24/16	6.80	6.02	1.91	0.16	11.7	5.23	-88.9	4.48
	Round 4	06/29/16	6.82	10.95	6.41	0.19	15.3	8.72	-205.3	7.70
	Round 5	06/28/17	6.58	8.30	4.91	-0.03	14.5	6.74	-33.5	5.97
	Round 6	06/13/18	6.90	14.59	11.90	0.34	14.2	9.50	-263.2	8.54
GEI-MW-7	Round 1	08/28/15	7.38	34.1	1.1	0.19	17.0	22.52	-201.8	21.32
	Round 2	12/17/15	7.33	18.82	3.01	0.65	12.2	12.20	-371.5	11.10
	Round 3	03/24/16	7.20	16.91	2.51	0.15	10.4	15.45	-147.4	14.29
	Round 4	06/29/16	7.11	20.69	0.67	0.18	15.1	16.38	-240.1	14.93
	Round 5	06/28/17	7.11	23.88	2.84	0.03	14.9	93.35	-300.1	18.49
	Round 6	06/13/18	7.28	34.82	0.00	0.44	13.2	21.92	-353.7	20.40

**Notes:**

<sup>1</sup>Monitoring well locations are shown on Figure 2.

<sup>2</sup>Groundwater monitoring activities were discontinued following Round 4 in accordance with Ecology's May 24, 2017 opinion letter (Ecology, 2017).

°C = degrees Celsius

mV = millivolts

g/L = grams per liter

NTU = Nephelometric Turbidity Units

mg/L = milligrams per liter

ppt = parts per thousand

mS/cm = microsemens per centimeter

**Table 3**  
**Summary of Groundwater Chemical Analytical Data**  
 Former Shell Oil Tank Farm Site  
 Anacortes, Washington

Groundwater Monitoring Well <sup>1</sup>	Groundwater Monitoring Event	Date Measured	Petroleum Hydrocarbons			Benzene (EPA 8021)	Metals	
			Gasoline-Range (NWTPH-Gx)	Diesel-Range (NWTPH-Dx)	Heavy Oil-Range (NWTPH-Dx)		Total Cadmium (EPA 6010)	Dissolved Cadmium (EPA 6010)
GEI-MW-2	Round 1	08/28/15	100 U	260 U	410 U	1 U	--	--
	Round 2	12/17/15	100 U	260 U	410 U	1 U	--	--
	Round 3	03/24/16	100 U	250 U	410 U	0.2 U	--	--
	Round 4	06/29/16	100 U	260 U	410 U	0.2 U	--	--
	Round 5 <sup>4</sup>	--	--	--	--	--	--	--
	Round 6 <sup>4</sup>	--	--	--	--	--	--	--
GEI-MW-4	Round 1	08/28/15	100 U	260 U	420 U	1 U	--	--
	Round 2	12/17/15	100 U	250 U	410 U	1 U	--	--
	Round 3	03/24/16	100 U	260 U	410 U	0.2 U	--	--
	Round 4	06/29/16	500 U	260 U	410 U	0.2 U	--	--
	Round 5 <sup>4</sup>	--	--	--	--	--	--	--
	Round 6 <sup>4</sup>	--	--	--	--	--	--	--
GEI-MW-5	Round 1	08/28/15	100 U	<b>280</b>	410 U	1 U	0.5 U	0.5 U
	Round 2	12/17/15	100 U	260 U	410 U	1 U	0.4 U	0.4 U
	Round 3	03/24/16	100 U	<b>340</b>	410 U	0.2 U	4.4 U	4.0 U
	Round 4	06/29/16	500 U	<b>260</b>	470	0.2 U	4.4 U	4.0 U
	Round 5	06/28/17	400 U	<b>300</b>	400 U	-- <sup>4</sup>	-- <sup>4</sup>	-- <sup>4</sup>
	Round 6	06/13/18	100 U	<b>260</b>	410 U	-- <sup>4</sup>	-- <sup>4</sup>	-- <sup>4</sup>
Duplicate (GEI-MW-5)	Round 1	08/28/15	100 U	250 U	410 U	1 U	0.5 U	0.5 U
	Round 2	12/17/15	100 U	<b>340</b>	410 U	1 U	0.4 U	0.4 U
	Round 3	03/24/16	100 U	<b>350</b>	410 U	0.2 U	4.4 U	4.0 U
	Round 4	06/29/16	500 U	<b>300</b>	410 U	0.2 U	4.4 U	4.0 U
	Round 5	06/28/17	100 U	<b>270</b>	410 U	-- <sup>4</sup>	-- <sup>4</sup>	-- <sup>4</sup>
	Round 6	06/13/18	100 U	<b>260</b>	420 U	-- <sup>4</sup>	-- <sup>4</sup>	-- <sup>4</sup>

Groundwater Monitoring Well <sup>1</sup>	Groundwater Monitoring Event	Date Measured	Petroleum Hydrocarbons			Benzene (EPA 8021)	Metals	
			Gasoline-Range (NWTPH-Gx)	Diesel-Range (NWTPH-Dx)	Heavy Oil-Range (NWTPH-Dx)		Total Cadmium (EPA 6010)	Dissolved Cadmium (EPA 6010)
GEI-MW-7	Round 1	08/28/15	100 U	250 U	<b>440</b>	1 U	--	--
	Round 2	12/17/15	100 U	<b>280</b>	410 U	1 U	--	--
	Round 3	03/24/16	100 U	250 U	400 U	0.2 U	--	--
	Round 4	06/29/16	500 U	250 U	400 U	0.2 U	--	--
	Round 5	06/28/17	100 U	250 U	400 U	-- <sup>4</sup>	-- <sup>4</sup>	-- <sup>4</sup>
	Round 6	06/13/18	100 U	260	410 U	-- <sup>4</sup>	-- <sup>4</sup>	-- <sup>4</sup>
Site-Specific Cleanup Level (µg/L)			800/1,000 <sup>3</sup>	500	500	23	8.8	8.8

**Notes:**

<sup>1</sup>Groundwater monitoring well locations are shown on Figure 2.

<sup>2</sup>Site-specific groundwater cleanup levels are referenced from Table 1 of the Groundwater Sampling and Analysis Plan for the Cap Sante Marine Site (GeoEngineers, 2014).

<sup>3</sup>Cleanup level is 800 micrograms per liter (µg/L) when benzene is present.

<sup>4</sup>Groundwater monitoring activities were discontinued following Round 4 in accordance with Ecology's May 24, 2017 opinion letter (Ecology, 2017).

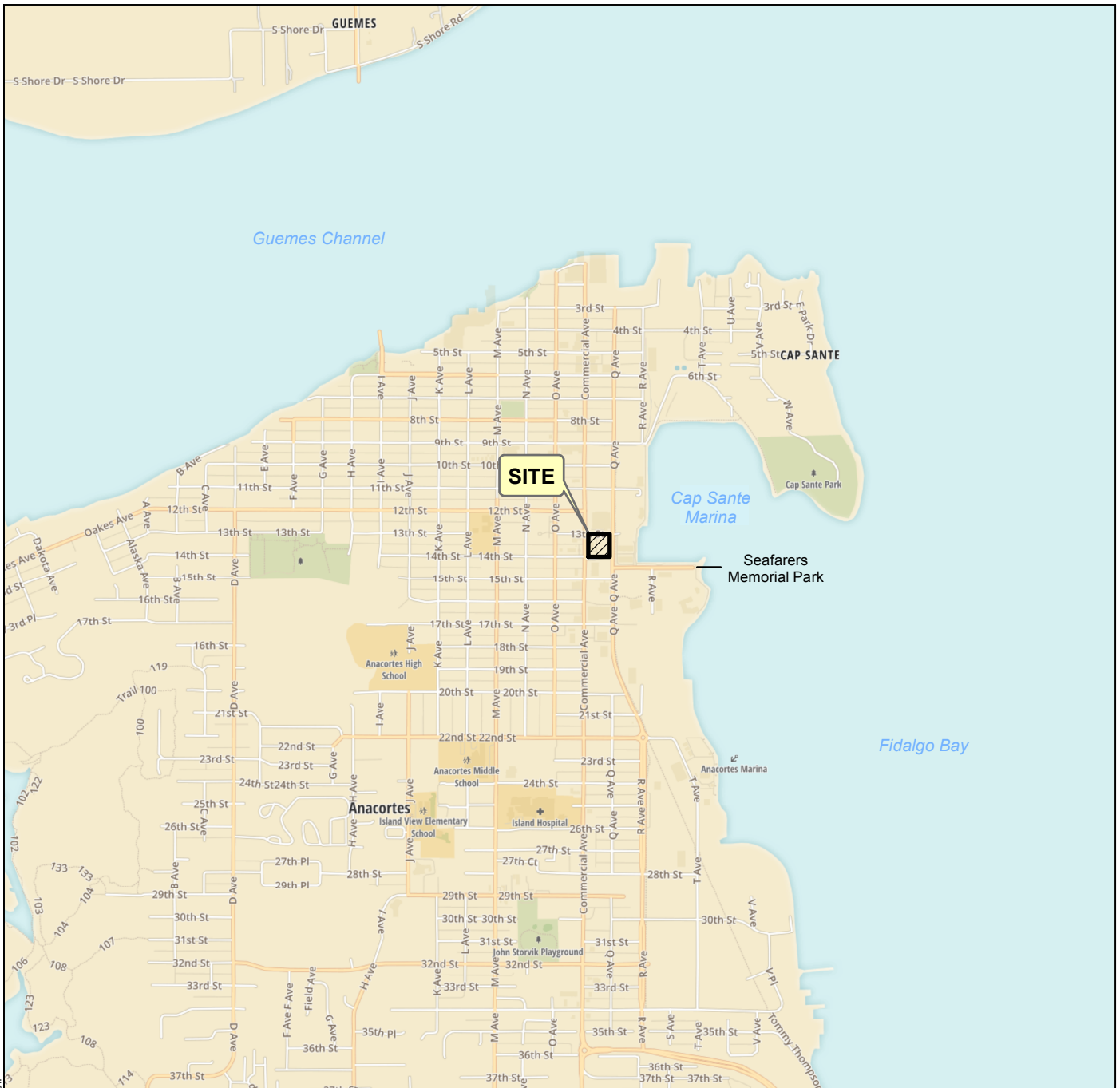
EPA = U.S. Environmental Protection Agency

U = qualifier indicating analyte not detected at level above listed practical quantitation limit

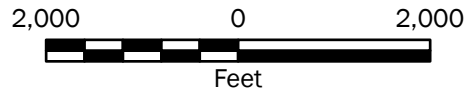
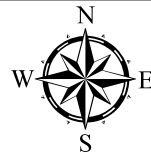
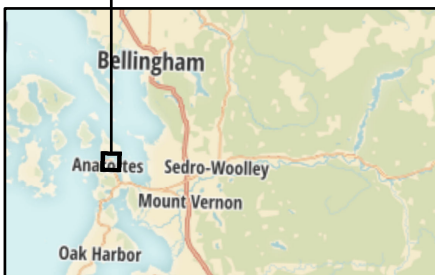
Chemical analyses performed by OnSite Environmental Inc. of Redmond, Washington.

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**Vicinity Map**

Former Shell Oil Tank Farm  
Anacortes, Washington

**Notes:**

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

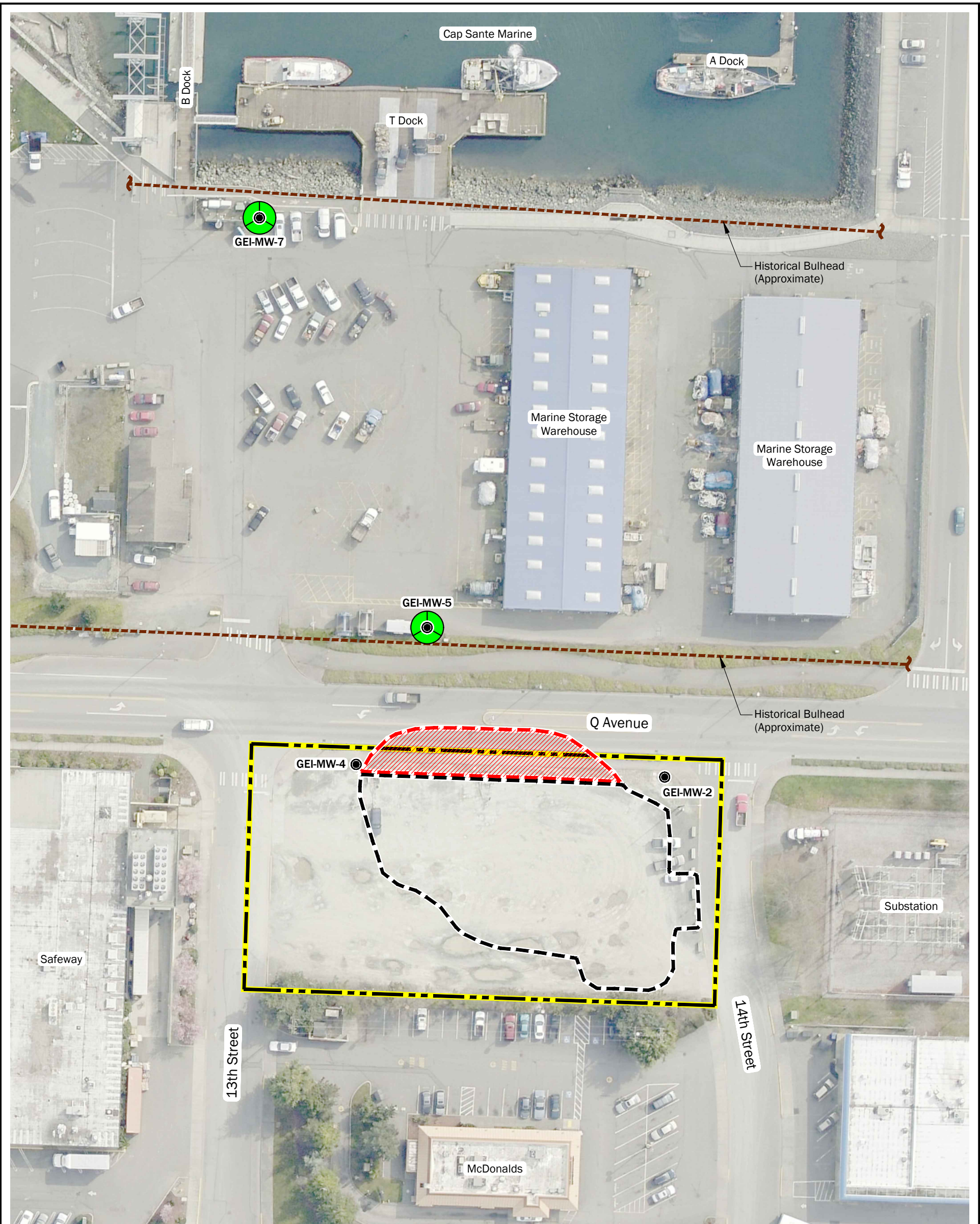
Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N



**Figure 1**





**Legend**

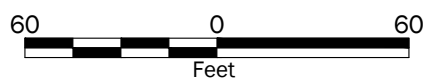
- Former Shell Oil Tank Farm Area (Approximate)
- GEI-MW-4 ● Post Construction Groundwater Monitoring Well
- Cleanup Action Remedial Excavation Limit
- Approximate Area of Residual TPH, Benzene and/or Cadmium Contaminated Soil
- TPH Petroleum Hydrocarbons (Gasoline, Diesel, and/or Heavy Oil)

**Groundwater Chemical Analytical Results**

- Gas Diesel
- Heavy Oils
- Detected at a concentration greater than the cleanup level
- Not detected or detected at a concentration less than the cleanup level

**Notes:**

- The locations of all features shown are approximate.
- This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

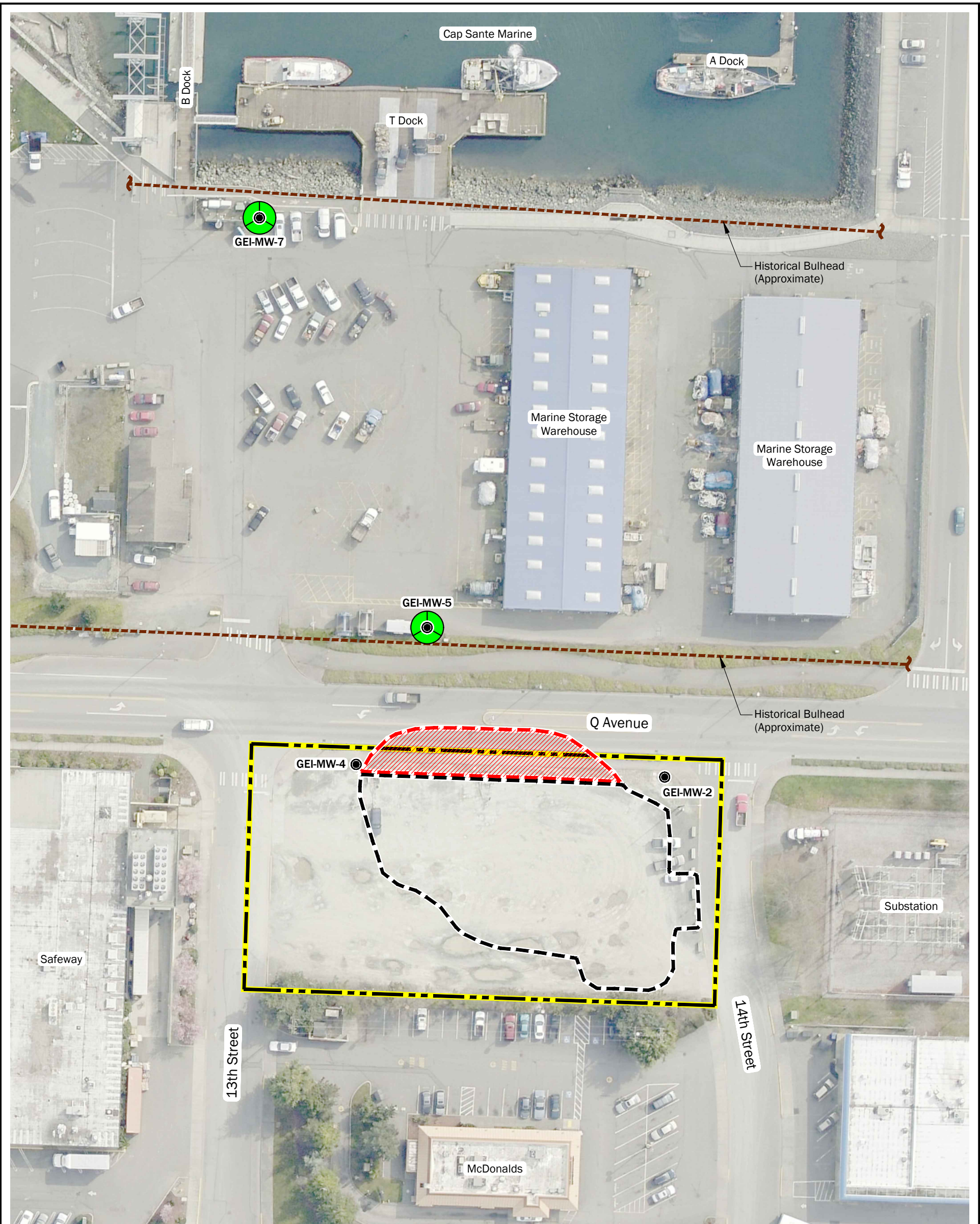


Data Source: Aerial imagery provided by the Port of Anacortes. Imagery date: 2014.

Projection: WA State Plane, N Zone, NAD83, US Foot

<b>June 2017 Groundwater Monitoring Event</b>	
<b>Former Shell Oil Tank Farm Anacortes, Washington</b>	
	<b>Figure 2</b>





**Legend**

- Former Shell Oil Tank Farm Area (Approximate)
- GEI-MW-4 ● Post Construction Groundwater Monitoring Well
- Cleanup Action Remedial Excavation Limit
- Approximate Area of Residual TPH, Benzene and/or Cadmium Contaminated Soil
- TPH Petroleum Hydrocarbons (Gasoline, Diesel, and/or Heavy Oil)

**Groundwater Chemical Analytical Results**

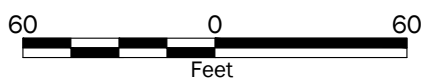
- Gas Diesel
- Heavy Oils
- Detected at a concentration greater than the cleanup level
- Not detected or detected at a concentration less than the cleanup level

**Notes:**

- The locations of all features shown are approximate.
- This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial imagery provided by the Port of Anacortes. Imagery date: 2014..

Projection: WA State Plane, N Zone, NAD83, US Foot



<b>June 2018 Groundwater Monitoring Event</b>	
<b>Former Shell Oil Tank Farm Anacortes, Washington</b>	
	<b>Figure 3</b>

P:\5147012\CAD\08\Environmental\5147012-08\_F02-03 Site Plans.dwg TAB:Fig 3 - 2018 Date Exported: 07/25/18 - 13:52 by tmichaud

**APPENDIX A**  
**Well Completion Logs**

DRAFT



## SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS  MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS  MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS <small>(LITTLE OR NO FINES)</small>		<b>GW</b>	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		<b>GP</b>	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		CLEAN SANDS <small>(LITTLE OR NO FINES)</small>		<b>GM</b>	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		SANDS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		<b>GC</b>	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS  MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SANDS <small>(LITTLE OR NO FINES)</small>		<b>SW</b>	WELL-GRADED SANDS, GRAVELLY SANDS
		SANDS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		<b>SP</b>	POORLY-GRADED SANDS, GRAVELLY SAND
		SANDS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		<b>SM</b>	SILTY SANDS, SAND - SILT MIXTURES
		SANDS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		<b>SC</b>	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS  MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS  LIQUID LIMIT LESS THAN 50	SILTS AND CLAYS		<b>ML</b>	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
		SILTS AND CLAYS		<b>CL</b>	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		SILTS AND CLAYS		<b>OL</b>	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS  LIQUID LIMIT GREATER THAN 50	SILTS AND CLAYS		<b>MH</b>	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
		SILTS AND CLAYS		<b>CH</b>	INORGANIC CLAYS OF HIGH PLASTICITY
		SILTS AND CLAYS		<b>OH</b>	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			<b>PT</b>	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

### Sampler Symbol Descriptions

	2.4-inch I.D. split barrel
	Standard Penetration Test (SPT)
	Shelby tube
	Piston
	Direct-Push
	Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

## ADDITIONAL MATERIAL SYMBOLS

SYMBOLS		TYPICAL DESCRIPTIONS
GRAPH	LETTER	
	<b>CC</b>	Cement Concrete
	<b>AC</b>	Asphalt Concrete
	<b>CR</b>	Crushed Rock/Quarry Spalls
	<b>TS</b>	Topsoil/Forest Duff/Sod



Measured groundwater level in exploration, well, or piezometer



Groundwater observed at time of exploration



Perched water observed at time of exploration



Measured free product in well or piezometer

### Graphic Log Contact



Distinct contact between soil strata or geologic units



Approximate location of soil strata change within a geologic soil unit

### Material Description Contact



Distinct contact between soil strata or geologic units



Approximate location of soil strata change within a geologic soil unit

### Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

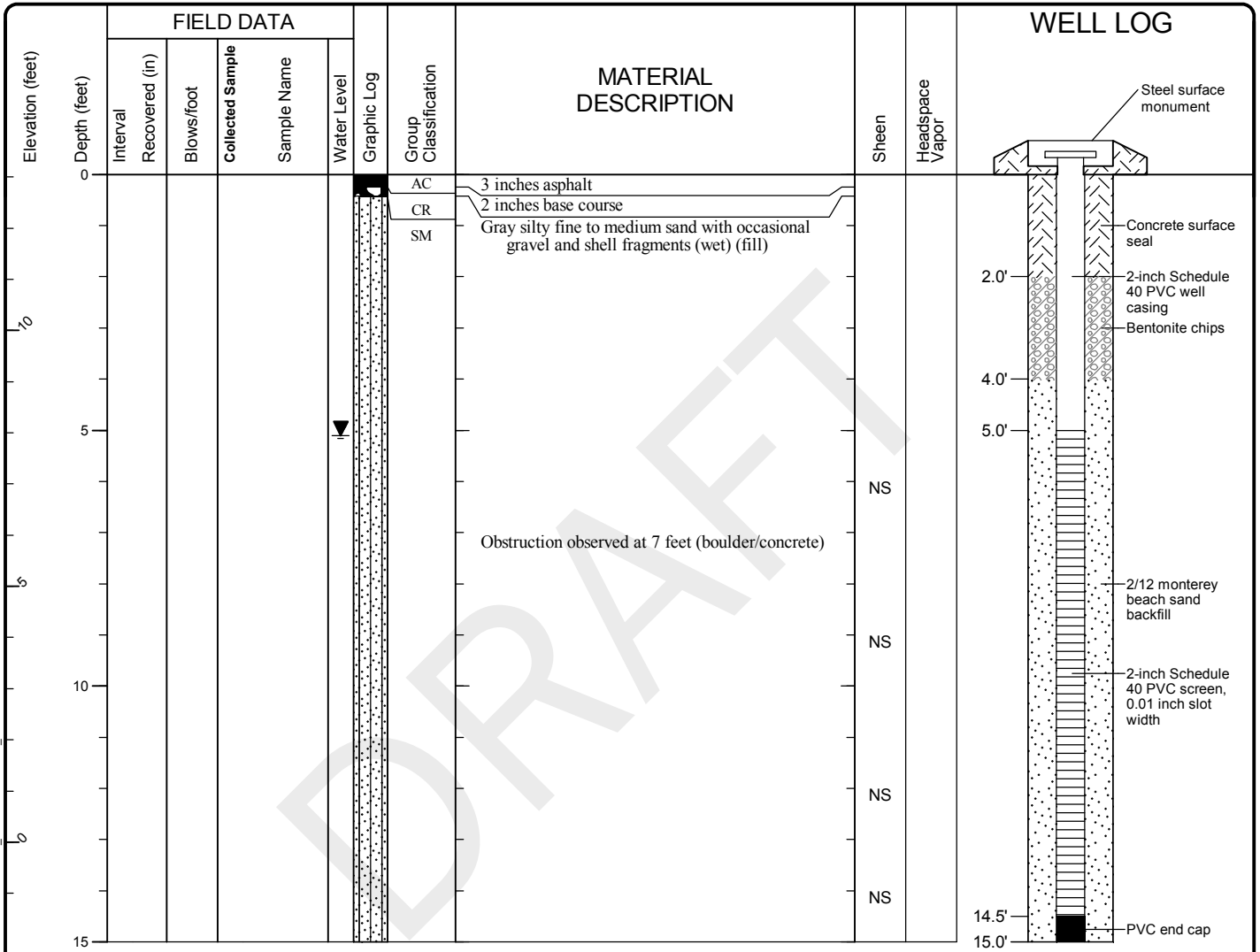
### Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

## KEY TO EXPLORATION LOGS

Start Drilled	2/10/2012	End	2/10/2012	Total Depth (ft)	15	Logged By	AJ RST	Checked By	RST	Driller	Cascade Drilling, LP	Drilling Method	Hollow Stem Auger
Hammer Data	N/A			Drilling Equipment	CME 75		Licensing agency well number: <b>BHM146</b> A 2 (in) well was installed on 2/10/2012 to a depth of 15 (ft).						
Surface Elevation (ft)	13.1			Top of Casing Elevation (ft)	12.7		Groundwater						
Vertical Datum	MLLW			Date Measured							Depth to Water (ft)	Elevation (ft)	
Easting (X)	1209594.048			Horizontal Datum		NAD83		3/6/2012		5.1		7.57	
Northing (Y)	556333.162												
Notes: Air knife from 0 to 5 feet. No samples obtained, soil descriptions based on drill cuttings. PID malfunction - No head space vapor readings.													



Note: See Figure B-1 for explanation of symbols.

### Log of Monitoring Well GEI-MW-5

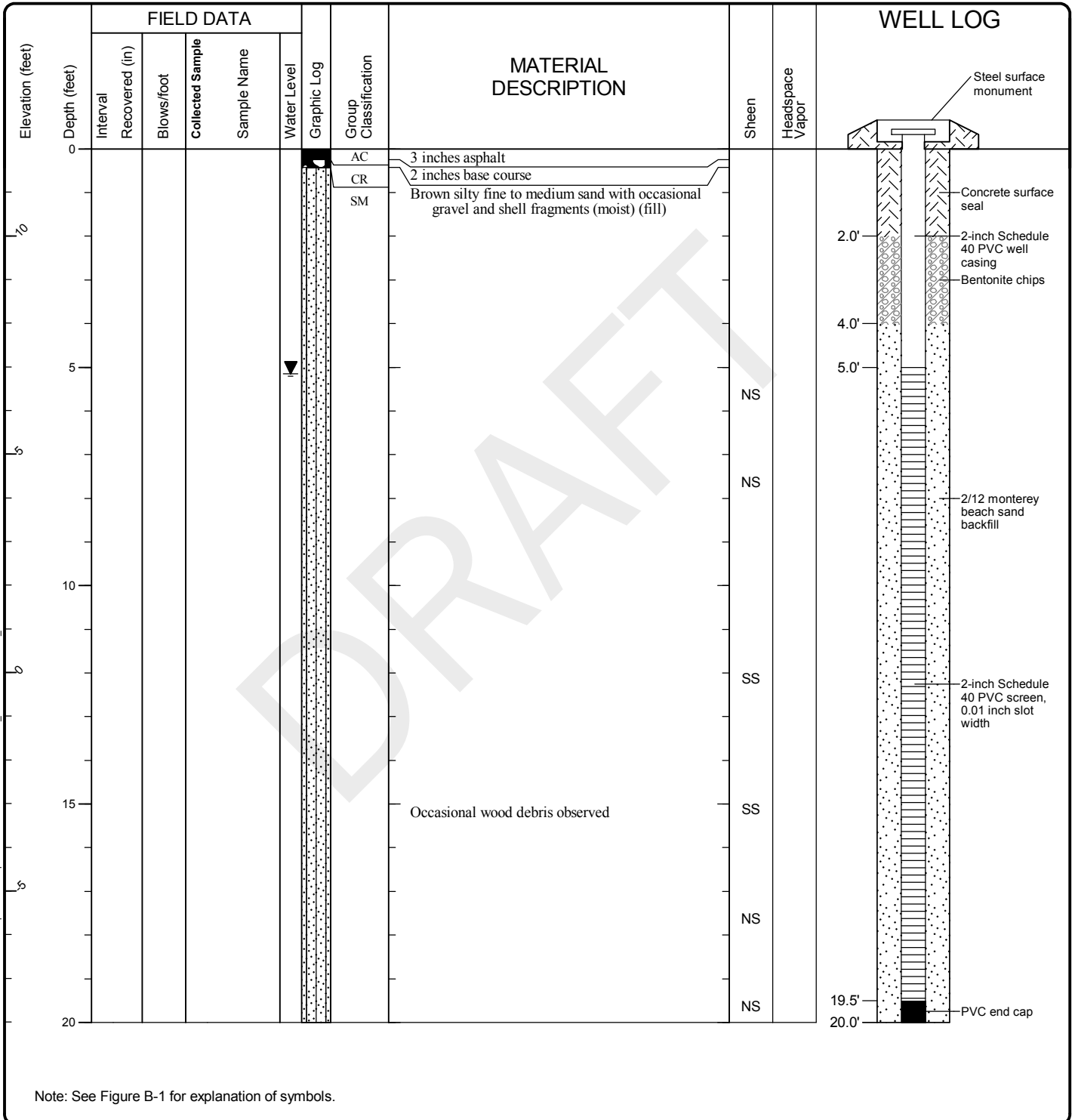


Project: Former Shell Oil Tank Farm  
 Project Location: Anacortes, Washington  
 Project Number: 5147-012-02

Seattle: Date: 4/9/12 Path: C:\USER\STINASH\DESKTOP\514701202.GPJ DB Template\Lib Template: GE OENGINEERS8.GDT\GEI8\_ENVIRONMENTAL\_WELL

Start Drilled	2/10/2012	End	2/10/2012	Total Depth (ft)	20	Logged By	AJ RST	Checked By	RST	Driller	Cascade Drilling, LP	Drilling Method	Hollow Stem Auger	
Hammer Data	N/A			Drilling Equipment	CME 75		Licensing agency well number: <b>BHM147</b> A 2 (in) well was installed on 2/10/2012 to a depth of 20 (ft).							
Surface Elevation (ft)	12.0			Top of Casing Elevation (ft)	11.7		Groundwater Date Measured							
Vertical Datum	MLLW			3/6/2012							Depth to Water (ft)	5.2	Elevation (ft)	6.50
Easting (X)	1209845.159			Horizontal Datum	NAD83									
Northing (Y)	556436.0145													

Notes: Air knife from 0 to 5 feet. No samples obtained, soil descriptions based on drill cuttings. PID malfunction - No head space vapor readings.



### Log of Monitoring Well GEI-MW-7



Project: Former Shell Oil Tank Farm  
 Project Location: Anacortes, Washington  
 Project Number: 5147-012-02

Seattle, Date: 4/9/12 Path: C:\USER\STINASH\DESKTOP\514701202.GPJ DB Template\Lib Template: GE\ENGINEERS\GDT\GEI\ENVIRONMENTAL\_WELL

**APPENDIX B**  
**Chemical Analytical Data**

DRAFT





14648 NE 95<sup>th</sup> Street, Redmond, WA 98052 • (425) 883-3881

July 7, 2017

Robert Trahan  
GeoEngineers, Inc.  
600 Stewart, Suite 1700  
Seattle, WA 98101-1233

Re: Analytical Data for Project 5147-012-08  
Laboratory Reference No. 1706-346

Dear Robert:

Enclosed are the analytical results and associated quality control data for samples submitted on June 28, 2017.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

A handwritten signature in black ink, appearing to read "DB", with a long horizontal flourish extending to the right.

David Baumeister  
Project Manager

Enclosures



Date of Report: July 7, 2017  
Samples Submitted: June 28, 2017  
Laboratory Reference: 1706-346  
Project: 5147-012-08

### Case Narrative

Samples were collected on June 28, 2017 and received by the laboratory on June 28, 2017. They were maintained at the laboratory at a temperature of 2°C to 6°C.

Please note that any and all soil sample results are reported on a dry-weight basis, unless otherwise noted below.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

DRAFT



Date of Report: July 7, 2017  
Samples Submitted: June 28, 2017  
Laboratory Reference: 1706-346  
Project: 5147-012-08

### ANALYTICAL REPORT FOR SAMPLES

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Notes
GEI-MW-5_062817	06-346-01	Water	6-28-17	6-28-17	
GEI-MW-7_062817	06-346-02	Water	6-28-17	6-28-17	
DUP_062817	06-346-03	Water	6-28-17	6-28-17	
Trip Blank_062817	06-346-04	Water	6-28-17	6-28-17	

DRAFT



Date of Report: July 7, 2017  
 Samples Submitted: June 28, 2017  
 Laboratory Reference: 1706-346  
 Project: 5147-012-08

**NWTPH-Gx**

Matrix: Water  
 Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
<b>Client ID:</b>	<b>GEI-MW-5_062817</b>					
Laboratory ID:	06-346-01					
Gasoline	<b>ND</b>	400	NWTPH-Gx	6-29-17	6-29-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	87	61-118				
<b>Client ID:</b>	<b>GEI-MW-7_062817</b>					
Laboratory ID:	06-346-02					
Gasoline	<b>ND</b>	100	NWTPH-Gx	7-5-17	7-5-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	98	61-118				
<b>Client ID:</b>	<b>DUP_062817</b>					
Laboratory ID:	06-346-03					
Gasoline	<b>ND</b>	100	NWTPH-Gx	6-29-17	6-29-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	82	61-118				
<b>Client ID:</b>	<b>Trip Blank_062817</b>					
Laboratory ID:	06-346-04					
Gasoline	<b>ND</b>	100	NWTPH-Gx	6-29-17	6-29-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	87	61-118				



Date of Report: July 7, 2017  
 Samples Submitted: June 28, 2017  
 Laboratory Reference: 1706-346  
 Project: 5147-012-08

### NWTPH-Dx

Matrix: Water  
 Units: mg/L (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
<b>Client ID:</b>	<b>GEI-MW-5_062817</b>					
Laboratory ID:	06-346-01					
Diesel Range Organics	<b>0.30</b>	0.25	NWTPH-Dx	6-30-17	6-30-17	
Lube Oil Range Organics	<b>ND</b>	0.40	NWTPH-Dx	6-30-17	6-30-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>o-Terphenyl</i>	101	50-150				
<b>Client ID:</b>	<b>GEI-MW-7_062817</b>					
Laboratory ID:	06-346-02					
Diesel Range Organics	<b>ND</b>	0.25	NWTPH-Dx	6-30-17	7-3-17	
Lube Oil Range Organics	<b>ND</b>	0.40	NWTPH-Dx	6-30-17	7-3-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>o-Terphenyl</i>	100	50-150				
<b>Client ID:</b>	<b>DUP_062817</b>					
Laboratory ID:	06-346-03					
Diesel Range Organics	<b>0.27</b>	0.25	NWTPH-Dx	6-30-17	7-3-17	
Lube Oil Range Organics	<b>ND</b>	0.41	NWTPH-Dx	6-30-17	7-3-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>o-Terphenyl</i>	97	50-150				



Date of Report: July 7, 2017  
 Samples Submitted: June 28, 2017  
 Laboratory Reference: 1706-346  
 Project: 5147-012-08

**NWTPH-Gx  
 QUALITY CONTROL**

Matrix: Water  
 Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
<b>METHOD BLANK</b>						
Laboratory ID:	MB0629W2					
Gasoline	<b>ND</b>	100	NWTPH-Gx	6-29-17	6-29-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	89	61-118				
Laboratory ID:	MB0705W1					
Gasoline	<b>ND</b>	100	NWTPH-Gx	7-5-17	7-5-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	95	61-118				

Analyte	Result	Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
<b>DUPLICATE</b>								
Laboratory ID:	06-346-01							
	ORIG	DUP						
Gasoline	<b>ND</b>	<b>ND</b>	NA	NA	NA	NA	30	
<i>Surrogate:</i>								
<i>Fluorobenzene</i>				87	87	61-118		



Date of Report: July 7, 2017  
 Samples Submitted: June 28, 2017  
 Laboratory Reference: 1706-346  
 Project: 5147-012-08

**NWTPH-Gx**  
**CONTINUING CALIBRATION SUMMARY**

<b>Lab ID</b>	<b>True Value (ppm)</b>	<b>Calc. Value</b>	<b>Percent Difference</b>	<b>Control Limits</b>
CCVH0629G-1	2.50	2.67	-7	+/- 20%
CCVH0629G-2	2.50	2.34	6	+/- 20%
CCVD0705G-4	5.00	5.26	-5	+/- 20%
CCVD0705G-5	5.00	5.81	-16	+/- 20%

DRAFT



Date of Report: July 7, 2017  
 Samples Submitted: June 28, 2017  
 Laboratory Reference: 1706-346  
 Project: 5147-012-08

**NWTPH-Dx  
 QUALITY CONTROL**

Matrix: Water  
 Units: mg/L (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
<b>METHOD BLANK</b>						
Laboratory ID:	MB0630W1					
Diesel Range Organics	<b>ND</b>	0.25	NWTPH-Dx	6-30-17	6-30-17	
Lube Oil Range Organics	<b>ND</b>	0.40	NWTPH-Dx	6-30-17	6-30-17	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>o-Terphenyl</i>	96	50-150				

Analyte	Result	Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
<b>DUPLICATE</b>								
Laboratory ID:	06-346-01							
	ORIG	DUP						
Diesel Range Organics	<b>0.303</b>	<b>0.285</b>	NA	NA	NA	NA	6	NA
Lube Oil Range	<b>ND</b>	<b>ND</b>	NA	NA	NA	NA	NA	NA
<i>Surrogate:</i>								
<i>o-Terphenyl</i>				101	97	50-150		





Date of Report: July 7, 2017  
Samples Submitted: June 28, 2017  
Laboratory Reference: 1706-346  
Project: 5147-012-08

**NWTPH-Dx**  
**CONTINUING CALIBRATION SUMMARY**

<b>Lab ID</b>	<b>True Value (ppm)</b>	<b>Calc. Value</b>	<b>Percent Difference</b>	<b>Control Limits</b>
CCV0630R-T2	100	94.1	5.9	+/-15%
CCV0630R-T3	100	98.9	1.1	+/-15%
CCV0703R-T1	100	91.2	8.8	+/-15%
CCV0703R-T2	100	92.6	7.4	+/-15%

DRAFT





### Data Qualifiers and Abbreviations

- A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.
  - B - The analyte indicated was also found in the blank sample.
  - C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.
  - E - The value reported exceeds the quantitation range and is an estimate.
  - F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.
  - H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.
  - I - Compound recovery is outside of the control limits.
  - J - The value reported was below the practical quantitation limit. The value is an estimate.
  - K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.
  - L - The RPD is outside of the control limits.
  - M - Hydrocarbons in the gasoline range are impacting the diesel range result.
  - M1 - Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.
  - N - Hydrocarbons in the lube oil range are impacting the diesel range result.
  - N1 - Hydrocarbons in diesel range are impacting lube oil range results.
  - O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.
  - P - The RPD of the detected concentrations between the two columns is greater than 40.
  - Q - Surrogate recovery is outside of the control limits.
  - S - Surrogate recovery data is not available due to the necessary dilution of the sample.
  - T - The sample chromatogram is not similar to a typical \_\_\_\_\_.
  - U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
  - U1 - The practical quantitation limit is elevated due to interferences present in the sample.
  - V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.
  - W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.
  - X - Sample extract treated with a mercury cleanup procedure.
  - X1 - Sample extract treated with a Sulfuric acid/Silica gel cleanup procedure.
  - Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.
  - Z -
- ND - Not Detected at PQL  
 PQL - Practical Quantitation Limit  
 RPD - Relative Percent Difference





# Sample/Cooler Receipt and Acceptance Checklist

Client: GES

Client Project Name/Number: 5147-012-08

OnSite Project Number: 06-346

Initiated by: *AM*

Date Initiated: 6/28/17

## 1.0 Cooler Verification

1.1 Were there custody seals on the outside of the cooler?	Yes	No	<u>N/A</u>	1 2 3 4
1.2 Were the custody seals intact?	Yes	No	<u>N/A</u>	1 2 3 4
1.3 Were the custody seals signed and dated by last custodian?	Yes	No	<u>N/A</u>	1 2 3 4
1.4 Were the samples delivered on ice or blue ice?	<u>Yes</u>	No		1 2 3 4
1.5 Were samples received between 0-6 degrees Celsius?	Yes	<u>No</u>	Temperature: <u>13</u>	
1.6 Have shipping bills (if any) been attached to the back of this form?	Yes	<u>N/A</u>		
1.7 How were the samples delivered?	<u>Client</u>	Courier	UPS/FedEx	OSE Pickup    Other

## 2.0 Chain of Custody Verification

2.1 Was a Chain of Custody submitted with the samples?	<u>Yes</u>	No		1 2 3 4
2.2 Was the COC legible and written in permanent ink?	<u>Yes</u>	No		1 2 3 4
2.3 Have samples been relinquished and accepted by each custodian?	<u>Yes</u>	No		1 2 3 4
2.4 Did the sample labels (ID, date, time, preservative) agree with COC?	<u>Yes</u>	No		1 2 3 4
2.5 Were all of the samples listed on the COC submitted?	<u>Yes</u>	No		1 2 3 4
2.6 Were any of the samples submitted omitted from the COC?	Yes	<u>No</u>		1 2 3 4

## 3.0 Sample Verification

3.1 Were any sample containers broken or compromised?	Yes	<u>No</u>		1 2 3 4
3.2 Were any sample labels missing or illegible?	Yes	<u>No</u>		1 2 3 4
3.3 Have the correct containers been used for each analysis requested?	<u>Yes</u>	No		1 2 3 4
3.4 Have the samples been correctly preserved?	<u>Yes</u>	No	N/A	1 2 3 4
3.5 Are volatiles samples free from headspace and bubbles greater than 6mm?	<u>Yes</u>	No	N/A	1 2 3 4
3.6 Is there sufficient sample submitted to perform requested analyses?	<u>Yes</u>	<u>No</u>		1 2 3 4
3.7 Have any holding times already expired or will expire in 24 hours?	Yes	<u>No</u>		1 2 3 4
3.8 Was method 5035A used?	Yes	No	<u>N/A</u>	1 2 3 4
3.9 If 5035A was used, which sampling option was used (#1, 2, or 3).	#		<u>N/A</u>	1 2 3 4

### Explain any discrepancies:


1 - Discuss issue in Case Narrative

3 - Client contacted to discuss problem

2 - Process Sample As-is

4 - Sample cannot be analyzed or client does not wish to proceed



14648 NE 95<sup>th</sup> Street, Redmond, WA 98052 • (425) 883-3881

June 22, 2018

Robert Trahan  
GeoEngineers, Inc.  
600 Stewart, Suite 1700  
Seattle, WA 98101-1233

Re: Analytical Data for Project 5147-012-08  
Laboratory Reference No. 1806-154

Dear Robert:

Enclosed are the analytical results and associated quality control data for samples submitted on June 14, 2018.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

A handwritten signature in black ink, appearing to read "DB", with a long horizontal flourish extending to the right.

David Baumeister  
Project Manager

Enclosures



OnSite Environmental, Inc. 14648 NE 95<sup>th</sup> Street, Redmond, WA 98052 (425) 883-3881

This report pertains to the samples analyzed in accordance with the chain of custody, and is intended only for the use of the individual or company to whom it is addressed.



Date of Report: June 22, 2018  
Samples Submitted: June 14, 2018  
Laboratory Reference: 1806-154  
Project: 5147-012-08

### Case Narrative

Samples were collected on June 13, 2018 and received by the laboratory on June 14, 2018. They were maintained at the laboratory at a temperature of 2°C to 6°C.

Please note that any and all soil sample results are reported on a dry-weight basis, unless otherwise noted below.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

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### ANALYTICAL REPORT FOR SAMPLES

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Notes
GEI-MW-05_06132018	06-154-01	Water	6-13-18	6-14-18	
GEI-MW-07_06132018	06-154-02	Water	6-13-18	6-14-18	
Dup_06132018	06-154-03	Water	6-13-18	6-14-18	
Trip Blank	06-154-04	Water	---	6-14-18	

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### NWTPH-Gx

Matrix: Water  
 Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
<b>Client ID:</b>	<b>GEI-MW-05_06132018</b>					
Laboratory ID:	06-154-01					
Gasoline	<b>ND</b>	100	NWTPH-Gx	6-20-18	6-20-18	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	76	66-117				
<b>Client ID:</b>	<b>GEI-MW-07_06132018</b>					
Laboratory ID:	06-154-02					
Gasoline	<b>ND</b>	100	NWTPH-Gx	6-20-18	6-20-18	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	74	66-117				
<b>Client ID:</b>	<b>Dup_06132018</b>					
Laboratory ID:	06-154-03					
Gasoline	<b>ND</b>	100	NWTPH-Gx	6-20-18	6-20-18	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	75	66-117				
<b>Client ID:</b>	<b>Trip Blank</b>					
Laboratory ID:	06-154-04					
Gasoline	<b>ND</b>	100	NWTPH-Gx	6-20-18	6-20-18	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	77	66-117				





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### NWTPH-Dx

Matrix: Water  
 Units: mg/L (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
<b>Client ID:</b>	<b>GEI-MW-05_06132018</b>					
Laboratory ID:	06-154-01					
Diesel Range Organics	<b>ND</b>	0.26	NWTPH-Dx	6-15-18	6-15-18	
Lube Oil Range Organics	<b>ND</b>	0.41	NWTPH-Dx	6-15-18	6-15-18	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>o-Terphenyl</i>	85	50-150				
<b>Client ID:</b>	<b>GEI-MW-07_06132018</b>					
Laboratory ID:	06-154-02					
Diesel Range Organics	<b>ND</b>	0.26	NWTPH-Dx	6-15-18	6-15-18	
Lube Oil Range Organics	<b>ND</b>	0.41	NWTPH-Dx	6-15-18	6-15-18	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>o-Terphenyl</i>	89	50-150				
<b>Client ID:</b>	<b>Dup_06132018</b>					
Laboratory ID:	06-154-03					
Diesel Range Organics	<b>ND</b>	0.26	NWTPH-Dx	6-15-18	6-15-18	
Lube Oil Range Organics	<b>ND</b>	0.42	NWTPH-Dx	6-15-18	6-15-18	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>o-Terphenyl</i>	87	50-150				



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**NWTPH-Gx  
 QUALITY CONTROL**

Matrix: Water  
 Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
<b>METHOD BLANK</b>						
Laboratory ID:	MB0620W1					
Gasoline	<b>ND</b>	100	NWTPH-Gx	6-20-18	6-20-18	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>Fluorobenzene</i>	74	66-117				

Analyte	Result	Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
<b>DUPLICATE</b>								
Laboratory ID:	06-154-01							
	ORIG	DUP						
Gasoline	<b>ND</b>	<b>ND</b>	NA	NA	NA	NA	NA	30
<i>Surrogate:</i>								
<i>Fluorobenzene</i>				76	74	66-117		



Date of Report: June 22, 2018  
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Laboratory Reference: 1806-154  
Project: 5147-012-08

**NWTPH-Gx**  
**CONTINUING CALIBRATION SUMMARY**

<b>Lab ID</b>	<b>True Value (ppm)</b>	<b>Calc. Value</b>	<b>Percent Difference</b>	<b>Control Limits</b>
CCVH0620G-1	2.50	2.57	-3	+/- 20%
CCVH0620G-2	2.50	2.37	5	+/- 20%

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**NWTPH-Dx  
 QUALITY CONTROL**

Matrix: Water  
 Units: mg/L (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
<b>METHOD BLANK</b>						
Laboratory ID:	MB0615W1					
Diesel Range Organics	ND	0.25	NWTPH-Dx	6-15-18	6-15-18	
Lube Oil Range Organics	ND	0.40	NWTPH-Dx	6-15-18	6-15-18	
<i>Surrogate:</i>	<i>Percent Recovery</i>	<i>Control Limits</i>				
<i>o-Terphenyl</i>	86	50-150				

Analyte	Result	Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
<b>DUPLICATE</b>								
Laboratory ID:	06-154-01							
	ORIG	DUP						
Diesel Range	ND	ND	NA	NA	NA	NA	NA	NA
Lube Oil Range	ND	ND	NA	NA	NA	NA	NA	NA
<i>Surrogate:</i>								
<i>o-Terphenyl</i>				85	83	50-150		



Date of Report: June 22, 2018  
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**NWTPH-Dx  
 CONTINUING CALIBRATION SUMMARY**

<b>Lab ID</b>	<b>True Value (ppm)</b>	<b>Calc. Value</b>	<b>Percent Difference</b>	<b>Control Limits</b>
CCV0615F-V1	100	101	-0.9	+/-15%
CCV0615F-V2	100	102	-2.2	+/-15%
CCV0615F-V3	100	101	-1.5	+/-15%
CCV0615R-V1	100	98.6	1.4	+/-15%
CCV0615R-V2	100	102	-1.6	+/-15%
CCV0615R-V3	100	104	-3.7	+/-15%

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### Data Qualifiers and Abbreviations

- A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.
  - B - The analyte indicated was also found in the blank sample.
  - C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.
  - E - The value reported exceeds the quantitation range and is an estimate.
  - F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.
  - H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.
  - I - Compound recovery is outside of the control limits.
  - J - The value reported was below the practical quantitation limit. The value is an estimate.
  - K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.
  - L - The RPD is outside of the control limits.
  - M - Hydrocarbons in the gasoline range are impacting the diesel range result.
  - M1 - Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.
  - N - Hydrocarbons in the lube oil range are impacting the diesel range result.
  - N1 - Hydrocarbons in diesel range are impacting lube oil range results.
  - O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.
  - P - The RPD of the detected concentrations between the two columns is greater than 40.
  - Q - Surrogate recovery is outside of the control limits.
  - S - Surrogate recovery data is not available due to the necessary dilution of the sample.
  - T - The sample chromatogram is not similar to a typical \_\_\_\_\_.
  - U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
  - U1 - The practical quantitation limit is elevated due to interferences present in the sample.
  - V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.
  - W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.
  - X - Sample extract treated with a mercury cleanup procedure.
  - X1 - Sample extract treated with a sulfuric acid/silica gel cleanup procedure.
  - Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.
  - Z -
- ND - Not Detected at PQL  
 PQL - Practical Quantitation Limit  
 RPD - Relative Percent Difference





# Onsite Environmental Inc.

Analytical Laboratory Testing Services  
14648 NE 95th Street • Redmond, WA 98052  
Phone: (425) 883-3881 • www.onsite-env.com

## Chain of Custody

Turnaround Request  
(in working days)

(Check One)

Same Day  1 Day

2 Days  3 Days

Standard (7 Days)  
(TPH analysis 5 Days)

\_\_\_\_\_  
(other)

Laboratory Number: **06-154**

Company: **Geo Engineers**

Project Number: **SHZ-012-08**

Project Name: **POA - Shell**

Project Manager: **Robert Tahan**

Sampled by: **RST/KRA**

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix
1	LEI-MU-05 - 06/30/19	6/13/19	13:05	L
2	LEI-MU-07 - 06/30/19	6/13/19	13:00	L
3	Dup - 06/30/19	6/13/19		S
4	Temp Blank			S

Number of Containers	Laboratory Analysis																	
	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx <input type="checkbox"/> Acid / SG Clean-up	Volatiles 8260C	Halogenated Volatiles 8260C	EDB EPA 8011 (Waters Only)	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals	Total MTCA Metals	TCLP Metals	HEM (oil and grease) 1664A	% Moisture
5			X	X														X MS/MSD
5			X	X														
2			X	X														

Received	Relinquished	Signature	Company	Date	Time	Comments/Special Instructions
		<i>[Signature]</i>	LEI	6/14/19	9:45	
		<i>[Signature]</i>	OSE	6/14/19	9:45	
Received	Relinquished					
Received	Relinquished					
Received	Relinquished					
Reviewed/Date	Reviewed/Date					

Data Package: Standard  Level III  Level IV

Chromatograms with final report  Electronic Data Deliverables (EDDs)



# Sample/Cooler Receipt and Acceptance Checklist

Client: GES

Client Project Name/Number: 5147-012-08

OnSite Project Number: 06-154

Initiated by: KL

Date Initiated: 6/14/18

## 1.0 Cooler Verification

1.1 Were there custody seals on the outside of the cooler?	Yes	<input checked="" type="radio"/> No	N/A	1 2 3 4
1.2 Were the custody seals intact?	Yes	No	<input checked="" type="radio"/> N/A	1 2 3 4
1.3 Were the custody seals signed and dated by last custodian?	Yes	No	<input checked="" type="radio"/> N/A	1 2 3 4
1.4 Were the samples delivered on ice or blue ice?	<input checked="" type="radio"/> Yes	No		1 2 3 4
1.5 Were samples received between 0-6 degrees Celsius?	<input checked="" type="radio"/> Yes	No	Temperature: <u>5</u>	
1.6 Have shipping bills (if any) been attached to the back of this form?	Yes	<input checked="" type="radio"/> N/A		
1.7 How were the samples delivered?	<input checked="" type="radio"/> Client	<input type="radio"/> Courier	<input type="radio"/> UPS/FedEx	<input type="radio"/> OSE Pickup <input type="radio"/> Other

## 2.0 Chain of Custody Verification

2.1 Was a Chain of Custody submitted with the samples?	<input checked="" type="radio"/> Yes	No	1 2 3 4
2.2 Was the COC legible and written in permanent ink?	<input checked="" type="radio"/> Yes	No	1 2 3 4
2.3 Have samples been relinquished and accepted by each custodian?	<input checked="" type="radio"/> Yes	No	1 2 3 4
2.4 Did the sample labels (ID, date, time, preservative) agree with COC?	<input checked="" type="radio"/> Yes	No	1 2 3 4
2.5 Were all of the samples listed on the COC submitted?	<input checked="" type="radio"/> Yes	No	1 2 3 4
2.6 Were any of the samples submitted omitted from the COC?	Yes	<input checked="" type="radio"/> No	1 2 3 4

## 3.0 Sample Verification

3.1 Were any sample containers broken or compromised?	Yes	<input checked="" type="radio"/> No	1 2 3 4
3.2 Were any sample labels missing or illegible?	Yes	<input checked="" type="radio"/> No	1 2 3 4
3.3 Have the correct containers been used for each analysis requested?	<input checked="" type="radio"/> Yes	No	1 2 3 4
3.4 Have the samples been correctly preserved?	Yes	<input checked="" type="radio"/> No	N/A 1 2 3 4
3.5 Are volatile samples free from headspace and bubbles greater than 6mm?	<input checked="" type="radio"/> Yes	No	N/A 1 2 3 4
3.6 Is there sufficient sample submitted to perform requested analyses?	<input checked="" type="radio"/> Yes	No	1 2 3 4
3.7 Have any holding times already expired or will expire in 24 hours?	Yes	<input checked="" type="radio"/> No	1 2 3 4
3.8 Was method 5035A used?	Yes	No	<input checked="" type="radio"/> N/A 1 2 3 4
3.9 If 5035A was used, which sampling option was used (#1, 2, or 3).	#		<input checked="" type="radio"/> N/A 1 2 3 4

### Explain any discrepancies:

3.4 #1 pH not < 3

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1 - Discuss issue in Case Narrative

2 - Process Sample As-is

3 - Client contacted to discuss problem

4 - Sample cannot be analyzed or client does not wish to proceed



**APPENDIX C**  
**Data Validation Reports**

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**Project:** Port of Anacortes – Former Shell Tank Farm  
June 2017 Groundwater Samples (Round 5)

**GEI File No:** 5147-012-08

**Date:** April 27, 2018

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This report documents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2B data validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of groundwater samples collected as part of the June 2017 (Round 5) sampling event, and the associated laboratory and field quality control (QC) samples. The samples were obtained from the Former Shell Tank Farm Cleanup Site located in Anacortes, Washington.

### Objective and Quality Control Elements

GeoEngineers, Inc. (GeoEngineers) completed the data validation consistent with the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (USEPA 2010) (National Functional Guidelines) to determine if the laboratory analytical results meet the project objectives and are usable for their intended purpose. Data usability was assessed by determining if:

- The samples were analyzed using well-defined and acceptable methods that provide reporting limits below applicable regulatory criteria;
- The precision and accuracy of the data are well-defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

In accordance with the Quality Assurance Project Plan (Appendix A of the Compliance Monitoring Plan; GeoEngineers, 2014), the data validation included review of the following QC elements:

- Data Package Completeness
- Chain-of-Custody Documentation
- Holding Times and Sample Preservation
- Method Blanks
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Laboratory and Field Duplicates
- Initial Calibrations (ICALs)
- Continuing Calibrations (CCALs)
- Miscellaneous

## Validated Sample Delivery Groups

This data validation included review of the sample delivery group (SDG) listed below in Table 1.

**TABLE 1: SUMMARY OF VALIDATED SAMPLE DELIVERY GROUP**

Laboratory SDG	Samples Validated
1706-346	GEI-MW-5_062817, DUP_062817, GEI-MW-7_062817, and TRIP BLANK_062817

## Chemical Analysis Performed

OnSite Environmental, Inc. (OnSite) of Redmond, Washington, performed laboratory analysis on the groundwater samples using the following methods:

- Gasoline Range Hydrocarbons by NWTPH-Gx method
- Diesel and Lube Oil Range Hydrocarbons by NWTPH-Dx method

## Data Validation Summary

The results for each of the QC elements are summarized below.

### Data Package Completeness

OnSite provided all required deliverables for the data validation according to the National Functional Guidelines. The laboratories followed adequate corrective action processes and all identified anomalies were discussed in the relevant laboratory case narrative.

### Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. The COCs were accurate and complete when submitted to the lab.

### Holding Times and Sample Preservation

The sample holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses. The sample cooler arrived at the laboratory at a temperature of 13 °C. Upon arrival at the laboratory, the sample containers were immediately stored in refrigeration at a temperature of 4 °C. The samples were placed in refrigeration within 12 hours of the time that sampling occurred.

### Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. A method blank was analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks for all applicable

methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

### **Trip Blanks**

Trip blanks are analyzed to ensure that any there is no potential volatile contamination introduced in the transportation process. A trip blank (TRIP\_BLANK\_062817) was analyzed with the batch of samples for Gasoline Range Hydrocarbons at a frequency of 1 per 20 samples. None of the contaminants of concern were detected above the reporting limits in this trip blank.

### **Matrix Spikes/Matrix Spike Duplicates**

Since the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis on one sample from the associated batch, known as the parent sample. One aliquot of the sample is analyzed in the normal manner and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery is calculated. Matrix spike duplicate (MSD) analyses are generally performed for organic analyses as a precision check and analyzed in the same sequence as a matrix spike. Using the result values from the MS and MSD, the relative percent difference (RPD) is calculated. The percent recovery control limits for MS and MSD analyses are specified in the laboratory documents, as are the RPD control limits for MS/MSD sample sets.

For inorganic methods, the matrix spike is followed by a post-digestion spike sample if any element percent recoveries were outside the control limits in the matrix spike. The percent recovery control limits for matrix spikes are 75% to 125%.

One MS/MSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

### **Laboratory Control Samples/Laboratory Control Sample Duplicates**

There were no laboratory control sample/laboratory control sample duplicates performed on the associated batch samples.

### **Laboratory Duplicates**

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration less than five times the reporting limit for that sample, the absolute difference is used instead of the RPD. For organic analyses, the RPD control limits are specified in the laboratory documents. For inorganic analyses, the RPD control limit for groundwater samples is 20 percent. Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met.

### **Field Duplicates**

In order to assess precision, field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. Precision is determined by calculating the RPD between each pair of samples. If one or more of the sample analytes has a concentration less than five times the reporting limit for that sample, then the absolute difference is used instead of the RPD. The RPD control limit for groundwater samples is 35 percent.

**SDG 1706-346:** One field duplicate sample pair, GEI-MW-5\_062817 & DUP\_062817, was submitted with this SDG. The precision criteria for all target analytes were met for this sample pair.

### **Initial Calibrations (ICALs)**

The initial calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. For all organic analyses, the percent relative standard deviation (%RSD) and relative response factors (RRF) values were within the laboratory control limits and also the control limits stated in the National Functional Guidelines for Organic Superfund Data Review (USEPA 2017).

### **Continuing Calibrations (CCALs)**

The continuing calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. For the NWTPH-Gx analyses, the %R values were within the control limits of  $\pm 20\%$ . For the NWTPH-Dx analyses, the %R values were within the control limits of  $\pm 15\%$ . For organic analyses, the percent difference (%D) and relative response factors (RRF) values were within the control limits in the National Functional Guidelines for Organic Superfund Data Review (USEPA 2017).

### **Overall Assessment**

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate %R values. Precision was acceptable, as demonstrated by the laboratory/field duplicate RPD values.

No data points were qualified for any reason. All data are acceptable for the intended use.

### **References**

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

U.S. Environmental Protection Agency (USEPA). "National Functional Guidelines for Organic Superfund Data Review," EPA-540-R-2017-002. January 2017.

GeoEngineers, Inc., "Compliance Monitoring Plan, Former Shell Oil Tank Farm, Anacortes, Washington," prepared for the Washington State Department of Ecology on Behalf of the Port of Anacortes, GEI File No. 5147-012-04, July 29, 2014.

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**Project:** Port of Anacortes – Former Shell Tank Farm  
June 2018 Groundwater Samples (Round 6)

**GEI File No:** 5147-012-08

**Date:** June 28, 2018

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This report documents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2B data validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of groundwater samples collected as part of the June 2018 (Round 6) sampling event, and the associated laboratory and field quality control (QC) samples. The samples were obtained from the Former Shell Tank Farm Cleanup Site located in Anacortes, Washington.

### Objective and Quality Control Elements

GeoEngineers, Inc. (GeoEngineers) completed the data validation consistent with the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (USEPA 2010) (National Functional Guidelines) to determine if the laboratory analytical results meet the project objectives and are usable for their intended purpose. Data usability was assessed by determining if:

- The samples were analyzed using well-defined and acceptable methods that provide reporting limits below applicable regulatory criteria;
- The precision and accuracy of the data are well-defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

In accordance with the Quality Assurance Project Plan (Appendix A of the Compliance Monitoring Plan; GeoEngineers, 2014), the data validation included review of the following QC elements:

- Data Package Completeness
- Chain-of-Custody Documentation
- Holding Times and Sample Preservation
- Method Blanks
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Laboratory and Field Duplicates
- Initial Calibrations (ICALs)
- Continuing Calibrations (CCALs)
- Miscellaneous

## Validated Sample Delivery Groups

This data validation included review of the sample delivery group (SDG) listed below in Table 1.

**TABLE 1: SUMMARY OF VALIDATED SAMPLE DELIVERY GROUP**

Laboratory SDG	Samples Validated
1806-154	GEI-MW-05_06132018, DUP_06132018, GEI-MW-07_06132018, and TRIP_BLANK_180614

## Chemical Analysis Performed

OnSite Environmental, Inc. (OnSite) of Redmond, Washington, performed laboratory analysis on the groundwater samples using the following methods:

- Gasoline Range Hydrocarbons by NWTPH-Gx method
- Diesel and Lube Oil Range Hydrocarbons by NWTPH-Dx method

## Data Validation Summary

The results for each of the QC elements are summarized below.

### Data Package Completeness

OnSite provided all required deliverables for the data validation according to the National Functional Guidelines. The laboratories followed adequate corrective action processes and all identified anomalies were discussed in the relevant laboratory case narrative.

### Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. The COCs were accurate and complete when submitted to the lab.

### Holding Times and Sample Preservation

The sample holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses. The sample cooler arrived at the laboratory at a temperature of 5 °C. Upon arrival at the laboratory, the sample containers were immediately stored in refrigeration at a temperature of 4 °C. The samples were placed in refrigeration within 12 hours of the time that sampling occurred.

### Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. A method blank was analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks for all applicable

methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

### **Trip Blanks**

Trip blanks are analyzed to ensure that any there is no potential volatile contamination introduced in the transportation process. A trip blank (TRIP\_BLANK\_180614) was analyzed with the batch of samples for Gasoline Range Hydrocarbons at a frequency of 1 per 20 samples. None of the contaminants of concern were detected above the reporting limits in this trip blank.

### **Matrix Spikes/Matrix Spike Duplicates**

Since the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis on one sample from the associated batch, known as the parent sample. One aliquot of the sample is analyzed in the normal manner and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery is calculated. Matrix spike duplicate (MSD) analyses are generally performed for organic analyses as a precision check and analyzed in the same sequence as a matrix spike. Using the result values from the MS and MSD, the relative percent difference (RPD) is calculated. The percent recovery control limits for MS and MSD analyses are specified in the laboratory documents, as are the RPD control limits for MS/MSD sample sets.

For inorganic methods, the matrix spike is followed by a post-digestion spike sample if any element percent recoveries were outside the control limits in the matrix spike. The percent recovery control limits for matrix spikes are 75% to 125%.

One MS/MSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

### **Laboratory Control Samples/Laboratory Control Sample Duplicates**

There were no laboratory control sample/laboratory control sample duplicates performed on the associated batch samples.

### **Laboratory Duplicates**

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration less than five times the reporting limit for that sample, the absolute difference is used instead of the RPD. For organic analyses, the RPD control limits are specified in the laboratory documents. For inorganic analyses, the RPD control limit for groundwater samples is 20 percent. Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met.

### **Field Duplicates**

In order to assess precision, field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. Precision is determined by calculating the RPD between each pair of samples. If one or more of the sample analytes has a concentration less than five times the reporting limit for that sample, then the absolute difference is used instead of the RPD. The RPD control limit for groundwater samples is 35 percent.



**SDG 1806-154:** One field duplicate sample pair, GEI-MW-05\_06132018 & DUP\_06132018, was submitted with this SDG. The precision criteria for all target analytes were met for this sample pair.

### **Initial Calibrations (ICALs)**

The initial calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. For all organic analyses, the percent relative standard deviation (%RSD) and relative response factors (RRF) values were within the laboratory control limits and also the control limits stated in the National Functional Guidelines for Organic Superfund Data Review (USEPA 2017).

### **Continuing Calibrations (CCALs)**

The continuing calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. For the NWTPH-Gx analyses, the %R values were within the control limits of  $\pm 20\%$ . For the NWTPH-Dx analyses, the %R values were within the control limits of  $\pm 15\%$ . For organic analyses, the percent difference (%D) and relative response factors (RRF) values were within the control limits in the National Functional Guidelines for Organic Superfund Data Review (USEPA 2017).

### **Overall Assessment**

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate %R values. Precision was acceptable, as demonstrated by the laboratory/field duplicate RPD values.

No data points were qualified for any reason. All data are acceptable for the intended use.

### **References**

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

U.S. Environmental Protection Agency (USEPA). "National Functional Guidelines for Organic Superfund Data Review," EPA-540-R-2017-002. January 2017.

GeoEngineers, Inc., "Compliance Monitoring Plan, Former Shell Oil Tank Farm, Anacortes, Washington," prepared for the Washington State Department of Ecology on Behalf of the Port of Anacortes, GEI File No. 5147-012-04, July 29, 2014.